What can GE offer small farmers? Photo: Bert Lof

Using the poverty of the south to justify GM food to the north

Many concerned people, both in the South and the North, are appalled at how the poverty of the rural people of the South is made use of to justify genetically modified food to Northern consumers. The following reasons were cited in a letter of protest:

1. Poverty in the South is structurally rooted in the prevalent North-South relationships. The present systems of international resource control, commodity pricing, education, training, research, finance, banking, insurance, transportation etc. are all components of the system that controls wealth and poverty, and which started being put in place during the slavery and colonial periods and have matured in this post-colonial period. Southern poverty, especially rural poverty, is a consequence of this.

2. As such, the solution to rural poverty lies in a multidimensional corrective measure that would enable sufficient local control of the appropriation of the benefits that arise from the use of and trade in resources, as well as the application of labour.

3. The assumption that the complex rural poverty that afflicts the South can be solved through single technological inputs is grossly incorrect and totally objectionable since it would misdirect efforts.

4. Though technological inputs have a role to play in rural development, and genetic engineering could be a technology to consider, it would remain but one technology among many. For example even if potential yields of food crops were to be dramatically improved, if storage, transportation, marketing, distribution, and the ability to buy the food were not simultaneously improved, the effort would still remain ineffective. In fact, as we keep pointing out, it is not shortage of food that is the problem, but its distribution. More GE food is not the point: it is improving access and local food security. But corporations do not profit from such solutions.

5. There are high yielding varieties in rural areas, but their impacts remain limited by the bottlenecks imposed by many of the other variables. The agricultural research stations that are found in Southern countries have also produced many such varieties and the potentials of these varieties remain unrealised because of the other negative factors. But research must continue so that there will always be higher yielding varieties to be used as and when conditions allow it. It is a gross oversimplification to state that such seed would solve rural food problems. The picture is the same with seed of improved nutritional quality such as vitamin A rice.

6. At the heart of the inequity that maintains the present poverty of the South is the inherited positive advantage that the Northern transnational corporations enjoy. We consider the use of the South's rural poverty to justify the monopoly control and global use of genetically modified food production by the North's transnational corporations, not only an obstructive lie, but a way of derailing the solutions to our Southern rural poverty. It is the height of cynical abuse of the corporations' position of advantage.

■

(from a letter to the Channel Four News and The Times newspaper, UK, in response to a documentary (Equinox) and article (Gm foods and the luxury of choice) signed by a large group of concerned people from all continents)

Visit our website: www.ileia.org

Say no to GMOS: Grassroots education, activities and resources in Texas for consumer choice and a genetically viable future

www.saynotogmos.org

This activist website provides a lot of information about the disadvantages of growing GM crops. Scientific information in a readable style, but also a lot of information on court cases throughout USA and Canada. Real grassroots information.

People and Plants online

www.rbgkew.org.uk/peopleplants/

People and Plants promotes the sustainable use of plant resources, and the reconciliation of conservation and development, by focusing on the interface between people and the world of plants. This website is a gateway to information on practical ways of working with communities in applied ethnobotany. Its main focus is on Africa, Asia and the Pacific. Besides newsletters and interesting links, the *People and Plants Handbook* series, which is a source of information on applying ethnobotany to conservation and community development is available from this website. It is designed for people who work in the field, including park managers, foresters, students, researchers, cultural promoters, and members of non-governmental, governmental and indigenous organisations. These handbooks are also available in Spanish. (downloadable and printed)

Transgenic plants and world agriculture

Report, 46 p, 2000, downloadable pdf file.

www.nap.edu/html/transgenic

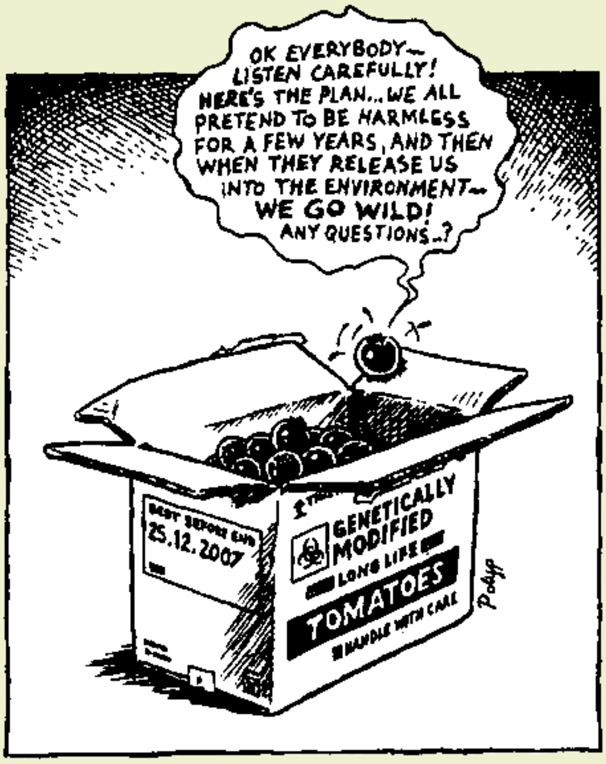
A working group consisting of a number of Academies of Sciences from all over the world, including the Third World Academy of Sciences, has prepared this report. These scientists have come together to provide recommendations to the developers and overseers of GM technology and to offer scientific perspectives on the ongoing public debate on the potential role of GM technology in world agriculture.

The report concludes that developers of GM technology should make sure that their efforts address the needs of small farmers in developing countries. It recommends a number of security measures. It also states that the system of patents and licenses should be broken down to facilitate sharing of GM technology with scientists in developing countries.

FoEE Biotechnology Programme

www.foeeurope.org/biotechnology/about.htm

Friends of the Earth Europe's Biotechnology Mailout is an overview of the ecological, ethical, political and legal developments of biotechnology in the European Union. The principle aim of the mailout is to provide regular, reliable information on the ecological, social, political and legal aspects of genetic engineering and thereby generate public awareness and debate, and provide a factual basis for campaigning by interest groups. The FoEE Biotech Mailout is published every six weeks as a paper and an E-mail version. It is available from this website, also in Spanish.



AG Biotech Infonet: Genetic Engineering, impacts and implications

www.biotech-info.net/

This website covers all aspects of the application of biotechnology and genetic engineering in agricultural production and food processing and marketing. It is a resource for anyone trying to better understand the implications of agricultural biotechnology. The goal is to facilitate access to critical, original documents and information, and recognised experts.

Christian Aid: Biotechnology and Genetically Modified Organisms

www.christian-aid.org.uk/indepth/0001biot/biotech.htm

This is the position paper of Christian Aid about biotechnology and Genetically Modified Organisms. Christian Aid's concern is with the implications and effects of biotechnology on developing countries, and on small farmers and the poor in those countries in particular. Its view is that, taken together, the possible environmental effects and the concentration of commercial control add up to a major threat to developing countries' food security and to the sustainability of poor farmers' livelihoods.

GeneWatch

www.genewatch.org/

GeneWatch UK is an independent organisation concerned with the ethics and risks of genetic engineering. It questions how, why and whether the use of genetic technologies should proceed and believes that the debate over genetic engineering is long overdue. Though the home country of GeneWatch is United Kingdom, the site is oriented to a worldwide audience and provides a lot of information.

GENET Archive

www.gene.ch/archives.html

This site has been established to support discussions about genetic engineering and to provide information intelligible to non-scientists. At present decisions are being taken which are influencing society and the environment worldwide: New crops are being planted and products derived from them are being sold fraudulently (without labels and risk information) on the world market.
Huge areas are being invaded by newly designed organisms: organisms whose long-term effects to eco systems are unknown and which can never be brought back if there are adverse effects. This archive provides plenty of background information.

International Food Policy and Research Institute: Biotechnology and Genetic Resource Policy

www.ifpri.cgiar.org/index.htm

This site of IFPRI provides downloadable policy papers about biotechnology and genetic resource management for developing countries, eg. booklet of CGIAR Centre Policy Instruments, Guidelines and Statements on Genetic Resources, Biotechnology and Intellectual Property Rights.

Friends of the Earth's European campaign to halt GMO pollution

www.foeeurope.org/halt-gmo-pollution/home.htm

Thorough information on the European anti GMO movements and the state of the art concerning GMOs in the different European countries.

Biotechnology and food: Voices from a Southern Perspective

www.southernvoices.nl/announce1.html

An online debate about biotech has taken place on this website. More information is to be found in the lastest issue of Biotechnology and Development Monitor. Here ordinary people could join the discussions on biotech, as still is possible on the ILEIA website.

CIMMYT: Biotech in the developing world

www.cimmyt.cgiar.org/ABC/map/developing_world/index.htm

CIMMYT, the international maize and wheat improvement center, provides information about biotech and corn crops in the developing world. A number of informative papers is available on this site for free, many also in Spanish.

Can agricultural biotechnology make a difference in Africa?

Woodward B, Brink J and Berger D, 1999, AgBioForum vol. 2(3/4) pages 175-181

www.agbioforum.org

There has been much recent dicussion on the potential impact of biotechnology on the development in Africa. Would a strategy combining conventional breeding with good crop management, farmer participatory research, and the provision of disease-free planting material be sufficient to increase yields in Africa? This paper states that the introduction of transgenic crops combined with the conventional approach mentioned above could contribute to improving the yields obtained by African farmers.

Grains of delusion: Golden rice seen from the ground

Report, 12 p, 2001, downloadable pdf file.

www.grain.org/publications/delusion-en.cfm

This document available from the website of GRAIN was researched, written and published as a joint undertaking between BIOTHAI (Thailand), CEDAC (Cambodja), DRCSC (India), GRAIN, MASIPAG (Philippines), PAN-Indonesia and UBINIG (Bangladesh). The report concludes that, while many doubt the ability of golden rice to eliminate vitamin A deficiency, the machinery is being set in motion to promote a GE strategy at the expense of more relevant approaches. The best chance of success in fighting vitamin A deficiency and malnutrition is to better use the inexpensive and nutritious foods already available, and in diversifying food production systems in the fields and at household level.

Cropchoice

www.cropchoice.com/index.asp

Cropchoice is an information source for American farmers about genetically modified crops, alternatives, management options, and profitability. Cropchoice has news that big companies may not want farmers to hear. An informative and well ordered source.

Themes for next issues

Issue 18.2, May 2002.

Rural communication and information management for sustainable family farming.

Rural communication and information management play an important role in spreading information on successful farmer innovations and in getting access to new knowledge. Participatory development programmes increasingly use rural radio, TV and other mass communication media as tools for farmer-to-farmer exchange. In some places, farmers even use mobile phones to get information on market prices. The use of internet and CD-ROMs by development workers, researchers and even farmers for networking and information exchange is gradually increasing as communication facilities improve. Yet, in many rural communities, traditional methods of communication continue to have a significant impact on the spread of information. What practical experiences have been gained with new as well as with more conventional approaches to rural communication and information management to enhance the expansion of farmer movements towards sustainable agriculture? How can access to electronic information and communication technologies be enhanced? How can these technologies be made into participatory tools? What experiences have been gained with local centres for information and farmer exchange? These are some of the practical questions that we wish to raise in this issue. First deadline for contributions: 1st of February 2002.

Issue 18.3, August 2002

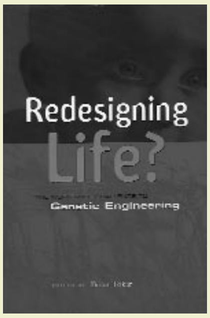
Ecological soil management, key to sustainable agriculture

Many problems in agriculture are related to soil and soil fertility management, i.e. soil erosion, low efficiency of fertilisers, nutrient imbalances, soil borne diseases, pests and weeds, soil compaction, farmer induced drought, water pollution, etc. Successes in raising productivity and ecological sustainability in agriculture often come from improvements in soil management. More insights are being gained into ecological soil and soil fertility management in the tropics. What do we know of ecological soil management? How do (traditional) farmers look at soil management and what can we learn from approaches such as organic agriculture, agroecology, natural farming, integrated soil fertility management, zero tillage and integrated pest management? Can traditional and organic technologies be combined with chemical fertilisers? As organic soil management technologies can be very labour demanding, appropriate mechanisation can be important. What experiences have been gained in this regard? Ecological soil management is site and crop rotation specific. What experiences have been gained with fine-tuning ecological soil management for specific conditions and rotations? Your practical experiences are very welcome. First deadline for contributions: 1st of May 2002.

You are invited to contribute to these issues with articles (about 800, 1600 or 2400 words + 2-3 illustrations and references), suggest possible authors, and send us information about publications, training courses, meetings and websites.

Redesigning life? : the worldwide challenge to genetic engineering by Tokar B (ed). 2001. 432 p. ISBN 1 85649 835 2 (pbk) : USD 19.95. ZED Books, 7 Cynthia Street, London N1 9JF, UK / zedbooks@zedbooks.demon.co.uk

Everyone who wants to know about the hazards of new genetic technologies should certainly read this book. It is a comprehensive examination of the critical threats of genetic engineering, and provides the knowledge required to counter and transcend it. Twenty-six internationally respected critics from all over the world provide their analysis of the issues, the inherent social and ethical implications, and the stories that made the headlines and brought genetic engineering to the forefront of public controversy.



The editor, Brian Tokar, has written a very useful and informative introduction called challenging biotechnology. Part I of the book consists of eight articles about health, food and the environment. Part II discusses medical genetics, science and human rights. In part III patents, corporate power and the theft of knowledge and resources are dealt with and part IV is about the worldwide resistance to genetic engineering. The list of "resources for information and action" at the end of the book provides useful links to many organisations and sources.

The book draws on the expertise of many experienced writers, is very readable and highly recommended. (WR)

Biotechnology : building on farmers' knowledge by Bunders J, Haverkort B, Hiemstra W (eds). 1996. 240 p. ISBN 0 333 67082 5 : GBP 8.95. ETC Netherlands, PO Box 64, 3830 AB Leusden, The Netherlands. Macmillan Education, Houndmills, Basingstoke RG21 6XS, UK.

This book aims at demonstrating the wealth of alternative biotechnological knowledge among farmers. They manage micro-organisms in the areas of animal health, biopesticides, food processing and crop genetic resources. Farmers' knowledge should be the starting point to make biotechnological research less supply-driven and more demand-driven. Part 1 examines existing biotechnological practices of farmers in animal health, biopesticides, food processing and crop genetic resources.

It begins with the experiences of one farmer from Kenya. Part 2 focuses on science-based bio-technology research and assesses the potential for small-scale farmers in the tropics. As views on the potential contribution of formal biotechnology research to food security differ widely, a chapter on the socio-political context has been included.

Part 3 presents a participatory and interactive methodology that builds on farmers' knowledge and makes use of the latest scientific insights. It ends with a model for integrating the formal and informal research and development systems.(WH)

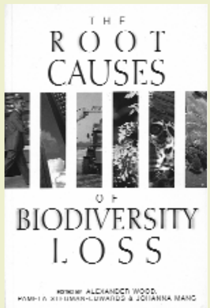
Biotechnology of food crops in developing countries : plant gene research, basic knowledge and application by Hohn T, Leisinger KM (eds). 1999. 222 p. ISBN 3 211 83240 8, GBP 34.00. (Plant Gene Research). Springer-Verlag, Wien, New York.

This book advocates biotechnological innovations as an important tool for agriculture in developing countries. The recent advances in gene technology, plant transformation, and the growing knowledge of DNA sequences of plants as well as of their most important parasites and symbionts offer many interesting prospects for the breeding of new crop varieties.The book contains results of agricultural research on crop improvement, obtained worldwide. The researchers who have written this essay take into consideration some ethical and socio-political aspects of crop improvement. But the larger part of the book focuses on technical information for the improvement of the major grains and other staples important for the various climatic zones of the third world. The successes and routes to obtain crops resistant to fungi, viruses, insects, and other pests, adapted to harsh climatic and soil conditions, and of high yield and nutritive value are described. Useful information for agricultural researchers.(WR)

Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options by Correa CM. 2000. 96 p. ISBN 1 85649 737 2 (Pbk) : GBP 16.95. ZED Books, 7 Cynthia Street, London N1 9JF, UK / zedbooks@zedbooks.demon.co.uk ; Third World Network, Malaysia.

The whole architecture of international trade is being fundamentally recast by the various agreements which the new agency, the World Trade Organization, is responsible for policing. This book cuts through the daunting technicalities of one of the most important of these agreements, that dealing with Intellectual Property Rights and their treatment as internationally tradeble commodities. Professor Correa helps us understand what the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement) is about and explains its main provisions. This book is an essential introduction to TRIPS and provides elements to develop policies and laws on intellectual property from a developing-country perspective.

The root causes of biodiversity loss by Wood A, Stedman-Edwards P, Mang J (eds). 2000. 398 p. ISBN 1 85383 699 0 GBP 17.95. WWF. Earthscan Publications, 120 Pentonville Road, London N1 9JN, UK / www.earthscan.co.uk : earthinfo@earthscan.co.uk

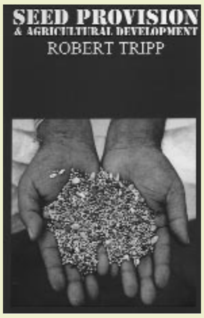


This book is a result of the "Root Causes Project", a joint project of The World Wide Fund for Nature (WWF), Macroeconomics for Sustainable Development Program Office (MPO) and the Global Environment Facility (GEF). These organisations are convinced that the conservation of biological diversity needs to be based on an understanding of the factors and the dynamics that drive its loss. The project conducted case studies in ten separate countries: Brazil, Cameroon, China, Bulgaria and the Slovak Republic, India, Mexico, Pakistan, Philippines, Tanzania, and Vietnam. Analysis of the findings has been used to provide a framework for understanding the interrelationship between socio-economic root causes and biodiversity loss. This framework gives a clear picture on how the various parts of the puzzle, from local population growth to national politics to international markets, together drive loss of biodiversity at a given site. This book is an invaluable contribution to understanding these processes, and provides a basis for effective conservation of diverse resources. Strongly recommended for economists and policy makers besides ecologists and conservationists. (WR)

Anti-GenetiX : the emergence of the anti-GM movement by Purdue DA. 2000. 161 p. ISBN 0 7546 1216 3 USD 37.50. Ashgate publisher, 130 Milton Park, Abingdon, OX14 4SB, UK / orders@bookpoint.co.uk ; www.ashgate.com.

The development of genetically modified foods has given rise to much widespread and heated debate on the possible consequences-both positive and negative- of this new technology. Based on his PhD thesis, Derrick Purdue has written a book that explores the emergence of a social movement in response to the patenting of life forms via biotechnology and the global crisis of natural and agricultural biodiversity. This book outlines the connections between gene patenting and biotechnology, their impact on international relations, and examines the social movement emerging against GM food. It gives a lot of information on issues such as intellectual property rights, application of patenting to genes and the consolidation of expert systems. The book is recomended for people who want to take part in the global GM food discussions.(WR)

Seed provision and agricultural development : the institutions of rural change by Tripp_R. 2001. 192 p. ISBN 0_85255_420_6 GBP 14.95. Overseas Development Institute (ODI), London UK / publications@odi.org.uk. James Currey Publishers, 73 Botley Road, Oxford OX2 0BS, UK.



Seed is at the forefront of many debates about development. It features in concerns about globalisation and intellectual property rights. Controversies over the future of biotechnology focus on the impact on seed systems. Robert Tripp has based this book about seed provision on six years of research in various aspects of seed system development. The examples in the book are drawn from original research in Asia, Africa and Latin America, as well as from an extensive review of the literature.

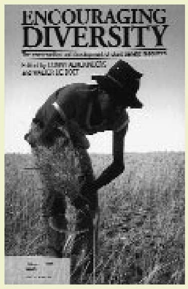
The book provides a detailed look at the strengths and weaknesses of seed management in traditional farming systems, reviews the history of formal plant breeding and the origins of seed trade, and examines the roles of the public and private sectors in the contemporary seed systems of industrialised and developing countries.

The book also describes the major types of aid interventions in developing country seed systems and explains why many of these have not been successful. With this book the author allows the reader to have a comprehensive picture of seed provision and the complexities involved within the context of agricultural development.(WR)

Organic cotton : from field to final product by Myers D, Stolton S (eds). 1999. 267 p. ISBN 1 85339 464 5 : GBP 16.50. The Pesticides Trust, Eurolink Centre, 49 Effra Road, London SW2 1BZ, UK. Intermediate Technology Publications (ITP), 103-105 Southampton Row, London WC1B 4HH, UK / orders@itpubs.org.uk ; www.itpubs.org.uk
This book is rich with details of successes, difficulties and challenges. It is primarily about organic cotton, though it goes on to tell a wider and vitally important story about how agriculture can become more sustainable while making significant improvements to people's lives. Cotton is a globally important fibre, providing returns to many small farmers in developing countries, as well as being worn at one time or another by most of the world's population. But most cotton is produced in a way that causes great damage to the environment.

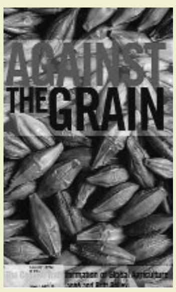
This book describes organic cotton production and processing, and is the first complete overview of its kind. There are signs that organic cotton is moving into a mass market. The book provides a very good and complete picture of the insights gained so far, and compiles case studies from all over the world. Besides cultivation (including the growing of genetically engineered cotton) and processing, attention is paid to economic and marketing aspects, the conversion process, certification and support requirements for projects.(WR and IHG)

Encouraging diversity : the conservation and development of plant genetic resources by Almekinders CJM, Boef W (de). 2000. 368 p. ISBN 1 85339 510 2. Intermediate Technology Publications, 103-105 Southampton Row, London WC1B 4HH, UK / orders@itpubs.org.uk ; www.itpubs.org.uk
Presents around 80 brief contributions with perspectives and experiences in plant genetic resources in the South and the North, from established institutions, researchers, pioneers and activists. These experiences illustrate the apparent conflict between crop conservation and crop development, and contribute to the understanding of opportunities that new approaches and activities in this field offer. Similarities between problems in the South and the North are apparent. Experiences and perspectives of genebanks, plant breeders, seed programmes and NGOs involved in crop development and conservation are analysed and placed in the context of new approaches in local and global Plant Genetic Resource (PGR) management by the formal and informal sector. The last part of the book talks about future developments in PGR management. It discusses the implications of integrated and adaptive management approaches in PGR management and the institutional organisation required to bring about changes that can help farmers and professionals in PGR management stand up against the pressures of a range of external global forces.



Agrafood: biotech 2001. 24 p. subscription for one year USD 698.-. Agra Europe (London) Ltd., 80 Calverley Road, Tunbridge Wells, Kent TN1 2UN, UK / www.agra-net.com ; marketing@agra-net.com. AgraFood Biotech no. 65 October 2001.
The Journal AgraFood Biotech, published every two weeks, reports on the application of biotechnology in agriculture and food. The debate over GM products has reached a global level. The US, China and Argentina are spearheading the growing of GM crop varieties and biotechnology companies are continuing to fund the development of GM food products. Consumer and environmental organisations in Europe and elsewhere are lobbying for a halt to trade and the freedom of choice for the consumer over the purchase of GM foods. By reading AgraFood Biotech you can stay in touch with the latest industry issues, discussions and regulations. The journal does offer objective and accurate reports on the subject , but at a very high price.(WR)

Against the grain : the genetic transformation of global agriculture by Lappé M, Bailey B. 1999. 163 p. ISBN 1 85383 576 5 : GBP 15.99. Earthscan Publications, 120 Pentonville Road, London N1 9JN, UK / orders@lbsltd.co.uk ; www.earthscan.co.uk
This book from 1999 still is a valuable, politically-oriented contribution to the debate about biotechnology, genetic engineering and transgenic crops and animals. The book examines new developments and their implications, looking in particular at developed countries. The achievements of transgene technology have penetrated into our lives at an enormous speed and scale, whether we like it or not. This publication helps to shape our viewpoint by a thorough analysis of the situation. Contains a glossary of terms, useful in this difficult field.

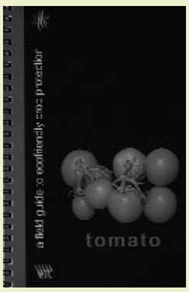


Farm planning 2000. 36 p. USD 4.-. World Neighbors (WN),4127 NW 122nd St. Oklahoma City, OK 73120-8869, USA / order@wn.org ; www.wn.org. (The practical guide to dryland farming series no 7).

This new manual on farm planning in the series practical guides to dryland farming is a useful booklet for extension workers and farmers. The booklet aims at helping farmers to fulfil farm families' needs and overcome problems caused by poor planning. Extension workers in the province Nusa Tenggara Timur in Indonesia have developed approaches for facilitating farm planning. In a process that involves the whole family, extension workers help farmers learn to analyse their needs as well as the problems they face. By better understanding these issues, farmers are better able to find more effective ways of managing available natural resources in order to improve their productivity. This approach is described here in a clearly-written and sufficiently-illustrated booklet. The booklet is also available in the Bahasa language and can be ordered from Studio Driya Media, Jl.Ancol Timur XIV, no.1 Bandung 40254 Indonesia / ybm-sdm@indo.net.id (WR)

National strategies for sustainable development: learning from experience: website CD-Rom for supporting dialogues / volume two. 2001. cdrom. GBP 30.- non OECD 15.-. International Institute for Environment and Development (IIED), 3 Endsleigh Street, London WC1H 0DD, UK / www.nssd.net
Natural Resources Institute (NRI).
With this CD-ROM, NRI and IIED made available their website with information and dialogues about strategic planning for sustainable development in developing countries for people that have not so easily access to internet. All the information on the website is to be found on the CD-ROM. It includes information and documentation in English, French and Spanish from participating countries, project documents and policy guidance, a bibliography on strategies for sustainable development, with many full text documents. Every three months an updated CD-ROM is available. This is a nice example of how to keep in contact with people who are not able to surf the internet daily. (WR)

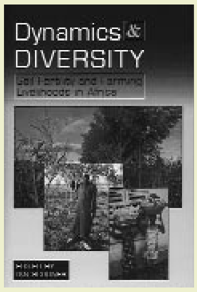
Tomato : a field guide to ecofriendly crop protection by Lanting H, Rao MS, Ravi K. 2001. 52 p. ISBN 81 87293 04 7. Agriculture Man Ecology (AME), 368, 4th Cross, JP Nagar 3rd Phase, Bangalore 560078, Karnakata, India / amebang@giasbg01.vsnl.net.in.
This first booklet in a series of field guides, AME has planned, is an illustrated handbook of insect pests and diseases most commonly found in the tomato-growing regions of India. It aims at promoting organic plant protection practices. This user-friendly and practical guide is primarily intended for tomato growers in India and their extension workers. The booklet provides clear information on organic protection measures for the economically important and prevalent pests of tomato and has plenty of pictures of the mentioned pests. Recommended.(WR)



Shifting cultivation: towards sustainability and resource conservation in Asia 2001. 421 p. ISBN 1 930261 01 2 USD 15.-. IFAD, IDRC, CIIFAD, ICRAF, International Institute of Rural Reconstruction (IIRR), Y.C.James yen Center, Biga, Silang, Cavite, Philippines / www.iirr.org ; Bookstore@iirr.org.
This resource book was produced through a participatory writeshop organised by IFAD, IDRC, CIIFAD, ICRAF and IIRR in August 2000 in the Philippines. The aim of the workshop was to produce a publication that would be of special relevance to development workers and trainers from local and national governments, agricultural colleges, NGO's and small farmer organisations. The focus therefore is on short, succinct overviews, which are generously illustrated and attractively presented. The resulting resource book is to be used and disseminated widely and readers are encouraged to utilise the materials in any form considered relevant: for training purposes, farm-radio broadcasts, in schools etc. Relevant materials can be adapted and translated freely.

The current shift of focus of many development agencies towards the very poor must draw attention to the marginalized groups of minorities dependent upon shifting cultivation for their livelihoods. This publication offers reasons for being optimistic about what can be achieved with these groups. The book deals extensively with traditional shifting cultivation systems and practices, with adaptive strategies and best practices, with research and development approaches and with future directions for shifting cultivation. A very important information source on agroforestry. (WR)

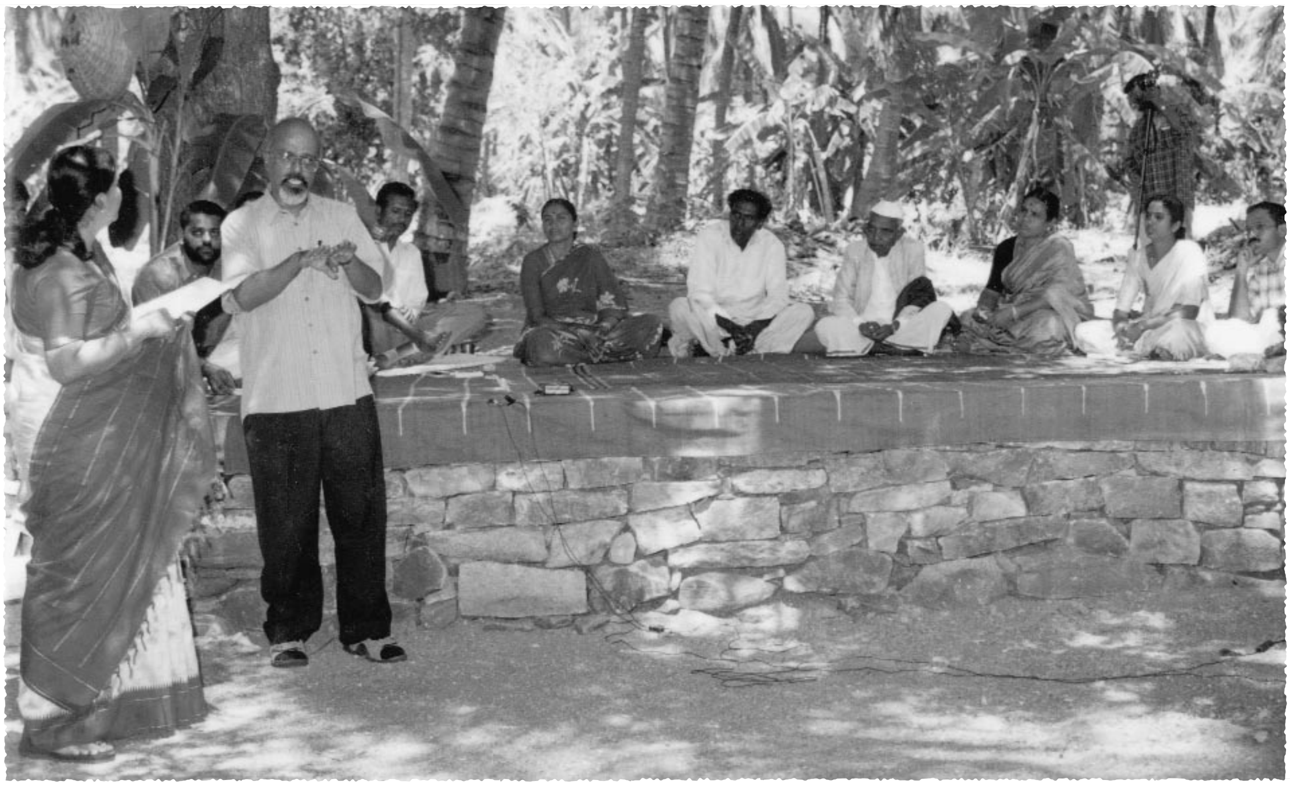
Dynamics and diversity: soil fertility and farming livelihoods in Africa: case studies from Ethiopia, Mali and Zimbabwe by Scoones I, (ed.). 2001. 256 p. ISBN 1 85383 820 9 GBP 16.95. Earthscan Publications Ltd, 120 Pentonville Road, London NI 9JN / earthinfo@earthscan.co.uk / www.earthscan.co.uk.



Ian Scoones is a well known expert in the field of soil fertility and small scale farming in Africa. With this new book on the subject he adds an important reference work to his list of publications. This book is based on research carried out by teams of researchers from Africa and Europe over three years in a range of contrasting locations. The research results add up to a new approach to looking at soil management issues in Africa, with significant implications for development policy and practice. The results suggest a more positive view of the prospects for sustainable agriculture in small-scale farming systems in Africa than the overridingly negative views of crisis and collapse that have dominated the policy debate. The research also points to the need for developing new technologies and management practices which are suited to the diversity of farmer needs and settings, when addressing the challenges of natural resource management. (WR)

Food for all: can hunger be halved? by Madeley J. 2001. 48 p. ISBN 18 7067 055 8 free or GBP 5.00. FAO. (Panos Report no 42). The Panos Institute, 9 White Lion Street, London N1 9PD, UK / www.panos.org.uk ; markc@panoslondon.org.uk.
This nice little booklet available free of charge from the Panos institute or downloadable, is a scream for action to the world's governments. Hungry people cannot wait another 15 years.

In 1996 the world's governments agreed to cut world hunger in half by the year 2015. But today there are still nearly 800 million people who go hungry every day. Over 140.000 people die from hunger related diseases each week. This report examines the reasons why we are not making more progress towards halving hunger. It outlines who the undernourished people of the world are, and where they live. It looks at the links between hunger and poverty, and examines the successes and failures of different kinds of agriculture in increasing food production to the levels needed. The effects of international agreements made in the World Trade Organisation and other fora on reducing hunger in the world today and how more progress can be made is also discussed.



Dr PK Ghosh of Dept Biotech, GoI, presents the results of government tests of GM crops. Photo: AgroIndia

Citizens' juries on GMOs and farming futures in India

Michel Pimbert, Tom Wakeford and PV Satheesh

Over the past quarter century a number of 'participatory' methods have been developed in an attempt to democratise policy-making. Some of these methods and processes include citizens' juries, neighbourhood forums, consensus conferences, scenario workshops, multi-criteria mapping, participatory rural appraisal, visioning exercises and deliberative polling. These methods have the potential to empower people to move beyond being passive recipients of development policies or users of externally-imposed technologies, to become active "makers and shapers" of the policies and technologies that affect their lives.

This article describes the use of some of these methods in enabling citizens to assess the pros and cons of using Genetically Modified Organisms (GMOs) in small scale farming, in India.

Citizens' Jury on GMOs, Karnataka

This citizens' jury was organised by ActionAid India and took place on a farm in a small village in the state of Karnataka, India. This dryland area of the Chitradurga district contains a high proportion of marginal farmers and landless peasants.

As it is the lives of small farmers that would be primarily affected by the introduction of GMOs, the jury was composed of fourteen small and marginal farmers, six men and eight women. They represented the variety of farming traditions, income levels and social groupings. The jury also included expert witnesses who presented evidence for and against GMOs and other participants and observers. Scientific Institutes, commercial biotechnology corporations (Monsanto), development NGOs, Farmers Unions and Government agencies were represented among them.

A multi-stakeholder panel ensured that the jury event was conducted in a trustworthy and fair manner. All deliberations were filmed and subsequently made publicly available ensure complete transparency.

The jury spent three to four days hearing information from 'witnesses' on the merits and limitations of GMOs. The subject under discussion was the possible future role of GMOs in the context of reducing rural poverty and promoting sustainable agriculture.

No to GMOs

Having heard four days of evidence, the jury gave its verdict on the question: Would you sow the new commercial (GMO) seeds proposed by the Indian Department of Biotechnology & Monsanto on your fields? The results were: 4 yes, 9 no, 1 invalid ballot paper (by secret ballot). The jury's rejection of the GMO seeds was not simply a negative response. It was supplemented by a list of actions that should be taken by the government and transnational corporations to get better acceptance for their new seeds.

- Microbes and beneficial insects should not be damaged. Also new seeds should not cause damage to animal populations and other environmental elements.
- They should be lawfully released only after extensive field trials for 5-10 years in which farmers shall be involved, not only in yield assessments, but in safety, environmental and other aspects.
- They should not damage the next crop that is grown on the same field or adjoining fields.
- The success of the new seeds should be judged not just under lab conditions, but also, on fields involving farmers.
- The technology must be easy to adapt.

Surmangala, a woman farmer, cross questions a witness about insect resistance to GM crops. Photo: AgroIndia

A proportion of the jury felt that there was no use of such technologies since they were inherently eco- unfriendly, and would destroy biodiversity. Others in the jury were ready to grow the new seeds so long as certificates from the concerned company were issued to protect them from any potential risk to their livelihood. Yet others felt that GM crops were OK, so long as it was kept to non-food crops.

The jury responded cautiously to the issue of increasing farmer confidence in multinational corporations (MNCs) and biotechnology:

- A proportion of the jury was afraid of any contact with MNCs, having heard about them in the context of WTO and patents. They felt that the powerful MNCs, which develop their seeds in laboratory conditions, could ultimately gain control over seeds and farmers' sovereignty.
- If the seeds fail for any reason, whether to do with the technology itself, or weather conditions, the MNCs should not only compensate for the loses, but also buy up the whole crop at double the price.

Citizens' Jury / Scenario Workshop on Food Futures for Andhra Pradesh

Prajateerpu, the citizens' jury on food and farming futures in Andhra Pradesh (A. P.), was another exercise in involving rural people in decisions that have a strong impact on their livelihoods. This participatory process was jointly organised and facilitated by the UK-based International Institute for Environment and Development (IIED) and the Institute of Development Studies (IDS) and the India-based Andhra Pradesh Coalition in Defence of Diversity, The University of Hyderabad, AP and the all-India National Biodiversity Strategy and Action Plan (NBSAP).

This citizens' jury was made up of small and marginal farmers, food processors and consumers. Reflecting the reality of rural Andhra Pradesh, the jury also included a large proportion of Dalit (untouchable caste) and indigenous (known in India as 'adivasi') people. Over two thirds of the jury members were women, reflecting the greater role women have in agricultural work. The jury members were presented with three different scenarios. Over a period of four days, they listened to and cross-questioned twelve witnesses including representatives of the Government of A.P., the Indian branch of the International Federation of Organic Agriculture Movements (IFOAM) and Syngenta, one of the world's largest biotechnology corporations. It was up to the jury to decide which of the three scenarios, or combination of elements from each, was most likely to provide them with the best opportunities to enhance their livelihoods, food security and environment twenty years from now.

Three visions for the future

Vision 1: Vision 2020.

This scenario was put forward by Andhra Pradesh's Chief Minister backed by a loan from the World Bank. It proposes to consolidate small farms and rapidly increase mechanisation and modernisation. Production enhancing technologies such as genetic modification will be introduced in farming and food processing, reducing the number of people on the land from 70% to 40% by 2020.

Vision 2:

An export-based cash crop model of organic production. This vision is based on proposals within IFOAM and the International Trade Centre (UNCTAD/WTO) for environmentally friendly farming linked to national and international markets. It is also increasingly driven by the demand of supermarkets in the North to have a cheap supply of organic produce and comply with new eco-labelling standards.

Vision 3:

Localised food systems. A future scenario based on increased self-reliance for rural communities, low external input agriculture, the re-localisation of food production, markets and local economies, -with long distance trade in goods that are surplus to production or not produced locally.

Here, too, the jury/scenario workshop process was overseen by a panel consisting of a variety of interest groups (donors, government, civil society organisations). It was presided over by a retired Chief Justice from the Supreme Court of India. The panel's role was to ensure that the entire process was carried out in a fair and unprejudiced way. As part of the methodology, media professionals were also involved in relaying information on the event to a larger audience.

Jury supports localised food systems

The key conclusions reached by the jury – their 'vision' – included a desire for:

- Food and farming for self reliance and community control over resources
- To maintain healthy soils, diverse crops, trees and livestock, and to build on our indigenous knowledge, practical skills and local institutions.

And opposition to:

- The proposed reduction of those making their livelihood from the land from 70%-40% in Andhra Pradesh
- Land consolidation and displacement of rural people
- GM Crops - including Vitamin A rice & Bt cotton
- Labour-displacing mechanisation
- Contract farming
- Loss of control over medicinal plants including their export

Some key lessons

a) The voices of small and marginal farmers can enter the policy process when appropriate methodologies are used as in the two cases mentioned. For example:

- putting the perceptions, priorities and judgement of ordinary farmers at centre stage,
- conducting the events in a rural setting : under a tamarind tree on a farm (Karnataka) and a the farm of a rural training centre (Andhra Pradesh),
- getting government bureaucrats, scientists and other expert witnesses to travel to farmers in order to present evidence on the pros and cons of new technologies,
- using television and video technology to ensure transparency and free circulation of information on the process and the outcomes

b) In both Karnataka and Andhra Pradesh, the jury process demonstrated the competence with which farmers, many of whom had not finished basic schooling, or were even illiterate, could discuss often highly technical issues to which they had no previous exposure, such as genetically engineered crops. They achieved this by carefully eliciting from each witness the information relevant to their livelihoods. Rather than attempting to build up a basic knowledge of genetics, they asked whether the 'new seeds', as they called them, could address their needs, such as returning organic matter to their soils, and reducing their susceptibility to rapidly changing market prices for their harvested produce.

c) As in the case of a controversial technology such as GMOs, a wider understanding of the inter-linkages between biotechnology, corporate control, and local power structures is more likely to be achieved by taking a scenario approach than by merely asking a jury to say yes or no to a particular technology. In Karnataka, the comparison was of two starkly different technological approaches to agriculture (or visions) – one based on GM seed and continued chemical use, the other on saved indigenous seeds, traditional technologies and organic methods. In the "Prajateerpu" example, the jury was able to compare and evaluate three contrasting whole scenarios, each being the logical product of a series of interdependent values, assumptions and predictions. GMOs were thus not taken and judged in isolation - they were perceived and evaluated as an integral part of a wider system or development model.

d) In a recent briefing paper on GM crops and the Third World, the UK Government's Overseas Development Institute condemned the "poorly informed arguments" that used "formulae, slogans and slick advertising". It called for greater research towards providing sound evidence on the risks and potential benefits of GM crops for the South. "The most pressing need", it concluded, "is for good information". Citizen juries, scenario workshops etc. clearly offer appropriate methodologies to address this information deficit. More fundamentally, these methods and approaches can help overcome the *current deficit in democracy in policy processes, science and technology.* At the very least this means moving beyond the rhetoric of "listening to the voices of

Brazilian small-scale farmers and poor consumers reject GMOs

The second citizen's jury on GMOs took place in Belem do Para, capital of the Amazonian State of Para, Brazil, in September 2001. 800 small-scale farmers, landless people and poor urban consumers attended the event, organised by ActionAid Brasil, FASE (national Brazilian NGO), Assema (associations of small farmers from Maranhão State), MST (land less movement), CUT (central of labour unions) and the municipality of Belem.

Before the event, the organisers chose 6 community-based associations (2 landless settlement associations, 2 rural workers' labour unions and 2 urban associations). These organisations provided the organisers with complete lists of membership. 4 members, 2 men and 2 women, were picked at random from these lists, in public and in the presence of the local press. Thus, 24 potential members for the jury were identified. The first activity of the jury was to select, at random, 7 members from this list for the jury (4 women and 3 men). After that, the judge, head of the Law faculty of the Federal University of Pará, read the case, which had been agreed upon by the prosecution and defence, prior to the hearing. This case presented a definition of GMOs, the scope of the jury – GM agricultural varieties tolerant to herbicides, insects, plant diseases and new nutritional qualities, and the questions that the members of the jury were suppose to answer: 1) Can GMOs address the problem of hunger? 2) Can GMOs improve the food security of small-scale farmers? 3) Is there enough evidence that GMOs do not threaten the environment? 4) Is there enough evidence that GMOs do not threaten food safety? 5) Is the process of liberalisation of tests and commercial use of GMOs democratic, transparent and careful enough?

After the presentation of the case, the prosecution and the defence lawyers made their first speeches, presenting the main arguments against and in favour of GMOs. The prosecutor was a lawyer from the municipality of Belem, and the defence lawyer was a researcher on biotechnology, from the Federal University of Pará. After the opening statements, the lawyers invited their witnesses, three each. Each witness gave a 20-minute long presentation, and was then cross-examined by the defending and prosecuting lawyers, the judge and the members of the jury. The witnesses of the prosecution were an economist - a specialist on patents and transnational corporations, a geneticist - professor at the University of São Paulo and a specialist on environmental matters, and an anthropologist - a specialist on rural sustainable development. The defence witnesses were two biotechnology researchers from EMBRAPA, the national agricultural research institute, and a professor from the Federal University of Paraíba - a specialist in biochemicals and a member of the national commission on biosafety.

After the presentations and cross-examination of the witnesses, the defence and prosecution made their closing arguments, after which the members of the jury went with the judge and an assistant to a closed room to proceed with the secret ballot on the 5 questions above. The members of the jury voted unanimously against GMOs with a clear NO to all five questions.

This event had various outcomes. The sentence itself has confirmed the position of the national campaign for a GMO-free Brazil, which states that GMOs threaten the environment, food safety and small-scale farming. But the main outcome is not the sentence itself, but the strong, new experience that these 800 poor people had, listening and learning about the very different opinions on GMOs for 2 days. These people, always excluded from the process of policy-making in issues that affect them very much, had the opportunity to access all the information and to decide about it via the members of the jury. Another outcome was the appropriation of the methodology. Several months after this event, some students from a very poor area of Maranhão State have organised a citizen's jury on GMOs in their schools!

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the poor" to actually planning, funding and acting more on the basis of the poor's own definitions of life and well being. It means taking their policy futures and visions of food and farming as starting points. Donors, and the think tanks they rely on, need to experiment more with initiatives such as those described here and re-orient their theory and practice accordingly.

e) The results of the jury had a significant impact in global media and lobbying arenas. However, the process has so far not been conducted over a long enough time-scale so as to bring pressure on national and state governments, donors and corporations that are significant forces in the lives of India's rural poor. Once citizens' juries reach their conclusions it is essential that appropriate intermediary individuals and channels exist to act between the jury and those with the power to create change. NGOs, federations of farmers' organisations and consumer organisations have a role to play and can use the findings of the juries for their campaigns and lobbying activities.

To sum up, the Karnataka citizens' jury on GMOs and "Prajateerpu" were both innovative attempts to include the genuinely poor and socially excluded into policy-formulation processes. Bringing perspectives of the developing world's farmers to national and global debates about the pros and cons of GM crops is based on a belief that rural people in the South have a democratic right, and sufficient knowledge, to judge the issue for themselves. The jury outcomes will hopefully encourage more public deliberation and pluralism in the framing and implementation of policies on poverty, food and agriculture in India, thus contributing to better democratic governance.

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http://www.actionaid.org/resources/resources.shtml
- More information on **Prajateerpu** at:
http://www.iied.org/agri/IIEDcitizenjuryAP1.html
http://www.ids.ac.uk/IDS/env/envnew.html
http://www.ddsindia.org/

Discussing genetic engineering with communal farmers in Zimbabwe

Zimbabwe is surrounded by countries (South Africa, Malawi, Zambia and Mozambique) where testing or commercial production of Bt cotton and/or Bt maize has already taken place. Zimbabwe-based seed companies - Monsanto, Pioneer and Pannar - are awaiting permission from the Zimbabwean Biosafety Board for Bt cotton and Bt maize field trails. For communal farmers, maize is the staple crop and the most common cash crop. As such, they should be able to make informed and reasoned choices about the introduction of GM crops, argue many NGOs. They emphasise that sharing information on what GE technology is, whether it is needed and the possible alternatives is important. The "impact assessment methodology of GE organisms on the livelihoods of resource-poor people", developed by ITDG (Intermediate Technology Development Group) is one such information-sharing initiative.

In Zimababwe, the assessment was carried out as a comparison between two technologies: IPM/IPPM (Integrated pest management and Integrated production and pest management) and genetically modified crops. The exercise consisted of six steps:

Step 1: Introduction of the programme, Group discussions on farming systems (community strengths and assessment of assets related to crop/animal production).
Step 2: First group information sharing on GM crops and Bt-maize. Second group: information sharing on IPM/IPPM.
Step 3: Farmers' response, questions and clarifications about the technologies
Step 4: Assessment of the technology (Bt-maize and IPM/IPPM) under the Sustainable Livelihoods Framework.
Step 5: Overall assessment by farmers.
Step 6: Feed back on the communication approach and process.

An interesting feature of this methodology was the use of drawings to explain genetic engineering to farmers who did not have an education in biology. This methodology helped farmers to get insight into the topic, and to ask questions like: "How does the Bt gene get expressed in the stalk and the leaves but not in the cob?", Are the Bt genes passed on to the progeny?", Which other insects die besides the stalk borer". Farmers also discussed aspects such as fertility requirements, weevil resistance, environmental impact etc. "What effect would it have on soil structure, and on the crops that are grown thereafter?" was another question asked. Farmers also raised their concerns about resistance build-up in pests. They were also keen to find out about the economics related to the price of Bt seed and the cost saving in pesticides.

Other important categories were health, religion and power-relations. Farmers wanted to know whether the toxin that kills maize stalk borers wouldn't also affect them in the long term, by eating the stalks and the cobs, by eating meat of animals fed on Bt-maize stalks. A strong feeling of powerlessness towards the seed sector/agribusiness was often mentioned. One farmer said: " if farmers see a variety that kills all insects, they will want it, because they don't understand the other factors". On which another remarked: "marketing companies don't give the full picture, for example Dieldrin, they just said how good it was, but said nothing about the human health effects or how to use it safely."

"We may be given seed, or sold it cheaply by companies for a while, but then the subsidy may be withdrawn and we've all lost the varieties we used to use".

Another farmer raised the issue of control mechanisms against contamination of their varieties: "we talked to our neighbours to try and reduce contamination by keeping the maize varieties separated from each other... but without by-laws we can't make decisions as a community on excluding varieties". Another remarked: "Even if there is a law against a variety, people may still want to grow that variety, Any law must be monitored for enforcement, otherwise it is pointless".

This exercise shows, once again, that farmers, given the chance, are perfectly capable of discussing technical issues related to GE and in making their choices.

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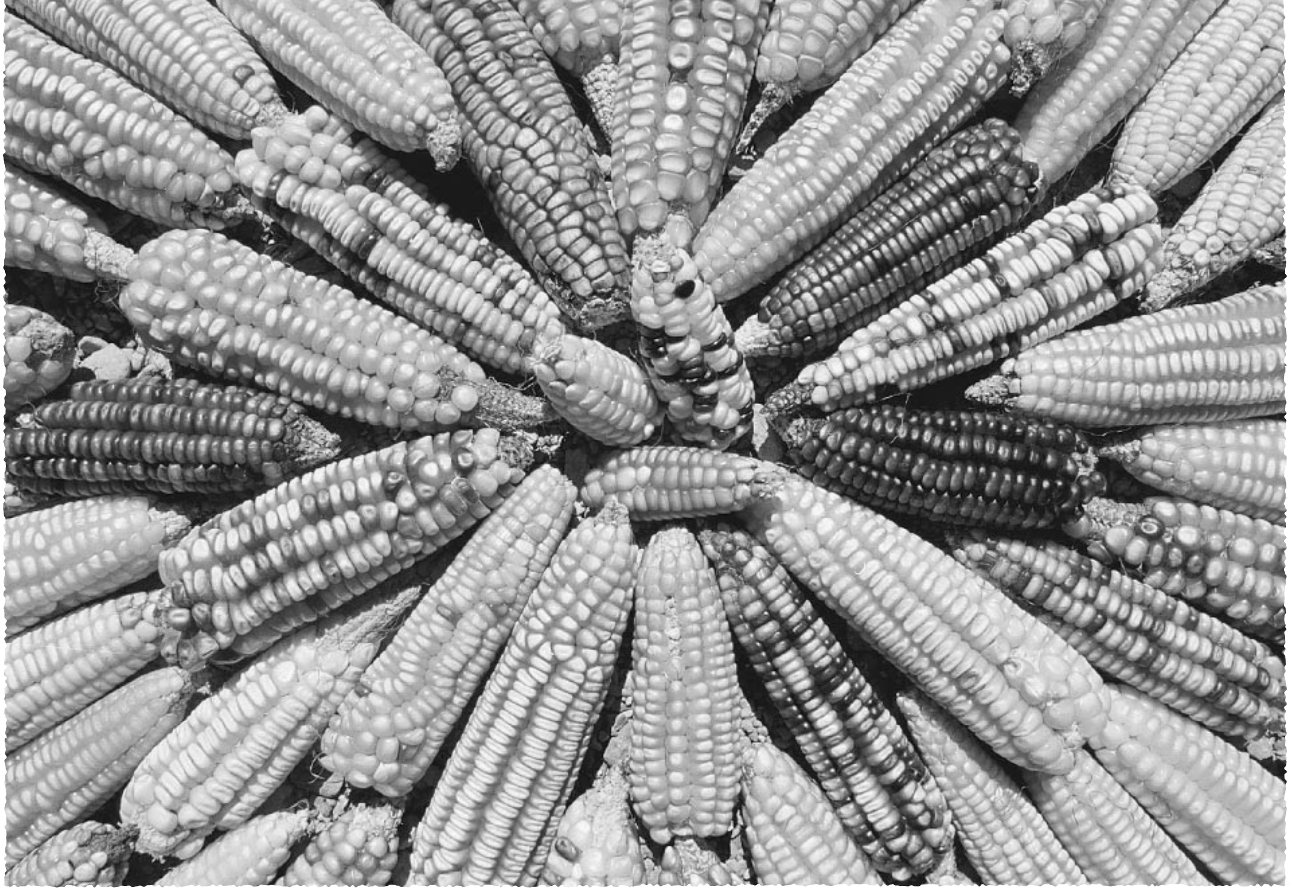

Can we afford to loose this diversity of maize? Photo: Greenpeace

Mexico, centre of diversity for maize, has been contaminated

Doreen Stabinsky and Niccolo' Sarno

The Mexican government, by means of its Intersecretarial Commission for Biosecurity and Genetically Modified Organisms (CIBIOGEM), announced research showing that 15 of 22 communities where maize seeds were tested this year were found to have been contaminated by GE maize. 3 - 10% of the maize seed tested contain genes from GE maize. Two communities showed even higher rates of contamination. Clearly many traditional maize fields in the region have been contaminated but authorities do not yet know the extent of the contamination.

GE varieties are not grown in Mexico but they are imported from the United States for feed and industrial use. The contamination was found in the rural Southern Mexican states of Oaxaca and Puebla, centres of origin and diversity of maize strains grown around the planet.

The magnitude of the problem in Oaxaca is large and the potential for contamination of neighbouring fields is a serious reality. While most maize pollen will fall within 500 meters of the crop field, transport of pollen over longer distances is possible. Bees can disperse pollen up to several miles; under unusual weather conditions, wind may carry pollen up to hundreds of kilometres.

Why care about crop genetic contamination and genetic diversity?

Jack Harlan, the famous botanist, has noted that genetic diversity "stands between us and catastrophic starvation on a scale we cannot imagine." According to the UN Food and Agriculture Organization (FAO), 75% of our crop genetic diversity has been lost within the last one hundred years. Loss of genetic diversity is epidemic worldwide; it is termed genetic erosion.

Because of the continued need of modern breeding programmes for new characteristics and genes, crop genetic conservationists concern themselves with preserving wild relatives of crop plants, as well as those local varieties of crops that small-scale agriculturalists grow in the many diverse cropping system habitats found throughout the world. Often these wild relatives and landraces, as local varieties are often called, are found in small populations, making conservation difficult.

Crop diversity is essential to the future of our agricultural systems. But it is also an essential component of our cultures. Consider the many varieties of potatoes grown by peoples living in the Andes, or the wide variety of eggplants, squashes and gourds used throughout Asia. Preservation of crop diversity is also a means of preserving elements of cultural diversity.

Maize under threat

Lack of genetic diversity can be linked to many of the major crop epidemics in human history. For example, in 1970, the maize crop in the southern United States was attacked by a disease called Southern cornleaf blight. Because of genetic uniformity among the maize varieties grown across the US, the loss to this disease was great – in total the US lost 15% of its harvest – at the time worth around US$1 billion. Loss of genetic diversity due to loss of cultivated varieties – genetic erosion – is happening in maize as well as in all our other major and minor crop plants. According to Genetic Resources Action International "only 20% of local maize varieties reported in Mexico in 1930 are still known."

Currently maize resources are under threat in two primary ways: the displacement of local varieties and the contamination of teosinte (see Box next page) by hybrid maizes. These threats are likely to increase in magnitude with genetically engineered maize.

Consequences of transgene contamination for the teosintes

Because crop plants and their wild relatives are closely related evolutionarily, they are often able to interbreed. This means that there is the potential for genetically engineered crops to hybridise with wild relatives and for the offspring to be viable. Most scientists agree that teosintes and cultivated maize interbreed. The offspring of a maize-teosinte cross may be more or less successful than the wild parent; either result could have negative long-term consequences for diversity conservation.

One problematic result of a maize-teosinte cross would be if the crop-wild relative hybrids were more successful in some way. Certainly crops engineered to be tolerant to pests and their offspring would have an advantage over wild relatives that had no such novel gene. Scientists have raised the concern that such hybrids could become problem weeds, creating a nuisance for farmers and also out-competing the wild relatives in the non-agricultural environment.

A second concern raised by scientists is the potential for crop-to-wild gene flow to lead to the extinction of rare species. This extinction can happen in two ways – through processes known as swamping and outbreeding depression. In swamping, the population of wild plants is continually exposed to the crop, and hybrids are continually forming. If the hybrids are viable and continue to mate with the wild relative, eventually the genetic integrity of the wild relative is swamped by the continual influx of genes from the cultivated plant. Small populations and rare species can be lost. The second process is known as outbreeding depression, where there is detrimental gene flow, resulting in offspring that are less fit. Eventually the population disappears. According to Ellstrand et al. (1999), "both phenomena can lead to extinction rapidly."

Most of the small populations of wild teosintes are already under serious threat. Contamination from an escaped transgene could push them over the edge.

GE maize poses broader ecological threats as well

Most probably, the contaminating gene found in Mexican landraces is a form of the Bt gene, which produces a pesticide toxic to many species of lepidopteran insects. There has been a huge controversy in the United States and other countries over the use of Bt genes primarily because of the potential ecological impacts associated with plants producing the pesticide. These impacts include harm to non-target organisms, including species such as the monarch butterfly and the green lacewing, a beneficial predatory insect; and impacts on soil biota through discharge of Bt from maize roots.

The diverse ecological risks associated with Bt maize are troubling if one considers that the contamination of maize landraces could be long lasting. As noted above, the gene will almost certainly transfer to the landraces it contaminates; farmers and natural selection forces will help to maintain populations containing the gene. If the gene becomes widespread in landrace populations, as it appears to be currently, the ecological damage will be impossible to prevent or mitigate.

Greenpeace believes that the only way ahead is for the Mexican government to implement an emergency plan that should include the following steps:

- Undertake immediately a rapid assessment of the scope and magnitude of the contamination in Mexico and the GE varieties involved.
- Determine the source of the contamination.
- Declare an immediate halt to the importation of GE maize.
- Develop and implement immediately a de-contamination plan.
- Establish quickly national legislation and regulations to guarantee that this contamination will not occur again.
- Investigate the legal responsibilities of the governmental authorities that allowed the contamination to take place.
- File legal action on behalf of the affected communities against the companies responsible for production and dissemination of GE maize.

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In Mexico, teosinte, the closest wild relative of cultivated maize, is found growing from Chihuahua to Oaxaca. In addition to teosinte, a large store of maize diversity exists in the multitude of landraces – local cultivated varieties – grown throughout Mexico and other maize growing countries in Central and South America. In Mexico, the thousands of landraces of maize are called criollo maize.

The many varieties have different growing characteristics suited for changing climate conditions. In Chihuahua, Mexico, the fast growing variety Apachito is planted when the rains are delayed. Coloured varieties correlate with varying maturation periods. Blue and red pigments in maize stalks help maize varieties warm up quickly on cool mornings. This makes them especially suitable to be planted earlier in the year. A fast maturing variety in Colombia was given the name matahambre, which translates as 'hunger killer'.

Many small farmers depend on maize for food and money.
Photo: Bert Lof

Plants protecting other plants
An alternative to pest-resistant GM crops

Luis Gomero Osorio

One of the justifications for the development of GM crops is to build-in resistance to insects and diseases, which in turn is expected to reduce the negative impact of agrochemicals on health and the environment. Of the total area planted to GM crops worldwide in the year 2000, 19% represent insect-resistant crops and 7% occupy crops combining both herbicide and insect resistance. Herbicide-tolerant crops form the majority as they fit very well in the strategy of large agrochemical companies like Monsanto that sell the seeds with the chemical inputs such as glyphosate in one package.

Research on genetic modification that is taking place in the Andean countries is predominantly focusing on plant health: herbicide-tolerant cotton and soya, resistance to Lepidopteros in cotton, resistance to nematodes in potatoes, resistance to white leaf in rice etc. Significant financial and human resources are being invested in research that will eventually bring benefits only to large-scale industrialised agriculture. The majority of Andean farmers will not benefit from the introduction of these GM varieties.

Biodiversity as a source for plant protection

In agriculture, the fight against harmful organisms is essential, and it is therefore necessary to develop appropriate technologies to regulate and control pests. Environmentally-friendly, biological options that do not make use of Genetic Modification do exist. These options are based on natural crop protection approaches that make use of the diversity found in nature itself. Some institutions are already investigating and promoting these non-chemical and non-GM options, providing excellent and competitive alternatives for pest management.

Preparation of plant-based pesticides on the farm. Photo: Bert Lof

The challenge in natural crop protection is to have simple and low-cost technologies that are able to regulate pests and diseases and to reduce or completely avoid the problem of contamination by agrochemicals. One such natural crop protection approach is based on the use of plants with biological control properties. Plant types with insecticidal properties that can be used in curative form are equally important. At the moment successful experiences with this type of plant products exist and some of them are even available on the market.

Peru has a great potential of plants that have these properties, but research programmes to validate the technical and ecological benefits of these plants are required. Until now, the research efforts for seeking alternatives to chemical inputs have been very limited. A review of research indicated that over the past 40 years, 90% of research has been related to the management of chemical inputs rather than in finding alternative options.

Plants that protect other plants

Within the framework of ecological pest management, an important and promising set of technologies is being provided by making use of plants as biological control agents. An inventory made in Peru indicated the existance of more than 300 plant species - both native and imported - that are useful for the management of populations of harmful insects. 14 possible applications emerge from this inventory, of which the most important are insecticide, repellent, nematicide and fungicide, indicating that ecological pest management has a great potential for further development.

So far, most of the research work has been focused on the rescue and technical validation of a series of these plants. Many plants have demonstrated a certain level of efficiency in regulating pests and diseases, and have been proven on the basis of statistically-sound research. E.g. extracts from a wild forest plant named "cardo santo" (*Argemone sufusiformis*) was found to be an effective regulator of *Spodoptera frugiperda* populations (army worm) in their larvae stage; "cuncuno" (*Vallesia glabra*) and "laurel" (*Nerium oleander*) demonstrated to be efficient fungicides, especially to control *Fusarium solani* and *Rhizoctonia solani*; in some zones of Peru, plants like "cola de caballo" (*Equisetum sp.*) are being used to regulate the presence of "Rancha" (*Phytophthora infestans*) in potatoes. The high silicium content of the plant helps in neutralising the multiplication of the fungus.

Similarly, research is being done on the identification of plants with properties for controlling nematodes such as "crotolaria" (*Crotolaria sp.*) and – again – "cardo santo". Furthermore, the oil of various plants helps to fight pests that cause damage to grain in storage. Research demonstrates that with small investments, the damage of pests in the warehouses can be mitigated.

The use of extracts of the wild coastal plant "tonuz" (*Pluchea chingoyo*) has shown to be of great potential to control "polilla" (*Phthorimaea operculella*) in stored potatoes, a plague that inflicts great economic damage to Andean farmers. Also the use of eucalyptus (*Eucalipthus sp.*), muña (*Minthostachis spp.*) and lantana (*Lantana camara*) has been reported by the International Potato Centre (CIP) as being capable of controlling pest attacks on stored potatoes.

Many more experiences exist. Although the steps towards more ecological pest management are just being taken, alternative and competitive approaches on the basis of the diversity of plant species will be found in the future.

Plants with a market potential

Large-scale use of plant-based biological control is not yet taking place. The existing experiences are mainly related to the traditional use by farmers, cases that are unfortunately not very well documented. Nevertheless, the existence of four plants widely-known and studied for their biological control properties represent an alternative for pest control. Their characteristics and potential for commercial application are as follows:

a. Kumo (*Lonchocarpaus nicou L*)

Kumo is widely distributed in the forests of Peru where it grows spontaneously as a wild plant. In other zones of the Amazon forest it is also known as *barbasco*. This plant contains in its roots a well-known toxic substance, locally known as *rotenona.* Native farmers use it to for pest control and for fishing. Before the 1950s this plant was harvested and exported, but after the introduction of synthetic pesticides its use has gradually declined.

Plant extracts used in pest control. Photo: Bert Lof

Recently, a private company has again taken up the collection of this plant and has begun exporting it, mainly to the U.S.A. On the local market it is now being sold as a bio-pesticide with the commercial name "Agrosan". At the moment, a small plant for the processing of Kumo is being set-up in the Apurimac valley as part of a United Nations programme to promote alternatives to coca growing. Similarly, another company is offering rotenona in a liquid formula. Kumo controls a good number of pests and therefore has a great potential for agroecological agriculture.

b. Sabadilla *(Schoenocaulon officinale*)

This is a plant with insecticidal properties that is mainly known in Venezuela, Colombia and Mexico. In Peru, it is supposed to have been introduced before the 1950s in order to control skin infections as it kills fleas, lice and mites. After the introduction of DDT in the country, this plant was used less and less, and, today, its insecticidal qualities are hardly known to young farmers and agricultural workers. Farmers indicate that the plant is disappearing because of burning and is only to be found in very degraded and hilly zones.

Sabadilla is a perennial plant belonging to the family of the irises. It is the mature seeds that have the insecticidal properties. The main pests it controls are fleas, fall army worms, corn borers, lice, mites, thrips, leaf bugs and cockroaches (Gaby Stoll, 2000).

c. *Neem* (*Azadirachta indica*)

The neem tree, pertaining to the Meliaceae family, originates from Southeast Asia and is very well known world-wide because of its biological control properties. Though the tree was probably brought to Peru a long time ago, it is only recently that a number of institutions like the Network for Action on Alternatives to the use of Agro-chemicals (RAAA), have started distributing seeds on a larger scale. At the moment, around 3.000 seedlings have been planted in various areas.

Neem is cultivated in many regions of Africa, Australia and Latin America, because it adapts very well to the soils and semi-arid climates in tropical and sub-tropical countries. It shows a good tolerance to dry conditions and soil salinity. Its medicinal properties present a potential for treating animals and humans.

The specific use of neem in India for natural crop protection, has extended almost world-wide over the past number of years, including a great number of countries where it is being sold commercially. The production of insecticide from the neem seeds can be done in a relatively simple, artisanal way or else as an industrial process.

Studies indicate that the active substances of the neem seed (Azadirachtin, Salanin, Nimbin, Nimbidin, Meliantrol, etc.) have repellent effects. Upon ingestion, they have a very special effect on the metamorphosis of insects, preventing their growth and development. These substances are not toxic to human beings, mammals, birds, reptiles and fish. Applied in the indicated concentrations they do not affect the beneficial flora or fauna in the cultivated fields.

d. Paradise tree (*Melia azedarach*)

This is a tree that grows in wild form in Peru. It is a close relative of the neem. It contains contact toxins that can serve as an insecticide, repellent, and growth inhibitor. RAAA has made investigations to demonstrate their effectiveness in the control of fall army worms with satisfactory results. In Cuba there is already some experience in making use of the insecticidal properties of the Paradise tree. A commercial product on the basis of melia is available under the name Melitox. The seeds of this tree can also be processed in the same way as neem seeds.

Conclusion

Biological Control represents a concrete alternative to the use of GM crops, because it saves and strengthens the ecological balance that existed before the use of agrochemicals. This control method diminishes the dependency of local farmers on external inputs like pesticides, thus allowing for healthier living and working conditions.

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Organic Cotton Production
an alternative to GM Cotton for small farmers?

GM cotton is unlikely to have much appeal to small-scale cotton farmers. Photo: Coen Reijntjes

Dorothy Myers

Global cotton production has tripled (to around 20 million tonnes) since the 1930s largely due to the intensive use of synthetic chemicals; irrigation and higher-yielding varieties have also played their part. Large quantities of the most toxic pesticides are used on the cotton crop - with associated health and environmental problems, especially in developing countries. Regulatory systems are weak or are not enforced; farmers are not adequately informed of the dangers and lack the necessary skills and equipment to protect themselves and their families. Recent NGO research in Benin has revealed many poisonings and deaths related to the use of the highly toxic pesticide, endosulfan.

GM cotton production

By 2000, some 5.3 million hectares of genetically modified (GM) cotton were grown, representing 16% of the total cotton area planted worldwide. It is grown commercially in Argentina, Australia, China, South Africa and the USA. There are three main types of GM cotton: herbicide tolerant (tolerant to glyphosate and bromoxynil – 2.1 million ha), insect resistant (with the *Bacillus thuringiensis -Bt-* toxin genes inserted – 1.5 million ha) and a third type which combines both attributes (1.7 million ha). Concerns about the increasingly widespread use of this technology abound. Predicted reductions in herbicide use appear not to have occurred and transfer of genes to related wild species seems inevitable. There are also concerns about the development of resistance to Bt. Strategies are in place to prevent this happening but questions have arisen about their effectiveness and enforcement. Moreover, GM cotton is unlikely to have much appeal to small-scale cotton farmers in the South – mainly for economic reasons. For example, GM cotton is sold as a package that includes the herbicide which the cotton is engineered to tolerate – usually glyphosate. Farmers are also required to buy new seed each season contrary to their customary seed saving practices. GM seed is more expensive than conventional seed since a 'technology fee' is included in the price.

Alternative cotton production

Concerns about costs and the detrimental effects on health and the environment of the high usage of synthetic pesticides on cotton have persuaded many small-scale farmers to seek alternatives where opportunities exist. Expanding interest on the part of Northern consumers and established verifiable regulatory systems for organic production such as the IFOAM Basic Standards (see p.12) have stimulated interest in the development of projects in many countries. Organic cotton production started in Turkey and the USA in the early 1990s. Other projects followed throughout the last decade in South Asia, Africa and Latin America.

Certified organic cotton fibre is currently produced in widely varying production systems in 12 countries. Global production of organic cotton was about 8000 tonnes in 1997 and indications are that it has stayed stable at that level since then.

In most of the organic cotton projects involving small-scale farmers there has been significant involvement of outsiders. Projects have been initiated and supported by a variety of actors including private companies (eg. Remei, Verner Frang, Bo Weevil), development cooperation agencies, and NGOs (PAN-UK, for example). Knowledge of marketing practices and potential markets is often in short supply, when projects are not directly linked to companies that buy the output.Financial support is also needed to meet the costs of organic certification. A good level of technical support has been a feature of many projects and is essential in the early stages of transition to organic when decreases in output may occur.

As is to be expected, a range of factors seems to determine the success, or otherwise, of organic cotton projects including project structures, management, agronomic back-up and expertise, market conditions and access. The key factor is the motivation of farmers which, especially for small farmers in Africa, for example, appears to be determined by economic reasons first and foremost. With the collapse in recent years of state extension services, the level of support available within projects to help convert to organic systems has also proved to be highly significant and is much appreciated by farmers.

Finding local solutions

At the technical level, organic cotton is a product of an organic farming system, which relies on crop rotation, organic fertilisation and on non-synthetic chemical pest control methods. More specific technical details of production systems are site-specific and are determined by local conditions. In Benin, for example, a palm oil tree residue is used as fertiliser, in Uganda a species of black ant is used for pest control, and in Senegal and elsewhere neem extract is used for pest control. In addition to cotton, such integrated systems produce other crops, which can also generate income and should be accounted for when assessing profitability.

In general, organic systems produce less than conventional systems, but this is compensated through savings on inputs, payment of premiums, and perceived improvements in health for people, their animals and their environment. In Zimbabwe, for example, even though yields were lower in organic than in conventional cotton production systems, profits were higher even for the poorest farmers. The approach was highly valued by AIDS widows as reported in an article of the LEISA Magazine (Vol. 17.1, p.28). Differences in results depend on whether significant amounts of synthetic chemicals have been used in the previous production system and on the role and position of cotton in the overall production system. The conversion period is obviously longer where large quantities of chemicals have been used previously.

In Senegal, the number of women participating in the project in Koussanar is increasing steadily. In the past they have been unable to grow cotton because of lack of access to credit for inputs. People who are normally excluded from cash crop production within input-based conventional systems are able to participate in organic systems because no cash investment is called for up-front.

Experiences from Benin and Senegal

Work on sustainable alternatives to pesticide-dependent agriculture at the Pesticides Action Network UK (PAN UK) has focused on promotion and support for organic cotton production with partners in Senegal and Benin. Benin is highly dependent on its cotton crop for export, and at the domestic level cotton is the main cash crop for many farmers. Crop protection in the conventional cotton sector relies entirely on chemical pesticides. The Beninese NGO, OBEPAB, started working on organic agriculture in 1995 when a group of farmers from Mangassa in the Djudja district of Benin approached OBEPAB for help. The farmers had become dissatisfied with the conventional production system. Their profits were being eroded through increased costs of inputs and they were concerned about the lack of openness in the state system – especially regarding payments for their cotton crop. Farmers had become aware of the serious problems related to the pesticides that they were called upon to use.

The number of farmers involved in organic cotton production has increased steadily over the years, from about 100 initially to over 200 now. Kitche Denis is one of the Mangassa farmers who converted to organic. He described the situation in the following way:

"We used chemicals on our cotton crop and had higher yields than now, but we were often sick and had to spend some of the money we earned on medicines. After harvesting groundnuts this season, I grew cotton without any chemical fertiliser or pesticides. We used palm oil cake, ash, and cattle manure as fertiliser and put the organic matter back into the soil through the cotton leaves, which fall early. We treated the pests with extracts of neem, crushed papaya leaves, cow urine and garlic. There are ten in my family and we all work in the fields, sometimes with extra help. The women do the sowing, weeding and harvesting. And with organic agriculture it is safe for them to be in the fields with the children because the natural sprays do not harm us.

We are now in our fourth season of organic cotton production and yields are increasing year by year. My message to other farmers is that we should rely on ourselves instead of depending on others. Our neighbours admire our village and want to become like us and the number of farmers in the project is increasing each year."

More farmers join

PAN UK is currently involved with partners in research covering all the African organic cotton projects. Results are expected in early 2002. Country reports indicate that farmers join and decide to stay in the organic system, not only because of the financial, health and environmental benefits. Their interest also has to do with being paid on time, not becoming indebted, and having a good level of support. Farmers have also expressed the view that their knowledge and experience is valued, which in turn generates greater confidence. It is vital that information and experiences generated by the projects is widely shared in order to expand the take-up of organic agriculture and to build a credible alternative to conventional production which may in future be increasingly dominated by GM crops.

However, the rapid spread of GM cotton could pose a threat for organic cotton producers as the Basic Standards for Organic Agriculture prohibit the use of GM varieties. Where organic and conventional cotton are grown side by side, contamination could be an issue. Organic cotton farmers are accustomed to planting with a 'safe' distance between their organic fields and the conventional fields of their neighbours to avoid spray contamination. The introduction of GM cotton reinforces this requirement and probably would require greater distances. To date, most small-scale organic cotton farmers are not faced with this problem – but that could change in the future.

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Genetically modified soybeans
Blessing or curse for Brazilian agriculture?

Jean Marc von der Weid and José Maria Tardin

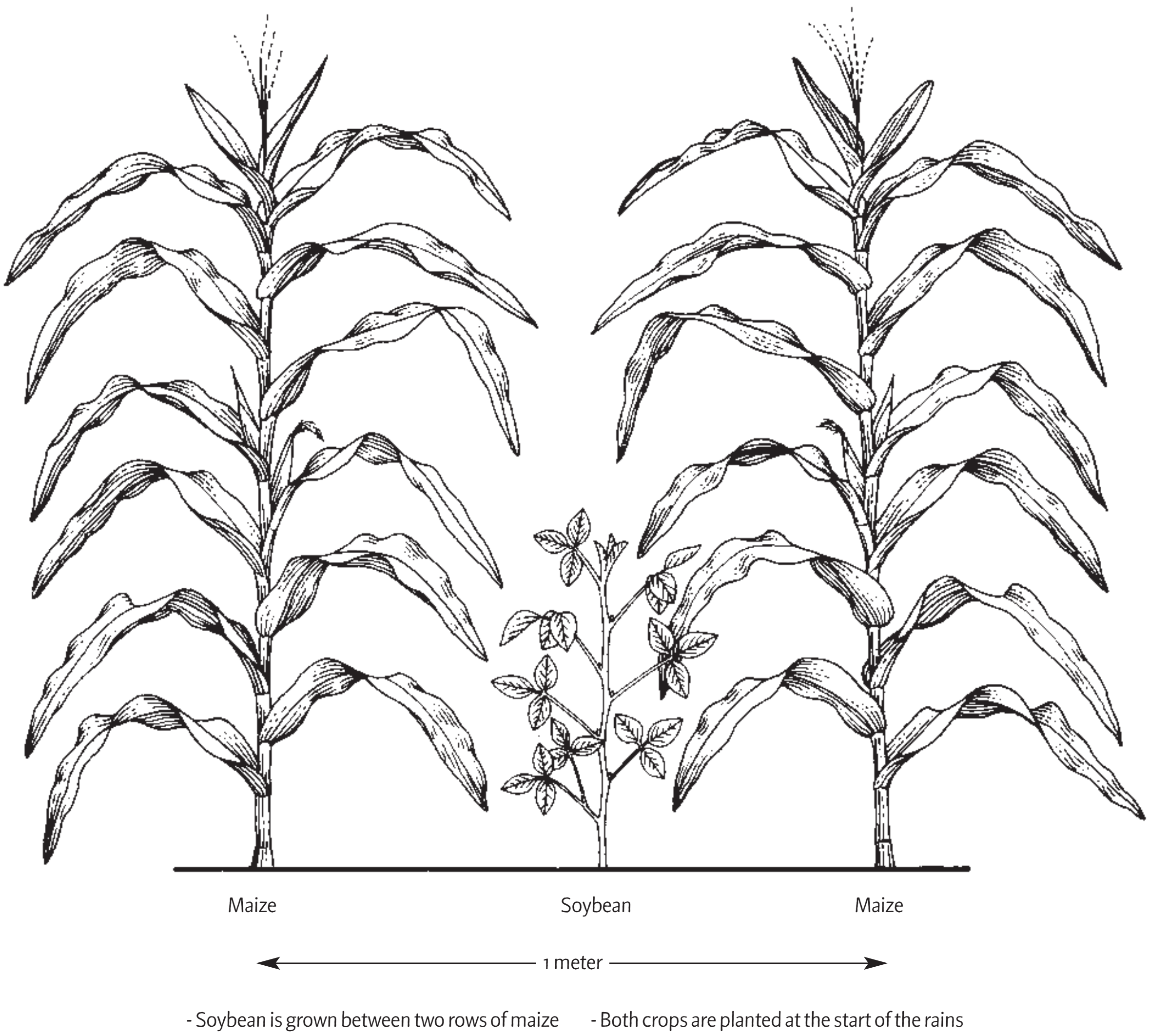
Brazil is the "last of the big dominoes" in the soybean market still resisting the GM onslaught. *"If Brazil legalizes biotech production"*, says Bob Callanan, a spokesman for the American Soybean Association, *"Europe and Asia would have almost nowhere to turn for adequate supplies of non-biotech soybeans"*. The United States, Brazil and Argentina account for about 90% of soybean exports with Brazil occupying 26.4% of grain, 24.8% of soybean meal and 16.2% of soybean oil exports worldwide. The demand for non-biotech soybean has grown to 25% of the EU market, 44% of which is supplied by Brazil (Pelaez and Schimidt, 2001). The Brazilian anti-GM position is therefore decisive for the future of GM agriculture as a whole, for as Callanan says, *"if that (Brazil) goes, it's all gone"*.

Having this picture in mind Brazilians have to decide where their strategic interests lie. According to the Brazilian government, the transnational corporations like Monsanto and Syngenta and the big soybean producers, the country will lose markets if it lags behind in biotechnological improvements in soybean production. Nevertheless, sober assessments of agricultural performances, costs and market opportunities dismiss this position as completely unreal. This article shows that Brazil is doing well without GM soybean, and what's more, that agroecological soybean production is a viable and competitive option for many small-scale farmers in Brazil

Conventional non-GM soybean production

Over the past 30 years soybean production has developed enormously in Brazil, with increases in both yields and area planted. The most spectacular growth has been in the state of Mato Grosso and the Cerrado area of central Brazil. Here soybean yields have more than doubled, whereas harvested areas have increased about tenfold. Given the relatively low cost of land clearing in Brazil, it is likely that soybean production will continue to increase in the years to come.

During this period, soybean production systems have been able to reach this level of high performance with reduced costs



Intercropping - one feature of the agroecological system of soya production (diagram from "A farmer's primer")

because of strong inputs from public research. Conventional genetic improvement has permitted farmers in various ecosystems to choose from around 170 varieties. In addition, the widespread adoption of nitrogen-fixing bacteria (NFB) eliminated the use of expensive nitrogen fertilizers. Moreover, the major pest threat to soybean production in Brazil, the *Anticarsia gemmatalis* worm, is controlled with a cheap biological agent, *Baculovirus anticarsia*.

Considerable reduction of Soybean production costs have also been due to the fact that at least 30% of the seeds used are produced by the farmers themselves. More recently conventional soybean farmers have very rapidly adopted less costly direct sowing, no till methods. In this system herbicides are intensively applied to suppress weed infestation resulting in heavy leaching of residual chemicals.

Comparing GM to non-GM soybean

The question to be answered is a simple one: does GM soybean have enough advantages to compensate for the risks of adverse impacts? If we compare yields of Brazilian non-GM soybean to USA yields (50% planted to GM soybean), the latter attained 2,560 kg/ha in 2000/01, and the former 2,710 kg/ha. In the 5-year period since the introduction of GM soybean in the USA the average yield was 2,520 kg/ha. compared to 2,400 kg/ha. in Brazil (Pelaez and Schimidt, 2001). Even though the USA has increased its acreage of GM soybean drastically in this 5-year period, the figures indicate that the yields of non-GM soybean in Brazil have increased faster than soybean yields in the USA with GM varieties.

Production costs are found to be higher for GM soybeans. In 1998/99 GM soybeans cost 611.70 US$/ha in Illinois, USA, whereas conventional soybeans cost 373.80 US$/ha in Mato Grosso, Brazil – a marked difference to GM soybeans!

Theoretical calculations on what GM soybeans would cost in Brazil also showed a disadvantage against the conventional product. Admitting industry claims of 30% herbicide reduction as true, GM soybeans would still cost 24.75 US$/ha more than conventional soybeans. Costs of GM seeds (76.50 US$/ha) clearly outweigh herbicide costs reduction.

This comparison can be taken further by looking at the export markets to see where Brazilian interests reside. With the increasing demand for non-GM soybeans from Europe, Brazilian exports have soared from 11 million tons in 1999 to 14 million tons in 2000, whilst US exports have stagnated. Moreover, non-GM soybeans have got a premium of 11 US$/ton, whereas prices for biotech products have dropped (Pelaez and Schimidt, 2001).

Apart from economic concerns, there are also environmental concerns. Scientists have warned against the intensive use of herbicides as these chemicals can have harmful effects on soil bacteria. As research in the USA indicates, decreased nitrogen fixation is a likely explanation for the 5-10% yield drag of RR GM soybeans when compared to otherwise similar conventional varieties (Benbrook, 2001). This negative impact will be far more pronounced in Brazil as varietal improvement has been geared to increase response to NFB (Nitrogen Fixing Bacteria). If GM soybean has negative impacts on NFB, then the losses incurred by Brazilian farmers could be substantial, as the gain in terms of reduced nitrogen fertilizers amount to 1.8 billion dollars annually (Franco and Baldani, 1999).

With all these clear advantages for non-GM soybeans why have Brazilian farmers in the southern state of Rio Grande do Sul taken the risk of smuggling GM soybean seeds from Argentina? According to some big soybean producers it is a supposed benefit to farmers of 14.00 US$/ha by using GM soybean seeds. But, in fact, this claim is clearly untrue considering that the Brazilian farmers are getting their smuggled seeds at 16.40 US$ per bag whereas the real cost of a bag is around 57,40 US$. And this is only possible because Monsanto has chosen not to enforce its prohibition on the re-sale of GM soybean seeds on farmers in Argentina, a tactical move to facilitate GM acceptance both in that country and in Brazil.

The agroecological alternative

In southern Brazil, Agroecological soybean production is being developed as part of its family-farmer programme by AS-PTA (a Brazilian NGO) and the Farmers' Forum for the Southern Paraná Regional Development (see LEISA 17.03, 23-25pp). It is based on direct sowing, no-till using green manure varieties as cover crops and weed control based on mechanical/ hand weeding. It is reported to have minimum soil losses, minimal losses from leaching, and no soil, food nor water contamination.

If we compare agroecological soybean production with conventional systems in Brazil the advantages are astounding. Studies made by AS-PTA on the property of the Bischoff family - a family from the southern state of Paraná experimenting with agroecological systems - indicate a yield of 2,677 kg/ha from the soybean plot for the agricultural year 2000/01, whilst production costs were 240.95 US$/ha. Prices for conventional and organic soybeans also differed significantly, 17.20 US$ compared to 24.60 US$ per 60kg bag of grain. The Bischoffs who were testing the new agroecological alternatives for soybean production on a 2.4 ha plot are increasing the acreage by 300% for the 2001/02 season. In the nearby southeastern Paraná region agroecological soybean production is already a major economic alternative for family farmers, with nearly 400 of them involved in this activity since 1995.

How can such extreme cost differences between GM (USA), conventional (Mato Grosso, Brazil) and agroecological (Bischoff) soybean productions be explained?

The Bischoffs noticed that weed infestations have dropped by 50% in 4 years with continuous agroecological practices in their bean and maize plots. They expect this to be the case also in their soybean plots, further reducing their production costs in comparison to chemical systems. The Bishoffs do not use any chemicals in their system, adopting crop rotations, green manuring and biofertilizers produced on the farm. No pesticides or fungicides are used and the Bischoffs attribute this to crop rotations and the conservation of natural vegetation on the borders of the plots, which harbour predators of pests. They also use low doses of lime to correct soil acidity.

Around 10,000 family farmers in this region are involved in intensive experimentation on various agroecologial practices, particularly in soil management, traditional seed improvement and agroforestry. The Bishoffs, like all participants in this programme, have small holdings with diversified cropping systems, including beans, maize, soybeans, potatoes, erva mate (a kind of Brazilian tea) etc.

In the light of the figures presented above, we can conclude, beyond any doubt, that agroecological soybean production is competitive with both conventional and GM cropping systems, without the harmful impacts of the former and the apparent risks of the latter. Wider application of these experiments depends more on enabling public policies, mostly related to credit, rural extension and participatory research.

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The push pull system – a less risky, less expensive and sustainable option for pest control Photo: Bert Lof

The Push-Pull system
a viable alternative to Bt maize

Flemming Nielsen

In early 2000, a five-year test programme with genetically engineered Bt maize was initiated in Kenya. The aim of this programme is to reduce the considerable damage of stemborer larvae that attack the leaves and stems of maize plants resulting in yield losses of 15 - 40% in East Africa. The recommended practise today for stemborer control is the use of chemical pesticides. Not only can the farmers hardly afford these expensive chemicals, these chemicals also cause environmental and health problems. It is evident that alternative solutions to suppress these pests are badly needed.

Although Bt maize is being promoted rather aggressively at present, it is certainly not the only option. Promising organic alternatives have been developed. One of them is the push-pull system that relies on natural repellent and trapplants. The system has passed the trial phase successfully and is now being promoted by the national extension system in Kenya. Not only does the push-pull system address the stemborer problem – it also suppresses the noxious witchweed (*Striga hermonthica*) that causes further yield losses of 10-20%.

Background

Stemborers are larvae of moths such as *Noctuid Busseola fusca*. In Africa four indigenous species of stemborer are significant pests in grains. They feed on natural grasses and used to be kept in check by natural enemies like the wasp *Cotesia sesamiae*. However, this balanced eco-system was disturbed when maize was brought into Africa about 100 years ago. Maize had little resistance to the African stemborers. About 70 years ago an exotic stemborer found its way to Africa from India and Pakistan. This is the spotted stemborer *Chilo partellus* that in its area of origin is a harmless pest. However, in Africa it has no natural enemies and consequently it has developed into a major pest in maize.

Approaches to pest control

Four main approaches to fighting stemborers have been developed:

a. Pesticide application

Pesticide application has been the recommended practise for a long time but it is expensive, causes health and environmental problems and kills natural predators.

b. Genetically modified Maize

Bt maize that produces pesticide thus killing the stemborer larvae is currently being tested but not released yet. Bt maize is created by adding a pesticide-producing gene from the bacterium *Bacillus thuringiensis* (Bt) to the maize. It was originally developed to kill the European corn-borer, which is a close relative of the African stemborer, so it is likely to be efficient in controlling the pest, at least initially. Early last year the multinational company Novartis started a 5-year test programme in Kenya with Bt Maize at the cost of US$ 6.2 million. They are collaborating with the governmental Kenya Agriculture Research Institute (KARI), the Kenyan Ministry of Agriculture and the International Maize and Wheat Improvement Centre (CIMMYT).

Apart from the problems of genetic pollution (see pg. 25) and farmers' dependency on a few multinational companies (see editorial pg. 4) for their seeds, there is also evidence that pests quickly develop resistance to Bt maize.

To reduce the risk of genetic pollution, most countries require farmers to have a buffer zone of 100 m to related non-GE crops. Most countries are likely to increase the demanded buffer zone after recent studies have shown that pollen is easily spread 800m or even further (New Scientist 24 November 2001). To delay the development of insect resistance to Bt maize it is recommended that farmers create a "refugia" of non-GE crops for the pests to feed on. Most small-scale farmers will not be able to create the required buffer zone or allocate land for a "refugia".

c. Introduction of natural predator insects
In Asia, the wasp *Cotesia Flavipes Cameron* is a natural enemy of the *Chilo partellus* stemborer. In 1993, the Kenya-based International Centre of Insect Physiology and Ecology (ICIPE) introduced the wasp to Africa as a biological control agent. The wasp tracks down the stemborer larvae buried deep inside the maize stalks and lays its eggs into the pest. The eggs hatch and consume the borer from within.

After successful field trials the wasp is now being released on a larger scale. It shows great potential in fighting the introduced spotted stemborer and three of the indigenous species. Results so far indicate that the stemborer population has been cut by half in Kenya's Kwale and Kilifi districts, four years after the initial release. The wasp has steadily spread and is now found throughout the southern part of Kenya.

ICIPE is currently working with national programmes in Kenya, Uganda, Somalia, Ethiopia, Mozambique, Malawi, Zambia, Zimbabwe and Zanzibar to release the Cotesia wasp.

So far, no side effects have appeared or are anticipated because the wasp is very specialised. However, history tells us that the introduction of a foreign species can have totally unanticipated long-term consequences.

d. The push-pull system
The fourth approach is the push-pull system in which intercropped repellent plants "push" the insects out of the fields to trap crops outside the fields that "pull" the insects in. This system makes optimal use of existing biological interaction and relies on mechanisms that have proven to be stable in nature over extended periods. This system is now beyond the trial phase and is being actively disseminated in Kenya.

This article takes a closer look at the push-pull system because it is the most "mature" alternative to genetically modified crops. It is also the least risky, offers the best long-term stability, can be managed by small-scale farmers, and requires no expensive inputs.

The Push-Pull system
The Kenya-based ICIPE has headed the development of the push-pull system for maize in East Africa. Close collaborators include the governmental Kenya Agricultural Research Institute (KARI) and the Institute of Arable Crop Research (IARC), Rothamstead, UK.

Initially, the principal scientist Dr. Zeyaur Khan and his team identified more than 30 grasses with strong stemborer-attracting odours. Farmers were invited to select the grasses they preferred. They chose Napier grass (*Pennisetum* purpureum) and Sudan grass (*Sorghum vulgare Sudanese*) both of which are important fodder crops. The grasses produce a gummy substance that traps the pests and only 10% of the stemborer larvae survive to adulthood.

Of the repellent plants that were researched, the choice was for Molasses grass (*Melinis minutiflora*) and the leguminous Silverleaf (*Desmodium uncinatum*). Research shows that the molasses grass repel stemborer by releasing a complex mixture of volatile substances (terpinoles, nonatrienes etc). It also increases stemborer parasitism by harbouring a natural enemy, the wasp *Cotesia* sesamiae. In trials, Molasses grass reduced crop loss from 40% to 4.6%.

Silverleaf also turns out to have a number of positive attributes apart from repelling the stemoborer. It is nitrogen fixing, a good forage crop and surprisingly it also happens to be very efficient in suppressing the noxious Striga (witchweed, *Striga hermonthica*) weed that is spreading quickly across Africa. Striga is a parasite that feeds on the maize roots and can cause a total crop loss. Currently the average crop loss due to Striga in East Africa is estimated to be 10-20%. Trials have shown that maize intercropped with Silverleaf can suppress Striga by a factor of 40 compared to mono-cropped maize. The reason for this effect is not understood yet but is currently being researched by ICIPE.

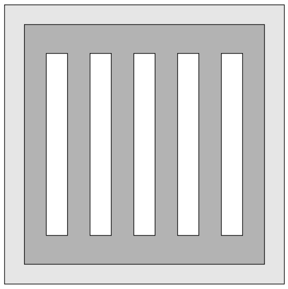

Figure: Push-pull system

In practise, the push-pull system consists of line planted maize with intercropped rows of Molasses grass and/or Silverleaf, surrounded by a belt of Napier and/or Sudan grass.

On-farm testing
The push-pull system was initially tested by more than 600 farmers in 6 districts of Kenya. In the fertile region of Trans Nzoia a yield increase of 15-20% was observed. In the semi-arid Suba district, where both stemborer and Striga damage is high, a substantial increase in maize yield has occurred over the last four years. Economic analysis of the on-farm trials shows that farmers who plant Napier grass and Silverleaf together get a return of US$ 23 for every US$ 10 invested, as compared to a return of US$ 14 from mono-cropped maize.

After the successful on-farm trials, the push-pull system has now been officially released in Kenya and is being disseminated through the extension system. The response by farmers is very positive.

The future
The biological principles of the push-pull system are not new. In fact they are used in many traditional intercropping systems. However, the application of science has made it possible to make very efficient use of these basic biological principles. Similar systems are likely to work elsewhere but may require different repellent and trap crops. Other research centres are already experimenting with push-pull systems. For instance the ARC-Grain Crops Institute in South Africa is conducting research on the use of Vetiver grass as a trap crop around maize fields.

The push-pull system is an ideal option as it builds on existing resources, does not create dependency, is manageable by small farmers and does not pose a threat to the eco-systems. It is estimated that full adoption of the push-pull system by small-scale farmers in East Africa will increase food production sufficiently to feed 6-8 million more people.

However, this system is of little interest to profit-oriented private companies, as it does not require any external inputs. And it is this very fact that may be the biggest obstacle to its dissemination.

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The System of Rice Intensification
Agro-ecological opportunities for small farmers?

Norman Uphoff

Besides Madagascar, where it was developed in the 1980s, the system of rice intensification (SRI) is now showing, also in other countries, that it can be more productive than other methods for growing irrigated rice.

A full description of the SRI methodology can be found in the ILEIA Newsletter 15.3&4, pp48-49 with additional information in ILEIA Newsletter 15.4, p.12.

Encouraging results

A recent communication from Sri Lanka reported SRI yields between 9.3 t/ha for a traditional variety (*Rathhel*) and 17.8 t/ha for an improved variety (BG-358) (Gamini Batuwitage, Additional Secretary, Ministry of Lands). Communications from Cuba have reported yields of 9.1 and 9.6 t/ha for first-time users of SRI, working from written instructions (Rena Perez, Advisor, Ministry of Sugar).

SRI gives healthy plants and higher yields
Photo: Association Tefy Saine

Trials with SRI during 2000 at the national agricultural research station at Sapu, The Gambia, gave yields between 5.3 and 8.5 t/ha (Mustapha Ceesay, former director of Sapu station). Two analyses of SRI yields on farmers' fields in two different areas of Madagascar over a five-year period, involving over 1,000 farmers, showed an average of 8 to 9 t/ha (data from Association Tefy Saina around Ranomafana, 1994/95-1998/99; and from a French-assisted project on the rehabilitation of small-scale irrigation systems around Antsirabe and Ambositra during the same period).

Results with SRI practices naturally differ from place to place, between seasons, and across varieties. There is surely also a skill factor involved in how well farmers observe their fields and how carefully they manage the plants, soil, water and nutrients.

Agroecological management - the key

Agroecological management requires attuning practices to crops and conditions, rather than applying a fixed set of practices. The latter "technological" management assumes that the most determining factors are genetic, rather than the management of interactions between genetic potential and environmental conditions which guides an agroecological approach to crop production.

SRI has revealed for rice –and possibly also for other crops- that there exists a substantial genetic potential that can be effectively tapped by adjusting the agronomic management practices. Association Tefy Saina, which has pioneered the work on SRI in Madagascar, has shown that SRI practices will double production for practically all of the rice varieties, local or improved. Indeed, the highest yields with SRI methods have come from "improved" varieties: a World Bank 1996 report on rice in Madagascar, noted that four farmers in the Andapa region who used SRI methods with the high-yielding variety (HYV) IR-46, developed by the International Rice Research Institute, averaged 13.7 t/ha, with one farmer reaching 16.5 t/ha. Similar high yields were obtained in the Ranomafana area with x265, derived from IR-15, and 2067, descended from Tainung-16, a Chinese HYV. Note that the government research agency FoFiFa reported the average yield from 2067 as 5.6 t/ha, with a 'maximum observed yield' of 7.7 t/ha. In the 1998-99 season, a farmer near Soatanana, in his sixth season using SRI, had a yield of 21 t/ha with 2067, more than 10 times the national average (CIIFAD 1999, p.47). Based on these results one may well question whether, indeed, research in genetic engineering can be as effective in raising yield levels as research in agronomic management.

Is genetic modification necessary?

Thus the SRI experience leads one to two very different conclusions:

1. There appears to be ***a large genetic potential in existing rice varieties*** that can still be tapped through agroecologically sound practices. This would imply that genetic modification efforts are not necessary, at least for some time to come, if increasing food production and lowering costs of production are the main objectives. Farmers at Namal Oya in Sri Lanka found not only that SRI methods raised their yields from 2.9 t/ha with conventional

methods to 8.5 t/ha, but they also calculated that it reduced their costs of production, from 6 rupees/kg to 3 rupees/kg.

2. Agroecological methods of crop production appear to give ***better results with genetically-improved varieties***. Some varieties have a greater potential for tillering, root growth and grain filling than others in response to wide spacing, aerated soil, and other SRI practices. Quite likely, though we have not been able to evaluate this systematically, some varieties would also have better pest and disease resistance, or greater drought tolerance, when grown with SRI practices. This implies that there is still considerable potential for conventional breeding and selection to identify varieties that are specifically adapted and responsive to SRI practices.

The question of whether *transgenic* research is justified or needed is different from whether *genetic improvement* should be undertaken. There may be risks with the former that are as yet inadequately assessed, and one can reasonably object to companies with criteria of success based more on private than on public interests directing and driving the process of genetic modification. Such ‘broad-spectrum’ objections don’t apply to conventional genetic improvement towards SRI adapted varieties.

SRI Field. Photo: Association Tefy Saine

Soil health - essential for increasing yield

A different line of criticism of GMOs would be that a preoccupation with genetic changes deflects efforts from studying and improving what may be the most important factor in increasing yield: the management of natural resources. As we work with SRI and try to explain differences in plant response to the different management practices, our attention is increasingly directed to differences in soil quality, or more metaphorically, in soil *health* as understood in terms of soil biological activity.

There has been much concern about the conservation of biological diversity in recent decades. Almost all efforts have focused on above-ground flora and fauna. We think that soil biodiversity - the vast and complex communities of bacteria, fungi, mycorrhiza, actinomycetes, protozoa and nematodes as well as earthworms and other soil ‘megafauna’ - holds the key to high productivity with SRI methods.

Given such high yields from some of the poorest soils in the world, one would expect yields to decline over the years. This is certainly to be expected when only low-quality organic material is applied, rather than nutrient-rich chemical fertilizer. Yet, farmers find that their yields usually increase from year-to-year. This we think is due to increases in the variety and number of micro-organisms playing different roles in plant nutrition such as biological nitrogen fixation and phosphorus solubilisation.

SRI is not necessarily an ‘organic’ methodology; it can be used with agrochemicals. But the systematic evaluations we have done so far show that continuous use of compost gives higher yields than does NPK fertilizer. Also, pest and disease problems under SRI are usually not serious enough to warrant the use of biocides, and thus a ‘healthy’ soil can be maintained, which in turn further reduces the need for chemicals.

Optimal use of resources

Much research and evaluation remains to be done on SRI. It will not be appropriate or feasible in all rice-growing areas, e.g. there needs to be sufficient irrigation and drainage infrastructure to control water applications and maintain well-drained soils. Although the SRI practices may have the potential to double or triple the production of rice in the world, this is not a reasonable goal or use of the methodology. Rather it should give small farmers additional opportunities to raise the productivity of their land, labour and water resources, while trying to meet their staple food requirements.

Ultimately, productivity is what is most important to farmers: how to get the most from their limited land, labour, capital and (increasingly) water. Understanding *the sources and biological processes* that lead to increased productivity should be a researcher’s overall priority, while working closely with farmers. We think that SRI confirms the general value of an agroecological perspective, and that this should increasingly guide agricultural research, not only for rice but also for other crops (Stoop et al. 2002).

Further genetic research will be more beneficial if it is linked to agroecological theory and practice, not assuming that gains in productivity are due only or even primarily to genetic improvements.

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Non-GE approach to salt tolerant rice

As the problem of salty soils grows, so does the search for salt tolerant rice. In parts of Northeastern Thailand rice harvests are seriously decreased due to salinity. Much of the research in the last years has relied on molecular biology to find salt-tolerant genes and move them to the desired plant species. However, Chalermpol Kirdmanee of the National Centre for Genetic Engineering in Thailand has a breakthrough that is not based on transgenic plants. By searching through the country’s rice “gene bank”, a collection of 7000 indigenous varieties, Chalermpol selected 4 that can withstand high levels of salt. He says, “We can’t grow genetically modified organisms in Thailand, so I wanted to find something that farmers could use.” He credits the country’s rich biodiversity with his progress.

The newly selected rice strains are part of a larger project to find salt-tolerant plants for Northeast Thailand. In a four-year field experiment conducted by Chalermpol’s lab, salt-tolerant grasses and trees reduced the level of salt in the soil from 10% to less than 0.5%.

Source: “Salt of the Earth” by Anne Marie Ruff, The Far Eastern Economic Review

Stimulating GMO-free breeding for organic agriculture: a view from Europe

Edith Lammerts van Bueren and Aart Osman

In the mid-90s the organic agricultural sector decided not to allow the use of GMOs in organic production. This was partly due to the risks of undesired and unknown environmental and health-related side effects of GMOs. But the main reason was a more ethical choice of respecting the integrity of plants and animals. The decision to remain GMO-free is incorporated in the Basic Standards of the International Federation of Organic Agriculture Movements (IFOAM) and hence applies worldwide. These standards define how organic products are produced, processed and handled. Most organic certification bodies use these standards for certification purposes.

A new vision for organic plant breeding

European organic agriculture is greatly dependent on the conventional seed industry. Organic farmers use modern productive varieties, bred for a high-input farming system with the use of chemicals. Although these varieties yield better than the old land races, they are not adapted to specific organic conditions. They lack traits like nutrient uptake efficiency, early soil coverage against weeds, broad field tolerance against pests and diseases etc. This was hardly an issue in the organic sector in The Netherlands until the threat of GMO varieties put it on the agenda. Space was thus created for a thorough discussion on the suitability of current plant breeding techniques for organic agriculture.

Louis Bolk Institute, a private research institute for organic agriculture, organised a discussion with all key players in the organic and conventional sectors (organic farmers, traders, commercial plant breeders and researchers of national agricultural research institutes) in the Netherlands. This resulted in a vision on organic plant breeding that was further discussed at workshops throughout Western Europe in order to formulate a common standpoint for those involved in organic seed production. The findings were finalised at a recent workshop by a group of European key players (organic sector, commercial seed enterprises). The resulting proposal was forwarded to IFOAM for incorporation in the Basic Standards for Organic Agriculture.

Avoiding undesired cross-pollination. Photo: Louis Bolk Institute

Cross pollination within natural barriers Photo: Louis Bolk Institute

Principles of organic farming as the basis

Judging the suitability of plant breeding methods is based on the principles of organic farming. Organic farming is not merely the avoidance of chemical fertilisers, pesticides and GMOs. It takes the living soil as a basis and uses methods which stimulate (agro-)ecological processes, without exhausting natural resources. Being founded on the integrity and intrinsic value of living entities like the soil, plants, animals and human beings, organic farming respects the environment, farm ecology and the complexity of nature. This attitude of respect prevents farmers from taking actions that affect a plant's reproductive potential and impede the sustainable use of cultivars.

Thus, the concept of organic plant breeding as formulated by the European key players reads as follows: "*The aim of organic plant breeding is to develop plants which enhance the potential of organic farming and bio-diversity. Organic plant breeding is a holistic approach that respects natural crossing barriers and is based on fertile plants that can establish a viable relationship with the living soil.*"

Biodiversity - an essential feature

As biodiversity is one of the main features of a sustainable organic farming system, the organic sector places great value on the free exchange of the genepool. The rights of breeders are respected but patents and techniques to make plants sterile endanger the free exchange, and consequently the genetic diversity. One of the techniques to prevent free exchange of genetic diversity is the utilisation of *cytoplasmic male sterility* without restorer genes to produce hybrids (see Box p.14). The absence of restorer genes prevents the production of seeds and hence this type of hybrids should be forbidden. All other types of hybrids produce viable seeds. They do not maintain purity after multiplication at the farm, but can still be used for developing new varieties.

Seed saving is not practised in the highly specialised horticultural sector in Europe. Dutch organic farmers prefer to buy their seeds, and most of them prefer hybrids. The uniformity of the plants allows for mechanical harvesting and reduces the requirement of seasonal labour that is scarce. Whether hybrids are the best option for the South depends very much on the socio-economic circumstances. Often there are valid arguments against hybrids. Low-income farmers who do not have sufficient funds to buy new seeds every year are better off with varieties that they can multiply inexpensively.

The cell level divide

The biotechnological techniques used in modern plant breeding (see Box p.14) can be divided into those that stay within the realm of life and those that go beyond. If the cell is considered the lowest organised structural entity of life, then all breeding techniques that intervene below cell level do not conform to the organic principles. This means that genetic modification (which interferes at DNA level) and protoplast fusion should be forbidden for the organic sector. All other cell biological techniques, including embryo rescue techniques and in vitro-pollination, are acceptable.

A few plant breeders are willing to go further: not only banning the techniques that go below cell level, but also avoiding those that intervene at cell level. The proposed certification system will label the latter as “organic varieties”. Varieties that respect the standards for organic breeding, but go beyond plant level, will be labelled as “organic seeds”. “Organic seeds” come from conventional breeding programmes, which respect the organic breeding standards and are multiplied under organic growing conditions for at least one generation.

Re-thinking plant breeding

For the breeders who want to work with as little biotechnology as possible, the challenge is to develop new concepts and breeding strategies that make it redundant. Most biotechnological techniques in plant breeding are used to introduce specific genetic resistance traits from wild relatives and other species into modern cultivars. This has led to a disproportionate reliance on resistant genes and negligence of other characteristics and techniques that prevent the build-up of diseases and pests. For example, the build-up of soil-borne fungal diseases is delayed in cereals, which are taller and have a more open plant structure (opposed to the compact short straw types). Growing varietal mixtures and intercropping also prevents disease epidemics. An organic breeding strategy would therefore aim at compensating for low genetic resistance with a better plant structure and varieties that perform well in mixtures. In this way it would not rely just on a single resistant gene, but on a larger, more sustainable set of measures. Breeding with as little biotechnology as possible requires a rethinking of what we want to achieve and how we can reach our goals. The principles of organic agriculture can help us with this task.

The breeding fields of Vitalis, a Dutch organic breeding company
Photo: Louis Bolk Institue

Setting standards for organic breeding

The development of new varieties requires considerable financial investments. As a relatively small sector, organic farming in Europe depends largely on conventional seed breeders for new varieties. Setting standards for organic plant breeding can influence technology development for the organic sector. These standards specify the techniques allowed for the development of new varieties. To make the implementation of these standards feasible, the private (conventional) seed sector has been involved in the discussions on organic breeding from the beginning.

‘Think twice before you act’: EU blocks new GM crops to be released

GM Crops such as Bt-maize, RR soybean and Bolgard cotton, are widely accepted in the United States, but public opinion in Europe continues to be increasingly sceptical to GMOs. Only 11 GM varieties were licensed for cultivation in the European Union before an informal moratorium was introduced in 1998 as compared to some 50 GM varieties that are commonly planted in the US, Canada and Argentina.

Last October, EU governments rejected the idea of lifting this three-year ban on importing and planting of new GM crops. Environment ministers spoke against plans to restart licensing GM seeds. Biotech companies like Monsanto and Novartis have been waiting for years to start selling their new varieties of modified maize, soy bean, etc. in the EU. A total of 13 GM varieties are awaiting approval. In 1998, a number of EU countries said they would not allow any new GMOs into the EU until tough rules on testing, labelling and tracing were put in place. Before such an operational system will be implemented it could take another two years, or even longer if the issue of environmental liability has to be turned into law as well.

In non-EU member Switzerland, the release of genetically altered plants into the environment is also forbidden. The government states that, on the basis of current knowledge, it is not possible to gauge the dangers to humans and the environment of the release of such organisms. This precautionary principle by (some of) the EU countries and neighbouring Switzerland is an important acknowledgement of the fact that GM crops are different from “naturally” improved varieties. ‘Think twice before you act’ seems to be the European answer to GM crops.

Sources: www.ictsd.org/weekly, and www.nzz.ch/english/swiss_week

The formulation of standards for organic plant breeding gives the seed companies clarity on what is expected from them. Some companies in the Netherlands, like Vitalis Biologische Zaden, are willing to adhere to these standards and breed organic seed without using the undesirable biotechnologies.

The standards for organic plant breeding do not indicate how the actual varieties should look like. Louis Bolk Institute helps farmers to formulate their specific wishes (i.e. adaptation to organic soil, tolerance to problematic diseases etc.) by way of crop ideotypes. Seed companies are requested to provide varieties, which comply with these ideotypes for trials on farmers' fields. The trials are evaluated in the field with farmers and breeders. Here a platform of discussion between breeders and farmers is created. The exchange of knowledge stimulates the development of varieties, which better meet the needs of the farmers and are more adapted to an organic farming system. ■

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Biotechnological Techniques applied in Plant Breeding

At cell level

Embryo culture Ovary culture In-vitro pollination	Used for crossing of closely related species, such as cultivated tomatoes and wild relatives. Such crosses occur in nature but do not result in viable seeds as the embryos are aborted prematurely. When these organs are separated from the plant and grown in test tubes, they develop into mature plants.
In-vitro selection	Mostly used to select new varieties, which are tolerant to stress conditions, such as salinity. Plants are grown in test tubes containing a salt solution. Plants that survive are selected.
Anther culture Microspore culture	Pollen and anthers are grown in-vitro. These male sexual organs are not fertilised and hence contain only half a set of chromosomes. This set is doubled with chemicals to get plants that are genetically identical.
Meristem culture Micro propagation Somatic Embryogenesis	This is used for a rapid propagation of plants with an identical genetic make-up. Plant cells are multiplied in test tubes and these cells are regenerated into new plants.

Below cell level

Genetic modification Protoplast fusion	Genetic material of unrelated species that do not cross in nature are inserted into cells. Protoplast fusion implies the merging of complete cells. In genetic modification only small pieces of foreign DNA are inserted into the cell.
Cytoplasmatic Male Sterility (CMS) without restorer genes	Used to produce parent lines for hybrid production which are male sterile. A plant cell is merged with a cytoplast (a plant cell of which the chromosomes are removed). The cell plasma of the cytoplast contains factors, which cause male sterility. CMS does occur in nature, but is accompanied with factors that neutralise the male sterility. When CMS is transferred from an unrelated species into a crop, without the neutralising factors (restorer genes), the new male sterile plants can not be multiplied in nature.
DNA marker assisted selection	Certain sequences of DNA can be associated with certain plant traits. These sequences (markers) can be used to select plants for characteristics, which are not directly visible in the field, such as drought tolerance. This technique makes use of available DNA sequences in the plant cells, but does not change them, and is acceptable for organic agriculture. Sometimes radiation or genetically modified enzymes are used to detect these markers, which is not acceptable for organic farming. Detection can be done with substances that are permitted by organic agriculture such as fluorescence.


Small farmers need a basket of options to meet their site-specific requirements Photo: Bert Lof

Biotechnology
a basket of options

Bert Visser

From traditional to modern biotechnologies
The brewing of beer from barley or bananas, wine making, the fermentation of milk into various products such as yoghurt and cheese as well as of soybean into curd, the combination of cereals and pulses to improve nitrogen availability, the use of ethnoveterinary vaccines to protect cattle are all examples of traditional biotechnology. According to the Convention on Biological Diversity (1992) biotechnology is defined as 'any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use'. The keywords in this definition are living, technological, and products. Biotechnology that has been developed and utilised by humans over the ages falls within the parameters of this definition. However, it is not this traditional use of biotechnology that has brought it into the focus of current global debate.

Recent sharp increase in the knowledge of biological science (biochemistry, molecular biology, genetics) has complemented these traditional forms of biotechnology with modern applications. Not only are modern biotechnologies based on new scientific knowledge, they also depend largely on the availability of capital and skilled human resources. This makes biotechnology a specialised affair and takes it into the realms of private research funded by multinational corporations. And it is this trend in biotechnology and the perceived risks that has aroused the present debate.

Much of the debate is centred on two questions: (a) who determines which applications to develop and where to apply? (b) who benefits from those applications? To widen the public debate and to render the discussions productive, a basic knowledge of major modern biotechnologies amongst a larger public is indispensable. The aim of this article is to describe four major modern biotechnologies, their applications and the inputs they require, i.e. *in vitro* technologies, detection technologies, genomics and genetic modification. Although the last application is discussed in more detail, care should be taken not to equate biotechnology to genetic modification of living organisms.

In-vitro technologies
The meaning of the Latin words *'in vitro'* is 'in glass'. In-vitro technologies separate parts of living organisms in closed containers to manipulate and maintain this material. Several well-known and relatively older applications belong to this category.

Plant tissue culture became established in the 1970s. It involves the maintenance of plant material (complete plants, specific organs or cells) under sterile conditions and in the presence of nutrients. Plant tissue culture allows the rapid multiplication of crop plants at a small scale in comparison to *'in vivo'* (living) conditions. Starter material for crops can thus be supplied in large quantities, solving bottle-necks in supply to farmers. Particularly for crops that are propagated vegetatively (not through seed), plant tissue culture forms a useful instrument to multiply starter material. Plant tissue culture also allows for the cleaning of virus-infected starter material. A third use of plant tissue culture is to conserve useful crop genetic resources in a less vulnerable environment than in the field. Finally, plant tissue culture, done in-vitro, can be used to transfer useful traits from wild relatives into crop varieties by crossing sexual barriers that do not take place under normal (in vivo) conditions.

Nowadays, more than a thousand plant species are being propagated in tissue culture. The costs of plant tissue culture are modest. A new banana plant of a desired variety can be produced and made available at less than one US dollar. This option also offers the added benefit of providing healthy planting material. Oil palm, cassava, potato and ornamentals are also propagated in-vitro. The only facilities required are two rooms: one in which the material can be handled under sterile conditions, and the other a growth room with the necessary light, temperature and humidity. Basic training is adequate to teach the principles of sterile handling of material. Local communities who have been trained to do so and have access to the facilities can manage in vitro growth. In-vitro technologies are also used in animal husbandry. Artificial insemination of cattle is a rather old application, in which sperm is stored under sterile conditions at low temperatures for large-scale insemination. Modern extensions of this technology are: "in vitro fertilisation", in which a sperm and an egg cell are made to fuse, thus speeding up the generation of new breeds; "embryo transfer", which allows the use of carrier animals for the new offspring to develop; and "cryopreservation", the storage of valuable starter material at very low temperatures. Evidently, these applications are being used both in animal breeding, and for the conservation of animal diversity. Except for artificial insemination, which is a low-cost application, the costs here are much higher than for plant tissue culture and require more advanced facilities.

Detection technologies
Detection technology has been developed to detect the presence or absence of specific traits in individual organisms. A major part of this technology is the use of an array of DNA marker techniques. These marker techniques make use of patterns of specific DNA sequences (the building blocks of all genetic information) that reveal the genetic difference between two individual organisms. This technology has considerably increased the speed of plant and animal breeding. If DNA marker sequences are linked to specific traits, such sequences can be used to search for the presence these traits in the offspring of a cross breeding, long before the trait is actually expressed. A

major aspect of these techniques is that they do not alter the DNA (the genes, the traits). Instead they just allow a fast appraisal of what can be found in the offspring of a breeding programme. Various forms have been developed over the last fifteen years that differ in robustness, costs, facilities needed, and the type of information provided.

In comparison to in-vitro technologies, costs in this case are higher and the facilities required are more advanced. Until now, the extent to which this technology is applied in plant and animal breeding and its impact is much larger than that of genetic modification (see below), because it requires less time and financial investments. These techniques are being applied in small-scale agriculture as in a maize-breeding project aiming to increase the drought tolerance in local maize germplasm in Kenya and Zimbabwe. Markers have also been used to better understand farmers' selection of local rice varieties in the Philippines and Vietnam, and to more efficiently maintain the genetic diversity in enset, a staple crop of small-scale farmers in Ethiopia.

Monoclonal antibodies constitute another biotechnological detection technology. Cells derived from the immune system that produce specific antibodies are maintained and multiplied in-vitro for the production of large amounts of antibodies that can be used to search for specific material. Apart from main applications in health care, the technology is being used in agriculture to detect pathogens (agents causing pests and diseases) in plants and animals, thus allowing accurate pest and disease management. These technologies are used to provide the pest/disease free import guarantees on products as required by many countries, facilitating cross-border exchange of plants and animals. Whereas the costs for the development of monoclonal cells producing specific antibodies are high and specialist expertise is needed, the use of such monoclonal cells and their antibodies is relatively simple and requires only modest facilities.

Tissue culture can be useful for small farmers. Photo: AgroIndia

Genomics

Genomics is a field of biology that has developed very rapidly over the last decade. It involves the large-scale sequencing of DNA, including entire genomes (all the DNA of a single individual), and the comparative analysis of the resulting sequences across species barriers. Major highlights in this field are the sequencing of the total DNA of man, but also of a substantial number of micro-organisms (model organisms, pathogens and organisms used in traditional biotechnology), of plants (including rice) and of animals. Genomics produces enormous datasets and a complete new science, bio-informatics, has been developed to handle these databases and to allow retrieval and analysis of the information they contain. The costs of genomics research are high and only a few specialised institutions worldwide, located almost exclusively in developed countries, are able to contribute to this newly-evolving science. Although no immediate spin-off for agricultural applications should be expected in the next 5-10 years, a detailed knowledge of plant and animal genomes will, in the long run, speed up breeding, also in tropical agriculture.

Genetic modification

Genetic modification, also termed genetic manipulation, concerns the transfer of genetic information - in the form of DNA sequences - across sexual barriers between species, which under normal conditions would not exchange DNA. The resulting organisms are called genetically modified organisms (GMOs) or transgenics. Genetic modification is currently used only to introduce a single new trait, which might be based on the activity of a single gene, or a small number of genes. The number of genes with known functions that has been isolated is still too small to allow for more complicated traits or combinations of traits to be introduced using genetic modification. In agriculture, genetic modification has been applied in a number of major crops. The majority of these applications involve the introduction of resistant traits, particularly to herbicides and insects. A smaller number of applications involve the quality of the resulting product, e.g. the shelf life of tomatoes, or the production of alternative sweeteners in sugarbeet. Whereas farmers mainly deal with the former type of agronomic applications, the processing industry and consumers are confronted with the latter. Transgenic animals have been produced under laboratory conditions, but up to now have not been released for industrial application.

In all cases, the costs of developing GMOs are high, and the technology is dependent on very expensive facilities and highly skilled experts. The cost of the development and commercialisation of a GMO crop variety was recently estimated at US$30 million. In an increasing number of countries, legislation and regulations to contain GMOs and their products during the development and extensive testing phases before release are strict and costly. Although 70 transgenic crop varieties were registered for commercial cultivation in 1999, as of now international agricultural biotechnology companies have focussed their activities on a few crops, including the seed companies' cash earners such as cotton, rapeseed, maize, soybean, and wheat.

Impact on tropical agriculture

In developed countries agriculture has been industrialised over the course of the twentieth century. Breeding has developed from a farmer's activity into a specialist's affair. The conditions of the farmers' fields have been adjusted to the new breeds by extensive application of fertilisers and pesticides. Crops have become increasingly uniform to facilitate mechanised cultivation, harvesting and processing. Because of the more capital-intensive nature of agriculture, the size of an average economically sustainable farm has increased several times over the last century. Agricultural biotechnology will certainly enhance this trend by increasing the dependence of the entire production chain on a very limited number of crops and varieties with new traits. Modern agriculture will continue to be high-input dependent and become even more uniform. Genetic modification will allow the production of the same raw materials (e.g. plant oils) in different crops. The negative impact of modern agriculture on agrobiodiversity might be worsened by the wide-scale introduction of genetically modified crops and farm animals.

Tropical agriculture, however, is still dominated by small-scale systems. Often, farmers' access to external inputs is low. Therefore, international companies developing GM crops do not consider small-scale agriculture as an important market. Besides, GM crops would not cater to the diverse agro-ecological conditions encountered in farmers' fields and would be of little benefit to them.

The field release of GMOs is generally heavily regulated and major short-term effects on the crops and the agro-system environment are expected to show up in the test phase. Yet, small-scale systems may well have to face the environmental risks of GMOs. In the long term it is difficult to imagine how the appearance of GMO traits in non-GMO crops can be avoided as a result of uncontrolled crossing, particularly in cross-fertilising species. The question is whether we regard this an unacceptable tinkering of nature, a risky development in terms of food safety and environmental and genetic pollution, or simply as a new harmless step in the interference of humans on the plants and animals that provide our food. In any case, it will certainly pose problems to the organic agriculture sector that is devoted to the maintenance of a GMO-free chain.

Although GMOs may currently have little or no direct relevance to small-scale tropical agriculture, this reality does not follow from the biological nature of biotechnological applications but from the socio-economic context in which biotechnological applications are developed. This leads us to the question of whether and under what conditions other appropriate biotechnologies for small-scale farmers are feasible.

Appropriate biotechnologies: a reality or fantasy?

Biotechnology has the potential to serve all farmers, including small-scale farmers in tropical production systems. Appropriate biotechnologies may be developed on the basis of demand and in consultation with farmers and/or their representatives (community-based organisations, supportive NGOs, dedicated extension services). It can be expected that modern biotechnologies that require relatively few investments and that can be applied in-country or even in the community stand the best chance of being appropriate. In particular, this could apply to plant tissue culture technology to produce healthy, much valued varieties in large enough quantities. Also the use of monoclonals may in time allow farmers and extension services to monitor for specific pests and diseases. The use of artificial insemination could be extended also to well-adapted indigenous breeds. Cryopreservation and tissue culture of valuable plant and animal varieties and breeds might also serve the small-scale farming sector in providing a back-up for their genetic resources maintained in the field. All these applications form a potential reality.

However, it can be doubted whether genetic modification has anything to offer to small-scale farmers other than a growing dependence of farmers on the seed industry. It can be doubted whether and to which extent the lack of interest by the private sector will be compensated for by increased public breeding efforts that should prevent a widening technology gap between a rather small number of commercial crops and crops of regional or local importance. On the other hand, it should be realised that for any application in the public domain aimed at benefiting small-scale farmers, co-operation with the private sector will be absolutely indispensable since the private sector owns all the key patents needed to develop GMOs. The case of Golden Rice forms an interesting one as it represents an exceptional effort in the public domain to alleviate problems of low-income groups including many small-scale farmers in developing countries (vitamin A deficiency) through the application of genetic modification. However, many patent exemptions in the form of licences had to be obtained to allow Golden Rice to be developed for farmers in developing countries, and whether Golden Rice will fit social and cultural patterns will have to be awaited. Also, it is yet too early to predict how often such patent exemptions will be granted to allow the development of public sector initiatives to benefit the small-scale sector.

In my opinion, more than the risks of monster organisms, food safety problems and environmental pollution, the real threat of GMOs might be the socio-economic dependence it creates for its users from the companies selling such GMOs.

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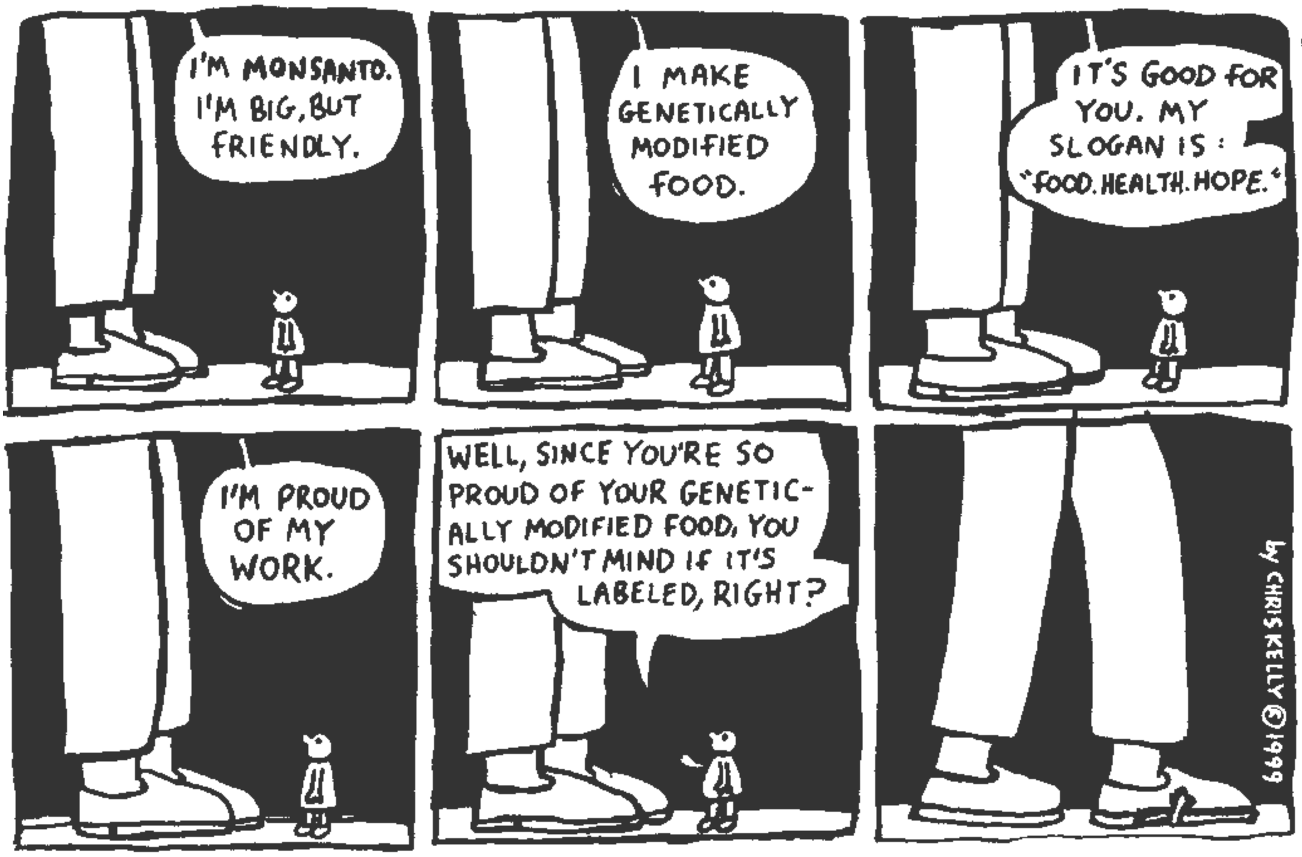


Bt crops are likely to increase the risk of farmers who are already risk-prone. Photo: Bert Lof

Genetically engineered crops
will they feed the hungry and reduce poverty?

Peter Rossett

Small and peasant farmers are the primary producers of staple foods, accounting for very high percentages of national production in most Third World countries. This sector, which is so important for food production, is itself characterised by poverty and hunger, and in some cases lagging agricultural productivity. If these problems are to be addressed by a proposed solution – genetic engineering in this case – we must begin with a clear understanding of their causes. If the causes lie in inadequate technology, then a technological solution is a possibility. Thus let me begin by examining the conditions faced by peasant producers of staple foods in most of the third world.

Historical background

The history of the third world since the beginning of colonialism has been a history of un-sustainable development. Colonial land grabs pushed rural food producing societies off the best lands most suitable for farming. These lands were converted to production for export in the new global economy dominated by the colonial powers. Instead of producing staple foods for local populations, they became extensive cattle ranches or plantations of indigo, cocoa, copra, rubber, sugar, cotton and other highly valued products.

Farming peoples–accustomed to the continuous production of annual crops on fertile, well-drained soils with good access to water– were driven into marginal areas. As a result forests were felled and many fragile habitats were subject to un-sustainable production practices, in this case by poor, newly destitute and displaced farmers. The favoured lands were, simultaneously, being degraded by continuous export cropping at the hands of Europeans.

National liberation from colonialism did little to alleviate the environmental and social problems generated by this dynamic. Post-colonial national elite came to power with strong linkages to the global export-oriented economy, often, indeed, connected to former colonial powers. The period of national liberation, corresponded with the rise of capitalist market and production relations on a global scale, and in particular, with their penetration of third world economies and rural areas. This was the era of modernisation with its dominant ideology that bigger is better. In rural areas it meant the consolidation of farmland into large holdings that could be mechanised, and the notion that the "backward and inefficient" peasantry should abandon farming and migrate to the cities where they would provide the labour force for industrialisation. This ushered in a new era of land concentration in the hands of the wealthy, and drove the growing problem of landlessness in rural areas. The landless rapidly became the poorest of the poor, subsisting as part-time seasonal agricultural or day labourers, share croppers or migrating to the agricultural frontier to fell forests for homesteads.

Thus rural areas in the Third World are today characterised by extreme inequalities in access to land, in security of land tenure and in the quality of the land farmed. By keeping wages and living standards low, the elite guarantees that healthy domestic markets will never emerge, reinforcing export orientation. The result is a downward spiral into deeper poverty and marginalisation, even as national exports become more "competitive" in the global economy. One irony of our world, then, is that food and other farm products flow *from* areas of hunger and need *to* areas were money is concentrated, in the North.

The same dynamic drives environmental degradation. On the one hand, rural populations have historically been relocated from areas suitable for farming to those less suitable, leading to deforestation, desertification and soil erosion in fragile habitats. This process continues today, as the newly landless continuously migrate to the agricultural frontier.

The situation is no better in the more favourable lands. Here the better soils of most nations have been concentrated into large holdings used for mechanised, pesticide and chemical fertiliser-intensive, monocultural production for export. Many of our planet's best soils are today being rapidly degraded, and in some cases abandoned completely, in the short-term pursuit of export profits and competitiveness. The productive capacity of these soils is dropping rapidly due to soil compaction, erosion, waterlogging, and fertility loss, together with growing resistance of pests to pesticides and the loss of in-soil and above-ground functional biodiversity. The growing problem of "yield decline" in these areas has recently been recognised as a looming threat to global food production by a number of international agencies.

Changes in macro economic policies

The past three decades of world history have seen a series of changes in national and global governance mechanisms. These changes have been made within a paradigm that sees international trade as the key resource for promoting economic growth in national economies, and growth as the solution to all ills. The balance of governance over national economies has shifted away from governments toward market mechanisms and global regulatory bodies like the WTO. Southern governments have progressively lost the majority of the management tools in their macro-economic policy toolboxes. The ability of Southern nations to ensure the social welfare of poor and vulnerable people, achieve social justice, guarantee human rights, and protect and sustainably manage their natural resources, have been critically weakened.

They have been forced to drastically cut government investment and to slash or eliminate subsidies of all kinds, including social services and price supports for small farmers. While such changes have in some cases created new opportunities for poor people to exploit new niche markets in the global economy (organic coffee, for example), they have for the most part undercut both government provided social safety nets and guarantees. The majority of the poor still live in rural areas, and these changes have driven many of them to new depths of crisis in sustaining their livelihoods. Increasingly they have been plunged into an environment dominated by global economic forces, where the terms of participation have been set to meet the interests of the most powerful. Small farmers find the prices of the staple foods they produce dropping below the cost of production in the face of cheap imports freed from tariffs and quotas.

Lagging productivity

Third world food producers demonstrate lagging productivity not because they lack 'miracle' seeds that contain their own insecticide or tolerate massive doses of herbicide, but because they have been displaced onto marginal, rain-fed lands, and face structures and macroeconomic policies that are increasingly unfavourable to food production by small farmers. These then, are the true causes of low productivity. In fact, in many parts of the third world, especially in Africa, *farmers today produce far less then they could with presently available know-how and technology,* because there is no incentive for them to do otherwise - there are only low prices and few buyers. No new seed, good or bad, can change that, and thus it is extremely unlikely that, in the absence of urgently needed structural changes in access to land and in agricultural and trade policies, genetic engineering could make any dent in food production by the world's poorer farmers.

When seen in this light, it should be clear that genetic engineering is only touching at best the conditions and needs of the farmers we are told it will help – it in no way addresses the principal constraints they face. But superficial is a far cry from 'bad.' Now I turn to the question of whether genetically engineered crops are simply irrelevant to the poor, or if they might actually pose a threat to them. First we must ask about the actual circumstances of peasant farming.

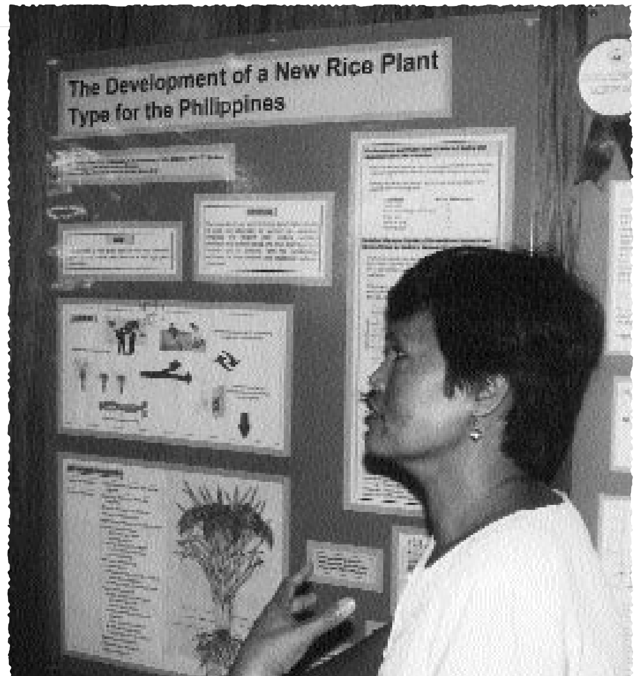
Complex, diverse and risk-prone agriculture

Peasant farmers have historically been displaced, as described above, into marginal zones characterised by broken terrain, slopes, irregular rainfall, little irrigation, and/or low soil fertility. Being poor they are victimised by pervasive anti-poor and anti-small farmer biases in national and global economic policies. As such, their agriculture is best characterised as complex, diverse and risk-prone.

In order to survive under such circumstances, and to improve their standard of living, they must be able to tailor agricultural technologies to their variable but unique circumstances, in terms of local climate, topography, soils, biodiversity, cropping systems, market insertion, resources, etc. For this reason such farmers have over millennia evolved complex farming and livelihood systems which balance risks. Typically, their cropping systems involve multiple annual and perennial crops, animals, fodder, even fish, and a variety of foraged wild products.

Repeating the error of top-down research

Such farmers have rarely benefited from 'top down' formal institutional research and 'green revolution' technologies. Any new strategy to truly address productivity and poverty concerns will have to meet their needs for multiple suitable varieties. Formal research methods are not able to handle the vast complexity of physical and socio-economic conditions in most third world agriculture. This stems from the discrepancy between hierarchical research and extension systems, which value monocultural 'yield' above all else, and complex rural realities. In reality seeds have multiple characteristics that cannot be captured by a single yield measure, and farmers have multiple site-specific requirements for their seeds, not just controlled-condition high yields. These interconnections stand in direct contrast to formal breeding procedures. Given such conditions the inescapable conclusion is that a different approach, participatory breeding by organised farmers themselves, which takes into account the multiple characteristics of both seed varieties and farmers, is essential. Miracle seeds will not just be developed in laboratories and on research stations and then effortlessly distributed to farmers. Yet genetic engineering is in direct contrast to participatory, farmer-led research.



Will the "super" rice presently being developed by IRRI meet the needs of small farmers? Photo: Bert Lof

Proponents of genetically engineered varieties are repeating the very 'top down' errors, which led first generation green revolution crop varieties to have low adoption rates among poorer farmers.

Yet it is clear that the biotech juggernaut is moving ahead a full speed. What then, are the risks associated with 'forcing' genetically engineered varieties into complex, diverse and risk-prone circumstances?

Risks for poor farmers

The most common transgenic varieties available today are those that tolerate proprietary brands of herbicides, and those than contain insecticide genes. Herbicide tolerant crops make little sense to peasant farmers who plant diverse mixtures of crop and fodder species. Chemicals would only destroy key components of their cropping systems.

Transgenic plants, which produce their own insecticides – usually using the 'Bt' gene - are rapidly failing as pests build up resistance to insecticides. Instead of the failed "one pest-one chemical" model, genetic engineering emphasises a "one pest-one gene" approach, shown over and over again in laboratory trials to fail, as pest species rapidly adapt and develop resistance to the insecticide present in the plant. Bt crops violate the basic and widely accepted principle of "integrated pest management" (IPM), which is that reliance on any single pest management technology

It is not a lack of technology that holds farmers back... photo: Bert Lof

tends to trigger shifts in pest species or the evolution of resistance through one or more mechanisms. In general, the greater the selection pressure across time and space, the quicker and more profound the pests' evolutionary response. Thus IPM approaches employ multiple pest control mechanisms, and use pesticides minimally, only in cases of last resort. An obvious reason for adopting this principle is that it reduces pest exposure to pesticides, retarding the evolution of resistance. But when the product is engineered into the plant itself, pest exposure leaps from minimal and occasional to massive and continuous exposure, dramatically accelerating resistance. Most entomologists agree that Bt will rapidly become useless, both as a feature of the new seeds and as an old standby natural insecticide sprayed when needed by farmers that want out of the pesticide treadmill.

At the same time, the use of Bt crops affects non-target organisms and ecological processes. Recent evidence shows that the Bt toxin can affect beneficial insect predators that feed on insect pests present on Bt crops, and that windblown pollen from Bt crops found on natural vegetation surrounding transgenic fields can kill non-target insects. Small farmers rely for insect pest control on the rich complex of predators and parasites associated with their mixed cropping systems.

In fact Bt retains its insecticidal properties after crop residues have been plowed into the soil, and is protected against microbial degradation by being bound to soil particles, persisting in various soils for at least 234 days. This is of serious concern for poor farmers who cannot purchase expensive chemical fertilisers, and who instead rely on local residues, organic matter and soil microorganisms (key invertebrate, fungal or bacterial species) for soil fertility, which can be negatively affected by the soil bound toxin.

When the Bt genes fail, what would poor farmers be left with? It is entirely possible that they would face the serious rebound of pest populations freed of natural control by the impact Bt had on predators and parasites, and reduced soil fertility because of the impacts of Bt crop residues plowed into the ground. These are farmers who are already risk-prone and Bt crops would most likely increase that risk.

In the Third World there will typically be more sexually compatible wild relatives of crops present, making pollen transfer to weed populations of insecticidal properties, virus resistance, and other genetically engineered traits more likely, with possible food chain and super-weed consequences. With massive releases of transgenic crops, these impacts are expected to scale up in those developing countries, which constitute centres of genetic diversity. In such biodiverse agricultural environments, the transfer of coding traits from transgenic crops to wild or weedy populations of these taxa and their close relatives is expected to be higher. Genetic exchange between crops and their wild relatives is common in traditional agroecosystems and transgenic crops are bound to frequently encounter sexually compatible plant relatives, therefore the potential for "genetic pollution" in such settings is inevitable.

In sum, these and other risks seem to outweigh the potential benefits for peasant farmers, especially when we consider the factors that currently limit their ability to improve their livelihoods, and the proven agroecological, participatory and empowering alternatives available to them

No role for GM crops

It is not a lack of technology which holds such farmers back, but rather pervasive injustices and inequities in access to resources, including land, credit, market access, etc., and other anti-poor policy biases. Two approaches make the most sense under such conditions: 1. technologies, which have pro-poor diseconomies of scale, like agroecology and 2. organisation into social movements capable of exerting sufficient political pressure to reverse policy biases. There is little useful role that genetically engineered crops can play.

The next time we hear of the latest 'magic bullet' invention altruistically developed in private sector labs for the benefit of the poor, we would do well to keep in mind the true causes of hunger, poverty and lagging agricultural productivity in the third world.

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Genetic engineering: not the only option

"Genetic engineering is often justified as a humane technology, one that feeds more people with better food. Nothing could be further from the truth. With very few exceptions, the whole point of genetic engineering is to increase the sales of chemicals and bio-engineered products to dependent farmers."
David Ehrenfield, Professor of Biology, Rutgers University, USA

The Gene Revolution

A new agricultural revolution is taking place: the "genetic engineering revolution". For the first time it is possible to break through natural species' barriers, systematically moving genes from one species to another that do not combine in nature. This is done by transferring genetic material, for instance, from bacteria to plants. Proponents of genetic engineering (GE) claim it will provide new plants and animals that would lead to a more environmentally-sound agricultural production with crops that produce their own pesticide thus reducing the use of chemical pesticides. They also promise crops that produce medicine, plants tolerant to salt and drought and enriched food to restore micro-nutrient deficiencies. Many see GE as "the" solution to hunger, poverty and many health problems. Some advocates go a step further by accusing opponents of genetic engineering as 'colonialists who withhold technologies from poor farmers' (p.36).

It sounds too good to be true. But when we begin to look behind the façade of this promise-filled development, many important questions emerge:

- Who benefits from genetic engineering and who loses?
- What are the risks and who will bear them?
- What are the alternatives to genetic engineering?

This issue of LEISA Magazine and the accompanying journal "Biotechnology and Development Monitor" attempt to explore these questions.

Genetic Engineering is different

GE, also known as genetic modification or manipulation (GM), is part of what is termed "biotechnology" or "biotech" in short. Biotechnology is a very inclusive term, ranging from natural fermentation, to safe and relatively cheap practises like in-vitro propagation to genetic engineering. A good starting point to understand the different types of biotechnology is the article by Visser on p.9. It gives an overview of the potential, costs and expertise required by each of them.

In this issue, the focus is on genetically modified crops as they have far-reaching implications on sustainable agriculture in general, and farmers' livelihoods in the South in particular. Genetic engineering is sometimes presented as just another step in a continuous process of agricultural development. In other words, there is no reason to worry. However, this argument cannot be justified. Genetic engineering is radically different from previous technologies because it allows for the moving of genes between different species across natural boundaries, which makes the risks unpredictable.

Ecological concerns

Despite many reassuring words by companies, researchers and some governments, many concerns about the implications of GM crops remain. Major concerns relate to the consequences for the ecological systems into which they are being introduced. These concerns are often neglected by the GM seed industry, the authorities approving their access to the market and the farming communities making use of the proposed technologies. For instance, the insertion of Bt (*Bacillus Thuringiensis*) genes was thought to be a silver bullet, a permanent solution to insect problems. But the model of "one pest – one solution" does not work forever, as is the case with pesticides; sooner or later resistance builds up. Similarly, building of herbicide resistance in plants is headed for trouble as it unleashes basic ecological reactions. Excessive use of herbicides as a major or only tool of weed management, will eventually reduce the sensitivity of weeds to herbicides and create an even worse weed problem. It is "to a large extent a victim of its own success". Recently, more and more evidence is being brought to support the fact that these concerns are not negligible. Yield decline in GM soybean, for instance, is being traced to reduced root development, nodulation and nitrogen fixation.

Another effect is related to the unexpected impact of gene transfer and its consequences. One example from USA tells how genes from one bacterium *Xanthomonas* were transferred to another soil bacterium, *Kebsiella planticola*. The new organism was meant to ferment stubble into alcohol, thus providing farmers with an extra source of income instead of burning the stubble. However, a test by the authorities found that wheat planted in the soil containing the new organism was killed by it.

In Europe, scepticism is widespread due to the many ecological concerns that surround the introduction of GM crops. A de facto moratorium on releasing genetically modified organisms has been in place since 1998 (p.13) One can draw no other conclusion than that, in many countries, GM crops have been brought too early into the market and that precaution should prevail.

Private companies appropriate farmers' livelihoods

One thing that makes the development of GE unique in the history of agriculture is that it is almost fully controlled by private companies. Transnational corporations (TNCs), often with their roots in the production of agro-chemicals, carry out the laboratory research, field trials, production and sale of GM crops. They spend enormous amounts of money on developing herbicide-resistant crops that are being sold to farmers as a package inclusive of both the herbicide and the seeds. Through patents these TNCs keep competitors at bay. It appears that GE technologies are not being developed because of their problem-solving capacity, but because of the patent - and thus profit - it can bring to the companies. For instance, in the 1980s, Monsanto was not interested in genetically engineering virus resistance into plants, as it would bring minimal profits. In the "old days" public-funded international or national agricultural research centres could have stepped in and carried out that research. However, the public research centres seem to be loosing ground in access to the knowledge and genetic material, thus widening the gap between public and private research. Recently, private companies have been pushing further, trying to get exclusive rights over nature's genetic resources as in the case with Monsanto's application seeking patent protection related to (wild and domesticated) soy beans.

Terminator technology takes the issue further. This technology, in which genes are manipulated to be able to switch seeds on and off by treatment with chemicals provided by one and the same GM seed company, effectively prevents farmers from keeping their seeds for replanting. Strong public opposition has forced the companies to give up this line of research, but they still hold the patents to the technology.

These examples illustrate very well what kind of agricultural development these companies promote, namely high-input, highly industrialised monoculture systems, which force farmers to buy packages of inputs from just one company. In this context it is rather shocking that, in 2001, the US government generously funded biotechnology research and development in agriculture with a budget allocation of US$ 310 million, whereas support for organic farming was less than US$5 million. Farmers have expressed their concern about these developments, as can be concluded from the citizen's juries conducted in many parts of the world (p.27). Rossett also clearly illustrates that GM crops have very little to offer to farmers in risk-prone, diverse and complex agriculture (p.6). It is expected that GM crop research will be very slow in responding to the needs of low-input agriculture.

Contamination: No guarantee that crops are GE-free

The contribution from the Louis Bolk Institute (p.12) shows that the organic movement does not consider GM crops as organic. It accepts conventional breeding and the new technologies available to assist it, but finds manipulation at the cell level and below as unacceptable. The article describes how the debate on GE has led organic farmers to reconsider their dependency on seed companies that focus on high-input agriculture.

But how can farmers be sure that they grow GM crops, considering that seeds and pollen spread by wind, water, birds and insects. Large areas can be contaminated by the introduction of GM crops by a single farmer. In the US, contamination by GM crops is now such a big problem that organic farmers find it almost impossible to get GM-free seeds. Tests have shown that "organic crops" from the US are often contaminated with engineered genes despite farmers' efforts to stay GM-free. Consequently, the international organic movement (IFOAM) is considering refusing certification of organic crops from the US. But who will pay for the damage inflicted on the organic farmers in the US?

Who bears the risk?

With the introduction of agricultural genetic engineering, the costs of contamination and other costs of reduced market shares are being imposed on farmers, consumers and the environment as a whole - not only in Europe or North America, but also in the South! Will GM seed companies bear the risk of releasing these crops in the South? What will happen if things go seriously wrong, e.g. a GE crop turns out to have negative health effects or becomes a serious ecological threat?

The GM crop in question may be banned but that does not mean it will stop existing. This situation is not comparable to that of an agricultural chemical which turns out to have unanticipated side effects after a number of years. The effect of such chemicals will eventually disappear from the environment. Not so with GM crops that are likely to survive in the wild and spread their genes through crossing with other plants. This is already taking place in Mexico where wild relatives of maize have been contaminated with genes from GM crops (p.25). Since Mexico is the centre of maize diversity, such contamination constitutes an irreplaceable loss. The wide variety of genes in wild plants and in traditional agriculture is the main insurance we have to cope with new demands on crops – whether caused by new pests and diseases, increased salt levels or changing climates. In Southern Brazil, estimates are that despite the ban on GM crops, 30% of the soybean acreage is already contaminated, thus threatening Brazil's GM-free status (p.19).

The risk of an unintended introduction of GM crops is more threatening in countries where no legal framework exists, as is the case in many African countries. For instance, one expert from Zambia expressed his concern that illegal trade in GM varieties is most likely once neighbouring countries have it. Again, who will bear the risk?

Alternatives

But do we really need GM technology to combat malnutrition, to improve local production and to make agriculture more productive. Has the introduction of GM crops contributed to the reduction of poverty? The FAO (United Nations Food and Agricultural Organisation), in a recent report, indicated that "for the world as a whole there is enough, or more than enough, food production potential to meet the growth of effective demand, i.e. the demand for food of those who can afford to pay farmers to produce it." This implies that "any residual hunger problems will be largely poverty, rather than production-related", which means that reaching the goal of food security for all should be based on a premise other than genetic engineering. Alternative approaches to agricultural production are, therefore, essential.

Over the years, LEISA Magazine has documented a wealth of agro-ecological, low-external-input alternatives to agricultural production. The articles in this issue confirm, once again, that the potential of LEISA is far from exhausted. The case of natural crop protection from the Andes (p.23) indicates that there are many plants in nature, which provide us with clues for better pest management. During a forum in the Netherlands, an Indian journalist informed the audience that agricultural research in India is only making use of 3% of the total of 3000 rice varieties that are known. Research done in Thailand indicates the potential that exists in nature for selecting and breeding varieties with desired characteristics such as salt tolerance (p.16). Many ecological principles that are still being overlooked, underestimated or sidelined, deserve more attention as they provide relatively cheap, controllable and low external input solutions to many problems that farmers face. The System of Rice Intensification (SRI) is an example of the many roads to sustainable agriculture that are hardly explored (p.15). Moreover, these approaches are not accompanied by the many risks - both economic and ecological – that GM crops are posing.

The push-pull system in Kenya (p.17), organic cotton production in Senegal (p.21) and zero-tillage no-herbicide soybean cultivation in Brazil (p.19), are examples of ecologically-sound alternatives that already exist. They are not a danger to the environment, nor do they make the farmers dependent on agricultural supply companies. Third world farmers will certainly be much better off if research efforts and resources are dedicated to agro-ecological approaches that have wide-ranging possibilities.

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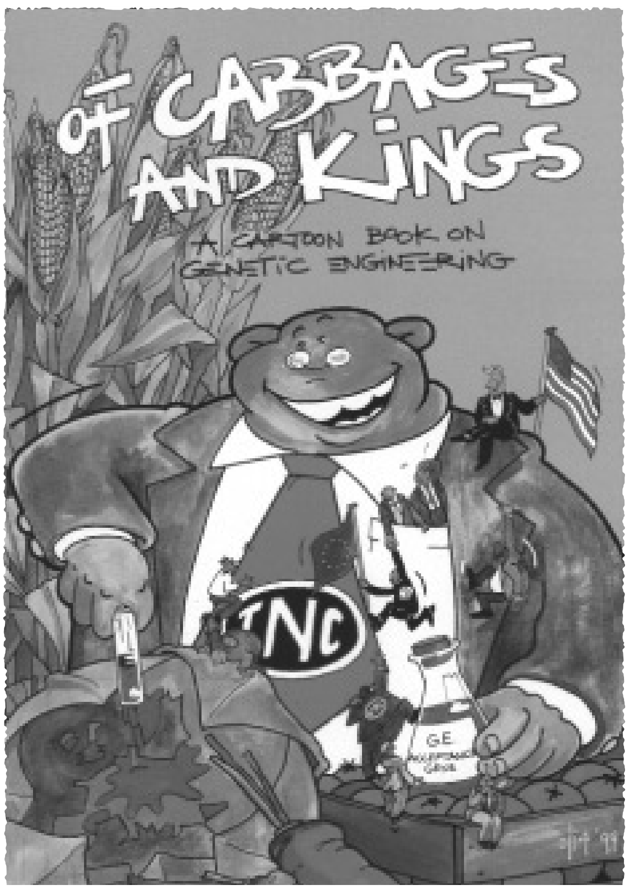

Cartoon book on genetic Engineering,
A Seed Europe, P.O.Box 92066, 1090 AB, Amsterdam, The Netherlands
www.groundup.org/cartoon/toon.htm

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Harvesting potatoos in the central highlands of Peru
Photo: GIAREC, Peru

The editors have taken every care to ensure that the contents of this magazine are as accurate as possible. The authors have ultimate responsibility, however, for the content of individual articles.

The editors encourage readers to photocopy and circulate articles. Please acknowledge LEISA Magazine and send us a copy of your publication.

ISSN: 1569-8424

C O N T E N T S

If poverty and hunger in the world are to be reduced, then the reasons for these problems need to be understood. Starting with a short historical background, the author traces the changes that have taken place in national and global governance mechanisms, leading to some of the most pressing problems faced by small farmers today. In his opinion, GM crops will not address the principal constraints faced by farmers; in fact the risks they face far outweigh any benefits. The author emphasises that it is not a lack of technology that holds farmers back, but pervasive injustices and inequities to resources including land, credit, market access etc.

Among the many different approaches to pest control in maize, the push-pull system shows great potential for small holder farmers. Repellent plants intercropped with maize "push" the insects out of the fields into trap crops outside the field that "pull" the insects in. The system makes optimal use of existing biological interactions, offers long-term stability and requires no expensive inputs. In Kenya, the grasses selected by the farmers as repellents and as trap crops have the added benefit of providing fodder and in suppressing the vicious weed Striga. The system has now been released officially in Kenya and is getting a very positive response from farmers.

ILEIA is the Centre for Information on Low External Input and Sustainable Agriculture (LEISA) in the tropics. ILEIA seeks to promote the adoption of LEISA through the LEISA Magazine and other publications. It also maintains a specialised information database and an informative and interactive website on LEISA (**http://www.ileia.org**). The website provides access to many other sources of information on the development of sustainable agriculture.

LEISA is about Low-External-Input and Sustainable Agriculture. It is about the technical and social options open to farmers who seek to improve productivity and income in an ecologically sound way. LEISA is about the optimal use of local resources and natural processes and, if necessary, the safe and efficient use of external inputs. It is about the empowerment of male and female farmers and the communities who seek to build their future on the basis of their own knowledge, skills, values, culture and institutions. LEISA is also about participatory methodologies to strengthen the capacity of farmers and other actors to improve agriculture and adapt it to changing needs and conditions. LEISA seeks to combine indigenous and scientific knowledge, and to influence policy formulation in creating an environment conducive for its further development. LEISA is a concept, an approach and a political message.

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27 Citizens' juries on GMOs and farming futures in India

Michel Pimbert, Tom Wakeford, P.V. Satheesh

Over the past quarter century a number of participatory methods have been developed to democratise policy-making. Citizens juries is one such method that is being used widely to get farmers involved in the debate on GMOs, which has a direct impact on their lives and livelihoods. This article describes two such juries conducted in India, in Karnataka and Andra Pradesh. In both instances, the farmers clearly said "no" to GMOs, and supported localised food systems instead.

23 Plants protecting other plants - an alternative to pest-resistant GM crops

Luis Gomero Osorio

Peru, like many other countries in this region, is endowed with many plants that can be used for pest control. With the introduction of chemical pesticides, the use of these plant-based substances has gradually decreased. However, the genetic engineering of crops to build-in resistance to pests has brought the discussion of natural protection methods back on the agenda. Some of these plant-based pest control agents are well known and are available commercially, but there are many more possibilities, considering the diversity of plant species.

DEAR READERS

There is hardly anyone, from producers to consumers, who will not be touched by the latest technology in agricultural development - genetic engineering of crops and animals. It is a subject that is raising much debate and controversy today, all across the globe, and at all levels of society. It is therefore quite obvious that ILEIA should dedicate an issue of the LEISA Magazine to the subject of biotechnology and GM crops, but then from the vantage point of small farmers and sustainable agriculture. As it is still very uncertain what benefits small farmers will gain from GM crops and what risks are involved, it would not be wise to focus all development efforts on genetic engineering. This issue, therefore, especially explores some of the many alternatives to GM crops.

We are very glad that we could join up with the "Biotechnology and Development Monitor", a journal that specialises in issues of biotechnology related to development, and thereby give you additional and useful reading on the subject. The Monitor's selection of articles related to small-scale farming systems, i.e. legislation and regulation of GMOs, complements those of the LEISA Magazine very well.

Of course, such a joint venture would not have been possible without the support of donors to meet the extra costs. ILEIA and the Biotechnology Monitor are extremely grateful to the Dutch donor organisations HIVOS, ICCO and NOVIB for their generous contribution toward this project.

This double-pack of the LEISA Magazine and Biotechnology Monitor is going out to a combined readership of nearly 20,000 people. Although we have tried to ensure that addresses are not duplicated, there is a good possibility that some of you may receive more than one pack. Please pass it on to a colleague or friend who could make use of the information, and if interested, become a future subscriber.

We hope that the information in these articles will give you more insights into genetic engineering and available alternatives and help you make the right choices. **We also take this opportunity to wish you much success in all your endeavours in the year 2002 in working towards a socially responsible and environmentally friendly agriculture.**

The Editors

december 2001 volume 17 no.4

LEISA

Magazine on Low External Input and Sustainable Agriculture

GE – not the only option

Readers and ILEIA staff discussing what they learned from the LEISA Magazine. Photo: Flemming Nielsen

ILEIA visits Ethiopia

During the first half of September Anita Ingevall and Flemming Nielsen of the ILEIA team spent two weeks meeting several readers of the LEISA Magazine in Ethiopia, assisted by Yohannes GebreMichael. Here is a short report on their visit.

The skies were dark grey and the rain poured down as we trudged along in search of some of the readers that had responded to the questionnaire we sent out with the LEISA Magazine 17.2. In this questionnaire we asked our readers in Ethiopia how they actually use the information they get through the LEISA Magazine. We wanted to know if we could establish a link between the information provided in the Magazine and what people actually do in their work; in other words, we were trying to ascertain how the Magazine impacted people.

We know from earlier evaluations of ILEIA that our readers appreciate the Magazine very much and find it useful. But what does this mean concretely? Does the Magazine actually have an impact at field level? Does it influence people and change their perceptions, ideas and actions? Does it have an impact on policy level? We wanted to gain some insights into these questions, and find out who our readers are and what they do with the information.

We chose Ethiopia for this study as it is home to more than 2000 regular subscribers, one of the largest readerships we have. The country is still heavily dependent on agriculture and regularly struck by famine. For the past 25 years many different donors have been active in trying to improve the productivity of Ethiopian agriculture through different programmes and different approaches. In spite of these efforts the natural resources continue to degrade and a breakthrough in agricultural productivity has not been achieved.

Getting in touch with the persons we had selected, based on the questionnaires, proved more difficult than expected. Bad telephone lines, sickness, job transfers etc. were some of the odds to be dealt with in getting to people. But nothing could have prepared us for the truly positive responses we received once we actually got in touch !

We visited people in and around Addis Abeba, North of Debre Berhan and in Tigray, South of Debre Zeit and around Awassa, from different backgrounds and with different tasks in agriculture. Among them were farmers, policy makers in the government ministries in Addis Abeba, workers in NGOs or people involved in research, training and education. What struck us was their resourcefulness and dedication to really make a difference in agriculture. Interested, reflective and innovative they were managing to do a lot more than what their circumstances allowed.

We found examples of direct implementation of technologies described in the Magazine. Frequently, the Magazine was used as a source of training material at different levels and as a point of up-to-date references. Some of the articles had inspired people to write research proposals. Several people told us that their ideas on how agriculture should be done had changed completely after reading the Magazine for some time, and others how their approach to farmers and indigenous knowledge had changed fundamentally as a result of ideas presented in the Magazine. Most of the persons we met considered the Magazine as a resource that was directly relevant to their own conditions. It kept them informed about similar developments around the world, which made them feel part of a larger 'movement' and which confirmed that 'they were on the right track', as one reader put it.

We found that most readers share their copy of the Magazine with friends and colleagues and that the articles often served as a basis for discussions. We were convinced that the Magazine should remain free of charge for those who wish to receive it. This allows individuals to subscribe, thus increasing accessibility and preventing the Magazine from being locked up in an unused library or in the boss's room. We learnt that clear instructions on subscriptions and renewals could reduce a lot of confusion. What we also found was that most of our readers are men. Not a surprising finding as technical personnel in agriculture and forestry most often are men, although agriculture as such involves the whole family and in many situations puts the major load on the women. As we consistently try to increase the number of articles that features women in the LEISA Magazine, we would also like to see our number of female readers increase. So, please, inform your female colleagues about the Magazine and how to subscribe!

We would like to thank all the persons we met in Ethiopia for sharing their time and experiences with us. For us it has been an invaluable and very inspiring experience, which will keep us going and which will certainly have an impact on the Magazine. ■

This study was made possible through the generous contribution of the Swedish International Development Co-operation Agency. The findings will be made available in a report. ILEIA will also produce a small booklet to document the work of a number of Ethiopian readers met during this study.

A keen reader of the LEISA Magazine. Photo: Flemming Nielsen

New themes for LEISA Magazine

Issue 18.2, May 2002.

Rural communication and information management for sustainable family farming.

Rural communication and information management play an important role in spreading information on successful farmer innovations and in getting access to new knowledge. Participatory development programmes increasingly use rural radio, TV and other mass communication media as tools for farmer-to-farmer exchange. In some places, farmers even use mobile phones to get information on market prices. The use of internet and CD-ROMs by development workers, researchers and even farmers for networking and information exchange is gradually increasing as communication facilities improve. Yet, in many rural communities, traditional methods of communication continue to have a significant impact on the spread of information. What practical experiences have been gained with new as well as with more conventional approaches to rural communication and information management to enhance the expansion of farmer movements towards sustainable agriculture? How can access to electronic information and communication technologies be enhanced? How can these technologies be made into participatory tools? What experiences have been gained with local centres for information and farmer exchange? These are some of the practical questions that we wish to raise in this issue.

First deadline for contributions: 1st of February 2002.

Issue 18.3, August 2002

Ecological soil management, key to sustainable agriculture

Many problems in agriculture are related to soil and soil fertility management, i.e. soil erosion, low efficiency of fertilisers, nutrient imbalances, soil borne diseases, pests and weeds, soil compaction, farmer induced drought, water pollution, etc. Successes in raising productivity and ecological sustainability in agriculture often come from improvements in soil management. More insights are being gained into ecological soil and soil fertility management in the tropics. What do we know of ecological soil management? How do (traditional) farmers look at soil management and what can we learn from approaches such as organic agriculture, agroecology, natural farming, integrated soil fertility management, zero tillage and integrated pest management? Can traditional and organic technologies be combined with chemical fertilisers? As organic soil management technologies can be very labour demanding, appropriate mechanisation can be important. What experiences have been gained in this regard? Ecological soil management is site and crop rotation specific. What experiences have been gained with fine-tuning ecological soil management for specific conditions and rotations? Your practical experiences are very welcome.

First deadline for contributions: 1st of May 2002.

You are invited to contribute to these issues with articles (about 800, 1600 or 2400 words + 2-3 illustrations and references), suggest possible authors, and send us information about publications, training courses, meetings and websites.

Launching the new LEISA website:

www.ileia.org

We are proud to present the LEISA Website – the entry to LEISA resources on the internet.

- **Do we need genetically modified crops?**
  Voice your opinion and read what other people think in the Themes section.
- **Want to search the specialised database on LEISA documentation with 9,000 records?**
  Then try ILEIADoc.
- **Tired of wasting hours searching for links to LEISA information on the Internet?**
  Then check the Links section for the best links to other LEISA-related sources.
- **Looking for a particular article in the LEISA Magazine? Then go to the Magazine section.**
  All articles since 1995 are available for you to read, download and print!
- **Wonder what LEISA related conferences are coming up? Check the Events section.**
- **Do you have a LEISA question that needs an answer?**
  Post it at the Open Forum where the LEISA community will help you find an answer.
- **Want to order a book, subscribe to the LEISA Magazine or change your mailing address?**
  Check out the Subscribe section.

Community Integrated Pest Management

http://www.communityipm.org/Concepts/sustliveo1.htm

The words of Mochtar Lubis *"never in my wildest dreams did I think that a programme about 'bugs' would bring the dawn of democracy and liberation to Indonesian villages"* explain the importance of this very good and informative website on Community IPM, a starter activity for development of sustainable livelihoods. The website provides information on concepts, cases, country programmes, events and makes many links with other organisations on IPM. There is also a Newsletter and many downloadable documents: case studies, training materials and scientific papers, among them the longer version of the article by Russ Dilts on p.18.

Future Generations

http://www.future.org

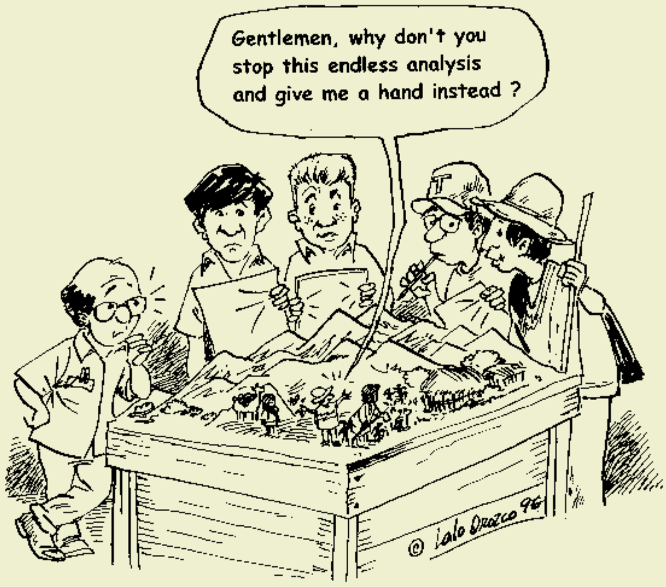
Future Generations has a remarkable track record as an international non-governmental organisation sharing knowledge and experience of how communities can change sustainably and equitably. Future Generations currently works on both sides of the Himalayan range - in the Tibet Autonomous Region of China and the states of Arunachal Pradesh and Utteranachal in India. The Future Generations model of community-based conservation and sustainable development can and should be applied around the globe.

The approach permits development success from one community to expand (or "scale up") quickly to other communities. The process of "going to scale" facilitates a rapid yet site-specific expansion of community progress that remains sensitive to local ecology, culture, and economics. The Future Generations website provides useful information on sustainable development, including a resource page with multimedia material and a variety of reports, among others '**The Future Generations model for community change**' and several pre-published chapters from the new book by Taylor-Ide DC and Taylor CE, **Just and lasting change: when communities own their futures** to be published by John Hopkins University Press (see Taylor p.14).

Scaling up participatory approaches

http://www.gtz.de/agriservice/areas/topics/topic6/topic_6d.html

This page on scaling up participatory approaches is found on the website of GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit). Participatory approaches in community development are designed for use at local level. Participation implies that the number of people involved is small. However, scaling up is necessary to use these approaches in overall development programmes. Two questions are addressed on this page: how can participatory approaches (PA) be institutionalised in research and extension organisations and how can PA become general practice, to benefit large numbers of people.



Smart Library on Scaling Up

http://scalingup.smartlibrary.org/

This website contains a lot of information on scaling up of organisations. Text from a number of documents that handle issues of scaling up are available with a bibliography of the documents used. Scaling up processes in NGOs are discussed in detail. Information on why and how NGOs scale up and what problems can be expected is also available on the website. An easy and fast information source, but does not tackle the issues in depth.

Indigenous conservation tillage system in East Africa with an example of their evaluation from South West Tanzania

by R. Kayombo, J. Ellis-Jones and H.L. Martin, 1998. Available on:
http://www.fao.org/ag/ags/AGSE/ agse_e/3ero/Namibia1/c12.htm

This paper, available on the pages of FAO, documents existing indigenous conservation tillage systems in water scarce conditions and in semi-arid zones, and analyses the usefulness and shortcomings of indigenous conservation tillage in a case study from South West Tanzania. It provides 20 pages with information on these farming systems in East Africa,

The World Bank, participation, community driven development

http://www.worldbank.org/participation/
http://www.worldbank.org/wbi/sourcebook/sbhome.htm

These two World Bank sites provide information on participation in development programmes. The first page contains case studies and reference literature on the subject; the case studies are ordered country wise. There are also links to other information sources. This site is a rich source of information on community driven development, participatory monitoring and other related topics.
The second site provides a sourcebook on participation. Participation is a process through which stakeholders influence and share control over development initiatives and the decisions and resources that affect them. This Sourcebook is primarily intended for readers who have already decided to use participatory approaches in their professional work. The book is meant to strengthen ideas about participation and how to put it into practice. The ways of working presented in this manual can improve projects, contribute to the development process, and help reach the poor.

Conservation Agriculture

http://www.fao.org/landandwater/portals.htm

The FAO Land and Water portal has a section on conservation agriculture (conservation / zero / no tillage). Among its contents is an overview paper on experiences with conservation tillage: 'Frontiers in conservation tillage and advances in conservation practice' by R. Derpsch. This portal also gives access to the African Conservation Tillage Network.

Gender, land, and livelihoods in East Africa: through farmers' eyes by Verma R. 2001. 261 p. ISBN 0 88936 929 1. International Development Research Centre (IDRC), PO Box 8500, Ottawa, ON, Canada K1G 3H9 / www.idrc.ca/books/

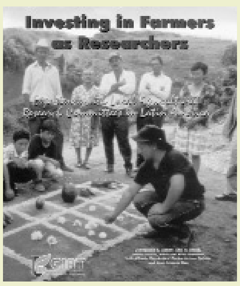
Research into the relationship between gender and natural resource management in Sub-Saharan Africa has taken a step forward due to people like Ritu Verma. Her analysis of the relationship between people and land recognizes the extraordinary complexity of soil management in an era of macroeconomic change. It centers on the social relations that dictate land use practice in Maragoli District, W.Kenya. A large part of the book is dedicated to the case study, which focuses on the complex gendered dimensions of soil management, farming and livelihood strategies of individuals who are differently positioned.

Part one is an introduction to the research, part two gives the historical background of the region. Part three, four and five present the research findings and gender analysis of the case study. The book illustrates the complexity and diversity of women's lives with extensive use of personal narratives and photographs from the farmers of Maragoli.

Interesting reading for researchers, practitioners, and professionals in development organizations, grass-roots organizations and government working on issues of gender, soil management, land tenure, income generation, and off-farm livelihood strategies. (WR)

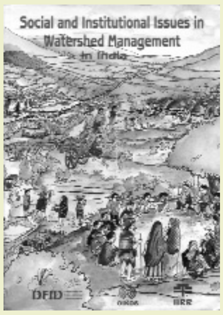
Investing in farmers as researchers: experiences with local agricultural research committees in Latin America by Ashby JA, Braun_AR [et al.], 2000. 199 p. ISBN 958 694 030 6 USD 40.-. CIAT, Publications Distribution Office, Apartado Aéreo 6713, Cali, Colombia / L.Garcia- CIAT@cgiar.org, www.ciat.cgiar.org. (CIAT Publication no 318).

This report describes experiences with an approach to participatory research and development in Latin America appropriate for poor farmers, called Local Agricultural Research Committees (CIAL spanish abreviation). The CIAL is a farmer-run research service that is answerable to the local community. The community elects a committee of farmers, the CIAL. The CIAL conducts research on priority topics and reports its results back to the community. Both the CIAL members and the community benefit from this approach.



The report describes the history and results of a number of CIAL's in Equador and Colombia. It is an impressive example of how poor farmers can help themselves and their community to increase their food security. The report ends with a long list of research topics investigated by CIALs throughout Latin America. The main topics are development of local crop varieties, resistant to pests or adapted to local soil conditions (potato, maize, cassava etc.) and evaluation of livestock diets for poultry, pigs etc. There is also a bibliography with training materials and manuals. This report is a source of useful information for anyone involved in agricultural research and development. (WR)

Social and institutional issues in watershed management in India, 2000. 407 p. ISBN 0 942717 86 4, OIKOS, India and International Instutute of Rural Reconstruction (IIRR), Y.C.James Yen Center, Silang, Cavite, Philippines / information@iirr.org financed by DFID-UK.



This resource book produced during a workshop held in India, in March 2000, has brought together "tried and tested" experiences in dealing with social and institutional issues in watershed development. The purpose in putting together this collection of resource materials is to provide trainers, project/field managers, local government officials, researchers and policy makers with a handy, user-friendly resource book on social and equity issues in watershed management. Oikos and IIRR has succeeded in making a comprehensive and user-friendly resource book with a lot of instructive illustrations focused on an extensive number of topics related to participatory watershed management. Fortunately, attention is also given to establishing partnerships and linkages between governmental, non-governmental, technical, social and credit institutions. This is important for sustainability of watershed management as well as for scaling up. (WR)

Nature in war; biodiversity conservation during conflicts : international seminar by Blom E, [et al], 2000. 174 p. USD 20.-. Werkgroep Ecologie en Ontwikkeling,programme of the Netherlands Committee for IUCN, Plantage Middenlaan 2B, NL 1018 DD Amsterdam / mail@nciucn.nl. (Mededelingen Nederlandse Commissie voor Internationale Natuurbescherming ISSN 0923-5981 no. 37).

This publication is the output of a workshop organised by a Dutch-based group of independent international nature conservationists called "nature in war". Members of NGOs from regions that experienced conflict situations illustrated the enormous damage to natural resources and rural areas caused by war. But at the same time they stated that conservation measures are possible and very important for the local situation. Recovery after the conflict is greatly favoured by nature conserving measures during the conflict situation. Nature conservation can prevent the total destruction of the environment of local communities. This publication gives recommendations for all stakeholders in conflict situations, governments, NGOs, humanitarian organisations etc., on how to avoid destruction of biodiversity and other natural resources. (WR)

Understanding diversity in farming practices in Tigray, Ethiopia
by Beyene A, Gibbon D, Haile M, 2001. 18 p. NUTNET programme, International Institute for Environment and Development (IIED), Drylands Programme. (IIED Managing Africa's Soils, ISSN 1560-3520 ; 24). Drylands Programme, IIED, 3 Endsleigh street, London WC1H ODD, UK / drylands@iied.org ; www.iied.org/drylands.

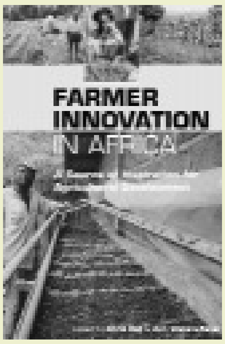
This paper presents the results of a study undertaken in Tigray, Ethiopia, to explore local people's perceptions and understanding of their land resources, and the way that their views influence natural resource management. The findings of the study indicate that the cultural and social meanings attributed to specific areas play an important role in the physical condition of fields. The conclusion of the researchers is that policy makers therefore need to pay more attention to the relationships between people and land, and to the value that farmers attach to different fields and plots. (WR)

Improvement of Neem and its potential benefits to poor farmers
by Childs FJ, [et al.], 2001. 32 p. ISBN 0 90534 29 8. HDRA the organic organisation, Ryton Organic Gardens, Coventry CV8 3LG, UK / www.hdra.org.uk/research , enquiry@hdra.org.uk Forestry research Programme of DFID.

This extensive review on the use of neem (Azadirachta indica) as a multi-purpose tree contains a list of published and unpublished literature, a consultation during a global electronic workshop and information obtained through fieldwork in Ghana and India. Research shows that the main use of neem is for medical purposes, with only a few farmers using neem in crop protection. Constraints for the use of neem in crop protection have been identified and possible solutions are suggested. The report gives an overview of the possible uses of neem, the constraints at the moment and possible interventions for increasing the benefits of the neem trees. The report comes with a neem database on 3.5 inch disk with bibliographic references relevant to the study. (WR)

The overstory book : cultivating connections with trees by Elevitch CR, Wilkinson KM (eds.), 2001. 414 p. ISBN 0 970254415 USD 49.95. Permanent Agriculture Resources (PAR), P.O.Box 428, Holualoa, HI 96725 USA / par@agroforestry.net, www.agroforestry.net.
This hard copy of the first 75 editions of the electronic journal "The Overstory" is a rich source of information on agroforestry. For people working with agriculture, trees, forests or sustainable resource management the book can function as a manual, filled with useful information in easy-to-read, single-subject articles. The articles are arranged content-wise so that interresting chapters like: saving water, soil and fertility; growing trees for forestry; seeds, seedlings and tree basics; animal assistants etc. form the contents of the book. Subscribers of the journal already know the value of the articles, but this arrangement of the articles together with the "learning more" bibliography and the good index with an additional index on botanical names of trees gives the book added value. Every article ends with further reading suggestions and weblinks and even the articles within the book are linked by a "related chapters" list at the end of each chapter. (WR)

Farmer innovation in Africa - a source of inspiration for agricultural development edited by Reij. C. and Waters-Bayer.A., October 2001. ISBN 1 85383 820 9 UK£ 16.95.-. Earthscan, 120 Pentonville Road, London N1 9BR, UK. E-mail: earthinfo@earthscan.co.uk www.earthscan.co.uk
One of Africa's major untapped resources is the creativity of its farmers. This message comes through very clearly in this volume of studies on how, in spite of adverse conditions and lack of appropriate external support, small-scale farmers - both men and women - are able to experiment and innovate in order to improve their livelihoods. Numerous lively examples show how a participatory approach to agricultural research and development - one that builds on local knowledge and innovation - can stimulate the creativity of all those involved, and not simply the farmers themselves.

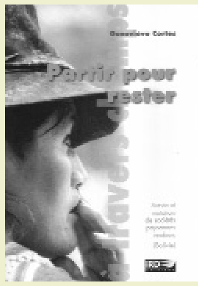


This rich source of case studies, written primarily by African extension workers, researchers and farmers, analyses how agricultural and development policy can be changed. Among the contents are: Farmer innovation and remarkable innovators; Building partnerships for innovation in land husbandry; Farmer innovation: process, evidence and analysis; Evaluation and extension of local innovations, Raising awareness and mainstreaming. The book will be invaluable for development workers, researchers and policy makers, as well as for students and teachers of agriculture, environment and sustainable development.

Municipal solid waste management, involving micro and small enterprises : guidelines for municipal managers by Haan HC, Coad A, Lardinois I, 1998. 154 p. ISBN 92 90493 65 8 : GBP 18.00. Publications Department, International Training Centre of the ILO, Viale Maestri del Lavoro 10, I-10127 Turin, Italy, SKAT. Intermediate Technology Publications, 103-105 Southampton Row, London WC1B 4HH, UK / itpubs@gn.apc.org.
This handy manual about urban solid waste management is meant for municipal managers and others interested in municipal issues. The book is divided into several sections that answer specific questions like "why involve the private sector" or "what policy decisions must be made before starting". It covers the "why" and "how" of involving new entrepreneurs and small community-based groups in the collection of garbage. The last part of the book, "the annexes" contains case studies from Latin America, South-east Asia and Africa , sample contracts and backup information. (WR)

Weed management in the humid and sub-humid tropics by Rijn PJ (van), 2000. 234 p. ISBN 90 6832 123 4 USD 32.50. Royal Tropical Institute (KIT). KIT Press, P.O.Box 95001, 1090 HA Amsterdam, the Netherlands / publishers@kit.nl ; www.kit.nl.
This thorough book on weed management is written by three scientific experts in weed management in tropical crop systems. The abundant growth of weeds can cause high losses in tropical crop yields if no control methods are practised. The first part of the book deals with the nature of weeds, ecology, control, cropping systems and main weed species. The second part deals with weed control methods in general and in various crops. A variety of control methods, also mechanical and biological/ ecological, are described per crop. The last chapters are on weed control in pastures and on aquatic weed management. (WR)

Partir pour rester : survie et mutation de sociétés paysannes andines (Bolivie)



by Cortes G, 2000. 414 p. ISBN 2 7099 1459 X FF 150.-. Institute de Recherche pour le Development(IRD) éditions, 213, rue la Fayette, 75480 Paris cedex 10, France.
Geneviève Cortes is a French researcher in rural development and migration dynamics. She has written this study about migration and the complexities it brings about in Andean smallholder economies. The book in French has summaries in English and Spanish. The work sheds light on the economic and sociocultural changes of rural areas in the Andes (Bolivia) analysed in relation to migration. The way in which spatial mobility of smallholder farmers moulds new relationships with space and with home territories is explored, and also the role of migration in agricultural production, modes of consumption and food systems. The study combines both quantitative methods like socio-economic monitoring of households, and qualitative approaches like observations and participation. (WR)

Participation of the poor in development initiatives : taking their rightful place by Long C, 2001. 192 p. ISBN 1_85383_761_X : GBP 15.95. Institute for Development Research (IDR). Earthscan Publications, 120 Pentonville Road, London NI 9JN / earthinfo@earthscan.co.uk / www.earthscan.co.uk.
This book is an analysis of the progress made by donors and governemental agencies during the past decade to embrace participatory development approaches and incorporate it in their policies and procedures. NGOs in different parts of the world use participatory development as common language for decades, but large donors like the World Bank and USAID have changed their policies in favour of primary stakeholder participation only in the last decade. The book describes this process of incorporation. (WR)

NGO's, states and donors: too close for comfort? by Hulme D, Edwards M (eds.), 1997. 309 p. ISBN 0 333 66582 1 (pbk): GBP 12.99. Save the Children. (International Political Economy Series). Intermediate Technology Publications, 103-105 Southampton Row, London WC1B 4HH, UK / itpubs@itpubs.org.uk
The contributors to this volume have presented a wealth of experiences, data, concepts and competing analyses of what is happening in the relationships between NGOs, states and donors. Donors have poured funds into NGOs, governments have allocated them major responsibilities and their number and size have grown. This book raises the question as to whether this popularity has helped them to solve the problems of poverty, or whether it has changed them to become part of the "development industry" that they used to criticise. The picture that emerges from the general reviews and detailed case studies of African, Asian and Latin American NGOs is a complex one. However, the authors warn that NGOs are getting closer to donors and governments and more distant from the poor whom they seek to assist. (WR)

Farmer-led extension : concepts and practices

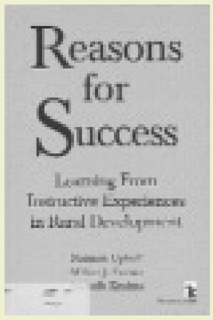
by Scarborough V, Killough S, Johnson DA, Farrington J (eds), 1997. 214 p. ISBN 1 85339 417 3: GBP 12.95. Overseas Development Institute (ODI), Regent's College, Regent's Park, Inner Circle, London NW1 4NS, UK. Intermediate Technology Publications (ITP), 103/105 Southampton Row, London WC1B 4HH, UK.
This book presents the outcome of an international workshop held in the Philippines, promoting farmer-led approaches to agricultural extension. The workshop distinguished between truly farmer-to-farmer extension, extension undertaken and controlled by farmers themselves, and approaches aiming at a greater involvement and influence of farmers in extension organised by others, governmental or non-governmental organisations. Based on a very rich collection of cases from all parts of the world, the book formulates lessons and recommendations on both forms of farmer-led extension. According to the authors the second form of farmer-led extension may be applicable on a wider scale but only if public sector extension is really prepared to give up part of its power and become responsive to interests and initiatives from farmers. (LvV)

The inter-group resource book: a guide to building small farmer group associations and networks by Lawrence T, Rouse J, Thomas G, 2000. 104 p. Food and Agriculture Organization of the United Nations (FAO), Viale delle Terme di Caracalla, 00100 Rome, Italy / www.fao.org
This publication of FAO is the third in a series of field manuals on small farmer group development, and deals with the topic of developing inter-group associations. As a development strategy small groups have been promoted in order to strengthen the collective self-help capacity of small farmers. However, individual small groups often do not have the resources needed to pursue broader objectives. In such cases some sort of inter-group cooperation is needed to achieve results. With this publication FAO aims at helping groups to build inter-group associations that are capable of financing and managing their own activities, using their own resources and without need of outside help. The manual provides practical information on this subject, in the form of guidelines that cover the whole process of establishment to management of an association. This manual is available for free, downloadable from internet, and FAO encourages users to translate it into their own language and to adapt its contents to their own conditions. (WR)

Learning together through participatory extension : a guide to an approach developed in Zimbabwe by Hagmann J. [et al.], 1998. 59 p. Department of Agricultural, Technical and Extension Services (AGRITEX); German Development Cooperation (GTZ); Intermediate Technology Development Group, Zimbabwe (ITZ). Universum Verlagsanstalt, D-65175 Wiesbaden, Germany.
This booklet, written for field staff and middle-level extension managers, describes a community-oriented approach to rural extension based on farmer experimentation and learning. The action-learning cycle integrates four main phases: social mobilisation through a situation analysis carried out jointly by insiders and outsiders, community-level action planning, implementing of activities and farmer experimentation, and monitoring and evaluation through sharing experiences and ideas. A major focus is on local institutional development. The process in practice - with all its steps - is described and clarified through examples from the field.

Scaling up participatory watershed development in India: lessons from the Indo-German Watershed Development Programme
by Farrington J and Lobo C, 1997. ODI Natural Resource Perspectives nr 17
http://www.odi.org.uk/nrp/17.html
Upscaling individual successes to a large-scale programme calls for a perspective of macro-management which, at the same time, has to be rooted in and responsive to the micro-level. This paper describes the experiences of the IGWDP in semi-arid India with the upscaling of participatory watershed development over wide areas. Both the involvement of stakeholders at international, national, district and local levels and the field level collaboration of NGOs, community-based organisations and government departments are discussed and criteria for selection are given. Micro-level watershed rehabilitation reverses environmental degradation and permits a shift in sustainable productivity in the lower slopes of watersheds. This report contributes to the search for participatory but rapidly replicable approaches to micro-watershed rehabilitation. (WR)

Reasons for success: learning from instructive experiences in rural development by Uphoff N, Esman MJ, Krishna A, 1998. 232 p. ISBN 1 56549 076 2 (pbk): USD 19.95. Kumarian Press, Inc., 14 Oakwood Avenue, West Hartford, CT 06119-2127, USA / kpbooks@aol.com.



This book is written as a companion volume to "Reasons for Hope", a collection of case studies of programmes that have succeeded in improving prospects of rural households. Successful large-scale and sustainable programmes for rural development are much more the exception than the rule. These books focus on rural development programmes that have had important impacts in their countries and some even beyond their national borders. A wide range of successful experiences in developing countries all over the world is described. In "Reasons for Success", the authors analyse not only how these initiatives have become successful, but also how to generalise these often local initiatives. The most important aspects that contributed to the success of the initiatives are dealt with in the different chapters of the book: the learning process and assisted self-reliance; the importance of good leadership; local organization and participation; knowledge about how to take better advantage of the available resources, natural, physical and human. This readable book is a rich source of information that shows ways to improve people's livelihoods whilst sustaining the environment. (WR)

Sustainable rural livelihoods: what contribution can we make? by Carney D (ed.), 1998. 213 p. ISBN 1 86192 082 2. Department for International Development (DFID), 94 Victoria Street, London SW1E 5JL, UK. (Issues).
The main papers of the Natural Resources Advisers' Conference on sustainable rural livelihoods organised by DFID in 1998 are collated in this book. The book opens with an informative introduction on definitions and explanations of sustainable livelihoods, written by Diana Carney, the facilitator for DFID's Sustainable Rural Livelihoods Advisory Committee.
The papers in the Key Issues part relate to policy consistency. The Entry Point papers go into some detail about the contributions to the sustainability of rural livelihoods that can be made by involvement in any particular area (biodiversity, ethical trade etc.). This book marks a starting point for thinking about a relatively new policy direction and the opportunities it presents. (WR)

Livelihood transformation in semi-arid Africa 1960-2000 : policy lessons from farmers' investment choices in Kenya, Senegal, Niger and northern Nigeria. 2001. Drylands Research, 17 Market Square, Crewkerne, Somerset TA18 7LG, UK / mikemortimore@compuserve, mary@marytiff.demon.co.uk; www.drylandsresearch.org.uk. (Drylands Research Working paper, ISSN 1470 9384 ; 40).
These are the proceedings of a workshop organised by the Overseas Development Institute (ODI) and Drylands Research in the series "Transformations in African agriculture" held at the London School of Economics in January 2001. It is part of a study that aims to relate long-term environmental change, population growth and technological change, as a follow-up to the well-known study by Mary Tiffen, Mike Mortimore and Francis Gichuki in Machakos District: "More people, less erosion: environmental recovery in Kenya". The hypotheses and policy recommendations generated by that study were tested in four other African dryland environments: Makueni District, Kenya; Diourbel Region, Senegal; Maradi Department, Niger; and Kano Region, Nigeria. Farmers' investments over time were compared in order to increase understanding of the effects of government policies on farmers' strategies and their choices between farm and non-farm activities. For each study area, several working papers and a synthesis were prepared. An overall synthesis was discussed at the workshop as reported in these proceedings. The results confirmed that rural people are innovating and finding solutions and opportunities in response to market and environmental conditions, but have often been constrained in these efforts by inappropriate government policies that do not give space for local dynamics. The working papers and syntheses can be obtained from Drylands Research or at the website (address see above), which contains the abstracts of all the working papers. (AWB)

Information revolutions: how information and communication management is changing the lives of rural people by Mundy P, Sultan J. 2001. 234 p. ISBN 92 9081 2289. Technical Centre for Agricultural and Rural Cooperation (CTA), Triops, Hindenburgstrasse 33, D-64295 Darmstadt, Germany / triops@net-library.de ; www.net-library.de.
This publication of CTA is also available in French (Les révolutions de l'information) and an electronic version can be found at www.cta.nl. With this book CTA addresses an important topic. The possibilities for information gathering and sharing are rapidly increasing at the moment due to fast technology development. But what perspectives does such development have for rural people. Efforts to use communication in rural development have three aims: provide information to audiences; help audiences find information and facilitate dialogue among audiences. This book comprises success stories of projects that promote information exchange in rural areas of Africa. The book is divided into nine sections, each with up to six stories about particular institutions or sets of institutions. There are sections on radio and television, newspapers and newsletters, literacy and local languages, computers and telecommunications, farmers' groups and markets, farmers' knowledge, research and extension links, research networks, and libraries. The stories are carefully chosen; only proven local or national initiatives that really contribute to communication are included. Therefore the book is very useful to everyone who wants to profit from information technology development. (WR)

Participatory watershed research and management: where the shadow falls by Rhoades RE, 1998. 20 p. International Institute for Environment and Development (IIED), 3 Endsleigh Street, London WC1H 0DD, UK / sustag@iied.org. (IIED Gatekeeper series, ISSN 1357-9258; SA 81).
Professor Robert Rhoades, who has more than 30 years experience in international development, warns in this paper of the pitfalls in the conceptualisation and operationalisation of integrated participatory watershed projects. He mentions a number of problems, which he calls "landmines" that can be expected on the way of implementing participatory watershed management. All these landmines are discussed with remarks on how to avoid them. The paper closes with urgent steps to be taken and an appeal to share experiences and to learn from mistakes. (WR)

Cover crops in smallholder agriculture: lessons from Latin America by Anderson S, Gündel S, Pound B, 2001. 152 p. ISBN 1 85339 530 7 USD 22.50. ITDG, Publishing, 103-105 Southampton Row, London WC1B 4HL UK, orders@itpubs.org.uk / www.itpubs.org.uk

Lessons learned in Latin America about the use and dissemination of cover crops in different agroecosystems need to be made more widely available not only in the Spanish-speaking, but also in the Anglophone regions. That is the aim of this workshop report. It concentrates on smallholder agriculture in developing countries where cover crops could provide an appropriate technology for risk-prone and resource-poor farming situations. The selected case studies from different countries within Latin America, which have been analysed during the workshop, form the skeleton of the report. The numerous experiences and variety in lessons learned for a wide range of agroecosystems makes this report a useful reference tool for extensionists, researchers and NGO workers around the world. It is well written and easy to understand. (WR)

Economic conditions for sustainable agriculture
A new role for the market and the state

Ruerd Ruben

Field research by the Development Economics Group of Wageningen University on various agro-ecological practices used by farmers in Central America (Nicaragua, Honduras, Mexico and Costa Rica), East Africa (Kenya, Ethiopia, Zanzibar) and West Africa (Mali, Burkina Faso, Benin) provides interesting comparative results regarding the economic effects in different settings. For this research, four specific criteria were used to assess the economic attractiveness of different types of agro-ecological practices: (i) profitability, e.g. the contributions to farmers' income and consumption, (ii) effect on input efficiency, (iii) consequences for labour use, and (iv) impact for risk management. On the basis of these findings, recommendations for policy reform are discussed.

Profitability
Adoption of agro-ecological practices can only be expected when farmers attain higher and more stable income and consumption opportunities. Contrary to what is usually expected, farmers are likely to apply yield-increasing and sustainability-enhancing inputs for commercially-oriented production activities. In the cotton belts of Southern Mali and Burkina Faso, fertilisers, crop residues and animal manure are mainly used for cash crops that guarantee sufficient monetary returns to warrant these costs. Similarly, animal traction and improved tillage yield higher returns when applied on more fertile fields where commercial crops are grown. In the Central Chiapas region of Mexico, crop residue mulching only appears to be profitable when combined with animal traction on fields devoted to intensive market-oriented maize activities.

Although we found that agro-ecological practices are likely to be adopted by subsistence-oriented, medium-size farmers in remote regions where opportunity costs are usually low, farmers' engagement in market exchange can still be considered an important condition for profitable and sustainable agriculture. Engaging in trade provides financial resources for the purchase of complementary inputs and consumption goods. Market development enhances the willingness to invest, while involvement in market exchange generally improves farmers' responsiveness to price incentives.

Input efficiency
Agro-ecological approaches are strongly based on the substitution of chemical inputs by integrated nutrient and pest management systems. High costs of inorganic fertilisers and other agro-chemicals often drive farmers to rely on locally available resources. Reducing the reliance on purchased inputs implies that good substitutes can be found and that complementary relations between different inputs are recognised.

Prospects for sustainable agricultural intensification strongly depend on the possibilities to improve *input efficiency*, e.g. the marginal returns derived from an additional unit of (organic or inorganic) inputs. Nutrient efficiency (i.e. fertiliser uptake) is determined by the availability of complementary micro- and macro-nutrients, notably soil organic matter and phosphorus. Nutrient recovery and the efficiency of uptake can be enhanced through (i) soil and water conservation measures, and (ii) frequent nutrient applications at times required by the crops (e.g. shortly after sowing and with sufficient rainfall). Both activities are highly labour-demanding and can hardly be mechanised. Input efficiency tends to be low when complementary inputs are not available at the right time or in sufficient amounts.

Organic and chemical inputs are not full substitutes, and combinations of locally available resources with selectively applied external inputs often yield the best results. We found that farmers hesitate to refrain completely from the use of purchased inputs, because it permits better timing of activities, reduces the demand for labour in critical periods, and contributes to a better appearance of the products in the marketplace. Given the low nutrient content and the delayed nutrient availability from organically produced fertilisers (green manure, mulch, dung, compost), chemical fertilisers are gradually reduced but not completely abandoned.

Labour productivity
Most analyses of sustainable practices devote attention to short- or long-run yield effects without acknowledging labour requirements and returns to labour. Family labour is thus wrongly considered as an 'abundant' resource. For most small farmers labour is scarce and strong limitations exist for substituting external inputs by labour. For a systematic evaluation of the attractiveness of such practices from the farm household's perspective, returns to land and labour need to be compared simultaneously. Agroecological intensification can only contribute to poverty alleviation when returns to land and labour increase simultaneously. When agroecological practices are analysed, attention has to be given to *marginal* returns compared to other activities (i.e off-farm employment; hiring-out of land).

Agroecological practices can be relatively intensive in the use of labour. Physical soil conservation measures promoted in the Central American hillsides and West African lowlands have resulted in yield increases, but require large amounts of labour for construction and maintenance and involve substantial costs for the purchase and transport of materials. Given their high labour intensity and long gestation period, returns to labour of such measures are mostly critical. Similarly, green manure practices and crop residue mulching in Mexico and Honduras require additional labour for harvesting, transport and under-ploughing. Mixed cropping and agroforestry systems in Central America and East Africa show low returns to labour due to high establishment, maintenance and harvesting costs. Production of fodder crops for livestock in West Africa improves the availability of manure and enable farmers to recycle crop residues, but demand considerable labour investment. Labour requirements for integrated pests and disease management in Zanzibar are equally high due to the substitution of manual for chemical operations. Mechanisation is not a feasible option due to very sloping terrain and the small scale of operations.

We found that high labour intensity can be a major limiting factor for adoption. Labour tends to be scarce in semi-arid areas during the periods of soil preparation, weeding and harvesting and competition for labour occurs when mulching, manuring or crop residue recycling are introduced. Resource-poor farmers are likely to derive part of their income from off-farm activities that have to be reduced when labour-led intensification of their farming system takes place. Farmers are likely to adjust their production system only when the additional income derived from those activities favourably compares to labour's opportunity cost. Some practices, notably physical soil conservation measures, can be executed in off-season periods, but take up leisure time that may be reserved for social or communal purposes.

Risk-coping

Resource-poor farmers prefer to rely on fairly diversified patterns of activities to ensure appropriate levels of risk management. Farmers facing risk prefer immediate revenues and therefore investment activities with long gestation lags are not popular. Diversification of cropping and livestock production and their integration with (agro)forestry, aquaculture and improved fallow practices could reinforce the resilience of farming systems through processes of nutrient recycling, biodiversity management and integrated pests and disease control. Consequently, yield levels tend to be more stable and dependency on purchased inputs can be reduced.

Risk management can also take place through farmers' engagement in off-farm and non-farm activities. The revenue streams derived from these activities are far less dependent on variable weather conditions and thus provide an adequate insurance against shocks.

Policy Reforms

Agroecological practices are widely promoted by farmer groups and NGOs to reduce the dependency on purchased inputs and to reinforce ecological sustainability. On the long run, genuine sustainability requires that these practices become economically feasible and independent of external support. To facilitate sustained adoption of agroecological practices, the following economic policy conditions should be in place:

Stable and remunerative *market prices* for agricultural products are effective as incentives to mobilise resources towards sustainable production systems. Massive adoption of new cropping systems could, however, lead to pressure on market prices and loss of initial returns.

Agricultural intensification also implies that land, labour and capital resources can be effectively mobilised. Secure and recognised *land and water rights* are an important condition to enhance farmers' willingness to invest. Well-defined ownership, use and transfer (inheritance) rights permit farmers to invest in land improvements and input purchase, and provide a suitable collateral for lending.

Rural *financial systems* are necessary to facilitate farmers' borrowing for investment, input purchase and insurance purposes. While formal banks are usually less inclined to lend to smallholders, local credit and savings schemes could contribute substantially to reduce transaction costs and risks for rural investment.

Reinforcement of the market environment can be considered as an important incentive for investments in sustainable agriculture. However, incentives should be related to '*farmer needs pull'* rather than '*technology push'*. Market prices should reflect real scarcity relations as perceived by the farmers and must not be distorted by improper interventions by the state or local NGOs. Subsidies on inputs or credit are not useful to enhance the lasting adoption of agroecological practices. Subsidies on demonstration plots are less convincing to farmers compared to experiments conducted on their own fields and investments made with own resources. In a similar vein, financial support systems based on farmers' own savings proved to be far more sustainable than subsidised credit systems.

Interventions to improve the market environment in favour of agro-ecological practices:

- Increasing the prices of imported inputs like fertilisers and other agrochemicals through adjustment of the exchange rate (devaluation) and elimination of input subsidies;
- Improving the efficiency of input delivery and output marketing systems, looking for a reduction of the transaction costs involved in market exchange through (public and private) investments in services and infrastructure provision;

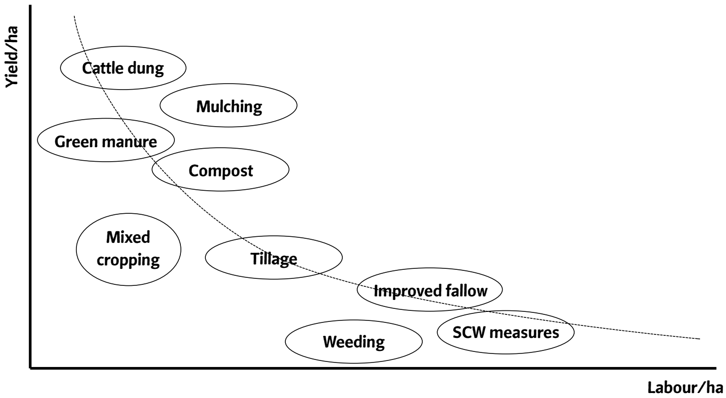


Figure 1: Factor intensity and yield effects of major NRM practices

The figure provides an overview of some agro-ecological practices used by Central American farmers, taking into account expected yield effects and labour requirements. The final selection of suitable practices made by the farmer is likely to depend on the labour/output price relationship.

- Introduction of user charges and fees for water, roads and technical assistance to facilitate the rationing of scarce resources towards the most efficient farmers, and to guarantee the institutional sustainability and maintenance of these services;
- Creation of more competitive markets through reduction of the market entry costs, including the establishment of farmers trading co-operatives, market information services, etc.;
- Improving value addition in agricultural production and marketing through investments in agro-processing, trade centres, product certification, etc.;
- Enhancing the backward and forward linkages of agricultural production, promoting integrated agro-commodity chains based on delivery of improved implements;
- Diversification of factor and commodity markets, enabling farmers to gain access to off-farm and non-farm income sources that will enable the intensification of their farming systems.

Public investments in infrastructure are required to support the development of local factor and commodity markets. Market development and reduction of transport costs are the most important requirements for sustainable agricultural intensification, since exchange relations favour access to complementary inputs and provide incentives for investment. Improving poor farmers' access to physical infrastructure represents a major condition for equitable and sustainable rural development. Without such efforts, low-input technologies tend to be restricted to medium-size farmers who are only marginally engaged in market exchange.

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How successful is the Wadi model?

Sharad Mahajan, Madhuri Newale, Pratap Pednekar

In 1982, the BAIF Development Research Foundation initiated a programme to improve the living situation of tribal communities in South Gujarat affected by environmental degradation and labour migration. In direct interaction with the tribal communities the *Wadi* (orchard) model, which combines improvement of human and ecosystem wellbeing, was gradually developed. Today, over 25,000 families from 300 villages have adapted the model. It is now to be implemented in Maharashtra and Rajasthan to cover an additional 20,000 families. In ILEIA Newsletter Vol.16.1 (pp18-19) the *Wadi* model has been presented and would be useful reading for those interested in a more detailed description. This article discusses the impact of the Wadi model.

Women obtain an additional income from tomato cultivation. Photo: Sharad Mahajan

Assessing the Dharampur Experience

Dharampur is one of the major tribal blocks of South Gujarat (India) situated in the forest. The area covered under forest is 46 % and is declining due to area brought under cultivation (a part of which turned into wastelands) and land used for settlements. The block consists of 237 villages comprising 287,600 people of which 98% belong to scheduled tribes. The hilly region has poor land and water resources as well as infrastructure facilities. The tribal population consists of small and marginal farmers (land holding less than 2ha) and the landless. The farmers use the land for production of food grains. Most of the tribals migrate to urban areas in search of work as hired labour.

The *Wadi* model has been taken up in the Dharampur block since 1995. 11478 families from 145 villages have adopted the model during the last 5 years.

The effect of the interventions was assessed using community based indicators. Focus group discussions with members of Planning Committees (*Ayojan Samitees*) of the Village Development Forums (*Gram Vikas Mandal* - GVK) were organised to develop the appropriate indicators. Discussions were centred around the perception of the community about development, the current situation and their vision. Information on selected indicators was gathered through household surveys, special studies related to cropping pattern, land use, status of development of GVKs and access to services. The overall effect of the model has been assessed through the 'Barometer of Sustainability'. The results are as follows.

Investing in orchard development

The participating families have established orchards on 4260 ha without disturbing the traditional cultivation area. The major part of the orchards are planted on wasteland (18%) and marginal lands (75%). The orchard plantation includes mango and cashew together with multi-purpose forestry tree species along the borders of the orchard. Farmers have planted 225,000 mango trees, 450,000 cashew trees along with 5 million forestry trees.

Almost half of the total area under orchards is treated with appropriate soil and water conservation measures. These include trench-cum-bunds for gentle and medium slope lands and tree platforms with upstream trenches for steep slope lands.

Each family establishes an orchard on their own marginal or wasteland. Core support for orchard development is provided in the form of material (good quality inputs e.g. grafts, saplings of forestry plants, fertilisers, organic manure, farm tools etc.) and training. Considering the long gestation period, the participants are encouraged to work on their own plots for land shaping and aftercare of the orchard. A token cash support is paid to the family for the labour it invests. It helps families to sustain and ensure proper maintenance of orchards. Participants also receive additional support to develop water resources as a group for income generation activities. The support is provided as a partial grant and credit (25%). The costs involved for orchard development on 0.4 ha are about US$450 see table 1.

Table 1: Per family costs for development of 0.4 ha orchard model

Particulars	Cost (Rs.) Material	Labour	Total	Period of support
Orchard establishment	3150	1030	4180	One time cost incurred during first year
Land shaping		3500	3500	One time cost incurred during first 2-3years.
Orchard maintenance	8040	2100	10140	Recurring cost indicated from second to seventh year of orchard development
Water resources development and irrigation	1450		1450	Utilisation not for individual basis but on user group basis
Credit component	On an average 25% of the above costs for income generating activities, water resources development, irrigation systems etc,			
Training and health component	About 5 % of the total cost per family for five years			
TOTAL COST	Rs. 20,000/ -(rounded off) i.e. approximately US$450			

Improved utilisation of land and water resources

The combined effect of orchard development, land shaping and utilisation of available water has led to a change in the cropping pattern.

- Establishment of orchard and cultivation of crops has increased the land use in the range of 30 -75%. About 40 % of the families have taken up winter cultivation (earlier only rainfed agriculture in summer). The visible impact of the cropping pattern change is crop diversity. Major crops cultivated before the programme were cereals (paddy, coarse millets), pulses (pigeon pea, gram), oil seeds (niger). Farmers added new crops: vegetables (brinjal, tomato, chilli, cucumber, etc) root crops (onion, turmeric, sweet potato), watermelon, wheat, banana, etc.
- About 55 % of the families have increased the average paddy area from 0.36 to 0.5 ha. Rice is the main staple food. Growing of other crops for the market is observed in areas having appropriate water facilities. Cultivation of perennial crops is also increasing. This includes coconut, guava, lime, jackfruit, ber, etc. An overall change in the cropping pattern is observed on 51% of the total area under cultivation.

Settlement in own environment

Tribals see orchard development as an opportunity to build some assets in the existing subsistence living condition. They take every care to make it successful. In many orchards, elderly family members are engaged in watch and ward throughout the day. About 55% families have either shifted or planned to shift their houses into the orchards. Thus, a resource once considered as written-off has now become a shelter for life.

Families have not only started building and utilising productive resources but also acquiring new skills. The baseline situation indicated that only 13% of their income was generated from local productive sources and the economy was primarily dependent on labour migration. Orchards have now started bearing fruits, the cropping pattern has changed, the use of inputs (seeds, fertilisers) has improved and subsidiary agricultural activities such as mango grafting, nursery raising, etc are being initiated. This has brought about a complete reversal in the sources of income and about 60 % of the families now generate more than half of their income from local productive resources.

Improved quality of living

Settlement of tribals in their own environment and opportunities for developing own resources is reflected in the improvement of their living conditions. The visible changes are observed in a considerable reduction in migration, self sufficiency in food grains and improved access to safe drinking water and health services.

Reduction in migration. The baseline situation indicated that 85% of the families were migrating for an average period of 68 days. The people engaged themselves in labour work at construction sites, chemical factories, grape gardens, vegetable packaging centres etc. Women migration was also a common feature in the area and was observed in 35% families. This situation has changed and about 76% families have reduced the migration period (of which 50% have stopped migration). Migration of women has also come down to 15%. People now look forward to increase productive sources of income and simultaneously augment their income through opportunities of local labour.

Self-sufficiency of food grains. On an average the families were procuring food grains worth Rs.1680/- annually, constituting 40% of the cash income. Now, the families have directed their efforts towards achieving self sufficiency in food grains. This has been observed as an immediate effect of land treatment. The area under paddy cultivation has increased. More than 93% families have reduced their food grain purchases of which 57% do not purchase any more. In fact 29% families have even generated income through sale of food grains.

Availability of fuelwood. Another significant requirement of families is fuel wood. The families were dependent on forest resources to meet the same. Various fuel-wood species namely *Leucaena leucocephala, Acacia auriculiformis* and *Gliricidia* trees have been planted around the orchard. These plantations can fulfil fuel wood requirements up to 60 % depending on the number of established forestry trees. Promotion of energy saving devices such as improved cook-stoves has slightly reduced the fuel-wood requirement. 26% of the families are using these improved cook-stoves.

Development of support services (Primary Health Service, Safe Drinking Water and Credit). Usually the families had to travel up to 10 km to avail even primary treatment. Travelling within the area is difficult due to lack of transport and infrastructure facilities. As a result, families used to get treatment from traditional healers and Primary Health Centres wherever easily accessible.

Local youth (especially women) trained as Village Health Guides have not only improved access to health care but also made the communities more aware on health related aspects. This is quite indicative from the fact that Village Health Guides have been the first contact for primary treatment. The first trimester registration of pregnant women has increased from 27 % in 1996 to 42 %. Also, national campaigns such as Pulse Polio have succeeded with over 95 % coverage for immunisation.

The only safe source of drinking water available before the programme was hand pumps, as open wells were not chlorinated.

The fruits of the orchard plantation, ready to harvest. Photo: Sharad Mahajan

Women have learned how to care for the fruit trees. Photo: Sharad Mahajan

Yet 31 % hand pumps were not functional. Regular chlorination of open wells, awareness generation among families for home chlorination and putting non-functional hand pumps into use through repair and maintenance has ensured safe drinking water to about 80 % families.

There were only two banks in the area catering to the needs of people from 145 villages. The limited availability of resources together with poor access to credit reduced the scope of development. The programme interventions have brought improvements in the existing resources use. The GVMs are empowered to mobilise and manage the resources in terms of savings and credit. Credit facilities for consumption as well as production purposes are now available in 109 villages.

Building local action

The *Wadi* model has become a common thread for participating families and provides them a group identity. A total of 1790 *Ayojan Samitee* members from 143 GVMs are directly involved in the management of all village level activities. Development of the GVM is linked with a feeling of ownership among members, operational regularity and consistency, self-management capacity, resource mobilisation and responsiveness to people's needs. This is seen from actions like establishment of community dwellings, initiation of regular savings, grain banks, organisation of community marriages, literacy classes, collective procurement and sale of produce, etc. The credit facility available through the GVMs has provided easy access to timely and adequate credit to the participants and ensured sustainability of the development in the long run.

Due attention is given to women as well. All the orchards have joint ownership of husband and wife. Women are organised into self-help groups and take up supplementary income generation activities with regular savings and credit. Simultaneously, need based activities to reduce workload and drudgery of women are taken up.

The field functionaries are engaged in mobilising the people and promotion of technologies for common use through demonstration and training. These functionaries, being local, have an advantage of better understanding the people and the village situation. The training and work experience has given them an opportunity to acquire a special status – "a helping hand" in the village and confidence in dealing with external agencies. There are 114 field guides, 111 Village Health Guides, 250 self-help group leaders, 120 barefoot accountants, 71 hand pump technicians, 87 oil engine technicians and a number of nursery technicians.

The strong cadre of local functionaries, *Ayojan Samitee* members and self-help group leaders has boosted the local initiatives and enhanced the management capacity of people.

Score on the "Barometer of Sustainability"

The "Barometer of Sustainability", a tool developed by the International Union for Conservation of Nature (IUCN), is used to combine indicators related to human wellbeing together with ecosystem wellbeing. It treats both people and ecosystem equally on two scale axes as shown in Fig. 1.

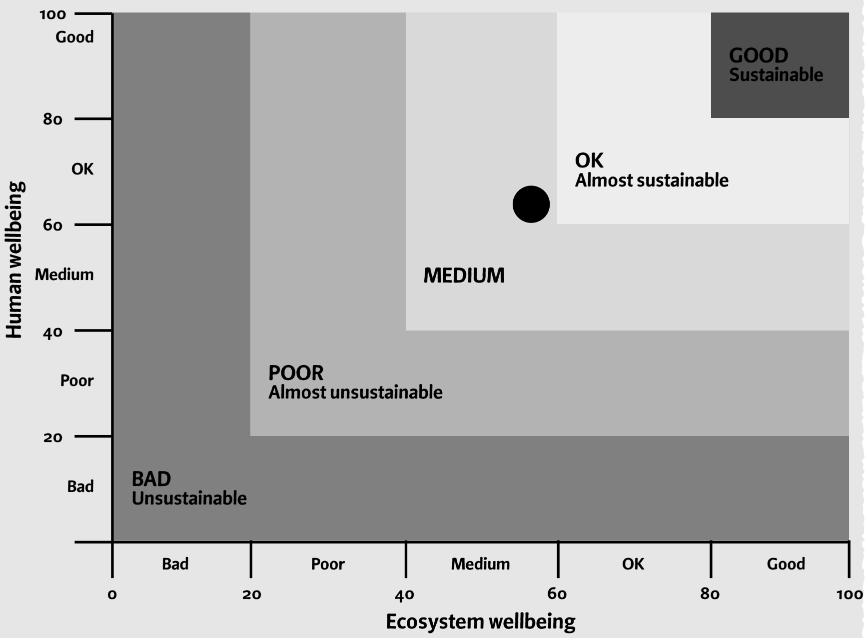
The scale is divided into five sectors in an ascending manner from unsustainable (bad) to sustainable (good). Conclusions about conditions of people are expressed as a point on the human wellbeing axis as an index of human wellbeing. Similarly, conclusions about conditions of ecosystem are expressed as a point on ecosystem wellbeing axis as an index of ecosystem wellbeing. The intersection of two points provides reading of overall wellbeing and progress towards sustainability. The tool implies that improvement in human wellbeing should not be at the expense of a decline in ecosystem wellbeing.

Fig 1 indicates the current stage of development in the tribal region of Dharampur due to the model interventions as discussed above. The regeneration and effective utilisation of available resources - mainly land and water - are considered as important dimensions of ecosystem wellbeing. In order to bring about these changes, settlement of tribals in their own environment, changes in quality of living and building local action are crucial and thus these factors are considered as part of human wellbeing.

The intersection of human wellbeing and ecosystem wellbeing scores falls on the border of the intermediate to almost sustainable band with the final score at 60. This indicates a balanced growth at the end of five years. This five-year phase can be considered as a formative phase for reconstructing the resource base and building confidence among the people. The programme has not just remained planting trees but has offered a basket of opportunities to shape the people's future. This is quite evident from actions such as families shifting their houses into

Fig 1. Barometer of Sustainability

Human wellbeing	
Quality of living	56
Settle in own environs	67
Building local action	67
Ecosystem Wellbeing	
Land	63
Water	50



the orchards, becoming receptive to new concepts and techniques (mango grafting, nursery raising, composting, appropriate irrigation systems, immunisation, etc) and thinking towards optimum utilisation of available resources. The GVM has taught people to look beyond self interest.

The key to these changes is: linking the development of people and the environment. The synergetic effects of these efforts lead to sustainable development. There is a direct co-relation between the quality of ecosystem and human wellbeing. The status of health, wealth and quality of living are dependent upon diversity, productivity and nature of the ecosystem of which people are an integral part. The wellbeing of an ecosystem depends on people's actions which in turn flourishes people's lives.

Well established cashew orchard of a tribal family.
Photo: Sharad Mahajan

Reasons of success

Families, initially sceptical about the interventions, start realising the potential of developing a life time asset soon after seeing the initial results. Planting of trees develops hope in the minds of tribals which further stimulates thinking to make better use of available resources. This becomes the turning point in the life of tribals. Soon families start building check-bunds, nurturing the orchards, land shaping and cultivating new crops.

The regular interaction, exposure to new technologies, visits to innovative and progressive farmers, sharing and learning from one another's experiences increases the awareness and knowledge of people. These actions help build the receptivity to newer concepts and techniques. As a result, tribals once knowing more about harvesting trees than planting them, learn the art and science of plantation and orchard management. Traditional wisdom and the new knowledge assimilated not only helps to establish the orchard but also brings change in agricultural practices, health seeking behaviour and women's status in the family as well as in the village.

The newly found identity as "*wadi* owners" inspires them to come together and the process of development gets a boost through collective action. The GVM becomes the vehicle of "people-owned, people-managed development". Thus, development takes the shape of a mass movement with mass village participation.

A cadre of local field functionaries gets associated with the GVMs to facilitate extension of services in the areas of agriculture, health, record keeping, funds management, etc. The GVKs initiate the process of building resources through savings, credit and support services development (grain banks, agro service centres etc.) to fulfil the people's needs. The increased trustworthiness, credit worthiness and self-confidence enable tribals to gain access and control over resources.

With the passage of time, an entry with a single activity (orchard development) leads to comprehensive community development, individual thinking is replaced by collective action and the tribals once trapped in a dependency syndrome enjoy freedom and power. Thus, the model carves out a new family with the help of already available sources, inspiration and perspiration.

Replication of the model

The time-bound, result oriented model that started with just 42 families, from eight villages in 1982 in the tribal block of Vansda in South Gujarat, is replicated in tribals blocks of Maharashtra, Gujarat and Karnataka covering about 25,000 families from about 300 villages. It is also to be implemented in Maharashtra and Rajasthan to cover additional 20,000 families.

The model has received worldwide recognition. The project was presented as a successful replicable model for poverty alleviation at the UNDP Forum of Ministers for Poverty and Environment in NewYork, USA in 1999 and at the Global Dialogue in Hannover, Germany. Various government agencies in India are now involved in promotion of orchard development and a few of them have supported NGOs taking up the model. BAIF is also engaged in providing techno-managerial support to development organisations. For this it has received the support from Government agencies such as National Wasteland Development Board, National Rural Employment Programme, Tribal Development Department, District development agencies, Banks and various international agencies.

The model has evolved over a period of time considering peoples' needs. Agencies adopting the model should consider its comprehensive nature and use it with suitable changes considering local conditions to achieve maximum benefits.
A multidisciplinary team comprising of professionals from agriculture, community health, engineering, social science and extension workers is required to manage the large-scale programmes. It is necessary to develop forward and backward linkages considering resource development and utilisation. These include banks, markets, credit institutions, research organisations etc. The agencies must use participatory strategies, emphasise on capacity building of people, bring in gender development and promote local institution development to achieve sustainable development.

Poor infrastructure limits the pace of development even after successful orchard development. Proper roads, availability of electricity, banking structures, inputs supply centres, market information and development of marketing facilities are the key areas in which government agencies could provide support. Also governments need to mobilise resources to provide long term and timely financial support.

Conclusion

The magic of *wadi* is that it provides self-employment and thereby creates confidence among tribals for self-reliance. It provides opportunities for tribals to make a decent living on the strength of natural resources in their vicinity and within their reach. The *wadi* model has proved that the poor, the illiterate and the oppressed can be idealised through mutual co-operation and collective efforts.

■

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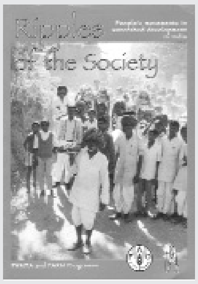
Designing and scaling up productive natural resource management programs: decentralisation and institutions for collective action

by Talib Esmail, 1998. Rural Development Department, World Bank. Available on: http://www.fao.org/waicent/faoinfo/sustdev/ROdirect/Rofo0036.htm

Practical guidance is provided for programme planners on how to design community-based Natural Resource Management programmes that can be scaled-up. It is based on a review of programmes that have achieved some degree of success in this sphere. Recommendations are put forward on policy preconditions, programme strategies, structure of programme implementing agencies, and appropriate financing mechanisms.

Ripples of the society: people's movements in watershed development in India.



Sheena, Ghandhi Peace Foundation / Sharma PN (editor) Participatory Watershed Management Training in Asia Program FAO. 1998. 128 pp. For copies write to: Environmental cell: Gandhi Peace Foundation, 221 Deen Dayal Upadhaya Marg, New Delhi-2, India, or, Dr. Prem N. Sharma, FAO, PO Box 25, Kathmandu, Nepal.

The document is based on eight case studies from the Himalayas and the rainfed desert areas of India. Traditionally, watershed management has been a way of life in the Indian mountains and rainfed areas. The analysis puts the experiences in a historical context to explain why efforts started dying out in the recent century. This happened as the society lost its ownership and control over the process of watershed development due to interference of an alien culture, which continues to impose hypothetic solutions even today without any regard to the native culture. This situation continues to accelerate the loss of confidence among the people in their own capabilities. The analysis shows how to revert this situation so that the national efforts can result into sustainable efforts where the official efforts and the people's efforts work in tandem to make the present day watershed development efforts sustainable (Sharma). A booklet with inspiring stories of endogenous development.

Scaling issues in Integrated Natural Resource Management: Conceptual considerations

by J. Lovell, A. Mandondo and P. B. Moriarty, 2000. Available on: http://www.inrm.cgiar.org/documents/workshop_2000.htm

A description of "lessons" learned from all over the world with two scaling types, the first related to 'scale', the second to 'scaling-up'. The paper discusses the conditions under which INRM is most likely to be successful, and the need to reconcile current top-down and bottom-up approaches, both of which are needed to achieve effective delivery in a structured programme beyond the scale of a few villages or isolated success stories.

Scaling up: Critical factors in leadership, management, human resource development and institution building in going from pilot project to large scale implementation: The BRAC poultry model in Bangladesh

by Md. A. Saleque, 1999. Available on: http://www.husdyr.kvl.dk/htm/php/tune99/5-Saleque.htm

BRAC's poultry program in 1999 reached more than one million poor women following a model that is now known as the Bangladesh or BRAC-DLS model. This paper has documented the model's potential for creating income for the poorest women. Learning on the basis of feedback from the users has been a key element in its evolution. The model is now applied in 380 of Bangladesh's 460 Thanas.

Grassroots development and the issue of scale: a Colombian case

by Steven D. Pierce. Available on: http://www.iaf.gov/jrnl19-2/pierce.htm

The Inter-American Foundation has chosen to meet the challenge of scaling up through outreach strategies in Colombia. Recognising that structural poverty can only be overcome through broad-based alliances among local people, their organisations, the State, the private sector, and the non governmental organisations, the Foundation has sought to establish strategic partnerships with key Colombian entities. The partnership with Fundación Social, a unique case study of how to scale up, is described in detail on this website.

Scaling up successful agroecological initiatives in Latin America and the Caribbean

by Miguel A. Altieri, Daniel Buckles, Rolando Bunch, Simon Carter, Antonio Casanova, Paul Engel, Ruben Figueroa and Carlos Venegas. Available on http://nature.berkeley.edu/~agroeco3/sane/index.html

In this article the authors present their scaling up research project. The agroecological approach to rural development, promoted by the Latin American Consortium on Agroecology and Sustainable Development (CLADES) and other NGOs in Latin America, emphasises the need to consider environmental, social, technical and cultural aspects of sustainable rural development. In Chile, Cuba, Peru and Honduras, members of this consortium have been promoting agroecological initiatives for several years with tangible benefits to food security and natural resource conservation in specific rural communities. Given the benefits and advantages of such initiatives, two basic questions emerge: (1) why these benefits have not disseminated more widely and (2) how to scale up these initiatives to enable wider impact?

The research proposed by this project will test a series of strategies to scale up successful agroecological experiences in specific areas of four countries. The areas chosen have contrasting potentials in terms of institutional capacity, social organisation and environmental and economic conditions.

The main hypothesis of this proposal is that scaling up is possible if NGOs are able to:

- network more effectively with farmers' associations and other institutions
- strengthen links, training, dissemination and validation at a farmer to farmer level
- strengthen the role of rural promoters
- improve the participation of farmers in niche markets.

The goal of the project is to initiate and monitor these four scaling up experiences, undertake a comparative analysis to evaluate the impact of the different strategies employed, and systematise lessons learned (IDRC).

Financing the future: options for agricultural research and extension in Sub-Saharan Africa

by Beynon J [et al.], 1998. 163 p. ISBN 1 902477 00 6. Oxford Policy Management, 6 St Aldates Courtyard, 38 St Aldates, Oxford, OX1 1BN, UK / admin@opml.co.uk

The objective of this book is to review options for sustainable financing mechanisms for agricultural research and extension to meet the needs of smallholder farmers. The study focused primarily on assessing the situation in, and seeking policy proposals for, Sub Saharan Africa, but reviewed a broad range of international experience reaching conclusions that are of much broader application. The outcome is a clear and well-constructed essay on financing research and extension. The summary table of operational guidelines at the end of the book is helpful for readers who want to compare the numerous options for alleviating financial constraints described in the text. (WR)

Kalakhoont village's spin out of the poverty cycle began on a rainy day in June this year. Four days of rain filled up to the brim the long-forgotten tank in this nondescript village of Jhabua district in Madhya Pradesh (MP), India. Crippled by two consecutive droughts, when an NGO, Action for Social Advancement, offered to renovate the tank, it was hard for the residents to decide to contribute 25% of the renovation cost. Three-metres of silt was removed in the renovation. The decision has paid rich dividends and now promises to change the lives of the villagers forever. "There is enough water for the next three years," says an excited Nana Basna, president of the lift-irrigation society formed to regulate water use in the village. "The stored water will be enough to irrigate more than 61 hectares (ha) of land".

20.000 villages secured food production by reviving rainwater harvesting. Photo: Ganesh Pancare / CSE

A story of hope and of major change

For the first time in 50 years, several state governments are dealing with drought in a different way - moving away from drought relief to drought mitigation. The droughts of 2000 and 2001 have seen Andhra Pradesh, Gujarat, Madhya Pradesh (MP) and Rajasthan undertake major rainwater harvesting programmes - getting people to conserve rainwater that falls in their villages.

This year the MP government organised the world's biggest ever rainwater conservation programme — *Pani Roko Abhiyan* (Stop the water campaign). Chanting *Gaon ka paani gaon me, Khet ka paani khet mein* (Water of the village in the village, Water of the farm in the farm), some 706,304 water harvesting structures were created from February to June.

In the four states put together, there are probably over 20,000 villages today undertaking rainwater harvesting seriously. The good rains of June and July this year have already filled up tanks, ponds, *johads* (traditional earthen check dams) and other structures built by people with support from government and non-governmental organisations (NGOs). There is jubilation.

But this achievement also poses several challenges for governments and NGOs. Firstly, how will they ensure that the many thousands of structures are properly maintained? Experience shows that when communities harvest rainwater for 5-8 years and keep groundwater recharged, they can withstand as much as three years of consecutive droughts. However sustainability of the structures is crucial and depends solely on who manages these structures. Government apathy has led to the death of millions of the country's water structures. Where communities are in control this does not happen easily.

In MP, people will be given absolute ownership of the structures to which they contributed one fourth of the costs. The state government is incorporating certain structural changes for transfer of ownership to the *gram sabhas* (village assemblies) who will be responsible for the maintenance of the structures. Yet, the Gram Swaraj Act that gives power to the village assemblies seems almost ineffective. In Rajastan, the minister of irrigation, Kamla Beniwal, ordered the demolition of a *johad* built by the community of Lava ka Baas being of the opinion that: "People do not have the right to tamper with the flow of water... as water resources belong to the government".

Secondly, the experience of villages like Ralegan Siddhi in Maharashtra, and Sukhomajri in Haryana, which started water harvesting in the 1970s, shows that this is just the beginning of rural ecological and economic regeneration. Water improves agriculture, improved agriculture improves animal husbandry and once people begin to harvest water they begin to take care of their watershed, which means more trees and forests. The combined incomes from improved agriculture, animal husbandry and tree wealth have the potential to not just alleviate, but literally eradicate rural poverty. How will governments and NGOs ensure that water harvesting leads to total ecological and economic regeneration of our villages over 10-15 years?

To make water conservation a sustainable social movement the government needs to put in prolonged efforts. Most of India's poverty eradication programmes have failed because they have been short-term interventions. Even India's largest watershed programme in MP is set to withdraw from villages after only four years, and will as in previous experiences undo the advantage of drought proofing. Ecological regeneration only brings prosperity when it is managed with mature community institutions that need time to be built up.

And, finally, what does this mean for people's rights over water? India's water laws, mindless derivatives of the colonial laws, give too many rights to the government. As a result, when chief ministers want water harvesting structures built, the irrigation departments look away. But not when a village or a NGO wants to do so. Will the government get rid of its 19th century hangover and hand over the rights of rainwater to the people in the 21st century?

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From: Richard Mahapatra, Kazimuddin Ahmed and Binayak Das (introduced by Anil Agarwal). **A water journey**. Cover story in *Down To Earth* August 15, 2001, pp25-39. Centre for Science and Environment, 41, Tughlakabad Institutional Area New Delhi – 110062, India. Fax: +91-11-608 5879; Email: cse@cseindia.org ; Website: www.cseindia.org .

More information on up-scaling water harvesting in India: LEISA, ILEIA Newsletter March 2000, Vol.16, No.1, pp11-15.

Make use of CSE's **special offer** of 4 excellent publications on water harvesting: **Making water everybody's business**; **Dying wisdom**; **Water Links-2** and, **Water harvesting manual**, at a discounted price of US$ 48 (postage included).

Towards sustainable pond farming

Michiel Verweij

"Before we had these farm ponds we could only farm in the wet season and everybody migrated to make money to survive. Now with these ponds we can work on our own land, year round, and we produce a surplus to sell at the market. These ponds give us hope for our community and children" said Máximo Gonzales in the April 1996 issue of the ILEIA Newsletter (Maita and Verweij 1996). This article described an unique system of interconnected farm ponds in the Oloy community near Cochabamba, Bolivia. The development of the farm pond system unleashed a process of fast change in peasant farming. Peasant families improved their farming system by developing new strategies to produce vegetables, grains, fruit trees, aromatic herbs, and to raise animals. Now, farm pond farming is spreading fast and integrated agriculture is promising to become a sustainable production system suitable for small farmers on Andean slopes. Based on the experiences of CORACA, a peasant organisation that has contributed significantly to the promotion and development of family farm pond farming, the author analyses further the development and spread of the system.

History of pond farming

The population of the Quechua-speaking community of Oloy is concentrated in the lower parts of the region, on the gently undulating 'pampas' with silt-clay soils at an altitude of about 2100 metres above sea level. The climate is semi-dry, with an average annual rainfall of 450 mm between November and March. Until the farm ponds were built, rainfed maize was the main crop.

The first farm ponds date back to the eighties, when small water reservoirs that the peasants themselves had dug out (k'hochas) were enlarged with the help of heavy machinery that political parties made available to the communities. Rainwater is collected in these farm ponds, taking advantage of the runoff from the higher slopes or water from a nearby watercourse during rainy weather.

Between 1990 and 1991, on the request of community members, the PDAR programme to prevent migration to coca-growing areas built interconnected farm ponds in Oloy. This work was complemented with a rock-cement diversion dam in the Yuraj Yuraj watercourse, to fill the ponds during the rainy season. This dam and the 5 km long conveyance ditch connected and filled 20 family ponds (storage capacity about 1000 m^3) and 2 community ponds (storage capacity about 10,000 m^3).

Given the lack of other permanent water sources, farm ponds have become a source of water for domestic use, drinking water for animals, supplementary irrigation of summer crops and for small-scale irrigation of highly valuable dry season crops. The water in the family ponds is used to irrigate up to 0.25 ha of farmland on which onion, garlic, tomato, beans and other vegetables are grown. Some farmers even have enough water to grow fruit trees. It is common practice to protect the irrigated area and farm pond from cattle by building fences around them with thorny branches, barbed wire or stone or brick walls (see figure 1). The land inside the fence can range from 0.3 to 4 ha.

There is no clear category for these farm ponds in terms of irrigation or soil and water conservation. Rainfed farm ponds are usually referred to as a means of preserving water and soil and for collecting water. This is fair enough if the water runs off the slopes above the pond, but in many cases it rains further away from the production area, therefore the water is obtained from other parts of the small valley catchment. This is why some authors refer to irrigation (Pacey & Cullis; 1986, p8).

In recent years, the area under irrigation was expanded considerably and production was intensified by increasing the number and size of the ponds. In the community of Aiquile, for example, more than 1000 new ponds were constructed in the nineties. Now, a large number of government organisations, municipalities, NGOs and peasant organisations are digging, with the use of earthmoving tractors, hectares of farm ponds in many Bolivian communities. Many different designs are used for

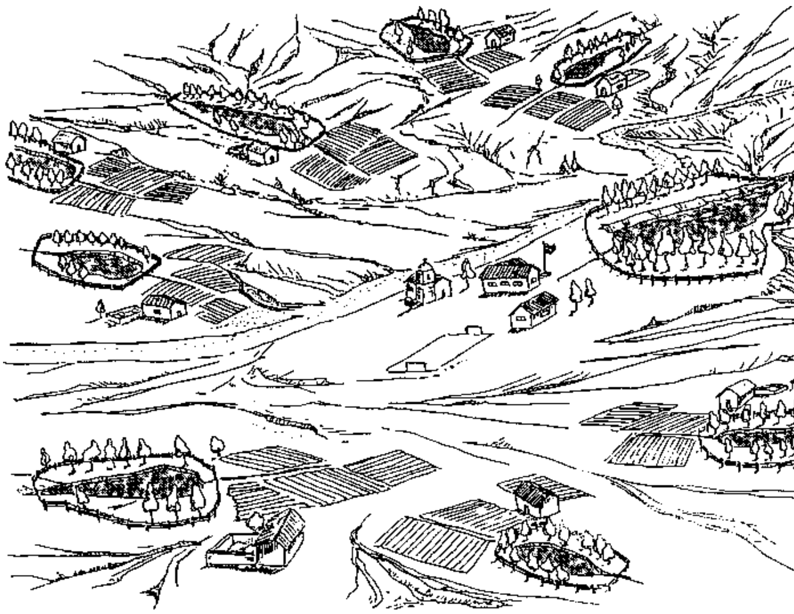

figure 1: Overview of farm ponds in the community of Tarija (Verweij, 2001)

the construction of these ponds. The costs of the ponds differ from US$ 300 for a simple small pond of about 300 m^3 to US$ 2000 for a larger and more sophisticated pond, and up to US$ 4000 for a 5000 m^3 pond. The funding arrangements also differ per organisation. Funds come from the local municipality, the national government or a foreign funding agency. Farmers normally pay a contribution of 10 - 20 % of the total costs in advance.

Different strategies of farm pond farming

Once water is available, a part of the new farm pond users (about 25% of the farmers in CORACA's operational area) concentrates on growing crops like onions, tomatoes and potatoes for the market. These ***market farmers*** tend to grow one or two crops intensively and then leave the land to lie fallow after the harvest, when the water runs dry. Their production system is intensive and yields are high: more than 40 tons per ha. of tomatoes and 30 tons of onions. Without much help from outside, they sell the produce in their own town as well as in Sucre and Cochabamba. In 1999, when prices of tomatoes were high, tomato farmers earned up to US$1800 from a 2000 square metre plot, spending US$425 on fertilisers, pesticides and transport. They had never before had so much money in their hands and earned back their initial investment in one year! But prices are not always high and increasingly farmers start to feel the economic and ecological problems related to monoculture market farming.

A second but increasing group of families are producing on a less intensive and lower-cost basis and largely for home consumption. Their production conditions are often less favourable and they do not accept the high costs and risks involved in market agriculture. Compared to traditional rainfed farmers, these farmers have increased the number of crops (vegetables, grains and fruits) they grow and the amount of surplus products they bring to the market. For these ***conservative improvers*** the farm pond is very important to secure water for human use, their animals and some food crops during the dry period. It has enhanced their quality of life, improved their diets and increased their income. Finding markets for surplus products is sometimes a problem, but with the help of CORACA (who has the contacts) these farmers always find a buyer.

Towards sustainable pond farming

In general, yields in pond farming are up to 4 times higher than the regional rainfed production levels and the contribution of pond farming to regional food security is increasing fast. It is, therefore, obvious that the sustainability of the system is crucial.

However, not every farmer knows how to take care of these systems, which means that the euphoria of earning money from tomatoes did not last long. Those who planted tomatoes year after year have noticed that their soil is getting depleted and that the presence of pests and diseases is increasing. Production costs are increasing every year as more fertilisers and pesticides are needed to maintain the same production level. Unfavourable market prices cause even more frustration. These farmers now realise that the production and sustainability of their farming system depends on much more than just water. They realise that working with some factors and neglecting others is counterproductive. It is no use having water on the plot if the soil is deteriorated or eroded. Nor is there any sense in producing high amounts of products for the market if these can neither be sold nor transformed.

Fortunately, insight into alternative, ***integrated farming*** is increasing. About 10% of the farmers with a farm pond are experimenting with this third farming strategy, which is gradually being developed. These farmers diversify their cropping system and integrate livestock as well. Their plots are turning into regular orchards, with over 25 species of vegetables, grains, fruit trees, forage, aromatic herbs and flowers. There is a growing tendency to keep small animals like guinea pigs, hens, ducks, partridges, bees and fish. These families use their small plots to a maximum by growing crops around the borders of their farm pond and fruit trees, forestry species, ornamental plants, shrubs or forage alongside the fences. Since these plots are fenced in to keep animals out, wild vegetation grows in the corners and on the borders of the farm pond (fig.2).

The families are very fond of their farm ponds and gardens. Based on their own ideas and available resources, they create irrigation systems using gutters, pipes and aqueducts. They also protect their borders with grass and stones, adorn their gardens with flowers, obtain all kinds of fruit seeds and seedlings and build terraces or bench terraces to make their small plots as productive as possible. Their infectious enthusiasm is creating an interesting and innovative type of competitiveness. However, many of these initiatives lack a technical basis, which is why the results still leave much to be desired. Adequate monitoring and backstopping by expert technicians would guarantee even better results.

By having a diverse small-scale production system financed with own and local funds, farmers can produce a larger variety of products and can make the peasant economy more secure. The fact that they can increase control and lower costs is an additional advantage. This is very evident as far as agro-chemicals are concerned; these farmers use only one third of the amount used in irrigated plantation agriculture in Santa Cruz. Integrated farming is a more balanced strategy of farming, which combines market and self-sufficiency objectives within a more ecologically sustainable, overall approach.

Further improvements needed

In fact, development of family farm pond farming has just started. Farmers with access to farm ponds listed the following demands for improvement at a workshop:

1. Community/farmer organisation (production and marketing, awareness of collective values).
2. Soil and water management (farm planning, soil and water conservation practices, irrigation canals, gully control)
3. Integrated Pest Management (training, development of local practices).
4. Marketing (seeking markets for local products and opportunities for new crops, establishing relations with companies, seeking and creation of opportunities).
5. Financial management (loans, help in calculating production costs).

An increasing demand for technical support has been noted since farm pond construction was initiated. Often, farmers start to pay attention only when they encounter real problems. For example, the demand for high quality seeds (see box 1) is coming up only now after many diseases have been spread. Still, farmers express their need for holistic monitoring from a peasant farmers' perspective. Once the problem of water shortage was solved, questions arose about a more sustainable, ecological and healthy way of production, applying integrated pest and soil fertility management methods.

Having worked on productive aspects, peasants are also looking towards processing, transforming and marketing of their products, which is something they cannot do on their own. Developing the farming community means that all these aspects have to be worked on. Anyone who intends to support this process has the moral obligation to go beyond farm ponds and technological packages. That is why today's agricultural scientists and rural instructors must have a more complete understanding of sustainable agriculture and the food production chain. They also should be versatile and take an active part in peasant struggles.

Social Capital

Experience showed that it is fundamental to raise the self-esteem of peasant farmers before they can do anything for improving

Box 1. Production of high quality seeds

The farm pond garden is a farm jewel because water is assured. Yields tend to be more than 4 times higher than in rainfed conditions. Products are more regular and of better quality. In order to capitalise on the production potential, irrigated plots deserve only the best inputs, i.e. seeds, fertilisers and manpower.

For example, what happens if inferior quality seeds are sown in the plot? First of all, production would be lower and secondly, the farm would be infected with diseases, nematodes and insects. This will reduce the productive potential of the land for a long period, as some pests and diseases, and nematodes in particular, are difficult to eliminate. The saying "seeds are half the technological package" means that one must start with an excellent seed in order to get a good harvest.

For this reason CORACA formulated a proposal to multiply high quality, basic potato seeds in irrigated plots. It is enough to sow small areas because the high yield makes rapid multiplication possible. This saves the buying of expensive seeds and guarantees good seeds for use in rainfed areas of the farm or for sale. More than 13 bags of good quality seeds can be obtained from one bag of basic seeds. The same strategy could be applied to other crops.

(Based on the presentation of Gonzalo Reynaga at a CORACA Seminar)

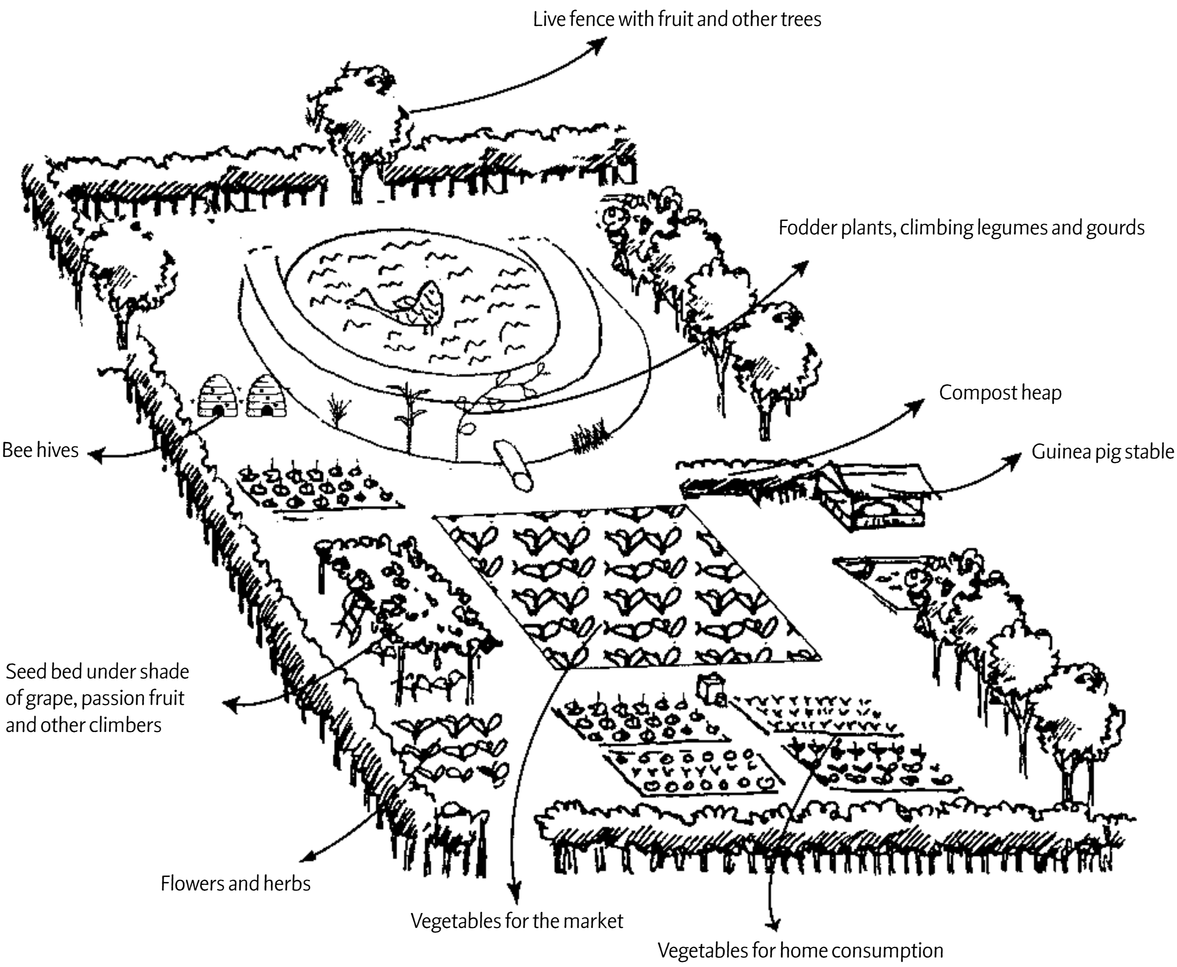

figure 2: Diversified pond farm (Verweij 2001)

their situation. They must be made aware of their valuable know-how, skills and potential and realise that they are capable of making changes. Peasants can evaluate examples and alternatives and apply them, provided that they have the information, inputs and instruments, and, above all, self-confidence.

Social capital was identified as an essential precondition for working together in a change process. Social capital, in terms of self-esteem, credibility of the support agents involved, mutual respect and confidence between peasant families and the support organisation, and shared background and responsibility, is needed to obtain tangible results.

Social capital creates the belief that things can actually improve. If there is ample social capital, peasant farmers will have the courage to demand training and advice on issues that are important to them, copy successful examples and demand the right conditions to carry out joint experiments with technicians.

Growing institutional concerns

Paradoxically, many small support organisations are withdrawing from regions with adverse development conditions, either because they have lost their funding completely or are fighting to survive and avoid more cut-backs. Meanwhile, the highest international development co-operation authorities have discovered the key to development: good governance and institutional development at macro level. But their strategy stops at that level with no connection to the peasant farmers and their support organisations at micro level, which means that peasant demands will not be heard nor met. Times are hard for support organisations at micro level because they are not considered sustainable, democratic nor representative, and therefore do not justify financial support, whilst peasant organisations have to finance themselves to become sustainable.

It is indeed necessary to work at macro-level to develop regional development plans, favourable economic policies for agricultural development, strong national institutions and international trade relations, but without support to local NGOs and peasant organisations there will be no credible and concerted development efforts at micro or at macro level. In many cases the construction of farm ponds has helped to build up social capital between peasant families and support organisations. Advantage must be taken of this social capital to synchronise development initiatives at macro and micro level to make further practical development of sustainable family farm pond farming feasible. ■

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Farmers talk about their experiences with the Minister of Mahaweli Development at a national seminar in 1999. Photo: MASL

Scaling up participatory development in agricultural settlements

Chesha Wettasinha

The Promoting Multifunctional Household Environments (PMHE) Project was operational in Mahaweli System C, Sri Lanka, from 1991 to 2000. It was a bi-lateral development cooperation between the governments of the Netherlands and Sri Lanka, with consultancy services provided by ETC. During this period, it developed and scaled up a strategy for sustainable agricultural development based on farmer participation.

Introduction

The Mahaweli Development Programme (MDP) is considered the most ambitious development initiative undertaken in Sri Lanka in the recent past. Five major dams constructed on the largest river "Mahaweli" supplied irrigation water to an area of 144,000 ha, deemed unproductive due to lack of water. Nearly 125,000 families were settled in the downstream areas during the early and mid '80s – many of them poor, landless peasants who left their homelands and journeyed to the "promised land" with the dream of becoming proud owners of a plot of irrigated paddy land. Each settler family was entitled to 1 ha irrigated lowland and 0.2 ha. rainfed highland for a homestead.

The Mahaweli Authority of Sri Lanka (MASL) was the government agency set up for the sole purpose of making this programme work. It played a central role in the construction of irrigation and other infra-structure, in human settlement and in the development (also agricultural) of these vast settlement areas under its purview. Administratively, the area is divided into Systems (B, C, G, H etc), Blocks and Units. An Unit is more or less comparable to a village with an average of 150 resident farm families. Several units form a Block, and several Blocks form a System. Around 11,000 employees arranged in a strictly hierarchical order managed this vast programme until the agency underwent restructuring in the late '90s and 60% of them were made redundant. Yet, the MASL remains to be one of the biggest government agencies, which as a river-basin authority, will continue to be involved in management of these areas in partnership with farmers and other stakeholders.

The PMHE Project entered the Mahaweli arena in the early '90's, when the "Mahaweli dream" had begun to blur. Initial euphoria amongst settler farmers had given way to grievances and apathy – they were far from prosperous; in fact many of them were deep in debt and some had even lost the right to their land. Increasing costs to counter falling yields and poor market prices made paddy farming unprofitable. Socially, too, the settlers were severely affected. There was hardly any feeling of community; disconnected families struggled in isolation to make ends meet. And it was in this context that PMHE was given the task of developing a strategy for sustainable agricultural development for the Mahaweli settlements.

Identifying bottlenecks to development

A 9-month action-research undertaken in close cooperation with settler families in 2 units of System C helped PMHE get a deeper understanding of settler life and identify the specific bottlenecks to development. These were classified under the following broad categories: inability to adjust to new surroundings due to background and origin; blue print approach to development adopted by the MASL which did not meet site specific requirements; insufficient income from paddy farming leading to serious indebtedness; poor social cohesion and lack of organisational capacity among farmers; dependency on the MASL due to prolonged assistance given in an attempt to cushion the "settling in" process.

Developing a strategy for participatory development

These problems that hindered settler development and methodologies to overcome them formed the basis for the 3-year implementation phase that followed. PMHE worked in 12 settlement Units in 6 Blocks of System C during this period.

Most of the work was at grassroot level and of an experimental nature. Experiences gained in the field contributed to developing, through continuous adaptation and together with farm families, a strategy for participatory development that was suited to the specific socio-economic and ecological conditions of the area and its inhabitants. It hinged on the principles of LEISA, participatory methodologies including PRA and PTD, organisational development and gender. The strategy consisted of two main interventions at farmer-level - ***sustainable resource management and community strengthening*** – following a process approach. Farm planning, farmer experimentation, farmer to farmer exchange, community mobilisation through small self help groups and farmer organisation strengthening were the key components of these interventions.

The changes that took place in the 12 Units were evidence to the success of the strategy. Integration of crops and livestock on the farms resulted in improved family nutrition, higher family income and a better microclimate; farmers were gaining more confidence in finding site-specific solutions to their agricultural problems through experimentation. Small groups proved to be an excellent forum for building self-reliance, forging a collective spirit and forming the basis for community strengthening. Small group members were gaining the confidence and the ability to bargain for better prices, demand for services, set up enterprises, build linkages for development purposes etc. In short, a process of sustainable agricultural development based on farmer participation was set in motion.

Sustaining and spreading participatory development

Having demonstrated that sustainable agricultural development can be achieved within Mahaweli settlements, it was now important to find ways of sustaining and spreading the process of participatory development. Real success was in ensuring that the many thousands of farm families in Mahaweli settlements would have similar benefits. As such, much of PMHE's energies in its final phase (1996-2000) was focused on creating the conditions in which the strategy would be adopted and adapted by the important development actors in Mahaweli settlements, particularly the farm families and the staff of the MASL. Three large lines of action for scaling up can be distilled from PMHE's experience:

- Strengthening the capacity of settler farmers to sustain and spread elements of the strategy
- Institutionalising the strategy for participatory development within MASL
- Sharing the experiences with a wider circle of development actors beyond MASL

Strengthening the capacity of settler farmers

Providing farmers the knowledge and skills to support other farmers in activities such as farm planning, farmer experimentation, group building etc. was a very effective way of sustaining the process of participatory development. Several methods were used.

a. Farmer to farmer exchange, as an integral part of most interventions, ensured that farmers passed on their experiences and innovations. Farmer to farmer exchange took a variety of forms: group discussions, inter-group events, cross visits, visits to resource farmers, farmer presentations etc.

b. Developing the skills of selected farmers to be village level extensionists/ facilitators was another way of ensuring the horizontal spread of the strategy. This also took several forms, depending on the motivation and interests of the farmers. ***Praja Sevakas*** or community servers were those men and women who had a vision and were interested in being facilitators of the process of community development. As such they were given an all-round training and regular backstopping for an extended period of time, so that they could carry on the process of

Interaction between farmers and trainees at a training session of MASL staff. Photo: PMHE

community development even without external assistance. Community mobilisation, Farm planning and experimentation, participatory development and the use of relevant tools, basic accounting and financial management, village development planning and monitoring, small scale business development were among the many topics covered in their training. These Praja Sevakas took an active role in building their communities. Most importantly they were able to identify and analyse problems with the people, find suitable solutions, plan and implement activities, get the services required, monitor and evaluate activities collectively and share the experiences with others. ***Resource farmers*** on the other hand were farmers who were interested in sharing their knowledge and experiences in a particular area of activity like experimentation, livestock keeping, crop husbandry. These farmers were given additional support in further developing their skills, not only in agriculture but also in aspects such as communication, group moderation etc. Some among them were trained as facilitators of farm planning and were able to work with groups of farmers in developing sustainable farm plans. Others were able to function as village level livestock extensionists capable of providing basic veterinary services, supporting farmers in building marketing linkages etc. The capacities of the *Praja Sevakas* and Resource Farmers were recognised and acknowledged not only by their fellow villagers, but also by the MASL and many outsiders. Respected as trustworthy and able leaders of the community, they were appointed to office in farmer organisations and looked after the interests of the community. Their technical prowess had earned them a reputation far from home – they were approached not only by farmers, but also by private companies, NGOs etc. who needed farmer-level liaison to support their development ventures in the region.

c. Farmer seminars and workshops were yet another way of getting more farmers involved. *Praja Sevakas* and Resource Farmers often took an active role in such events. Unlike the small-scale farmer to farmer exchanges, these events attracted much larger numbers of farmers from a wider geographical area. Considering that most of the Mahaweli systems are newly settled and sparsely populated areas, these events were excellent for making new contacts and forging new partnerships.

Institutionalising the strategy within MASL

The process of participatory development could not be sustained within the Mahaweli systems, unless the MASL supported it. Having mentioned earlier the strictly hierarchical nature of the organisation, its blue print approach to development and its paternalistic attitude towards the settlers, taking on an approach to development based on farmer participation required fundamental changes. These changes had to be brought about at all levels – enabling field staff to take on the role of development facilitators through a process of training and backstopping, assisting middle-level staff to manage participation and lobbying at the higher-level to bring about favourable conditions for participatory development.

a. Training and backstopping of staff: *Training* was a key element of the capacity building process. Nearly 100 training workshops were conducted in the period January 1995 to June 2000. The main subject areas covered by the training were Participatory Rural Appraisal, Farm Planning, Participatory Technology Development, Community Mobilisation, and Organisational Development. The curricula for these training programmes were tailor-made to the requirements of MASL staff, with aspects of Participatory Monitoring and Evaluation and Gender built in. Training was initially undertaken with those officers who worked in direct contact with farmers at Unit and Block level and then worked up and across the many layers of the hierarchical structure to the top. Contents of the training programmes varied according to staff category - field level training was usually much longer with a large component of field-work, whilst shorter workshops or seminars were used for managerial levels. However, most training events included an opportunity for trainees to interact directly with farmers. Training of trainers was done simultaneously in order to build up the capacity for training in participatory methodologies within the organisation. Another important activity in this regard was the preparation of systematic training manuals, which could be used by the MASL trainers. *Backstopping* followed training as another key element of the capacity building process. It facilitated the application of newly gained knowledge and skills. It took many forms and evolved over the period to consist of sharing sessions for trained staff, post-training refreshers, joint monitoring of post-training assignments, on-the-job guidance to trained staff in routine activities and training impact assessment. *Support to the Human Resources Development Unit* of MASL was a crucial activity that tied up, in a sense, all the input into capacity building of staff. As the unit responsible for all training activities within the organisation, it was important to provide them with the knowledge and skills required not only to continue training and backstopping, but also to adapt training to meet the changing requirements of the organisation and its staff.

b. Support to manage participation: Field Officers who adopted a participatory working style needed to be understood and supported by their superiors. Within the MASL hierarchy, this was primarily in the hands of Block Managers, who supervised all field staff in a given Block. Institutional Development and Organisational Strengthening (ID/OS) was considered a very useful tool for Blocks Managers in stimulating the changes required towards managing participation. Being trained in ID/OS, Block Managers were provided backstopping in a variety of applications, ie. analysing the activities of the Block office in relation to all actors in the community and finding areas for networking, analysing the tasks and skills of Block staff to determine a more efficient use of human resources, incorporating participatory action planning for preparation of annual and seasonal Block plans etc. This intervention brought about noteworthy changes - farmers' priorities were being incorporated into plans, collaboration was sought with other actors (NGOs, government line ministries and farmer organisations) in development activities, Block staff were working more effectively and barriers among them were being broken down as collective goals were pursued.

c. Creating conditions to sustain the process: The full potential of all changes at field and middle level could only be realised if the strategy for participatory development was fully integrated within the MASL. It was only then that the benefits could reach settlers in all Mahaweli Systems. Here again PMHE worked on many fronts and with many key persons, mainly at the higher levels of the organisation. *Seminars and workshops* were specially prepared to provide decision-makers with a clear picture of field developments and raise issues that needed attention. These were also occasions in which farmers were given an opportunity to discuss matters directly with higher officials of MASL. *Close collaboration with sectional heads* was very important in keeping a continuous and open dialogue about the process of participatory development and its implications. Such dialogue helped to incorporate their views and led to strong support for the strategy. Many openings for integrating elements into routine MASL programmes were found. For instance farmer to farmer extension as a means of sharing experiences and farm planning as a tool for sustainable resource management were integrated into many field level agricultural programmes. *Policy advocacy* was another step in creating the legal framework for further expansion of the strategy into other Mahaweli Systems. It built on the foundations laid through awareness raising and dialogue and resulted in key elements of the strategy being included into MASL policy for rural development. The new agricultural extension policy of the MASL, for instance, incorporated participatory analysis and farm planning for identifying crops and extents to be cultivated in a given season, farmer experimentation as a means of finding site-specific solutions, farmer-to-farmer extension as a means of sharing experiences, participatory monitoring and evaluation methods for end-season evaluations etc. Similarly, the small group approach to community mobilisation and the participatory analysis and planning approach to strengthening farmer organisations were integrated into MASL's guidelines for Farmer Organisation strengthening.

Sharing experiences with a wider audience

Although MASL was the main focus of PMHE's efforts to institutionalise participatory development, it certainly did not exclude others who could benefit from shared experiences.

A Praja Sevaka conducting training for a small group of farmers. Photo: PMHE

Networking, workshops and seminars, visits of interested persons and documentation were some of the main activities undertaken for this purpose.

a. Networking: Two networking experiences deserve special mention as being very fruitful. The first is the *PID/PRA* (participatory interactions in development/ participatory rural appraisal) *Network* in which PMHE played a very active role for many years as a member of the working committee. The Network consisted of organisations and individuals, practitioners and trainers in participatory methodologies involved in a variety of sectors – health, agriculture, rural development, relief and rehabilitation. This meant that a wide range of experiences was made available for sharing. This Network made a considerable contribution to promoting participatory development in Sri Lanka by sharing and publishing experiences, grooming national trainers and providing access to resources. MASL was introduced to the Network by PMHE and together were able to share some of the unique experiences in using participatory methodologies for development in the Mahaweli settlements. The PTD (participatory technology development) Working Group is the second successful networking experience. PMHE and two other projects working in the field of sustainable agriculture founded the Working Group, which grew to accommodate other projects, government as well as non-governmental organisations. Apart from sharing experiences and learning from each other in a very systematic manner, the Working Group was instrumental in creating a pool of national trainers in PTD. PMHE made a significant contribution to this training effort, which was also used to train MASL staff. These efforts of the PTD Working Group was commended in a study undertaken by a leading university in Sri Lanka to ascertain the effectiveness of training in participatory extension methodologies on the working styles of government field extension officers.

b. Workshops and seminars: The workshops and seminars that fell into this category were mostly at national or regional level. Some were joint initiatives of the above-mentioned networks, and the others were organised by PMHE alone. But all of them had the purpose of bringing the message of farmer participation in sustainable development to those who had a stake in policy formulation and decision making, among them politicians, directors of government agencies, representatives of the donor agencies, heads of research institutes, academics etc. A notable feature in all these events were the presentations of farmers, which gave much more credibility to the message that was being promoted.

c. Visits of interested persons: Although it appears an insignificant aspect, visits were actually a very tangible way of promoting participatory development. Unlike in any of the other options for sharing, visitors could go right down to where things were happening – to the field and talk to the farm families. Despite certain logistical constraints, visits were by far fact the best exposure to the facts. Even the hardest of sceptics were unable to leave without having food for thought.

d. Documentation: Apart from documentation that was prepared with a specific focus on the MASL, resource material of a general nature was created for the purpose of scaling up. The lack of relevant material in the national language *Sinhala* prompted PMHE to take on the *translation* of a number of key books that covered the basics of participatory development and were simple enough for use by field workers and farmers. *Case studies* of farmers' experiences published in several periodicals reached a wide audience within and outside the country. More comprehensive information on the strategy as a whole, or important elements thereof, were written up in *reports, books etc*. that were widely distributed. Special mention in this regard should be given to the video produced by PMHE that provided a concise account of how the strategy was developed and efforts in scaling up within the MASL. The original made in English was versioned into Sinhala for use in Sri Lanka, and in German and French to fulfil the requests of many who wanted to use it in other parts of the world. The video has been screened at many events, national and international, and been distributed to many development organisations worldwide.

Some reflections on scaling up

In reading an article of this nature, there is a tendency to imagine that scaling up was indeed a logically-arranged package of activities which were implemented quite straight forwardly. This, however, was not the case at all. Much of what is written in this article evolved over a couple of years and through a process of action and reflection. Yet, PMHE gained a good measure of success in scaling up - starting with a few farm families in 2 Units of System C the strategy was adapted by the MASL for implementation in all Mahaweli areas, counting direct or indirect benefits to thousands of settler farm families.

In evaluating the success of such a programme, attention would usually be given to the more obvious aspects such as the training of field staff, systematic documentation, capacity building of farmers etc. But there are certainly other, less significant aspects, which deserve mention.

Flexibility - PMHE, like any other bi-lateral project, had its objectives, interventions, activities etc. set out in neat planning matrices. But in implementation, PMHE was able to adopt a flexible approach that allowed for responding to changing conditions, capitalising on new opportunities and finding the right entry points.

Perseverence - What PMHE undertook was primarily a task of transforming people - changing their attitudes and perceptions through an intensive process of capacity building, the results of which are hard to show and quantify in the short term. This was at times a dilemma for PMHE as a time-bound, donor-funded project. It was only sheer perseverance and commitment that enabled PMHE to get the time it needed to complete, satisfactorily, the task it had begun.

Meeting felt need - The strategy developed through PMHE interventions filled a vacuum in the Mahaweli settlements - it found solutions to the most pressing economic, social and environmental problems of the settlers. As such it found favour, not only in the eyes of settler farmers, but also the MASL.

Shared ownership - Although PMHE invested substantial energy in developing the strategy, it avoided falling into the trap of claiming total ownership to it. In a true sense of participation, it created an environment in which farmers and MASL staff could say, "we did this ourselves". This is not to say that PMHE was not proud of its achievements, but rather to emphasise the importance of not holding on to findings in a way that hinders the spread.

Conclusion

What better way to conclude this article than with the words of a farmer who wrote this poem in farewell to PMHE:

"All the efforts that PMHE took
to support and guide us, to make us aware
To motivate us towards sustainable development
We will values as precious gems

The farmers who were fallen
Got strength to stand up
We respect immensely
PMHE's input in this

Even though you leave us now
What you gave us will live on
And be given to the next generation
As a heritage that lives on"

■

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The author wishes to acknowledge the farm families and MASL staff who so enthusiastically and untiringly worked together with the project in making this experience a success.

Farmers are looking for more options and more species, not only for soil fertility improvement, but also for fodder, grain and other benefits. Photo: ICRAF

Scaling up fallow management innovations

Freddie Kwesiga, Andreas Böhringer, and Glenn Denning

Southern Africa has a fast growing human population, making food security a major challenge. Over 70% of the population live in rural areas and depend largely on rain-fed traditional agricultural practices. The climate is characterised by unimodal highly erratic and unpredictable rainfall lasting four to five months from November to April, followed by a severe dry season. The average annual rainfall ranges from 500-1200 mm. The eco-region is mainly an undulating plateau landscape, with a mean altitude range of 600-1200 m above sea level. Maize constitutes the predominant food crop. Livestock production (cattle, goats and pigs) is extensive and traditional communal grazing is widespread.

Fertilisers and improved germplasm that fuelled Asia's "Green Revolution" have generally not worked throughout Africa. There are some commercial farmers in Zimbabwe and South Africa who have utilised the Green Revolution approach. However, the Green Revolution has by-passed the majority of peasant cultivators (80% of the regions farming communities) Here, agricultural production is dominated by complex, diverse and low-input farming systems characterised by infertile soils, unreliable rainfall and low yields. The majority of these farmers live in remote villages with little or no access to research and extension services, high yielding seed varieties, capital and credit, fertilisers and pesticides.

Farmers resort to cheaper options over which they can exercise greater control. In the densely populated areas such as the Shire highlands of Southern Malawi, mixed intercropping of maize with *Cajanus cajan* is common. Other strategies practised include crop rotation using cereals and legumes, application of crop residues and manure and traditional fallowing.

Fallow management research in Eastern Zambia

Fallow management and other agroforestry interventions have been the subject of the International Center for Research in Agroforestry (ICRAF)'s research since 1985. The most promising amongst them are improved fallows with *Sesbania sesban, Tephrosia vogelii, Gliricidia sepium and Leucaena leucocephala.* Results from Zambia show that *Sesbania sesban* is the species most preferred by farmers. However, on-station research has shown that coppicing species, particularly *Gliricidia sepium,* has a high potential to complement *Sesbania*. In general the coppicing species are able to suppress the striga weeds, diversify biomass resources and produce fuelwood on farm. If the clay content in the soil is less 10% S*esbania* fallows will not grow well. Sandy soils, root knot nematodes and the crop damaging leaf beetle *Mesoplatys* can be major constraints to the widespread use of *Sesbania sesban.*

Sesbania improved fallows have a great potential to increase maize yields with or without application of inorganic fertilisers. Maize grain yields of 5 and 6 t/ha were obtained in 1990 and 1991 following 2 and 3 year S*esbania* fallows, respectively. This was in comparison to 4.9 and 4.3 t/ha from continuously cropped maize with fertilisers (112 kg N/ha) and 1.2 and 1.9 t/ha without it. In addition, 15 and 21 t/ha of fuelwood were harvested after 2 and 3 year fallows, respectively (Kwesiga et al,1999). If the Sesbania biomass at the end of the fallow is above 9 t/ha, a farmer can grow maize for 3 years before going back to the fallow phase. For biomass yields of approximately 7 t/ha, a maize growing period of two years and then reverting the field back to fallow is recommended.

Economic analyses revealed that these improved fallow systems were feasible, profitable, and acceptable to farmers. The returns per labour day were very similar to those of the fertiliser option. After six years the returns from one year and two year fallows were considerably superior to the control option of continuous maize cultivation without fertilisation (Kwesiga and Coe, 1994)

The demonstrated potential to increase maize production without applying inorganic fertilisers has excited thousands of farmers who are enthusiastically participating in the evaluation of this technology. The number of farmers who are testing and using a range of improved fallow practices in the Eastern Province of Zambia has increased dramatically: from 200 in 1994/95 to about 10,000 in 2000. There are 100,000 farm families in Eastern Zambia who could potentially benefit from this innovation and 120 million farmers in the wider Southern Africa Development Cooperation (SADC) region. The challenge now is to scale up the adoption of this technology.

Scaling up improved fallows in Eastern Zambia

Farmer involvement initially followed the classical technology-transfer approach of diagnosing farmers' priority problems followed by on-station research and then on-farm research. Since 1992, on-farm research became the main vehicle for assessing the biophysical and economic performance of the technology, with farmers gradually taking over the design and management of trials in their fields. Nevertheless, farmer designed and managed experiments were characterised by intensive farmer-ICRAF interaction and substantial support was provided to individual farmers in terms of information, training and technical backstopping visits. This support extended to individual farmers could be considered as the minimum incentive necessary for making a technology like improved fallows to be adopted in the first place. In fact such incentives are necessary for an innovation like agroforestry which takes a long time to provide tangible benefits. Scaling up is about people and not technologies alone. Our approach to technology dissemination is demand-driven, being highly dependent on private sector equipment manufacturers, seed and seedlings producers, retailers, and farmers for its success.

The enthusiasm generated by increases in maize yields after *sesbania* fallows has triggered a large demand for the technology by farmers. Dissemination and farmer experimentation with improved fallows has now evolved into a true client-driven process.

Why and how farmers adopt the technology

A participatory study to understand why and how farmers decide to adopt improved fallows was undertaken with 81 women and 40 men in four villages. The main findings are:

- Exhausted soil fertility and lack of alternative innovations are the driving forces for trying improved fallows;
- Awareness and information about the potentials of the improved fallow technology are pre-conditions to use. Women have less access to information, less formal education and hence should be given special attention when disseminating improved fallows;
- The current use of the technology appears to be spread evenly by both men and women farmers;
- Better off farmers are more likely to test first, presumably because they are better able to cope with risk, however out of the poorer ones that are testing, women are more successful and more likely to expand planting of improved fallows on their farms;
- Among women users, the largest numbers come from female-headed households where women can take their own decisions on land management choices;
- Men are more likely to test for the first time only after hearing about the potential of improved fallows, whereas women are more likely to test after seeing first hand for themselves, ideally from peer farmers.

ICRAF's main strategies for scaling up

Working with government extension service

Government structures are often rigid, hierarchical and autocratic and have a natural tendency for centralisation, bureaucracy and control. In spite of these draw backs, working with government to scale up may be more beneficial to the poor because governments:

- remain largely responsible for social services including health, education and agricultural extension on which the poor rely;
- remain the ultimate arbiters of wider political changes on which sustainable development depends;
- are seen as the only providers, especially in Africa.

Constraints and difficulties of the government system - resources in short supply, lack of motivation due to low salaries, poor conditions of service - have to be recognised and accepted beforehand. Inevitably, if progress has to be achieved, it will be slow. Thus, agencies that undertake to work in partnership with governments must be committed for a long time. ICRAF, for instance, has a memorandum of understanding with the government of Zambia, to conduct agroforestry research and development work in her territory. In return, ICRAF gets land for experimentation, scientists on secondment, access to field sites without interference, and an enabling environment to work with the rural poor. The improved fallow technologies were developed in partnership with government research agencies and extension services.

A Sesbania sesban improved fallow plot on a farmer's field. Photo: ICRAF

Personalities and relationships between individuals are a vital element in successful government–NGO partnerships, without which no amount of money or advice will make a difference. In Eastern Zambia, ICRAF still enjoys very good relationships with the political establishment; from the office of the provincial minister to chiefs and village headmen who allocate land and influence local policies. ICRAF's good relationships with the provincial and district agricultural offices have enabled access to the district Farm Institutes to demonstrate technologies and get feedback from farmers. The camp extension officers were attached to the project to learn and be trained in agroforestry technologies as well as to select farmers with whom to conduct initial on-farm trials. This pathway is still one of our main strategies for scaling up. Furthermore, ICRAF has access to the government media to disseminate technologies, and hopes to impact on government policy and practice when the conditions for influence become favourable.

Networking and partnerships with NGOs

World Vision International (WVI) in Zambia and ICRAF share the objective of addressing food security through increased farm productivity. Whereas ICRAF had developed the technology, it lacked the capacity and mandate for wider dissemination. ICRAF's capacity to mobilise at the grassroots level could only reach very few farmers carrying out on-farm research. At the same time, its traditional partners, mainly government extension services, had limited understanding of natural resource management strategies since they were largely commodity based. They were also constrained by limited budgets that curtailed their day to day functioning including training.

Therefore, to move forward in a manner that would benefit smallholder farmers, ICRAF needed partners with the willingness to understand her technologies as well as the capacity and credibility to operate at grassroots level. WVI has a grassroots network of staff and volunteers trained to facilitate extension. It also has networks with churches, women's organisations and other community groups. World Vision was aware of the potential of agroforestry interventions and had, at a small scale, already tried out using improved fallows.

With both parties acknowledging that they needed each other, it was easy to find common ground. A jointly designed 5-year project aimed at introducing improved fallow technology to 12,000 small-scale farmers in the Eastern Province of Zambia. For its part, ICRAF agreed to provide the technical aspects, which included training in nursery development and management, supply of initial seed, training of trainers and guidance to farmers, provision of laboratory support and soil etc. In general, ICRAF would be on hand to answer technical questions from WVI staff.

The project included components such as introducing agroforestry to communities that had not been reached by ICRAF and government extension agencies, crop diversification, soil moisture conservation, improved farmer access to agricultural extension and markets. By the 1999/2000 planting season, the project was working with over 3000 farmers. The number of farmers adopting and planting improved fallows is expected to increase sharply once the main groundwork has been laid.

Building grassroots movements to replicate successful projects
ICRAF facilitates exchange programmes for introduction of new technologies between farming communities that have experience in agroforestry. The main objectives are empowerment of farmers as trainers, knowledge transfer from farmer to farmer, farmer assessment of technology performance and farmer-to-farmer backstopping of activities. The more intensive farmer-to-farmer capacity building programmes usually last 3-5 days in host villages. Planning and organisation of programmes including content is largely carried out by host farmers. ICRAF provides some logistical support like transporting farmers, while the host farmers organise accommodation, meals and entertainment in the village for the trainees.

We have found that one participant of such a farmer-to-farmer capacity building programme reaches an average of 6-10 fellow farmers at home, who again will plant agroforestry trees on their land. This, together with the low costs involved, makes the farmer-to-farmer exchange pathway a very attractive one for achieving sustainability and wider impact. The advantage of the farmer-to-farmer training linkages between the Eastern Province of Zambia, the Central & Southern Regions of Malawi and the bordering areas of Mozambique is of interest. We call this area the "Chichewa Triangle", as language and culture are the keys for successful dissemination. Further geographic diffusion by building bridges to other neighbouring languages and cultures in the region is anticipated.

Influencing policy reform: Linking with grassroots organisations
In addition to the dissemination efforts highlighted above, ICRAF has organised workshops for different levels of policy makers to promote the adoption of agroforestry. The policy makers range from village headmen in traditional authorities to paramount chiefs, elected officials, senior civil servants and the private sector. These workshops have been very useful and have helped to produce strong recommendations (by-laws) that protect and promote on-farm cultivation of trees. The large number of stakeholders in natural resource management issues and the existence of groups with conflicting interests necessitate the involvement of various levels of policy makers in these processes. For example, in Eastern Zambia institutional arrangements authorise free range grazing of livestock after the harvest of crops. For those land users who may want to establish nurseries and plant improved fallows and other trees in their farms, this arrangement poses a serious threat to the survival and sustainability of the desired agroforestry interventions. In 1998, ICRAF in Zambia facilitated a workshop under the auspices of the local traditional chiefs to identify institutional arrangement that hindered or accelerated adoption of agroforestry technologies and to seek ways of alleviating those constraints. The workshop provided an opportunity for institutional arrangements to be established to facilitate wide adoption of agroforestry. These included:

- penalties on those whose livestock damaged agroforestry trees and crops because they did not herd their animals during the cropping season
- time periods when bush fires can be set–early burning after harvest
- prolonged tenure on leasehold land if the land user planted trees
- by laws empowering the local authority to prevent crop cultivation on hill sides if soil conservation measures were not adhered to.
- revisions to the chiefs act by the government to reinstate some of the powers of the chiefs and other traditional authorities.

Factors contributing to the current achievements
Development is a process whereby people learn to participate constructively in the solving of their own problems. The driving force is people's enthusiasm for change. People who work with development programmes must motivate farmers through results rather than by promises. Our current achievements so far can be attributed to:

- Correct diagnosis of farmers' problems from the onset of the programme;
- Involvement of farmers and extension staff in the research process from the inception of the programme. The scientists, like the camp extension staff, spent much time interacting with farmers and could respond quickly to the needs of farmers;
- Starting small and using local knowledge in the design of solutions;
- Demonstrating easily recognisable results;
- Testing a wide range of management options with farmers (e.g., offering different species with intercropping and pure stand options) and then allowing them the freedom to modify, innovate, and improve the prototypes;
- The technology that could be used by men and women alike (half of the participating farmers are women) It also appears to be attractive to different types of farmers, e.g., high income and low income, ox-and hoe-cultivators.
- Working with partners at all levels: government research and extension services, local farmer groups and big NGOs like World Vision who shared a similar vision with ICRAF;
- The funding of the research programme(thanks to Sida and CIDA) has been adequate and for a reasonable length of time,
- Ex-ante economic analysis helped identify key features of the technology that make it financially attractive, e.g. bare-root

seedlings and the superiority of a two-year fallow over one- and three-year fallows;
- Development of an adaptive research and dissemination network for testing and extending the technology in new areas.

Constraints to scaling up agroforestry innovations

- ***Erratic and low seasonal rainfall during establishment*** means that many of the agroforestry seedlings planted will fail to establish, and those that do, will not grow very well. This diminishes the impact of the fallows on maize yields. Farmers are more cautious about establishing sizeable nurseries and instead prefer to make smaller ones so that less effort is wasted if a season of poor rains occurs. The lack of sufficient water is a further disincentive to the establishment of nurseries.
- ***Seed availability*** is a major bottleneck for scaling up the adoption of agroforestry technologies in the region. Even though most farmers are producing their own seed, the demand for seed remains high. ICRAF is developing a seed strategy that will establish the amount and variety of seed available now and make projections for future demand. The strategy will provide guidelines on collecting tree seed and establishing seed orchards. It will also provide clear seed quality control and pricing guidelines within the region and for each country. This work will be undertaken in collaboration with competent seed centres, which also have the mandate to produce and certify seed. In addition, the project will create awareness aimed at increasing the involvement of farmers and the private sector in seed production, distribution and marketing.
- ***Initial support to farmers and NGOs.*** As the project builds up momentum for scaling up it will need adequate technical backstopping capacity for the various farmer trainers, groups and organisations. ICRAF's present capacity in not sufficient to provide backstopping to all partners, who need to go through at least one cycle of the technologies before they gain the confidence and know-how to manage the scaling-up process on their own.
- ***Weak extension services***. Throughout the region, government research and extension services are largely enfeebled or paralysed through lack of staff, low salaries, low morale and lack of operating funds. It is left to the project to catalyse the relevant government services. On the other hand, farmers are enthusiastic and actively helping in scaling up. The issue is how to keep them motivated with different options that generate results and address their food needs.
- ***NGO constraints***. NGOs offer very good collaboration to the project and the opportunity to tap personnel, community contacts, financial resources and geographic coverage that the project by itself would be unable to achieve. However, the NGOs are rarely able to manage the dissemination of project technologies alone due to high staff turnover, short life spans and coverage of small areas. Besides, these NGOs usually have priorities other than agroforestry in their programmes, and most are unable to provide any technical backstopping as they usually have no relevant research capacity and few technical skills. In recognition of these weaknesses, ICRAF will continue to provide training and technical backstopping to empower these important partners in scaling up.
- ***Diversity of agroforestry technologies***. To date the project has developed and successfully tested appropriate technologies that help small farmers to replenish soil fertility, and to grow woodlots and fodder on their farms. The soil fertility improvement technologies are simple, yet essential for sustainable farming and to eliminate the annual food deficit in the region. Woodlots and fodder offer the opportunity to create cash flow in the farming system. Although each technology was developed in a different country they are all relevant and adapted throughout the region. But, attempting to extend multiple technologies at the same time will reduce the rate at which farmers are contacted.
- ***Lack of funds***. It requires only US$ 20 per month to motivate a field extension Camp Officer and US$200 to hold a community field day (about 200 farmers). It is such small amounts of funding at the farmer level that are required to undertake effective dissemination and scaling up of innovations. At the moment, project budgets for field dissemination activities are very small as dissemination is only being undertaken in a few target areas. Increased dissemination budgets for field activities will be required if dissemination is to be directly stimulated by the project on a significant scale.

Reflections on scaling up

Scaling up is about people and meeting their needs by delivering appropriate technologies to those who need them most. Our experience on scaling up the improved fallow innovations in Eastern Zambia shows that this is feasible. The involvement of farmers in the research and development process has been highlighted as a very important element for the achievements realised so far. However, we have noted that the task of scaling up from thousands to millions requires the following to be in place:

- exciting results;
- willing farmers;
- seed and seedling production and distribution networks;
- smart partnerships with government, and NGOs, farmers and farmer groups, traditional leaders and policy makers all working together to make it happen;
- enabling policies and markets since technologies on their own cannot be effective in the absence of such incentives;
- farmer feedback and research backup to address second generation issues such as pests and diseases.
- leadership and the will to make it happen.

The impact of research on the lives of poor people is usually highly localised and often only produces islands of success. NGO programmes tend to be good but limited in scope. In contrast, governmental development efforts are often larger in scale but limited in their impact. It is only a synergistic partnership among all parties that can produce greater impact or scaling up as demonstrated by the collaboration between ICRAF, the government and WVI in Zambia.

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Photo: ACRAF

Scaling up the Landcare and NRM planning process in Mindanao, Philippines

Delia C. Catacutan, Agustin R. Mercado, Jr. and Marcelino Patindol

The International Centre for Research in Agroforestry (ICRAF) has been conducting research on contour hedgerow technologies for the past decade in Claveria, Misamis Oriental, assessing the management strategies that address key technical constraints of the system. Since adoption of the technology by farmers was low, ICRAF refocused its efforts in finding alternative systems that address the technical and institutional issues of conservation farming. Natural vegetative filter strips (NVS) provided simple solutions to the technical constraints of soil conservation on sloping farms. These are buffer strips laid out on the contour in which natural vegetation is allowed to re-grow into thick, protective cover. NVS also provided the foundation for complex agroforestry systems with fruit and timber trees. This system is being widely adopted, enhanced by a dissemination approach called "Landcare".

Landcare is a movement of farmer-led organisations supported by local governments with backstopping from technical service providers - they share knowledge about sustainable and profitable agriculture on sloping lands while conserving natural resources. This dynamic voluntary movement has grown to include more than 5000 farmers in 250 groups from five municipalities in northern, central and eastern Mindanao. Today, Landcare has become the melting pot for farmers and others who discuss issues, share lessons, invest talents, skills and other resources geared towards better land husbandry and protection of the environment from degradation. It threads a path for constructive, long term and practical action at a community level for tackling environment and sustainability issues for the well-being of people and their communities.

Experiences with and strategies for scaling up the Landcare approach and the locally-led natural resource management planning process are described here.

Farmer innovations in erosion control

ICRAF's project sites are located in two adjoining provinces in northern Mindanao, namely Misamis Oriental and Bukidnon, in the municipalities of Claveria and Lantapan respectively, with similar biophysical conditions. Rainfall is about 2200 mm/year and soils are degraded, acidic (pH 4.5-5.2) with low availability of P (Mercado et.al, 2000). Sloping fields in Claveria experience up to 200 t/ha of soil loss annually. About 95% of the cropping activities (mostly maize and some vegetable) take place on lands of more than 15º slope.

Contour hedgerows of pruned leguminous trees or Sloping Agricultural Land Technology (SALT) had been promoted in Claveria since the early 1980's by the Philippine Department of Agriculture (DA). It aimed at providing effective soil erosion control, organic fertiliser to the companion crops, fodder for ruminants, fuelwood for farm families, and restoration of water quality and quantity in the watershed etc. In spite of these benefits, farmers' adoption was not widespread due to high labour in establishment and maintenance of the hedgerows, resource competition between the hedgerows and associated crops, limited added value from hedgerow pruning, and poor species adaptation.

However, farmers began to adapt the technology. Some placed their crop residues in lines on the contour to form "trash bonds". These accelerated the growth of native grasses and weeds and soon formed stable hedgerows with natural front-facing terraces. Others laid out the contour lines but didn't plant anything. These contour lines eventually evolved into natural vegetative strips (NVS) that controlled erosion but needed less maintenance and labour than the tree based contour hedgerows.(Mercado et al, 2000).

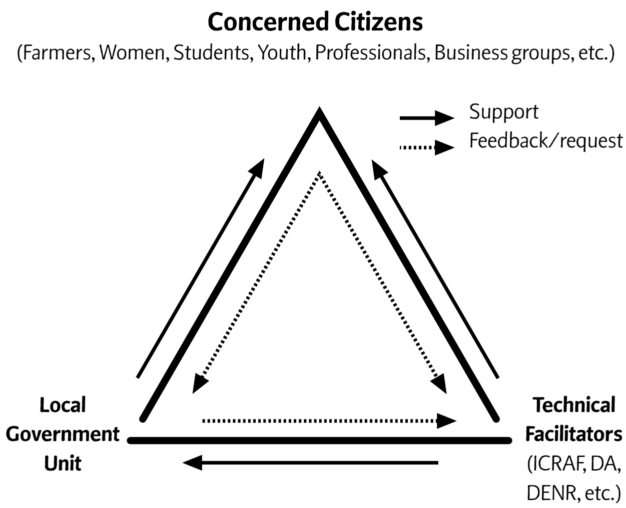
These simple innovations attracted many farmers in the area. In 1994, it was estimated that 150 farmers had adopted contour hedgerow systems while the number of pruned tree hedgerow fields decreased after 1990. The new wave of hedgerow systems was predominantly NVS with contour ploughing replacing up-down tillage.

The evolution of Landcare

ICRAF also developed and put into test an extension programme that rapidly and inexpensively diffuses conservation farming and agroforestry technologies using the group approach. This approach was found effective in strengthening government extension programmes and expedited the dissemination process. It also encouraged local governments to provide technical, leadership, logistics and policy support. At the beginning farmers came together to exchange knowledge and skills on soil conservation and agroforestry practices. With time they felt the need to be more cohesive and to look at other degradation issues - a process of group development that required leadership skills. This key institutional innovation for technology dissemination gave birth to “Landcare”, a land conservation approach and movement, which has its origin in Australia (Campbell and Siepen 1996).

What is Landcare?

The Landcare approach is based on effective community groups being in partnership with local government. Such groups respond to issues affecting them and are more likely to find and implement solutions independently, rather than follow those imposed by external agencies. Landcare is about people and the key to success is based on a mature social capital and a close bond between and among farmers ‘communities’ and governments. The tripartite relationship of key actors in Landcare: grassroots Landcare groups, local government units (LGU) and technical service providers and facilitators (ICRAF, Department of Agriculture (DA), Department of Environment and Natural Resources DENR, others) is indicated in the figure below. The success of Landcare as an approach is dependent on how these 3 key actors interact and work together.



In 1996, we started our technology dissemination programme in response to farmers’ requests for technical assistance in conservation farming. 25 farmers requested for training on the establishment of NVS and decided to form a group and share the technology with other farmers. That group of 25 farmers made the history of Landcare in Claveria. Today, there are more than 250 Landcare groups in Claveria and Lantapan. Most of them are based in the sub-villages *(sitio or purok)* and are federated at the village *(barangay)* and municipal levels. More than 3000 farming families are involved and have successfully extended conservation farming technologies to more than 2000 farmers and established more than 300 communal and individual tree nurseries (Mercado et al 2000). Thousands of fruit and timber tree seedlings are planted on the NVS, on farm boundaries, on buffer zones of protected areas, on riparian areas, and some are planted on small-scale tree plantations. Some groups have also linked with other service providers, including the business sector, for funding of their nursery activities and livelihood projects.

Who is involved in Landcare?

Landcare is a voluntary group that is currently represented by a large number of farmers. However, interests from other sectors - women, students, youth and professionals - are emerging. This implies a wider applicability of Landcare for a range of community groups in varying situations. They are:

1. Concerned citizens in the community who are:
- Willing to share their talents, skills and other resources
- Usually resource poor and want to improve their livelihoods
- Willing to learn, share experiences and employ new sustainable farming techniques
- Committed to resource conservation and protection and the creation of workgroups for the purpose
- Tillers, non-tillers, owners, tenants of the land

2. Local Government Units (LGUs) who can provide:
- Policy support for the institutionalisation of conservation farming, agroforestry and other practices for sound environment and natural resource management, and budget allocations through creation of local ordinances.
- Leadership in facilitating Landcare groups and related activities
- Capacity-building programmes for the overall development of Landcare
- Financial support for Landcare activities

3. Technical facilitators (ICRAF and other line-agencies) who can provide:
- Appropriate technologies for sustainable agriculture and natural resource management
- Facilitation for Landcare group formation and their activities
- Information, communication and education programmes
- Network support for Landcare groups

What are the aims of Landcare?

The issues in Landcare are varied and usually location-specific, and form the basis for defining goals. Generally, however, Landcare aims at:

- Protecting, conserving and restoring the resource base: soil fertility by controlling soil erosion and other conservation technologies that increase and sustain farm productivity.
- Engaging in field level action research that addresses other issues on sustainable agriculture and natural resource management.
- Developing marketing strategies for agroforestry and environment-friendly farm products
- Strengthening and empowering local people to think, create and initiate activities that improve livelihoods as well as protect the environment from degradation.
- Sharing technical knowledge among researchers, extension agents, local officials, farmers, students, women, professionals, business sector, civic groups and other members of the community about sustainable agriculture and natural resource management.
- Seeking technical and other forms of assistance from government and non-government agencies as well as private companies.
- Drawing support from all sectors for the common interest of land care.
- Fostering and safeguarding the welfare and interest of its members.

Steps of the Landcare approach

During the gestation and evolution of Landcare in Claveria, we identified the following steps in developing this approach as summarised below (Garrity and Mercado, 1998).

1. Select sites with good potential

This is to bring conservation farming technologies to where it is most needed—on sloping lands where soils are prone to erosion. It also involves meeting with key leaders in the local government units, interested farmers, and other stakeholders. Their understanding of the issues to be addressed and their willingness to support and complement the programme are crucial to the success or failure of Landcare at a given site.

2. Expose key farmers to successful technologies and organisational methods

The aim is to develop strong awareness among prospective key actors - especially innovative farmers and farmer leaders - of the opportunities to effectively address production and resource conservation objectives through the new technologies. The success of the activities can be measured though the enthusiasm developed to adopt the technologies within the community. Exposure activities include:

- Cross visits to the fields of farmers who have successfully adopted the technology
- Training experience for farmers in the target communities to learn about the practices through seminars in their villages; and
- Opportunities for farmers to try out the technologies through unsubsidised trials to convince themselves that they work. If so, these farmers become the core of a conservation team to diffuse the technology in the municipality

3. Organise conservation teams at the local level

Once it is clear that there is a critical threshold of local interest in adopting the technology and a spirit of self-help to share the knowledge among the villages of a municipality, then the conditions are in place to support the implementation of a municipal conservation team. The team is composed of an extension technician from the Agriculture Office and possibly from the Environment and Natural Resource Office, an articulate farmer who has experience in applying the technology, and an outside technical facilitator. The team will initially assist individual farmers in joint implementation of desired conservation farming practices. Later, they can conduct seminars and training at the village level if sufficient interest arises. During these events, the team can respond to requests for the organisation of formal groups.

4. Evolve Landcare farmers organisation

If and when the preconditions are in place for a Landcare farmer organisation, then the facilitator may assist the community in developing a more formal organisation. A key ingredient for success is identifying and nurturing leadership skills among prospective farmers. This may involve arranging for special training in leadership and management for the farmer leaders and exposing them to other successful Landcare organisations. Each village may decide to set up its own Landcare Association and a Village Conservation Team. A village may organise Landcare Association sub-chapters in their sub-villages. A sub-village conservation team usually includes a local farmer technologist, the sub-village leaders and the councillor assigned in that sub-village. The sub-village conservation teams are the front liners in conservation efforts providing direct technical assistance, training and demonstration to farmer households. They are backstopped by conservation teams at the village and municipal levels. At the municipal level, the Landcare Association is a federation of all village level Landcare groups. The municipal conservation team is part of a support structure, which also includes other organisations that can assist the chapters for the organisational set up of the Landcare Association.

5. Attract local government support

Local governments can provide crucial political and sustained financial support to the Landcare Association in meeting its objectives. The municipality has its own funds earmarked for environmental conservation. These can be targetted to Landcare activities that enhance natural resource conservation. The municipality can be encouraged to develop to a formal natural resource management plan, which can help guide the allocation of funds.

The villages can also allocate financial resources from their regular internal revenue allotment. These funds can be used to organise the conservation teams and Landcare Association activities at the village level. The municipality can complement the funds of the villages, just like it happened in Claveria. The municipality allocated 50,000 pesos (about 1,250 US$) to each village to support Landcare activities. External donor agencies can best support Landcare development by allocating resources for leadership and human resource development, communication equipment and transportation to enable the Landcare leaders to make maximum use of their time.

We noted that Landcare performed impressively in villages whose activities were mostly funded by the local (village) government. Here the village officials made sure that the activities were well implemented so that their investments paid off, as compared to those that were in part funded externally. This implies that when the investments are coming from local funds to support self-help activities, it is likely that local people ensure the gains of their investment, resulting in good and successful projects, and sustained actions.

6. Monitor and evaluate

Monitoring is a necessary tool to assess the progress of the activity and use outputs for strategising activities or planning actions to make the programme more dynamic and relevant to the needs of the target community. For monitoring purposes, ICRAF has been keeping records of all those who have attended a training or had been assisted with establishing NVS on their farms, as well as farmers who requested assistance. Details on farming and conservation practices, training and follow-up needs are recorded on a diagnostic card, which is updated on regular follow-up visits by ICRAF staff. The leaders of the Claveria Landcare Association (CLCA) chapters and sub-chapters have been supporting this activity by facilitating the distribution and collection of the diagnostic cards to and from the sub-villages and new CLCA members.

Scaling up the natural resource management planning process

In 1996, the local government of Lantapan embarked on a bold step to develop their "natural resource management and development plan". It was probably the first of its kind in the history of local development planning with emphasis on natural resource management. The planning process was designed by the local government and technically supported by an international research consortium in which ICRAF is an active member. The plan drew national recognition and emerged as a model for a local government-led, participatory and research-based planning process. Today, the plan is vigorously implemented through public-private partnership. This means, everybody involved in either research or development activities within the area need to streamline their programmes towards meeting the objectives of the plan.

Based on the experiences in Claveria and Lantapan, different scaling-up modalities were developed (Catacutan et al. 2000).

MODALITY 1: ***Scaling up through the local development planning process*** *(From Claveria to Lantapan)*. This mode requires an engagement with LGUs in their local development planning process, resulting in the institutionalisation of the project at the planning stage as in Lantapan. Landcare is embedded in the bigger NRM and development plan of the municipality.

MODALITY 2: ***Scaling up through "integration" within the conventional extension programme of local government line agency: Municipal Agriculture Office (MAO)*** *(from Claveria to Malitbog, Bukidnon)*. The local government of Malitbog invited ICRAF to help them develop their Landcare programme.

Landcare was then embedded in the extension programme of the MAO in Malitbog that provided both human resource and financial support. Local champions – persons committed to Landcare – play an important role.

MODALITY 3: ***Scaling up through the local development planning process and integration in existing local programmes*** *(Lantapan to Manolo Fortich, Bukidnon)*.

This modality is a marriage of the two modes cited above.

MODALITY 4: ***Province-wide scale scaling up through integration of programmes implemented by government-line agencies and special local warm bodies at the provincial level*** *(Lantapan and Claveria to other municipalities in the two provinces)*. This mode requires a review of the different line-agencies and special warm bodies operating within a provincial scale and involves an understanding of their mandated programmes and identifying committed local champions who can mobilise programs on a provincial scale.

MODALITY 5: ***Scaling up through networking, collaboration and integration in existing special projects implemented by both public and private sectors*** *(for provincial, regional to national levels)*. We identified pathways whereby NRM can be streamlined in the development goals of different government line agencies from the provincial level down to the municipalities such as the Protected Area Management Board, Provincial Planning and Development Office, National Government Agencies such as Department of Environment and Natural Resources (DENR) and the Department of Interior and Local Government (DILG) and the League of Municipalities. The challenge was to contextualise NRM in respective programmes and mandates of these agencies.

We also have had interaction with other development service groups engaged in this issue, such as the Governance on Local Democracy (GOLD) project of the Associates in Rural Development Inc., and recently again, the Philippine Watershed Coalition. A potential partner for future scaling up is the Forest Management Bureau in implementing the Philippine National Watershed Management Strategy.

Keys to Success

In our experience, there are key principles that should be applied when scaling up technologies, concepts or processes. These are:

1 - Identify your strategic partners. You can do this, by critically examining your potential entry points that can be government officials, government offices, government programmes or NGOs, POs and their programmes. Be sure to get as much knowledge about your potential partners - their programmes, skills and even their personal interests.
Be conscious of the different personalities of people.

2 - Build that strategic partnership. Partnership is about relationship. It is important to approach the relationship as equal partners and be open on what each partner can invest. We are very careful as we carry the banner of an International Centre. We usually begin by saying, "we are here, not as a bank, a donor, or a sponsor, but—we are here to share our experience and our little successes".

3 - Use opportunities to build upon the programme.
Don't create confusion or chaos in an already organised system. Refrain from being identified as "Organiser" but as "Innovator and Facilitator". Avoid creating foreign structures. The key word is "Refinement" not "Re-engineering". Your proposed programme should be put in the context of already existing programmes by reviewing their working structures and relations and building on it. Be subtle and kind, and don't impress upon them that you are there to solve their problems. At the end of the day, they should claim ownership to the programme.

4 - Be flexible. Flexibility is very important in partnership building, from conceptualisation to implementation, but avoid "double standards". Each locality has its own unique conditions. Your scaling-up modes and even the project level approaches for the delivery of outcomes should vary according to local conditions.

5 - Maintain good communication and a friendly attitude. Just as in any relationship, communication is essential to success. Occasionally, socialise with your partners, but don't loose the limits. Be respectable by avoiding broken promises - don't promise anything you are not able to deliver.

6 - Be dynamic and innovative. Make things exciting by bringing in new and relevant information to your partners from time to time. Don't forget to be humble - yet show that you know something and that you are willing to share it with them.

7 - Be reflective and encourage your partners also to reflect on issues, problems and past events. It is always important to evaluate how things were delivered and look forward to mid-course corrections, if necessary. This can be a mutual learning exercise by the partners themselves.

8 - Networking. Invest in network building and maintain a supportive role to the network. Building networks is like building relationships - it is therefore, important to show an untiring effort and sincerity to potential networkers.

Challenges and future plans

Our analysis indicates that there is more to be done in further releasing the power of the Landcare concept. The public and non-government sectors can assist in facilitating group formation and networking among groups, enabling them to grow, develop their managerial capabilities, and enhance their ability to capture new information from the outside world. They can also provide leadership training to farmer leaders to ensure the sustainability of the organisations. Cost-sharing external assistance can also be provided. For this, the use of trust funds can be emphasised, where farmer groups can compete for small grants to implement their own local Landcare projects. This has been remarkably successful in the Australian Landcare Movement. We envision that the Landcare approach may be suited to other locations in the Philippines and elsewhere, providing a national focus for the sustained management of resources by farmers with minimal local government support (Mercado et al, 2000). On the other hand, the NRM planning process manifests a strong basis in the implementation of provisions mandated in the Philippine Local Government Code. Both Landcare and the local NRM process exhibit the essence of local governance. The modalities for scaling up provide more options for project implementers to contextualise approaches for scaling up on the basis of opportunities and build the blocks for accelerated progress in that local condition.

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Farmer recommendations after 15 years of innovation

Güinope was the site of a highly acclaimed people-centred development project in the 1980s. The ACORDE / Ministry of Natural Resource / World Neighbors' Integrated Development Program (IDP) was unique for its time, since it promoted local innovation for generation of responses to needs rather than relying on technology transfer. Furthermore, it was one of the first efforts in Latin America to employ villagers as principal agents of change. Fifteen years after the inception of the IDP and ten years after its completion, the authors interviewed farmers in their fields and held a series of participatory workshops with 10 former farmer promoters (FPs), now influential farmer leaders. The results of this study were published recently in *Agriculture and Human Values* (see end). Some reflections of the FPs on rural development programmes are summarised here.

In 1982, the IDP felt that soil conservation and the development of FPs offered the greatest opportunity for community progress. Fifteen years later, FPs expressed the need for development organisations (DOs) to give attention to new priority areas. Community populations have become increasingly transitional. This has drastically changed traditional mechanisms of learning, leadership, and organisation. External cultural influences have placed new pressure on local norms and behaviour, and agricultural modernisation emphasising export-oriented and extensive agriculture is threatening the sustainability of smallholder production systems.

The FPs felt that the most effective projects were those that facilitated community participation. Projects should, they said, include men, women and youth, begin with local interests and experience, rely on available resources, and ultimately permit the community to direct change. It was also important for DOs to enable leadership and to collaborate through local leaders. They added that such leaders should be chosen based on their ability to learn, success in applying innovations, and demonstrated volunteer spirit.

Projects, they said, should not focus on single-answer solutions or technical themes, but rather embrace the local complexity. They argued that the best way to achieve this was through cultivating the "human farm": the head (ability to think), the hands (ability to implement ideas), and the heart (motivation to initiate and complete tasks). Further, they encouraged DOs to become facilitators, enabling communities to develop and implement independent initiatives by assisting them in organising, getting access to information, representation in political circles, and logistical support.

The FPs mentioned that present priority areas demanding support were marketing of commodities, irrigation, credit for investments, and attention to the development of new leaders in the community, especially women in leadership roles. They also sought conditions that would permit children to become independent farmers or entrepreneurs, rather than labourers. Such changes would demand new platforms for the community's voice in government decision-making and the formulation of policies.

Ultimately, the local leaders downplayed the role of technologies in rural development and called for special attention toward enabling communities to confront external pressure, particularly recent government "modernisation" policies they felt threatened community livelihoods.

The FPs presented their ideas to a forum of 30 representatives from 12 DOs as well as 15 farmers from the Güinope area. An open discussion followed the presentation, and the group summarised nine essential project attributes and strategies for more effective development work (Table below).

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From: Stephen Sherwood and Sergio Larrea. **Looking back to see ahead: Farmer lessons and recommendations after 15 years of innovation and leadership in Güinope, Honduras.** Agriculture and Human Values 18: 195-208, 2001. Contact address: International Potato Center, PO Box 17-21-1977, Quito, Ecuador. Email: sherwood@cip.org.ec

Essential project attributes and strategies for more effective rural development

Attributes	Strategies
1. **Increasing participation**	Begin with local priorities Be inclusive (include women and other disadvantaged groups) Work with local knowledge and available resources Increase involvement of local actors in decision-making and ultimately permit community control over initiatives.
2. **Avoidance of paternalism**	Avoid using external incentives (e.g. gifts and subsidies) to motivate Use success to inspire increasing involvement and participation
3. **Integrated human development**	Attend to the "Human farm" (development of knowledge, skills, and motivations) View technologies as tools and their use as means rather than ends
4. **Community-oriented flexible projects**	Respond, do not lead Develop projects and methodologies in collaboration with communities Grow with the changing needs, interests, and abilities of intended beneficiaries
5. **Collaboration with multiple institutions**	Involve the entire range of local organisations Develop abilities to work together Build linkages among multiple development organisations and coordinate efforts
6. **Start small**	Begin with small, manageable projects that permit people to build confidence and abilities without involving them in substantial risk
7. **Quality agents of change**	Employ extensionists and promoters who are: • experienced in farming • competent with agriculture, teaching, and organising • genuinely sensitive to the local situation
8. **Local leadership and innovation**	Enable local leadership and achieve change through leaders Chose leaders who: • have thirst and ability for learning • have successfully applied innovations on farms • demonstrate volunteer spirit Promote democratic (rather than autocratic) leadership styles Promote independent learning (experimentation, analytical skills, and self-discovery)
9. **Local initiative**	Encourage communities to generate projects Provide organisational support Facilitate access to information, teaching materials, and provide logistical support

Scaling up sustainable agriculture

Lessons from the Campesino a Campesino movement

Eric Holt-Giménez

For thirty years the *Campesino a Campesino (CaC)* movement of Mesoamerica has been hard at work developing Sustainable Agriculture, patiently, empirically, step by step. What started as a village alternative for a small group of Cachikel Mayans in the Highlands of Guatemala has spread through Mesoamerica in spite of (and sometimes because of) military conflict, widespread agrarian failures and chronic economic crisis. Presently there are well over ten thousand practising farmers in Central America alone.

The effectiveness of the agroecological practices promoted by the movement were made clear in the aftermath of Hurricane Mitch: thousands of "agroecological" farmers survived the century's most destructive hurricane with more topsoil, less erosion and fewer crop losses than their neighbours practising conventional agriculture. (LEISA Magazine 17.1, p.18-20).

A Campesino a Campesino workshop, Santa Lucia, Nicaragua. Photo: Eric Holt-Gimenez

The essence of Campesino a Campesino

CaC is more than a wide-flung, loosely related collection of NGO projects. It is not simply a horizontal methodology for learning or technology transfer. It is a social *movement* based on the belief that farmers are capable of developing their own agriculture (Holt-Gimenez, 1996).

The CaC movement **"walks"** on the legs of 'innovation and solidarity' by experimenting on small, local scales and by widely sharing knowledge, creativity, experience and wisdom, farmer to farmer.

The movement **"works"** with the two hands of 'production and protection'. By focusing on overcoming limiting factors to production and on strengthening the weak ecological functions in the agroecosystem, farmers first reduce and then substitute external for internal inputs. To the extent possible, they gradually eliminate inputs altogether by redesigning the farm system to rely primarily on ecosystem functions. Protection of the environment then becomes crucial to the productive function of the farm. Watershed hydrology, habitat and biodiversity become key considerations for on-farm soil and water conservation and pest management, thus linking farmers' collective watershed management to their individual farm management.

The movement **"sees"** with the shared visions of farmer-led sustainable agriculture. In its **"heart"** members of the movement are motivated by deeply held beliefs in the divine, in family, in nature and community. The shared expression of these beliefs in practice has led CaC to reaffirm the cultural capabilities and the social imperative of farmers' contribution to sustainability, both locally and globally (Holt-Gimenez, 1997).

Basic principles of Campesino a Campesino

The basic principles of CaC evolved from Roland Bunch's concept of "people-centred development" three decades ago:

- Start small, go slowly
- Small-scale experimentation to overcome limiting factors and stabilise ecological functions
- Multiplier effect
- Limit introduction of technology
- Teach others
- Reduction, substitution, redesign: 3-phase conversion to sustainability
- Vertical and horizontal integration of production

Lessons from experience

Experience over the years has brought out a number of activities and methodological/ organisational lessons. First is the centrality of campesino culture. Farmers learn from each other by sharing wisdom, creativity and knowledge, not just information and techniques. Rather than simply transferring technologies, farmers first and foremost "make culture" - sharing that leads to action builds a culture of sustainable agriculture. Technology transfer is actually just one (and not always the primary) component of this cultural matrix.

Part of farmers' enthusiasm for developing agriculture comes from the sense that they are actually contributing to and shaping society. This subjective, but very powerful motivational force has been nurtured through **cross visits**, "**encuentros**" (farmer gatherings… sometimes similar to scientist's symposia) and the inclusion of farmer-promoters in workshops held by national and international agencies for agricultural development.

Farmer promoter teams have played a key role in CaC. Teams have the advantage of spreading the knowledge, time, talents and risk among several like-minded promoters. They also allow for entry and exit of farmers from promoter duties and the continual renovation of the team itself. Teams are peer mentorship programmes for young or new promoters, as well as a reservoir of expertise for NGOs who frequently hire experienced promoters, (either on short or long term basis) to open new programmes. Teams also ensure an installed capacity for a wide range of social, economic and technical activities that work directly and indirectly to help sustainable agriculture scale out (geographically) and up (i.e., research, organic certification, Fair Trade, etc.). Promoter teams usually rely on an agricultural technician from an NGO for technical, logistical and/or some form of economic support for their activities. Field days, study sessions and workshops that are held continuously have been broken down to modular 1-3 day activities to make them more accessible to farmers. Some teams have found it important to arrange themes and experiments seasonally to coincide with the cropping calendar of local farmers.

A more sustainable agriculture

This combined approach of developing pools of local expertise and sharing experiences widely has accomplished three important tasks in the development of a more sustainable agriculture:

1) It has generated and adapted locally-based alternatives that are easily incorporated to the ecology of each particular area, increasing agroecological diversity and resilience,
2) It has spread simple, adaptable technologies at low cost to thousands of farmers and has improved the capacity to innovate,
3) It has developed farmers' social and agroecological capabilities.

The widespread adoption of Velvet Bean (*Mucuna pruriens*) and other green manures in Mesoamerica is largely due to farmer to farmer innovation and solidarity, as is the knowledge and practice of soil and water conservation technologies (ILEIA Newsletter 13.3, pp.12-13). These farmers have often been the first and/or most successful in converting to organic practices, in diversifying their markets, and in vertically integrating production.

While over 10,000 farmers identify in one way or another with the movement, thousands more have been influenced. (The numbers are undetermined because these farmers fall outside the NGO areas of influence). Likewise, many professionals within NGOs have adopted parts of the CaC methodology or technologies without specifically identifying with the movement. In fact, the movement has profoundly influenced the technical and methodological agenda of many NGOs in Latin America (ILEIA Newsletter 16.2, p.26).

Success not the only key for spread

In the recent Central American study on Farmers' Agroecological Resistance to Hurricane Mitch (Holt-Giménez, 2001), one thousand practising farmers indicated that their reasons for adoption of sustainable practices included:

- Need (highly degraded agroecosystems, high cost and diminishing returns on credit and external inputs)
- Access to farmer to farmer training
- Consistent technical assistance
- Access to appropriate credit and market opportunities

However, while these factors help explain CaC's success, the question remains, "If it works so well, why hasn't it spread more?" One thousand conventional farmers from the same study indicated that their lack of adoption was due to:

- Insecure access to land
- Too much land (can afford to degrade the agroecosystem)
- Access to credit for external (chemical) inputs
- Lack of time/labour (engaged in pluri-activity)
- Ignorance
- Apathy

At this juncture, the limits to scaling out appear to be related to the structural problems of scaling up. These problems have less to do with technologies and methodologies than with national policy contexts and institutional behaviour. The CaC movement provides a perspective on these factors as well.

Factors that impede scaling out

Lack of documentation: There has been little "*sistematización*" or documentation of the movement done in a way that actually provides feedback to technicians, promoters and farmers. This has meant that the sharing of most of the agroecological, methodological and organisational knowledge in CaC is limited to farmer to farmer exchanges. While these horizontal learning networks are of prime importance for building the culture for sustainable agriculture, the lack of documentation prevents these lessons from scaling up into institutional networks. This in turn limits institutional learning, resulting in many projects "re-inventing the wheel." Further, lateral learning by government and private sector institutions is virtually non-existent, resulting in little headway for CaC outside the informal social networks connecting remote villages and the NGO institutional world.

No effect on formal research: Several interesting studies regarding technologies and methodological approaches have been undertaken. Some national and most international centres for agricultural research (NARIs and IARCs) have a small section or project that deals with sustainable agriculture, in general. Yet, CaC has not significantly affected formal agricultural training and research. In fact, lately, privately-funded research in biotechnology has begun to dominate IARC research agendas, dwarfing sustainability-oriented projects, which remain isolated and wield little influence.

Lack of appropriate training: Not only is formal research for sustainable agriculture largely out of touch with the farmers who are actually practising it, relatively few agronomists or technicians are being trained to work in agroecology or with campesinos. While it is true that over the last ten years, many technicians have learned about sustainable agricultural techniques, (primarily on the job, many from campesino promoters), very few have any grounding or formal training in agroecology. Thus they have difficulty applying basic ecological principles to solving a changing array of complex agroecological problems. This also limits their ability to design effective on-farm agroecological experiments, hampering innovation.

Adoption with no integration: Success and the lack of a fixed organisational focus encouraged many NGOs to adopt CaC methodologies (and its rhetoric if not its ideology). However, this has not always translated into greater farmer input or control over programmes, nor has farmer-led sustainable agricultural development necessarily become a guiding approach for NGOs. NGOs are still primarily accountable to donors, and few of them have direct mechanisms for accountability to farmers. While it is true that farmer participation is a key indicator in most project evaluations, "participation" continues to mean the participation of farmers in the NGOs' projects, and only rarely considers the nature of the participation of NGOs in farmers' processes for development. The conflation of "participation" and one-way accountability prevents clear strategies for farmer organisation and empowerment (beyond technologies and/or markets), particularly in regards to influencing the policy context for sustainable agricultural development. Claims to partnerships

Don Pedro Rodriguez, promotor, Nicaragua explains how CaC walks on the legs of solidarity and innovation, works with the hands of production and protection, has a heart that loves family, nature and other campesinos, and eyes for a campesino vision of the future. Photo: Eric Holt-Gimenez

notwithstanding, campesinos remain "clients" of most development programmes, rather than "constituents" of organisations working for social change.

Inability to influence decision makers: Despite its extensive presence in one of the largest farmers' unions in Central America, CaC has not been very successful in scaling-up its agenda within national and regional farmer organisations. Basically, promoters from CaC have been unable to penetrate decision-making circles (boards, directorships, etc.), dominated by medium and large producers interested primarily in conventional agriculture. Consequently, while some farmers' unions can boast of CaC projects (this is important for obtaining international funding), the lack of power sharing and the dominant conventional strategies for agricultural viability precludes these unions as lobbying agents for sustainable agriculture.

Rogelio Sanchez Ledesma, a Mexican promoter helping Jose Jesus Mendoza (now a well known Nicaraguan promoter) to establish the first terraces on his land in 1987. Photo: Eric Holt-Gimenez

Conflicting economic interests: The importance of economic viability has led many CaC groups to establish international linkages for Certified Organic and Fair Trade marketing. While both Fair Trade and the Certified Organic market have proven a windfall for many campesino groups, neither is *necessarily* agroecologically sustainable or *intra*-generationally equitable. Farmers anxious to obtain quick certification have chopped down forests for access to fertile, uncontaminated soils. Others have shifted from diverse agroecosystems that produce food for local consumption to organic monocultures geared for export. Finally, many NGOs, eager to attract farmers to their projects, substitute broad-based organising efforts around food security, autonomy and sustainability, for short term, market-oriented strategies. This has drawn in farmers interested more in profits than sustainability and has excluded those farmers whose factors of production do not permit farming for the international market.

Establishing linkages with the international market does not in and of itself develop local or inter-sectoral linkages with urban, consumer, or environmental interests. But these linkages on local, national and regional scales cannot be ignored if scaling up itself is to be sustainable. This does not mean that sustainable agriculture must operate outside the market or that Certified Organic and Fair Trade should not be pursued. Simply, it means that programmes for sustainable agriculture cannot afford to push market options uncritically.

Unfavourable institutional and policy contexts: The decentralised, informal and horizontal nature of CaC has given tremendous resilience and diversity to the movement, whose reticular development has allowed it to establish effective technical and methodological alternatives for sustainable agriculture over a broad geographical area. The knowledge-based, farmer-driven approach has been especially appropriate to the ecosystem-specific nature of sustainable agricultural development. However, it appears that CaC has found its limits in the unfavourable institutional and policy contexts that do not favour sustainable agriculture or farmer-led development. There are many credit and market mechanisms that could be brought in to improve the conditions for sustainable agriculture, as well as research, training and extension programs - just as they were for the Green Revolution. However, the lack of effective political will on the part of governments and research centres makes this a remote possibility. Developing this political will depends in large part on pressure from civil society. For the CaC movement to successfully influence decision makers reluctant to sustainable agricultural policy, institutional mechanisms for this expressed purpose must be developed. How much of this can or should happen within the NGO, academic, or private (market) sectors should be a subject of serious debate. It is likely that all avenues should be pursued in some form.

Movements and alliances for scaling up and out

To be an effective social movement for sustainable agriculture, CaC may well need to establish broad social alliances for sustainability with other sectors and with actors from Central America's new social movements (gender, environment, urban dwellers, social justice, etc.). Given that many NGOs working in sustainable agriculture also address many of these issues (either within the agricultural project or within the organisation itself), there may be good opportunities for this. However, it should be noted that while NGOs have been very good at introducing issues, technologies and methodologies into civil society, until now, they have not necessarily pursued a strategy for building movements or alliances for social change. Many professionals working within NGOs see their organisation or their project as and end in itself, and not as a means to enable social change. On the other hand, Central America's rich (if violent) political history has meant that activists once involved in movements for social change are still around, many of them are in NGOs working for sustainable agriculture. Experienced or not, these professionals can help develop strategies for "scaling out" through movements such as CaC*,* and "scaling up" through farmer-led, inter-institutional alliances.

CaC illustrates the importance of farmers' movements for developing sustainable agriculture on the ground. Perhaps the most pressing lesson is simply that agriculture in general will change not only when farmers change, but when farmers (and their allies) are capable of changing the institutions that hold change back. We still have much to learn about just how to do that. The formation of international and regional alliances for influencing agricultural research and development may provide a useful way to overcome the present policy impasse in sustainable agriculture.

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Scaling up, and further scaling up participatory development

Jean Marc von der Weid

Since 1995, AS-PTA has facilitated a successful family-farmer programme in the central-southern part of Paraná, **Brazil**. Thousands of farmers have gone through a process of discovering solutions to their farming problems and thereby improved their understanding of the principles of ecology and agroecology.

This region of Brazil is part of the Atlantic Forest, a very diverse and rich rainforest with a subtropical, cool and humid climate. Average rainfall varies between 1,300 and 1,700 mm per year. The area is hilly to mountainous, with small flat stretches at the bottom of the watersheds. Family farms of less than 50 ha, constituting 90% of all farms in the region, are concentrated on a third of the farmland. Large haciendas account for the remainder. Diverse crops are grown on these farms. Beans and tobacco are the main cash crops, followed by onions, potatoes and *erva mate* (a kind of native tea). Corn is grown by most farmers mainly for home-consumption and fodder. Horses play an important role as draught animals and nearly all family farms have a few heads of cattle, some pigs and poultry.

The farming systems mix traditional and modern features, chemical or organic fertilisers are used depending on the farmer's resources. With generally low average yields, family income varies from US$ 660 to 1020 per year.

The programme initiated by AS-PTA covers 22 municipalities (about 13,000 sq. km) with a population of 250,000 people (roughly 55,000 family farmers).

Farmer experimenters testing herbal herbicides. Photo: AS-PTA

Major problems

Inherent natural conditions like soil acidity and low phosphorous content together with small farmland holdings and reduced fallows, cause a number of social, economic and environmental problems. The lack of financial resources does not allow farmers to take measures to deal with the tendency of soil nutrient depletion and decreasing yields. Steep slopes and heavy rainfall, combined with "up-down" tillage practices causes significant soil erosion. The replacement of traditional bean and corn varieties by improved ones has had devastating effects on agro-biodiversity and crop efficiency. Last but not least, indiscriminate use of agro-chemicals has given rise to toxic contamination among farmers and in the environment, without any significant reduction in pests or crop diseases. Difficulties in access to credit and markets also contribute to low income patterns in the region.

The approach adopted by AS-PTA was to identify major constraints in agriculture through participatory methods and to develop technical solutions through participatory research involving all farmers. Agroecological alternatives were presented by AS-PTA's technical team and by the farmers. These suggestions were then tried and adapted by the farmers on their own fields in small-scale experimental plots designed by them.

Technological innovations

Dozens of possible technologies were tested according to the choice of farmers, either as individual or joint efforts. While any one of these innovations can be adopted on its own (this is not a technological "package"), they proved to be most efficient when applied in combination with each other. Each farmer, having to deal with specific conditions, therefore can chose which innovations to adopt and how to adapt them to his/her concrete situation. At community and regional meetings, the results of these tests were presented and discussed by farmers. Field visits were used to illustrate the better technologies to other farmers. This encouraged others to take up new experiments thus engaging more farmers in the process of discovering more complex and adapted solutions. New participants engaged in the experimentation as information on the first group's results spread through initiatives undertaken by AS-PTA. In order to structure its work, AS-PTA has grouped the proposed technologies into three main technical programmes, along with a few minor ones.

The most widespread programme is on **Genetic Resources** and involves nearly 5000 farmers. It tries to identify traditional varieties of maize, beans and potatoes and to bring them back into general use amongst farmers. The purpose is to seek greater adaptability to a range of environmental conditions and to the farmers' different goals and systems. Genetic diversity of crops has been lost due to strong incentives and policies aimed at the introduction of improved varieties. Such "improvements," however, did not provide the anticipated yield increases as they required a rich soil and a host of external inputs. Farmers could not afford to apply the entire Green Revolution "package," and were, therefore, unable to gain all its benefits. Meanwhile, traditional varieties were disappearing and farmers were left with no option but to use poorly adapted "modern" varieties.

The Genetic Resources programme involved older farmers, some of whom still had seeds of traditional varieties, and tried to encourage farmers to test these varieties for selection. The next step was to identify farmers' seed-production methods and evaluate the more efficient methods. This local knowledge-based process was also used in breeding new varieties and in establishing methods for seed conservation and storage.

The second major programme aims at **Ecological Soil Management**. A broad range of innovations was tested. Many of them have been adapted by farmers in different ways and combinations. These include managing crop stubble without burning, the cutting of native vegetation after fallow periods also without burning, planting along contour lines, the use of winter and summer green manure crops, improvement of fallow land with green manure, changes in spacing for inter-crops, the use of an organic leaf fertiliser known as a biofertiliser (produced by the community itself), the use of a compost produced by bio-dynamic farmers to accelerate the decomposition of organic matter, the use of lime and rock phosphate etc.

As a result, disease and pest problems have reduced considerably since the varieties tend to be selected for resistance and receive more balanced fertilisation than in the chemical NPK system. When needed, copper sulphate (Bordeaux blue) or sulfocalcium applications are used, and the leaf-based biofertiliser also provides protection against pest attacks. Weed control is much more difficult and complex, and is carried out with a locally developed no-till, no-herbicide system.

The third major programme focuses on **Agro-Forestry**. It essentially involves native forestry in the *araucaria* forests (a large pine tree, native to this part of South America), one of the most biodiverse ecosystems in the world. The key crop in this programme is another native plant, the *erva mate*, used to make a tea that is widely consumed in southern Brazil. Official research and rural extension services have been encouraging farmers to abandon their traditional native forestry systems enriched with

Ashes is used to make compost, locally known as 'independence fertiliser' . Photo: AS-PTA

erva mate trees and move to open-field plantations, as used in Argentina and Uruguay. This innovation causes tremendous environmental damage as it stimulates the destruction of native forests while promoting intensive use of herbicides and insecticides.

The AS-PTA worked with a group of farmers with long experience in forestry to find a way of improving the traditional *erva mate* management system. The basic principle lies in accelerating natural plant succession and in combining unexploited forest species with the *erva mate* (see ILEIA Newsletter Vol.16, No.3, pp 17-18). Another aspect of this programme is to stimulate the planting and management of medicinal herbs inside the native forest areas, in conjunction with the production of teas and the dissemination of a system of practical medicine known as "bioenergy".

One small-scale programme that has a great potential for food and nutritional security is the promotion of **family gardens**. Diverse crops are grown in these gardens without the use of chemical fertilisers and pesticides. Women have taken up this initiative as a means of meeting family food requirements.

Strategy, process and methods

From the beginning, AS-PTA ensured that the development process did not conflict with the farmers' spontaneous cultural, spiritual and organisational forms. It was clear that the communities' own histories were fundamental to understanding what they believe in today. It gave rise to an important process of re-valuing knowledge and beliefs deeply embedded in farmers' world views, which tend to remain hidden and not dealt with explicitly by the modern, technical ideologies that disqualify them. Farmers were able to become partners in their work with the AS-PTA because they were respected and understood within the framework of their ideology, culture, knowledge and beliefs.

AS-PTA began its work by creating relations with the leadership in the region's family-farming communities. This was facilitated by hiring local extension agents who had deep knowledge of the social dynamics of central-southern Paraná. Along with the local leaders, AS-PTA chose three communities in which to begin its work, involving about 30 families in two of them, and a hundred in the third. A **participatory diagnosis** about their agroecosystems helped to identify the key problems and their causes, as well as to motivate farmers and their families to get involved in this local development work. This resulted in an intensive process of **participatory experimentation** with the different options provided.

The practices that were being tested and selected in the first three communities were **disseminated** in different ways to other farmers. This included presentations by farmers or technical workers at church services, visits between communities to exchange experiences, collective planning of municipal and regional activities and joint participation in seed fairs and public-policy mobilisations. These efforts aroused varying levels of interest in the region's different communities, resulting in the formation of farmer-experimenter groups and trainers within the region, who then took the message to other communities, trained more experimenters and stimulated more and more exchanges of experiences. There is now an intense movement of farmers around the region, organising itself independently of AS-PTA, and making demands for support whenever necessary.

Training is an essential aspect in this approach, which is not limited merely to techniques taught by the AS-PTA staff, but also seeks to stimulate creative observation and the ability to innovate and adapt. Great value is placed on the farmers' own knowledge of agronomic practices and their ecosystems, which is then combined with new information introduced by the technical staff. One of the technical solutions that raised the interest of other communities was the re-introduction of traditional crop varieties, with selection and breeding done in community test plots. The AS-PTA provided training to a group of interested farmers, who then took it region-wide and made it a common learning experience.

This regional group, now made up of about 45 farmers, took on the training of other experimenters, who in turn went on training their neighbours. Significantly, it is not only the techniques (how to set up a seed field, breed maize, etc.) that are shared, but also the reasons behind the different innovations, and how to test it freely in order to improve and adapt it to each farmer's specific conditions.

Moreover, a Regional Development Forum was created with 15 municipal Farm Workers' Unions and approximately 200 Community Associations, women's and youth groups. The Forum took over the leadership and management of local development and has displayed a tremendous capacity for mobilisation, as was seen in the presence of 30,000 people at a regional event in 1999, called the Land Procession.

One interesting impact of this extraordinary activity of social interaction in the region was the breakdown of cultural barriers amongst communities of different ethnic and religious origins. Joint activities have brought the communities together and created a social identity of family farmers taking on their own development.

Without the intense participation of farmers in the process of producing and disseminating new knowledge, it would have been impossible for the programme to take this impressive leap. In five years, this approach allowed AS-PTA to reach out from three initial communities to 160 farmers, and then to 5,000 farmers.

Impact

Agronomic and economic impacts have been very significant considering that the process is far from reaching all the benefits it has to offer these farmers. On-farm seed production has increased substantially, with significant financial savings for at least 10% of the region's farmers. The diversification of traditional varieties has led to the re-introduction of 112 varieties of maize, 98 of beans, 10 of potatoes and 16 of rice (a secondary crop in the region that was not a priority in the Genetic-Resources programme).

Yields of these traditional varieties compare very well with commercial hybrids and the varieties bred at experimental stations run by the State (Instituto Agronômico do Paraná-IAPAR) and federal (Empresa Brasileira de Pesquisa Agropecuária-EMBRAPA) governments. Simply cultivating the best-adapted traditional varieties, with no other changes in farmers' productive systems, brought increases of up to 50% above the regional average, reaching 3600 kg/ha for maize and 1800 kg/ha for beans. Farms that adopt other agroecological techniques in addition to traditional varieties have attained yields of 5000 kg/ha for maize and 3000 kg/ha for beans.

There are no precise records for the impact on tobacco, onions and potatoes, but the farmers' impression is that the results have been just as positive, even though they are more risk-prone crops. More advanced farmers state that they can market high-quality organic produce, including tobacco, with yields comparable to conventional systems.

Qualitative evaluations done by farmers for *erva mate* yields in the new forestry system indicate that they are higher than in the traditional system and that the quality of the product is much better than in the modernised open-field system. Farmers infer that their yields are close to those of the modernised system mainly because major borer attacks have caused damage to open-field plantations, but no precise field surveys have been done to collect data for proof.

Farmers claim that **savings on inputs** are as much a motivation as are yield gains. For example, the introduction of no-till, no-herbicide planting in maize and bean fields on one farm that plants 5 hectares (average for the region) of these crops produced an average gross gain of US$563. The investment for the introduction of this technology costs US$400, meaning an immediate net gain of US$163. Once the no-till, no-herbicide system is established, yearly expenses are a little over 10% of the average fixed costs. This means that, from the second year on, a farmer can obtain a net gain of over US$500, just in maize and beans.

Another advantage of agroecology highlighted by farmers is the system's **greater resilience**. There is a higher tolerance to and lower occurrence of pests, fungi and nematodes, and less vulnerability to occasional dry spells. Tobacco, potato and onion farmers – who use the most insecticides and pesticides – show great interest in the human-health gains from replacing these inputs due to the many poisonings in the region. Less use of these inputs also implies a reduction in labour costs. Farmers who have a low investment capacity and break-even in the traditional system are attracted to these technologies that have a lower dependence on purchased external inputs.

Exchange of information on traditional maize varieties. Photo: AS-PTA

What is interesting about this programme is the wide adoption of techniques that were not essentially new to the region and its farmers. In fact technologies like green manuring and no-till planting had been promoted for a long time by public research and rural extension agencies without wide acceptance by farmers. Now, over 5,000 family farmers are directly involved in using the techniques, along with an unknown number of others who have been "contaminated" by the participants.

Conditions for the successful results so far

Well-established **community structures** in combination with the recent dynamics in social and political life at municipality and regional levels have been the basis for the achievements of the programme.

Another important factor that could be described as "ideological" is that the conventional Green Revolution model had reached its limits for many local farmers. In addition, the political and social dynamics of the 1980s that had demanded for greater access to Green Revolution facilities had already run its course. In its place, the alternative development model presented by the approach of agroecology and self-reliance has raised the expectations of farmers.

Partnerships between the local technical staff and farmers, and very clearly amongst the farmers themselves, complemented by external expertise, were the key to success. The AS-PTA core staff played an intermediary role in the search for new knowledge that could be assessed, adapted and incorporated by the farmers. Visits to other NGOs in southern Brazil helped to build up a pool of technical options to be experimented with locally.

Partnerships with research institutions were built slowly, and now include collaboration with the University of Londrina (genetic resources), IAPAR – the Agronomic Institute of Paraná (no-till planting), EMBRAPA-CNPAB –National Centre for Research in Biological Agriculture (green manure) and the UFRRJ – Federal University of Rio de Janeiro, Agricultural Development Research Centre (CPDA, public policy assessment). These partnerships are useful for the scientific assessment of techniques and results, and for the identification of bottlenecks and possible solutions or improvements.

According to one external technical evaluator who visited the programme, most of the techniques in use do not involve major innovations, but the way they are used, combined and adapted can be considered revolutionary.

Obstacles and limitations

The programme is currently facing two major limiting factors along with others of secondary importance.

Firstly, the farmers' lack of **access to capital** and the totally inadequate credit system slows down the process of incorporating new technologies. Although these innovations are inexpensive and do not demand recurrent expenses, farmers often cannot afford the investments. Adopting the no-till, no-herbicide technique, for example, demands an initial investment of 40-60% of the average annual family income.

Access to seeds for green manure. Seeds for green manure are expensive and hard to find in Brazil, especially considering the great diversity of species (over 30) used in the programme's experiments. Farmers depend on the on-farm multiplication of green-manure seeds, and therefore take a long time to transform their farms. The AS-PTA provides small amounts of seeds for farmers' test plots. Each of them is responsible for passing on a certain amount of seed to others for experimenting, and to multiply seeds for their own use.

A third major limiting factor has to do with the **market**. A handful of intermediaries control the buying of beans, onions, potatoes and tobacco, leaving farmers totally dependent on them. Consequently, prices are so low that they discourage production. "Why work so hard to change, if the profits end up in the middleman's pocket?" is a common question posed by farmers. These middlemen have also imposed the use of two high-input demanding bean varieties, sold by Monsanto and IAPAR, based on the preferences of supermarkets in Rio de Janeiro who buy most of Paraná's black beans. Trials done with one medium-sized supermarket outlet, however, have shown that consumers are interested in buying traditional bean varieties as long as they are mixed in "blends" with the same cooking time.

The same problem exists with other products, particularly potatoes and tobacco. For potatoes, size, shape and the absence of spots on the skin are more important than taste or nutritional value. With tobacco, the cigarette industry totally controls its contracted farmers, by supplying them with inputs and strictly controlling application thereof. Whatever the quality of the leaves, farmers who do not use the industry's "package" have no chance of selling their harvest.

Other constraints to scaling up the programme are related to the funding available with AS-PTA to support learning and exchange among farmers, to the limitations farmers face in buying small equipment, e.g. a grain dryer; and to public authorities creating countless problems, eg. making loans conditional to the use of "technological packages" or distributing commercial seeds for free.

Proposals to scale-up the programme

Credit will be a key to accelerating the process of adoption. On the short-term, there is no chance that market credit policies for family farmers will change. But, a larger-scale experience in this region with an alternative credit programme could help stimulate changes in the official credit program. The credit agents should be the Community Associations organised in a centralised support structure that would raise and distribute funds. This would simplify access to credit with each farmer's collateral guaranteed collectively, in solidarity, by the community. A loan of US$ 400 per farmer is enough to convert an entire farm. Under normal conditions the gains from the first year's harvest will be enough to pay back the loan.

Also organisation and administration of this flow of funds, including the training of community agents, will be important. There are already some experiences in the region on which to draw upon for organising and training work. The rate of expansion will also depend on increasing the farmers' ability to extend the social dynamic of training and experimenting. This means that the core of experimenters/trainers who lead the region's development process has to be increased.

The third important aspect in gaining scale is market access. To overcome the monopolies limiting the local producers' marketing potential, the family farmers' small cooperatives must have more infrastructure, as well as equipment to process the harvests. This means community grain dryers, drums for seed storage, humidity gauges, scales, sacking machines, sewing machines, elevators, conveyor belts, silos, corn threshers, huskers, greenhouses, *erva mate* processors, classifiers etc. The investment cost, about US$100 per farmer, could be supplied by loans as well. The operating costs of most of this machinery can be covered collectively by participants, as is already the case in today's smaller-scale experiences.

This investment is not aimed at replacing existing commercial agents, but at breaking down monopolies and obliging them to negotiate better prices with the farmers. Channels for direct access to supermarkets in Rio de Janeiro have already been opened, through which farmers' organisations could sell about one third of the total 100,000 tons of black beans produced in the region every year.

Conclusions

Our experience in central-southern Paraná shows how the work of one organisation through intensive social participation has been able to increase, 30 fold, the number of beneficiaries within 5 years. Further scale-ups will depend on greater investments in these new directions for Brazil's rural development. However, this budget is lower (around US$ 35 per year per farmer) than the amount spent on public rural extension services and the cost of agricultural research in Brazil (around US$ 1,000 per year per farmer).

AS-PTA's proposal for central-southern Paraná can point the way to new approaches for rural credit, as well as for public research and extension services. If implemented, the impact of these new approaches on sustainable family farming in Brazil will by far surpass the meagre results shown by the huge volumes of funds spent today in this social sector that includes a great majority of Brazilians now living in poverty.

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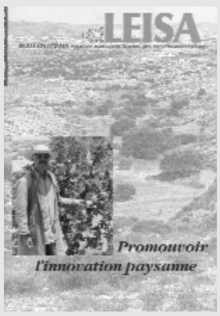

MERCI (thanks) to our French readers!

In January 2001, ILEIA published a French version of its issue on "Grassroots Innovation" (vol 16.02). This special issue was sent out to over 3000 addresses in French speaking countries of Africa. Of the 1300 that included a reply form, around 200 were returned to us. The response is very encouraging. The French readers complimented the LEISA Magazine with "very well done", "an efficient tool for participatory development", "the Magazine helps researchers and farmers to collaborate closely for a better tomorrow" and many more. They also gave us some good suggestions for improvements and stimulated us to continue with the idea of a regular French language edition of the LEISA Magazine. Meanwhile, we have approached a number of funding organisations to get this project off the ground. We hope to make a start, together with our African partners, early next year.

MERCI, once again, for your stimulating response!
And AU REVOIR

From zero tillage to conservation agriculture

An unexpected success

Sandrine Vaneph and José Benites

Conventional farming systems based on intensive and continuous use of the plough are difficult to sustain in several climatic zones as they cause degradation of the soil. Tillage-induced erosion in developing countries can exceed 150 t/ha annually and soil erosion is responsible for 40% of land degradation worldwide (FAO, 2001). Moreover, yields are beginning to stagnate or even decrease whilst inputs are increasing. In the early 1970s, farmers in Santa Catarina (Brazil) tried conventional terracing as a solution to the problems of continuous erosion and declining yields. The inconsistent results led farmers and researchers to tackle the problems at their source, trying to find solutions to avoid the direct impact of rainfall on the bare soil and to improve water infiltration. What began as green manuring has now evolved to residue-based zero tillage for maintaining a permanent soil cover (FAO, 2000; ILEIA Newsletter 1995, no.3, pp16-17). In 2000, the global area under zero tillage was estimated at 57 million ha, including 9.2 million ha in Argentina and 13.5 million ha in Brazil (FAO, 2001).

Zero-tillage, entry point technology for conservation agriculture. Photo: FAO

Principles of conservation agriculture

Zero tillage (or direct seeding), crop rotation and green manure cover crops (GMCC's) are essential elements in the successful expansion of conservation agriculture in Latin America. Farmers have realised that zero tillage alone is an imperfect and incomplete system in which disease, weeds and pests tend to increase and profits tend to decrease. Research conducted in southern Brazil also shows that zero tillage practices in combination with suitable crop rotations consistently reduce weed infestations (Derpsch, 1999). Based on this observation, a more integrated approach to zero tillage evolved which FAO now calls "conservation agriculture".

This approach implies conformity with the following principles (Benites and Ashburner, 2001):

- No mechanical soil disturbance – direct seeding or planting
- Permanent soil cover – making particular use of crop residues and cover crops
- Judicious choice of crop rotations

Implementation may vary according to the local conditions, problems and means, but zero tillage (direct seeding) is the key technique in the system. Direct seeding implements and tools are often adapted by the farmers themselves or, like in Brazil, by means of collaboration between farmers, technicians, researchers and the private sector (FAO, 2000). Crops are sown directly into a permanent soil cover which can be either residues from a previous crop (or imported straw) or a live cover crop. The permanent soil cover reduces the damaging impact of rain drops on the bare soil, retains soil moisture, regulates temperature, provides organic matter and is a potential source of nutrients.

Zero tillage applied within a conservation agriculture framework has proven to be a feasible farming practice applicable under a wide range of climatic, soil and social conditions, both for large and small-scale farmers.

The farmers-driven adoption process

Conservation agriculture is attractive to farmers for several reasons: it saves time and money, it makes available a longer period for planting, it leads to greater drought tolerance and generally higher yields. Despite these major advantages, farmers are still wary in adopting such radical changes. But in Brazil, the main reason for the rapid expansion of this system is that the farmers themselves are extremely active in promoting them. From the beginning, they have been involved in creating associations and networks, which also involve technicians and researchers from the Brazilian Zero Tillage Association for the Tropics (ZTAT) or the Clubes Amigos da Terra (CAT). These groups and networks provide support to members and have become very effective in farmer-to-farmer spread and acceptance of the ideas and the technologies. They have also begun to develop into significant local pressure-groups pushing for improvements in the policy and institutional environment as well as for political and legal support for their initiatives (FAO, 2001).

Supports to farmers' and NGOs' actions

Since 1995, the Brazilian government has been strongly involved in the process. Several ministries and research institutions are now collaborating with NGOs such as ZTAT and CAT and provide financial support, training of technicians, research support, integration of training sessions in universities, etc. Further support for zero tillage promotion was generated by collaborating with ABEAS (Brazilian Association for Higher Agricultural Education) and the University of Brasilia in the first graduate-level correspondence course in zero tillage in Brazil, in 1999 (Landers, 2000).

However, most agricultural policies still focus solely on increasing production, usually associated with packages of external inputs and technical interventions. In many cases, these policy frameworks are the principal barriers to the spread of more integrated, sustainable and productive agricultural systems (FAO, 2001).

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From farmers' field schools to community IPM
Scaling up the IPM movement

Russ Dilts

A people-centred IPM movement has grown in Asia over the last ten years, and is now spreading to parts of Africa, Latin America, and the Middle East. During this period, many variants have evolved, and continue to evolve, within the specific natural and operational environments of different countries, cultures, and communities. From the first Farmer Field Schools consisting of 25 farmers each to a people centred IPM movement, which counts several millions of farmers in many countries (e.g. more than one million farmers have been trained in Indonesia alone), the IPM programme has indeed gone to scale.

Farmer Field Schools - from extension to education

The IPM Farmer Field School programme emerged out of a concrete, immediate problem. Farmers were putting their crops, their health, and their environment at severe risk through massive abuse of highly toxic pesticides promoted aggressively by private industry and government. Pest species were becoming resistant and in some cases resurgent. What was called for was a large-scale decentralised programme of education for farmers wherein they would become 'experts' in managing the ecology of their field – bringing better yields, fewer pest problems, increased profits, and less risk to their health and environment. "Grow a Healthy Crop" is the first principle of the IPM programme.

The basic framework for the educational approach addresses three fundamental learning domains (adapted from Habermas.J):

1. Technical domain of work: If one has ever seen the look on the face of a farmer who doesn't comprehend why he lost his crop, despite all his hard work, one can readily understand the empowerment that occurs when a farmer regains control based upon direct understanding. From this emerged the entire '**Farmers as experts**' approach underlying the Farmer Field School (FFS). In Field Schools farmers themselves learn to conduct experiments independently, create learning materials on their own, manage a 'field laboratory', and plan for special sessions such as 'IPM Field Days' or 'IPM Popular Theatre'. Farmers do not master a specific set of contents or 'messages', rather they master a process of learning that can be applied continuously to a dynamic situation: the ecology of their field.

2. Practical domain of interaction and communicative action: Farmers do not work in a vacuum. Their attitudes, decisions, perspectives, and practices are greatly influenced through their interaction with their peers and community. From the outset the Field School intentionally included processes and methods that would provide such interaction. Participants work together in small groups to collect data from the field, generate analysis through discussion, present results, conduct experiments, and make group decisions for field management. For many farmers, unaccustomed to even speak in front of groups, this confidence building and process mastery is the most important outcome of their Field School experience.

Interaction skills are also addressed directly through exercises in communication, collaboration, group problem solving, and discussion/analysis techniques. The processes used for analysing social reality are in essence the same as those employed in 'discovering' ecological realities in the field. These skills are applicable not only to IPM, but also to everyday life

Members of a farmers association in Central Java reading their IPM newspaper PETANI. Photo: FAO

in the community. These skills do not come overnight, but must be practised and reinforced, and elaborated upon over time. This is assisted by the length of the Field School which lasts across an entire season and is begun with preparatory meetings which also include participatory methods of problem analysis and participant selection such as labour analysis, mapping, and joint 'learning contract' formation.

3. Domain of emancipatory action for empowerment: Emancipatory learning is the next step, in which people examine their internal or group constraints and options as they relate to a larger social, political, economic, and ecological environment. In this sense, the initial Farmer Field School, and even follow-up activities such as Farmer-to-Farmer training, farmer action research/field studies, etc. are just 'starters' for empowerment and local institution building. Further efforts are needed to allow for the evolution of empowerment within the community. Gaining control of one's fields is a first step, but soon farmers run into forces and systems outside their immediate control that must be addressed through other kinds of action.

Going beyond Field Schools - farmers as experts

Through evaluations and case studies we found villages where the cadre of trained farmers had 'captured' their entire community as they continued to spread and deepen IPM. However, in other locations we found that, even where good quality Field Schools had taken place, the programme had vanished with little trace. Based upon this, early in the programme a number of activities we started aimed at strengthening the roots of the programme within the community. Our goal was sustainable farmer initiative and the 'institutionalisation" of IPM at community level - this meant going beyond field schools.

- ***Farmers as trainers*** - We postulated that if farmers could master the process of 'discovery learning' in their own fields, they could also facilitate other farmers in their learning. The first 'Farmer to Farmer' IPM field schools emerged spontaneously. They were then built in as an integral part of the programme. Currently, nearly 50% of all IPM Farmer Field Schools are organised and run by IPM farmer trainers. Over 20,000 Field School graduates have gone on to be trained as farmer trainers and conduct Field Schools for other farmers.

- ***Farmer Researchers*** - Most believed that farmers would be limited to simple experiments and 'demplots'. However, in hundreds of locations farmers are currently engaged in field scientific investigations of complex local problems. Farmers are undertaking programmes previously thought impossible, such as the rearing, breeding, spreading and maintaining of complexes of bio-control agents (parasitoids, virus, bacteria) while training other farmers in their use. Now, IPM 'farmer researchers' are often invited to national research meetings on IPM to present their findings and their programs. Needless to say, researchers unfamiliar with the independence, intelligence, and diligence of IPM farmers are initially shocked.

Community IPM - from expert farmers to empowered communities

Again, we found that while this increasingly complex array of farmer-based activities was of great help in broadening and deepening IPM, the programme still resembled a 'menu' of follow-up activities and dependency upon central and provincial project funds remained high. Institutionalisation of IPM at community level had to be pursued.

- ***Farmers as strategic planners and organisers*** - In many locations networks of active IPM farmers had been established, and many of the functions previously done by government or NGO fieldworkers had been taken over. However, the organisers of most activities, except at village level, remained with outsiders. Within Community IPM, activities were developed that would provide trained farmers with the skills and opportunities to build their own institutions. For this, a number of different fora were initiated, at first funded by the national program. These included seasonal planning meetings for IPM farmers from villages and sub-districts. Herein farmers were trained in participatory planning methods while making actual plans for their groups, allowing plans and planning skills to be honed through interaction with other farmers. Groups were linked across communities and across villages into networks where they could discuss their plans and share experience. Farmers were also trained in methods of 'lobbying' local government and applying effective demand through organising. Once again, the farmers surprise people in their ability to develop thorough and detailed *strategic plans* incorporating problem and social analysis, 'vision', 'principles for action', strategy, tactics, and operational plans.

- ***Farmer policy making*** - As the 'Reformation' period in Indonesia has begun, so has IPM Farmer involvement in local politics since their networks represent one of the few organised institutions composed of true farmers. Most of these activities were focused at the sub-district level, which is seen as a *'strategic universe'* for farmer organising. In Indonesia, the sub-district is the interface between government and other services (banks, markets, etc.) and rural communities. Villages are often too small to provide the scope of institutions that farmer organisations need to interact with to improve their access to resources.

- ***Institutional diversity*** - An array of IPM farmer institutions has sprung up across the country. These vary from single-village focused activities to province-wide 'IPM Farmer Congresses' involving thousands of people. Some IPM farmer institutions have taken the form of networks, with meetings and leadership revolving across specific geographic areas. Others have formed more formal 'associations', some even with the official legal status of 'foundation'. Some have made close links with local government at various levels and serve as training/service agencies for government programmes. Others have linked to local political or social forces, such as Islamic organisations. In the last 6 months, some have even begun to dabble in the heretofore forbidden realm of 'practical politics', organising campaigns and getting IPM farmers elected to village head positions.

  As a point of principle within Community IPM, the training, education, funding, and other opportunities and resources provided do not foresee or proscribe any specific

IPM farmers from Cikoneng in West Java analyse their soils. Photo: FAO

  institutional outcome. The job of outside organisers is to provide tools, methods, skills, experience and opportunity only. It is up to the farmers themselves if they want to organise, for what, and how. At present various forms of IPM farmer organisations are still emerging, growing, dying, evolving, stalling, prospering, disappearing. Current efforts from the 'facilitators' involve bringing farmer organisers into the analytical dialogue through programmes geared to provide farmers themselves with the ability to document and analyse, to 'map' the progress of their institutional initiatives and to formulate ways to further strengthen their efforts.

- ***Institutionalisation and civil society*** -The goal of community IPM is the institutionalisation of IPM at community level. The Gerung case (see box p.21) provides a look at how alumni in one sub-district in Indonesia are working to institutionalise IPM in their villages. Specific organising activities include reactivating farmers groups, organising a sub-district alumni association, and taking advantage of water users associations. The farmers groups are planning and conducting a variety of activities to help farmers overcome specific field problems. The alumni association and water user associations serve to spread the results from field studies to all farmers in the sub-district. Apparently the leadership skills of farmer IPM trainers, their ability to facilitate open processes and group decision-making, has been recognised by local farmers. The farmer IPM trainers have been elected to leadership positions of farmers groups and maintain prominent positions in the water user associations. Local governments have provided funds to support Field Schools conducted by farmer IPM trainers. The provincial agriculture service believes that the activities of IPM alumni will lead to a sustainable agricultural system in Gerung. And having put themselves on the local institutional/ organisational map, alumni organisations are becoming institutionalised through the legitimacy accorded to them because of their activities.

A farmer field school in China. Photo: FAO

An important outcome of community IPM activities as they accomplish institutionalisation of IPM at the village level is that civil society in a given village is also strengthened. Government, non-alumni, and other local organisations are legitimising IPM and the IPM organisations being established in Gerung. This institutionalisation will influence behaviour patterns for all local organisations in Gerung. Hence, the conditions common to a strong civil society are being established. The civil society that evidently is taking root in Gerung will enable the community of farmers in Gerung to better manage the ecological and social conditions in which they live. This will in turn ensure greater stability in food production in the communities of Gerung. Community IPM leads to civil society and civil society will enhance local food security.

Keys to successful upscaling

Despite going against "conventional wisdom and conventional approaches", IPM has grown to be a farmer-driven movement in Asia. Looking closer at the process of scaling up, some keys to success can be found:

- Trusting in people as being able and willing to take control of their lives, communities and environment and capable of dealing with the ecological and social complexities of the programme
- Having a concrete entry point addressing a multi-faceted problem
- Pressing on realising that nothing worthwhile succeeds overnight.
- Developing a shared vision through continuous dialogue and reflections on accumulated experience
- Being aware that methods and approaches are not "neutral" and allowing for human views to be incorporated
- Making efforts to push down roles which reside "at the top" as in the case of strategic planning which is now done at community level by farmers
- Giving room for leadership to emerge, be built up, shared and rotated to maximise "human capital"
- Building "social capital" by helping people to learn to organise towards achieving goals that are worthy
- Tolerating, encouraging and enjoying diversity as the stimulus for learning.

Community IPM as an entry point for Sustainable Livelihoods

For the last 10 years, IPM training programmes in Asia have been pursuing multiple objectives with considerable success - farmer empowerment, conservation of biodiversity, food security, community education, protection of human health and policy reform amongst them. These multiple objectives have arisen from a growing recognition – among governments, NGOs, donors and farmers themselves - of the interdependence of different aspects of development, and the need to put people at the centre of the development process.

These concerns have given rise to the concept of 'sustainable livelihoods'. Within a Community IPM programmes, participatory approaches (including farmer-to-farmer training, action research and policy dialogue) are being used to transform a range of assets (including *natural, human and social capital)* into a number of livelihood outcomes, including security of incomes, food supplies and health, and improvements in rural civil society.

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More cases and specific information can be found at the Community IPM Website: htpp://www.communityipm.org

IPM farmers in Indonesia demonstrate for their rights. Photo: FAO

Initiatives of farmers in spreading the message

Experiences from Gerung Sub-district

IPM National Programme efforts established a critical mass of IPM alumni in Gerung. Since 1996, IPM Alumni have been organising several types of activities that, for the most part, they have funded themselves. They have been very active and creative in informing others about IPM and in establishing their own organisational network. They have forged steadily ahead in the development of a local farmer-led IPM Programme.

Farmer conducted field studies - Alumni conducted field studies have increased farmer understanding of ecological issues, to adapt and test out recommendations in local conditions, and to increase alumni confidence regarding their understanding of specific practices.

> "Farmers get worried during the first couple of weeks of soybean growth because of the appearance of bean seedling flies. Although only five percent of the plants may be lost, farmers begin spraying at this time. So that we would know when and at what levels damage could be sustained without significant loss in yields my friends and I set up this study. Planting distances are also important to this issue so we have worked with the farmers of Kebun Ayu Village who are conducting a planting distance study. We will use this study to establish a set of basic practices among the farmers in our Farmers Group in the planting of soybeans."
> - H.Fatuchorrohman, IPM Farmer Researcher

Alumni helping others to learn about IPM - IPM Alumni in Gerung have used all means, formal and informal, to help educate other farmers in the villages about IPM.

- **Religious training as a vehicle for IPM dissemination** - Twenty-nine year old Rusdi Aminullah, a farmer IPM trainer from Lembar Village, serves as a religious teacher at the Madrasah Nujumul Huda in his village. In the classes that he conducts he usually finds a way to incorporate IPM into his lessons.

> "I don't necessarily rely upon the curriculum or the school's schedule. Every time a topic arises that is connected to the environment, nature in general, or health I discuss the basic principles of IPM with my students. I hope to plant the seed of love for the environment that was created by God for the enjoyment of humanity not for humanity to destroy. If I can plant this seed now, they will grow to appreciate the importance of nature. I would be thankful if at the very least they will be able to influence their parents."

- **Dissemination of IPM by women through informal groups** - Women often take advantage of informal situations to discuss household issues with each other. Ms. Syifa'iyah of Lembar Village, an IPM alumni says,

> "I often gather with other women in the bruga (meeting place) and talk about IPM. I also teach at the Madrasah and every time we hold religious instruction for women I slip in information about IPM. I have told them that in this world, if you have rice plants you surely are going to have pests. But if there are pests, there will also be natural enemies that prey upon them. These natural enemies are there to help farmers. I have also talked about the danger of pesticides to the environment and to people."

IPM farmers organising - IPM Alumni have taken their own initiative to create a multi-tiered structure of semi-formal and formal groups. They have established an IPM Alumni Association through which the groups keep in touch with each other. The goal is to develop a system to sustain the IPM movement in Gerung. These efforts are independent of outside agencies.

- **The Bruga as the foundation for an IPM movement** - The custom of people gathering in the bruga of a household has been taken advantage of by IPM alumni to create a foundation for a semi-formal IPM network. The bruga of households are being used as meeting places for IPM discussion groups. These groups form the backbone of a farmer controlled IPM Network. According to Bachriandi, farmer IPM trainer,

> "Spreading information about IPM via bruga is appropriate, we farmers don't much care for formal meetings. At the bruga we can talk about IPM in a relaxed and informal manner without worrying about protocol. Farmers usually gather in the bruga in the afternoon as it starts to cool for a cup of coffee. While families have always had bruga, the role of the bruga has expanded in village life. The bruga serves a greater social purpose. With the advent of IPM an additional role has arisen for the bruga; they now serve as neighbourhood forums to support the spread of information about IPM and to strengthen the understanding of farmers regarding IPM principles. The bruga has given birth to farmers who embody the spirit of IPM. They are changing how they farm."

- **Farmer groups reorganised** - The farmer IPM trainers and other alumni in Gerung Sub-district have provided the leadership to breathe life back into inactive farmer groups. Alumni note that their FFS experience provided them with new ideas and a new perspective on how to work effectively as a group. As alumni brought new energy to their farmers groups, farmers in general learned that alumni had something new to offer both in terms of knowledge and motivation. They have helped members of their farmers groups to improve their farming practices by involving them in learning through field studies. IPM alumni, including farmer IPM trainers, have become the heads of their farmers groups and as such the nodes of an IPM movement. Among their roles as heads of farmers groups, the farmer IPM trainers have worked to connect one farmers group with another via the IPM network that has grown up. Farmers groups have become the second tier in the organisation of an IPM movement in Gerung Sub-district. The farmers groups provide bruga discussion group members with a forum for discussing IPM issues among a larger group of farmers. Farmers groups provide a context in which farmers can plan and effectively manage a variety of activities that respond to their needs.

- **Sub district level organisation** - The next tier of alumni organisations is at the sub-district level.

> "Along with other farmer IPM trainers and IPM alumni we are in the process of creating an IPM Alumni Association at the sub-district level. We feel that the primary activity of the association will be to expand the application of IPM by farmers via the implementation of field studies in response to field problems identified by farmers.",

says Rizalihadi, a farmer trainer involved in setting up the organisation.

- **A mega-tier** - Bachiariandi and Rizalihadi have promoted a new initiative - the inclusion of water groups to form a network that is more inclusive and more extensive than an IPM Alumni Association, a collective of farmers groups, or neighbourhood brugas. The same key individuals, IPM alumni and farmer IPM trainers, are in both, but there is a potentially larger audience for IPM by including water users groups. The heads of water users groups meet regularly. This provides a forum that allows for communication amongst all affiliated groups.

> "Rizalihadi and I agreed to try to expand our organising to truly cover all of the sub-district. Fortunately I am still trusted by farmers to co-ordinate the Collective of Farmers Water Users Association for Pengga Kanan and Rizalihadi holds the same position for Pengga Kiri. We will use this opportunity to spread Field Schools throughout the watershed areas of the sub-district. Wherever the watershed includes another sub-district, we will be active there as well. I get really nervous whenever I see farmers using poisons. Many farmers still don't realise that they are playing with fire. If they are unlucky they could die. We need to stop this. We, all of us farmer IPM trainers, are now actively pursuing this."

says Bachriandi. The network has helped farmers groups to take a co-ordinated approach to their activities. It has enhanced the ability of farmers groups to plan and organise activities, establish methods for sharing and exchange of information.

Scaling up social development

Carl E. Taylor

It is apparent that our current models of development are not working, especially when judged by the fundamental criteria of sustainability and equity. Scaling up of social development is our most urgent problem. It is a pleasant task therefore, to share experiences from the health sector about the complex concept of learning to "go to scale" and its possible relevance to the agriculture sector.

A universal process of scaling up

Our Johns Hopkins Rural Health Research Centre was based in the village of Narangwal at a teaching health centre of the Ludhiana Christian Medical College I had started when developing the first department of community medicine in India in the 1950s. In parallel, at the Ludhiana Agricultural University a remarkable team of international consultants was involved in laying the foundation for the Punjab's fantastic success in Green Revolution agriculture. I learned much from agricultural experts in those days of great enthusiasm when they were leaders in doing development at the level of the farm. Then they shifted from the biological growth model to the blueprint and explosion models (see box). Their successes seemed to grow fantastically and rapidly with massive publicity. But, they became more top-down in scaling up. Unexpected consequences and environmental complications followed from problems such as monocropping, overuse of chemical fertilisers and poorly controlled irrigation. The worst result was that the Green Revolution packages favoured the rich since investments cost too much for the poor. Family farms failed and the rich got richer.

Development experts have wasted many decades of rhetoric arguing whether top-down or bottom-up approaches are best. It is time to declare that the argument is false. This is not an either/or dilemma. We need both, but in a flexible and varying balance depending on local circumstances. There are no universal solutions in development, only a universal process to find appropriate local solutions in a biological growth model.

Three basic principles in building up valid processes of scaling up

Principle One – ***Three way partnerships are essential to maintain an effective working balance between bottom-up and top-down action.***

1. *The community must be treasured and always be in eventual control.* This is the bottom-up component.

2. *In a new role, government and NGO officials must learn to support community empowerment.* This is obviously the top-down component and it is here that most development projects fail because all the reflexes of officials are conditioned to demand that they be in control. A basic conclusion is that officials need to make a tremendous shift in their attitudes and values. They should realise that nothing will facilitate their success as leaders so much as delegation of control. As people close to the action take over the routine and dull tasks of management, it permits those higher in the hierarchy to focus on policy and innovation that will eventually set new directions.

3. *Experts must guide the process by learning how to synthesise scientific innovation with traditional wisdom.* The key concept is that the experts' responsibility is to bring the outside-in. They store and apply knowledge from around the world and open new horizons applying the best of modern science and simplifying it for rapid general use in improving human welfare. However, changing their attitudes and values is almost as difficult as re-training officials.

Principle Two – ***Action must be based on locally specific data.***

Growing experience with participatory methods of data gathering and decision-making shows that one of the commonest reasons for failure of development efforts has been the long tradition among officials and experts that they

GOING TO SCALE MODELS AND CHARACTERISTICS

Blueprint
- Experts select successful interventions from local or international experience
- Blueprint is designed by outsiders and imposed with regulations and targets
- Community participation becomes top-down community manipulation
- Tight supervision and incentives achieve quick results but lose sustainability

Explosion
- Focused interventions selected as national or global priorities
- Tight control and efficiency assured by vertical hierarchy for one purpose but usually duplicating management
- Effective in filling infrastructure gaps if then integrated into whole system
- Social mobilisation can strengthen local system but over-riding local priorities often destructive and not sustainable

Additive
- Bottom-up comprehensive and culturally adapted development at community pace
- Stimulated and financed by outside donor (NGO) usually works well in local area-great impact of inter-sectoral action
- Phasing over to local control often difficult because of dependency and being accustomed to outside pay and equipment
- Too slow to rapidly go to scale or fit into national system; need a top-down enabling environment for scaling up

Biological
- Existing successful community-based projects are selected which demonstrate self-reliant empowerment
- Healthy communities are not mechanical structures but replicating organisms
- Each community becomes a biological growth node for exponential and rapid expansion with infrastructure for enabling environment, sustainability and standards for equity
- Integrated inter-sectoral development evolves naturally as communities learn to demand services for their priorities

deliberately and consistently excluded the people from participating in decisions about their own future. Officials have learned the rhetoric of community participation, but it has in recent decades mainly been used in a distorted form for community manipulation. Data gathering for social development has been treated as a simplified version of social science research. People have been excluded from the process to ensure scientific objectivity. Modern experience is clear that the best way of promoting community ownership and empowerment is to get communities deeply involved in continuing data collection. The more important result is that when the people know how the data is gathered they trust the findings, feel ownership and are motivated to act.

*Principle Three – **Changes in community behaviour produce sustainable social change.***

The most sustainable social development depends not on outside inputs of money or materials but on behavioural change among the people. The changes in behaviour must include all partners. We find that the most difficult part of social change is to change the attitudes, values and behaviour of officials and experts. Calling for behavioural change seems to have similarities to preaching about religious revival. It is easy to talk about but hard to do. Behaviours are embedded in social norms. They change most readily when people experience practical demonstrations that meet their basic or imaginary needs and self interest in promoting the welfare of their families and friends. Most convincing are messages about successful innovation that are transmitted by people like themselves. Biological models of scaling up work mainly because they systematise the process of learning, community by community, in exponential expansion as people teach each other.

Three dimensions of going to SCALE

Through fieldwork in many parts of the world we have observed the biological approach to be the most common pattern for large-scale expansion. It unfolds in an organic way that appears at first hard to describe. But after analysing numerous examples, there appear to be three clusters of commonalties which we term dimensions and indicate by acronyms: When development is initiated by local people, action typically begins with community-based **SCALE One**: they try a few ideas, see success, then try some more. When a cluster of innovations are worked out, that community-based action becomes a demonstration for other communities, or **SCALE Squared**, providing formal training to other communities and refining ideas in an on-going way for greater local adaptation. When a larger enabling environment is created to nurture this process, the demonstrations and ideas to spread; the dimension that unfolds then is **SCALE Cubed**.

SCALE One – *Successful Change as Learning Experiences*
Bottom-up social development has gradually spread throughout the world with successful examples of empowered communities in every country and region. In different places the empowerment process started with varying kinds of projects focusing on innovation, in subjects such as: agricultural extension, income generation for women, education for women, primary health and nutrition care, family planning or small-scale crafts and home industry. A combination of factors that clicked with local culture, available resources and indigenous skills created the synergy to empower the community to continue expansion to a variety of other innovative changes.

Each community must start this process from where it is. The challenge is to identify priority issues that are both locally important and do-able. Because community energy grows mostly from success, perhaps the best starting point is a project that can mobilise the greatest energy – perhaps one involving primary health care, credit for women, forestry, emergency services. The starting point need not be an indigenous success. Who initiated the project is not important (for instance, in addition to community, a NGO, university, or government programme could have started the work.) as long as the community recognises the project as a success and accepts it as part of the community. This acceptance cannot be enforced, as then the community will not believe that it has the competence to continue.

Outsiders often press for action to begin with the most needy, but doing so reduces the chances of sustainability. Development is momentum, and momentum cannot be gained when the first step is uphill. Projects should be targetted at the neediest sections only after there is an example of success to build from. The subgroup that can least afford failure, should not be expected to take the lead position of being the first project where the probability of problems is higher and their competency levels are lower for solving those problems.

SCALE Squared – *Self-help Centres for Action Learning and Experimentation*
Few good interventions can be transferred directly from one setting to another, without some degree of adaptation. People adopt ideas and methods most readily when they see them being implemented in conditions similar to their own by people who are like them.

The central source of power in scaling up comes from a cluster of SCALE One communities which are selected as being representative of a whole region and then the motivation, capacity and resource base is provided to form them into a *learning centre*. Here bottom-up, top-down, and outside-in functions come together. Control of their future must remain with communities, but the extension function requires more active roles by officials and experts. This is where experts bring in and try out new ideas. A SCALE Squared centre is both a community-based laboratory and a school without walls. One lesson builds upon another; findings from one demonstration lead to solutions for new problems, as capacity is built and the knowledge base keeps expanding. These learning centres have two functions.

1. *The first function of a SCALE Squared Centre is educational but with a new learning by doing orientation. The action learning function moves communities beyond concern just for their own progress to intentional extension of the change process to other communities.* The SCALE One communities welcome people from other communities to learn how they can help themselves. In these exchanges and workshops both groups share questions as answers are worked out with mutual benefit. Doubts are cleared when visitors see people like themselves solving problems they struggle with every day. Some development projects spend as much as 50% of their budgets on bringing in consultants to draw up plans and do evaluations. Spending that money on arranging for community members to go to parallel projects and learning centres will almost always yield a far higher rate of return. Taking citizens and policymakers on trips may seem extravagant, but it opens doors to new areas of knowledge and provides role models to help them adapt what they see working.

2. *The second function of a SCALE Squared Centre is experimentation.* Experts from many disciplines are brought in to work with community leaders in the new discipline of participatory research. Their synergistic interaction combines

scientific understanding with traditional wisdom. Those of us who have had the privilege of doing this kind of research know that usually the most innovative and usable insights come from the village people and we can mainly supply skills and tools which they simplify and quickly learn to use even without our sophisticated jargon.

SCALE Squared centres should resist the temptation to become showcases. Communities understandably want status, outsiders want to take credit for having a "good" project, and activists in the community want affirmation. But making SCALE Squared centres look spectacularly good often make unreplicable, both them and the lessons they are trying to teach. As SCALE Squared centres become established in regions, it is useful to form a network for sharing among them; here modern technologies can help extend the reach of traditional experiential learning.

SCALE Cubed – ***Systems for Collaboration, Adaptive Learning and Extension***

Expanding social development successes to all communities in a region requires systems for extension based on a network of SCALE Squared Centres. Experience shows that communities left to their own resources usually do not spontaneously learn from each other. The systems needed for bringing about wider impact resulting in regional change include:

1. *System for sustainable collaboration and partnership* using approaches such as: seed grants; opportunities for communication between and with SCALE Squared Centres; objective critiques of ideas and experiences between communities, officials and experts; and special regional events such as fairs, competitions, concerts, festivals and formal workshops to create a sense of being part of a larger, expanding movement.

2. *System for adaptive learning.* The purpose is to provide opportunities for step-wise learning as communities learn about themselves using annual self-evaluation surveys. They develop an annual work plan and evaluate each year's achievements to do better incrementally. The SCALE Squared Centre provides the framework for testing new approaches to learning.

3. *System for extension of innovations.* I have been repeating the theme that the main difference from the blueprint approach is that in scaling up, the expansion of innovations grows biologically not mechanically in radiating ripples around SCALE Squared Centres. Officials and experts should not try to "remote-control" this extension, but let people do it themselves. However, growth will not happen by itself. Officials and experts are needed to create an enabling environment. They need to change their policies, laws, regulations and administrative infrastructure. People must be given control and very small incentives to change by providing simple resources not available locally. They need to change financing mechanisms, which mainly are designed to favour and suit the convenience of the people with money not those who use the money. They need to change basic relationships with the main service agencies: agriculture, health, education, public affairs, etc. Problems of inter-sectoral cooperation disappear when the communities have the right to ask for help. When communities build up capacity to know who can help and how to ask for it, then cooperation is sustainable.

Scaling up must start with successful communities and ensure a systematic process of replication to permeate a whole region so that all communities become SCALE One in being empowered to solve their own problems of social development. Some SCALE One communities will become SCALE Squared Centres. Other SCALE One communities will simply continue to build on their success, supported by demonstrations from SCALE Squared centres and the enabling SCALE Cubed environment.

If a government is out front trying to nurture the rapid spread of change, this community energy can mount very quickly. Expectations soar, people are ready to sacrifice (and others move in to take advantage) but the exponential potential is obvious. This energy can be quickly sidetracked if people begin to see leaders taking advantage of the momentum they have created.

Six criteria are needed to measure progress in social development

Modern management emphasises the need for indicators to measure progress. We have found that seeking universal indicators is unrealistic. Since every situation and community is different the specific indicators should be chosen to fit the local time and place. However, to have a rational framework, six criteria (within which local indicators need to be sought) must be defined.

1. ***Collaboration around a Shared Vision.*** Communities need to agree on the direction they want to go and a shared vision helps internal collaboration. This can evolve from immediate concerns or from underlying causal influences over time as observed in annual reviews.

2. ***Equity is defined as reaching out to those in greatest need and in providing opportunities to those who have been deprived in the past.*** The only way a whole community can improve overall welfare is when the groups, which have the greatest concentration of priority problems are helped to get better living conditions and lifestyle. In most communities local patterns of discrimination are deeply entrenched and outside pressure is needed to make the elite share. This can be done efficiently when top-down standards are set for communities that can be met only by improving conditions for those who have the greatest problems.

3. ***Sustainability is where most social development has failed and it requires measuring from the beginning for benefits that will last.*** Is development exhausting water, forest, and energy sources or increasing pollution? Are debt loads being incurred that cannot be repaid and will be passed onto future generations? Is change undermining treasured cultural values? There are always trade-offs that must be carefully, unselfishly and pragmatically evaluated.

4. ***Interdependence not dependency is essential for a just and sustainable process.*** Dependency produces victimisation and vulnerability to control by outsiders. In many instances outside assistance has been great in satisfying the egos of givers but has been terrible for the self-reliance that happens when capacity building is a primary goal. Development cannot be bought. Donors often want to pay start up costs to accelerate action but this will fail if this creates expectations both in the community and in neighbouring communities. Outside resources are certainly needed but they should be accepted only if they do not remove control from the community-except for the criterion that assistance must give priority to promoting equity.

5. ***Holistic action at community level is automatically inter-sectoral.*** Breaking development indicators into the bureaucracies' use of agriculture, health, education, etc. destroys the basic need for holism in action. Solving combinations of priority problems leads communities to awareness of underlying causes. Synergistic entry points emerge as each activity opens understanding of new potentials. Together they strengthen the fabric of community and family life to produce a "rising tide" of progress, in which the big boats should not swamp the little and leaky boats.

6. ***Iterative action leads to sequential learning and continuing adjustments in interlinked relationships.*** Using annual surveys a community tries one idea, the next try makes it work a little better, more people bring in their own improvements and behaviour changes to produce new social norms. Iteration gives opportunity to identify those loose ends and fix them incrementally until all fit together with growing precision. Action should not wait for precision to be imposed from external quality standards; instead quality control should depend on internal building of capacity. Once people have agreed on starting a do-able action, it should start while interest is high. Then the emphasis should be to recognise that failures will be frequent. But getting the action right is not as important as getting action going and then improving the process. The amazing thing is that in community development this is what succeeds because people learn from each other and the whole is greater than the sum of its parts.

Conclusions

Bottom-up social development has gradually spread throughout the world with successful examples of empowered communities in every country and region. These examples have convincingly shown that bottom-up social development does work. However, efforts to bring them to scale in large programmes invariably failed: the spark that produced the initial empowerment was lost in moving from an exclusively bottom-up to an exclusively top-down approach. What is needed is an approach, which systematises the process of a learning community. Each community becomes a node for exponential and rapid expansion. Healthy communities are replicating organisms. Integrated and inter-sectoral development evolves naturally, as communities learn to demand services for their priorities.

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Shortened version of a paper presented at the International Workshop on "Going to Scale: Can we bring more benefits to more people more quickly?" held at the International Institute of Rural Reconstruction (IIRR), Silang, Cavite, Philippines, April 2000.

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On Social Capital and Partnerships

SOCIAL CAPITAL means "trust" and "cooperation networks". As a form of capital, it is possible to invest on it to save and to stock it – but it is possible to lose it, too. The principal strategies for "investing" in social capital are:

- Create a "common space" among different institutions (social organisations, NGOs, public sector, entrepreneurs) to identify common goals as stakeholders.
- Make transparent the interests of the different institutions in negotiating common goals.
- Identify the "added value" of cooperation through the different types of support coming from each of the stakeholders. The added value is like the interest rate of social capital.

The main OUTPUTS of social capital are:

- Reduced "transaction costs" among institutions
- Increase in the "cooperation values" in a community or region
- Increased competitiveness of the stakeholders in the market.

How Social Capital Influences Scaling Up Efforts

Technical aspects

- Creates environment for farmers to reach agreements in their organizations to support an "inter-learning process" e.g. in sharing successful technologies
- Allows for agreements to be reached among farmers' organisations, NGOs and the public to promote watershed management and forestry programmes and other natural resource management/protection strategies and programmes.

Political aspects

- Makes way for defining and implementing common policies that promote sustainable agriculture in a local/regional context (e.g. tax reduction for NRM projects, laws to punish pesticide use, etc.)
- Facilitates designing and implementing common programmes for sustainable agriculture in a watershed and mobilising institutional resources (human, financial, physical). For example, the "round table" in the Cajamarca project permitted the municipality to multiply its resources through social and private resources by a ratio of 1:3 (three-fold).
- Demonstrates to the national government the importance of cooperation in a region to raise more funds for the decentralisation process.

Economic aspects

- "Social Capital" makes possible new loans from banks to farmers' organisations (social guarantees among farmers can serve as replacement/alternative to collateral requirements in the absence/lack of property rights to land).
- Makes it possible to design and implement new strategies to "reduce the risk" of markets (new roles among municipal governments, farmers organisations, NGOs, local banks and the private sector can increase the efficiency of institutional resources and to create "cooperative guarantees" to attract investments and loans).
- "Social Capital" among social, public and private institutions can increase the competitiveness of a region in the country (competitive advantages instead of comparative advantages).

Juan Sanchez

Ten fundamentals for scaling up agroforestry innovations

Many research and development organisations accept that the priorities and foci of research must be for development. In this light, the ten fundamentals described below provide the logical common ground on which research and development partnerships should be built.

SCALING UP AGROFORESTRY INNOVATIONS

Learning from success and failures
- *To enhance analytical and systematic learning about the performance of agroforestry innovations and the process associated with scaling up, both at a range of different scales and from the perspective of multiple stakeholders.*

Available germplasm
- *To ensure timely availability of quality germplasm to meet development needs.*
- *To analyse and compare the processes and cost-effectiveness of different methods of supplying and producing sufficient quantities of germplasm.*
- *To build the capacity of development partners, and especially farmers, to produce and distribute, disseminate or diffuse quality germplasm.*

Technology options
- *To identify existing technical agroforestry options that are likely to be appropriate in a defined and characterized project area for farmer experimentation, adaptation and adoption.*
- *To define the social, economic and biophysical boundary conditions (recommendation domains) of new potential agroforestry innovations.*

Farmer-centred research and extension approaches
- *Through participatory research, and in collaboration with development partners, to determine the adoption potential of agroforestry innovations.*
- *Through participatory research, build the capacity of farmers and communities to become agents of change and to take over some functions of existing research and extension bodies.*

Knowledge/information sharing
- *To ensure informed, effective and appropriate decision making by a wide range of stakeholders in the scaling-up process through the sharing of knowledge and information.*

Local institutional capacity
- *To create broad-based support and effective local implementation of scaling-up activities through the empowerment of farmers and local communities.*

Facilitation
- *To mobilize both existing and external expertise and resources to support the process of scaling up.*
- *To assist the coordination and integration of the scaling-up process within and between countries and regions.*
- *To ensure the sustainability and multiplier effect of scaling up through the empowerment of local institutions.*

Policy options
- *To achieve a favourable policy climate for the scaling up, adoption and impact of agroforestry.*

Market options
- *To build local and institutional capacity and develop strategic partnerships in the marketing process.*
- *To improve marketing information systems, define successful marketing strategies and product development plans, and help develop an enabling policy framework.*

Strategic partnerships
- *Expand and strengthen links amongst institutions and organisations with complementary agendas, expertise, resources and "reach".*
- *To improve the efficiency and effectiveness of partnership mechanisms.*

Source: Cooper PJM and Denning G, 2000. **Scaling up the impact of agroforestry research**. Report of the agroforestry dissemination workshop, 14-6 Sept 1999, ICRAF, Nairobi, Kenya

A project design framework for scaling up NRM research

Sabine Gündel, Jim Hancock and Simon Anderson

The overall question addressed during the workshop in Whitstable, UK, was "*what can research contribute to scaling up*". The mix of participants from relevant projects in Nepal, Uganda, Bolivia, Colombia, UK and the Philippines, from the North and the South, from academic and development backgrounds helped to bring out key issues, which contributed significantly to the process. During the workshop the participants discussed the importance of a framework for scaling up and identified strategic elements. The workshop was part of a wider review process facilitated by the Natural Resources Institute on which a report is available.

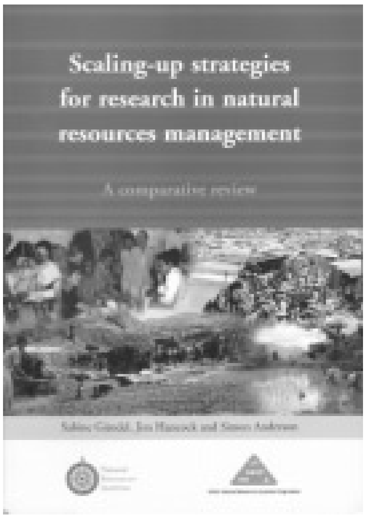
A project based framework

Creating impact from research results has in the past focused heavily on the "post-project" stage. However, many of the key strategies which have been identified as prerequisites for successful scaling up need to be addressed more extensively in the "pre-project" and "implementation" phases. Project oriented

Table 1. Activities, strategic elements and attributes of scaling up processes for NRM research

Project phases	Activities relevant to scaling up	Strategic elements towards successful scaling up		Attributes
Pre-project	Situation analysis	Engaging in policy dialogue on pro-poor development agendas.		Inclusive & plural
		Identify community, institutional, and environmental enabling and constraining factors to scaling-up		Recognise differentiation
		Appraisal of institutional capacity of agencies to be involved in scaling-up required.		
	Identifying target groups	Identifying appropriate research objectives and outputs within development processes to ensure widespread uptake		Consultative
	Setting objectives and outputs			Collegiate
	Developing M&E system	Identify indicators and planning, monitoring and evaluation methods to measure impact and process of scaling-up		Participatory
	Collaboration	Building networks and partnerships to increase local ownership and pathways		Constructive
	Funding mechanisms	Develop appropriate funding mechanisms to sustain capacity for expansion and replication		Innovatory
Implementation	Capacity building	Building capacity and institutional systems to sustain and replicate		Vertical sharing
	Institutionalising			Start early
	Partnership forging	Demand, supply & support actors identified.	Other resource organisations contribute with products and by building technical capacity	Collegiate
	Networking			Inclusive
	Awareness raising	Multi-media dissemination of findings.		
	Policy dialogue	Aggregate and assess findings from individual projects and derive policy relevant information		Pro-active
	M&E and Support studies	Central to scaling-up processes in providing evidence to influence policy-makers, in deciding what should be scaled-up and how this might be achieved		Participatory Plural Post-project
Post-project	Exit strategy	Concerted action required on a regional level		Concerted
	Dissemination	Should involve the target group as disseminators		Accessible
	Impact assessment	Built upon M&E. Representatives of target part of assessment team. Technological and livelihoods assessment required.		Participatory

development activities can be criticised for being too donor driven, time bound and often too narrowly focused in relation to the wider context. They do, nevertheless, serve as a primary tool in terms of moving from ideas into action. We have therefore chosen the broad flow of project design to develop a framework for scaling-up strategies.



The full version of the review document can be obtained from NRI

Table 1. shows the proposed framework for guiding scaling-up of NRM research. It links, chronologically, key elements which strengthen the likelihood of successful scaling up. In general, we advocate that scaling up should be considered during early stages of planning research activities. However, the strategic elements, while essentially recommended at the pre-project phase also have a bearing throughout the project and programme implementation phases. They can be used at different entry points in a research implementation process: reviewing ongoing work, as well as finished research projects with existing potentially useful outputs. It may also serve as additional material in evaluations of research programmes.

Key strategic elements for successful upscaling

1. ***Engaging in policy dialogue on pro-poor development agendas***. Research needs to be placed in the context of local, regional and national development agendas as this helps identify key entry points and the major needs. This is ideally done at an early stage so as to shape the overall project design, but can also be done through regular reviews of the project or at other development discussions.
2. ***Doing situational analysis to identify community, institutional, and environmental enabling and constraining factors to scaling up***. The likelihood of scaling up will be increased if key hindrances as well as opportunities are found out at an early stage, thereby allowing key channels for scaling up research activities and development outcomes to be identified. All enabling and constraining factors cannot be identified at the outset and so the research activities (project) will need to build in mechanisms to review new issues and plan around them or with them. This is crucial in terms of addressing the real priorities of target groups, as well as in identifying catalysts for scaling up.
3. ***Identifying appropriate research objectives and outputs within development processes to ensure widespread uptake***. Rather than identifying outputs and forms of dissemination just at the end of research, these should be shaped at an early stage together with stakeholders and users, and subsequently modified throughout the project. These outputs may include identification of solutions, which can be very technical in nature.
4. ***Identifying indicators and planning, monitoring and evaluation methods to measure impact and process of scaling up***. Should be central to scaling up processes in deciding what should be scaled up and how this might be achieved, and in providing validated evidence to influence policy-makers. To manage, learn from and gain credibility, methods and measures for assessing pro-poor and NRM impact on different scales needs to be elaborated. The intermediate supporting processes and institutional changes to achieve this will also need agreed measures and review mechanisms. Various participatory methods are vital to ensure open feedback. A major area of this work is in identifying cost-effectiveness, so as to work towards it.
5. ***Building networks and partnerships to increase local ownership and pathways to scaling up***. In order to achieve the above elements, researchers and their institutions need to develop relationships throughout the process which can then develop into firmer partnerships with development and other institutions, always with a firm link to the grassroots and end users. Personal relationships also foster direct interest and enthusiasm, increasing the chances of institutionalisation and spread of ideas.
6. ***Building capacity and institutional systems to sustain and replicate***. The capacity to manage 'learning through doing' is critical for scaling up to be an on-going and dynamic process. It is also important especially in the implementation and exit stage to internalise new ideas within institutions, especially within communities and government.
7. ***Developing appropriate financing mechanisms to sustain capacity for expansion and replication***. Maintaining flexibility and ensuring funding for softer activities (local and regional networking, capacity building, consultations) is considered in the pre-project stage. At the same time, one has to begin building ownership through clear shared resource commitments to activities. Seek opportunities for self-sustaining results in research outcomes, or at least mechanisms for reducing costs when expanding, replicating etc. Take into account the very real dynamics between technologies and wider economic spheres, and financial constraints facing local and government institutions.

The strategies and framework proposed are not prescriptive and have to be understood as a guide only. The limited number of successful cases in scaling-up research shows no absolute strategies or prioritisation of elements.

Major implications for research

The adoption of the above framework for guiding future research projects and programmes will have major implications for researchers and research programme managers:

- Project calls have to be addressed towards institutions and organisations in the target regions to strengthen the implementation of a demand-led approach.
- Shifting the emphasis of research to partners in developing countries may require the development of regional capacities in terms of demand-led approaches, sustainable livelihoods and scaling up and development of partnerships, and innovative means to fund, monitor and evaluate these strategies.

The implications for researchers and their institutions are:

- The establishment of functioning partnerships with in-country agencies, particularly in terms of working within participatory development processes and producing outputs suitable for addressing and communicating local and regional situations.
- That researchers and their institutions have to become accountable in their contribution to scaling up, which in turn requires the identification of indicators that show research effectiveness in terms of extent of impact.

■

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Farmers are interested to experiment on their own farms through Farmers' Field Schools. Photo: ICRAF

Going to scale

What we have garnered from recent workshops

Julian F. Gonsalves

Agricultural and Natural Resource Management (NRM) research and development projects often have too little impact in terms of farmers reached, poverty reduced, sustainability of the development process or influence on policy. Researchers and development workers are therefore constantly being challenged by colleagues, funders and policy makers to maximise impact and "scale up" the development process. In the present situation of reduced financial support to agricultural research and development (R&D) the interest in "Going to scale" is growing. Larry Harrington and colleagues (2001), in a paper presented at the NRM research meeting in Penang, warn us that if insufficient attention is given to scaling up, "*we will have failed in our purpose of contributing to poverty alleviation, food security and environmental protection*".

Evaluations of programmes are necessary to understand which approaches to scaling up are most effective or to show the effectiveness of new approaches, for example in participatory development. In the past two years, there have been at least four international events dealing with scaling up. ICRAF sponsored a workshop in September 1999, at Nairobi, looking primarily at how agroforestry innovations should be scaled up within a research and development framework. Two events were sponsored by the CGIAR NGO Committee and the Global Forum for Agricultural Research, (one held in October 1999 at the World Bank in Washington and the other in April 2000 in Silang in the Philippines). The most recent event focussed a bit more directly on NRM research: this was held at Whitstable, sponsored by the Natural Resources Institute UK in January 2001.

The approach, in at least three of the four workshops, was to use cases and participants' own experiences to derive common principles. Although the case analysis did not allow for drawing up any general models, some important principles and lessons were identified at the workshops. The goal of this article is to discuss these principles and lessons with the purpose of improving our general understanding of the process of scaling up. Some references are also made to relevant important literature.

Several of the cases presented in the Philippines workshop are included in this issue of the LEISA Magazine.

What is scaling up?

The first emphasis of scaling up is on reaching *larger* numbers of people. Also, the need to get specific innovations and methodologies accepted by conventional (mainstream) research, development and policy institutes in order to bring about institutional change is sometimes referred to as scaling up or "mainstreaming", especially by proponents of participatory approaches (Long, 1999).

With the renewed focus on poverty alleviation, questions of equity and distribution of benefits are invariably raised. Given the wide interest in the subject, it is probably not surprising that participants in the Philippine and Washington workshops arrived quite quickly at the following multidimensional understanding that ***scaling up leads to more quality benefits to more people over a wider geographic area more quickly, more equitably and more lastingly***. This operational definition has served as a basic assumption and starting point in subsequent meetings.

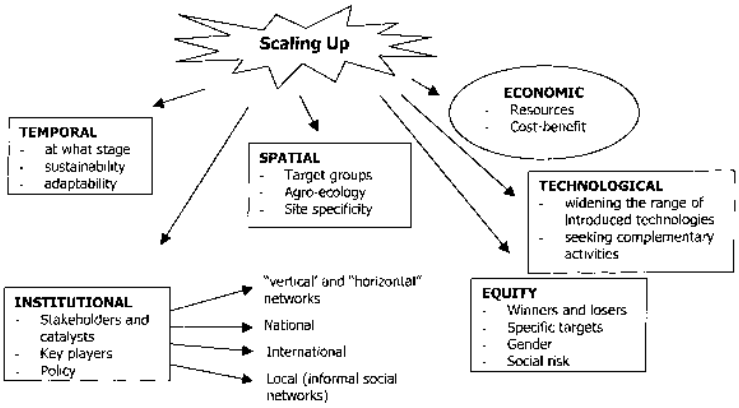

figure 1: A framework to summarise participants' understanding of the contexts of scaling up

Figure 2:
GOING TO SCALE
More Benefits, More People, More Quickly
As one goes up higher the institutional levels (vertical scaling up), the greater the chances for horizontal spread; likewise, as one spreads farther geographically (horizontal scaling up), the greater the chances of influencing those at the higher levels.

VERTICAL SCALING UP is higher up the ladder. It is institutional in nature that involves other sectors/ stakeholder groups in the process of expansion - from the level of grassroots organizations to policy-makers, donors, development institutions and investors at international levels.

HORIZONTAL SCALING UP is geographical spread to cover more people and communities and involves expansion within same sector or stakeholder group. Others refer to it as a scaling out process across geographical boundaries. Achieving geographical spread is also realized through scaling down - increasing participation by decentralization of accountabilities and responsibilities particularly in breaking down big programs into smaller programs/projects.

Types of scaling up

Among the first to discuss types of scaling up approaches was Clark (1991) who, in examining the work of NGOs, distinguished between three types of scaling up: ***project replication***, ***building grassroot movements*** and ***influencing policy reform***.

In their paper to the Philippine workshop, Uvin and Miller discuss in considerable detail a taxonomy of scaling up. They suggest looking at scaling up in terms of structure, programme, strategy and resource base, and propose four types of scaling up: quantitative, functional, political and organisational (Box 1).

Carl Taylor, on the other hand, using primarily his experience in the health sector, has suggested four models of going to scale: ***blueprint***, ***explosion***, ***additive*** and ***biological*** (see box Carl Taylor p.14). He makes a case for what he calls a biological model for scaling up involving a number of stages. Action usually begins at the community level and starts with a few simple ideas. With success more ideas are tested. When a cluster of innovations are worked out, that community based action becomes a basis for learning by other communities. These communities serve as learning centres. Other communities learn from that experience and adapt it further. Finally, when a larger enabling environment is put in place the ideas spread rapidly. These approaches are discussed in more detail in his article on page 14 and in his forthcoming book.

At the Washington meeting, an attempt was made to systematise the various perspectives of scaling up arising from the workshop discussions (see figure 1). There is the spatial dimension wherein technologies spread to larger numbers of farmers over a wider area. However, this should also include helping communities strengthen their ability to solve their own problems. The temporal dimension refers to the need to know when a certain technology or process can be scaled up. The economic dimension reminds us that the cost effectiveness of the effort has to be kept in mind. Does the availability of resources to scale up guarantee that the efforts of an institution will be sustained? The technological dimension often includes the need to diversify the range of technologies or to implement complementary approaches in order to achieve synergism. Scaling up is always multi-dimensional, involving technological, process, institutional and policy innovations.

Vertical and horizontal processes: up, down and out

One of the more easily understood concepts is that scaling up has both *vertical* and *horizontal* processes. The vertical process represents efforts to influence policy makers and donors and is

Box 1. Four types of scaling up (Uvin and Millar, 2000)

Quantitative: A programme or an organisation expands its size by increasing its membership base or constituency through increase in geographic area or budgets.

Functional: A community-based programme or a grassroots organisation expands the number and the type of its activities e.g. from agricultural production to health, nutrition, credit, training, literacy, etc.

Political: The organisation moves beyond service delivery towards empowerment and change in structural causes of underdevelopment. This usually involves active political involvement and the development of relations with the state.

Organisational: Community-based programme or grassroots organisations increase their organisational strength to improve the effectiveness, efficiency and sustainability of their activities. This is through diversifying fund sources, increasing level of self-financing/income generation, assuring the enactment of public legislation earmarking entitlements within the annual budgets for the programme, creating external links with other organisations, or improving internal management capacity of staff.

generally institutional in nature. The horizontal process refers to the spread across communities and institutions and geographic boundaries (see figure 2).

Larry Harrington and colleagues (2001) introduced the following ways of understanding scale as it is applied to NRM work:
- ***Scale of analysis:*** from plant to plot to farm to watershed to regional scales;
- ***Scale of intervention point:*** "high-level" interventions (e.g., policy change, adjustments in institutional arrangements or property rights, fostering of collective action) vs. "low-level" interventions (e.g., programme of farmer experimentation or extension on specific NRM practices);
- ***Scale of investment*** in intervention strategies: small vs. large investments in extension, in farmer experimentation programmes or in efforts to inform policy;
- ***Scale of community empowerment:*** the number of communities with capacity to undertake their own research and adaptation through processes for local learning;
- ***Scale of geographical coverage*** of an NRM practice: whether the practice is limited to a village or watershed, or whether it has attained regional or national significance;
- ***Scale of impact***, e.g., the extent to which desirable outcomes (improved system productivity and resource quality) are achieved through NRM research.

Farmers, NGO and government staff learning about vegetative strips in farmer's field. Photo: ICRAF

The scales are linked and greater impacts are generated from higher levels of investment in suitable interventions or from more efficient use of these investments through reliance on community empowerment leading to expanded geographic coverage of suitable practices.

No to blue prints and cookie cutters

The strong interest in *planning* for scaling up could lead to an undue reliance on predetermined activities and strategies. There were early reminders from David Korten and Carl Taylor (p.14) about the limitations and dangers of relying on blueprints. Carl Taylor warns us that ***there are no universal solutions but only universal processes*** in social development work. At the Washington meeting, Norman Uphoff stressed that what we need is frameworks and not blue prints and that too often we try to find straight line solutions and to routinise innovation. Standardisation is often stressed, but what we probably need is systematisation, which is less "strict". Uphoff warned participants of the dangers of viewing scaling up as merely replication (the cookie cutter approach) since quality scaling should involve multiplication through adaptation not replication. It is probably in this context that the limitations of model and pilot projects are also increasingly being raised. The emphasis on strengthening organisational and learning capacities emphasised by numerous participants (probably the single most mentioned concept) results from an appreciation of the concerns raised by Korten, Taylor and Uphoff.

Building capacities to innovate and the learning process approach

To achieve scale and to also ensure sustainability in programmes of technological enhancement, the strengthening of local capacities to innovate may often be just as or even more important than the technologies themselves. Knowing and understanding the underlying principles are crucial. Strengthening peoples' capacities to innovate were often mentioned in the four workshops as being important in up-scaling and sustaining impact.

Knowing the principles behind a technology and improving capacities to innovate helps communities cope with changing environments and new problems. Many feel that technologies are usually adapted not adopted. One example of wide-scale adaptation by farmers can be seen in the Landcare programme in the Philippines (p.31), where thousands of farmers have decided to adapt a range of soil conservation approaches based on a basic principle of vegetative strips across contours. Farmers utilise the contours in a diverse manner, some letting vegetation establish itself while others enhance the grass strips by planting fruit and timber trees species. Still others plant annual species and short-term perennials or use the contours to raise fodder grasses.

Farmers, communities and local organisations that are exposed to a wide range of available best practices can locate which ones are relevant to their particular situations. The usual approach here is to talk about the value of a basket of technological options. Presenting farmers with options could foster or strengthen the drive to innovate or adapt.

Divergence of methods

Peter Horne of CIAT made a point at the Washington workshop about the value of a divergence of methods. This, he said, was good primarily because of the huge complexity from site to site. He felt that local people needed to be assisted with resources and knowledge to deal with the complexity in their own situation. If the capacities to innovate are to be strengthened, farmers probably need not only a wider diversity of technologies but also a wider diversity of methods or approaches. The ICRAF meeting referring to collaborating institutions indicated that in order to learn from successes and failures with using these diversities of technologies and methods, there was a need to develop an analytical learning culture amongst partners.

The ongoing documentation and systematisation of experiences with wide ranges of technologies, strategies and methods is a useful tool for discovery and dissemination. These best practices must guide the process of scaling up: systematisation of lessons needs to be planned for, if successful sharing is to take place at different levels. Unfortunately there is a lack of documentation on best practices dealing with sharing between farmers, NGOs and different institutions.

Partnerships and alliances

The nature of most efforts to scale up involve a multiplicity of players and it is therefore not surprising that all the four workshops stressed the importance of institutional collaboration and partnerships. Many would argue that partnerships are an essen-

Farmer to farmer exchange: a very effective means of dissemination. Photo: PMHE

tial element of a strategy to scale up: to reach larger numbers of people in horizontal scaling up, a wider range of organisations might be involved. The need for widening the representation of stakeholders, especially policy makers and local leaders was also stressed. Involving a wide range of actors at different levels also helps capitalise on different strengths among various players. In vertical scaling up, efforts are directed towards reaching policy makers and planners, which may need the involvement of a lesser number of organisations.

The ICRAF workshop stressed the value of a strong network of partners with shared and complementary agendas. There will, however, be a need to continually review the agreements on collaborations and exit strategies. Partners must accept that collaboration has its own costs and resources must be set aside for this.

Ownership and social capital

However, as was emphasised in the Washington meeting, merely engaging multiple stakeholders in a consultative process is not adequate to build ownership. Instead, strategic alliances need to involve the participation of a broad range of stakeholders as early as possible and in different stages of the project cycle. The report of the Whitstable meeting (Gündel and Hancock, 2001), which focused on project cycle dimensions, pays special attention to this. It reminds us of the need for flexibility at all stages and the need to avoid rivalry in terms of ownership of innovation as it is not the technologies which matter as much as the process.

It is indeed a reality that competition and mistrust between players exist in almost all situations and that these are considered as impediments to scaling up efforts. Inter-institutional collaboration and coordination is not only important, it is crucial and a prerequisite for maximising impact. However, we are reminded that reaching consensus and gaining commitment from the different stakeholder groups are important first steps. In this context, several references were made by Juan Sanchez at the Washington meeting about the value of social capital (Box, p.17). He emphasised the value of the '*mesas de concertacion'* (roundtable discussions involving community members, their local government and those engaged in R&D). It was felt that efforts to enhance and strengthen the social capital would improve the quality of partnerships and foster increased networking. The value of cooperation is stressed, whether in arriving at common policies or in joint action. Different institutional interests are considered in negotiating strategies. Transparency and accountability of the different partners is fostered.

The driving forces: building upon "sparks" and "champions"

The urge to scale up is often associated with the need to expand initially successful small-scale experiences or pilot projects. From the Workshop discussions, participants identified other driving forces or "sparks" that stimulate technologies, processes, principles, programmes, organisations, etc. to be scaled up. While the initial successes continue to be recognised as providing the sparks, the "timing" (when they come) remains to be properly analysed. Sparks come unexpectedly – and they tend to come from everywhere. They may be generally unpredictable. Examples of such sparks are:

Local champions - people or individuals within institutions can be driving forces to the scaling-up process. These can be people with unique skills within the community who are strongly motivated to initiate and support change.

Development practitioners - to show impact and account for their work, practitioners need to achieve the numbers, i.e., scale up without necessarily sacrificing quality. This desire to reach out to more people in more communities to prove that they can make a difference can provide the sparks for development programme to go to scale. These sparks come about as practitioners try to empower people or shift power or authority towards a desired state or try to be simply of help to farmers.

Support groups - stakeholder groups external to the community, like donors and parent organisations of local groups and the people behind them – development workers, extensionists, researchers, etc. can be sparks as well. These include people who are eager to share with others and consequently get widely recognised.

Success in small-scale initiatives can provide inspiration to go to scale.

Crisis - crisis situations and the raising of questions on where technologies, projects, programmes, etc. should lead to - can also become sparks.

However, Carl Taylor warns us, that in moving from a bottom-up to top-down approach, the spark that produced the initial empowerment can be lost. Experts can "engineer out the spirit and human energy that gives heart, motivation and life to the process."

While recognising the value of champions, many participants cautioned about the fragility of a process championed only by a single person. This is probably why the IDS Participation studies (1999), while reinforcing the importance of champions also reminds us about the challenge for the future to multiply the number and effectiveness of champions, especially local ones. Relying too much on a single champion could affect the long-term sustainability of the effort and limit its expansion to other areas. One has to find and support champions wherever they are - in government, in donor agencies, in civil society etc.

The critical role of markets as driving forces

The Washington and Nairobi meetings put a considerable amount of emphasis on the value of markets in influencing scale. Paul Rice at the Washington meeting had three core messages for participants: 1) all farmers produce to market – they need to produce but they also need to sell and earn; 2) farmers need to organise themselves to achieve economies of scale to produce economically and profitably; 3) consumers are increasingly concerned about social and environmental concerns and are often willing to pay more for quality products. Farmer

Farmer promoters of Campesino a Campesino conduct workshop for farmers. Photo: Eric Holt-Gimenez

organisations can help their member farmers take advantage of the economies of scale and better prices. Co-operations marketing large volumes of produce can negotiate better prices and access distant markets. But, for many farmers it is also equally important to recognise their need to reduce risks.

Participation and scaling up

In all the workshops discussed in this report, the question invariably arose about whether participation is sacrificed during efforts to scale up. Uphoff, Esman and Krishna (1998), in their review of cases, cite the case of the National Dairy Development Board's work in India which indicates that, inevitably, there are risks of "dilution and diminution of effort" and that patterns of organisation and operation were compromised in scaling up. However, the authors emphasised that the criterion of success is whether the capacity for collective action that has been fostered is used by rural people to improve their lives in other ways.

At the Silang workshop, the issue on how to *maintain* not only adequate levels of participation but also how to assure quality in expanded programmes was raised. While believing that participation should not be sacrificed in scaling up, many participants felt it was inevitable. A lack of participation however, could also mean that benefits are not being maintained. It could also suggest the existence of tension resulting from different paradigms of development e.g., top-down approaches used in a government bureaucracy and the bottom-up approaches of NGOs. However, if a right approach is used, a NGO-GO link can help NGOs to *mainstream* participatory approaches that they have developed or are engaged in.

Broad-based grassroot level movements can also provide the pressure to bring about change at higher levels. An initiative like a farmer field school can be important, because these are often precursors of local institutions (e.g., farmers' associations). The large-scale, people-centred IPM programme in Asia has built, over the last decade, local capacities to engage farmers in active learning. A decentralised farmer-led approach, we know, has been useful in tackling location-specific demands of tropical agroecology (see Dilts, p.18). However, this programme also involved a process of large-scale re-education, often using training as the initial strategy.

Planning for scaling up: implications for project design, monitoring and evaluation

The Whitstable workshop raised a concern about the fact that in natural resource management research projects, the issue of scaling up is only addressed in the *post-project* phases. In other words, scaling up is not thought of earlier nor is it planned for. Participants at the workshop in Silang came up with a checklist to facilitate planning. Participants of the ICRAF workshop made an overview of the fundamentals of scaling up agroforestry research (see p.13). The Whitstable meeting identified key strategic elements for scaling up activities in the pre-project, implementation and post-project phases. All of these have implications for project design for which a guiding framework was created (Gündel et al, p.11).

One important implication is the need for donors to fund a pre-project phase where a considerable amount of time and effort is engaged in situational analysis, defining target groups, objectives and outputs and a monitoring and evaluation (M&E) system. This also involves an engagement in policy dialogue on a "pro-poor" agenda. The Whitstable report also suggested that the focus on M&E should be established at an early stage but not necessarily with rigid indicators but "*with initial ideas of what aspects of process and what levels of impact will be addressed*."

In their book, "Reasons for Success", Uphoff, Esman and Krishna (1998) raise concerns about donors being wedded to the project approach despite evidence that this is not a good way to use resources. They believe that if a project is carried out in a learning process mode, many of the pitfalls of a blue print orientation can be avoided. The authors call upon donors, especially when they have confidence in a certain approach to rural development and certain leadership and model of operations, to fund programmes on a "*wholesale*" rather than a "*retail*" basis, allowing for flexibility and complementarity. The bottom line, according to Uphoff, Esman and Krishna, is that while funding is required, "***successful rural development programmes depend more on ideas, leadership and appropriate strategies than money!***"

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Lessons for scaling up LEISA

Editorial

In a bid to guarantee food security for all, policy makers argue for a doubling of food production in the next two decades together with poverty eradication. What's more, they expect such increases to be brought about with no added pressure on natural resources. Farmers, as primary producers, want to survive, stay in business and increase their income, and therefore wish to raise productivity, reduce costs and minimise the negative impact of their production systems on human health and the natural resource base. Clearly, policy makers, researchers, development workers and farmers have a common interest to improve agricultural production. However, agricultural development is complex and diverse, and stakeholders often do not agree on the remedies and strategies that are best.

Many research and development programmes try to address the above objectives. Although there are many successful cases around the globe, only a few of them are spreading fast. To optimise returns to effort and spread impact to as many farmers as possible, it is important to analyse which approaches are successful and why. How these approaches contribute to the different objectives of sustainable agriculture, and which research and support methodologies are most effective in enhancing agriculture development and large-scale application should also be analysed. It is increasingly understood that conventional Green Revolution (GR) agriculture and top-down research and development approaches have strong limitations. This explains the growing interest to learn lessons from alternative approaches that have spread to many farmers - 'gone to scale'.

Recent workshops on 'going to scale'

To learn about the factors that influence 'going to scale' of agricultural research and development, leading to '*more quality benefits to more people over a wide geographic area more quickly, more equitably and more lastingly'*, four recent workshops (Gonsalves p.6) brought together information on approaches which are spreading fast. Although these workshops mainly focused on the methodological aspects of research and development and less on impact, the cases collected for these workshops give interesting examples of present success stories, with insights into enhancing and constraining factors for scaling up. In this issue of the LEISA Magazine we include the main findings of these workshops (Gonsalves p.6; Guendel et al p.11; ICRAF p.13) and a selection of the most interesting cases. Several additional cases are also included and reference is made to some cases published in earlier issues of the LEISA Magazine (ILEIA Newsletter).

Success stories

As we see it, there are 3 groups of success stories:

- Success stories from conventional high-external-input agriculture: Integrated Pest Management (IPM; especially in irrigated GR rice in Southeast Asia but increasingly in other crops and parts of the world) and Zero Tillage (ZT; especially in commercial rainfed agriculture in Latin America). These approaches are now being embraced by millions of small and large farmers, some of them combining both. The benefits of these approaches are clear: lower costs and higher income, less damage to human health and the environment (IPM), significant reduction of soil erosion (ZT) and increased production. In Southeast Asia more than one million small and larger farmers have been introduced to IPM in so-called Farmer Field Schools. The focus in IPM is gradually shifting from pest to crop to system management, and from a technical to a community approach, which in Indonesia is becoming a social movement of farmers (Dilts p.18). ZT first spread rapidly among large farmers, but now even small farmers are adopting it, as technology adapted to their conditions is becoming available. ZT in Latin America is basically developed by farmers but is now getting massive support from research and government (Vaneph and Benites, p.22).
- Success stories from semi-subsistence, low-external-input agriculture using entry point technologies such as cover crops (LEISA Magazine 13.3, p.12-13), water harvesting (Verweij p.43; CSE p.46; LEISA Magazine 16.1, p.11-15), natural vegetation strips (Catacutan et al. P.31) and traditional seed varieties (Von der Weid, p.23 ; Zhardhari LEISA Magazine 17.2 p.19). These technologies are spreading among thousands of farmers, often supported by NGOs. The innovation process is strongly driven by participatory farmer experimentation and farmer-to-farmer exchange evolving into social farmer movements for development of agroecological agriculture such as Campesino a Campesino (Central America; p.27), Landcare (Philippines; p.31) and Nayakrishi Andolon (Banglandesh; LEISA Magazine 17.2, p.16-18).
- Success stories from organic agriculture, sometimes in combination with fair trade (ILEIA Newsletter 14.4). This trend is a result of increasing ecological awareness and market demand for 'healthy' organic products, especially from consumers in rich countries.

From natural vegetation strips to agroforestry, Landcare in Mindanao, Philippines. Photo: ICRAF

An overview of the main success stories and their impact has been published by Pretty and Hine (2001): *Reducing food poverty with sustainable agriculture: a summary of new evidence* (see also LEISA Magazine 17.1, p.21).

Towards agroecological agriculture

All these success stories show that situation and farmer-specific entry point technologies are very important as they bring fast economic results, make further investments possible and create the enthusiasm, motivation and self-confidence necessary to further develop more integrated agroecological agriculture (LEISA) and sustainable livelihoods (Mahajan p.48). Later these technologies may become less important, as broader and more flexible sets of technologies are adopted, depending on changing needs, conditions, problems, insights and skills (Sherwood and

Larrea, p.30). Zero tillage farmers in Brazil, for example, have realised that herbicide based no-tillage is still far from sustainable and are now developing a broader approach: conservation agriculture (Vaneph and Benites, p.22). In all these cases, farmers have learned to use local natural resources and ecological processes in more efficient ways, to reduce the use of costly external inputs and to intensify agriculture ecologically. Thus, monoculture systems gradually evolve into integrated systems. In general, ecological intensification also leads to higher ecological sustainability and resilience (Holt-Gimenez p.27). In most cases (except in organic agriculture), farmers do not exclude agrochemicals completely but use them cautiously in a way that is appropriate for their specific economic conditions (Ruben p.52). Reduction of the use of external inputs and development of integrated agriculture, however, may only happen after farmers have experienced the negative impacts of monocropping (Verweij p.43). The drive towards agroecological agriculture is strongest in subsistence conditions where agrochemicals are too expensive to use, credit is not available and farming has to satisfy a wide array of subsistence needs (Von der Weid p.23). Nevertheless, this drive also exists in commercial agriculture where farmers and researchers try to develop integrated pest, disease, weed, soil and water management (Dilts p.18; Vaneph and Benites p.22).

However, farmers' interests are not limited to agriculture. Increasingly, small farmers are investing labour not only in agriculture, but also in non-farm and off-farm income generating activities (Ruben p.52). Development of agroecological agriculture and local healthcare, off-farm income generation and strengthening of local value and knowledge based decision making (see e.g. Mahajan p.48) can be mutually supportive and serve as crucial elements for successful development of sustainable livelihoods.

Participatory development

The participants of the four workshops stressed the importance of participatory development and 'social capital' for successful expansion of agricultural research and development programmes (Gonsalves p.6). Participatory analysis and planning, farmer-to-farmer exchange and learning, farmer experimentation, participatory monitoring and evaluation, and integration of indigenous and scientific knowledge are all important elements of such participatory processes. The Farmer Field School approach, which combines experimentation for learning and innovation, farmer promoters and farmer-to-farmer exchange, is the motor of success in the Community IPM (Dilts p.18) and Landcare (Catacutan et al p.31) movements and is influencing other participatory research and development programmes as well. (see LEISA Magazine 16.2).

Creation of regional research and development platforms for information sharing, planning and coordination is also mentioned as an important tool for 'going to scale', as successfully used in the development of ZT (Brazil, p.23) and the improvement of groundnut production in India (LEISA Magazine 15.1&2, p.72). Consortia of farmer organisations, NGOs, government and international agencies and recognition of the complementary roles these different stakeholders play is clearly important for success as well (Catacutan et al p.31; Kwesiga et al p.35).

Participatory development of site specific agroecological agriculture and sustainable livelihoods requires basic rethinking and relearning of land use and rural development by farmers as well as development staff and researchers. This calls for massive efforts in human resource development. The PMHE programme in Sri Lanka proved that motivation and retraining of government staff in participatory and agroecological approaches is possible, also on a large-scale (Wettasinha p.39).

Supporting farmer movements

The potential of participatory and agroecological approaches to increase agricultural production, eradicate poverty and improve the natural resource base comes out clearly in these cases. The fact that large numbers of farmers are following these approaches already says a lot. Additional economic data, although very difficult to gather because of the complexity of agroecological systems, is providing further insight into why, where and when low-external-input technologies can work (Ruben p.52). Supporting farmers' movements for agroecological and social development such as those in Indonesia (IPM), Brazil (ZT), Central America (Campesino a Campesino) or the Philippines (Landcare) could indeed be the most effective way for 'going to scale'.

However, many forces and conditions work against the spreading of agroecological development as shown by Holt (p.27) and Von der Weid (p.23). Some of the constraints are: lack of awareness about the potential and necessity of agroecological agriculture and participatory development amongst policy makers and researchers; the prevailing Green Revolution and biotechnology paradigm; lack of funding of agroecological and participatory programmes; lack of credit for small farmers, especially for development of agroecological agriculture; lack of appropriate training; clientalism on the part of NGOs which keeps farmers dependent on external support; inability to influence policy makers; lack of participation of farmers in local and national decision making and the lack of cooperation and coordination between farmer, consumer, environment and development organisations. Most agricultural policies still focus solely on increased yield per area, usually associated with packages of external inputs and technical interventions. In many cases, these policy frameworks are the principal barriers to the spread of more integrated, sustainable and productive agricultural systems (Mahapatra et al, p.46; Vaneph and Benites p.22).

Yet it is important to get strong and coordinated support from local and national administration, research, communication, education, CSOs, private companies and funders as confirmed to some extent by the IPM (Indonesia), ZT (Brasil), Landcare (Philippines) and water harvesting (India) movements. But Taylor (p.14) and Holt (p.27) point out, validly, the risk of losing the sparks of innovation when the bottom-up approach is changed into a top-down approach as commonly followed by governmental agencies. It is therefore very important that international policy institutions, governments and research make the switch:

- From reductionist approaches to interdisciplinary, holistic and social learning approaches,
- From commodity-oriented research to system-oriented research at the local level,
- From high-external-input systems to low-external-input systems that enhance agroecosystem functions and optimise the sustainable use of local resources,
- From a centralised, expert-driven approach to a decentralised, agroecosystem-specific approach to science that complements farmer and indigenous knowledge and experimentation, and recognises and enhances local research potential.

To advocate for and contribute to this process, strong alliances between farmer organisations, consumer organisations, development and environmental civil society organisations and researchers, who already have made the switch, are very important (Holt-Gimenez p.27).

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The regional editions for Latin America and India contain selections of articles from LEISA Magazine together with articles of more regional and local interest.
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The editors encourage readers to photocopy and circulate articles. Please acknowledge LEISA Magazine and send us a copy of your publication.

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CONTENTS

ILEIA is the Centre for Information on Low External Input and Sustainable Agriculture (LEISA) in the tropics. ILEIA seeks to promote the adoption of LEISA through the LEISA Magazine and other publications. It also maintains a specialised information database and an informative and interactive website on LEISA (**http://www.ileia.org**). The website provides access to many other sources of information on the development of sustainable agriculture.

LEISA is about Low-External-Input and Sustainable Agriculture. It is about the technical and social options open to farmers who seek to improve productivity and income in an ecologically sound way. LEISA is about the optimal use of local resources and natural processes and, if necessary, the safe and efficient use of external inputs. It is about the empowerment of male and female farmers and the communities who seek to build their future on the basis of their own knowledge, skills, values, culture and institutions. LEISA is also about participatory methodologies to strengthen the capacity of farmers and other actors to improve agriculture and adapt it to changing needs and conditions. LEISA seeks to combine indigenous and scientific knowledge, and to influence policy formulation in creating an environment conducive for its further development. LEISA is a concept, an approach and a political message.

Renew your subscription now!!
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35 Scaling up fallow management innovations in Eastern Zambia

Freddie Kwesiega, Andreas Bohringer and Glenn Denning

Improved fallows with *Sesbania* and other species have been the focus of ICRAF's research since 1985. These improved fallow systems have a great potential to increase maize yields with or without application of inorganic fertilisers. This fact alone has increased the number of farmers testing and using improved fallow practices in Eastern Zambia from 200 to 10,000 in just 5 years. ICRAF's is now developing ways of scaling up the adoption of this innovation to benefit the many thousands of farmers in Eastern Zambia, and in the South African region. ICRAF is, however, not unaware of the constraints that have to be overcome in order to achieve success.

DEAR READERS

This issue of the LEISA Magazine is on 'lessons in *scaling up* of LEISA research and development programmes, *to bring more benefits to more people, more quickly, more equitably and more lastingly'*.

Case studies and workshop reports from four recent international workshops on *going to scale of agricultural research and development* have been made available to us for this purpose. A selection from this material complemented with several other successful cases makes up this issue. The introductory article (p.6) is written by Julian Gonsalves, the guest editor for this issue and former Director of the Sustainable Agriculture Programme of the International Institute for Rural Reconstruction in the Philippines and proponent of sustainable agricultural approaches for 20 years. He was involved in organising two of these workshops and served as a resource person in the other two. This article provides a summary of the main findings of the said workshops, and together with those of Cooper and Denning (p.13), Gündel et al (p.11) and Carl Taylor (p.14) would be of special interest to planners, managers and trainers of research and development programmes. The rest of the articles, which deal with more practical cases, should certainly be more appealing to the majority of our readers.

The production of this 'larger than regular' 60 page issue was made possible by the additional financial support from the NGO Committee of the Consultative Group on International Agricultural Research (CGIAR), for which we are very grateful.
New themes for the upcoming issues of the LEISA Magazine and the new ILEIA Website and its interactive discussion platform are introduced to you on p.59. Your contributions to these issues and comments on earlier issues are invited and highly appreciated.

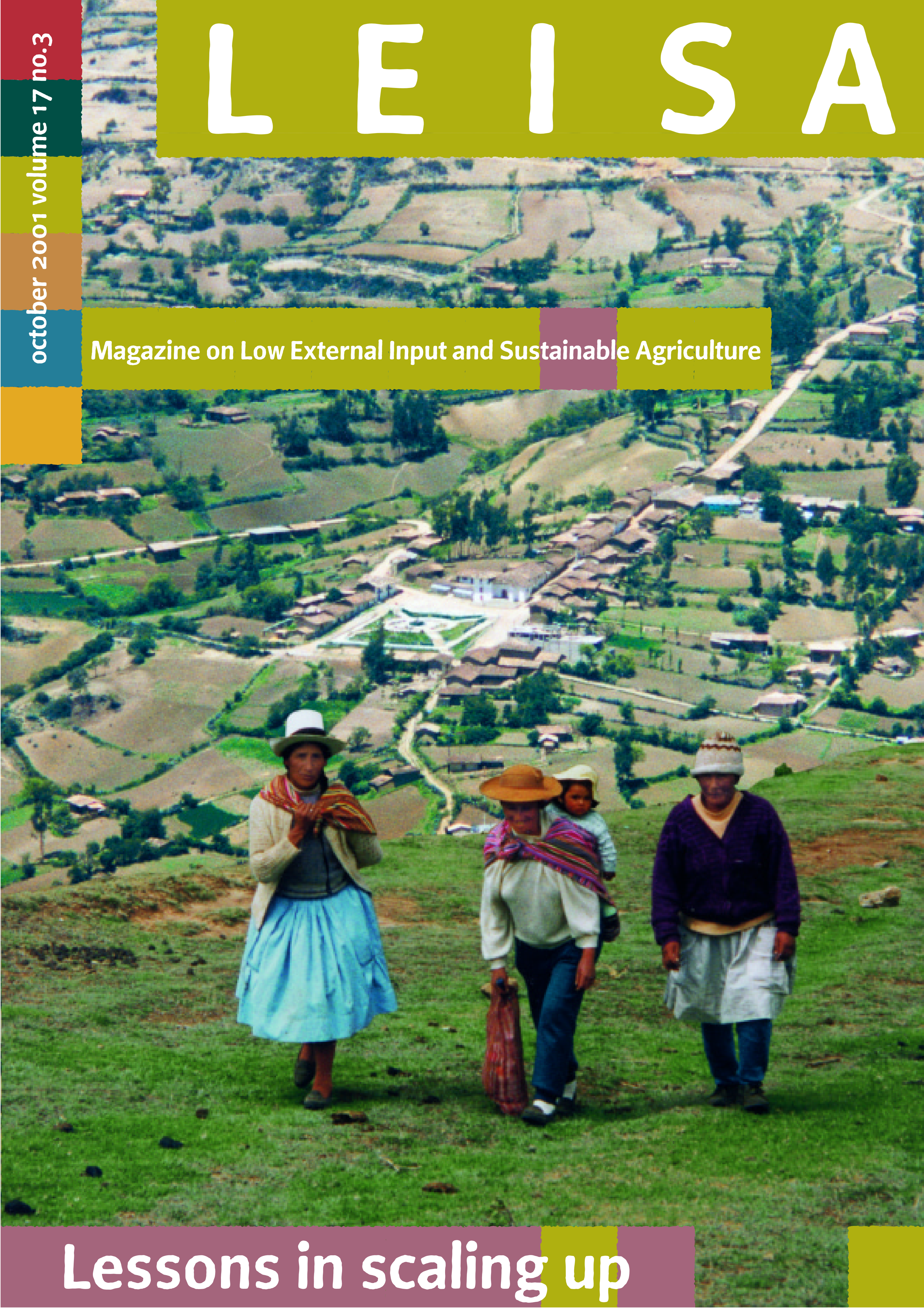
On the back cover is a short report on the readers' survey conducted in Ethiopia. This survey is the first in a series that ILEIA hopes to undertake in the coming years to get better insight into what information readers really need and how they use the information that is provided. The findings of this survey were very encouraging - every visit was an inspiring example of how useful the Magazine is to its reader, and in more ways that we could think of. We are rewarded by the fact that the LEISA Magazine is indeed serving its readership.

The Editors

LEISA

Magazine on Low External Input and Sustainable Agriculture

october 2001 volume 17 no.3



Lessons in scaling up

“Orphanaging baby corn”

The traditional rice farmers of Chiang Mai’s Mae Tha district took to baby corn growing in 1983 as a way of supplementing their decreasing income. Rice yields had dropped and the harvest could not even feed the families who lived there, leave alone bring an additional income. The companies involved in buying the baby corn from farmers brought in the seeds and fertilisers, and bought back the produce at guaranteed prices, setting off the costs of inputs.

In the early years, farmers grew baby corn twice a year - in the dry and rainy seasons. A family could survive on the income of 1300 bahts from approximately 0.32 ha. By the nineties, when baby corn production had reached its peak, farmers were growing it six times a year, just to make ends meet. Taking around 45 days to be grown, and another 15 days to be harvested, farmers were forced to work day and night, especially at harvest time. With the land being severely exploited, maintaining production meant changing to improved seeds and fertilisers. This increased production costs, but the guaranteed price for baby corn remained static since 1983.

The buyers grade the corn in 3 sizes according to factory standards: small, medium and large. The low exchange rate of the baht caused by the economic slump brought in higher income to exporters who sped up their exporting. Consequently, only the small sized baby corn was bought as dictated by the Japanese and European markets. Harvesting time is crucial to the size of the baby corn. Just a day too late, and the size would not be right, which meant that only about half the harvest would be bought up. The rest would be rejected. Hence, the income dropped whilst the production costs stayed the same. Yet most farmers had no choice - they were pushed to produce the small sized baby corn that could be sold, risking even their health. Sarcastically, farmers began to call the crop “orphanaging baby corn”.

Nevertheless, a few farming families have turned away from baby corn and taken up alternative agriculture: growing mixed types of fruit trees, garden vegetables and plants. Even some of the baby corn growers have started to include trees and other crops in their farms. Many of them have discovered that concentrating on one particular crop is not a good idea, and that farming needs diversity.

Baby corn production in Mae Tha has reached its peak. Ten years of monocropping has so severely damaged the soil that farmers have to buy more inputs to maintain production which they can’t afford. But the only interest of the baby corn exporting factories is a steady supply of raw material and so it’s time to move on, looking for greener pastures. This is very usual of modern-day capital, which moves from one place when all its good things have been siphoned off to another place. With making profit the only target, there is no appreciation or compassion towards the farmers or the land. ■

Adapted from “Impacts of economic meltdown on the villages” published in Thai Development Newsletter, No. 34, January-June 1998

Fulani herders with their cattle at an overnight camp on farmers’ fields, Central Nigeria. Photo: Wolfgang Bayer

Themes for next issues

February 2002 Vol.18-1

New ways in smallholder animal husbandry

Never was so much said about animal husbandry than when the Foot and Mouth Epidemic hit Europe during the last months. Following several other animal-related controversies in the recent past, this new epidemic triggered fierce debate and protests. Even governments were forced to agree that there was something terribly wrong in the way animals were managed within the industrialised food system. Are animals simply “production machines”? Aren’t food safety, ecology and the health and well being of animals essential as well?

For families in the South, farm animals are often very important, not only for food and other economic reasons, but also for deep-rooted cultural and social aspects. Should they copy the unsustainable trends from intensive animal husbandry in Europe as often propagated by development programmes? Or should development initiatives build on indigenous practices and involve the people themselves? How could indigenous and scientific knowledge support each other in making animal husbandry healthy and productive? How could cultural and social aspects be dealt with? Is it important to look at gender roles in animal husbandry, especially in terms of access to and control of animal assets and labour division? How should species diversity be maintained, inbreeding prevented and animals upgraded? How can integrated (tree-) crop-animal systems be developed or improved? Should interactions between wild life and domestic livestock be considered? What income generating activities could be developed around animal husbandry to secure the livelihoods of animal keepers? What marketing arrangements are undertaken by farmers and how can these be improved? And what about veterinary services that are so essential to animal husbandry?

All these questions and more have urged ILEIA to take up animal husbandry as the theme for the first issue of 2002. Your experience counts in working towards a more sustainable system of animal husbandry, both for the North and for the South. Please send your contributions to us before 1st January 2002.

Information on the themes for September (Going to scale) and December (Alternatives to biotechnology) issues can be found in issue 16-4 and 17-1, p.36.

You are invited to contribute to these issues with articles (about 800, 1600 or 2400 words + 2-3 illustrations), suggest possible authors, and send us information about interesting publications, training courses, meetings and websites.

Learning together for change: facilitating innovation in natural resource management through learning process approaches in rural livelihoods in Zimbabwe by Hagmann J. 1999. 330 p. ISBN 3 8236 1314 6 : EUR 25.60. (Kommunikation und Beratung, Sozialwissenschaftliche Schriften zur Landnutzung und ländlichen Entwicklung 29) Margraf Verlag, Postfach 1205, 97985 Weikersheim, Germany margraf@compuserve.com

The efforts of the Zimbabwean agricultural research and extension agency Agritex and its partners to pioneer an effective farmer-led extension cum PTD approach in the province of Masvingo have been well documented. (see Farmer Research in Practice p. 153-173 and the ILEIA Newsletter v.13 no.3 (October 1997) "Rebuilding Lost Soil Fertility"). The result has become known as "Kutaraya" or "Let's try". It combines solid participatory agricultural extension methods with those of the social change approach known as Training for Transformation. This was realised through the intensive collaboration of the government agency Agritex and the NGO ITDG, with prolonged funding support of the German Government. In this book, Jurgen Hagmann, one of the key researchers in the Masvingo activities from as early as 1991 and still involved in backstopping Agritex, provides a detailed insight into the developments that led to Kutaraya and its successful application. Even more important is its contribution in linking these experiences with fundamental social science insights and discussions. Following scientists such as Röling, he argues that changes in natural resource management practices are not necessarily inspired by technical expertise alone, but are often a result of interactions between various interests and sets of knowledge. Facilitating joint experimentation and learning among resource users can encourage innovation - just what Kutaraya tries to put into practice. Hagmann's efforts to be thorough and cover all aspects have led to a voluminous publication, yet one of great interest for those who are not just interested in the nuts and bolts of farmer-led agricultural development, but also its theoretical foundations. (LvV)

Incentives in soil conservation : from theory to practice by Sanders DW ... et al. (eds) 1999. 384 p. ISBN 81 204 1347 4 : USD 39.95. World Association of Soil and Water Conservation (WASWC). Science Publisher, PO Box 699, Enfield, N.H. 03748, USA / sales@scipub.net, www.scipub.net

This publication compiles contributions on the use of incentives (direct or food-for-work payments, tax concessions etc.) and disincentives (fines, taxes, exclusion from government benefits etc.) in soil and water conservation programmes from all over the world. The results of such programmes have been mixed, and this book is meant to be an overview as well as a guide for future programmes. The book is divided into three parts: the first deals with the theoretical and conceptual considerations, the second with national and regional programmes and the last presents case studies and projects. It is a combination of experiences that is very valuable. (IHG)

Rural credit and self-help groups : micro-finance needs and concepts in India by Karmakar KG. 1999. 374 p. ISBN 0 7619 9345 2 : GBP 29.99. Sage Publications, 6 Bonhill Street, London EC2A 4PU, UK / orders@sagepub.co.uk / www.sagepub.co.uk

This book deals with the problems and prospects of rural credit in India. The writer has worked as an officer in various banks for over 22 years, and has made an in-depth study of the existing rural credit delivery system. In this book he makes many valuable suggestions for strengthening and restructuring the system, based on Asian financial role models. The book studies the micro-finance needs of the rural poor, and offers the solution of self-help groups to enable the rural poor to aim for economic empowerment. Recommended reading for rural bankers, NGO volunteers and credit specialists. (WR)

Information management for development organisations by Powell M. 1999. 160 p. ISBN 0 85598 410 4 (pbk). (Skills and practice series). OXFAM Publications, 274 Banbury Road, OX2 7DZ Oxford, UK.

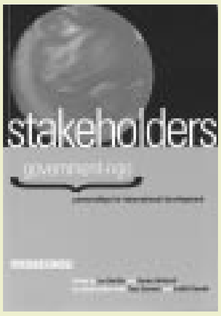
In this era of information and communication, development organisations can feel overwhelmed by the amount and variety of information available, ranging from wage records and purchase orders to evaluation reports and conference notes. This book can be helpful in understanding the links between the various information items available and in classifying them, so that they can be used as a tool for planning, implementing and monitoring. The described approach is illustrated with case studies from community groups and non-government organisations. The book can also be used by people only interested in certain aspects of information management as the different chapters can be read individually. Most chapters conclude with a list of practical issues and suggestions which makes it helpful to check what one's own practice of information management consists of. (IHG)

The distribution and regeneration of Boswellia papyrifera (Del.) Hochst. in Eritrea by Ogbazgi W. 2001. 131 p. Wageningen University and Research Centre (WUR), Department of Environmental Sciences, Silviculture and Forest ecology Group, Droevendaalsesteeg 3, PO Box 342, 6700 AH Wageningen, The Netherlands. (Documents sur la Gestion des Ressources Tropicales = Tropical Resource Management Papers, ISSN 0926 9495 ; 35).

Boswellia is a gum-producing multi-purpose tree that grows in the savannah belt from northern Nigeria eastwards to the highlands of Ethiopia and Eritrea. Despite its economic importance, it has become a threatened species as natural Boswellia woodlands are converted into agricultural fields and unregulated grazing hinders natural regeneration. This paper/thesis research presents distribution and regeneration factors of the woodlands. (IHG)

Tropical forest resource dynamics and conservation : from local to global issues by Wiersum KF (ed). 2000. 172 p. Wageningen University and Research Centre (WUR), Department of Environmental Sciences, Forest Policy and Forest Management Group, Droevendaalsesteeg 3, PO Box 342, 6700 AH Wageningen, The Netherlands. (Documents sur la Gestion des Ressources Tropicales = Tropical Resource Management Papers, ISSN 0926_9495 ; 33).

This book presents an overview of recent social science research in the Netherlands concerning the conservation and management of tropical forests. It describes the three main fields that can be distinguished in contemptorary tropical forest research on the basis of several contributions. The first field is related to forest use by local communities including options for community level management of forest resources (Bulu forest tenure in Cameroon and storytelling to ameliorate communication). The second is research at the macro-level about the economic and political processes that can explain forest degradation and conservation (cases from Senegal, Ecuadorian Amazon, Sierra Leone and a political perspective on a Costa Rican environmental campaign). The third field is the most interdisciplinary: it focuses on the land-use dynamics at the forest fringe and refers to factors and forces both at the local as well as the global level (cases from the Tojobal Highlands, Mexico, the highlands of Papua New Guinea and the Philippines and Indonesia). (IHG)



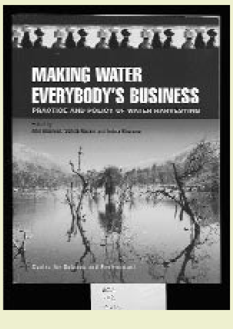
Stakeholders : government-NGO partnerships for international development by Smillie I, Helmich H (eds). 1999. 317 p. ISBN 1 85383 589 7 : GBP 25.00. Organisation for Economic Co-operation and Development (OECD), 2, rue André-Pascal, 75775 Paris Cedex 16, France. Earthscan Publication, 120 Pentonville Road, London N1 9JN, UK / orders@lbsltd.co.uk.
This study provides an overview of the relationships of governments in "Northern" countries, including Australia, New Zealand and Japan, with development-support NGOs in these countries, as well as relationships between these NGOs and both the European Union and the World Bank. The chapter on trends and issues in government-NGO relationships analyses how the NGOs are maturing and becoming more realistic in their dealings with government agencies, but also points to some of the dangers of dependency on government funding. It traces the evolution toward stronger evaluation of NGO activities, a form of evaluation that tends to focus on output rather than process and learning. Also funding relationships have evolved from matching grants to contracts, blurring the borderline between organisations of concerned and committed civil society, on the one hand, and service providers and executing agents of government, on the other. The largest part of the book - the country studies - are useful as reference material, but are not particularly exciting to read. They give a sense of history and trends, and reveal some of the differences in how NGOs are defined in these countries. However, the current information about official policies with respect to NGOs will quickly be out of date. The book is based on a meeting arranged by the Organization for Economic Cooperation and Development (OECD) in January 1998 to promote open dialogue between civil society and governments of the OECD countries. (AWB)

Agricultural terracing : development perspectives by Ojha ER. 1997. 77 p. Ratna Pustak Bhandar, PO Box 98, Kathmandu, Nepal.
This handy, compact and very practical monograph looks at different aspects of terracing. The author, a native of the Nepalese hills, examines evolution, construction, operation, and maintenance of terraces. In many parts of the world, land pressure has been very high for time immemorial given the shortage of arable land and the early demographic pressure. The only solution open to people for survival was by building terraces, no light decision given the tremendous task of constructing and maintaining such structures. Terracing is a last option when all other practices such as contour cultivation, crop rotation and strip cropping have revealed themselves as inadequate in keeping soil erosion in check and maintaining productivity. Different types of terraces are described, the use of which is dictated by the environment as much as by demographic factors and the degree of agricultural mechanisation. Labour is a heavy constraint when dealing with terraces not only for their construction, but also for their maintenance; difficult in case of outmigration or other causes of depopulation. Farmers' participation is of paramount importance in terracing, as illustrated by cases where terraces were constructed through forced labour or when farmers were not convinced of their productivity. The author gives some factors to be considered in a cost-benefit analysis of terraces. There are magnificent pictures in this book giving a glimpse of the enormous toil that must have gone into constructing and maintaining these structures. (WB)

Integrated soil fertility management by Hilhorst T, Toulmin C (eds). 2000. 64 p. ISBN 90 5328 283 1. Ministry of Foreign Affairs, Rural and Urban Development Department, P.O.Box 20061, 2500 EB The Hague, The Netherlands. (Policy and Best Practice Document ; 7).
Food security, poverty alleviation and environmental protection are important objectives of the Netherlands' development cooperation policy. A more sustainable agriculture is vital for achieving these objectives, and it is for this purpose that the Netherlands Ministry of Foreign Affairs issues a series of policy documents, which, so far, includes: Sustainable Land Use (1993), Sustainable Irrigated Agriculture (1998), Water for the Future - Integrated Water Resource Management (1998) and Participatory Integrated Pest Management (1999 and reviewed in New in Print 17.1). This new contribution to the series examines the issues at stake in relation to soil fertility management, the reasons why policy makers should be concerned about soil degradation, the lessons learned from interventions in this field and the type of policies which contribute to a more sustainable management of soils. Up-to-date background information! (IHG)

Dynamics and development of highland ecosystems : highlights on the hills in far-western Nepal by Ojha ER. 1999. 279 p. Walden Book House, PO Box 2071, Kathmandu, Nepal.
This study, with a lot of quantitative data, analyses the agroecosystem of a remote highland region in West Nepal to determine ways and means of improving the socio-economic and environmental conditions of the people living in this typical low-external-input area from which the resources are gradually draining away. The traditional terrace system is well analysed, building on an earlier study by the same author: 'Agricultural terracing: development perspectives' (see above). A list of recommendations is included in the last chapter. (CR)

Making water everybody's business : practice and policy of water harvesting by Agarwal A, Narain S, Khurana I (eds.). 2001. 456 p. Centre for Science and Environment (CSE), 41 Tughlakabad Institutional Area, New Delhi 110062, India / cse@cseindia.org , www.cseindia.org.
After the enormous success of the monumental work "Dying wisdom: rise, fall and potential of India's traditional water harvesting system (State of India's Environment, fourth citizens' report)(1997), about India's traditional water harvesting systems, CSE has published this new impressive book. It continuous from where "Dying wisdom" stopped and provides, besides new descriptions of traditional rural water harvesting systems, many examples of communities which have undertaken water harvesting programmes in the recent past. The focus is widened to examples outside India, and also to urban water harvesting programmes. New technologies which can by useful to safeguard the quantity and quality of water are also presented. It is not only the low rainfall which causes water shortages, but more the heavy reliance on surface and groundwater alone which calls for a revival of traditional water harvesting systems. Another important problem lies in the heavy dependency on the government for the provision of water. The book is a strong plea to let communities to take water management in their own hands and to become involved in water provision as well as the protection of water resources. (IHG)



A package containing Making water everybody's business, Dying wisdom, Water links-2 and the Water harvesting manual is available from CSE for a discounted price of USD 48.00

Slow Food Movement

http://www.slowfood.com

The association founded in Bra, Italy, in 1986 has grown into an international movement with more than 60,000 members in 35 countries on all continents. The manifesto of the movement states, “slow food is the avant-garde response to the fast life that has changed our lives and threatens the environment and the landscape in the name of productivity.” The website of the movement is packed with information on events, courses, publications and information on food and drink. Slow Food Editore, the publishing company of the movement, has two quarterly magazines: “Slowfood” on agroindustrial production and “Slowine” dedicated entirely to wine. The Ark of Taste and Slow Food Praesidia are two projects promoted by the movement to protect biodiversity and the right to taste. Information on these projects is posted on the website. Membership can be obtained by on-line registration.

Centre for Environment and Society, University of Essex, UK

www2.essex.ac.uk/ces

The CES is a trans-disciplinary research centre located in the Department of Biological Sciences at the University of Essex. It is engaged in a wide range of basic, applied and action-oriented environmental research, capacity development, teaching and training, and outreach through publications and seminars. Its web site contains some interesting reports on the ongoing research programmes, amongst others on: Sustainable agriculture; Externalities – the real costs; Sustainable development for local economies; and Community participation. There is also interesting reading on conferences dealing with sustainable agriculture and local economies, e.g. Pretty, 1998. Taking back the middle for local economies.

Food Security Resource Centre of the Institute for Agriculture and Trade Policy

http://www.iatp.org/foodsec/

On this site you will find an events calendar, organisational listings, a full text document library and on-line discussions on a variety of issues including: food security, food safety, the industrialisation of agriculture, the World Food Summit, US agriculture policy and upcoming negotiations on agriculture at the WTO. This is an interactive website, which allows you to instantly add your events, contact information or even upload documents to the library.

Focus on the Global South

http://www.focusweb.org

As reflected in its name, Focus on the Global South directs its attention on addressing issues that affect the whole South, in four thematic areas: economic and financial liberalisation; security and conflict; state, market and civil society; culture and globalisation. Interesting publications on globalisation - bulletins, books and articles - can be accessed through this website.

International Forum on Globalisation

http://www.ifg.org

The International Forum on Globalisation (IFG) is an alliance of more than sixty leading activists, scholars, researchers and writers formed to stimulate new thinking, joint activity, and public education in response to economic globalisation. The website provides contact information of IFG associates, allows access to many relevant publications, gives an overview of upcoming events. Interesting links are available for those who wish to get more information on certain topics or like-minded organisations.

World Bank - environmentally and socially sustainable development

http://www-esd.worldbank.org

This address gets you straight to the World bank’s site that deals with environmentally and socially sustainable development. The pages on Rural Development and Agriculture provide access to information on issues related to globalisation at the policy level. It also allows you to follow the electronic discussion on “Agricultural Trade and the World Trade Organisation” being conducted from June 10 to August 10, the findings of which will be taken to the next WTO Ministerial meeting in Qatar in November 2001. The e-discussion aims to provide wide consultations with public and private stakeholders in both developed and developing countries on emerging trade issues from a development perspective. Join the discussion by sending a blank e-mail to join-ag-trade@lists.worldbank.org, give your opinion and get involved.

Centre for Alternative Agricultural Media CAAM

http://www.farmedia.org

CAAM, the Centre for Alternative Agricultural Media, is a non-governmental organisation in India working towards a farmer friendly communication system. More detailed information on the many activities of the organisation which include writing for farmers, self-help journalism etc. can be found on the website. Interesting cases of farmers developing alternatives to modern agriculture, written from the farmers’ point of view, are posed on the site. CAAM-net is the electronic bulletin of the centre, which is sent out to a network of friends and professionals concerned with pro-farmer communication efforts. You can subscribe to the bulletin by sending an e-mail to caam@vsnl.net with “subscribe” as the subject.

Research Foundation for Science, Technology & Ecology

www.vshiva.net

This Indian based organisation, founded and headed by Vandana Shiva, works on biodiversity conservation and farmers’ rights. The organisation is a strong proponent of the grassroots ‘localisation’ movement, the countervailing citizens’ agenda for protecting the environment and people’s survival and livelihood from economic and political ‘globalisation’. Among its programmes are:

- **Navdanya,** is its main programme on the conservation of biodiversity. It places the farmer at the centre of conservation and empowers her/him to take control over the political, ecological and economic aspects of agriculture.
- **Diverse Women for Diversity**, one of the latest programmes, seeks to herald a global campaign of women on biodiversity, cultural diversity and food security. It seeks to strengthen women’s grassroots movements and provide women with a common international platform to air their views on globalisation, emergency of genetic engineering and patents on life forms.
- **Lok Swaraj Movement** to assert people’s sovereignty over decisions and resources that affect their lives and livelihood – food, seed, land, water and the commons and to save the country being hijacked by a new form of colonialism. **No patents on life, Monsanto quit India** and **Global campaign against biopiracy** are among the many campaigns organised by RFSTE.

There is also information on publications by Vandana Shiva and others. Shiva’s latest publication: **Stolen harvest: the hijacking of the global food supply** (p 30), however, is not included yet. Several interesting articles on economic and political globalisation can be down loaded. RFSTE also publishes a hardcopy magazine, **Bija the seed, a quarterly monitor on Biodiversity, Biotechnology**

and Intellectual Property Rights. Although this magazine has a strong focus on India, it provides interesting background information for other people involved in the anti-globalisation movement as well.

RFSTE, A60, Hauz Khas, New Delhi – 110016, India. Phone: +91 11 6868077; Fax: +91 11 6856795; Email: vshiva@giasdl01.vsnl.net.in ; http://www.vshiva.net

Institute for Food and Development Policy - Food first

http://www.foodfirst.org

For 25 years, the Institute for Food and Development Policy - known as Food First - has been committed to establishing food as a basic human right. As a progressive think tank, it has impacted many people through publications, workshops and courses, and involvement in activist coalitions. Food first's stand against globalisation and trade liberalisation is firm and uncompromising. The well-organised website provides access to many of the organisation's reports, papers, fact sheets and backgrounders, which are a must for anyone interested in knowing how real change is being effected, both in individuals and government policies.

Essential Information

http://www.essential.org

Essential Information is an NGO set up in 1982 with the purpose of getting citizens more active in their communities. Under the banner, "Essential information, encouraging activism", the website provides information to meet this objective. The Multinational Resource Centre, within Essential Information, provides free information to activists, environmental and consumer groups, and other interested parties in Southern countries, who find themselves increasingly exploited by the abuses of multinational corporations. If you need free information on any multinational company that is operating in your city, region or country, then contact MRC by e-mail mrc@essential.org Skillshare is a project of MRC that sets up meetings between activists and experts from the South and the North to help build the capacity of Southern NGOs to take action on incineration, toxics and waste management issues. More information on this initiative can also be obtained on the e-mail address given above.

International Society for Ecology and Culture (ISEC)

http://www.isec.org.uk

ISEC is a non-profit organisation concerned with the protection of both biological and cultural diversity. Its emphasis is on education for action: moving beyond single issues to look at the more fundamental processes that influence and shape our lives. ISEC has worked in more than 12 countries, from the UK and the USA to Thailand and Bhutan. Its programme in Ladakh, India, which started in 1975, has won international recognition for countering the negative effects of globalisation (see page 20). ISEC supports community initiatives to rebuild self-reliance and self-respect; is involved in local, national and international networking and campaigning to strengthen the localisation and anti-globalisation movement; produces books, reports, films and holds conferences to promote locally-based alternatives to the global consumer culture.

Roots of change, one of its programmes, is a guided group self-study on how globalisation is affecting the own local community and other communities around the world and on what strategies can be developed for effective local action.

Publications strongly recommended by ISEC are:

- **Bringing the food economy home: the social, ecological and economic benefits of local food** by Helena Norberg-Hodge, Todd Merrifield and Steven Gorelick ISEC, 2000, US$7.00 It reveals that the globalisation of food is not only undermining farmers and damaging the environment, but also is posing a real threat to human health, food security, local economies and, ultimately, consumers.
- **Small is beautiful – big is subsidised** by Steven Gorelick. ISEC, 1998, US$6.00 It shows how taxpayers' money is used to promote an ever larger scale of economies. Using numerous examples and astonishing statistics, the author demonstrates how the global economy along with the infrastructures it necessitates is a key factor in the increase in a whole range of environmental and social problems – from climate change to the erosion of community.
- **From the ground up: rethinking industrial agriculture** (new edition) by Helena Norberg-Hodge, Peter Goering and John Page. ISEC and Zed Books 2000, see page 30.

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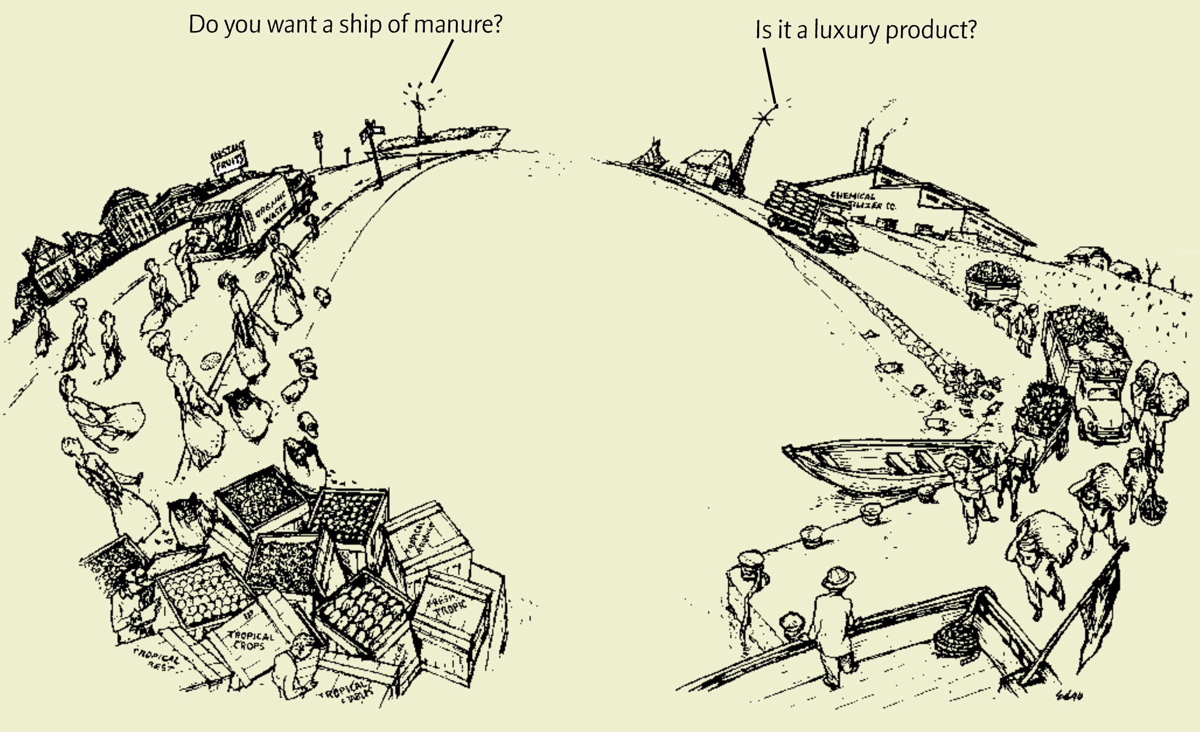


Agricultural trade in times of globalisation - workshop proceedings and papers

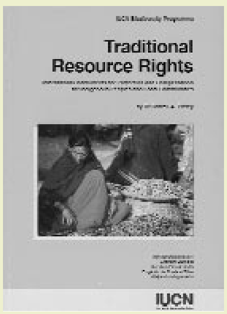
by Silke Spielman (ed).2000. 65pg.ISBN 3-9805354-7-9. BUKO Agrocoordination, Nernstweg 32-34, D-22765 Hamburg, Germany/ bukoagrar@aol.com Website www.bukoagrar.de

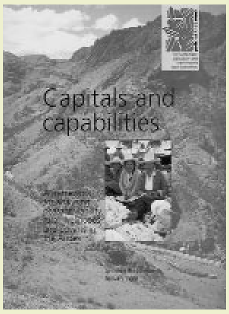
On the invitation of the BUKO Agro Coordination of German developmental action groups, more than 40 representatives of NGOs, farmers organisations, trade unions, churches, and other social movements from all over the world met near Hamburg in October 1999 to discuss "Agricultural trade in times of globalisation". Having discussed a broad range of themes, which are documented as reports from working groups, the participants agreed that agriculture is not just another sector of economic production, but a way of life, which has to be dealt with differently than industrial production and services. Regional development, fair trade, eco-labelling, food sovereignty, national agricultural policies and the WTO are some of the themes. The resolution adopted by the participants for the Third WTO Ministerial in Seattle is found as an annex to the report. It states that they will work together using different ways of influencing the WTO and develop stronger cooperation between farmers, workers, NGOs and other social groups for protecting food security. Although the report is primarily for the participants, its contents could be interesting and inspiring to those involved in trade and development issues. (CW)

Traditional Resource Rights - International instruments for protection and compensation for indigenous peoples and local communities

by Posey D.A.1996. 221 pg. ISBN 2 8317 0355 7 IUCN Gland, Switzerland and Cambridge, UK. Copies available from IUCN Publications Services Unit, 219c Huntington Road, Cambridge CB3 0DL, UK.

Although the UN Convention on Biodiversity recognises the role of indigenous peoples and local communities in enhancing and maintaining biodiversity, it does not provide specific mechanisms to protect their rights to genetic materials, knowledge and technologies. The Traditional Resource Rights (TRR) concept presented in this book is proposed as a guide to the development of *sui generis* (new and unique) systems for protection and compensation of indigenous and traditional peoples for their knowledge, technologies and biological resources. The book provides a detailed overview of a series of International Instruments with the intention of identifying existing support for protection of indigenous peoples and local communities. Key principles are identified across major agreements and declarations. TRR are viewed in the light of guiding efforts to harmonise human rights with trade, development and environmental laws, initiatives and policies. (CW)





Capitals and capabilities - a framework for analysing peasant ability, rural livelihoods and poverty on the Andes

by Bebbington A., 1999. 54pg ISSN 1561-1256 International Institute for Environment and Development IIED, 3 Endsleigh Street, London WC1H 0DD, UK. E-mail bookshop@iied.org

This paper is one of several which provide the contextual and conceptual background to "Policies that work for sustainable agriculture and regenerating rural economies", a collaborative research undertaken by IIED's Sustainable Agriculture and Rural Livelihoods Programme. The paper discusses the limitations to the current debates on the rural sector in Latin America, which have led many to question the future viability of peasant livelihoods in the Andes. It attempts to build a framework that approaches rural livelihoods and poverty without automatically linking its analysis to agriculture and natural resources. The framework looks at resources from a much wider perspective and considers five types of "capital" assets - produced, human, natural, social and cultural capital. Assets, or capitals in this framework, are not merely means through which people make a living, but give meaning to life. They are not simply resources that people use in building livelihoods, but are assets that give them the capability to be and to act. Access is seen as a critical resource that enables people to build sustainable, poverty alleviating rural livelihoods. Particular attention is paid to social capital as an asset through which people are able to widen their access to resources and other actors. (CW)

The subsistence perspective - beyond the globalised economy

by Mies M. and Bennholdt-Thomsen V., 1999. 246 pg ISBN 1 85649 776 3 GBP15.95 Zed Books Ltd., 7 Cynthia Street, London N1 9JF, UK.

The book begins with a conversation that took place between Hillary Clinton, the then First Lady of the US, and a group of women in Bangladesh. Ms. Clinton's intention was to find out for herself whether the success stories of the Grameen Bank projects were true. In the course of the interview she found out that indeed the women were empowered - they had an income of their own, some assets in the form of cows, chickens or ducks, and their children went to school. But when it was Ms. Clinton's turn to answer the very same questions, the women concluded that Ms. Clinton was not empowered - she had no cow, no income of her own and only one child. This story somehow embeds the radical alternative to the current globalised, free market industrial system posed in this unique book - a new economics and politics based on a subsistence perspective. The authors explain subsistence as empowerment based on peoples' own strength and cooperation with each other and with nature. Rather than the endless accumulation of wealth, the aim of the subsistence perspective is happiness, quality of life and human dignity. The arguments in the book together with the cases are convincing evidence that real development only works when it is done from the bottom-up. An insightful book that gives food for thought and action. (CW)

Villages for the future: crops, jobs and livelihood

by D. Virchow and J. von Braun (Eds), 2001. Springer (forthcoming).

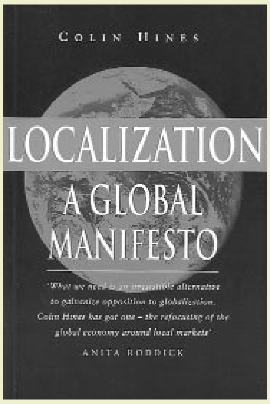
This publication focuses attention on the problems and the opportunities of rural areas worldwide at a time when globalisation impacts deeply on them. It is based on papers presented at the Global Dialogue: "The Role of the Village in the 21st Century: Crops, Jobs and Livelihood" in Hannover at the World Exposition in August 2000. The selection of articles ranges from scientific papers analysing particular issues of rural development to short reports from practitioners describing examples of sustainable solutions for the rural populations in different regions of the world. The contributions are grouped a round four major themes, which can be seen as starting points for further debate:

- political and institutional frameworks to foster rural development;
- natural resources management and related actions;
- broadening the technological base of rural economies;
- improved linkages between urban and rural areas.

The overall message of the contributions is unanimous: there is a promising future for the rural areas worldwide, if adequate policies can be enforced and more efficient and fair institutions can be created.

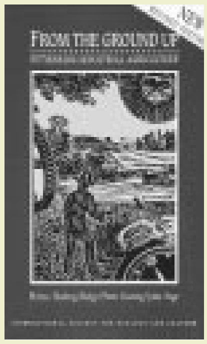
World Development Report 2000/2001: Attacking poverty. World Bank 2000. Oxford University Press ISBN 0-19-521129-4 paperback. Email: books@worldbank.org; www.worldbank.org
The World Bank's vision on rural poverty, the causes and a framework for action: promoting opportunity, facilitating empowerment, and enhancing security – with actions at local, national, and global levels. Actions should be site specific, as illustrated by many case study boxes. The publication contains many references and world development indicators. An impressive publication with many good arguments, but lacking an analysis of what economic transition and economic, political and cultural globalisation is doing to urban and rural people. Therefore, doubts can be raised as to what extent the vision presented in this publication will contribute to end poverty (CR).

Localization - a global manifesto by Hines C., 2000. 290 pg GBP 10.99 ISBN 1 85383 612 5 Earthscan Publications Ltd., 120 Pentonville Road, London, N1 9JN, UK. E-mail: earthinfo@earthscan.co.uk
"To protect the local, globally" is the alternative to globalisation that this book very passionately promotes. The book is laid out in 3 parts. The first "The Problem - Globalisation" examines the downsides of globalisation and provides a brief history of trade. Part 2 "The solution - localisation" looks at localisation as something done by people, not as something done to them and discusses the potential advantages of the local. It also considers in detail what is required to build sustainable communities. The seven chapters of this part are dedicated to seven basic steps to be introduced in making the transition towards localisation. Re-introduction of protective safeguards to rebuild local economies localising production and dismantling transnational companies, localising capital, a localist competition policy, taxes for localisation are some of them. Part 3 "How localisation might come about" looks at the different entry points to be taken in making localisation a reality and is detailed in 8 chapters. The book concludes, controversially, on the note that localisation will bale out the market and calls all those interested to join hands under the banner, "Localists of the world unite - there is an alternative" (CW)



Taking back the middle for local economies by Jules Pretty, 1998. http://www2.essex.ac.uk/ces
An article on the principles and characteristics of local economies and local food systems. Examples are mainly from the UK.

From the ground up - rethinking industrial agriculture by Norberg-Hodge H., Goering P. and Page J. 2001 New revised edition 118 pg. ISBN 1 85649 994 4 Zed Books Ltd., 7 Cynthia Street, London N1 9JF, UK in association with International Society for Ecology and Culture, a charitable organisation based in Devon, UK and Berkeley, USA.



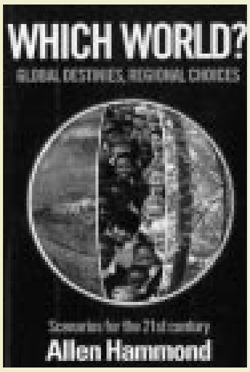
The introduction to the book " From global to local - sowing the seeds of community" gives in a nutshell the essence of its contents. It outlines the global industrial food system, globalisation, free trade and genetically modified organisms and points out the damage in terms of the loss of biological diversity, increased poverty as farmers get pushed out of their livelihoods, and the general decline in agriculture. Having described this rather depressing state of global agriculture, the author brings back hope by showing how people have begun to resist these trends and revert back to what is called the "local food movement". The two parts of the book that follow take up the same discussion, but then in detail. The first, "Industrial agriculture: broken promises" discusses the negative impacts of many aspects such as hybrid seeds, chemical fertilisers, pesticides, mechanisation and biotechnology. The second part, "The new agriculture: back to basics" shows how a move towards more ecological agricultural practices could undo the damage - social, economic and environmental - done by industrial agriculture. Written in simple terms and an easy-to-read style, the book communicates the urgent need for re-thinking industrial agriculture, clearly and without compromise. (CW)

International trade in agricultural commodities - liberalization and its implications for development and poverty reduction in the ACP states, Policy series 5 by Coote C., Gordon A., Marter A., 2000. 79pg. ISBN 0 85954 518 0: GBP5.00. Natural Resources Institute, University of Greenwich, UK. Copies can be obtained from: NRI Catalogue Services, CAB International, Wallingford, Oxon OX10 8DE, UK quoting EP 5.
One in a series that deals with current policy issues of importance to developing countries and countries in transition, this publication focuses on international agricultural trade and developing countries, particularly the ACP (African, Caribbean and Pacific) countries. It aims to provide guidance on ways to make trade policy more pro-poor and builds up the case in four sections. The first section looks at trade liberalisation and poverty. The second gives an analysis of how ACP countries participate in trade and how it effects poverty, livelihoods, gender and the environment. Section 3 looks at ways of increasing ACP participation and benefits from trade, which includes a section on EU trade and development policies. The concluding section provides recommendations for enabling the poor to benefit from agricultural trade. They are grouped into: international action to help developing countries to get the best deal from trade liberalisation; targeting the export sector in developing countries without overlooking the importance of the food sector in its own right; focused interventions to ensure that the poor benefit from improved opportunities for trade. (CW)

Stolen Harvest - the hijacking of the global food supply by Shiva V. 2000 146pg. ISBN 0 89608 607 0 South End Press, 7 Brookline Street 1, Cambridge, MA 02139-4146, USA
This book by well-known author and environmental activist Vandana Shiva describes the negative impacts of globalised industrial agriculture on small farmers, the environment and the food we eat. In each of the first six chapters, the author talks about the many losses that people face due to globalised agriculture - food security, biodiversity, environmental destruction, loss of control and values etc. All arguments in the book are substantially supported with examples from India, but the case made by the author goes beyond India to people the world over who are affected by corporate-controlled agriculture. In the last chapter, "Reclaiming food democracy", the author talks about public action against these destructive modern trends, challenging people to work towards claiming food freedom in their everyday lives. Written with passion and commitment, the book will not only shock you into reality it will also stimulate you to exercise your rights in reclaiming food democracy. (CW)

Which world? Scenarios for the 21st century - global destinies, regional choices by Hammond A., 1998. 306pg GBP 18.99 ISBN 1 85383 582 X Earthscan publications Ltd., 120 Pentonville Road, London, N1 9JN, UK. E-mail earthinfo@earthscan.co.uk

This book is about the future - an attempt to look at the world in the year 2025 or 2050. It is one of the results of the 2050 Project - a study organised by three major research organisations to consider demographic, economic, technological, environmental, social, cultural, political and other factors that may determine the future of the planet. It also draws on the vast experience of the author in studying global trends. The book constructs three possible scenarios of three altogether different visions of the world - a Market World in which current patterns continue; a Fortress World that reflects fundamental but undesirable social change; and a Transformed World that reflects fundamental and desirable social change. The book also analyses critical long-term trends that would shape the future of the world - demographic, economic, technological, environmental, social, political etc. Considering that global destiny is dependent on regional choices, the book discusses several crucial regional choices that would determine whether the world will become peaceful and prosperous or polluted, impoverished, and violent. In closing the author suggests that both optimistic and pessimistic futures will be fully within the range of possibility, given the present long-term trends. He believes that the outcome will depend on the choices human societies make in the coming decades. Yet, on a more personal note, the author is reasonably optimistic that the outcome will be closer to the Transformed World vision and cites some examples that he hopes will stimulate further thought and action. Readers are also invited to join the on-line discussion on this topic at www.hf.caltech.edu/WhichWorld and share their views. (CW)



The case against the global economy & for turn towards localization edited by Edward Goldsmith & Jerry Mander, July 2001. Earthscan, 120 Pentonville Road, London N1 9JN, UK. ISBN 0 85383 742 3, 336 pp. 14.95 (paperback). Orders@lbsltd.co.uk or www.eartscan.co.uk

The new and fully revised British edition explores the greatest political debate of our time: the blind rush towards a single global economy and its devastating consequences on employment, poverty, democracy, human rights, cultural diversity, and the natural world that sustains us. Twenty four leading economic, political, agricultural, and environmental scholars and activists, fourteen of whom are members of the International Forum on Globalisation, argue that free trade and globalisation are producing precisely the opposite effects to those promised. With 70% of global trade controlled by just 500 corporations, only a radical change in direction towards local economy, democracy and self-sufficiency can assure human welfare and prevent environmental and climatic catastrophe.

Beyond Malthus - Nineteen dimensions of the population challenge by Brown L., Gardner G. and Halweil B. 2000. 168 pg. GBP12.95 ISBN 1 85383 656 7 Earthsacn Publications Ltd., 120 Pentonville Road, London, N1 9JN, UK. E-mail earthinfo@earthscan.co.uk

200 years after Malthus' legendary essay on population, the world population has exceeded the 6 billion mark. The earth is more crowded today than ever before. A number of limits to sustainability are being surpassed, or are about to be. This book looks at the consequences of population growth on 19 dimensions of human life - environmental and social. Grain production, fresh water, forests, biodiversity, cropland, housing, jobs, climate change and waste, are some of them. It talks about “demographic fatigue” - the growing inability of poor governments with burgeoning populations to cope with new threats to society. It calls for population stabilisation by intelligent and human social and economic policies and suggests some options like debt relief, family planning assistance to those who lack access, educating young people on the benefits of smaller, more sustainable family units etc.(CW)

Genetically modified crops out of control, organic agriculture threatened

The organic industry in the US is in a crisis. Contamination of organic products, namely maize, soybean and canola, by genetically engineered (GE) crops is being reported consistently. Not only is there evidence of organic products being contaminated, but the very seed stock organic farmers depend upon is now also contaminated. There may not even be enough clean organic seeds of some crops, such as maize, for this planting season. For example, 77 of the 281 seed companies in the US found their maize seed to be contaminated with the genes of Starlink GE maize, which is approved for animal consumption only. A further 68 seed companies are still awaiting the results of their tests. Not surprisingly, this contamination found its way into the human food chain and caused the withdrawal from the market of over 300 products.

The issue of seed contamination strikes the heart of organic standards. Organic standards of the EU and IFOAM, and many others, are quite clear when they state that GE crops must not be used in organic production systems. GE crops are still not permitted for general cultivation in most parts of the world. However, in countries where GE crops have been given free access, the situation could be as serious as in the US. To put a halt to further use of genetically engineered crops, IFOAM has asked for an immediate ban of genetic engineering in agriculture.

ILEIA fully supports all attempts to stop genetic pollution, as this will not only affect organic crops but also conventional crops and their wild relatives. For consumers, this may mean that it will become impossible to obtain GE free products from these crops.

Stop genetic engineering!

“IFOAM calls on governments and regulatory agencies throughout the world to immediately ban the use of genetic engineering in agriculture and food production, while there is still a chance to stop this unwanted pollution. IFOAM further holds genetic engineering industries responsible for the damage they have inflicted on organic farmers. Governments are therefore urged to pass legislation that makes GE companies liable for all genetic pollution caused by the products they own.”

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Governance in international agricultural research – time for change

Participatory breeding of crops valuable to small farmers in marginal areas of the tropics is not the mainstream research activity of the sixteen research centres in the Consultative Group on International Agricultural Research (CGIAR). With some exceptions in the form of model projects, the research conducted by the centres is focused on Green Revolution agriculture with biotechnology included recently. Small farmers have benefitted little from this approach as they have different needs and apparently do not see its relevance to increase food production. If research priority setting would be done at regional level, and if regional cooperation and participation of small farmers would become a more basic organisational principle, the poor in these areas could probably benefit more from international agricultural research than they did in the past three decades. Many Civil Society Organisations (CSOs) therefore call for regionalisation of agricultural research.

Although the CGIAR has made certain politically important moves, notably by putting its genebanks under the auspices of FAO, by supporting action against biopiracy and by rejecting the Terminator technology, they have not looked into the negative aspects of Green Revolution agriculture. With pressure increasing after the UNCED in Rio in 1992, a "Renewal" was launched, and at the end of the 1990s, a "System Review" questioned the whole CGIAR system. But few changes have resulted.

To increase the relevance of its research to small farmers, the CGIAR took the initiative of organising the Global Forum on Agricultural Research (GFAR) in Dresden, Germany, 21-23 May 2000. Many CSOs as well as the world's largest organisation of small farmers, La Via Campesina, joined the meeting in a sceptical but constructive mood. The rare opportunity to discuss on equal level with scientists from formal research organisations was considered valuable. They were somewhat sobered when their distinctly different position, especially on modern biotechnologies, was levelled out in a Global Vision, and their offers to collaborate were hardly noticed. However, they backed the idea to have Regional Fora and a Global Forum, where research priorities were to be set, and opted for including development issues in the Fora (1).

A year later, in May 2001, "Change" was on the agenda of the CGIAR biannual meeting of its members, the Northern donor governments and foundations, and a number of Southern governments. Yet, the decisions taken in Durban, South Africa, point to more centralisation, not regionalisation. Part of the future research was to be organised around "Challenge Programmes". And new topics were presented - the impact of climate change on agriculture; water management; and the impact of disease on livestock production and trade – in order to attract new funding, even before a priority setting process was carried out in the regions.

More centralisation is likely to come from the three other structural decisions:

- To abolish one of the two annual CGIAR member meetings, and to establish an Executive Council administered from the World Bank, Washington. The Interim Executive Council consists of a limited number of "shareholders" (CGIAR/GFAR terminology for donors), and representatives of Centres, GFAR, industry and NGOs. Small farmer organisations (SFOs) do not have a seat. The rest of the donors may come as observers, making the poorer South less likely to afford attendance at the foreseen two to three yearly meetings.
- To abolish the FAO-based Technical Advisory Committee, which had a budgetary say and carried out strategic research planning and impact assessment. These functions will most likely be attached to the Executive Council. The functions of the new FAO-based Science Council are under consideration; in the worst case, they may be limited to peer reviewing.
- To increase power to Washington with a new System Office that provides services to the Centres, especially for public awareness and fundraising. The existing CGIAR Secretariat will probably be integrated into this Office.

CSOs presented their ideas on a regionalised agricultural research system, where the role of the CGIAR would be catalytic (2, 3). This was strongly supported not only by the regional research organisations, but also from many donors. Regional priority setting is important to the CGIAR and its donors. But, the GFAR chair R.K. Paroda could report only very slow progress. Broadening the participation from national agricultural research institutes to include other "stakeholders" (CGIAR/GFAR terminology for constituencies), like farmer organisations and NGOs seems to be especially difficult. The CSO regional contact persons who were nominated in Dresden have been only marginally involved. In Central America, two parallel processes are developing: La Via Campesina and the NGO Committee have started regional priority setting by SFOs and NGOs, in addition to the Regional Forum. The GFAR has announced its readiness to integrate the two.

Participation of CSOs at the final CGIAR Mid-Term Meeting in Durban was higher than ever before. The NGO Committee of the CGIAR, after arranging an electronic conference early this year, held an international CSO/SFO workshop in Frankfurt, Germany, that produced a "CSO Declaration for Durban" signed by eighty CSOs (2). An African NGO workshop in Durban, likewise organised by the NGO Committee, supported the issue with a declaration and a press statement; many of the 40 participants were active during the Mid-Term Meeting. The Canadian-based RAFI and the German NGO "Forum Environment and Development" presented a joint paper (3) and commented on the Durban decisions when the meeting ended. CSOs will continue to advocate for the regionalisation of the CGIAR in preparation of the International Centres' Week (renamed the Annual General Meeting) in October 2001.

■

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1 - German NGO Forum Environment & Development: **Food For All – Farmers First In Research**. International Workshop of Non-Government and Small Farmer Organisations on Research for Poverty Alleviation, Dresden, Germany, 19-20 May 2000. Workshop report, Bonn, Germany, October 2000. An NGO report on GFAR 2000 is included.

2 - A respective CSO Declaration for Durban signed by more than eighty CSOs was distributed together with a statement of African NGOs.

3 - **In Search of Firmer Ground**, RAFI Occasional Paper, 19 October 2000; RAFI and German NGO Forum Environment and Development: **In Search of *Common* Ground II. CDMT - Can Dinosaurs Make Teammates?** May 2001.

Farming economically to revitalise agriculture

Jan Douwe van der Ploeg

Many of the attempts to revitalise agriculture in Europe and to create sustainable rural livelihoods involve a shift away from agriculture's traditional 'core' activities - production of food and fibre. By means of diversification 'new' on-farm activities such as farm tourism, care and on-farm processing are introduced. These new rural development practices are often perceived as a 'rupture' with conventional farming practices (e.g. conversion to organic farming). However, a considerable proportion of the alternatives in rural development is emerging gradually from conventional agriculture. This will be illustrated by the example of dairy farming in the province of Fryslân in the Netherlands. Similar examples are found also in other agricultural categories, elsewhere in the country.

Farming styles

In the past four decades, farm development in Europe has been dominated by the modernisation paradigm. Continued scale increase and intensification was seen as the only viable type of farm development.

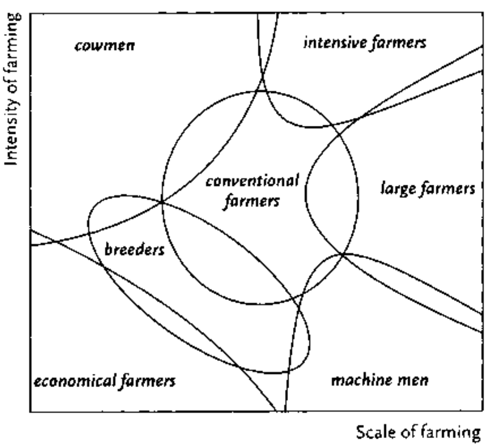

Figure 1. Farming styles in Friesian dairy farming

Several studies have pointed out that the homogenisation of agriculture - envisaged by modernisation policies – through the disappearance of 'non-viable' farms has not, in fact, occurred. Heterogeneity in farm type and structure is a persistent feature of European farming and the indications are that this diversity increased during the modernisation period. The patterns of heterogeneity in agriculture correspond to different farming styles (Van der Ploeg 1994), which are essentially the different strategies applied by farm households in respect of the markets, policies and technologies relevant to them. Figure 1 shows the different farming styles in Friesian dairy farming, they are arranged here according to scale and intensity of the farm enterprise.

Farming economically

Farming economically is the farming style that emerged as one of the most important alternatives and unexpected responses of Friesian dairy farmers to modernisation. Farming economically is basically a strategy to contain monetary costs as far as investments, loans and expenditure on external inputs are concerned. Farming economically, therefore, can be equated with 'low-external-input agriculture'. Central to this farming style is also the mobilisation, use, development and reproduction of internal resources.

In the heydays of modernisation (1960-1990), the strategy of farming economically enabled many farms to remain viable without entering into the logic of modernisation. Today, farming economically seems to have become the dominant style. It provides farming families with a way of countering the increasingly threatening situation of limited milk production quotas, decreasing prices, the high cost of land and milk quotas, and the obligation to farm in a more environmentally sound way.

An example: Hoeksma's farm

Together with his two sons, Taeke Hoeksma runs a farm that is a perfect example of farming economically. Compared to a reference group of some 80 dairy farms, this farm shows a wide range of differences. Taken in isolation each difference is small and may seem almost irrelevant. However, taken together the difference is significant. It should be noted that these individual differences are interconnected.

Veterinarian costs are low on Hoeksma's farm - Euro 38 compared to Euro 67 per cow per year. This is related to a lower milk yield - 6,449 kg compared to 7,526 kg per cow - and higher labour input, which means that more care is given to the animals. In turn, a lower milk yield reflects the fact that less industrial feed is used. One remarkable feature is the combination of high grassland production - 8,453 compared to 7,224 kVEM - and the relatively restricted use of fertiliser - 217 kg nitrogen per hectare compared to 300 kg indicating high levels of technical efficiency. The costs associated with hired labour are also low clearly reflecting the high labour input of Hoeksma and his sons.

As much as on the cost side, there are also remarkable differences on the benefit side. Because of the lower milk yield and the composition of feed and fodder, the fat and protein content of the milk produced on the Hoeksma farm is higher. Combined with a particular distribution of production over the year - winter milk gets a better price - this translates into a higher milk price. When additional revenues from the sale of heifers and cows are also included, the total revenue on Hoeksma's farm comes to Euro 39.41 per 100 kg milk compared to Euro 34.42 for the reference group. The surplus, after deducting all costs except those associated with labour, is Euro 11.12 compared to Euro 5.23. While the labour input on Hoeksma's farm is much higher, the 'nett margin' is the same implying that higher labour input is remunerated according to normal standards.

This concrete example enables us to better understand the concepts of the strategy of farming economically. Agricultural production is built on two resource flows (Van der Ploeg et al. 2000). The first flow refers to the mobilisation of resources through markets in the form of commodities, the second to the production and reproduction of resources within the farm.

Farming economically (low-external-input agriculture) could be specified as the search for the domination of the second, non-commoditised flow over the first, commoditised one. It also involves a search for a high level of technical efficiency - the ratio between the total output and the resources used - without entering too deeply into new chains of dependence, i.e. without enlarging the first flow of commoditised resources. In this way three elements emerge as decisive in the strategy of farming economically.

1. The overall degree of commoditisation is low.
2. The technical efficiency is high due to the centrality of both the quantity and quality of labour.
3. The socio-technical networks through which resources are mobilised contrast with markets as they are primarily based on non-commoditised relations.

All these elements can be found on Hoeksma's farm. Labour and craftsmanship play a central role. The use of external inputs including veterinarian services, hired labour, cattle feed, bought fodder, fertiliser, and animal purchases have been significantly minimised and contrast sharply with practices on farms in the reference group. At the same time the use of internal resources such as grassland and manure is geared to high levels of technical efficiency. In this respect, it is significant that several of the resources available have been developed and specified so they fit within the overall strategy. Hoeksma, for example, uses traditional Friesian cattle rather than the widely used Holsteins. It is also significant that he and his sons participate in several nature conservation and landscape management schemes.

Relevance of farming economically

Modernised farming with scale increases and farming economically at farm level can both lead to a reduction in cost price. Their effects on rural development in the wider sense, however, are very different (see Table 1).

Farming economically generates more income and employment through decreased dependence on external resources that have to be mobilised through the market, and higher levels of technical efficiency. In addition it is a strong response to deteriorating market conditions and may provide an adequate line of defence to further squeezes that result from the forces of liberalisation and globalisation. Therefore, farming economically is an effective way of reproducing farming over time and one that has shown itself to be highly competitive. Because of the strategy of farming economically, more farms - and therefore employment and income opportunities - have been retained in the countryside and this has contributed to its liveability and social cohesion.

The impact of farming economically on rural development, however, goes beyond strict economic parameters. In environmental terms, it tends to be more sustainable than other farming styles. Several studies have pointed out that economical farming results in relatively low levels of nitrogen loss and that further reduction is in line with their farming strategy. Ecological sustainability and economic efficiency do not necessarily run counter to each other. The two can coincide and strengthen each other within the 'low-external-input' strategy of farming economically.

Starting point for rural development

Farming economically developed historically as a multi-purpose use of resources. Economical farmers worked to secure small benefits wherever possible and together these contributed in generating a viable farm income. In the changing context of rural development, continuous adaptation through small steps for risk avoidance appears to be one of the greatest potentials of the style of farming economically. National surveys indicate that the rate at which economical farmers enter new rural development activities such as nature and landscape management is relatively high, 34% compared to 15% for large farmers. Similar differences emerge when other activities such as organic farming, direct sales, multiple activity or mixed farming are discussed. Farming economically appears to offer a viable starting point and reservoir for diversification into other fields of rural development. Several features of this particular farming style, such as its high labour input, the incidence of surplus labour, independence from external inputs and relatively low stocking densities, result in more flexibility when it comes to the opportunity of taking up new rural development activities. Other farming styles – especially those of large and intensive farmers – are much less flexible.

'Protected spaces' needed

Despite the potential for rural development, the prospects for farming economically are somewhat contradictory. As a farming style it runs counter to the dominant 'technological regime'. The interrelated whole of (new) technologies, prescriptions, laws and regulations (especially generic legislation to reduce pollution) and knowledge stocks, for example is evolving in such a way that any room for manoeuvre that may have been available for the economical farmers is being progressively reduced. The Dutch agro-expert system that, for a variety of reasons, focuses strongly on economies of scale plays a crucial role in this process.

The critical factor in the success of economical farmers and their institutional allies will be their ability to develop and consolidate what Iacoponi, Brunori and Rovai (1995) have called 'rural districts'. The rural district is a political, institutional or territorial space that provides the conditions necessary to stimulate strategic innovation and the development of appropriate farming systems. Only when such 'protected spaces' are created within the dominant 'technological regime' can the style of farming economically prosper and unfold further along the lines of rural development. The central question for rural development policies at supranational, national and regional level is whether or not they will contribute to the construction of such 'protected spaces'. Such an approach, I think, would be far more cost effective than a multitude of rural development subsidies.

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Based on: Ploeg JD, van der, 2000. **Revitalising agriculture: farming economically as starting ground for rural development.** *Sociologia Ruralis*, 40 (4) pp.497-511.

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See original article

Table 1: Comparison of the key features of farming economically and modernised farming

Farming economically	Modernised farming
1. Sustain and/or improve income levels by developing and recombining self-controlled resources	1. To sustain and/or improve income levels new resources are mobilised through markets
2. Flexible and multiple use of resources	2. Resource use and allocation is highly rigid
3. Step-by-step development of proportionate nature (built upon available resources)	3. Continuous scale-increase of disproportionate nature (dependent upon external resources)
4. High level of surplus per unit end-product	4. Low level of surplus per unit end-product
5. Tendency towards multipurpose enterprise	5. High degree of specialisation
6. Local innovativeness is central	6. Dependent on availability of new technologies
7. Step-by step changes, learning by doing	7. Pattern of 'turn-key' projects
8. Centrality of family labour and community networks	8. Pursues technological solutions and formal institutions
9. Can influence off-farm prices and be active in building markets	9. Off farm prices and markets are 'fixed' and are to be passively followed
10 Low level of external inputs, low financial costs	10. Labour is replaced by inputs and new technologies
11 Sustainability (to be) grounded on 6,8,10	11. Sustainability (to be) grounded in 7 and 8
12 Farming is (re)-connected to local ecosystems	12. Farming disconnected from local ecosystem
13 Relatively small resource base needed to generate acceptable income level	13. Relatively large resource base needed to generate acceptable income

Family agriculture and globalisation

Farmer organisations need tools to improve their strategic positioning in relation to local and global change. Photo: CIRAD

Bruno Losch

Family farms throughout the world play a central role in the production, processing and commercialisation of agriculture, and in natural resource management. Family agriculture is characterised by the special link between economic activities and the family structure, which affects the decision making process, the organisation of family labour, the choice of activities and the management of family wealth. Family farms are very diverse and operate in a variety of economic, social and ecological conditions. Family farmers can be landless, small-scale or large-scale; they could produce for home consumption and the local or international markets, and are increasingly involved in off-farm economic activities. Having to adapt to new conditions, frequently, has kept them innovative.

Since the eighties, family agriculture is being confronted with a rapidly changing economic, institutional and political environment. Several crucial economic reforms are taking place: structural adjustment, liberalisation and globalisation of trade and development of regional trade zones. These changes are accompanied by radical institutional reforms due to the withdrawal of state intervention leading to reduction of support services to farmers, reorganisation of production sectors, revision of land tenure legislation, decentralisation of administration and planning, etc. Farmers face international competition, the removal of price regulations and subsidies and the closure of national product boards. In most countries these reforms also bring political liberalisation that provides new space and opportunities to economic actors, local institutions, professional organisations, NGOs, and civil society in general, at local and national level. Family farmers and their organisations are forced to adapt to these changes. This

The African Farmers' Academy

The African Farmers' Academy (Upafa) has been created by the APM-Africa Network (Agricultures Paysannes et Modernisation) for strengthening the capacities of farmer organisations to better understand the rapid economic and institutional changes that are taking place, designing strategies that match the expectations and interests of their members with the opportunities and constraints of the new (inter)national market place and improving their skills to take part in consultations and negotiations. The CIRAD-TERA Family Agriculture programme is one of the partners in this project. In February 2001, Upafa started with the first module of an alternating training (combining training sessions and individual work on the participants' own organisation) course in Dakar, Senegal. 25 officials from national, regional and local, sub- and multi-sector based farmer organisations from 12 African countries are participating.

Six 15-day modules have been planned for the coming two years. The modules will focus on analysis of the evolution of the participants' local societies and developments in the national and international context (1), changes of the economic (2) and institutional (3) environment of agriculture; the positioning of farmers organisations in a changing world (4), the objectives and approaches of strategic planning (5) and strategic programming and negotiation (6). The second and third modules will be organised in Mbalmayo, Cameroun and Bohicon, Benin respectively.

The training will place emphasis on the participants' experiences and contributions, and will stimulate reflection and action. Each participant will draw up a professional project during the period of training in relation to his/her organisation. The diverse backgrounds of the participants will enable comparison of experiences and passionate discussion.

This initiative is supported by the French Ministry of Foreign Affairs and the Charles Leopold Meyer Foundation.

More information: Upafa, c/o Réseau APM-Afrique, BP 10008, Yaoundé, Cameroun. (237) 21 53 89, Fax : (237) 20 55 20, email : apm@camnet.cm means improving their skills to analyse the new situation, to develop new strategies, to plan and implement new activities, and to become effective players in the economic and political arena. Professional farmer organisations play an increasingly important role in rural development, taking over services previously provided by the State and engaging in economic and political negotiations.

The Family Agriculture programme of CIRAD

This programme is one of the 28 research programmes of CIRAD, a French governmental institution, which undertakes collaborative research to support agricultural and rural development in tropical countries. The programme has 4 main objectives:

- To analyse adaptation processes of family farmers and their organisations to the changing environment
- To identify technical, economic, organisational and institutional innovations that enable sustainable adaptation of the agricultural production/ processing units and services to the new context
- To study support structures that can give farmers more control over the processes of change, for example, strengthen farmer organisations to take part in consultations and negotiations.
- To strengthen farmers and their organisations to make better use of the opportunities created by the new economic, political and institutional environment.

The research programme follows three thematic lines:
The **first** focuses on the strategies of the actors and the way they take decisions. It deals with the diagnosis of the production units, their objectives, the changing environment and room for manoeuvre. It provides tools to improve diagnosis and decision making by local actors. Among the current projects are studies of the strategies and dynamics of farmers in the irrigated zone in Senegal and in the cotton-producing areas of Western and Central Africa, and the interactions between the climatic and economic risks in the technical choices made by farmers in Brazil and Mexico.

The **second** looks at farmer organisations, agricultural institutions and services. It deals with the reformulation of roles between the public and private sectors and the coordination of stakeholder action. Current projects include the collaborative research-action-education programme (see box p.25), support to the African Farmers' Academy (see box p.24), strengthening the role of farmer organisations in research and extension services in Western and Central Africa, helping farmers to improve cotton marketing in Mozambique, and creating a website on microfinance (http://www.cirad.fr/mcredit).

The **third** line is on value adding and marketing of agricultural products. It deals with analysis of the regional dynamics of production, processing and commercialisation, and ways to support rural agroindustry to improve the quality and commercialisation of local products. In this way it mobilises and strengthens local expertise and production systems. Some projects are: promotion of agrifood resources and culinary expertise in Africa, and assistance to the Latin American rural agribusiness network - PRODAR (www.prodar.org), consisting of 15 national networks of development organisations, research institutes, universities and producer organisations. PRODAR promotes rural enterprises in micro-regions – local agrifood systems – to improve the competitiveness and commercialisation of local products, for instance, *camu camu*, a fruit from the Amazon with a high content of vitamin C and *uña de gato* and *sangre de grado*, plants used as natural medicines.

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Farmer organisations deal with the challenge of globalisation

The collaborative research-action-education project 'Farmer organisations deal with the challenge of globalisation' finalised its first phase with an international workshop in Montpellier, France, in November 2000. It brought together the country programme coordinators from Ecuador, Chile, Peru, Uruguay, Senegal, Cameroon, Benin, Zimbabwe and China. Several organisations of farmers and indigenous people were involved in each country. This project is implemented with the networks RIAD (Red interamericana agricultura y democracia) in Latin America and APM-Africa with support from Charles Leopold Meyer Foundation and the French Ministry of Foreign Affairs.

The objective of the programme is to provide farmer organisations with methods and tools to improve their strategic positioning in relation to local and global change. The first phase focused on the analysis of the economic and institutional changes faced by family farmers in the past 15 years, how the farmer organisations perceived these changes and the activities developed by the organisations in response to the new challenges.

The workshop provided opportunity for comparison and reflection on the methodologies used and results obtained by the national and international teams, and formulation of the objectives, activities, methodologies and organisation of the second phase of the project.
It was concluded, among others, that the economic and institutional reform programmes in all countries are very similar in objectives, principles and orientation, though implemented differently. Farmer organisations, therefore, should not generalise the analysis of their situation nor develop uniform strategies. Each situation is different and has to be analysed thoroughly to understand what room for manoeuvre farmers and their organisations have.

In all countries, the economic production environment has become less stable and family farmers tend to respond with short-term strategies. The capacities of farmers to cope with the constraints and make use of the new opportunities created by the reforms differ largely. This causes further socio-economic stratification and competition for land, and sometimes for water. Agriculture in peri-urban zones and sectors of family agriculture not involved in export production are particularly vulnerable. Many family farmers do not have the resources to improve the competitiveness of their products. Thus, the search for competitiveness and the impoverishment of a large part of the rural population is increasing pressure on the natural resources and the employment situation.

The strategies developed by the organisations vary between technical/ institutional adaptation and efforts to change the rules of the economic and institutional games. Two main strategies in the first category are:

- Improvement of the competitiveness and profitability of agriculture and development of a support structure to reach this objective.
- Development of 'alternative agriculture', technically (sustainable agriculture, biodiversity, etc) as well as economically (direct relations between producers and consumers, fair trade, etc).

Sometimes both strategies are combined. In some instances funding agencies have a strong influence on the strategies followed.

In the second phase of the research-action-education programme the Latin American partners will focus on farmer organisations and democratisation (e.g. decentralisation of power, participation in policy making), farmer organisations and sustainable agriculture, food security and regional integration. The African partners will focus on the contribution of farmer organisations to development of a culture of peace for prevention and mediation of conflicts, coordination of farmer organisations at regional and national level, and rural development programmes implemented by farmer organisations with a sectoral and territorial focus.

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SAT tutors and students merging indigenous and scientific agricultural knowledge. Photo: Pascal Molineaux

Strengthening Local Economies and Community Identity

Pascal Molineaux

All over the world, the increasing force of social and economic globalisation has undoubtedly been a phenomenon of great impact in the community-sustaining network of human relations during the last decade. Numerous studies demonstrate how human relations inspired in an essentially competitive spirit with market oriented values - actively promoted by global enterprises whose only goal is short-term maximisation of economic profits - are penetrating into the social and cultural value systems of people, displacing traditional values and eroding essential community-based identity structures.

Historically, the human being has always had a deep-rooted communal identity. Constructed through a complex network of interdependent human relations, based on common beliefs and value systems, trust built through social interactions, a common history and spontaneous solidarity, this identity until very recently still gave orientation and purpose to life. A child grew – and should continue to do so – embedded in and protected by a nuclear family, itself within an extended family in which cousins, uncles and grandparents play a fundamental role, and a healthy community of neighbours and friends. It is in these three social contexts – of the close family members, distant family members and community – that the child develops a sense of belonging, a sense of identity and purpose in life. These, each in their own particular way, serve to educate and guide the child through life.

Organisation and knowledge - cornerstones of education

It is in this context that FUNDAEC's (Foundation for the Application and Teaching of the Sciences) grass roots experience in strengthening local economies and community identity can be analysed. Fundamentally, this experience is centred in the creation and evolution of locally based learning institutions and economically oriented structures that belong, in a true sense, to the local communities themselves. Organisation and knowledge are considered by FUNDAEC as the two main elements needed for people to take charge of their own development and interact as equals with the outside world. The learning institution that evolved in the pursuit of achieving this purpose through education is called the Rural University. It is a community-based system for the development of human resources. The Rural University sets in motion a series of learning processes in which the knowledge generated by rural people helps to create and increase the forces necessary to resist social disintegration and, eventually, to achieve positive change.

Tutorial Learning System (SAT)

The Tutorial Learning System (SAT in Spanish) is a high school equivalent curriculum embedded in the reality and needs of rural life. It is now approved by the Ministry of Education in Colombia and has close to 40,000 students in Colombia and another 2,000 in seven other countries. It offers an interesting experience in the creation of a locally rooted (and relevant!)

educational system connected to a national – and now international – movement of NGOs, public institutions and communities. The local SAT groups, of 15-20 students, guided by a trained tutor from the same community, have demonstrated their potential, as they apply the service oriented principles and concrete knowledge gained through the study of the SAT texts, to become active groups in the strengthening of a community identity. Their activities – which reflect an enormous diversity – cover educational activities with younger children, environmental activities, education, artistic, cultural and sporting events – and directly or indirectly foment a sense of community, of belonging. These activities have shown a great potential, especially among the participants and other youth in the community, in developing a sense of worth, a sense that rural, community based life is possible. This is remarkable in the context of a country known for its high rate of violence and insecurity, accelerating an already high rate of rural outmigration. No doubt, such a feat is, in each local context, a much-needed contribution to peace and understanding.

Moreover, the SAT educational movement strives to connect the participating students and institutions – now close to 50 NGOs and public institutions in Colombia alone – to the reality of a world advancing towards greater levels of unity. Achieving this, which is at once the promise and challenge of globalisation, we believe, can only be done, if the local, regional and national identities and value systems are strengthened and recognised. If not, globalisation will continue to cause havoc in the local economies, traditional value systems and community rooted identity, as it has been doing everywhere. Giving the SAT students – most of them living in marginal and isolated rural villages – access to modern knowledge systems is indeed a tremendous challenge, as this has to be done respecting their own empirical understanding of life's purpose. This is, in essence, what the programme strives at: providing a social learning space in which the students, with their own life experience, can participate in generating and applying knowledge in their own social and cultural contexts.

Positive results

And indeed, the programme is seen as truly revolutionary, providing very positive results. Graduates of the SAT programme emerge with comprehensive knowledge in agriculture, animal husbandry, soil chemistry, and other fields traditionally associated with rural vocations. They also come out with knowledge about how to create micro enterprises and have a greater consciousness of living in and serving their community. As such, they can, and do, initiate and participate actively in community development processes. Rural youth, who would otherwise have left in search of work, are now staying back and setting up small enterprises within their own communities, and earning their own living. SAT graduates have, in many communities, begun to take up some of the key public posts, like running the public telephone office, the public library, the local pharmacy, the kindergarten programme etc. These are the types of positions for which, in the past, the municipalities had to (and still do in many cases) find people from outside the community.

Solidarity groups

The other programme in which FUNDAEC has developed a noteworthy experience is in the creation and strengthening of solidarity groups in a wide variety of rural communities. The programme started in 1990, inspired by the example of the Grameen Bank of Bangladesh, with the help of a long-term loan from the InterAmerican Development Bank. The credit was used as an excuse to create local solidarity groups, in the belief that the traditional values of reciprocity, interdependence, trust, mutual help could be strengthened and thus contribute to enhance, in each community, a sense of collective identity. No doubt the increasing presence of a market-oriented economy and values emphasising the competitive, individualistic spirit have contributed to the erosion of such a collective sense of identity. As the programme has grown, the groups have shown great potential, each group receiving a basic training in solidarity-based value systems and the technical aspects of the productive project they plan to implement. On the one hand, the small productive projects have increased the welfare and given a greater sense of security to the participants. On the other, they have helped to foment, or strengthen, in the participants those essential values that gave – and must continue to give – meaning to the concept of community.

Return to community values

Members of solidarity groups support each other by sharing resources, knowledge and labour. Solidarity, in this case, is not confined to a group, but reaches out to other groups and the community at large. A few examples will suffice. One group member, in the village of Padilla in the Cauca department of Colombia, became aware that an elderly woman, living in a small house, in very poor conditions, had a leaking roof. The rainy season was soon to start. The group decided to provide a helping hand, as they had previously established a small solidarity fund. They all participated, during a whole day, in rebuilding the roof – the women preparing juice (the day was hot!) and food in abundance, each group member bringing some contribution for the reconstruction of the roof – nails, wood, tiles. In one day, the elderly women discovered she was a member of a community that cared for her, the participants rediscovered how powerful the principle of unity is, and the community recuperated a long-established tradition of mutual help – MINGA – that had of late been abandoned to a great extent. Another nucleus of five solidarity groups, in the neighbouring village of La Arrobleda, decided to pool their resources to buy a bull for their thirty or so milking cows. One person was responsible for taking care of the bull and costs were shared amongst all. They also decided to make the bull available to any community member who might need it, for a small fee. In another community, one of the group members lost her cow as it indulged in the sugar cane based sweet she produced. The group members and other members of solidarity groups in the community chipped in, and she was able to renegotiate the reimbursement of credit she had received to buy the first cow and get more credit to acquire a second cow. Again, this was possible because the network of human relations which make up community life and identity were alive and strong, thanks in part to the solidarity based groups established in the community.

Strengthening local communities

FUNDAEC's experience points clearly at two essential aspects to be considered if local communities are to confront the great – and potentially destructive – force of social and economic globalisation. Providing access to knowledge, in all its modern complexity, along with its generation and application as it interacts with locally based knowledge systems, is one. Efforts to create local structures that serve in strengthening local economies, within the context of a community value system and identity, is the other. And they go hand in hand.

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More information on FUNDAEC and the Rural University can be found on the following websites: www.bcca.org/services/lists/noble-creatiion and www.onecountry.org

Bia Kud Chum

A tool for creating strong, self-reliant communities

Wanlop Pichpongsa, Menno Salverda and villagers

The setting is Kud Chum district in Northeastern Thailand. The Green Revolution and the liberalisation of markets has led to community members becoming more and more dependent on externally set prices for rice, their main crop. They have entered a vicious cycle of debt, lost their community forests and indigenous knowledge, particularly in areas such as herbal medicines. As a result, they now face issues such as health problems and an exodus of village youth to Bangkok in search of work.

Various villages have over 20 years experience in trying to alleviate the problems of debt and achieve self-reliance. Their efforts have led to the formation of many active community organisations such as associations of traditional herbal practitioners, initiatives for integrated agricultural, a community owned rice mill supporting chemical free rice production, cooperative shops, women's producer groups and 'self sufficiency groups'. 'Self-sufficiency groups' aim at healthy production for household consumption, selling only the surplus of their goods. They also promote exchange of labour and tools amongst community members.

Why a community currency system?

In September of 1998, representatives from Kud Chum attended a seminar on community currency systems and self-reliance. They realised the many benefits that a community currency system would accrue: increased production for local consumption and self-reliance in the community; lower dependence on external markets; reduced outflow of money (Thai baht) and other resources from the community; decreased indebtedness as less money/credit is needed; enhanced diversification and sustainability of production; revitalised indigenous knowledge and good social relationships.

This sparked the creation of a local exchange system later named "Bia Kud Chum". In the Northeastern (Isan) language, 'bia' means 'seedling'. The name reflects the aim to develop into strong, thriving communities like small seedlings growing into large trees. As community members in Kud Chum are not very familiar with accounting practices, an user-friendly coupon or notes-based system was chosen.

How it is implemented

A working committee was formed to set up a community exchange system in five villages. It was given three main functions:

a. Accounting, which is carried out by elected managers. The managers facilitate the withdrawals and deposits of bia and administration of bia accounts.
b. Extension activities to support efficient and balanced use of bia between members
c. Monitoring and evaluation of the use of bia.

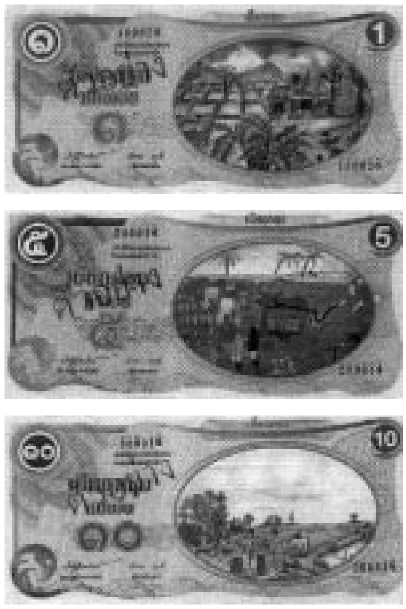
Group members have a credit limit of 500 bia, which they can withdraw from the "Bia Bank" (this name was abandoned due to lack of permission). Bia cannot be exchanged for baht and no interest is charged on bia withdrawn from or deposited into a member's account. Exchanging goods and services in the participating villages can be done using bia only, using bia together with baht or using baht only, depending on what the buyer and seller agree upon. Activities like community markets and skills training to stimulate diversification of local production were organised to support local exchange.

Bia Kud Chum ... against the law?

The community started to use bia for the first time in March 2000, attracting much attention from the mass media and officials. Some feared the use of bia might violate the law or could be a danger to national security. Some even suggested it could be a strategy to create an independent state. Due to this attention and under pressure from the Bank of Thailand (BoT), the use of the bia was suspended at the end of April, after just one month in circulation.

In July 2000, at a meeting of the Board of the Bank of Thailand, it was concluded that the use of Bia Kud Chum violated Article 9 of the Currency Act of 1958. This article 'forbids anyone from making, distributing, using or issuing any material to replace currency, except where permission has been granted by the Minister of Finance'. However, the Ministry of Finance (MoF) is considering the case again.

After a lull of 5 months, the villagers of Kud Chum resumed their activities in October 2000. However, transactions with bia are very limited due to the legal problem.



Community members produced poems and paintings illustrating the local way of life for the bia notes.

What's next?

In their efforts to become self-reliant, the five communities have been accused of breaking the law, an accusation that is far from being justified. Even though the Government has announced its intention to encourage the development of self-reliant and strong community economies, the case of Bia Kud Chum shows how it actually prevents this from being a reality.

"Bia" Kud Chum is indeed a seedling that, as it takes root, will help to bring about self-reliance for communities in Thailand. However, before seedlings can become great trees, and before these communities can achieve self-reliance, they will face many obstacles. The drive to overcome these obstacles requires the collective energies of people from a variety of backgrounds, communities, development organisations and government. There is a need to think, learn and explore alternatives together and to support each other in this quest for more just and sustainable economic systems.

Recently, the Thai Community Currency Systems Project (TCCS) held a meeting on community currency in which academics, NGOs, the BoT, the MoF, and the villagers from Kud Chum participated. There is a strong possibility now that Bia Kud Chum will be developed into a research project.

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Email: tccs@loxinfo.co.th More information on Bia Kud Chum and other Community Currency Systems on http:\\ccdev.lets.net\

Traditional agriculture in Ladakh. Photo: ISEC

Catalysing change in Ladakh

Helena Norberg-Hodge

When I first visited Ladakh in 1975, life in the villages was still based on the same foundations it had been for centuries, evolving in its own environments, according to its own traditional Buddhist principles. In the past, the region was protected from both colonialism and Western-style 'development' by its lack of resources, inhospitable climate, and inaccessibility. Change came slowly, allowing for adaptation from within.

One of the first things that struck me about Ladakh was the wide, uninhibited smiles of the women, who moved about freely, joking and speaking with men in an open and unselfconscious way. Though young girls may have appeared shy, women generally exhibited great self-confidence, strength of character, and dignity. Traditionally, most significant for the status of women in Ladakh was the fact that the informal sector of society, with women at the centre, played a much larger role than the formal sector. The focus of the economy was the household; almost all important decisions had to do with basic needs and were settled at this level. The public sphere, in which men tended to be leaders, had far less significance than it does in the industrialised world.

Since about 1974, however, external economic, political and cultural forces have descended on the Ladakhis like an avalanche, bringing massive and rapid disruption of all aspects of the traditional culture. Like so many other cultures exposed to the centralised global economy, Ladakh has become ever more dependent on distant centres of production and consumption. As local economic and political ties have been broken, Ladakhis have become estranged from one another. As the speed of life and mobility have increased, familiar relationships have become more superficial and transient. Villagers have come to be identified with what they have rather than with who they are. As a result of these changes, I have seen the strong, outgoing women of Ladakh being replaced by a new, alienated generation, unsure of themselves and extremely concerned with their appearance. Traditionally, the way a woman looked was important, but her capabilities, including tolerance and social skills, were much more appreciated.

In opposition to these trends, there is now a growing movement at work to restore and promote traditional culture in Ladakh. We at the International Society for Ecology and Culture (ISEC) have been working with an increasing number of non-governmental organisations and Ladakhi leaders to restore respect for Ladakhi culture and to counter the avalanche of forces that have led to a loss of self-respect among Ladakhis. One of these organisations is the Women's Alliance of Ladakh (WAL), which has gained considerable reputation for its work in promoting and preserving the cultural and spiritual foundations of Ladakhi culture. WAL encourages members to retain their cultural identity by challenging the claims of 'progress'. Groups of women from different regions of Ladakh come together to discuss the impact of 'development', their feelings about current trends, and their ideas about Ladakh's future. They talk about how communities and families are being broken down by the psychological pressures of advertising, television, and tourism; about the greed and envy that are now separating people; and about the women who have stopped spinning because it has come to be seen as 'backward'. Ladakhi women have been greatly strengthened by the opportunity to join with others to discuss these issues. Many now have renewed pride in being farmers, and in providing for their families.

The women of Ladakh are both willing and able to take direct, collective action to resist the forces that beset Ladakhi culture. A "No TV Day" has been organised, as well as a demonstration that managed to reverse a rule prohibiting the sale of women's vegetables in the central bazaar. In 1998, the WAL organised a tour of twelve villages in order to discuss the kind of future Ladakhi women wanted for their children, and to speak as a collective voice to influence more effectively the policies of both village leadership and the government. A further objective of the tour was to exchange local goods and to raise awareness about the need for the continued replanting of local crop varieties in the face of persistent government pressure to use "Green Revolution" technologies. As the tour moved from village to village, the group steadily grew in size, as women in each village responded to its message.

All of WAL's efforts, we believe, have had much positive impact on different sectors of Ladakhi society. These efforts have helped fuel a mounting dialogue among members of the community about appropriate paths toward the future and have had, at their core, women working for change for women.

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Helena Norberg-Hodge, ISEC, see page 33.

For **more information** on the impact of modernisation on the traditional societies of Ladakh and the initiatives supported by ISEC to rebuild self-respect and self-reliance:

- Norberg-Hodge H. **Ancient futures: learning from Ladakh (revised edition),** Rider Books 2000, US$12.00. Translated into 30 languages. Available from ISEC, see page .
- **Women's Alliance for Ladakh**, Chubi, Leh, J & K, India, 194101 India

"Barah Anaaj" - Twelve food grains: traditional mixed farming system

Vijay Zhardhari

Introduction

Terrace farming is practised in the UttarKhand district of the middle Himalayas. "*Fasal Chakra*" or Crop Circles is a method of farming adapted to the climatic conditions. Modern agriculture has tried but not succeeded in destroying this tradition of mixed cropping.

Two year rotation and mixed cropping system

Mixed cropping of the twelve food grains is done prior to the *Kharif* season. In different regions, these seeds are sown from mid-May to mid-June and harvested from mid-September to mid-October. These fields are left fallow after that, and are prepared again at the end of March. Farmyard manure is applied. Paddy and barnyard millet are sown and harvested by end September. In the *Rabi* season, wheat, barley and m*asur dal* is grown and harvested by end April. Again in the third year, twelve grains mixed cropping is done.

Twelve food grains mixed system

Ragi (finger millet) is the main crop of this system. Amaranth, *rajma* (kidney beans), lobia, horse gram, *math* (traditional soya), buck wheat, sesame, *mangjeer* (*tilhan* - an oil seed), m*akka*, green gram, black gram, local gram varieties etc. are sown together. In some regions, more or less than twelve grains are grown too. This method is foolish in the opinion of agricultural scientists. But, as it has been developed based on the knowledge and experience of the local people and got accepted from generation to generation, it cannot be unscientific.

Nutritional value of this system

Bread (*roti*) prepared from *ragi* flour supplies energy for a day of heavy work. It is rich in calcium, iron and iodine. *Ragi* grain extract has medicinal properties for animals. *Ragi* malt and extract can be consumed.

Amaranth is used to make bread (*roti*) and sweetmeats during the fasting and festival period. It is rich in fibre and protein. Buck wheat is used similarly. Both crops can be used as greens and have an economic value too. Traditionally, these crops were bartered for salt, but now they have good demand in the plains too.

Amaranth, maize and sorghum plants are tall. Kidney beans climb on these tall plants. These crops do not compete with each other. On the field bunds and rocky parts of the farm, lobia, black gram, local gram, horse gram, green gram and traditional soya are grown. These are consumed as *dal* and are used for other delicacies. Horse gram prevents the formation of stones in the kidney and other organs. And for those with the problem, consuming boiled horse gram water for one month can help cure it without surgery.

Traditional soya is considered the best among the *dals.* It is roasted and eaten like gram and is very delicious. Its flour is given to lactating cows to increase milk production. These cereals, pulses, and oil seeds provide all the nutritional requirements of the farmers.

The crops of the 'Barah Anaaj' system strengthen the inseparable relation between farming and livestock. The crops give valuable straw and husk for animal consumption.

Seeds of the twelve food grains mixed farming system. Photo: Coen Reijntjes

Pest, disease and drought resistance

This system is more or less free of pests and diseases. Even if it exists, only one or two crops in the mixture are affected. The rich biodiversity protects the other crops. Even in the case of heavy wind or storm, only one or two crops are affected. The *ragi*, pulses and oil seeds also show resistance against drought. At sowing time, the fields are very dry and the air is dusty. After one ploughing, *ragi* is sown and it needs only one shower to germinate. *Ragi* can survive even an extreme drought. Again, after a light rain and sunny period, inter-cultivation is done with the help of bullocks and local implements.

Problems with modern agricultural science

Modern agricultural science, however, emphasises only mono-cropping. In the hill areas, the agricultural scientists criticise the "Barah Anaaj" system of cropping as backward and uneconomical. Instead, they promote the growing of soyabean as a monocrop. The Government and the scientists of G.B. Pant Agriculture University promoted soyabean as a cash, oil, fuel and protein crop with free seeds and fertiliser kits.

Save the Seeds Campaign

The farmers in the hill area boycotted such cash crops through *"Beej Bachao Andolan"* (Save the Seeds Campaign). This campaign posed some questions to the Department of Agriculture and the agricultural scientists: Who will process the soyabean crop into oil and milk? For whom is the rich protein? In fact, the soyabean is meant for big industries and multinational companies; farmers selling their own products to the market and buying poor quality from the market for their own consumption. Understanding this trap, the farmers are turning back to the traditional system of farming. The "Save the Seed" Campaign is not only about conserving traditional seeds; it is about saving agricultural biodiversity, organic methods of farming and local traditions. The campaign has been able to conserve about 500 crop varieties. Out of this, the farmers are successfully growing about 100 varieties of paddy, 170 varieties of kidney beans, 8 varieties of wheat, 4 varieties of barley, and about a dozen varieties of pulses and oil seeds every year. ■

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"Fruit trees are improving the health of my farm and my family."
Photo: UBINIG

Nayakrishi Andolon: Recreating community based organic farming

Farhad Mazhar, Farida Akhter, Jahangir Alam Jony & Rafiqul Haque

Most farmers in the flood plains of Bangladesh shifted to Green Revolution agriculture during the sixties. Farmers began to face ever increasing problems as their survival base was being threatened. Gradually, a group of farmers developed an economically viable alternative to modern agriculture, community based organic farming, which is locally called *Nayakrishi Andolon*. Now, due to globalisation, the economic conditions for small farmers are deteriorating even further, and *Nayakrishi Andolon* is becoming a fast-growing movement of farmers.

New ways needed

Tangail is one of the flood-plain zones in Bangladesh. Every year, the river overflows into the paddy lands, often badly affecting the small farmers of the region. In 1988, they approached the local organisation, UBINIG, for support. In working with the farmers, UBINIG found out that it was not only the flood that posed a great problem for the farmers, but also the practice of so-called modern agriculture. To get a more comprehensive understanding of how farmers perceive chemical-based agriculture, UBINIG undertook a study in 1989-90. A wealth of information was collected through group and individual discussions with farmers. The farmers pointed out that:

- The fertility of the soil was clearly declining. More and more fertiliser was required every year to prevent yield decreases.
- The natural fish and frog populations were declining in quantity and diversity.
- Pest attacks in the fields were more widespread and intense.
- A general decline in livestock and poultry populations, not due to economic poverty, but the lack of fodder. The new HYV rice produce less straw than the local varieties.
- There were fewer birds, bees, butterflies and other insects in the village resulting in poor pollination and low yields of fruit trees.
- The nutritive quality of food was declining as farmers produced nearly no pulses and oilseeds, and a far less supply of fish, livestock products and fruits
- The health situation was worsening, with many more gastric, skin and respiratory diseases, and problems of women in childbearing. Pesticides were seen as killers of human beings, used for suicide and murder of women.

The farmers realised that the total amount of products and income of the farm was declining. In the case of HYVs, farmers figured out that calculating productivity and income on the basis of the yield of a single crop is faulty and misleading.

Nayakrishi Andolon

These experiences led the farmers to search for new ways of food production. Initially, the peasant women took the lead in stopping the use of pesticides, mainly for health reasons. Then, a group of farmers organised themselves to experiment with green manure and compost. Compost made of water hyacinth, available in plenty, became quite popular. This was the first breakthrough - this initial group of farmers became convinced that they did not need to depend on pesticides and chemical fertilisers. Soon '*Nayakrishi Andolon'* (New Agriculture Movement) spread from village to village as a community-based movement going beyond sustainable technologies to regeneration of the life activities and social relations of rural communities. It promoted the joy of living creatively with the entire world: human society and nature, visible and invisible, organic and inorganic.

UBINIG plays an inspirational role and is a source of alternative information for farmers. It interprets currently available knowledge into popular language. Together with UBINIG, farmers test new ideas in practical ways. Care is taken not to suppress the wisdom of farmers in the name of "science", yet farming life and knowledge is not romanticised.

Ten principles

As experience and confidence grew, the farmers developed a set of 10 simple principles for Nayakrishi farming.

Principle 1: Absolutely no use of pesticides. Pesticides do not only kill pests, they also kill other ecologically beneficial living organisms. Monoculture is one of the main reasons for pest attacks. Pests can be controlled without the use of poisons.

Principle 2: No use of chemical fertilisers. The land must be made healthy through alluvial sediments, organic fertiliser, crop mixing and agroforestry, which give natural nourishment to the soil and ensure the presence of living micro-organisms.

Principle 3: Manage pests through conservation and constant regeneration of biodiversity. The practice of multi-cropping has become popular, also for pest management.

Principle 4: Agroforestry with integration of local fuelwood, fruit and various multipurpose trees into rice and vegetable fields. Exotic or imported species are generally rejected.

Principle 5: Calculate total production and income of farming to the household and the community as a whole, not as the quantitative productivity of a single crop. This gives a more accurate view of the overall benefits of the farm.

Principle 6: All domesticated and semi-domesicated animals, livestock, poultry and birds are part of the farming household.

Principle 7: Agriculture is also aquaculture.

Principle 8: Seeds and genetic resources are common resources of the community and must be conserved at the household and community level. The privatisation of seeds and genetic resources, the patenting of life forms and genetic engineering is resisted.

Principle 9: Water is wealth because it brings fertile alluvial sediments.

Principle 10: Stop the use of deep tube wells for irrigation. A lot of harm has already been caused to the groundwater and to the cultivable land.

Farmers are aware that "external" application of inputs is a hangover from the old habits of chemical agriculture. They are constantly innovating new ways to increase the fertility of their soil, without "external" inputs. Nitrogen-fixing species of plants and trees are growing in popularity. Where chemical fertilisers have been used extensively, a gradual phasing out is suggested so that a decline in crop output is prevented.

Village workers are the backbone

The activities of Nayakrishi Andolon are coordinated through centres run by UBINIG in all districts to which the movement has spread. Training programmes, workshops and meetings are organised at these centres. UBINIG coordinates the activities of experienced Nayakrishi farmers training new farmers. The farmers use the centres as their meeting places and for mutual sharing of information.

The backbone of the Nayakrishi network is the *gram karmi* or village workers. They are mostly women farmers, who mobilise and train the farmers in their villages. Apart from networking and campaigning, *gram karmi* maintain audits of the natural resources of the village, which is vital in maintaining and managing the local biodiversity. The information is maintained collectively.

An annual farmers and weavers' fair is organised in Tangail to disseminate information at a wider level. Thousands of farmers, including those who follow conventional practices, participate at this fair. As such, it is an excellent event for debates, discussions and sharing of information between and among farmers of different areas. Cultural functions are an integral part of the fair.

Nayakrishi and biodiversity

Control over seed is the lifeline of the farming community. Women conserve, propagate and germinate seeds. The loss of seeds from the household also means a loss of power for women. The women of Nayakrishi, therefore, have started to rebuild their own *veez sampad* or "seed wealth". The concept strongly contrasts with concepts like "seed banks" or "gene banks". The peasant women are against any centralisation of seed wealth in the form of a "bank". Seed collection, conservation, preservation and regeneration in this context states that :

- Women must regain control over seeds and the associated knowledge and skills. The common seeds should be preserved at the household level.
- A specialised network looks after specialised seeds, or seeds that are not considered economically valuable to the villagers in immediate terms. It conducts investigations and tests to know more about particular varieties. There is interaction within and between villages among the seed-network members. Men can also be members of such a network. Information on seeds and collection cannot be shared with any "unknown" persons or agencies without the consent of the group.
- As an initial experiment, a community seed wealth centre enables Nayakrishi farmers to exchange seeds free of charge.
- The community seed wealth centre is based on the knowledge of the women in seed preservation and germination. It uses earthen pots for the preservation of seeds. The seeds are kept in a place not different from a farmer's house. The impact of the weather is observed closely and a standardised drying method appropriate for long-term preservation is studied.
- All *gram karmi* must maintain a nursery, and conduct nursery activities on a regular basis. Nayakrishi *gram karmi* sell their seeds and seedlings for generating part of their income.
- More research is necessary to evaluate and compare the performance of different indigenous and "high-yielding' varieties (HYVs).

With no more poisons used in the villages, farmers see an increase in varieties of fish and a wide range of uncultivated crops, either as partner crops from the multicropping fields or grown on common land. Local species, breeds and varieties of crops and animals are given priority. The trend is in finding a pattern that is best suited for a particular farm in its totality, with livestock, birds and fish. Raising local breeds of livestock is easy and profitable. Local crop varieties are usually economically advantageous and ecologically suitable. Farmers are not against HYVs offered by the formal sector as long as they can collect and preserve the seed, and as long as the varieties do not need pesticides, chemical fertiliser and water. They are strongly against hybrids which make farmers dependent on seed companies. The HYV seeds that can be cultivated the Nayakrishi way play a key role in the transition from the modern to the Nayakrishi system of cultivation.

Mixed cropping, it is important to find a combination of crops that is best suited for a particular farm. Photo: UBINIG

Nayakrishi farmers give priority to local varieties. Photo: UBINIG

Preservation and use of medicinal plants

The medicinal species and varieties are maintained and managed in the wild, although a few are domesticated. Nayakrishi argues that the medicinal value of a plant can best be ensured if the plant is collected from its own natural habitat. According to this principle, the maintenance and management of medicinal plants is done at two levels: through the structure of traditional midwives, and through women farmers who specialise in medicinal plants.

There are always one or two households in the village, who take the responsibility to ensure that all the common species and varieties are replanted, regenerated and conserved by the farmers. Some women specialise in certain species and varieties. Their task is to collect local varieties from different parts of Bangladesh and to monitor and document the introduction of a variety in a village or locality. They keep up-to-date information on the given species. Such specialisation encourages individuals to develop in-depth knowledge in a particular area. Since this knowledge is highly valued by the group, the person gets much respect and recognition that contributes to the process of building up a collective spirit and knowledge-sharing.

Nayakrishi marketing

The Nayakrishi farmers produce enough food crops to meet their subsistence needs. The surplus of vegetables, rice, pulses and oilseeds is sold first in their own villages, in the local *hat* – the weekly market, and bazaar – the daily market. People are very interested in buying food products that are grown without the use of chemical fertilisers and pesticides. Consumers are willing to pay a slightly higher price for better-tasting products. However, Nyakrishi farmers do not want their products to be considered as exotic or luxury items. They must be for the common people. So the farmers do not charge higher prices if they do not have to.

In one area, the Nayakrishi farmers from several villages have formed their own market. They gather twice a week and sell all their products collectively. They have put up a Nayakrishi banner to attract people to this market, which is gaining popularity.

In Dhaka, the capital, there is demand for local rice varieties husked in the traditional *dheki* – the husking wood. The farmers, in a limited way, are supplying this rice to Dhaka.

Counting the benefits

Around 65,000 families all over Bangladesh follow Nayakrishi principles and the movement is spreading fast. Most important is the general confidence among farmers that Nayakrishi is "economically viable". Besides, the ecological situation is improving, the land is regaining fertility and biodiversity is being enhanced.

Farmers' livestock populations have increased by between 100-200%. Their cash income has increased by around 50-200%. Mixed cropping is seen to be three times more productive than monocultures. It also provides revenue from cash crops. Farmers are economically better off because they do not have to incur the costs of inputs, while the crop output is almost the same as that of HYVs. Besides providing food security, it also is a good risk management strategy.

The community seed wealth centres have also been extremely effective. After the harvest, the farmers are obliged to return two times the amount of seed they took. This condition is waived if the harvest is unsuccessful. Most farmers, however, return more than is required of them because the seeds and the seed wealth centres are "theirs" and they benefit directly from them. The farmers can also sell their seeds in the market. Many local varieties have been collected and reintroduced. One seed wealth centre has collected nearly 70 varieties of jak fruit.

The farming community is more confident than before in their capacity to change their life situation. Without pesticides and chemical fertilisers and with a diverse, nutritious diet the farmer families are a lot healthier. There are also cultural impacts such as reduced incidences of violence against women. The very nature of the relationship Nayakrishi brings into the life activities of the villages empowers women, instead of suppressing them.

Potential for upscaling

Poor farmers, those having less than one acre of land, make up 75% of the Nayakrishi farmers. Among them, more women take the lead in mobilising other farmers. Poor farmers are attracted to Nayakrishi mainly for economic reasons. The prices of chemical fertilisers and pesticides have increased significantly, and they have to use more fertilisers than before. Many of them are indebted and forced to sell land because they are unable to cultivate anymore for lack of money.

Over time, Nayakrishi is also gaining acceptance among the middle farmers with 1-3 acres and surplus farmers with 3-5 acres of land. The representation is 20% (middle farmers) and 5% (surplus farmers). While the poor farmers are joining for subsistence reasons, the middle and surplus farmers have acknowledged the economic viability of the organic farming system as a whole. They have also realised the environmental hazards and the loss of biodiversity due to the use of chemicals and the overwhelming practice of monoculture.

At the national level, Nayakrishi is increasingly being taken up by smaller NGOs in their rural activities. Links forged with agricultural scientists is a significant achievement. The Nayakrishi practice has been able to provoke critical reflection in mainstream agricultural thought. A very co-operative and supportive relationship has been built up between Nayakrishi and the main agricultural institutions of the country.

Although policy-makers in the Ministry of Agriculture are quite aware of the Nayakrishi movement, it has received little support at the national level. UBINIG is now trying to influence them through issues of pesticides, seeds and irrigation. Against all odds, it has proven that there is a viable alternative to the destruction of rural societies by "progress".

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Back to the local - no more borrowed concepts

Cosmas Gonese and Raymond Tivafiri

The Zimuto area in Southern Zimbabwe is situated near one of the colonial agricultural institutions, which for decades has promoted market oriented conventional agriculture. Consequently, the communities in the Zimuto area were stimulated to adopt 'modern' agriculture. This, however, was done without analysing traditional 'agri-culture' and the local conditions. Many farmers made an abrupt shift from organic soil management to the utilisation of chemical fertilisers, which over the years has led to soil degradation. Many development agencies that came subsequently into the Zimuto area also rejected indigenous knowledge and replaced it with 'scientific' knowledge. They did not try to understand the culture of the communities in Zimuto either. Despite such external pressure, several traditional methods of farming that are combined with expressions of spirituality have remained alive.

A process to heal the land

The authors of this article were freedom fighters who operated in the Zimuto area during the armed liberation struggle in the 1970s. During this struggle there were concerted efforts to improve environmental conservation for livelihood self-sustenance. The communication and interaction between traditional leaders (chiefs, spirit mediums, influential elders etc.) and the freedom fighters were frequent and especially significant when it came to caring for nature.

In 1980, the new revolutionary government was installed. Initially, this government did not address the most pressing issues that the people had been struggling for, such as land ownership and the position of the traditional leaders. In fact, the laws passed in the early 1980s withdrew the power of the local chiefs, and failed to recognise the role of the spirit mediums. Instead, the government appointed local councillors in the communities. These actions led to a dramatic loss in the quality of woodlands, wetlands and other natural resources - the traditional rules and regulations that had protected them were no longer enforced by local leaders. Population pressure and land scarcity, due to the lack of land reform, worsened the problem.

There was a general feeling of unrest because the development agenda of the new government failed to take indigenous practices and institutions into account. In 1984, in reaction to these developments, a group of traditional leaders and war veterans decided to start a process that would try to 'heal the land'.

AZTREC founded

During the first year, local consultative meetings were held in 7 districts, during which traditional leaders, who were also farmers, met to discuss the issues of ecological degradation, lack of land and food security. They discussed a new strategy that would take into account indigenous practices in natural resources and land use management.

At a general gathering held a year later in Masvingo, the chiefs, spirit mediums and war veterans decided to found the indigenous development organisation AZTREC. Their major objective was the conservation of the environment taking woodland management, wetland management, agricultural land use, reforestation and cultural survival as the basic elements of their strategy. Indigenous knowledge, culture, norms and cosmovision are the strongholds of all the activities, which are guided and presided over by the ancestral spirits. The influential spirit medium Mrs Ambuya Nehanda was appointed as the patron of the new organisation. Since 1985 these general meetings of the traditional leaders are held twice a year to guide and advice the organisation.

Woodland management as a starting point

It was decided to take woodland management as the starting point for activities. This was because of the obvious importance of the woodlands for the farming families. In traditional culture, the woodlands are considered to be the habitats of the spirits, and they provide a place where rituals can be performed. In economic terms, the woodlands are important in the provision of meat from game and birds, materials for construction and crafts, and natural medicines. This is important to most people who cannot afford western medicines and fees for hospitals, and live in places where adequate western medicine is not even available.

To start with the improvement of woodland management, the traditional leaders talked to the village chiefs, or 'kraalheads', in their respective areas. They discussed traditional rules and regulations, and stressed the importance of re-installing and enforcing them again. Together they started to identify the woodlands, springs and wetlands (vleis), as well as the sacred sites in their area, and the rules and regulations that were used to protect them. The chiefs held meetings with their communities to discuss these issues. Soon, the village chiefs began to take over responsibility for the natural resource management, though officially this task was still in the hands of the government appointed councillors, who did not have the full backing of the population. Nurseries with indigenous tree species were started in the 7 districts under the guidance of the spirit mediums.

Initial resistance from the government

As had been expected, this initiative experienced considerable resistance from the government at different levels, for example

Paying respect to the spiritual world at Lamafina wetland spring to recreate the balance between the spiritual, natural and human world. Photo: AZTREC

A nursery for indigenous trees. Photo: AZTREC

the Forest Commission officials. Matters reached a climax when, in 1989, AZTREC decided to become an officially registered organisation and therefore required government approval. At first this request was rejected. Then AZTREC offered indigenous tree seedlings from their nurseries for the 'national tree planting day'. Forest Commission officials, who had initially refused to give due recognition to AZTREC, went to see the nurseries of indigenous tree species. They were very impressed because they had considered it impossible to grow indigenous tree seedlings in a relatively short period.

The indigenous seedlings were used during the national tree planting day on condition that the local chiefs would perform all the necessary rituals in the communities during the planting activities. The ceremonies were conducted and the activity was highly successful. This was the start of the formal recognition of AZTREC by the government.

From tree nurseries to commercial centres

In this way tree planting became a central element in AZTREC's activities, and the tree nurseries the centres of local activities. Once AZTREC was officially recognised, donors could be approached for financial support and extension staff was based in the nurseries. Each community analysed its situation and brought the seeds they considered necessary for the next season. Schoolchildren would come to dig soil, fill pots and prune roots. At tree planting time, the community would take the seedlings to their homes or to the community orchards and wood lots.

This work developed over the years. AZTREC now manages 12 central tree nurseries, and planting is no longer limited to the national tree planting day. The nurseries together provide some 50,000 seedlings each year, with 75% indigenous species and 25% exotic fruit trees, like mango. Since 1985 a total of 500,000 seedlings have been planted in some 280 communities. Moreover, AZTREC gradually took over all the government run tree nurseries in the region from the Forest Commission. Now, many of the wood lots established in the early days have matured, and are providing fruits, medicine, honey, and construction materials. These products are used for home consumption and for marketing. The central tree nurseries have become the commercial centres where these products are processed, stored and sold. These centres also contribute to bio-diversity conservation through rehabilitation of sacred woodlands, wetlands, vleis and springs.

Transformation into 'eco-cultural villages'

Over the past 6 years the tree nurseries have gradually been transformed into 'eco-cultural villages'. They have become centres for training and experimentation with organic farming, cultural promotion and 'eco-cultural tourism' and clinics of traditional health care for humans and animals. A local committee called 'Assembly' guides the transformation process of each eco-cultural village. Chiefs, spirit mediums, as well as representatives of farmers, women and youth groups have a seat in the Assembly. Each Assembly formulates policies and an annual strategic plan for its eco-cultural village. It also presides over cultural events, like rain making ceremonies and the management of sacred woodlands in the area.

In the surrounding areas, the 'kraalheads' are responsible for translating the policies into action. They have formed 'implementation committees', and in each zone these are divided into 'project committees' and 'project subcommittees' headed by local farmer innovators and practitioners. These subcommittees are active in organic agriculture, traditional health care, natural resource management, and income generating projects.

Localised organic agriculture

The concept of organic agriculture is filtering into the communities, as the external inputs for conventional agriculture have become unaffordable. Nearly 40 farmer innovators are developing local ways of organic agriculture by combining indigenous and external knowledge. They are experimenting with and demonstrating the techniques on their own farms around each of the 12 eco-cultural villages.

The farmer innovators have divided themselves into two groups: one group works with vegetable gardens using organic fertiliser, the second group focuses on organic dry land crop production. Traditional pest control measures like growing colourful and aromatic flowers to attract the predators that feed on the pests of the vegetable plants are used in the 13 vegetable gardens. Non-toxic herbal pesticides are sprayed, e.g. solutions from specific flowers. The vegetable gardens have generated considerable income for the families and have led to improvements in their nutritional status. The incidence of diseases related to protein shortage has declined in the communities.

The farmer innovators working on dry land farming are carrying out experiments with organic manure, non-toxic herbal pesticides and inter-cropping for the staple crops finger millet, bulrush millet and maize. Traditional ceremonies are held to ask the ancestors to protect crops from pests and diseases. It was found that organically produced crops could withstand drought better than chemically produced crops. Yields have been good; farmer innovators have harvested between 2.5 and 3 tons on half an acre of each crop where earlier the yields were minimal.

Initially, there was a lot of resistance from neighbouring farmers as well as extension staff from the Ministry of Agriculture. This started to change when the results became visible, both in yields and pest management. Local farmers were invited to see the results for themselves. Slowly, extension staff from the government also became convinced of the value of organic agriculture. Now, they are being trained in organic agriculture by AZTREC.

Healthcare and culture

Apart from their role in natural resource management, agriculture and marketing, the eco-cultural villages have several other functions. In the field of healthcare, demonstrations, exchange activities and clinics on traditional human and animal medicine have been organised. The terrible HIV/AIDS epidemic that has affected great numbers of young and middle-aged people makes activities in the health sector an urgent necessity. The eco-cultural villages actively function as health clinics and traditional pharmacies for the majority of the communities in the area. Patients receive treatment based on plant medicine and payments are made in the form of fieldwork or gifts of a chicken or goat.

Another major objective of the eco-cultural villages is cultural promotion. Many communal activities and festivities take place, including music, songs, folk tales, the use of traditional instruments, as well as an analysis of specific proverbs. Communities also organise meetings to discuss specific problems. A community with a problem, an increased incidence of rape for example, can discuss the situation and analyse how it can be improved. This process is guided by a spirit medium.

In several centres small libraries are being installed in which information on local indigenous knowledge is collected.

Eco-cultural tourism

A new concept is the promotion of educational eco-cultural tourism. National and international researchers come to carry out research on the local cultures. The Zimuto eco-cultural villages are regarded today as 'centres of excellence' of African indigenous knowledge systems, culture and cosmovision. Groups of tourists visit the centres to experience African culture. This venture is being expanded and developed through a relationship established with a tourist organisation in the Netherlands. It sends small groups of 18-20 tourists to stay for one week. The tourists are received and guided by the community and the traditional leaders and have to abide by the traditional rules set by the spirit mediums. They also contribute new ideas, which are selected using spiritual guidelines and fused with local knowledge and experience.

The successful concept is spreading

The concept of eco-cultural villages has been very successful. Apart from ecological regeneration and cultural rehabilitation, the centres are helping to reduce the employment problems amongst the local youth. New jobs are being created in processing and commercialisation of forest and agricultural products, like honey, vegetables and sunflowers, which are brought to the centres. Tourism provides jobs for local groups of dancers and musicians and for youngsters who work as tourist guides. As a result, migration to the towns has been considerably reduced.

In spite of former problems with the government, AZTREC is now officially recognised and supported both at the national and international level. As a non-political organisation, AZTREC has not taken sides in the recent political unrest in which land-hungry Zimbabweans forcibly took back the land that had been confiscated by white settlers during the colonial era. However, AZTREC was appointed by the government Community Based Resettlement Approaches and Technologies programme to assist in land resettlement activities. More than 50 farms have been designated, and AZTREC is involved in structuring resettlement schemes in conjunction with the Ministries of Agriculture and Local Government.

No more borrowed concepts

AZTREC has a strong network with other like-minded non-governmental organisations. Christian churches strongly oppose AZTREC's work, however. They shun initiatives that consider the traditional leaders and spirit mediums as the authentic custodians of the natural resources. Church leaders consider the approach taken by AZTREC contradicting the Christian philosophy. Communities in Zimbabwe and other African countries, however, have reacted positively to the work of AZTREC. Some organisations in Zambia, Malawi, South Africa and Swaziland have started to establish similar eco-cultural villages to address environmental and economic problems, taking their own cultures and indigenous knowledge systems as points of reference.

"The methodology described here is based on a very sustainable form of agriculture and natural resource management, in which indigenous knowledge and external concepts are combined. Because of the high price of external inputs, our own seeds and medicines got a chance to be tried again and to be proven worthy. Of late we feel that even the younger generation has come to realise the beauty of our own indigenous resources, and is deeply involved in all activities. We are convinced of the importance and good results of this strategy. You cannot build development on borrowed concepts - you need cross-fertilisation!"

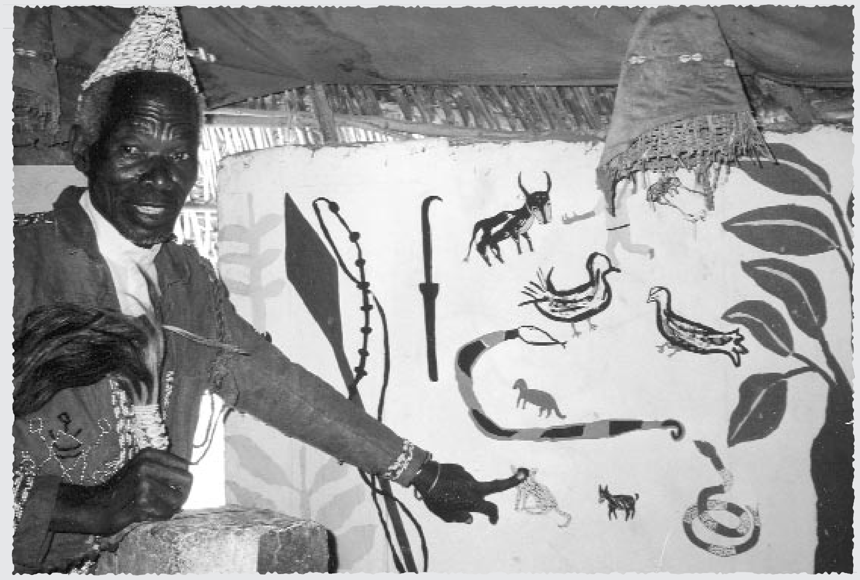
■

Cosmas Gonese and Raymond Tivafiri, AZTREC, address see page 15

Training in organic gardening. Photo: AZTREC

The ENIAKA initiative

Enhancing Indigenous Agricultural Knowledge in Africa



Spirit medium in Iganga, Uganda, explains how the flora and fauna influence healing and farming practices. African organisations met in Uganda to discuss ENIAKA Enhancing Indigenous Agricultural Knowledge in Africa, May 2000. Photo: COMPAS

The African organisations involved in the international Compas programme (see ILEIA Newsletter Vol.14, No.1, pp.26-27), CECIK and AZTREC, have several years of experience with endogenous development based on African culture. The partners agreed that in large parts of the African continent the picture is quite consistent: despite decades of development activities, food shortage and poverty are still widespread and in some cases have even increased. The majority of the rural people are still loyal to their own knowledge, belief and value systems. Though often hidden from the eyes of outsiders, the decisions on farming, health care and use of natural resources are to a large extent based on traditions, and traditional leaders play an important role.

For decades, schools, extension services, development programmes and churches have attempted to introduce new concepts that would substitute rather than build on these traditions. This development approach has often ridiculed and rejected traditional values, and development workers seem to have acquired modern attitudes. The rural people have developed skills to speak the language of the officials, while maintaining their own traditions. Most development professionals live in a dual reality: the African and the Modern.

In order to enhance the effectiveness of development interventions, the African Compas partners have emphasised the need to bridge the communication gap between the rural people and development workers. They have decided to upscale the Compas initiative in Africa in order to introduce the approach to other countries and to influence agencies into taking indigenous knowledge and values seriously. This was the start of the project called Enhancing Agricultural Indigenous Knowledge in Africa, ENIAKA.

Searching for information

During the initial phase of this project, country studies were carried out in Ghana and Zimbabwe. Small teams of local researchers reviewed and analysed the existing information on indigenous knowledge. In both countries less than 100 documents could be found on indigenous knowledge and practices related to soil and water management, crops, animal husbandry and food processing. Meanwhile, during a national workshop, development experts were able to identify more than 50 practices of rural people about which no written information is locally available.

At the same time a literature search was carried out in the major English language databases in Europe. The result was 1663 titles, most of them quite recent. These studies on indigenous knowledge are only available in Western based databases; African national-based development workers have very limited access to these resources. During national workshops in Ghana and Zimbabwe plans were made to fill these gaps. Teams were formed to visit farm families and to document existing indigenous knowledge and practices. The implementation of these plans, however, was delayed by an initial lack of funding.

A pan-African initiative

In December 1999 a pan-African meeting, with representatives of 12 African countries, was organised in Mazvingo, Zimbabwe. It was decided to form three regional clusters for the further enhancement of the initiative: East Africa, Southern Africa and West Africa. A regional co-ordinator was appointed for each region. Plans were made for national and regional follow-up activities.

In May 2000, a national workshop was organised in Uganda. Some 20 NGOs carried out case studies on indigenous knowledge on the basis of a checklist. During the workshop they discussed the outcome and the implications of this for development strategy. They reached the general conclusion that endogenous development has great potential, and agreed that it was necessary to address a number of national policy issues. Proposals for country workshops in Kenya and Tanzania have also been made. At the moment, however, lack of funding has inhibited these workshops and other follow-up activities in Uganda.

Proposal for five years

A five year plan has been formulated for the Southern African region. The activities include in-depth research on the agricultural and environmental knowledge of the rural people, improvement of capacities of NGO staff, establishment of a network for the exchange of information on indigenous knowledge, interregional and international exchange between farmers and rural leaders, and efforts to address national policies on technology development and the role of traditional institutions. Raising funds is the next step in the initiative for the Enhancement of Indigenous Agricultural Knowledge in Africa. AZTREC in Zimbabwe is co-ordinating the ENIAKA activities for Southern Africa, CECIK in Ghana for West Africa and CIOF in Uganda for East Africa.

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Compas - Comparing and Supporting Endogenous Development

The Compas Network is a collaborative effort of 22 development organisations in South America, Asia, Africa, and Europe to support endogenous development. Documentation of indigenous practices and cosmovisions are taken as the starting point to revitalise indigenous knowledge systems. Together with the communities, the changes in the knowledge system and the interaction with other sources of knowledge are identified. Options for endogenous development are analysed thereafter and translated into community based activities. The learning processes are exchanged through meetings, the 6-monthly Compas Magazine and a website (www.etcint.org/compas). Free copies of the Compas Magazine can be requested from compas@etcnl.nl or P.O.Box 64, 3830 AB Leusden, the Netherlands.

People's Caravan 2000

Sarah Hindmarsh

Engaging a crowd of over 50,000 on November 30 - one year since the massive protests against the World Trade Organisation (WTO) and its brand of globalisation - the People's Caravan 2000 ended three weeks of activities in India, Bangladesh and the Philippines, with simultaneous events in Japan,Korea and Indonesia. The People's Caravan travelled over 2,500 km through Tamil Nadu, India, Bangladesh and within Manila, the Philippines from November 13 - 30.

The Caravan called for an end to the devastating effects from the globalisation of agriculture and instead advocated genuine agrarian reform, food security, social justice and land and food without poisons.

Over 10,000 people - local farmers, agricultural workers, fisherfolk, students, scientists, teachers, the media, government officials, and anti-pesticide and anti-genetic engineering (GE) advocates - participated in lively discussions at public meetings, press conferences, and educational teach-in's at bus stops, in rice fields, in villages and towns. Food festivals, seed exchanges, songs and street theatre celebrated local initiatives towards more sustainable, healthy agriculture.

The Caravan was organised by Pesticide Action Network Asia and the Pacific (PAN AP); Society for Rural Education and Development (SRED) and Tamil Nadu Women's Forum (TNWF), India; UBINIG and Nayakrishi Andolon, Bangladesh; and Kilusang Magbubukid Ng Pilipinas (KMP), the Philippines; in collaboration with SHISUK, Bangladesh; CIKS and PREPARE, India; Gita Pertiwi, Indonesia; NESSFE, Japan; CACPK, Korea; and Food First, USA.

Rural communities discussed the transition from traditional farming to export-oriented crop production and its impacts on them - increasing landlessness; hazardous pesticide use; and the potential onslaught of unsafe, unproven experimental GE technologies.

Speaking in Bangladesh on land conversion and the erosion of food security, Santi Gangadharan, a pesticide activist with TNWF, said: *"As we travel this country we are very happy to find the fields so full of paddy. In India, most of the farmers have been forced to grow cash crops instead of food crops due to the process of globalisation and liberalisation and because the government wants more export earnings. Now there is no paddy. The fields have been converted into flower gardens for export. Due to globalisation many people in the villages have been forced to leave. They have left their traditional homes, entered urban areas and many of them are without enough food".*

Landlessness is rising among the poor farmers of Asia. This tragedy is particularly evident in the Philippines. Rafael Mariano, chairperson of KMP, is critical of the Filipino government's commitment to the WTO in promoting the World Bank's imposition of market-assisted land reform. This involves joint venture schemes that allow landlords and foreign capitalists to appropriate land for export crop production. "In effect, the schemes reduce the farmers to being farm workers receiving measly wages."

Asian countries, in general, are suffering from a collapsing agricultural sector. Much of this has to do with the use of Green Revolution farming practices, underpinned by monoculture cropping and the use of pesticides and fertilisers.

Farmer Jahanara Begum, speaking in Bangladesh, urged farmers not to abandon their traditional farming practises in favour of industrial agricultural methods. *"We have so many varieties of rice seeds, but instead we are going for the varieties of IRRI (International Rice Research Institute) and the seed companies. These seeds need a chemical package. When we use local varieties we get a yield of 40 kg of rice. When we use pesticides and the companies seeds we get 20 kg more but we also destroy our soil, water and biodiversity".*

She added: *"How many poisons are you using? We have lost our birds, our fish, the wildlife. We have lost all this for 20 kg more and we spend more money on our family's health. Transnational companies - they come, they go. They don't care about our health or our environment. No more, we've had enough! Stop using pesticides and gradually reduce the use of fertilisers. For our survival we have to commit ourselves to land and food without poisons!"*

Sarojeni Rengam, Executive Director of PAN AP, told the crowd that today the pesticides market is a $32 billion industry. With the advent of seeds, genetically engineered to tolerate herbicides or to be dependent on chemical inducers to promote growth and development, the use of hazardous pesticides will only increase.

Speaking on the development of GE rice, Farida Akhter, Executive Director of UBINIG said, *"UBINIG urged all farmers in the rice producing and rice consuming countries of Asia to resist planting GE rice as it is harmful socially, economically, environmentally and also an attack on farmers' sovereignty to produce their own staple food!"*

The People's Caravan also celebrated local initiatives towards more sustainable, healthy agriculture. Agriculture that is in the hands of the people, is for the people, and can really feed them and free them from dependence on hazardous pesticides and other dangerous agricultural inputs and technologies.

In Trichy, India, Tony Tujan, chair-person of the Asia Pacific Research Network (APRN), said: *"As sustainable agriculture practitioners, we have shown the world that we can grow food without poisons. We must all work together to challenge industrialised agriculture and agrochemical TNCs."* ■

From the 'summary of events' press release.
For more information contact: Pesticide Action Network Asia and the Pacific, Phone: +604 657 0271; Fax: +604 657 7445; Email: pcaravan@tm.net.my http://www.poptel.org.uk/panap/caravan.html .

People's Caravan 2000. Photo: PAN-AP

"Hybrid seeds, hybrid crops, ... even the children become hybrid", as an elderly woman put it. Photo: AR Vasavi

Loss of the local and spectres of the global

A.R. Vasavi

Farmers committing suicide, ever-expanding groups of people migrating to cities, angry farmers destroying unsold fruits and vegetables, riots at the grain markets as prices collapse, the distress sale of land - all these and more are testimony to the loss of the local and the spectre of the global in agrarian India. While the loss of the local is linked to the loss of local knowledge and social support structures, the spectre of the global looms in terms of the subordination of local agriculture to global market and institutional prescriptions, and the subsequent loss of self sufficiency and livelihoods.

The local undervalued and eradicated

The opening up of Indian agriculture to global capital and markets denotes not only a shift from the policy of agricultural self-sufficiency to one of integration into the market, but also of a substantial shift in the human-nature and human-human relations. Linked to the WTO rhetoric of enabling the nation to become competitive and of engaging in the global arena, the new agricultural agenda overlooks not only the strengths of the local, but also its needs and requirements. As many scholars have noted, agriculture in India is troubled more by the system of unjust access and rights to resources than by a lack of knowledge or capability. Yet, since the economic liberalisation agenda, policies to address the problems of inequitable distribution of resources, including any type of agrarian reform, have been completely overlooked. Instead, the whole body of local agro-ecological knowledge is identified as the basis for problems and is sought to be eradicated. In addition, the State, until now a key player in re-ordering agriculture, is partially withdrawing from agriculture, thereby enabling the emergence of national and international agri-business agencies to become key actors. Currently, in many villages, it is the agents of the agri-business companies whose presence and influence is more visible than that of the state's village and field workers.

Increasing dominance of agri-business

Drawing on their capital and marketing skills, global agri-business companies seek to maximise the low labour costs and eco-specific agricultural production, while retaining the existing pre-capitalist relations of production and work conditions. The establishment of contract-based seed farms in certain areas, such as Haveri and Ranibennur in Karnataka, are examples. Factory-like production conditions have replaced ecological practices, but the existing land-ownership and labour patterns have been retained. And contract farming based on rigid terms, in which the companies stipulate what, how and how much is grown by every contract farmer, signifies the loss of control over their production that agriculturists are subject to. More than HYV

(High Yielding Variety) cultivation, contract farming articulates the dominance of international finance, market and know-how over the economic, social and ecological bases of local agriculture.

Loss of the cultural basis and control

Such intense and significant integration into the agri-business and bio-technology regimes imply not only a loss of the collective, eco-specific knowledge but also of the local, cultural bases of agriculture. Such changes are significantly that of the loss of the veneration of nature, the separation of agriculture from ecology, devaluation of local knowledge, and the re-working of social relations and cultural orientations of people. Each of these is compounded by the new presence of global agri-business agencies, which re-enforce the individualisation of agriculture initiated by modern agriculture. Farmers interact with agri-business agents on a one-to-one basis, often competing among themselves, for access to information, inputs and assurance for sales. Also, as Lewontin (1998) notes, contract farming based on new bio-technologies renders farmers into wage labourers, a trend that aggravates the on-going pauperisation of medium and small-scale land operators.

Disintegration of the collective and loss of autonomy

Biotechnology based agricultural regimes, promoted by global agri-business, lead to a vertical integration of inputs and outputs in the agricultural production processes (Lewontin 1998). Such vertical integration (whereby the agency sells the inputs and also purchases the produce) at this level is matched and aligned with a disintegration of local, collective orientation to agriculture and the loss of autonomy in the production processes. New seed varieties shorten production cycles and increase productivity but deny farmers the ability and rights to reproduce the seeds. Knowledge and know-how must be gained from external sources, often together with the other inputs of fertilisers, pesticides and technology. As agri-business companies gain absolute control over the production process, States, especially in the developing countries, have less hold over such decisions and loose the right to democratic processing of such policies. This has been specifically noted in the context of the promotion of new biotechnologies, including Genetically Modified Crops (GMCs). In certain parts of India, policies to use and promote GM seeds and crops are not debated in public and people are not given any awareness of the potential fall-outs of such programmes.

Expecting high returns, ending with suicide

Yet, farmers are drawn to such programmes as agri-business agencies advertise the easy availability of a good life. An increasingly consumption-oriented public culture further encourages them to take to high income generating schemes. Expecting quick and high returns, farmers submit to such agendas with little or no anticipation of market downturns, loss of genetic diversity, loss of autonomy etc.

But the entry and growth of markets in the life of a community increases the imbalance of power among members of an agricultural community and that between a community and the market. Successful agriculturists not only withdraw from the immediate community of production, but identified as “progressive farmers” they form alliances not with the other agriculturists of their region, but with those who have a similar economic status. Further, in producing for the market with inputs from the market and in terms dictated by the market, agriculturists become subject to the turns and fluctuations of the market itself. While production is based on giving priority to market income over household subsistence, the failure of the market can mean the devastation of the household’s food security and the beginning of a vicious cycle of debt. This is specially so for small and medium agriculturists who, with little or no capital or access to resources, take informal credit at exorbitant interest rates, and are unable to recover basic costs at the end of the production cycle. And, crop loss, like agricultural production, has become an experience borne individually. The spate of suicides among farmers from all over the nation is linked to this combination of debt burden, individualisation and the loss of collective orientation in agriculture.

Lack of a farmers’ forum against globalisation

Though several districts of Andhra Pradesh, Karnataka, Maharashtra, and Punjab have reported suicides related to crop-loss, there is no substantial collective pressure from agriculturists against the state and agencies of capital. And, despite the fact that some Indian farmers’ movements question the globalisation of Indian agriculture, a well-developed and cohesive farmers’ forum against the new agricultural agenda is sadly lacking. In fact, membership in and support for farmers’ organisations are not as wide-spread as it is often made out to be. Instead, caste and religion-based mobilisation seems to be gaining strength, which breeds intolerance and pits communities against communities and some privileged communities against the State. Such mobilisation focuses on either reviving old symbols of heritage or in inventing traditions to counter an opposing group’s claims to exclusive heritage rights. While such cultural mobilisation may result in a limited number of agriculturists becoming political actors, it does not translate into policies that privilege economic or social equity.

Redistribution of resources needed

Though Gandhi largely overlooked the political and economic dimensions of rural communities, and most specifically their role in reproducing a hierarchical and unjust system, he recognised the importance of a decentralised, plural, rural culture. Asserting the importance of agriculture as a vocation, he believed it to be capable of being the seedbed of *Swaraj*; the new ethically and morally grounded system that would enable India to not only break away from colonialism but also generate a new civilisation. Yet, in contemporary India, agriculture and agrarian cultures are increasingly integrated into a global agro-regime that privileges elite consumption and access to capital over ecological and social sustainability. This is generating new tensions. Not only has globalised agriculture disembedded the production system from its ecological base, distanced individuals from the life of the community, rendered local knowledge (Ludden 1997) as “archaic”, it is also fast eroding the very foundational premises of India’s pluralism. While the skewed distribution of land, capital and access to water needs to be addressed urgently, the current trend is to enhance the productivity of select crops, thereby overlooking both the livelihood bases of people and the sustainability of agro-ecological systems. Pre-modern plural agro-ecologies enabled local ecology to influence agriculture, creating a range of agri-cultures. But, individuated, market -oriented agro-regimes lay the foundations for conditions in which the land will be rendered into what Marx (1966) noted as *“cleanly weeded land”* while the dispensed and displaced people will be treated as *“uncleanly human weeds”*.

■

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What is globalisation bringing peasant farmers in Bolivia?
Photo: COMPAS

Trade and hunger

The impact of trade liberalisation on small farmers

A recent publication by John Madeley collates information on the impact trade liberalisation has had so far on food security, poverty, ecological sustainability, gender etc. The survey covers 39 developing countries in Africa, Asia and Latin America. The case studies analyse impacts of the World Trade Organisation's (WTO) Agreement on Agriculture (AoA, signed in 1994), the World Bank/International Monetary Fund imposed structural adjustment programmes (SAPs, going on since 1980) and regional free trade agreements. Some of the key findings , mentioned in the overview, are summarised below.

Trade liberalisation

Under SAPs and AoA, developing countries have to make significant changes in their food and agricultural policies. They are obliged to open up their economies to cheap food imports and to drastically reduce support to their farmers. Most SAPs require more sweeping liberalisation measures than the AoA, and also demand related measures such as privatisation of state-run enterprises, the elimination of subsidies and price controls, and the abolition of marketing boards. By contrast, the AoA centres on trade liberalisation measures – it calls, for example, on member countries of the WTO to reduce tariffs on food imports by 24% over a ten-year period. The 48 least developed countries are excluded from this and other reduction commitments.
The AoA – a deal largely stitched up by the United States (US) and the European Union (EU) under pressure from business corporations – tightens the screw of structural adjustment.
The case studies show that this leads to:

Cheap imports

The majority of people in developing countries belong to farming families. Most farmers are small-scale, with at best a few hectares of land and sometimes much less. Competition from cheap imports, from the US and the EU but also from other developing countries, is putting small farmers out of business. Such imports are coming both through commercial channels and through dumping – food sold below the cost of production to dispose of surpluses. Ghana is just one of many countries in this survey which shows how food imports have demoralised small farmers. Having produced maize, rice, soybeans, rabbits, sheep and goats, the farmers cannot obtain economically viable prices for them, even in village markets. Their produce simply cannot compete with cheaper imports. Domestic food production is at risk as the agricultural sector is placed in jeopardy.

The studies show that liberalisation has led to an increase in the prices of farm inputs, causing huge problems for small farmers. The study of edible oils in India reveals the common problem of farmers paying more for their inputs but receiving less for their crop. In economic terms, trade liberalisation appears to have worsened the terms of trade between outputs and inputs. Consumers may appear to gain from cheap food imports. But they only do so if they have the money to buy, which many people in developing countries don't have. Cheap food imports damage the livelihoods of small farmers and also the countries' most basic economic sector – its food-producing sector. Also, if trade liberalisation gives more power to monopolies, then consumers eventually stand to pay higher prices.

More priority for export crops

Trade liberalisation, as many of the studies show, has resulted in more land and resources being devoted to export crops and less to domestic food production. In Benin, for example, government incentives have led to an increase in land under cotton: cotton exports have increased at the expense of food production and food security. The main study in Uganda points to evidence that the emphasis on exports, both traditional and non-traditional cash crops, has caused a decline in the production of food consumed locally, both in quantity and in variety. This has consequently undermined the food security of households.

Although governments are generally placing more priority on the export crop sector, farmers are not necessarily receiving better prices for these crops. World market prices for many of them are declining – as is shown in the studies on Kenya, Sierra Leone and Uganda. As private traders, and not governmental bodies, are mostly buying these crops, the prices offered to the farmers are related, in some degree, to the world prices. But the power of the traders may mean that the price offered to farmers is far below the world price.

Transnational corporations (TNCs)

Trade liberalisation is proving very beneficial for large entities such as TNCs – this is clearly seen in the studies on India, Philippines, Uruguay and Cambodia. But it is not just proving beneficial to them, it also appears to be helping them at the expense of the poor. The study on cotton in India shows how trade liberalisation is aiding TNCs at the expense of India's farmers. The FAO study included in the survey notes that this process is leading to the concentration of land ownership *"in a wide cross-section of countries"* and to the marginalisation of small producers, adding to unemployment and poverty.

In Mexico, the winners from trade liberalisation are concentrated in the country's fruit and vegetable growing areas where production is predominantly on large-scale, irrigated farms. There is a *"dramatic increase in investment in these areas, with large farms or firms leasing land"*. This finding is consistent with global patterns. The Cambodia study estimates that 10-15% of the country's farmers has become landless since the adoption of a liberal market economy in 1989. More land is being concentrated in the hands of a few.

Women

The studies on Kenya, Ghana, Uganda, Zimbabwe, Mexico, Jamaica and the Philippines all show how trade liberalisation is impacting heavily on women and accentuating gender inequality. In Kenya, as a result of the liberalisation of agricultural trade, many women cannot afford adequate chemicals and fertilisers, and farm output has declined. In Uganda, liberalisation may mean that the local parastatal depot is closed down, and producers have to go out of the village to sell their produce. If not, they are forced to sell their produce at lower prices to village traders who benefit from it.

Women, who produce 60 - 70% of food in most African countries, have been affected disproportionately by the elimination of subsidies, the drying up of credit and the surge of food imports as a result of trade liberalisation. Prices of farm inputs have risen and incomes of farming families have come under serious pressure. As a result, many have been forced to cut back on the quality and frequency of meals.

In Mexico, research has shown how male labour migration increases the workload on women and children, who are often withdrawn from school. It is estimated that women now comprise about one third of all the day labourers working in the Mexican countryside. "*To the extent that liberalisation accelerates these trends, it will exacerbate problems of inequality and rural poverty*", notes the study.

Studies on Kenya, Uganda and Zimbabwe show that trade liberalisation has had some positive effects – in Kenya, for example, it has enabled rural women to engage in micro and small enterprises. But the studies indicate that the negative effects far outweigh the positive.

Unemployment

There are no universal figures on people who have lost their jobs as a result of trade liberalisation over the last 20 years. In Mexico, between 700,000 and 800,000 livelihoods will be lost as maize prices fall, representing 15% of the economically active population in agriculture. In India, the jobs of 3 million edible oil processors were lost. In Sri Lanka there was "*a clear drop in rural employment*", says the FAO study, with 300,000 jobs lost following the decline in onion and potato production. It would therefore not be unreasonable to estimate a figure of at least 30 million jobs lost in developing countries because of trade liberalisation and related factors. When trade barriers are lowered, many small farmers leave their land and head for the cities and towns in hope of employment.

Environment

The cultivation of cash crops for export imposes considerable environmental costs. In the Philippines, for example, the extensive use of agrochemicals in export crop production has increased soil degradation and the loss of biodiversity. Liberalisation encourages producers to abandon traditional and ecologically sound agricultural practices in favour of export monocropping. Also, the encouragement of agri-based export cropping in special development zones creates massive colonisation of critical watersheds and the depletion of water resources in irrigated areas, previously planted to food crops. Trade liberalisation can lead to a more extractive and non-sustainable type of agriculture.

Government services

Under SAPs, liberalisation goes hand in hand with a reduction in government support to farmers, such as investment in agricultural research and extension, controlled pricing and marketing, and subsidies on inputs. Governments withdraw and leave their people to the free play of economic forces. Those with adequate resources may survive but the poor are left stranded. The Philippines is a typical case, where insufficient state support for services such as irrigation, post-harvest facilities and farm-to-market roads has meant that small-scale farmers are unable to improve productivity levels or get their products to market at prices that cover costs.

What price will we get for our groundnuts? Farmers in northern Ghana. Photo: Bertus Haverkort

Food self-sufficiency and sovereignty

The negative impact of trade liberalisation on food self-sufficiency, let alone food sovereignty, comes across in many of the studies. The effects of trade liberalisation on India's edible oils sector are startling. Tariff reductions, allowing for massive imports, turned India from being self-sufficient in edible oils to being the world's largest importer in a mere five years. In a number of countries, the liberalisation of markets has increased participation of private firms and individuals in the trade of food commodities, unlike in the past when public institutions dominated the trade. While, in theory, these activities could generate more employment opportunities, this does not seem to be happening.

Conclusion

As the author of the Thailand study says, *"Many of us have been saying for a long time that unchecked, liberalised global trade is a disaster waiting to happen. No one listened. Now it has happened"*. Small farmers are bearing the brunt of this *"disaster"*. But consumers too are vulnerable.

In free trade theory, production will allocate to where costs are low and consumers – poor as well as rich – will benefit from low prices. Much of the trade liberalisation of the last two decades has been based on the hope that agricultural production in developing countries will switch to high value crops for export, which would enable the import of cheap food to achieve food security. Reality is more complicated, however. The FAO study found that in countries like Ethiopia, Sierra Leone and Bangladesh, trade liberalisation did not bring the hoped-for benefits from exports.

Prices are far too low to make marketing of my wheat an attractive option. Photo: Fritz Berger

Agriculture is the main source of livelihood for hundreds of millions of people in developing countries. If small farmers are out-competed without an alternative source of livelihood, the availability of cheap imported food is not of much benefit to them. According to the studies, governments seem to be misled or pressurised to put too much faith in trade liberalisation, or to do it too quickly, without adequate preparation. Trade-based food security for the poor is – at least for the time being – more a mirage than a fact.

Trade liberalisation is only one factor exacerbating problems for the poor in many countries. The studies often reveal the interaction of factors that affect food security, such as privatisation, domestic economic and financial policies and the incidence of HIV/AIDS. As the study on Thailand points out *"the mess isn't simple"*; devastating weather patterns, massive unemployment, the need to earn foreign exchange *"to bail out an unbelievably irresponsible private sector"* are all factors.

Yet, liberalisation is a policy choice, and is not inevitable. This survey suggests that a fundamental review of the dominating policy paradigm is needed, and that, at the very least, WTO rules need changing so that developing countries can provide domestic support and other regulations to protect the livelihoods of smallholders and promote food security.

■

From: Madeley J, 2000. **Trade and hunger: an overview of case studies on the impact of trade liberalisation on food security**. A report of Church of Sweden Aid, Diakonia, Forum Syd, the Swedish Society for Nature Conservation and the Programme of Global Studies. It is available from Forum Syd, Box 15407, 104 65 Stockholm, Sweden. Phone: +46 8 506 370 99; Email: forum.syd@forumsyd.se . It can also be downloaded from http://www.forumsyd.se/globala.shtml

Causes of rural poverty

Farzana Panhwar

The Sindhi farmers in Lower Punjab, **Pakistan**, are being systematically kept in poverty due to the low prices they get for their products. This is caused by the policy of the Government to keep the prices of wheat and other agricultural commodities low so that commerce and industry can get cheap labour and high profits.

Presently, the price farmers get for their wheat is about half the world market price and half of what they received in 1950, taking into account the depreciation of the Pakistan rupee. When farmers use the optimal levels of inputs (costing approx. Rs 10,000 per acre) they can produce about 1,400 kg wheat per acre. If farmers get a price comparable to imported wheat they can afford to pay for the inputs and get an additional Rs 3,600 per acre. For a family with 5 acres of irrigated land this is an acceptable level of income for 6 months of family work.

Since farmers do not receive sufficient returns, they reduce on inputs by:

- Replacing deep ploughing and seed bed preparation by one harrowing only
- Replacing tractors by borrowed bullocks and own labour for drilling of seed
- Using poor quality seed produced by the farmer
- Using less fertiliser than the optimum
- Replacing most herbicides by manual weeding
- Using family labour for casual work and harvesting
- Avoiding periodic and precision land levelling
- Avoiding maintenance of water courses

This reduces yields to about 600 – 800 kg per acre most of which is for domestic use, seed for the next year and payment for borrowed inputs. Thus family labour is bartered for wheat needed for food with no accrued profits. Transition from subsistence to commercial farming is very difficult, as the costs of additional inputs are not compensated for by the additional returns from additional yields. As wheat production is insufficient to feed the population due to low yields, wheat is imported at about double the price paid to farmers and provided to the urban population at a subsidised price. Rural poverty, unemployment and insecurity, created artificially by forcing farmers to sell their products at low prices, is leading to unprecedented migration from rural to urban areas. These people, who end up living in ever-growing urban slums, face serious hardships and suffering.

■

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Go global or stay local?
Farmers return to the local economy

Farmers challenging 'globalisation'. People's Caravan 2000. Photo: PAN-AP

Editorial

International trade is growing fast. Products traded internationally are found everywhere in evidence of 'globalisation'. The World Trade Organisation (WTO), World Bank (WB), International Monetary Fund (IMF) and national governments enforce trade liberalistion and the removal of trade barriers with the strong conviction that it offers the best route to increased prosperity. Farmers are promised increasing benefits from free trade if they specialise on those products, which can be sold on the global market most competitively. In line with this thinking, export agriculture, Green Revolution (GR) technology and biotechnology are promoted globally (World Bank 2001; IFAD 2001) as the tools to increase agricultural production, alleviate rural poverty and eradicate hunger.

The negative impact of free trade

However, an analysis of the impact of free trade shows that most small farmers cannot compete on the global market (Madeley p.6). Decreasing prices and growing costs, due to national price policies, cheap imports and a host of other reasons, are forcing farmers to sell below cost price and to deplete their natural resource base (Panhwar p.8). Women farmers are affected disproportionately; this poses a threat to the food security of their families. In some countries, the production of main crops by millions of family farmers, like wheat in Brazil and oil seeds in India, has reached a near full stop and brought about large-scale unemployment (Madeley p.6). Many small farmers have become tied up in debt or in contract production, thus becoming poorly paid workers on degraded land (Hassarangsee p.36). Due to the disintegration of the collective spirit and the feeling that they have lost control, farmers in India often resort to suicide, seeing no other way out. (Vasavi p.9). Clearly, it is large export oriented farmers, agribusiness and especially Trans National Companies (TNCs) that are benefitting most from trade liberalisation.

A recent WB study by Lundberg and Squire found that free trade does indeed lead to income growth among the top 60% of the population, but has the opposite effect among the poorest 40%. Since 1990 the number of poor people is increasing again. Presently 1.2 billion people have to survive on less than 1 US dollar a day (IFAD 2001). 75% of them live in the rural areas, and include indigenous people, small farmers, women and children, who never had a chance to be part of or have fallen out of the global development model.

Globalisation of trade and technology are part of a much broader process of cultural globalisation. Due to the general increase in international trade, travel and mass communication, the Western consumer culture, symbolised by Coca Cola and MacDonald, is spreading fast. This is contributing to the loss of traditional culture, values and knowledge, disintegration of communities, loss of mutual solidarity and degradation of the environment (Vasavi p.9; Norberg-Hodge p.20).

The anti-globalisation movement

In reaction to these processes, a fast growing anti-globalisation movement is strongly manifesting itself. The People's Caravan (p.11) that travelled through Southeast Asia in November 2000 is one such manifestation, which campaigned for food security, land reform and agriculture free of poisons and biotechnology. The warning by IFOAM (p.31) that genetic pollution is spreading fast in the USA shows how important such protests are in raising awareness among citizens.

From 25-30th January this year the World Social Forum had its first global meeting in Porto Alegre, Brazil, to discuss the problems caused by globalisation. The dominance of economic over social interests, the growing inequality, the lack of human rights and respect for nature, and the increasing influence and lack of democratic control of TNCs and international institutions like the WTO were amongst them. But the main outcry of the conference was for a "different" agriculture. It called for an agriculture that produces the food needed locally and nationally, at human scale, with land given back to the farmers. It called also for minimum price guarantees and control given to farmers and nations instead of to TNCs. Ecologically sound agriculture producing safe food in an animal-friendly way was the alternative.

This emerging alternative to 'globalisation' is increasingly called 'localisation' (Hines 2000). As an alternative development approach, it gives priority to endogenous development - building on local concepts and resources, but does not exclude exogenous development - building on solutions from outside.

Understanding globalisation and localisation

It is important that family farmers are aware of and understand present trends of development, and how they are and will be affected by globalisation. They need to know what opportunities they have on the world market, how they could benefit from localisation and what choices they have to make. By strengthening farmers' organisations to analyse their situation, CIRAD (p.24) is helping farmers to design strategies to navigate their lives in a fast globalising world.

An analytical framework can be very useful for this purpose. The framework used by neo-liberal economists cannot explain local economies sufficiently as it looks mainly at the financial aspects. Pretty (1998) and Bebbington (1999), on the contrary, recognise five different capital assets, fundamental for local economic development and welfare:

- Natural capital – nature's goods and services.
- Social capital – the cohesiveness of people and societies
- Human capital – the status and capacities of individuals
- Physical capital – local infrastructure and stocks of produced products
- Financial capital – stocks of money

To understand these highly abstract concepts, one should consider the local economy as a bucket that the community likes to keep full. But, the bucket has holes in it. Every time someone buys something from outside the local economy, money leaks out. Each time natural resources are depleted or polluted, the natural stock diminishes. To balance this, money must flow in from the sale of raw materials, products or services to outsiders, or from migration work, pensions, grants or subsidies from outside. In an open market economy, the inflow of money is maximised by making use of comparative advantages, thereby increasing prosperity. But prosperity can also be increased by reducing the outflow of money and other resources by plugging the holes, preventing degradation of the natural resource base and, in a selective way, raising some additional income from outside, e.g. from niche markets instead of bulk markets (see Box).

Recreating local economies

It is important to note that local economies are not a strategy to create autarchic communities that are only self-sufficient, but totally disconnected from the rest of the world. Rather, it is first to make the best use of available resources (the first four principles), and then to engage and trade with other economies (the fifth principle). OA and LEISA help the local economy in a number of ways. They make better use of available natural and social resources. This is done by minimising the use of external inputs, by utilising and regenerating internal resources (nutrients, water, genetic resources, knowledge, skills) effectively or by combining both (see for example the principles of Nayakrishi Andolon, Mazhar et al, p.16).

Local economies foster deeper community spirit and self-reliance, ensure a better environment and provide more sustainable jobs (Pretty 1998). Where natural and financial resources are scarce, farmers cannot afford to use these resources in an inefficient and degrading way, as in Green Revolution agriculture. Where farmers cannot compete on the market without depleting their resource base and culture, a self-reliant local economy is a viable alternative to protect farmers from ending up in the urban drain. Endogenous development of local economies is not backward at all; it is an artful and knowledge-intensive way of living, as demonstrated, in principle, by many traditional 'agri-cultures'.

Gonese & Tivafiri (p.12), Mazhar et al. (p.16), Zhardhari (p.19), Norberg-Hodge (p.20) and Pichpongsa (p.21) present cases of endogenous development of local economies. After experiencing that their natural, social, human, physical and financial capital assets were draining away due to globalisation, farmers decided to return to community based endogenous development. They are recreating their local economies by building on indigenous culture, values, institutions, knowledge, seeds, medicines, local currency and traditional and organic agriculture or LEISA. These farmers produce mainly for self-sufficiency, but obtain some income from surplus sales on the regional market and from eco-cultural tourism.

Also for market agriculture

Market oriented farmers in economic stress situations follow similar strategies. In the Netherlands and Europe, *farming economically* is becoming an important alternative to the dominant model of large-scale specialised agriculture propagated by the Government. It is basically a way to counter decreasing prices, increasing costs and the obligation to farm in a more environmentally sound way by mobilisation, use, development and reproduction of internal resources combined with a high level of technical efficiency. Low-external-input agriculture taken up by the economic farmers generates more income and employment and tends to be more sustainable. To obtain additional income, economic farmers diversify with new activities such as subsidised landscape management, organic farming, local products, direct sales, tourism and off-farm activities (Van der Ploeg p.26).

Local economies and farming economically in the South and North move towards the 'subsistence perspective' which Mies and Bennholdt-Thomsen (1999) explain to be 'empowerment based on people's own strength and cooperation with each other and nature. Rather than endless accumulation of wealth, the aim of the subsistence perspective is happiness, quality of life and human dignity'. Isn't this truly sustainable development?

Self-reliant sustainable development possible?

But in the end, whether people really can escape from free trade thinking and take charge of their own development again may be a matter of community-based learning and values (Molineaux p.22). Changing the economic, political and institutional system will be a much harder and longer battle, but has to be pursued as well. Small farmer organisations and NGOs are, for example, trying to increase the influence of small farmers in setting priorities for international agricultural research (Gura p.28). These first efforts already give hope!

■

References see p. 29-31.

Five principles to enhance local economies

A – Make best use of local resources

1. Plug the leaks by using local renewable resources rather than externally sourced:
   - Organic Agriculture (OA) or Low-External-Input and Sustainable Agriculture (LEISA)
   - Local food systems and direct marketing
   - "Buy local" campaigns
   - Renewable energy generation
2. Recycle financial resources within the system by buying local goods and services:
   - Local currency and barter systems (Pichpongsa p.21)
   - Credit unions and other micro-finance arrangements
   - Community banks
3. Add value to local produce before it is sold to the outside:
   - Local processing and manufacturing
   - Labelling and accreditation for food and timber
   - Direct marketing, consumer supported agriculture
   - Eco(cultural) tourism
4. Connect people and institutions to build trust, new linkages and more exchanges:
   - "Buy local" networks
   - Democracy and participatory governance for community planning
   - Strengthening of local institutions, farmers' groups and community co-operatives

B – Exchange with other economies

5. Make use of external opportunities to attract external resources, especially money, knowledge, skills and new technologies:
   - Selling of quality products after value adding, e.g. certified organic or forest products
   - Farmer-to farmer exchange programmes
   - Rural radio, internet and other communication programmes
   - Governmental or non-governmental subsidies for rural development

Adapted from Pretty, 1998.

CONTENTS

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ISSN: 0920-8771

John Madeley

A recent survey covering 39 developing countries in the South describes the impact of trade liberalisation on food security, poverty, ecological sustainability, gender etc. The sweeping changes in the name of structural adjustment have not brought prosperity to the majority of the people. Unable to compete with cheap imports, many small farmers are being pushed out of their livelihoods. Others are being forced to take up export crop production at the expense of local food production and food security. Women are greatly affected by the loss of subsidies, drying up of credit, male labour migration etc. It is startling to note that countries, who a few years ago were self sufficient in certain products, have become key importers of the same products. The survey suggests a fundamental review of dominating trade policy in favour of protecting the livelihoods of small holders in developing countries and providing food security.

Farhad Mazhar and colleagues

It is not only floods that pose a threat to the livelihoods of Bangaldeshi farmers, it is also the practice of so-called modern agriculture. Farmers are well aware of the many negative effects of chemical-based cultivation and monocropping. Nayakrishi Andolon, or the New Agriculture Movement, began as a search for new ways of food production and has a following of nearly 65,000 farmers throughout Bangladesh. Organic farming, conservation of bio-diversity, indigenous knowledge and marketing locally are some aspects of the community-based movement.

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12 Back to the local - no more borrowed concepts

Cosmas Gonese and Raymond Tivafiri

Market-oriented conventional agriculture has been promoted for decades in the Zimuto area of Southern Zimbabwe. This type of agriculture did not take into account traditional "agri-culture" and the local conditions. In 1984, a group of traditional leaders and war veterans started a process to "heal the land" that led to the formation of the indigenous development organisation AZTREC. It aims at conservation of the environment through woodland and wetland management, reforestation, cultural survival etc. founded on indigenous knowledge, culture, norms and cosmovisions. Having faced initial resistance from the government, the initiative is now well recognised and the "eco-cultural villages" have become showpieces of local agriculture, healthcare and culture.

22 Strengthening Local Economies and Community Identity

Pascal Molineaux

The Tutorial Learning System (SAT in spanish), developed by the Rural University of FUNDAEC, is a high school equivalent embedded in the reality and needs of rural life. Graduates of SAT programmes not only gain appropriate knowledge but develop a greater consciousness of living and serving their communities. Solidarity groups, another programme of FUNDAEC, has helped bring back the tradition of MINGA or mutual help, thus reviving community life. According to FUNDAEC, providing access to knowledge and creating local structures that serve local economies are two crucial aspects for communities to contend with the forces of globalisation.

DEAR READERS

There is a lot of discussion and turmoil around 'globalisation', the complex economic and cultural processes of change that are presently reshaping societies. This issue of LEISA Magazine is on the impact of 'globalisation' on small farmers and their strategies to cope with these processes. The articles herein show that small farmers have great difficulties in being competitive on the global market, that their communities and cultures are falling apart, and that their natural resource base is degrading. Realising that they have waited too long for 'development' to come, communities return to local solutions in order to strengthen their economy and culture. Experiences in many countries in the South show that endogenous development of local economies can be very beneficial for farmers and their communities, as well as for the local environment. Market farmers in Europe, too, are successfully using low-external-input strategies to cope with economic stress, and a growing 'slow food' movement is giving back value to traditional food and regional production systems. In reaction to 'globalisation', civil society and small farmer organisations are calling for 'localisation', not only as an economic solution for small farmers but as a global and general approach to sustainable development.

LEISA Magazine (formerly called ILEIA Newsletter) has been publishing on local solutions developed by farmers to improve agriculture (LEISA) for nearly seventeen years and will continue to do so in the future.

The last issue "Coping with disaster" carried the new design. But as is so often the case, change does not come without pain. Many of you would have noticed the headings that had fallen out. We hope this unexpected printing error, for which we apologise, is resolved by the time that this issue goes to print.

The editors.

july 2001 volume 17 no.2

LEISA

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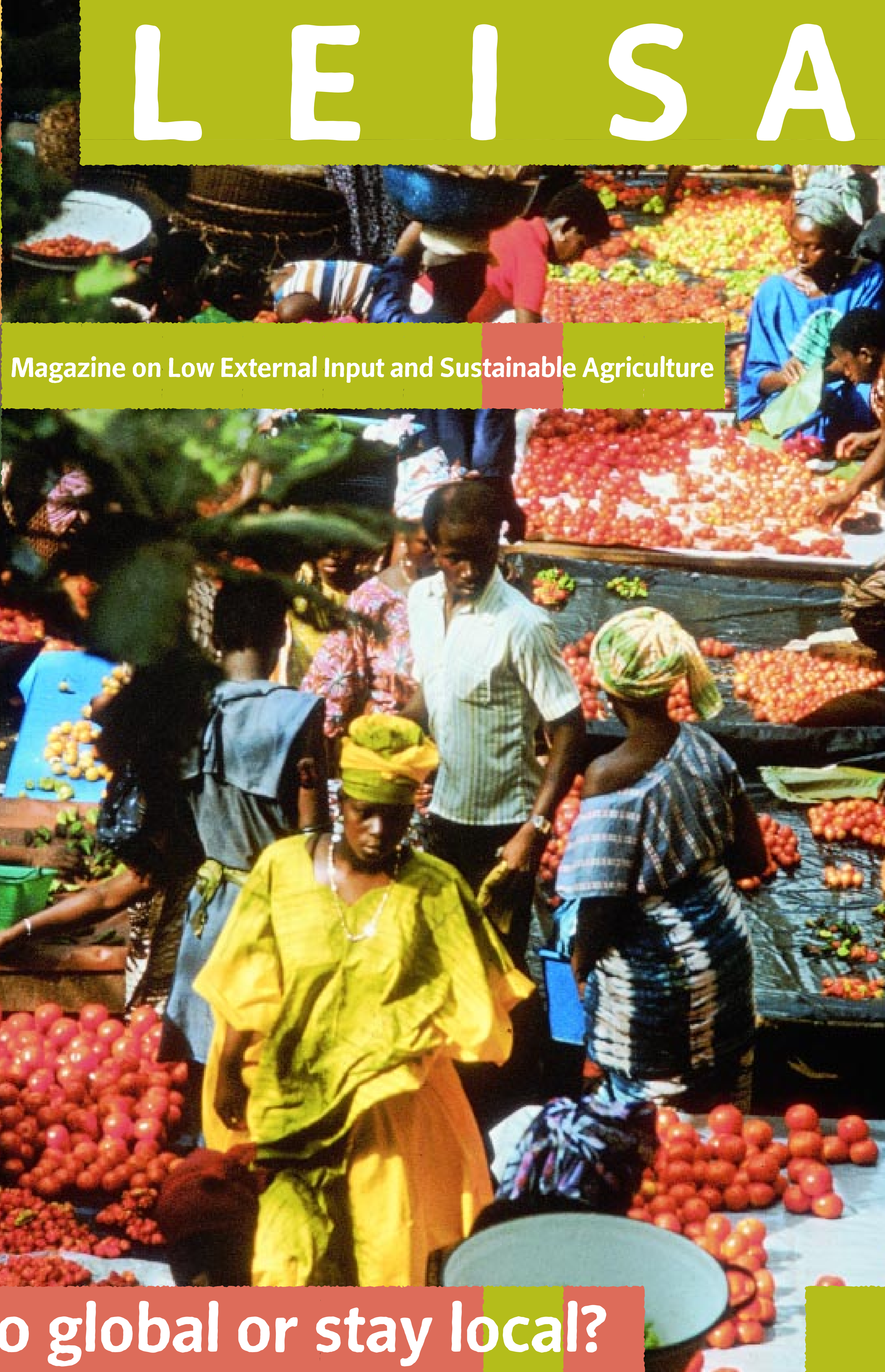

Go global or stay local?

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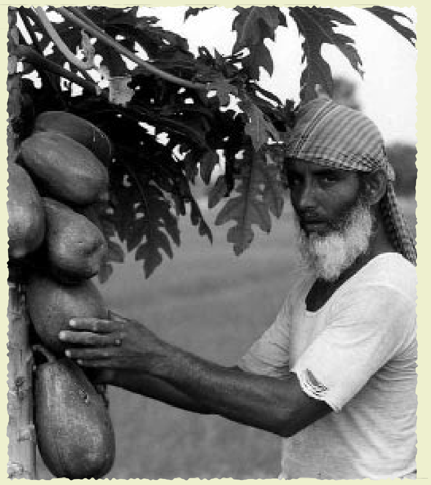

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DEAR READERS

The moral failure of the European livestock industry

Coen Reijntjes / ILEIA

Once again, Europe is engaged in the mass killing and destruction of farm animals to keep the livestock industry 'healthy'. The present Foot and Mouth Disease (FMD) epidemic follows outbreaks of swine fever and mad cow disease (BSE). It can only be controlled by massive 'preventive' slaughter, or so the public has been told.

Since 1991 European herds have not been vaccinated against FMD. This is a purely financial decision. A choice was made to orientate meat and milk production to the North American and Japanese market and these importers would only buy European products if they were clear of FMD antibodies. Antibodies conferred by vaccination could not be distinguished from antibodies present in animals suffering from FMD – hence the no vaccination policy. By accepting these export conditions, the livestock sector was able to secure a good income even though no animal in the last ten years has had any antibodies to protect it from FMD.

In recent months we have seen the fruits of this policy. More than one million animals: cattle, swine, sheep and goats, have been destroyed in the UK, one of the major advocates of the non-vaccination policy. Only a small percentage of these animals were actually suffering from FMD. The virus has now appeared in the Netherlands and has created panic. There are bans on animal movement and the transport of livestock products and large-scale slaughter of animals has started on and around the farms where the virus has been detected. Throughout the country there is confusion, protest, political wrangling and despair.

The FMD virus is extremely contagious. In general animals recover well and spontaneously from FMD, although milk and meat production may fall temporarily. FMD does not affect humans. In the present situation where export interests have priority, even the threat of FMD is a disaster for farmers, because herds are being destroyed for preventive purpose.

A vaccine exists. In the past, cattle were vaccinated every year. This provided reasonable protection. The best option was to vaccinate every six months. If an outbreak occurred, it could be controlled by quickly vaccinating herds in the vicinity of the affected farms and a few herds were destroyed.

Times have changed. The risk of FMD outbreaks have increased. Animals are kept close together and livestock and livestock products are routinely transported all over the world. The solution to the present outbreak is simple: vaccinate all FMD-susceptible animals. Technically and financially this is a feasible solution. However, export interests prevent implementation.

Once again the break down in moral values within the European agricultural sector gets visible. Within the intensive livestock industry there is little concern for animal welfare, food safety or the environment. More and more people are worried about the safety of industrially produced food or feel ashamed of being part of the present system. Many are turning to vegetarianism or becoming advocates of organic agriculture. Increasing numbers of politicians are aware things have to change. They are coming to recognise that food safety, animal welfare and the ecological soundness of agricultural production are legitimate concerns. It is now possible to discuss less intensive, more ecologically sound and organic ways of practising agriculture. The German Government has taken a firm decision to change its policies in this direction. But what will this mean in practice? Are we really ready to change our values or will entrenched economic interests continue to prevail? Now is the time for change!

Can you imagine this countryside without animals?

Themes for next issues

December 2001 Vol.17-4

Alternatives to Biotechnology

'Terminator Technology', 'Golden Rice', 'Bt Cotton or Maize', herbicide resistant 'Roundup Ready Soya' are the products of modern biotechnology. Some claim that such developments will solve the problem of world hunger and that we need Genetically Modified (GM) crops to meet the demands of a rapidly growing world population. But do we really need these technologies? Do they deliver what they promise? Are large companies investing in these technologies interested in the specific needs and requirements of smallholders in the tropics? Will low-cost and low-risk oriented farmers benefit from these technologies? And are there other biotechnologies not based on genetic modification that provide affordable and complementary tools for improving genetic resources?

In this issue on 'Alternatives to Biotechnology', we would like to focus on the specific claims made in favour of the introduction of the Genetic Revolution in tropical farming, the risks involved and the alternatives that exist around the world. For example, do natural pest control mechanisms in ecological maize or cotton production systems provide good alternatives to high external-input based Bt-Maize or Bt-Cotton? Do people who depend on integrated rice-based systems really need Golden Rice for their daily Vitamin A supply? Are herbicide resistant crops really needed in zero tillage systems? ***Deadline for contribution 1 September***.

Information on the themes of the July (**Globalisation challenged**) and September (**Going to scale**) issues can be found in the December issue of 2000, Vol.16-4, p. 36.

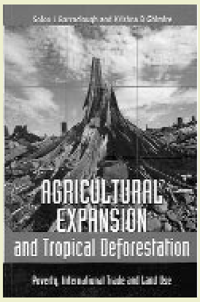
You are invited to contribute to these issues with articles (about 1600 words + 2 illustrations), suggest possible authors, and send us information about interesting publications, training courses, meetings and websites.

BOOKS

Manual on participatory 3-dimensional modelling for natural resource management

by Rambaldi G, Callosa J. 2000. 41 p. ISBN 971 8986 21 9. National Integrated Protected Areas Programme (NIPAP), Protected Areas and Wildlife Bureau (PAWB-DENR), Visayas Avenue, Diliman, 1101 Quezon City, Philippines. (Essentials of Protected Area Management in the Philippines, Vol. 7).

This manual of the Philippines Department of Environment and National Resources (DENR) is intended to assist participatory learning and action practitioners, NGOs, scientific institutions and others, who want to use community-based mapping as a tool for increasing the capacity of local stakeholders to interact with national and international stakeholders, and to express their views and assert their rights. Participatory 3-Dimensional Modelling is a cartographic method which merges Geographic Information System (GIS) generated data with people's knowledge. The manual is a step by step guide to making a relief model of a protected landscape or an ancestral domain in which all stakeholders are involved. The manual is a clear and useful tool, but digital maps and GIS expertise have to be available. This can make the process rather expensive. However, the resulting relief model will be an excellent visual aid for collaborative planning, for collaborative research, for protected area management, for increasing local communications capacity, etc. (WR)



Agricultural expansion and tropical deforestation: poverty, international trade and land use

by Barraclough SL, Ghimire KB. 2000. 150 p. ISBN 1 85383 665 6 GBP 14.95. UN Research Institute for social Development(UNRISD). Earthscan Publication, 120 Pentonville Road, London N1 9JN, UK / earthinfo@earthscan.co.uk ; www.earthscan.co.uk

Tropical deforestation has resulted in the conversion of large areas of tropical forest into other land uses. To remedy this degradation of natural resources, the social origins of deforestation processes and their social impacts have to be considered Deforestation stories that could contribute to the more sustainable use of natural forests have to include the political and socio-economic dimensions, as well as the ecological ones. The writers of this book have tried to do jut this. They draw empirical data from case studies ranging over three continents. They show that agricultural expansion and international trade are important factors in deforestation, but that their roles are varied and contradictory. The book ends with a look at public policy and institutional reforms at different levels that could help to promote more sustainable uses of tropical forest resources. (WR)

The dynamics of irrigated rice farming in Mali

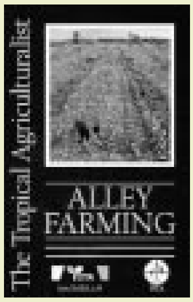
by Kater L,et al. 2000. 25 p. NUTNET programme, International Institute for Environment and Development (IIED), Drylands Programme. (Managing Africa's Soils, ISSN 1560 3520 ; 12). Drylands Programme, IIED, 3 Endsleigh street, London WC1H ODD, UK / drylands@iied.org / www.iied.org/drylands

This study of the Office du Niger, one of the largest irrigation schemes in sub-Saharan Africa, deals with the maintaining of soil fertility by the rice farmers and the risks of expanding the scheme. The rice farmers have recently diversified their production by growing vegetables on the rice fields in the dry season. They still have to add fertilisers because most of the rice stubble is consumed by livestock. In the dry season the herds browse rice stubble, and in the wet season they graze areas outside the scheme.

Expansion of the scheme will increase the pressure on the remaining resources outside the scheme, woodlands and dryland grazing areas. Sustainability can only be achieved when the rice farmers change their livestock management practices, and try to integrate their livestock and cropping systems. (WR)

Alley farming

by Kang BT, Atta-krah AN, Reynolds L. 1999. 120 p. ISBN 0 333 60080 0. Technical Centre for Agricultural and Rural Co-operation (CTA), PO Box 380, 6700 AJ Wageningen, The Netherlands. (The tropical agriculturalist / Coste R.(ed.)).



Alley farming, also known as avenue cropping, hedgerow inter-cropping or contour hedgerow system, is an agroforestry land-use system in which food crops are grown in alleys formed by hedgerows of trees and shrubs (preferably of nitrogen-fixing species). A livestock component may be included in the system as the hedgerow foliage can be used as animal feed. As such it is an excellent LEISA alternative in rainfed areas, particularly on sloping lands, as the hedgerows can greatly reduce soil erosion. Different aspects of this system are dealt with in a concise and practical manner, illustrated with diagrams and photos. This recent addition to CTA s 'The Tropical Agriculturist' series is written by scientists from the International Institute of Tropical Agriculture (IITA), which did research on and promoted the system in Africa. They also ponder over the low adoption rate by African farmers in comparison with Asian-Pacific farmers. (IHG)

Farmers' knowledge of soil fertility and local management strategies in Tigray, Ethiopia

by Corbeels M, Shiferaw A, Haile M. 2000. 23 p. NUTNET programme, International Institute for Environment and Development (IIED), Drylands Programme. (Managing Africa's Soils, ISSN 1560 3520 ; 10). Drylands Programme, IIED, 3 Endsleigh street, London WC1H ODD, UK / drylands@iied.org / www.iied.org/drylands.

In the semi-arid highlands of Tigray, Ethiopia, this survey was carried out to analyse local knowledge on soil fertility and soil fertility management practices. Land shortage and land fragmentation has increasingly forced farmers to abandon fallowing, manuring, terracing and using crop residues. The disappearance of these traditional practices has a considerable impact on soil fertility. One option would be to integrate the livestock and cropping system more closely. Farmers' experimentation with new practices is an important element in learning about integrated soil fertility management. (WR)

Stakeholder participation in policy processes in Ethiopia

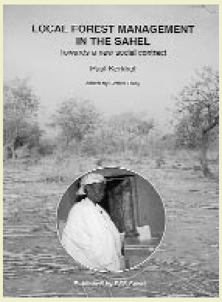
by Tessema W. 2000. 25 p. NUTNET programme, International Institute for Environment and Development (IIED), Drylands Programme. (IIED Managing Africa's Soils, ISSN 1560_3520 ; 17). Drylands Programme, IIED, 3 Endsleigh street, London WC1H ODD, UK / drylands@iied.org / www.iied.org/drylands

Degradation of the environment limits agricultural productivity in Ethiopia. Farmers aware of the problem, employ strategies like soil fertility management practices. This study sets out to examine the perceptions held by different people, institutions and agencies of the problems faced by farmers. It tries to identify possible policies and interventions. (WR)

Participatory integrated pest management by Weel P (ter), Wulp H (van der). 1999. 67 p. ISBN 90 5328 228 9. The Netherlands Ministry of Foreign Affairs, Development Cooperation, P.O.Box 20061, 2500 EB The Hague. (Policy and best Practice Document 3).
Published in the series Policy and Best Practice Documents, these papers are part of the official policy of the Dutch Ministry for Development Cooperation and provide up-to-date background information on topics that are considered important to the Netherlands development assistance programme. They address practical issues in different fields of development and provide guidelines for implementation. The issues in the field of IPM treated in the publication are of benefit to staff at Netherlands Embassies in developing countries who may be involved in identification, formulation, appraisal or review of IPM and crop protection projects, and preparation of policy or programme documents. Given the target audience, the language is non-technical and practical. New trends in the field of IPM stress the importance of participatory approaches now supported by several prominent international policy documents. In addition, the effective introduction of IPM requires a conducive policy environment that does not encourage the use of pesticides. The paper provides guidelines to support participatory IPM, focussing on assistance in the establishment and development of national IPM programmes; assistance to participatory IPM projects; and incorporation of participatory IPM components in ongoing or future projects or programmes. (WB-from executive summary)

Co-managing the commons : setting the stage in Mali and Zambia by Hilhorst T, Aarnink_N. 1999. 80 p. ISBN 90 6832 835 2 : NLG 19,50. Royal Tropical Institute (KIT), PO Box 95001, 1090 HA Amsterdam, The Netherlands / kitpress@kit.nl (Bulletins of the Royal Tropical Institute Series ; 346).
Commons are natural resources that are jointly used by various user groups and include forests, lakes, rangelands etc. In many cases the rights of the users are not well defined and a mingling of traditional and modern legal systems create confusion, resulting in overuse and conflict. This publication deals with a form of community-based management called ‘co(llaborative)- management’, offering opportunities for a more sustainable management of common resources by the establishment of formal agreements between user groups and the government. Two case studies are used to illustrate this approach. The first deals with co-management of forest and rangelands in southern Mali, the second with inland fisheries in northern Zambia. The final chapter dwells on the common elements shared by both cases and ways to facilitate the process of participatory management are explored. (IHG)

Local forest management in the Sahel : towards a new social contract by Kerkhof P ; Foley G, (ed) 2000. 83 p. ISBN 1 901459 28 4. SOS Sahel International UK, 1 Tolpuddle Street, London N1 0XT, UK / mail@sahel.org.uk



This report, also available in French, is the output of a research project in the Sahel, with emphasis on Mali, Niger and Sudan. It starts with a description of the existing methods of local community management of woodlands and the Sahelian forestry tradition partly imported from 19th century Europe. It describes the woodlands themselves, very different from European forests, and the way Sahelian families utilise the local woodlands in their survival strategies. The main developments in decentralisation and restructuring of the role of the state is described, and the report ends with the conclusion that natural woodlands can only be managed effectively on a voluntary basis by local communities operating within certain agreed constraints and restrictions. Local management needs to be negotiated between the various stakeholders involved. (WR)

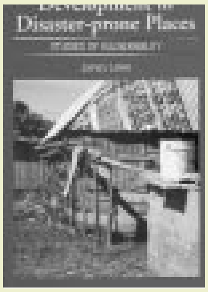
IPM and the citrus industry in South Africa by Urquhart P. 1999. 20 p. International Institute for Environment and Development (IIED), 3 Endsleigh Street, London WC1H 0DD, UK / sustag@iied.org Sustainable Agriculture and Rural Livelihoods Programme (SARL). (IIED Gatekeeper series, ISSN 1357 9258 ; 86).
IPM adoption in citrus is becoming important as part of the international market requirements, esp. in respect to pesticide regulations and criteria of buyers, and the increasing resistance to pesticides. This paper gives a critical overview of the importance of Integrated Pest Management (IPM) for the citrus industry in South Africa in general, and the contribution it can make to rural development in particular. The costs and benefits of IPM adoption for farmers and workers are discussed together with recommendations to encourage the adoption of IPM technologies in citrus at small farmer level. (IHG)

Meeting the challenges of animal traction : a resource book of the animal traction network for Eastern and Southern Africa
by Starkey P, Kaumbutho P (ed.) 1999. 326 p. ISBN 1 85339 483 1. The Animal Traction Network for Eastern and Southern Africa (ATNESA), PO Box BW540, Borrowdale, Harare, Zimbabwe DFID. Intermediate Technology Publications, London.
This book is one of several resource books published by ATNESA after the workshop on ‘Meeting the challenges of animal traction’ in Kenya in 1995. This particular resource book contains papers that address a number of important challenges to animal traction that relate to participation, environment, gender, extension, transport, equipment and animal husbandry. In addition, several papers describe national-level challenges and project attempts to address them. In sub Saharan Africa animal traction has been and still is an important way of increasing the surface area cultivated. Animal traction, placed in a comparative frame with hand hoeing and tractors, has many advantages. Though improper use of animal traction can aggravate environmental degradation, the technology is appropriate to agricultural development. The book also pays attention to post-war re-introduction of animal traction. A valuable resource book for all concerned with the development of animal power. (WR)

A training guide for in situ conservation on-farm : version 1 by Jarvis DI, et al. (eds) 2000. 159 p. ISBN 92 9043 452 X. International Plant Genetic Resources Institute (IPGRI), Via delle Sette Chiese 42, 00145 Rome, Italy CGIAR.
Agricultural biodiversity maintained on-farm by farmers has become an important way to conserve plant genetic resources in a local environment. This manual is written for Ministries of Agriculture and Environment, Universities, Research and Extension Institutions, NGOs and Community Based Groups. In the past, ex situ conservation programmes have been developed with conservation taking place in genebanks or botanical gardens. This guide provides information on expanding these conservation options to in situ conservation of crops on-farm. It mentions the advantages and disadvantages of in situ conservation and deals with a range of topics, from genetics to ecology and anthropology, including sampling, data analysis and participatory methods. The guide presents only the most basic and essential concepts. It is a compact but useful tool for the source group. (WR)

Development at risk? : natural disasters and the third world by Twigg J (ed.). 1998. 24 p. free of charge. Co-ordination Committee for the International Decade for Natural Disaster Reduction (IDNRD), London, UK / eadesa@raeng.co.uk :The booklet can be downloaded from www.gfz-potsdam.de/ewc98 or www.oneworld.org/idndr

This very readable booklet with four important contributions on the relationship of natural disasters and developmental progress is an important basic source of information on the topic. The first two articles look at the scale and nature of the disaster problem. The last two articles deal with ways of overcoming the threat of disasters. Poverty increases vulnerability to natural hazards, and in it the direct connection with development projects. Some people are more at risk than others, which implies that disaster mitigation has to be built on community participation. The booklet carries many examples from all over the world and makes clear why disaster preparedness is worth investing in. (WR)



Development in disaster-prone places: studies of vulnerability by Lewis J. 1999. 224 p. ISBN 1 85339 472 6: GBP 15.95. Intermediate Technology Publications, 103-105 Southampton Row, London WC1B 4HH, UK / orders@itpubs.org.uk

This book addresses the long overdue imbalance in disaster management: an over-emphasis on post-disaster assistance and a lack of attention to vulnerability reduction. Part one deals with causes for vulnerability in rural areas. In part two a number of case studies (Tonga, Antigua, Sri Lanka, Dorset) help to clarify vulnerability mechanisms. In part three the author offers development strategies for vulnerability reduction and increased disaster preparedness. Recommended reading for all those involved in the issue. (WR)

From feast to famine: official cures and grassroots remedies to Africa's food crisis by Rau B. 1990. 213 p. ISBN 0 86232 927 2, Zed Books, 7 Cynthia Street, London N1 9JF, UK.

This book, though not very recent, is still a valuable source on Africa's food crisis. The first part traces the origins of the crisis back to the colonial exploitation of the 19th century. This historical perspective is important to understand why the official cures discussed in the second part do not work. In the third part of the book, grassroots remedies are discussed. The writer states that 'free enterprise' and 'individual initiative' as important rules for the developed world override local realities and indigenous choices in developing countries. Listening to the people is what the author promotes with this book. He cites several examples of how indigenous agricultural knowledge has helped in coping with crises. (WR)

Women feed the world: world food day. 1998. 21 p. Food and Agriculture Organisation of the United Nations (FAO), Via delle Terme di Caracalla, 00100 Rome, Italy / www.fao.org

This brochure of FAO was published on the occasion of World Food Day, 16 October 1998. The fundamental contribution of women to household and national food security and the multiple roles rural women play throughout the entire food chain, from agricultural production to post harvest processing and marketing as well as in nutrition and food safety, was the reason for the publication. FAO believes that the battle for food security can be won only if the invaluable contribution made by women is recognised and supported. The document illustrates the important roles women fulfil and highlight the numerous needs they still have to cope with. The conclusion is that rural women must become visible partners in development and that their voice must be heard on par with that of men when policies and plans are elaborated. Yet, a lot has to be changed before this becomes reality. (WR)

Famine in the Sudan: causes, preparedness and response: a political, social and economic analysis of the 1998 Bar El Ghazal famine by Luka Biong Deng. 1999. 124 p. ISBN 1 85864 265 5 GBP 19.95. Institute of Development Studies (IDS),University of Sussex, Falmer, Brighton BN1 9RE, UK / ids@sussex.ac.uk. (IDS Discussion Paper 369).

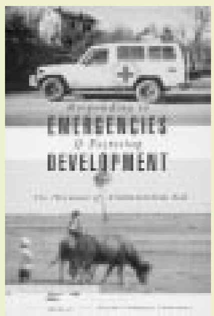
This IDS paper analyses the causes of the Bahr el Ghazal famine as a chain of political, environmental, economic and social factors, as well as a failure of public action and early warning systems. This detailed study of the causes of a severe famine disaster in 1998 shows the complexity of cause and effect when war, drought and failure of management together disrupt society. Even the international relief response was late and inadequate. The paper throws light on how disasters like this famine could happen, but unfortunately not on how disasters like this can be avoided. (WR)

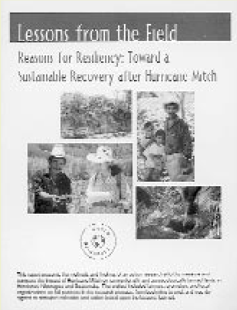
Waters of life: perspectives of water harvesting in the Hindu Kush-Himalayas: proceedings of the regional workshop on local water harvesting for mountain households in the Hindu Kush-Himalayas, Kathmandu, March 14-16, 1999 by Banskota M, Chalise SR. 2000. 101 p. ISBN 92 9115 104 1. International Centre for Integrated Mountain Development (ICIMOD), G.P.O. 3226, Kathmandu, Nepal / distri@icimod.org.np / www.icimod.org.sg

This document discusses, through a number of case studies, the methods of harvesting water throughout the HKH mountain region by a wide variety of people groups with special focus on the efforts being made by local communities. The Hindu Kush-Himalayas is the largest storehouse of fresh water in the lower latitudes. It is the source of major river systems, among others the Ganges and the Mekong. The extreme variability of climate and precipitation patterns as well as the inadequate knowledge on the hydrology of the rivers imposes limitations on the development of HKH waters. It concludes that concerted effort is needed to improve existing systems through community participation while expanding new systems at the same time. An annotated bibliography is annexed to the document. (WR)

Responding to emergencies and fostering development: the dilemmas of humanitarian aid by Pirotte C, Husson C, Grunewald F (eds). 1999. 183 p. ISBN 1 85649 755 0 (pbk) : GBP 14.95. ZED Books, 7 Cynthia Street, London N1 9JF, UK / zedbooks@zedbooks.demon.co.uk

Civil wars, genocide, natural disasters and other emergencies - this book is about how to respond to the fundamental difficulties thrown up by these humanitarian crises. The authors of the book are figures from leading emergency relief and development agencies. They write about their experiences and provide advice on how to act more effectively in the future. The book contains a small chapter on gender and emergency relief. This is an important part because women are often overburdened in crisis situations when they have to be sole providers for their children and families. The book includes many different voices and embodies an open-ended debate about the whole diverse process of international aid. (WR)





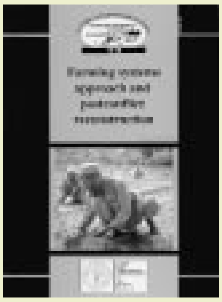
Reasons for resiliency: toward a sustainable recovery after hurricane Mitch. 2000. 32 p. USD 5.-, World Neighbours, 4127 NW 122nd Street, Oklahoma City, OK 73120-8869, USA / www.wn.org (Lessons from the field).
This report presents the results of the study on recovery after Hurricane Mitch in Central America in 1998. It shares the methods and findings of the participatory action research effort undertaken by nearly 2000 farmers in Honduras, Nicaragua and Guatemala. Eric Holt-Giménez's article in this issue focuses on the findings of this study, the conclusions of which are based on the numbers and figures mentioned in the report. This impressive piece of work proves the important possibilities of sustainable agriculture in creating and maintaining a stable ago-ecosystem, especially in disaster prone conditions. The study deserves broad recognition and imitation; at least policy makers in the involved countries should listen carefully. World Neighbours has done an excellent job by publishing the report in English and in Spanish, and making it accessible on the internet (on their web site) for free. (WR)

Changing course: recovery & research after hurricane Mitch.
2000. 17 min. USD 5.-, World Neighbours, 4127 NW 122nd Street, Oklahoma City, OK 73120-8869, USA / info@wn.org, www.wn.org
A video documentary of the above-mentioned research is available both in English and Spanish. Apart from Hurricane Mitch and its disastrous effects, it gives an impression of the field research and the farmers who were involved. It also illustrates the importance of the conclusions. The message is worth advocating. (WR)

Making less last longer: informal safety nets in Malawi
by Devereux S. 1999. 124 p. ISBN 1 85864 286 8 GBP 14.95. Institute of Development Studies (IDS),University of Sussex, Falmer, Brighton BN1 9RE, UK / ids@sussex.ac.uk : www.ids.ac.uk/ids. (IDS Discussion Paper 373).
Informal safety nets are defined in this paper as a subset of the range of coping strategies that people adopt in response to situations of acute food insecurity. Empirical studies across sub-Saharan Africa suggest that traditional practices of 'vertical' redistribution are rapidly disappearing under processes of commercialisation. Yet, 'horizontal' re-distributive practices - transfer to extended family networks and neighbours within poor communities - remain widespread but are highly vulnerable to risks that strike the whole community, i.e. drought. The paper describes studies of household coping strategies in Malawi, which confirm the importance of agricultural labour in rural areas as both a regular source of livelihood and a coping strategy in difficult years. Informal safety nets appear to play a more important role in urban areas than in rural areas, which could probably be attributed to the increased poverty in the latter. The paper ends with recommendations on the design of formal safety nets. The example of aid as inputs-for-work to boost production instead of food-for-work to support consumption is explained and the 'sustainable livelihoods' framework is argued to be usefully applicable to the design of formal networks. (WR)

Reducing risk: participatory learning activities for disaster mitigation in Southern Africa by Astrid von Kotze and Ailsa Holloway. International Federation of Red Cross and Red Crescent Societies, distributed by Oxfam UK, 1996, 301 pp, £14.95, ISBN 0 85598 347 7 .
Despite its focus on Southern Africa, this highly practical training resource can be used in other regions too. It is a collection of participatory learning exercises for people who work with communities at risk.

Risk-mapping and local capacities: lessons from Mexico and Central America by Trujillo M, Ordonez A, Hernandez C. 2000. 160 p. ISBN 0 85598 420 1 USD 18.95. Oxfam GB. (Oxfam Working Papers). Oxfam, c/o BEBC, PO Box 1496, Parkstone, Dorset BH12 3YD, UK / oxfam@bebc.co.uk
This paper describes an exercise carried out by Oxfam GB to map out the range of natural hazards and other risks to which people in Mexico and Central America are exposed. It relates the hazards to the complex social, economic, political, and cultural factors that increase the vulnerability of certain social sectors more than others do. The review of the threats and disasters across the region is very impressive. The maps showing the regional patterns of risk and vulnerability help to appreciate the importance of risk management in order to reduce vulnerability and insecurity and achieve sustainable development. The paper states the importance of fostering a culture of disaster preparedness in the different countries involved, and the importance of community participation in decision making to decrease vulnerability. The paper ends with an important chapter on the needs in disaster management in which warning systems, emergency plans and preparation for protection are discussed. (WR)



Farming systems approach and post-conflict reconstruction
by Schelhas B. 1998. 73 p. ISBN 92 5 104152 0; USD 8.00. Food and Agriculture Organisation of the United Nations (FAO), Viale delle Terme di Caracalla, 00100 Rome, Italy / www.fao.org. (FAO Farm Systems Management Series 14).
In this document, FAO presents important information on the linkages between the farming systems approach to development (FSD) and post-war rehabilitation and reconstruction. It is based on field experiences in development planning, rehabilitation and relief programmes. The aim of this document is to help small farming households in post-war situations to restore and improve agricultural productivity and levels of living in an equitable and sustainable manner, and strengthen preventive factors to reduce future recurrence of wars. The farming systems approach to development is a participatory approach. It is suitable for developing countries but also for countries undergoing heavy transformation processes like the Soviet Union. As an annexe, the booklet contains the example of the application of FSD in Afghanistan. (WR)

Roots up, strengthening organisational capacity through guided self-assessment. Revised and expanded edition.
World Neighbours, 4127 NW 122th Street, Oklahoma City, OK 73129-8869 USA. Fax: +1 405 752 9393; order@wn.org ; www.wn.org , US$ 20.00 plus postage.
The process presented in the guide provides local development organisations with the tools and perspectives necessary to strengthen their capacity by regularly reflecting on their performance, diagnosing internal strengths and weaknesses, identifying priority capacity areas, and designing action plans to improve effectiveness and long-term viability.

World Bank

http://www.worldbank.org

The pages of the World Bank website provide extensive information on disaster management and post-conflict reconstruction. Countries can ask for emergency recovery assistance, and be helped by the bank in financing investment and productive activities. The bank also helps with emergency-preparedness studies and technical assistance on prevention and mitigation measures to strengthen the country's resilience to natural hazards or lessen their impact. The pages are available in several languages, including Spanish and Portuguese. They offer information as well as downloadable reports.

Relief Web

http://www.reliefweb.int/

Relief Web centralises and disseminates information on humanitarian emergencies and natural disasters. This inforchers etc). Its Supplier Guide is an up-to-date and worldwide database of relief products, suppliers and service providers, i.e. you can find a firm, which can supply agricultural tools. Reliefguide provides an online tender area in which aid and development agencies can display their procurement needs. The aim of the Disaster Page is to bring together all parties involved in an ongoing disaster and create an effective exchange of information on aid-related operations and procurement needs. This part is stichers etc). Its Supplier Guide is an up-to-date and worldwide database of relief products, suppliers and service providers, i.e. you can find a firm, which can supply agricultural tools. Reliefguide provides an online tender area in which aid and development agencies can display their procurement needs. The aim of the Disaster Page is to bring together all parties involved in an ongoing disaster and create an effective exchange of information on aid-related operations and procurement needs. This part is still in the pipeline.

Pacific Disaster Centre

http://www.pdc.org/

This Centre is a federal information processing facility that supports emergency managers in the Pacific and Indian Ocean Regions. The page offers information on droughts and rainfall in the region.

International Decade for Natural Disaster Reduction 1990 – 2000

http://www.oneworld.org/idndr

This site provides information on IDNDR, activities, newsletter and an overview of the publications that have been published during the decade. It has been updated in December 1999.

Asian Disaster Preparedness Centre

http://www.adpc.ait.ac.th/

This Asian page on Disaster Reduction for Safer Communities and Sustainable Development provides a lot of information on disaster management, which can also be obtained in printed form. The centre offers courses and training material on disaster preparedness also in regional programmes.

United Nations High Commission for Refugees (UNHCR)

http://www.unhcr.ch

The majority of the world's refugees are found in marginal regions of poor, developing countries. Collecting shelter material and firewood can cause serious deforestation and soil erosion. Natural resources are threatened by the sudden arrival of large numbers of people. UNHCR and partner organisations seek to minimise the environmental impacts of refugee operations. Innovative, alternative solutions are being developed that enable refugee populations to become more closely involved with environmental management and rehabilitation. This site provides important information on refugees and the environment in English and several other languages.

Humanitarian Practice Network

http://www.odihpn.org/

The Humanitarian Practice Network of ODI is a leading information and analysis provider for the humanitarian sector. Its objective is to improve operational practice. The site provides information on this subject.

Disaster recovery, Iowa State University Extension

http://www.exnet.iastate.edu/Pages/communications/recovery/

This site aims to help Iowans make better decisions in tough times. Although tailored for rural families in the U.S.A., the site offers a lot of interesting information on post-disaster agriculture. Practical information, for example on how to manage trees after storm damage and how to store crops, can be very useful to farmers. This site is an example of how the internet can be used in disaster relief and recovery.

Disaster Preparedness and Emergency Response Association

http://www.disasters.org/

Information on emergency preparedness and management of emergency situations is provided by this website. It is available in English, Spanish, French, Portuguese, Italian and German. Besides information and the Disastercom Newsletter on pdf file, it provides many links to a range of organisations in the field of disaster preparedness.

Inter-Action-American Council for Voluntary International Action

http://www.interaction.org/

The page of the Council provides a lot of information and links. The Disaster Response Committee offers information on emergency response activities and reports on investigated emergency situations.
The sustainable development movement tries to promote dialogue, collaboration and action at project and policy levels on priority development concerns of InterAction members and their Southern partners in reducing poverty and achieving sustainable development. This part of the site offers information and links to organisations on sustainable development and agriculture, and on women in development.

United Nations Development Programme (UNDP)

http://www.undp.org

The page on crisis prevention and recovery gives important information on rehabilitation development initiatives.
The Disaster Management Training Programme DMTP offers country-specific training programmes for national governmental and non-governmental institutions and agencies in various areas of emergency management and disaster mitigation, prevention and preparedness. The DMTP also provides training for in-country UN system Disaster Management Teams. Wherever possible, DMTP provides training within a framework of national capacity building/ strengthening in disaster management programming. Unfortunately, information on agricultural rehabilitation is completely lacking.

Food and Agriculture Organisation of the United Nations (FAO)

http://www.fao.org

On the opening page of this very extensive and interesting web site of FAO is news on important agricultural emergencies like Mad cow disease, Foot and mouth disease, AIDS and climate change. It also gives access to the pages of the FAO agenda, special programmes and focus activities like: agriculture, forestry, sustainable development, gender and food security, and publications. The web magazine 'Agriculture 21' featured on the web pages on agriculture contains news, spotlights, archives and provides access to all specialised agricultural divisions within FAO. The part on organic agriculture, with downloadable FAO documents, photos, meetings and a discussion forum is of special interest to the LEISA community. The pages are available in English, Spanish and French.

International Federation of Red Cross and Red Crescent Societies

http://www.ifrc.org

This organisation posts news on recent disasters and aid campaigns from all over the world on its site. It contains an interesting article on a training programme in India on disaster preparedness for volunteers from the Indian Red Cross.

Sustainable agriculture to combat Global Warming

It is now widely acknowledged that the increase in emergencies due to disturbances and change of climate (droughts, floods, hurricanes) is strongly enhanced by 'Global Warming' (IPCC 2001). Global Warming is caused by the emission of 'greenhouse gases' through various human activities such as agriculture.

The 1997 Kyoto Protocol to the United Nations Framework Convention on Climate Change established an international policy context for the reduction of carbon emissions and increases in carbon sinks in order to address this problem. Under the Kyoto Protocol, industrial countries undertook a net reduction of greenhouse gases by 5.2% below 1990 levels by 2012. This implies the need to reduce emissions and increase sinks. Importantly, the Kyoto Clean Development Mechanism also provides incentives – known as 'carbon credits' – for countries that reduce their emissions or increase sinks of greenhouse gases.

In a recent study, Jules Pretty and Andrew Ball analysed the contribution of sustainable agricultural practices to the accumulation of carbon and the additional income this could provide to farmers if 'carbon credits' could be traded as agreed upon in principle in the Kyoto Protocol. The following is excerpted from their report.

Carbon in agriculture

Agricultural systems can contribute to carbon emissions through several mechanisms: I) the direct use of fossil fuels in farm operations; ii) the indirect use of embodied energy in inputs that are energy-intensive to manufacture (particularly fertilisers); and iii) the cultivation of soils resulting in the loss of woody biomass and soil organic matter. On the other hand, agriculture also can be an accumulator of carbon, when organic matter is accumulated in the soil, or when aboveground woody biomass acts either as a permanent sink or is used as an energy source those substitutes for fossil energy.

Long-term agricultural experiments indicate that soil organic matter and soil carbon are lost during intensive cultivation. But both can be increased to higher levels with 'sustainable management' practices. The greatest dividend comes from conversion of arable to agroforestry systems, as there is a benefit from both increased soil organic matter and the accumulation of above-ground woody biomass.

Grasslands within rotations, zero-tillage (or no-till) farming, green manures, and high amendments of straw and manures, also lead to substantial carbon accumulation. Zero-tillage with mixed rotations and cover crops can accumulate 0.66-1.3 t C/ha/year. The rates are higher in humid-temperate areas (0.5-1.0 t C/ha/yr), lower in the humid tropics (0.2-0.5 t C/ha/yr), and lowest in the semi-arid tropics (0.1-0.2 t C/ha/yr). For real impacts on climate change to occur, sinks must become permanent. This raises a core challenge for carbon trading systems, as there is no such thing as a permanent sequestered tonne of carbon.

Income from trading carbon credits?

The first carbon exchange or trading systems have set credit values from US$1.38 per tonne of carbon, though most commonly in the $2.50-5.00 range. For the United Kingdom, it is estimated that carbon sequestration could bring arable and grassland farmers between US$27million and US$220million per year if the government decided to pay for the ecological services provided by farmers. At current prices, it is clear that farmers are not set to become solely carbon farmers. However, systems accumulating carbon are also delivering many other public goods, such as improved biodiversity and clean water from watersheds, and policy makers may also seek to price these so as to increase the total payment package. Carbon, therefore, could represent an important new source of income for farmers, as well as helping to encourage farmers to adopt a wide range of sustainable practices. ■

From: Pretty J. and Ball A, 2001. **Agricultural influences on carbon emissions and sequestration: A review of evidence and the emerging trading options**. Centre for Environment and Society Occasional Paper 2001-03, Centre for Environment and Society and Department of Biological Sciences, University of Essex, Wivenhoe Park, Colchester CO4 3SQ, UK. The report can be requested from jpretty@essex.ac.uk or downloaded from http://www2.essex.ac.uk/ces.
Intergovernmental Panel on Climate Change (IPCC). 2001 **Climate change 2001: Impacts, adaptation and vulnerability**. IPCC Third Assessment Report. IPCC Secretariat, c/o World Meteorological Organisation, Geneva, Switzerland. Can be downloaded from http://www.ipcc.ch/ .

Correction

In LEISA Magazine Vol.16. No.4 on p.13 the old address of Permaculture Association (Britain) has been mentioned as source for the publication of Marc Bonfils. The correct address is: **BCM Permaculture Association, London WC1N 3XX UK; office@permaculture.org.uk**

Mrs Madondo, an AIDs widow, with her children and grandchildren surrounded by their weedy conventional cotton. Shortage of labour is a serious constraint for widows. Photo: Rexson Hodzi

Organic cotton to mitigate the impact of HIV/AIDS

Sam Page

Zimbabwe has one of the highest HIV infection rates in the world, with more than 26% of the sexually active population living with HIV. The driving force of this epidemic is poverty - it is forcing men to leave their families for extended periods in search of work and women to indulge in prostitution to raise money to feed their children. Local non-government and community-based organisations are at the forefront of the struggle against this pandemic.

In 1995, at the request of some 40 women farmers who could not afford to buy pesticides, Zimbabwe's first organic cotton project was set up in the Lower Guruve area. This initiative has since grown into a larger project, the Zambezi Valley Organic Cotton project, supported by the NGO African Farmers' Organic Research and Training (AfFOResT). Organic cotton and groundnuts are being produced for sale on the local and overseas markets.

The project is addressing a group of farmers who have been largely marginalised as a result of traditional law and agricultural policies: widows, many of them AIDS widows. Although many of these women may be HIV positive, it is the older women who are likely to be safe from HIV infection. As such, some older AIDS widows are responsible for six or more children, ranging from toddlers to teenagers. Many such widows are struggling to survive as smallholder farmers. While in the past widows involved in farming were a relatively small group, today, AIDS widows free of HIV and over the age of 40 are likely to be among the most productive farmers in Zimbabwe.

The impact of HIV/AIDS

The Lower Guruve area of the Zambezi Valley has not escaped the ravages of HIV/AIDS. Already more than one third of the families are headed by widows and there are an estimated 7,000 orphans living in the area. Child-headed households are also emerging. An initial HIV/AIDS impact assessment by the project has found that AIDS widows in particular suffer the effects of increased poverty, reduced availability of labour and the inability to make important management decisions. Interviews with a number of widows revealed the following adverse consequences of HIV/AIDS:

Shortage of labour

Widows suffer from a shortage of labour. Yields of the main crops cotton, maize and groundnuts are generally reduced due to late planting, smaller areas planted and poor management. Weeding seems to be the activity that suffers most. One of the women interviewed said: "*The farm activity most affected is weeding and we were delayed in picking cotton. It's impossible for me to go to the field, and it won't be possible next season either, or until the illness of my husband goes away. No one has relieved me since he got ill.*" Another woman commented: "*There's only me, my 12-year-old son and my mother-in-law who work on the land now. When my husband was alive, we would plough one acre in a day, but now we can only manage to plough half an acre*".

Shortage of cash

Shortage of cash is usually a consequence of the loss of income from either full-time employment in town or sources supplementary to farming, such as ploughing, thatching, carpentry, building or mechanical work. One woman said: "*When my husband was alive, I had my small project of making table mats, but now I can't afford the money to buy the thread*". She also had to reduce her acreage of cotton. In the 1997-1998 season, she planted five acres of cotton, whereas in 1994-1995 she and her husband had grown seven acres of conventional cotton. "*When I returned to the Valley I had difficulty in finding the money to buy seed and pesticides. So, I milked my cattle and sold the milk to buy seeds*." Another woman also suffered from a lack of money to grow her cotton. She had to sell an ox to buy the cottonseed and also to pay for her children's school fees and to buy food.

Lack of financial and management skills

This is a particularly acute problem in households where the deceased husband traditionally made all the important financial and farm management decisions. One woman, for example, mentioned that a cheque they had received from the Cotton company was made payable to her husband, who was unable to travel in order to cash it.

FFSs as support mechanism

Conventional smallholder cotton growing in the Zambezi Valley is usually based on monocropping and the use of five different pyrethroid and organophosphate pesticides. The current cost of these inputs is US$48 per hectare. In Zimbabwe, Farmer Field Schools (FFSs) were introduced in smallholder communal agricultural areas as a means of improving agricultural management practices, including the reduction or elimination of costly external inputs. These FFSs were adapted by AfFOResT to promote organic agricultural production.

Up to 90 farmers, many of them women, were trained by AfFOResT as Farmer Field Workers (FFWs) to facilitate FFSs for more than 900 other farmers over three years. During one month, these FFWs were trained at the Eco-Lab, just outside Harare (see ILEIA Newsletter Vol.13, No.4, pp12-13), in Natural Pest Management (NPM) and internationally certifiable organic agriculture, using a process known as *learning through discovery*. Once they had returned, each FFW held FFSs with 10 other farmers, at weekly intervals, throughout the growing season. Field staff regularly followed up this process to provide motivation and support. The project also managed to conduct *farmer participatory research* (FPR). In this system of research, innovative farmers were encouraged to generate their own research questions, while project scientists gave guidance in experimental design, including data collection and analysis, in a way that ensured that the farmers retain ownership of the results.

The AIDS widows said that they attended the FFSs because they gained strength from the support of other farmers and learnt how to grow cotton, hitherto regarded as a *man's crop*. They said that the system of intercropping and underplanting with food crops such as sorghum, sweet potato, cowpea and water melon, which had been introduced to eliminate the need for pesticides, also suppressed weeds, increased income and improved food security. In time they noticed that soil fertility was enhanced by following the project's recommendations for growing of live fences, conservation of leguminous trees in fields and rotation with groundnut and sunhemp.

Results compared

An analysis of costs and benefits during the 1997-1998 season indicated that organic cotton farmers had higher profits compared to conventional cotton growers. Although the average organic cotton yield was less than half that of the conventional crop in 1998, it gradually improved towards three-quarters of conventional yields by the year 2000. Year by year organic farmers gained a consistently bigger profit (see table). In 1998 and 1999, the farmers who had been certified as *organic* by the Eco-Certification Inspector received an additional 20% premium from the buyer.

It was estimated that the labour requirement was considerably reduced by replacing the 15 hours normally spent doing tasks associated with applying pesticides to conventional cotton, with 2 hours for attending a FFS and one hour scouting for pests and *farmers' friends* such as predators and parasitoids.

One widow indicated: "*I will grow only organic cotton next year because of the low labour requirement. There is less labour needed for weeding because some parts of the field are covered by cowpea. Less labour is needed for spraying too because the herbal sprays are made from plants in the bush nearby. I will not do any conventional cotton production because I have no money to buy inputs*."

It was concluded that organic farming systems have proven to be particularly appropriate for households affected by the AIDS pandemic, as they do not require the purchase of external inputs, they have reduced labour costs and they offer the farmers a premium when sold as a certified organic product.

AIDS prevention

The project has incorporated a component on women's vulnerability to HIV infection and prevention in its FFW training courses. A four-week training of male and female FFWs in May 1999 included two AIDS prevention sessions for men and women. During these sessions, condoms were promoted and the FFWs were invited to take batches with them to the Zambezi Valley to be sold at a small profit to their friends and families as an income-generating activity. The project is also sensitising communities on HIV prevention with the support of a consultant from the NGO Population Services International, who raises awareness on HIV and Sexually Transmitted Diseases and promotes the use of condoms.

NGO difficulties in averting HIV/AIDS

Despite its success in terms of mitigating the impact of HIV/AIDS and development of the production of organic cotton, this project is now on the verge of collapse. Since its inception, the biggest constraint has been the lack of funds. Now, the donor has withdrawn and aspects such as local project supervision, allowances for the FFWs, organic inspection and marketing, are suffering. The hard work of the past three years seem to get lost. This has happened despite a strong recommendation by an external evaluator to continue, and the recent nomination of the project by FAO/UNAIDS as a '*best practice*' in reducing vulnerability to the AIDS epidemic. This illustrates the difficulties local NGOs have in trying to avert the HIV/AIDS catastrophe.

■

Mrs Wingwiri and her son scouting their organic cotton crop. It is intercropped with sorghum, cowpea, pumpkins and sunhemp to increase diversity and improve food security. Photo: Rexson Hodzi

Table: Comparison of Organic and Conventional Cotton in Lower Guruve

	Organic Cotton		Conventional Cotton	
Year	Av. Cotton yield	Av. Profit (excluding premium)	Av. cotton yield	Av. Profit
1998	375 kg/ha	US$115	1,000 Kg/ha	US$75
1999	500 Kg/ha	US$64	1,000 Kg/ha	US$36
2000	750 Kg/ha	US$91	1,000 Kg/ha	US$55

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Further reading

- FAO 1999. **Sustainable agriculture / rural development and vulnerability to the AIDS epidemic.** UNAIDS best practice collection. UNAIDS, 20 Avenue Appia, 1221 Geneva 27, Switzerland. Fax: +41 22 791 4165, unaids@unaids.org, http://www.unaids.org/publications/documents/sectors/agriculture/Jc-fao-e.pdf
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Introducing new crops in a conflict situation: **Gender roles and innovation**

Roger W. Sharland

The ongoing war in **southern Sudan** and the widespread relief effort has resulted in a growing dependency in many communities on relief food. Air drops and other sources of relief food have increasingly become a major coping mechanism and an important component of many food economies. Within this context a number of agencies have been seeking strategies to increase food security through agricultural production.

Differences in food economy

Of the six food economy zones in southern Sudan, the main differences in the basic economy can be seen between the Equatorian tribes on the southern border and the agro-pastoralist tribes of the flood plains. The latter has a long tradition of agricultural production that is secondary to the importance of livestock in their lives, while the former depends almost exclusively on agricultural production. In the past couple of years, many areas of Western Equatoria province have returned to normal agricultural production, while the agro-pastoral areas to the north have remained relief dependent.

Searching for strategies

As part of my input to household food security strategy, I have examined what has enabled Equatoria to return quickly to food security while Bahr el Ghazal has remained relief dependent. One important factor identified in maintaining household food security in Equatoria has been the prevalence of fruit trees, especially mangoes, and the widespread cultivation of root crops (cassava and sweet potatoes) as well as the more traditional grain and oil seed crops. Although introduced into the food economy within the last century, root crops are now part of the established cultivation system of most Equatorial tribes.

Most of the agropastoralist Dinkas, who traditionally rely much more on their livestock for household food security, grow neither cultivated fruit trees nor root crops, and are much more vulnerable in their agricultural production. The disruption of the war over the last fifteen years has led to many changes including the loss of livestock and changes in the gender balance of the population, which has in turn led to large sectors of the population taking on new roles. This in turn seems to have led to an openness to try new ideas and technologies, including new crops.

Introducing new crops

During the 1999 planting season small amounts of planting material for fruit trees and root crops were introduced to a number of farmers in the Malualkon area of Northern Bahr el Ghazal. In January 2000, I facilitated a short workshop with those involved in the agricultural work and women from the local community. A very clear message from the workshop was that with the high population of livestock in the area these new crops cannot be grown in the same way that they are further south in Equatoria, and that local adaptations need to be made with local farmers. The main adaptations relate to three issues, namely the slightly shorter rainy season, and therefore longer dry season, the seasonal flooding that is common to that area and the roaming livestock, particularly in the dry season.

Adapting planting methods

Farmers are used to protecting their annual crops from livestock during the growing season, but both fruit trees and root crops need extra protection. This has led to trying out a new method of production of the root crops, cassava and sweet potatoes, especially in relation to the availability of planting stock. In Equatoria, annual new plantings are made from vines and cuttings obtained from the sprouting of plants that have survived the dry season. Planting material is plentiful and maintaining of stock or nurseries is not required. One of the adaptations made in Malualkon relates to maintaining the planting stock throughout the longer dry season when the livestock completely destroy any exposed plants. With cassava, some farmers have protected part of the area planted with stock proof fencing to provide the next season's source of cuttings. With sweet potatoes, a system of developing nurseries near water holes, which facilitates rapid growth due to well-manured soil, is being tried out for fast multiplication of vines.

New crops and gender roles

Of particular interest during the workshop were the gender roles in relation to the new crops and who to target with teaching. The different roles and division of labour in the production and

Contributions

Combating the consequences of flooding with farmer's innovation and experimentation by NJ Vermaak and D van Niekerk. Institute of Public Management and Development, Disaster Management Unit, Technicon South Africa, Private Bag X6, Florida 1710, South Africa. Email: dvniekerk@tsa.ac.za

The article reports on the devastating floods that occurred in Mozambique and adjacent regions during February 2000. It focuses particularly on the post-disaster period and the adaptations required from farming communities. Subsistence farmers in the Nzhelele region showed considerable potential for restoring their ecological balance by experimenting with new technologies and by taking preventive measures. The flooding disaster re-emphasised the need to avoid overgrazing and to protect natural vegetation. Such measures will improve farmers' resilience and their capacity to recover and sustain their livelihoods.

Foundation of traditions for drought mitigation with self sustainable agri-horticulture system in arid zone by Arun K. Sharma, Central Arid Zone Research Institute, Jodhpur – 3242003, India. Email: aksharma@cazri.raj.nic.in

After 8 years of experimentation the author developed a highly drought resistant, low-external-input agroforestry system based on Jujube (*Ziziphus mauritiana*) intercropped with annual grain legume crops, mainly green gram (see photo). It takes three years to develop fully but income is generated from the first year.
The system has been found to be sustainable with a rainfall of between 200-400 mm/year, provided the rainwater in the field is conserved and nutrients taken out of the soil with the harvested crop are returned in the form of manure. Experience showed that, on an area of one hectare, the system was able to meet the needs of a family of four that had four goats or sheep.

processing of the traditional crops, the different tools used and the preferences of men and women were discussed. This helped to gain an understanding of the gender issues involved in traditional cultivation, and how they could affect the wider introduction of new crops.

Thereon, we looked at the work involved in the production of new crops, which included not only root crops and fruit trees, but also swamp rice. In the case of root crops, particular attention was given to the work involved in protecting them from livestock and in fence building. The division of labour that emerged was based on local knowledge and experience and proved very different from the assumptions based on how the crops are grown further south in Equatoria.

Men's crops and women's crops

Both cassava and sweet potatoes were seen to be crops that require the input of both men and women if traditional roles are to be followed, with sweet potatoes considered more of a male crop and cassava more of a female crop. This is opposed to the experience of the Equatorian tribes, where cassava is the one crop that men frequently cultivate on their own. Division of responsibilities was less in relation to the nature of the crop and its produce (which is very significant in Equatoria) and more in relation to the type of tools used and the type of labour input.

For both crops, men's input was considered very important for the cutting of wood and building of fences to protect them from livestock, but what followed showed a significant division of labour. Sweet potatoes was seen as a crop with more male input because it is grown elsewhere in Sudan on mounds that require either a spade or the east African hoe to dig them, both tools more often used by men. It was also agreed that men should plant the vines, and as it is considered a cash crop that men should harvest it too. The work for cassava involves weeding which is more a woman's role, and the planting of the cuttings was also seen as a more female role, in contrast to that of the vines of sweet potato. For both crops women took on the responsibility of guarding the crop.

Assumptions challenged

The conclusion of this discussion was in contrast to what would be the normal practice in Equatoria. What we would have assumed is that the responsibility for cassava planting material should rest with the men and sweet potatoes with the women. The participants helped us to see that responsibility for cassava should be with the women and that of the sweet potatoes with the men, and that planting materials brought in should be divided accordingly. This is an interesting example of using farmer experience in relation to traditional crops in determining how an innovation can best be introduced from outside.

■

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How farmers, local NGOs and Government are fighting erosion on the island of Flores, Indonesia

by Herman WP Koopman, FADO Indonesia, Jl Letda Kajeng No.22, Denpasar (80234), Bali, Indonesia. Email: fadori@denpasar.wasantara.net.id .

The mountainous island of Flores is seriously affected by soil erosion. In the article soil conservation programmes carried out since the 1950's are discussed. Planting of contour hedgerows of Lamtoro (*Leucaena Leucocephala*) was very successful until 1986 when a major pest of Lamtoro made its appearance on the island - the psyllid *Heteropsylla cubana.* These jumping lice aggressively destroyed all the established leguminous hedgerows planted over a 20,000-hectare area. The very important lesson learned from this devastating invasion was that large-scale propagation of one exotic species is not to be recommended. The risk of pest outbreaks that cannot be naturally controlled are too high. Presently, a new approach has been developed. This focuses on sustainable agriculture as a whole and not just on erosion control. In this approach 'interception terraces' and the establishment of protective leguminous hedgerows of such species as Turi (*Sesbania sp.*) and Gamal (*Glyricidia sepium*) are promoted. It appears that the farmers and NGOs have found a good and effective way of fighting erosion. However, given the huge area, progress (about 1000 ha in the 1998-1999 rainy season) is still too slow.

Jujube – green gram agri-horticulture. Photo: AK Sharma

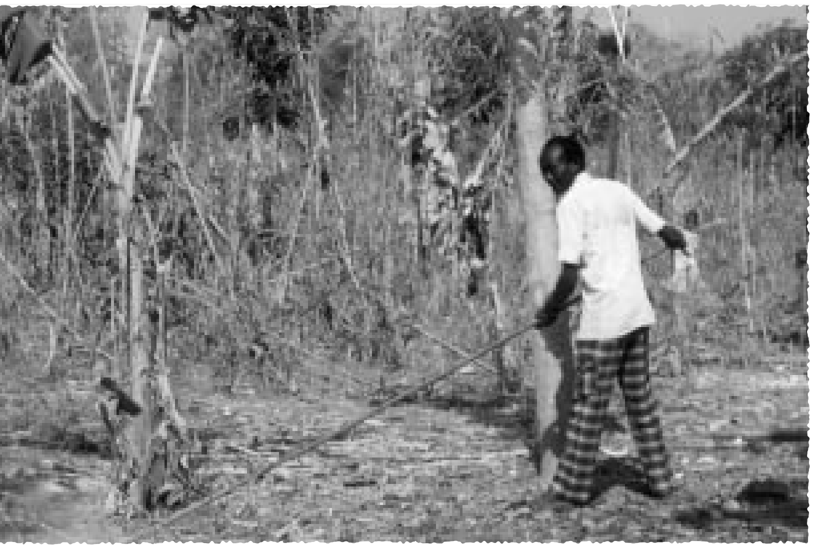
Rebuilding agricultural resilience: broader issues in rehabilitating rural livelihood systems

by Phil O'Keefe, John Kirkby and Andrew Collins, ETC UK, 117, Norfolk Street, North Shields, Tyne and Wear NE30 1NQ, UK. Email: office@etcuk.demon.co.uk .

Humanitarian assistance to mitigate natural disasters and, increasingly, complex political emergencies has increased twelve-fold from 1990–96. The challenge is not only to provide relief but to rebuild rural livelihood systems and to restore the resilience of agriculture. This is more easily said than done as the culture of humanitarian intervention is significantly different from participatory development practice. Emergency agriculture is much more developmental than humanitarian. There is a need to i) end the relief phase; ii) encourage restoration of local management of agricultural resources and to restore marketing systems, and iii) to increase resilience by upgrading the quality of inputs, especially improved seed varieties and blood stock lines. Emergency agriculture, to be successful, must capture immediate production opportunity. Humanitarian assistance has become much more professional, not least with the establishment of minimum standards in disaster response. Emergency agriculture, however, is not a part of these standards and remains the forgotten child of humanitarian assistance. Based on existing experiences the basic principles of emergency agriculture have to be thought through. This is what the authors have attempted to do.

The full articles can be requested from the authors or from ILEIA.

Understanding local adaptation of tools in a relief situation



Farmer using a long handled Sudanese hoe. Photo: Roger Sharland

Roger W. Sharland

Southern Sudan is a region that has seen civil war for all but ten of the last 45 years with many areas of the country dependent on relief aid. As the war has continued, relief agencies have realised the need for not only distributing relief food, but for increasing food security within the region through rehabilitating agricultural production. As people have had to leave their homes in the face of fighting and famine, seeds have often become scarce and tools have been lost. This has led to widespread distribution of seeds and tools by relief agencies.

Hoes and woes

The blacksmith picked up the hoe and threw it into the long grass behind him in a vivid show of disgust. This was not one of the hoes that he had made, but one that had been brought in by one of the many relief agencies in the area, and the recipient wanted the blacksmith to see if he could remake it into something useable. This scene could be repeated in many parts of southern Sudan, and such reaction comes not just from blacksmiths but also from the farmers. This type of hoe is causing frustration among farmers as it is not only the wrong shape but quickly breaks in the hard soil.

The response of the Sudanese blacksmith to the poor quality of a hoe, commissioned by an aid agency to be made by a manufacturer who has no idea as to its mode of use, is one indicator of the local knowledge of what are relevant tools. Blacksmiths make the tools that local people need and know about. They are innovators who adapt what is available to local use.

Why a Sudanese hoe?

The main tool for cultivation in southern Sudan is a flat push hoe, which is fitted to the end of a long handle as much as four metres long. The hoe head is fitted to the handle in the same way as a spear. These tools are not available from any source of mass production, but are made locally to local specifications by blacksmiths from within the various communities.

The push hoe scrapes the soil below the roots of shallow-rooting weeds. The shallow nature of the cultivation has long been a source of controversy by external agriculturalists, but has continued as farmers have experience that it is the most efficient way to cultivate in local conditions. The long handle is important as cultivation is normally done when the grass is at a significant length, and snakes are disturbed ahead of the cultivator. One important characteristic of cultivation in many areas such as the Moru is that most land is not prepared and cleaned before sowing, but sowing and cultivating are done at the same time as one activity. The broadcasting is done into the trash of cultivation.

Local adaptation overlooked

The need for well adapted seed that is suited to the climate and soil is widely recognised by agronomists, though not always given due consideration by those involved in quick response relief efforts. Much less recognised is the way farmers have developed tools relevant to their local conditions. The distinctly Sudanese types of hoes are not used in neighbouring countries such as Kenya and Uganda where agricultural land is short; the predominant tools are the mass-produced ones, uniformly used in the region. These manufactured hoes are easily available for relief agencies to buy, and are often the first choice for emergency tool distributions. The East African hoe is fixed at a right angle at the end of a handle not more than five feet long and uses a completely different action from that of the Sudanese hoe. Many of these hoes have been distributed throughout southern Sudan in recent years, but in most places are not the hoes of choice of the farmers. The action is unfamiliar and in most of the soil types they quickly split from hitting stones or rock hard baked clay during cultivation. They are also unsuitable for clearing large areas of savannah land. They do have uses in the agricultural economy, but not for the main cultivation, and in some areas even these hoes are taken to the blacksmith to be adapted to something more useful. A farmer recently showed me how he had got about half an inch of metal removed from each side to reduce the size to something much lighter, manageable and therefore more useful for his purpose.

Varied responses of relief agencies

As relief agencies have woken up to the fact that the East African hoe is of a completely different design to the Sudanese ones, response has been varied. One response has been to try to persuade people to use the new hoes with teaching that implies that the local hoes are backward and that the East African hoe is superior and is better. Such teaching ignores research done locally within Sudan in the 1970s and 1980s which showed conclusively that the local design of hoe is best suited for local conditions, and enables much larger areas to be cultivated with less energy expended.

The other reaction, which has been somewhat more positive, recognises that the local hoe is what is wanted and therefore should be supplied. Samples of the local hoes have been taken to Kenya and local manufacturers have been commissioned to make them in imitation. The result is the type of hoe that the blacksmith threw into the grass in disdain. I have seen countless of these hoes rejected and broken across the neck in different parts of southern Sudan, because they were not made in relation to the conditions of use.

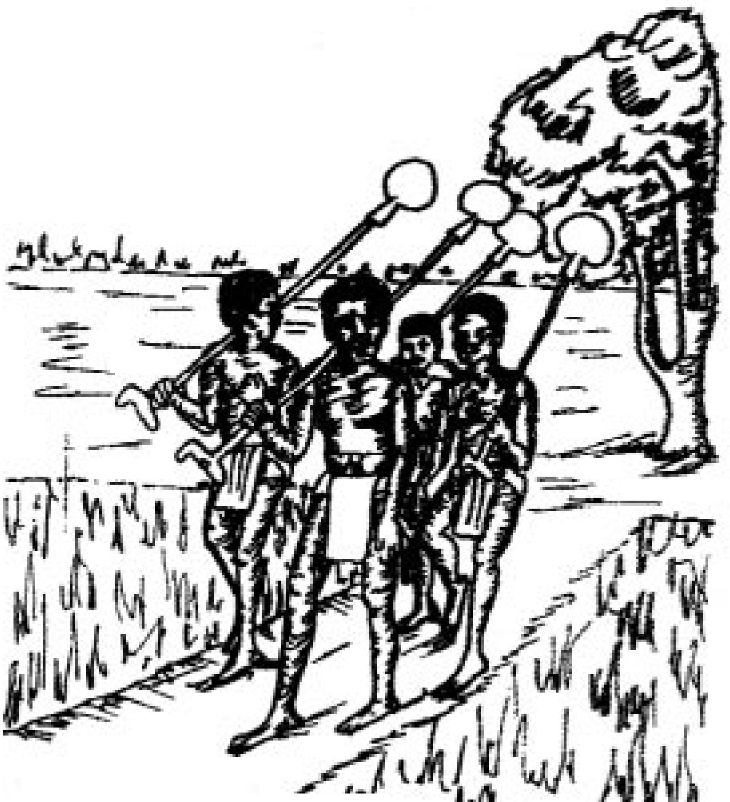
Taking note of local knowledge

The local blacksmiths on the other hand are in the community and use these same hoes and know the exact conditions that they are used in. They are directly accountable to the users, who are their clients and maintain quality control through the marketplace.

A further important observation is that although, superficially, the hoes used throughout southern Sudan have the same general shape and the same action, the actual size and shape of the head varies from area to area. For those who are unfamiliar with the soils and climate it may seem that the shape is merely a matter of local fashion or taste, in the same way that the shape of the drums or stools vary from tribe to tribe. However, on closer study one finds that the shape and size of the hoe used is a response to experience with the local conditions. Some hoes are more rounded, others are flat across the blade, and the size varies both from place to place and in relation to the field type or crop it is used for.

The shape of the tools is in fact a local adaptation to the conditions the farmers face in much the same way that the characteristics of the seeds they grow are. In hard and stony soil the blade wears down fairly fast, but this is taken into account and the use of the hoe changes with its size. For example amongst the Dinka of northern Bahr el Ghazal the new hoe is of a size used by the men in their general cultivation. By the second season this hoe has worn down to a size inefficient for the main cultivation, but which may be used either by the women as they assist the men in this cultivation, or else for the cultivation of groundnut fields in the lighter soils of the higher land. When materials are abundant a special hoe may be made for groundnut cultivation. By the third year, this hoe will be worn down to little more than a stump round the handle and this is the ideal hoe for the women to use in their weeding.

Beyond the different size and shape used in different areas, an important factor is also individual preference of need. Amongst the Moru, for example, many different sizes of the same basic hoe are wanted in relation to the strength (and pride!) of the user. A larger hoe can clear more land if the user is strong enough, but becomes inefficient if too large for the user's strength and skill.



Long handled Sudanese hoe.

So a farmer will order from the blacksmith the type of hoe most appropriate for himself.

Making relief work better

What therefore is the relevant response that relief agencies should be making in this situation? The blacksmiths can easily make tools, but what they are lacking is the raw material to make them. The most relevant response that I have been encouraging for many years is the distribution of quality steel plates, from which the blacksmiths can cut and make the tools to the specification of the local farmers.

As a blacksmith pointed out to me on a recent visit, good quality steel plates can be made into any of the tools needed, and the off cuts can be fashioned into knives or spears necessary for the wider life of the community. With the raw material of steel plates, any tool that is needed can be made by the blacksmith and the community can have greater control in what is most needed. The farmers in conjunction with the blacksmiths have developed the tools best suited to their situation, and recognition of this simple fact could greatly assist agencies to respond in a relevant fashion. ■

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Developing technology with farmers: a trainers guide
by Laurens van Veldhuizen, Ann Waters-Bayer and Henk de Zeeuw, 2000. Zed Books / ETC Netherlands. ISBN 977-6030-00-9.

A practical training guide for participatory farmer experimentation with low external input and sustainable agricultural technologies developed by ETC Netherlands. Available from CEOSS, PO Box 162-11811 Panorama, Cairo, Egypt. Phone: +20 2 2975901/2/3; Fax: +20 2 29755878; Email: ga@ceoss.org.eg . The book is available in English as well. Further information Peter Laban: ETC Netherlands, PO Box 64, 3830 AB Leusden, The Netherlands. Email: p.laban@etcnl.nl .

Farming for the future: an introduction to low external input and sustainable agriculture by Coen Reijntjes, Bertus Haverkort and Ann Waters-Bayer, 1999. PARC/MAAN/ILEIA.

Available from Palestinian Agricultural Relief Committees (PARC), PO Box 25128, Beit Hanina, Jerusalem - West Bank.

This publication is also available in English, French, Spanish, Portuguese, Bahasa, Thai and Chinese. Information on publishers can be requested from ILEIA.

Supporting community seed multiplication
The 'Rescue from the Pot' project

Rice seed in Sierra Leone: many varieties are usually found within the same family farm. Photo: Ivan Kent

Ivan Kent and Samuel P. Mokuwa

After a decade of civil war**,** access to a sufficient diversity of seed material is difficult for the small-scale rice farmers of **Sierra Leone**. Valuable stocks have been destroyed, and the disruption of national, regional and community level trading networks has hampered the spread of new technologies and their adaptations. After many years of attempts to provide planting material through emergency large scale aid distributions, there is now a need for a more subtle approach to support the recovery of local seed stocks and the social networks upon which they depend. With these aims in mind, the 'Rescue from the Pot' project, a joint initiative between local communities and the international NGO, Action Against Hunger, was started in March 2000, in the Southern Province of Sierra Leone, an area recovering from conflict.

Rice cultivation in the forest zone

Rice cultivation within the forest-zone of Sierra Leone takes place in a variety of ecological conditions, with upland and swamp environments often found within the same farm (Richards 1986). Farmers often plant several varieties of rice to match a range of soil and moisture conditions. The use of varied environments and cultivars of different cycle lengths allows the harvest to be spread over several months, thus reducing bottlenecks in labour and providing a variety of grains for the household, community and market. Although formal seed markets play an important role in the distribution of the more popular and widespread varieties, many landraces are distributed through informal channels and social networks.

Seed stocks lost due to conflict

Since the beginning of the civil war in 1991, almost all parts of the country have at one time or another suffered conflict or brutal rule by armed factions. Where fighting takes place, stocks of rice seed are lost as a result of looting, extortion and arson; markets and social mechanisms for exchanging seed are invariably disrupted. Maintaining access to particular varieties becomes difficult, especially when traditional source areas become 'off-limits' as a result of on-going conflict. In addition, continuing food insecurity means that seed stocks are often used for consumption.

Emergency distributions

External interventions in the agricultural sector in Sierra Leone, as in other war-torn countries, have been largely based on the delivery of seeds and tools. Dealing with tens of thousands of farming families, these operations provide basic, standardised inputs during the planting season in an attempt to replace lost quantities of seed and to prevent further population displacement or long term dependency on food aid.

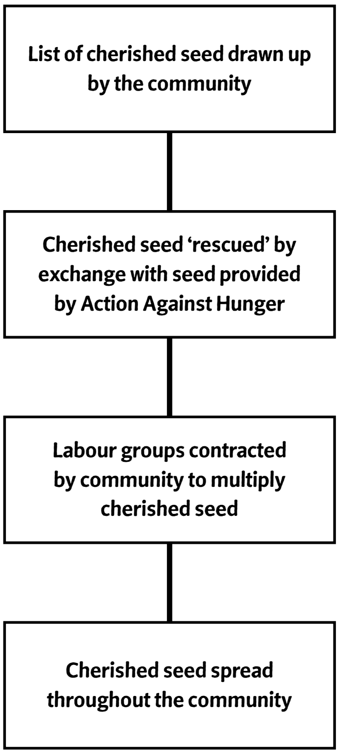
Due to their sheer size and logistical requirements, it is not possible for these operations to take into account the agro-ecologial diversity of each area, or the varied preferences occurring at the village or farm level. In Sierra Leone, programmes are therefore limited to the distribution of a few improved types, notably Rok3, a popular variety developed at the national Rice Research Station at Rokupr, tolerant to both swamp and upland conditions.

The versatility of such varieties make them a good option for large-scale emergency operations aimed at meeting immediate shortages of seed. However, aid agencies face difficulties in sourcing enough seed of sufficiently high quality, and repeated distributions of the same variety over several years do little to encourage the multiplication of more locally adapted and preferred landraces.

Cherished landraces

Three chiefdoms in the Southern Province of Sierra Leone were selected for the pilot phase of the project. After two years largely free of conflict, much of the population that had earlier fled had since returned home. While Rok3 and a handful of popular local landraces were generally available to most farmers, many 'cherished' landraces, suitable for particular ecological niches or cultural functions, were hard to come by.

However, some local landraces could still be found; a survey of 105 farmers carried out in three villages after the 1999/2000 harvest revealed that 16 rice varieties with distinct names were being used. Unfortunately, many of the sought-after or 'cherished' varieties were held only in small amounts by a few families and remained inaccessible to the majority of farmers. Furthermore, because of the still precarious food security situation, little of the cherished seed was saved for the next season. While it was recognised that the resources for multiplying the seed could be found locally, the disruption of social networks caused by the war meant that mechanisms for widening access to seed were missing. In response, chiefdom authorities decided to work with Action Against Hunger in order to rescue some of these cherished varieties.



Preferred characteristics

Once the outline of the project had been agreed upon, meetings were held to draw up lists of the most sought after seed. Through a system of matrix ranking, which included gastronomic as well as agronomic criteria (see box), several varieties were prioritised by each chiefdom. It was agreed that the varieties targeted for multiplication would be limited to those that were highly valued, but in short supply. The three chiefdoms involved in the project selected different varieties for multiplication, reflecting local preferences and varying degrees of scarcity.

Rescued for multiplication

The next stage of the project was to locate the cherished varieties within the community so that they could be 'rescued' for multiplication. It was agreed that cherished seed could be exchanged at a set ratio of 3:2 for a more common variety provided by Action Against Hunger, at designated trading points throughout the project area. Rice was 'exchanged' rather than bought for cash, in order to maintain the food security of households giving up their cherished varieties. At first, farmers were slow to come forward with their rice. However, after 2 weeks, a total of 6.5 metric tonnes of seeds had been exchanged for 9.8 metric tonnes of Rok3 seeds donated by Action Against Hunger.

Labour groups were then invited to grow the cherished varieties on behalf of the community. An agreement was collectively developed and signed by the group leader and master farmer in each group, and witnessed by the Paramount or Regent Chief - the chief custodian of land. A total of 42 labour groups, each with up to 25 members, were formed to multiply the cherished seed in the three chiefdoms. They were paid for their labour with food, and allocated a small percentage of the harvest. During the growing period, field extension officers and community counterparts made farm visits to monitor progress and estimate potential yield. In addition, regular village meetings provided an opportunity for group leaders to give updates on their progress to the chiefs.

Project not without difficulties

At the seed exchange stage, some field extension officers were unable to identify the 'cherished' varieties and some farmers donated and received the wrong type of seed. In one area, seed earmarked for multiplication was eaten on the order of the town chief during a village construction project, and in another the project was suspended indefinitely because armed militia looted the food stocks reserved for the workgroups multiplying the seed. Not all parties agreed on who should benefit from the scheme; displaced populations were not always able to take part in the project, since chiefdom authorities sometimes limited participation to long-term residents. Despite these difficulties, it is estimated that 35.5 metric tonnes of 'cherished' seed were made available to the wider community by the end of the first harvest.

Many lessons learned

The 'Rescue from the Pot' project illustrates the potential for incorporating local knowledge and capacities into the more common distribution-oriented seed programmes of aid agencies. But the transition from emergency seed distribution to community-based seed multiplication requires a set of new skills and a different mode of engagement between local communities and implementing agencies. Extension staff require more locally adapted skills (in both agronomy and conflict resolution); while farmers can benefit from training in seed multiplication and storage to produce good quality material. More importantly, regular contact between all parties is essential to nurture mutual trust and activities such as football matches and music events, as well as seed fairs and formal meetings can play an important role.

In an unstable post-conflict environment, communities are wary of investing in longer-term collaborations with aid agencies that may leave an area suddenly if fighting resumes or funding dries up. But frequent meetings with all actors help to enhance a sense of ownership as well as to re-establish traditional civilian structures disrupted by conflict. Although still in its early stages, farmers in the project area already have access to a broader range of seed types and even after a single season requests have been made for an extension of the 'Rescue from the Pot' project into the following year. ■

Characteristics of preferred varieties

- high tillering ability & large panicle formation
- adaptability to various soil conditions
- high yields
- tolerance / resistance to iron toxicity (for swamp varieties)
- good performance on short fallow bush
- quick maturity (thus shortening the 'hunger-gap')
- palatability
- high swelling during cooking
- attractive grain colour (red or brown pigmentation is preferred in local dishes);
- good storage after cooking

Luseni Cafenor - one of the project farmers with a field having a cherished variety 'rescued from the pot'. Photo: Ivan Kent

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Reducing food poverty with sustainable agriculture: new evidence

In 1998 the SAFE-World project started to audit recent worldwide progress towards sustainable agriculture. A survey of sustainable agriculture initiatives was conducted with the aim of investigating both processes and outcome, and to draw conclusions on whether such improvements could significantly help to feed the growing world population without causing further damage to environment and human health. At the end of 2000, the database contained information on 208 cases from 52 countries involving some 8.98 million farmers on 28.92 million hectares. On this basis it is estimated that on at least 3 % of the farmed land in Asia, Africa and Latin America, farmers are using sustainable agricultural technologies. A summary of the conclusions of the survey has been published on the web, and a book to be launched soon. The following are excerpts from this summary.

Types of improvement for sustainable agriculture

1: Better use of locally available natural resources – in 88% of the cases
2: Intensified use of microenvironments in farm systems (gardens, orchards, ponds) – 21%
3: Diversification by adding new regenerative components – 59%
4: Better use of non-renewable inputs and external technologies – 18 %
5: Social and participatory processes leading to group action - 55%
6: Human capital building through continuous learning programmes – 92%
7: Access to affordable finance (credit, grants, subsidies) – 17%
8: Adding value through processing to reduce losses and increase returns – 12%
9: Adding value through direct or organised marketing to consumers – 15%

Achievements

Of the 208 cases, 91 contain data on yield changes obtained by improvements as presented in the box. The proportional yield increases are generally: 50 – 100% for rain fed crops, though considerably greater in a few cases; 5 – 10% for irrigated crops, though starting from a higher absolute yield base.

Most initiatives report significant increases in household food production – some as yield improvements, and some as increases in cropping intensity or diversity of produce. The evidence shows that:

1. For 4.42 million farmers on 3.58 million ha., average food production per household increased by 1.71 tonnes (an increase of 73%).
2. For 146,000 farmers on 542,000 ha cultivating root crops (potato, sweet potato and cassava), the increase in food production per household was 17 tonnes (an increase of 150%).
3. For the larger farmers in Latin America (av. size = 90 ha/farm), total production increased by 150 tonnes per household (an increase of 46%).

Conducive factors

The successes have been mainly founded on:

- Appropriate technology adapted by farmers' experimentation;
- Social learning and participatory approaches;
- Good linkages between farmers and external agencies, together with the existence of working partnerships between agencies;
- Presence of social capital at local level.

It is concluded that if sustainable agriculture is to spread to larger numbers of farmers and communities, then future attention needs to be focused on:

1. Ensuring the policy environment is enabling rather than disabling
2. Investing in infrastructure for markets, transport and communications;
3. Ensuring the support of government agencies, in particular, for local sustainable agricultural initiatives;
4. Developing social capital within rural communities and between external agencies.

Proud portraits

Both the website and the publication present an impressive list of proud portraits of sustainable agriculture. Two examples:

Most initiatives seek both to reduce soil erosion and to make improvements in soil physical structure, organic matter content, water holding capacity and nutrient balances. One sustainable agriculture technology to spread at extraordinary speed is zero- or minimal tillage (ZT). For example, in Brazil, there were 1 million ha. under ZT in 1991; by 1999, this had grown to about 11 million ha. in three southern states only. ZT has resulted in better input use, water retention, soil management, diverse rotations, break crops for weed control (e.g. ray and black oats between maize/soybeans) and use of green manure and cover crops. ZT also cuts erosion and water run-off, thus reducing water pollution.

Many sustainable agricultural initiatives have reported very large reductions in pesticide use following the adoption of IPM through farmer field schools in rice agroecosystems.

In Kenya, about 2000 farmers have adopted 'push-pull' strategies developed by ICIPE to repel (push) stem borers from the cereal crop (maize and sorghum) using a repellent intercrop (e.g. molasses grass (*Melinis minutiflora*) and silver leaf (*Desmodium uncinatum*)) and to attract (pull) them to intercrop or barrier forage grasses e.g. Napier grass (*Pennisetum purpureum*) or Sudan grass (*Sorghum vulgare*). In this way maize yields have improved by 60 – 70 % in 1998-99. ICIPE has also found that intercropping maize with the fodder legumes silver leaf and green leaf (*Desmodium intortum*) reduced infestation of the parasitic weed, *Striga hermonthica,* by a factor of 40 compared to maize monocropping. This is significantly more than intercropping maize with soybean, sunhemp and cowpea.

Supportive policies are missing

The past decade has seen considerable global recognition of the need for policies to support sustainable agriculture. In most countries, however, sustainable agricultural policies remain marginal. The collected evidence shows that sustainable agricultural systems can be both economically, environmentally and socially viable, and contribute positively to local livelihoods. But without appropriate policy support, they are likely to remain localised in extent.

■

From: Pretty J and Hine R. 2001. **Reducing Food Poverty with Sustainable Agriculture: A Summary of New Evidence**. Final Report from the SAFE-World Research Project, Feb 2001. University of Essex, Colchester, UK. A summary of the report is available on http://www2.essex.ac.uk/ces/ResearchProgrammes/SAFEW47casessusag.htm

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Sustainable plots had 20% to 40% more topsoil. Photo: World Neighbors

Measuring farmers agroecological resistance to hurricane Mitch

Eric Holt-Gimenez

In October of 1998, Hurricane Mitch, one of the Caribbean's five most powerful hurricanes of the twentieth century, slammed into **Central America** causing US$ 6.7 billion in damage to infrastructure and industry (primarily agriculture) an amount approximately equal to 13.3% of Central America's GNP. Two meters of rain in less than one week coupled with mudslides and landslides washed away crops, animals, buildings, roads and bridges. Topsoil, lost from hillside farms, silted rivers that overflowed their banks, flooding fields and urban areas. Over 10,000 people died and 3 million were displaced or left homeless. The environmental damages were incalculable. The countries hardest hit were Honduras, Nicaragua and Guatemala. All areas affected by Hurricane Mitch are characterised by an uneasy mix of large-scale plantation agriculture and extensive cattle ranching (primarily for export) alongside small, very poor, subsistence farms. The hillsides and fringes of the large holdings are surrounded by mosaics of hundreds of thousands of poor rural families who eke out an existence by farming basic grains on ecologically fragile land and by engaging in a myriad of other seasonal, part-time, informal rural and urban work. Most observers agree that the unprecedented magnitude of the disaster is the consequence of decades of deforestation, non-sustainable agricultural practices and other forms of environmental degradation that left the region exceptionally vulnerable to an erosive event.

'Sustainable' farms suffered less

While first reports regarding agricultural damage simply indicated that the levels of destruction were massive, subsequent on-site observations began to reveal a more subtle, differentiated pattern. Farms using what are commonly understood to be 'sustainable' practices appeared to have suffered less damage than their 'conventional' neighbours. These farms belonged to smallholders working within a multi-institutional, regional movement for sustainable agriculture (agroecology or LEISA) known in Central America as Campesino a Campesino (Farmer to Farmer). The farming practices commonly encountered in Campesino a Campesino included a wide range of soil conservation and sustainable cultivation methods, tested and promoted by smallholders for nearly thirty years. Most common amongst them were soil and water conservation methods, reduced or discontinued use of chemical inputs, cover crops, agroforestry, in-row tillage, organic fertiliser and pesticides, and different forms of Integrated Pest Management.

An opportunity to compare impact

In general, these sustainable farms exist as islands and archipelagos within a greater, conventional 'sea'. While often localised and geographically fragmented, they provided an excellent opportunity to compare the agroecological resistance to the hurricane of sustainable farms to that of conventional farms. The presence of Campesino a Campesino, made up of farmers and technicians experienced in farm experimentation and farmer to farmer training, also provided the opportunity to carry out an extensive, participatory, action research project in the low, medium and high impact areas of Hurricane Mitch. Several researchers with years of experience working in the Campesino a Campesino Movement designed a study and wrote a proposal. World Neighbors, an NGO working in the region, agreed to sponsor the project, helped to find funding (Ford, Summit, Rockefeller and Inter-American Foundations), and provided administrative support.

Much interest in the study

From February through May of 1999, 40 different NGOs with sustainable agricultural research and development (SARD) projects trained and mobilised 100 farmer-technician teams and 1,743 farmers to carry out paired observations of specific agroecological indicators on 1,804 neighbouring, sustainable and conventional farms. The study spanned 360 communities and 24 departments in Nicaragua, Honduras and Guatemala. The primary objectives of participating in the study were threefold: First, farmer-promoters and NGOs in the Campesino a Campesino Movement were eager to compare their farms to conventional farms because demonstrating a higher level of agroecological resistance would imply a higher level of sustainability. After years of being told that sustainable agriculture was not 'viable', nor 'economical', they were anxious to dispel doubts about the importance and effectiveness of their practices. Secondly, NGOs were very interested in evaluating the effectiveness of years of support for farmer to farmer SARD. Commonly, these projects are evaluated on the level of implementation (number of workshops, participants, terraces, compost heaps, etc.) However, the study gave them an opportunity to evaluate the level of their agroecological impact. Finally, all participants were interested in influencing the agenda for agricultural reconstruction after the hurricane. If farmers could show that sustainable farms were more resistant than conventional farms, then a strong argument could be made for a participatory, sustainable agricultural reconstruction strategy.

A collaborative action

An intensive period of organising, training, data collection and field monitoring began in February of 1999. It was crucial that field data be collected before the onset of the rainy season in late April. Each team had one technician and two farmer-promoters. They carried out observations on the ten best examples of sustainable farms and on the ten neighbouring, conventional farms. Paired observations had to be located in close proximity, in the same position and cardinal orientation in the watershed, have the same general slope and similar environmental surroundings (fields, trees, infrastructure, etc.).

Agroecological indicators included topsoil depth, rill and gully erosion, percent vegetation, crop losses and structural damage. Each team member specialised in specific steps and measurements of the field procedure to reduce and standardise observational errors. The owners of both farms in the paired observations accompanied the team on both sustainable and conventional plots, then signed off on the field sheet indicating measurements and observations had been free of bias. Technicians interviewed farmers regarding their observations of the hurricane, the damage patterns, and the different reasons for any agroecosystem failures. National research coordinators in each country held periodic sessions with teams for feedback, troubleshooting and the correction of field errors.

Significant differences

Field data from the farmer-technician teams was entered into an interactive ACCESS database for each country. Initial results (averages) were processed for distribution among participants. While there was some local variation, the overall results indicated an overwhelming trend of higher agroecological resistance on the sustainable farms. Sustainable plots had 20% to 40% more topsoil, greater soil moisture, less erosion and experienced lower economic losses than their conventional neighbours. Statistical tests showed that some of these differences were highly significant (there was only a 0.0001 probability that these differences were due to chance) and most were acceptably significant (0.02 to 0.05).

Conventional farmers convinced

Fifteen different workshops were held in the countryside to share the results of the field research with participants and key local and municipal actors. Farmers, promoters, technicians and project coordinators collectively analysed the results and gave feedback. Sustainable farms had fewer and smaller gullies and areas of rill erosion. All of these indicators were seen as contributing to both productivity, and to the conservation of the watershed. Further, because of crop diversification, sustainable farms averaged lower economic losses, and in Nicaragua even showed profits, despite the hurricane. However, when correlated to steep slopes (>50%), high storm intensity and other extreme environmental factors, some of the differences between sustainable and conventional farms 'collapsed', indicating that these techniques have thresholds of effectiveness. Finally, the participants themselves indicated what could be the most impressive result of all: over 90% of conventional farmers participating in the study indicated a desire to adopt their neighbours' sustainable practices.

A learning process

Participants enthusiastically claimed that the study had been a highly successful learning experience, and one that had established new bonds of trust between farmers, promoters and technicians. For most farmers, it was their first experience with research, and for others, the first time results of on-farm research had been returned and shared with them.The study also revealed that, at the local level, many organisations and farmer groups had mobilised themselves already in response to the humanitarian emergency situation. Farmer to farmer groups helped to motivate self-help efforts in their communities, rather than simply waiting for outside assistance. This capacity for self-mobilisation among farmer groups indicates that resilience has a social as well as a technical dimension.

Vetiver Grass for disaster mitigation

Last year, around Christmas and New Year thousands of Venezuelans had a miserable time just trying to survive the floods that have ravaged their communities and homes. Although we do not know the details of all the causes behind the flooding and mud slides, we know that when vegetation is removed and the soils become fragile, even moderate rainfall conditions can bring about a calamity.

Vetiver Grass Technology (VGT), if used to stabilise agricultural land, peri-urban building areas, deforested hillsides, riverbanks, levees, and highway embankments, could help to reduce the damage that might occur from future high rainfall in Venezuela. The Vetiver Grass Network strongly urges policy makers and relief agencies to consider VGT as an important tool for rehabilitation and to provide jobs for thousands of unemployed people.

VGT has proven very effective in the Far East for protection against cyclones, just as in El Salvador and Honduras, where it provided near perfect protection against the ravages of Hurricane Mitch in 1998. Some of these stories have been documented and can be found at: http://www.vetiver.org . The website also contains reports from other parts of the world, and information on practical guides such as:

- Training manual of the international training course on the vetiver system. Hard copies of the training manual are available from The Royal Projects Development Board. To obtain a copy email your name and address to Suwanna Pasiri. <pasiri@mail.rdpb.go.th>
- Vetiver grass - a hedge against erosion. The Vetiver Network (TVN) has published a revised (fourth) edition of this book - commonly called the Green Book. Copies available from TVN.

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What's needed for scaling up of SARD?

With the aid of drawings, clay models and skits prepared by the participants, farmers then described how their fields and villages should look in three, five and ten years hence if agricultural reconstruction was implemented using farmer to farmer, SARD techniques. Then, farmers analysed the obstacles to the scaling up and scaling out of SARD, and suggested projects and policy ideas for participatory, sustainable agricultural recovery. In general, technology and training methodologies were not seen as limiting to SARD. After all, farmer experimentation, cross visits and farmer to farmer training are the pillars of the Campesino a Campesino Movement. However, it was strongly felt that national credit, market, agrarian and research policies favoured Green Revolution technologies rather than SARD. Although NGOs had been instrumental in establishing SARD alternatives, if SARD was to scale out nationally, and scale up institutionally, proactive national policies were required to push it beyond the NGOs local 'micro-project' sphere of influence.

Sharing of results

Findings from these workshops were synthesised and presented by the participants at national meetings in the capital cities of Honduras, Guatemala and Nicaragua. Key actors in government, relief, development and research institutions were invited. Farmers and technicians presented their findings; the national research coordinators, the methodologist and the principal investigator gave their reports. In-country researchers in agricultural economics and disaster prevention gave topical presentations. Notable figures such as Nobel Prize winner Rigoberta Menchu, several government ministers, and representatives from the United Nations gave keynote addresses. A video of the research project (see below) was shown and distributed.

Potential of SARD demonstrated

The Campesino a Campesino Movement in Central America has demonstrated the social, environmental and agricultural advantages not only of SARD, but also of farmer-led approaches to sustainable agriculture. The study itself demonstrates the tremendous potential for research and development within farmers' movements. While farmer-promoters within the Campesino a Campesino Movement have carried out on-farm experiments and have shared their knowledge across borders for thirty years, this was the first time ever that farmers had collaborated on a regional research project. Participants have expressed their desire to establish national and regional farmer research networks to continue their agroecological research.

Limited impact on national policies

A year after the study, the participating organisations from Nicaragua met to assess the impact of their research. Most organisations reported widespread adoption of agroecological practices at the project level by conventional farmers who had participated in the study or had heard of the findings. A number of NGOs had successfully used the study to persuade international funding institutions to support their efforts at sustainable reconstruction. Some participants were members of territorial committees and used the study to argue for sustainable reconstruction at the municipal level. One organisation gave a workshop on sustainable, participatory reconstruction to donors in Europe, and used the study as an example of the human capabilities in Central America.

This trend of local and territorial impact appears to have been repeated in Honduras and Guatemala. Unfortunately, the study does not seem to have had much of an impact on national reconstruction policy in any of the three countries. While there is evidence of receptivity to the sustainable approach by the government of Honduras, Mitch seems to have been forgotten in Guatemala. Official Nicaraguan reconstruction efforts have been plagued with political difficulties, with the government focusing on large-scale infrastructure projects designed to support tourism and conventional agricultural exports rather than sustainable agriculture. Efforts by NGO networks to influence national policy have not met with much success, with or without the study.

Public pressure needed

The Mitch study has uncovered a conspicuous 'policy ceiling' in sustainable agricultural development. While NGOs and the Campesino a Campesino Movement have been instrumental in developing the technical and methodological aspects of sustainable agriculture in Central America, they are limited in their ability to influence the *policy context*. Lack of a favourable policy context, and the lack of political will on the part of national governments to create one, appears to be holding back grassroots efforts at scaling up sustainable agriculture. The next task confronting sustainable agricultural development may be to translate farmer-to-farmer successes on the ground into the broad-based, public pressure needed to influence national policy-makers.

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For more information

- World Neighbors. 2000. **Reasons for resiliency: toward a sustainable recovery after Hurricane Mitch**, and accompanying video, **Changing course: recovery & research after Hurricane Mitch**. Both can be ordered on-line through the World Neighbors' web site (http://www.wn.org); by sending an e-mail to order@wn.org; or by writing, calling or faxing World Neighbors, 4127 NW 122nd Street, Oklahoma City, OK 73120 USA; phone: +1 405 752-9700; fax: +1 405 752-9393. See also page 30.

Participants enthusiastically claimed that the study had been a highly successful learning experience. Photo: World Neighbors

Working together on the land.
Photo: Rik Thijssen

Far from all oil palm turmoil

Gabriela Uran, Dina Hartono and Rik Thijssen

Oil palm has been one of the most vigorous agricultural sub-sectors of independent **Indonesia**. Since the 1970s, its acreage expanded from 100,000 ha to 3 million ha in 2000. This profuse growth has provided important economic benefits, but has also become a source of concern! Oil palm's high yields of edible oil correspond to application of high quantities of chemical fertiliser and pesticides. Much of the expansion of oil palm monoculture has been at the expense of Indonesia's tropical forest cover, and has displaced local communities without proper compensation (Hakim Bayar, 1999). It has also been held partly responsible for the forest and land fires during the 1997/98 El Niño phenomenon.

Unsustainable oil palm industry

During Indonesia's current period of economic crisis and political change the many weak points of this sub-sector were unveiled. In 1998, crude palm oil production declined for the first time since 1969. This decline was attributed to several factors, including increased production costs, difficulties to access credit, a 50% drop in the world market price of palm oil, as well as environmental effects, jointly exposing the rather unsustainable nature of the oil palm industry (Casson, 2000). Large financial losses were recorded and, technically, the main palm oil companies went bankrupt. Social unrest increased in and around oil palm estates.

Farming on Flores

Oil palm plantations in Indonesia are largely confined to the islands of Sumatra (78%) and Kalimantan (16%), where infrastructure exists for production and processing, or lowland is available in plenty. On Flores, the tenth largest island of the Indonesian archipelago, there are no oil palms. Largely 'forgotten' by the Central Administration, this island is frequently shaken up by earthquakes and volcanic eruptions. Flores is carved by deep ravines and rugged valleys; rainfall is unreliable and highly seasonal and can make water scarce. Understandably, it is not a first choice area for large-scale production of palm oil.

Instead, the dominant palm on Flores is the versatile coconut palm, found up to about 700 masl, on home compounds or in fields mixed with crops and sometimes livestock. It provides food, drink, oil, medicine, cash, fibre, timber, thatch, mats, fuel and domestic utensils. And it has proven to be one of the reliable cornerstones of the local way of life, even during periods of hardship.

When asked how the economic crisis or current political situation has affected their lives, local people often respond with a shy smile. Almost apologising for not being part of the real world, the world that has been so strongly affected by these major issues, Flores' people seem to have emerged largely unscathed. Of course, these events did not pass completely unnoticed. Many Florinese migrants returned home from Java and Malaysia because of loosing their jobs. Prices of daily necessities and services increased manifold. But so did the market price of agricultural produce. Cacao, vanilla, cloves and Robusta coffee suddenly made record gains. Besides this, rural inhabitants have, almost automatically, used their long-tested coping skills to provide enough food and other needs for all, including the returning labour migrants.

Still largely self-sufficient

Different cultures of Flores have their own systems of sharing food in times of shortages. Generally, borrowed food is paid back at a later stage in the form of food. Families never hide their food stock from others in the community. Maize is even stored in trees or open, simple bamboo structures in front of the house. Such security nets are especially appreciated by women who bear the responsibility for the family's food supply.

Women also expressed that they would feel very uncomfortable if the economic situation does not permit them in using certain 'luxury' goods such as sugar, soap and fuel for lighting. They would genuinely feel *malu* (embarrassed) when visitors arrive at their home, and they are not able to prepare coffee because sugar is not available or if friends stay away in the evening hours since there is no light in the house.

Florinese women, therefore, depend on alternatives. Buying sugar, soap and paraffin from a shop is, of course, preferred. But when cash is not available they resort to resources straight from

Farmers in the field: "there is great interest from the local communities for management of natural resources as well as for further diversification of plant species on their land". Photo: Rik Thijssen nature. Good sugar can be obtained from the sap of the arenpalm (*Arenga pinnata*), and also from the coconut palm. An alternative for soap is to use black lava stones or the small brown fruits from the local tree *Mengkudu* (*Morinda citrifolia*) for washing clothes. The latter also provides body soap or shampoo. Improvisation for lighting the house comes from a combination of two other very common trees: kapok (*Ceiba pentandra*) and kemiri or candlenut (*Aleurites moluccana*). For this purpose, kemiri nuts are crushed until the oil starts seeping out. Kapok fibres are then mixed with the kemiri paste and twisted around a stick to produce a 'candle'. Not surprisingly, coconut oil - the common vegetable oil on this island - can also be used for this purpose.

There is always something to eat

Before the 1920s, when rice was introduced on this island, the Florinese were strictly hunters of small game and swidden farmers growing mostly bananas and cassava. Their main farming method, slash and burn, caused serious erosion problems.

Assisted initially by devoted catholic missionaries and more recently by several local and a few international NGOs, people have settled and become serious farmers. The traditional staple food was short of protein and had been the reason of many health problems. Adoption of the introduced species maize and rice, as well as increased attention to some indigenous species including cocoyam (*Colocasia esculenta*) and forest turnip (*Pachyrrhizus erosus*) have not only brought the much needed diversification, but also increased food security in times of hardship. Local people can assure you now that 'there is always something to eat'. If rains are not plentiful and rice and maize yields are not enough, stocks of the other less drought-sensitive plants are utilised. Apart from these starch providers, people now plant a variety of pulses and vegetables. Perennial cash crops have become common, while families tend to keep a few small livestock. And the sea yields fish that can be salted or dried in order to be stored for more difficult times.

Recent innovations

Community based agricultural development projects, such as the ones facilitated by FADO (*see Box*), are for instance involved in soil conservation and soil fertility work. Large areas on slopes have been terraced and leguminous shrubs such as *Gliricidia sepium* and *Calliandra calothyrsus* have been grown as terrace stabilisers and green manure or fodder crop. Building erosion control structures is exhausting work, yet working together in groups always provides a stimulus for completing the job.

Many farmers have started making use of liquid manure made by fermenting leaves of leguminous species, sometimes mixed with animal manure, in barrels filled with water. Some are so enthusiastic about the results achieved in rice and vegetable production that they have invested in building concrete containers, dug in the soil, for fermentation of the organic matter.

Other spear-points in these projects are integrated pest management and planting of various perennials, cash crops as well as different fruit and timber species. Attention is also given to forms of more intensive goat production.

No interest in increasing profit

Interesting to note here is that there is great interest among the local communities for management of natural resources, as well as for further diversification of plant species on their land. However, it seems that intensification of farm enterprises is not really what they are after. People are focused on satisfying their needs rather than making efforts to increase profit from one single enterprise. Coffee, for example, is making a good price these days. But farmers with coffee have not changed their routine. Pruning of coffee is not practised while shade is provided in plenty to the coffee trees using, for instance, *Erythrina variegata*. Such a system may provide lower yields, but under relatively low standards of cultivation it also gives more even annual cropping and extends the productive life of the coffee plant.

The few goats kept by most families are used in case of festivities and special ceremonies. Economic crisis or not, the Florinese love to sing and dance while traditional and catholic ceremonies are an important aspect of life and are still proudly performed. There are, however, no farmers venturing into commercial goat rearing, although quality tree fodder (*Gliricidia*, *Calliandra*) is plentiful nowadays.

What has been learned?

Given these project experiences, the worst must be expected from a newly launched government credit and extension programme, funded by IFAD, which aims at converting 20,000 ha of community land on Flores into monoculture cashew nut plantations. *Would it really be too far away from the oil palm schemes to have learned a lesson?*

■

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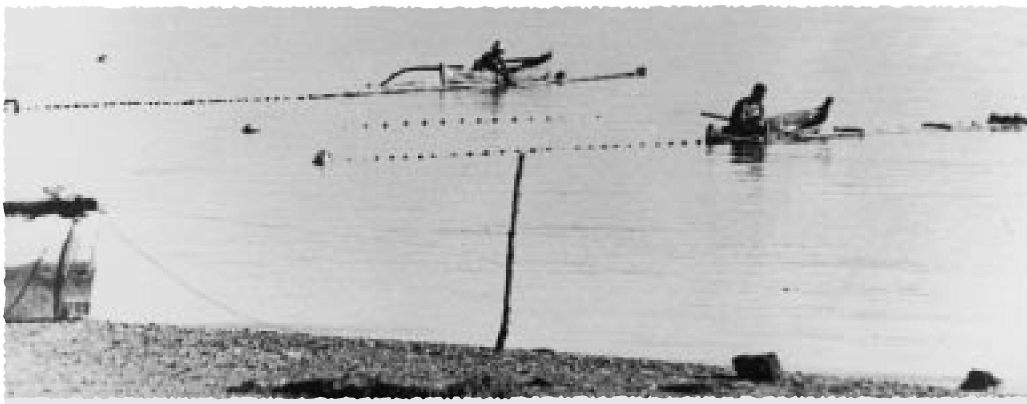

Fishermen collecting their catch near the shore. Photo: Rik Thijssen

FADO

FADO (Flemish Organisation for Assistance in Development) provides support to 34 Indonesian NGOs spread over 7 Provinces in Indonesia. On Flores, FADO is involved in agricultural projects with 10 local NGOs.

The focus of FADO's programmes in Indonesia is empowerment of farmers through developing sustainable agricultural practices with low external inputs, and building strong farmer organisations. In the programmes, FADO role is mostly in backstopping to increase organisational and technical capacity of local development actors. In early 2001, FADO merged with two other Belgian NGOs: Vredeseilanden and Coopibo.

FADO was co-responsible for the translation of ILEIA's publication **Farming for the future** into the Indonesian language. **Pertanian Masa Depan** 1999. Penerbit Kanisius, Yogyakarta.

Empowerment mobilisation for effective women's development

Raju Sharma

The Women's Empowerment Program (WEP) implemented by Pact was launched in December 1997. The main goal of this project is to empower 120,000 women from 21 lowland districts in **Nepal** to increase their roles in household decision-making, increase income for family well-being, and engage in collective action for necessary changes in their communities.

Education Curriculum and Training Associates (ECTA), a Kathmandu-based local NGO, has introduced the **Appreciative Planning and Action** (APA) approach as part of the low cost empowerment package being developed and applied under WEP. APA has proven to be a very effective and powerful tool for community mobilisation and motivation and for bringing about positive changes within organisations. The APA methodology is now being used successfully within other large organisations in Nepal, including NGOs, INGOs, donor agencies, and a major 5-star Hotel.

Women gain literacy by studying together using their own resources. Photo: Raju Sharma

Women's Empowerment Program

The Women's Empowerment Program has developed three interventions:

- ***Literacy***. Women study a self-instructional manual in-groups of two to twelve, achieving literacy for all members in about three months.
- ***Economic participation***. Follow up to the literacy package with neo-literate material with an economic focus. Women learn best practices for saving, credit, and income generating activities. This component includes three self-instructional manuals which women study in their groups for about nine months (3 months per manual).
- ***Rights, responsibility and advocacy***. This component, implemented by The Asia Foundation (TAF), includes a role for an outside facilitator since the material is a bit harder to understand than the literacy and economic packages.

Pact and ECTA do not provide facilitators, black boards, lanterns, or stationary which are normally supplied by other literacy programs, under the WEP principle that '**Dependency is not Empowering**.'

The seven D's of APA

APA, as a starter methodology, does not take more than 2 hours to generate a feeling among women and their groups that they can do many things on their own and do not need to wait for outside aid or financial assistance.

First, a positive and happy tone is set among the members. For this purpose, they are asked to recall and draw: *What are the most exciting things they have done in their communities with their own efforts that make them proud even today when they remember them?* This process is called '**Discovery**'. Since most people tend to forget their successes and rather focus on their failures, they are encouraged to think about their successes, and to understand and appreciate them. Recalling their successes fills them with energy and joy.

The second step is called '**Dream**'. The question here is: *What do you want your village and your children to be like after about 10 years time?* Here, they draw their colourful dreams and enjoy them. One concept emphasised is that if they really believe in their dream of something and sincerely work to achieve it, there is nothing in the world that they cannot achieve. Since these dreams are built directly on their own real accomplishments, they enable people to dream of things that are really achievable**.**

The third APA question encourages them to plan what they need to do in order to turn their dream into reality. If many needs are mentioned, they are prioritised according to necessity whilst focusing on the first among these. This they do by adding numbers to the pictures or expanding them to outline what is needed to pursue their project. This process is known as '**Design**'.

The fourth question is for each individual: *What will you commit to do in order to start to make your dream come true, to make your own or future generations' life easier and happier?* Here, each of the group members commits at least one thing she can do towards achieving their plan. After each member stands and makes her commitment the group celebrates by giving a big applause. This part is known as '**Delivery**'.

To further enhance the progress, the fifth question is put forward: *What can you do to initiate the project or the plan within 5–10 minutes time?* Here they will try to get started by making a detailed plan or drafting a needed letter. This is just to give a push towards their plan, and is known as '**Do it Now**'.

Before the end of the session, they are made to realise what was achieved that day. This is done by asking them to reflect on the good things that happened in the short meeting: *What was the best thing about today's discussion? Why was it the best part?* This is called '**Discuss/Dialogue**'.

'**Dance and Drum!**' is the end of the session with entertainment of 'Singing, Drumming and Dancing.' Here all are encouraged to dance and sing so that they leave in a very happy mood.

■

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It's time to celebrate the spirit of the African farmer!

Nigel Marsh

Aid agencies can do a lot to help farmers become productive again after a major crisis, but it is the spirit, ingenuity and effort of the farmers themselves that should be celebrated more. Examples from **East Africa** demonstrate how creative partnerships between humanitarian organisations and farming families can transform devastation into prosperity, and even 'drought-proof' communities.

Building on farmers' insights

The era of large-scale development interventions imposed by outsiders on a pliant rural population is, hopefully, gone forever. One does not have to travel too far to find yesterday's massive diesel-powered irrigation scheme lying redundant or a vast cash crop estate bled dry by corrupt officials. Surely everyone now accepts that it is best to build on farmers' own insights and experience, rather than 'take over' with an idea or a project that ordinary farmers can never genuinely feel they own.

Rwandan farmer Julienne Mukaremera's initiative is a good example of one that took wings because it was locally hatched. In 1996, she and her family came as returnee-refugees, from what was then Zaire to their former land in Gikongoro prefecture. Like virtually everyone else in Rwanda, Julienne's family started again from scratch. Watching her hungry children, like so many other mothers, made Julienne find reserves of energy and imagination she had not needed before. She pressed the World Vision workers, who had given her a hoe and some seeds, to help her set up a local farmer association, reviving an idea that was common before the 1994 war. Encouraging her female neighbours to join her in crop multiplication and terracing projects, she quickly took charge of not only her own association, but a whole group of associations – including some run by men. Together they established a farmer's store to sell seeds, tools and inputs to members, with profits redistributed among them at the end of the year. And in just a couple of years, they began to recreate the thriving community that they had lost during the war.

Women take the lead

A focus on women is one of the key elements in many successful agricultural interventions after crises. Be it in Burundi, northern Uganda or Somalia, it is so often women who take the responsibility, make the changes, push the local agenda. Several years ago a local leader in southern Sudan, Mary Nybol, was almost brutal in her denunciation of men who, for traditional reasons, resisted newly introduced ox-ploughing techniques.

"I am very proud to get the chance to tell our men to bring their bulls for training. Our men are too dictatorial. They think bulls should only be kept for marriages," she said, referring to the traditional practice of buying brides with oxen. *"We are going to convince them they are wrong",* she added bluntly – and who is going to argue with a woman who has given birth 19 times? *"We women are coming up, after a very hard struggle, and the men are going to accept us. We think more technically than our men do. We want to change the face of our land and the behaviour of our community".*

A year later, aid workers helped an association of elderly widows in her district of Bahr El Ghazar to start its own co-operative. By then, though, men were already queuing up alongside their womenfolk to learn how to plough with precious cattle, partly because of the leadership and example of Mary Nybol.

Communal work and private ownership

Co-operative ventures are often better than attempts to help farmers prosper as individuals. One of the encouraging examples in Kenya is a co-operative irrigation scheme at Morulem in the drought-ravaged Turkana district. Here, farmers have been shown how to dig and maintain shallow wells and use them for irrigation. The scheme, which began in 1992, benefits 1,228 farming families who own half an acre of land each on which they plant maize, sorghum, fruit trees and vegetables. They share their labour in tending their individual plots, and are jointly responsible for maintaining the irrigation scheme. The land has a plant nursery with 30,000 fruit tree seedlings.

The combination of communal activity and private ownership seems to foster the best instincts of everyone, and the current drought is demonstrating the results. While more than half of the 447,000 population of Turkana resorts to relief food, the people of Morulem are enjoying a harvest and even selling surpluses. Morulem has been so successful that other Turkana communities are now clamouring for help to establish similar schemes.

Simple projects, sound results

Generally speaking, in places prone to frequent disaster or insecurity, simpler schemes are more successful. Hand-dug wells, where they are possible, are better than bore holes which need costly maintenance. Ox-ploughing is more sustainable than importing tractors. Anything that involves tapping into the abilities of the community is going to succeed more readily than an importation of technology. ■

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Julienne Mukaremera. Photo: World Vision / Nigel Marsh

A pit filled with sorghum. Cables and plastic tubing are for measurement of the micro-climate in the pit. Photo: Kees Stigter

Underground storage of sorghum as a banking alternative

Nageeb Ibrahim Bakheit, Kees Stigter and Ahmed el-Tayeb Abdalla

In Jebel Muoya, in the Blue Nile area of **Sudan**, a survey made clear that the socio-economy of *matmuras* - underground storage pits for sorghum - should be understood as a banking alternative. This farmer oriented research supported a project on physical improvement of storage conditions. A bibliography on Sudanese agriculture published in 1994 concluded that traditional storage techniques, and traditional farming in general, had seldom been studied and had never been used as a basis for agricultural improvement. However, since 1985, the Traditional Techniques of Microclimate Improvement Project had done just this at universities in several African countries, including the University of Gezira in the Sudan. In 1992 the project started work on *matmuras*. Forced by increasing climate variability, more frequent failure of rains and hence a need for longer-term storage, farmers introduced innovations for grain storage with regard to the dimensions and linings of the pits. A formal scientific study of these farmer innovations was made to ascertain their suitability for the prevailing cracking clay (black cotton) soils under marginal, semi-arid conditions.

Local production situation

The type of agriculture concerned covers about 350,000 ha of rainfed sorghum, the staple crop of Sudan. Originally, production was organised in smallholdings around the villages, but nowadays sorghum is also produced on farms of up to 400 ha and as far as 30 to 40 km away from villages. Farmers hold land at one or more sites, which fragments crop growth. Although such fragmentation is disadvantageous due to inefficiency of resource use, the diversification of soil type and rainfall distribution that decreases risk is an advantage. Staggered planting times decrease risks further and increase the food supply period. Extension services are virtually unavailable and the production shows all the dangers of monocropping without rotations, resulting in very low productivity.

A banking and safety device

Subsistence farmers have *matmuras* as a safety device for food security. The *matmuras* can hold 2 to 10 tonnes of grain. With the introduction of more commercial and mechanised agriculture, *matmuras* have increased in size. The largest farmers store up to 70 tonnes of sorghum in one *matmura*.

With poorly developed property rights and lack of assets, farmers have no collateral and consequently no access to bank loans. Instead, they depend on the grain stored in *matmuras* to take care of the high cash needs at the beginning of the planting season. Farmers without sufficient capital in the form of stored sorghum rent part of their lands to those with *matmuras* in order to finance their farm operations. This is preferred to the *sheil* practice, an informal form of credit with extremely high interest rates, which requires produce to be sold before the forthcoming harvest or even before planting.

Innovations added

Traditionally, the pits are filled until a dome shape is formed by gravity at the angle of repose (see photo). Then a layer of chaff is spread on top of the sorghum, and a layer of soil of 25 to 50 cm extending about 30 cm from the rims of the pits completes the cap.

Both subsistence and commercial farmers are interested in innovations using shallower but wider pits and adding pit wall linings of chaff. Pits tend to become as shallow as 50 cm instead of up to 1.5 m. These innovations keep the grain drier by diminishing the ingress of moisture in two ways. First, they reduce leakage through cracks. Second, they minimise diffusion of water vapour from the wetter soil into the grain. The innovations increase grain temperatures leading to lower infestation of insects, which adds to cost-effectiveness. This also substantially improves the grain quality at the end of the storage period. As participatory and quantified experiments confirmed, this increases the safe storage period. These improvements are particularly important to subsistence farmers. Farmers with a considerable market surplus are advised to use polythene linings instead of chaff.

The research led to another innovation, particularly important for the smaller pits. The caps were increased to about 50 cm in thickness and extended to about 1 m. around the filled pits. This helped to cover cracks that would otherwise allow seepage of rainwater into the pits. When pits get larger, the filling with a dome of grain is abandoned. In this way, scientific research and farmer innovations jointly improved grain storage for food security as well as cash provision. ■

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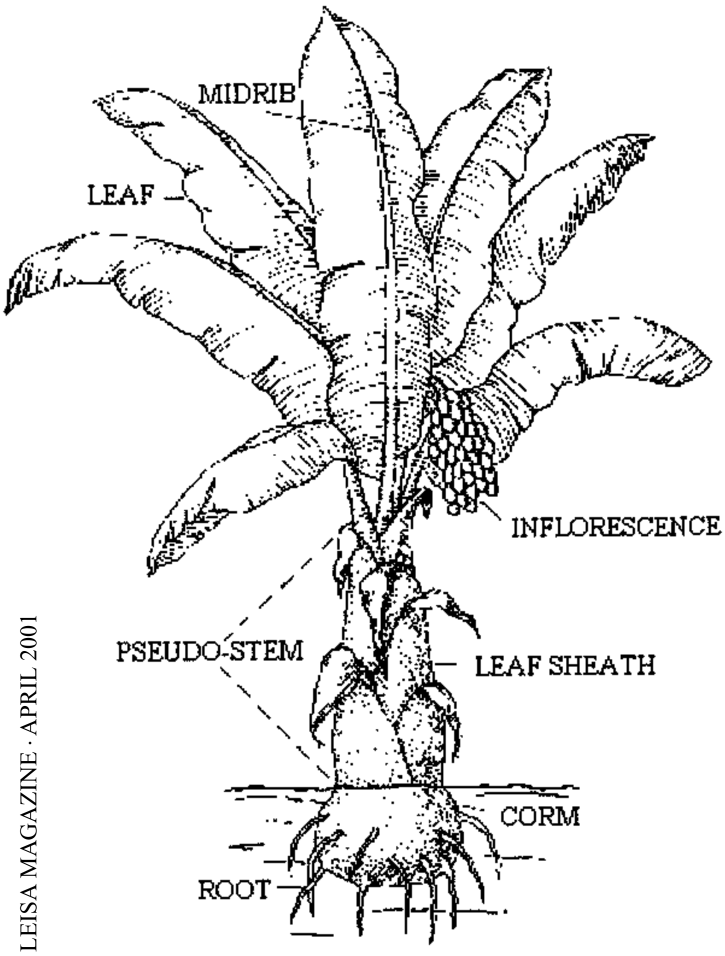
Enset - the tree against hunger

In the crisis years of the 1980s, parts of Ethiopia survived famine due to the utilisation of enset in subsistence farming. Also known as false banana, enset (*Ensete ventricosum*) helps to feed about ten million people in Ethiopia and Eritrea. Enset-based systems are among the most sustainable indigenous farming systems in Africa.

Because the development agendas of Western aid agencies still focus on cereals, enset continues to be largely ignored by development and research. Recently, the enset research team of the American Association for the Advancement of Sciences with Awassa Agricultural Research Center, Kyoto University Center for African Area Studies and the University of Florida has written a preliminary report on their research, which forms the basis of this article.

How it is grown

Enset is related to and resembles the banana plant (Plate 1) but is somewhat larger, up to 10 m tall with a pseudostem up to 1 m in diameter. Large quantities of carbohydrate-rich food come from its false stem and its underground bulb (corm). In spite of the extensive distribution of wild enset in the tropical belt, it is only in Ethiopia that the plant has been domesticated. Domesticated enset is planted at elevations ranging from 1,100 to more than 3,000 m receiving annual rainfall of about 1,100 to 1,500 mm, most of which falls between March and September. The average temperature of enset growing areas is 10 - 21°C and the relative humidity is 63 to 80 %. Enset grows well in most soil types, if they are sufficiently fertile and well drained.



Enset tree

There are 4 main sub-systems. In one sub-system enset is the staple food grown in dense plantations. Cattle are important to produce manure to fertilise enset fields. Other sub-systems combine enset, cereals and tuber crops in different combinations.

How it is used

The major foods obtained from enset are *kocho*, *bulla* and *amicho*. *Kocho* needs a lengthy period of processing and preparation, which is carried out by women. The first stage involves removing the leaf stalks and grading of the corm. Then the fibres are separated out and the pulp is crushed to extract the starch. This is put in a pit about 1.5 m deep and 1 m diameter, wrapped airtight with enset leaves before being packed down with stones. It is then allowed to ferment - a process, which may last anything from 4 months to three years. The pit is opened at intervals to allow aeration, and the enset leaves are replaced. This is repeated until the desired fermentation quality is reached or the food is needed. Finally, the fermented starch is dried and treated as flour. This can be used to prepare a pancake-like bread *ountcha*, which is eaten with milk and cabbage. *Kocho* is increasingly exported to urban markets.

Bulla is the unfermented starch of a mature plant, which can be prepared as a pancake or porridge. *Amicho* is the corm of a young plant, which is boiled and consumed as other tuber crops. Due to their low protein content these foods are eaten in combination with protein rich products like milk. The fibre is used to make sacks, bags, ropes, mats, construction material and sieves. Fresh enset leaves are used as food wrappers, serving plates and for stall feeding of cattle. There are many other uses, e.g. for medicines. A measurement on 34 farms showed an average annual yield of about 5,000 kg of *kocho* per ha. in addition to the other products.

Improving food security

Enset in the farming system contributes significantly to the stability of the food supply in several ways. Enset can: 1) be stored for long periods; 2) be harvested at any time during the year; 3) be harvested at any stage over a several year period; and 4) survive stress years that reduce other food sources.

During the 1984-85 famine, when cereal farmers from southwestern Ethiopia migrated from their villages in search of food, they learned how to cultivate and process enset. Returning home, they introduced enset agriculture, and *kocho* became an important part of their diet. In 1992, when cereal crops were severely damaged, they were able to avoid famine because of their increased dependence on enset. It is expected that enset can be introduced in many other regions to improve food security. However, this needs further study and work on trial-demonstration farms. Further research is needed on: diseases, mechanisation of processing, improvement of the livestock component, production of protein-rich food crops in enset systems, marketing of *kocho* and sustainability of enset farming under increasing population pressure and marketing.

■

From: Brandt SA, Spring A, Hiebsch C, McCabe JT, Tabogie E, Diro M, Wolde-Michael G, Yntiso G, Shigeta M. and Tesfaye S. 2001. **The 'Tree Against Hunger': Enset-based agricultural systems in Ethiopia**. The report with an extensive list of references can be downloaded from http://www.aaas.org/international/ssa/enset/ or requested from: The Africa Program, AAAS Directorate for International Programs, 1200 New York Avenue NW, Washington, DC 20005, africa@aaas.org Fax: 202-289-4958.

Mature dom palm with harvested leaves drying on the ground. Photo: Stephen Connelly

Trees for semi-nomadic farmers: a key to resilience

Stephen Connelly and Nikky Wilson

Like many peoples of the dry lands of Africa, the farmers of the savannahs in the Western Lowlands of **Eritrea** have survived the variation and stresses of their hostile environment through developing a flexible farming system involving a mix of crops and animals, production for cash and for subsistence, and widespread dispersion of activities over hundreds of miles. The resourcefulness and resilience of such farmers is well known and well documented. They are traditionally viewed by the outside world as semi-nomadic herders and opportunistic farmers ('agro-pastoralists'). In this article, however, we show that despite such views these farmers in Western Eritrea are also dependent on a third strand of the farming system: the management, collection and processing of forest products, and in particular of the dom palm (*Hyphaene thebaica*). This third strand is always important, but never more so than when disaster strikes – in times of drought and war forests become the key to survival.

Disasters strike frequently

The Western Lowlands of Eritrea are the easternmost extension of the Sahel, lying between Eritrea's border with the Sudan and the Eritrean/Ethiopian Highlands. Principally covered in semi-desert scrub and savannah woodland their low hills and plains are interrupted by three river valleys clothed in remarkably dense woodland, some of it mixed acacia and dom palm and elsewhere almost pure stands of dom. They are home to several hundred thousand people of six ethnic groups, each of which has developed their own distinctive survival system, involving greater or lesser emphasis on animals, crops, palm fibre and other forest products. All these systems are characterised by flexibility, and all have been repeatedly disrupted by the natural and man-made upheavals of the past forty years.

A series of major droughts has struck the area (early 1970s, 1982-5, 1990-1, late 1990s), causing repeated crop failure and massive livestock losses and – in the early 1980s – a complete collapse of the farming system, many deaths and mass exodus of the population as refugees. At the same time the area has been ravaged by war: the Lowlands changed hands several times in the thirty years of liberation struggle (1961-91) and villages and crops were repeatedly bombed and destroyed by warfare on the ground. After liberation (1991) and independence (1993) farmers picked up the pieces and started farming again under more settled conditions, though facing new threats from government development policies, and then in 1998-2000 by renewed war that saw the invasion of the Lowlands by Ethiopian armies.

Dependence on dom palm

At all times, forest products play a crucial role in people's livelihoods. The traditional farming system involves growing sorghum for food, and keeping camels, cattle, goats and sheep for food and occasional sale. Amongst all the tribes a vast range of subsistence needs (e.g. housing, tools, and some food) come from the forest, and for the majority of the Lowland population (belonging to the Tigre, the Beni Amer and the Hidareb tribes) the *principal* source of cash income is dom palm fibre. Palm leaves are cut on a massive scale from the riverine forests, and either sold in their unprocessed form or woven into mats, rope and other household utensils for sale in the markets of Eritrea and Sudan.

Under 'normal' circumstances - i.e. in peacetime and when rainfall is sufficient to allow at least some cropping and herding – dependence on the forest is greatest for the poorer members of the community. Those with few or no animals, or who cannot farm land – such as the many war widows – rely on cutting, weaving and selling palm for their survival on a permanent basis, while even for most richer farmers the dom is a vital source of income, particularly during the lean months of the year. The population clearly values the forests highly. This has been a factor in its preservation: farmers that we interviewed described harvesting patterns governed by informal regulations and an understanding of the nature of dom palm regeneration and growth. These systems prevent over-cutting through restricting access and over-frequent cutting, and their overall impact appears to be a sustainable management system.

Key element of resilience

In years of bad rainfall dependence on the palm forest increases as crop and animal production falls. In serious drought years cutting and selling palm leaves becomes the main source of income for most of the population – men travel miles from villages far from the rivers in order to cut palm leaves to buy food. At the same time food collection from the forest increases: dom palm nuts are a food of last resort for the poor in the hungry season before harvests, and in drought years they become a staple food for many.

One ethnic group – the Kunama – has a distinctly different approach to the forest. They cut very little palm for income, but collect food from twenty or more tree species. These include the dom palm and others that they value as food reserves for drought years when their crops fail: for them the riverine forests are their insurance, rather than a regular income source.

Thus harvesting from the forests provides a key element of the resilience of the farming system, enabling poor farmers to survive from year to year and entire communities to weather the bad years, even to survive for a time when war makes farming impossible. Only in major droughts does the system finally collapse and people become refugees.

In the period of peace from 1991-98 the palm forests were crucial in re-establishing a normal social and economic system in the Lowlands, both for those who had remained and for those who were returning from refugee camps. Livestock numbers were low and many female headed households (war widows) and physically disabled people in the villages had limited ability to farm. Harvesting and export of palm leaves has consequently been a major source of support for the Lowland population.

Forest or irrigation?

However, this revival of the traditional system has not been actively supported by the government's agricultural extension services. This appears to be partly because they recognise neither the importance of the forest to the farming system nor its sustainable nature. The Lowland farmers are seen as 'agro-pastoralists' for whom trees are a minor aspect of the farming system, and there is a widespread – though unfounded - belief amongst officials that cutting is carried out in ways that damage the trees.

The other major factor is that the government has other priorities: the forests occupy fertile land with high water tables, which is ideal for irrigated agriculture of cash crops such as onions and bananas. Increasing production of these is a high priority, in order to feed urban populations, raise hard currency through exports, and to attract investment from wealthy (often formerly expatriate) Eritreans. Thus the traditional system and the government's preferred land use are in direct competition, and the appropriation and clearance of forest land has caused serious tensions in the Lowlands between local people and the government. Exacerbated by current and historical ethnic and religious factors, this conflict over a resource fundamental to local livelihoods contributed to unrest and the recurrence of violence in the Lowlands during the 1990s. Ironically, the recent (1998/2000) war between Eritrea and Ethiopia may have stopped the clearance of forests for commercial farming, though once again presumably forcing local people to rely on the forest as farming becomes impossible.

Sustainable forest management

With the recent peace accord the question arises again of how local communities, government and – perhaps - outside researchers and agencies can work together. Although the deeper animosities are undoubtedly still present and intractable, the more immediate resource management issues should not be impossible to solve. This would require, however, that the government recognises both the importance of the forest to the local livelihood system, and the right of local people to have continued use of and control over the forest. It would thus have to forego – or at least restrict – the issuing of licenses for agricultural production in forestland. More positively, government and local people could work together on improving sustainable management – particularly where large numbers of former refugees are being settled - and on the provision of raw material for the industrial use of palm fibre.

In **conclusion**, we can say that for many farmers in the Western Lowlands of Eritrea, the riverine forests, and in particular the dom palm, are an essential resource for their survival. They show great flexibility in switching emphasis between the components of their farming system (crops, livestock and forest) to meet changing conditions, but their ability to cope with the uncertainty of marginal farming and the stresses of war and drought is ultimately underpinned by their reliance on the forest for income and food. This dependency is even greater for poor people, and especially for those who are prevented from farming by physical disability or by social custom, as is the case with female heads of households. This dependency has been strangely neglected by both officialdom and outside agencies and researchers. We believe, however, that the sustainable exploitation of the forest under local management systems has huge potential to ensure that farmers' coping mechanisms are both preserved and enhanced.

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The authors carried out social and silvicultural research on the riverine forests and farming systems of the Western Lowlands of Eritrea in 1995/6, and returned in the summer of 1997. The views expressed in this article are those of the authors. A full report is available as **Report on a preliminary study of the riverine forest resources of the South West Lowland Zone, Eritrea** from SOS Sahel International UK, 1 Tolpuddle Street, London N1 0XT, England (sossaheluk@gn.apc.org) or from the authors at nikkywiz@yahoo.co.uk.

The dom palm products market, Keren.
Photo: Stephen Connelly

Farmers' responses to reduce the risks of drought

Owen Shumba

Drought is a common phenomenon in the Southern region of the African continent and **Zimbabwe** is no exception. The annual average rainfall of Zimbabwe is about 600mm, but is markedly variable, particularly in drier regions. Since rainfall is the main climatic constraint to dryland agriculture, the country is divided into 5 natural regions for agro-ecological planning. Region I receives the highest rainfall while region V records the least annual precipitation. Farming systems range from intensive livestock and crop production in Region I to extensive beef production (ranching) in region V. However, some drought tolerant cash crops are grown in region IV and V. The lack of rain coupled with exceptionally high temperatures has been the cause of many droughts causing widespread disruption to many farming communities with the loss of crops and livestock.

Based in Zimbabwe, SAFIRE - The Southern Alliance for Indigenous Resources - is a collaborative initiative of several local and international NGOs, grassroots development agencies, government institutions, international organisations and individuals that assists rural communities in managing their natural resource base. Apart from its many activities, SAFIRE plays a pivotal role in the implementation of drought mitigation and preparedness initiatives in Southern Africa.

Recurrent droughts

Since 1901 Zimbabwe has suffered recurrent droughts. According to literature, the worst years with below average rainfall are 1911/12, 1923/24, 1946/47, 1972/73, 1981/82, 1982/83, 1986/87 and 1991/92. In a survey conducted by SAFIRE across nine districts in Zimbabwe, farmers recalled 6 – 16 (on average 10) drought years from 1918 to 1997 (see Table 1). Farmers' definitions of drought were diverse, including agricultural, hydrological, economic and meteorological aspects. According to the farmers, droughts seriously affected them both in the normally wet and dry seasons.

Table 1: No. of drought years remembered by farmers across nine districts of Zimbabwe 1918-1997

Rushinga	10	Mudzi	16
Nyanga	15	Chipinge	10
Mhondoro	10	Goromonzi	6
Chivi	10	Gwanda	9
Tsholotsho	10		

Impacts of drought

The 1991/92 drought had the most crippling effect in Zimbabwe and over much of the sub-region with many countries in the region having seasonal deficits of up to 80% of normal rainfall. There were unprecedented crop failures. The subcontinent, usually a food exporter, had to import 11.6 million tonnes of food worth over US$4 billion. Regional grain production fell some 60% short of expected levels. The droughts led to widespread suffering with loss of cattle and crops.

Farmers in the nine districts above summarised the major effects of these droughts as follows:

- Partial or complete crop failure (because of low soil moisture content and disease outbreaks)
- Livestock deaths
- Trees drying and dying
- Boreholes, rivers, springs and other water points drying and causing a scarcity of both livestock and human water supplies
- Shortage of basic commodities on the local markets
- Price hikes across all sectors
- High government expenditure because of food imports, especially yellow maize from Kenya
- Malnutrition, especially in children.
- Unemployment, coupled with rampant crime and robbery.

Farmers' coping strategies

Farmers' responses to the effects of drought have been varied. Below are some of the actions being undertaken to mitigate drought, especially by women in Nyanga, Chipinge, Mudzi, Chivi and Gwanda districts.

- ***Permaculture*** All the farmers interviewed stated that they were learning permaculture and practising it, both in their gardens and fields. Permaculture helps them prepare for drought through land use designs that enhance water conservation and bio-diversity.
- ***Water harvesting*** Farmers are harvesting water from rooftops and diverting water from natural springs into tanks. This ensures that they have a substantial amount of water stored up. In case of a drought the stored water will be able to sustain them for about five months depending on the volume of the tank. The water is also used for supplementary irrigation of vegetables and crops.
- ***Infiltration pits*** Some farmers are digging infiltration pits along contours. Water collects in the pits during the rainy period. When the weather becomes dry, as in the case of early stoppage of rains, the water spreads underground and is used by the plants. Crops can grow up to maturity by using this conserved moisture. The farmers in Nyanga and Chivi stated that even if there are only 5 days with rain in the whole rainy season, the crops will reach maturity using conserved and harvested water in the pits.
- ***Granaries*** A majority of the farmers interviewed store food to be used in case of a drought. They have a specific granary stocked with grain (sorghum, millets, and maize for a shorter period of time), especially those resistant to post harvest pests. This granary is kept untouched and out of bounds for children. Only the head of the household is allowed into it.
- ***Savings*** A fifth of the farmers across the nine districts save some money in order to purchase food in times of drought. These are the affluent farmers with flourishing business enterprises who can set aside enough money to buy food for a whole year if the rains fail.
- ***Drought tolerant crops*** Some farmers are slowly discarding the idea of growing maize as the main crop. They are shifting to the use of traditional crops e.g. small grains, i.e. millets, sorghums. These crops are drought resistant and therefore give a good yield even with very little rain. Farmers are also looking for indigenous maize varieties (i.e. *Kalahari*) that are short season, high yielding, drought tolerant and post-harvest pest resistant. An indigenous finger millet variety, *chiraufe*, is also planted in drought years. *Nyamunhororo,* a cucurbit, is popular as the small pumpkin ripens fast and saves people from possible starvation. It is not only drought resistant but can survive in poor soils. The early maturing cowpea variety *Vigna unguiculata* is also planted in drought seasons.

Building on farmers' initiatives

It is evident that farmers are proactively doing something for their survival in times of disasters such as drought. The array of initiatives shows that community livelihoods are dependent on a number of activities, capabilities and assets including both material and social resources. Rural community livelihoods would be sustainable when they can cope with and recover from stresses and shocks such as drought, floods or even HIV/AIDS, and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base.

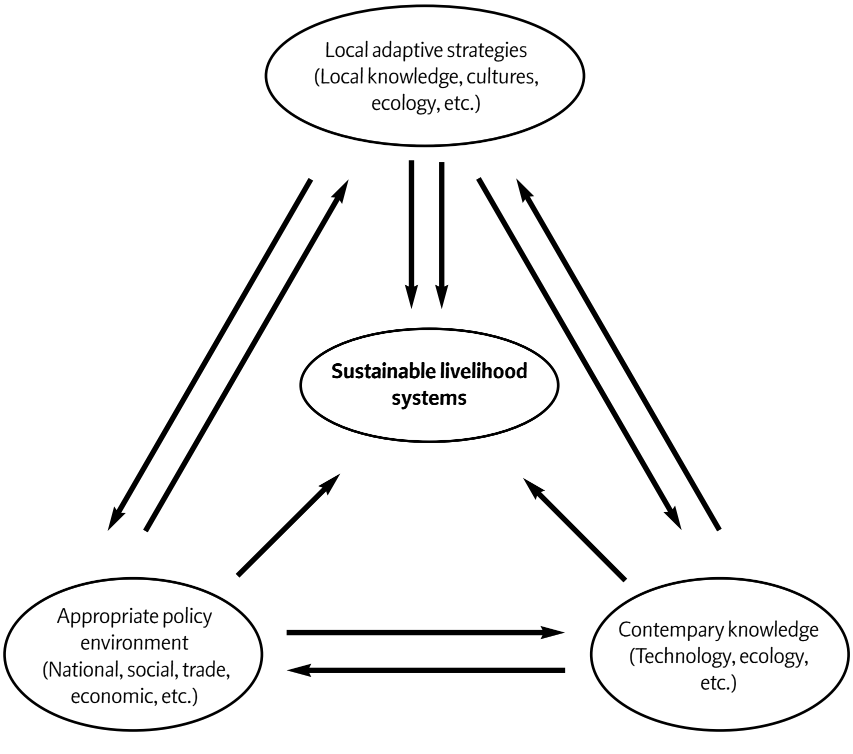
The main challenge for researchers, development practitioners and policy makers, therefore, is to facilitate this process and to build on what farmers are currently involved in. The main long term focus and goals of all drought mitigation projects implemented by SAFIRE and other partner NGOs such as ENDA - Zimbabwe, CARE Zimbabwe, Zimbabwe Freedom from Hunger Campaigns (ZFFHC) and ORAP have been to strengthen community livelihoods. The livelihood conceptual framework illustrated below has been the guiding principle in most initiatives.

Adaptive strategies

In its community drought mitigation initiatives in Zimbabwe, SAFIRE has sought to build on and promote the following community adaptive strategies:

- Multi-cropping to hedge against crop failure.
- Soil and water conservation (infiltration pits, tied ridges, water harvesting tanks and permaculture kitchen garden designs in general)
- Storage of a two year supply of indigenous maize and other drought tolerant varieties such as millet and sorghum.
- Income diversification (organic vegetable sales, organic cotton growing esp. with refugees in Zimbabwe, craft making, jam making and sales, soap making from *Jatropha curcas* oil, etc.)
- Community regulations and bylaws which control the conservation of certain trees and wooded areas.

Figure 1: Towards sustainable livelihoods and food security



This figure represents the three main systems leading to sustainable livelihoods in Africa's semi arid lands. Sustainable livelihoods draw most from the adaptive strategies that people and nature have evolved together, but they will also require an appropriate environment of social and policy conditions and will draw on contemporary knowledge systems.

Source: Rennie and Singh (1995)

Contemporary knowledge

The following new knowledge is introduced:

- Participatory ecological resource assessments conducted together with the communities in project areas.
- Oil extraction technologies either developed or sourced for the communities.
- Simple irrigation techniques such as bottle watering and low cost drip irrigation promoted in project areas.

Policy issues

The main responsibility of the government is to create an enabling policy environment, which will ultimately enhance the livelihoods of at-risk communities. Examples within the Zimbabwean context are:

- Land use/tenure: state vs community; agricultural modernisation: monocultures and cash at the expense of food security i.e. maize vs sorghum/millet.
- Marketing policies per se
- Livestock production and sale
- Promotion and legitimisation of indigenous knowledge by both government and researchers, especially in climate forecasting.

ENDA-Zimbabwe and the International Institute for Sustainable Development (IISD) have been in the forefront of analysing policies that impact livelihoods of rural people at-risk.

Achieving food security

Apart from effective networking, NGOs and governments need to work together towards fulfilling the concept of sustainable livelihoods systems, as elaborated above. This way, food security and community resilience to drought can be achieved in Zimbabwe and in Africa as a whole.

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Out of balance?
Resilience in farm level food security

Astrid Björnsen and Prem Gurung

Resilience can be defined as the capacity of a household to maintain basic sustenance in food and health. Farmers have developed manifold strategies to cope with frequently occurring minor stress factors resulting in fluctuating yields. Major disasters such as earthquakes or landslides, which occur periodically, are more difficult to prepare for. This article focuses on food securing strategies at farm and community level that contribute to a resilience capacity, and compares the disturbance factors and the resilience capacity of Nepalese farmers, then and now.

Farming in Nepal

Subsistence farming and on-farm storage remain cornerstones in the livelihood of the majority of people living in remote and marginal areas of **Nepal**. Exposed to annual monsoon rainfalls in summer followed by a dry winter, farmers are highly dependent on seasonal production and storage of cereals. Production, moreover, is threatened by storms, periodic droughts, erratic rainfall, and unprecedented floods.

Efforts to modernise agriculture in Nepal were first initiated in 1956. As a result of the population growth after the 1950s, peasants encroached marginal farming environments and agricultural production per capita stagnated. Urged to cultivate risk-prone areas, farmers became extremely vulnerable to food shortages. Since then the moderate level of household food security has turned to chronic food deficits in many areas (Seddon 1987 and Adhikari and Bohle 2000).

Resilience in the past

In response to seasonality and fluctuating yields, Nepalese farmers developed several strategies -technical, economical, social, and spiritual - to secure food. Interestingly, the majority of them aim at prolonging food availability rather than increasing yield.

The most important ***technical method*** is storage. Depending on the availability of resources, the locality and climate, a variety of storage structures such as cribs, woven baskets, pots, mud bins, trunks, chambers, and ground pits are used, none completely insect-proof. Farmers generally tolerate insect damage and grain spoilage. Moulded grain is consumed even though the adverse health effects are known. Infested grain is used for brewing alcoholic beverages, while severely spoilt grain is used as livestock feed, allowing for optimal resource use.

Feeding livestock with grain is an important ***economic solution*** to enhance resilience. It could be argued that farmers would do better using it for human consumption. However, farmers reason otherwise. Livestock is a hidden storage system. Surplus and inferior quality grain is converted to protein and other products. In times of need, livestock can be sold with added value and used for buying grain, if necessary.

Apart from human consumption and livestock feed, grain is allocated for seed, barter, payment and communal events.

Surpluses are also sold and invested in gold ornaments, the common 'insurance' against food shortage.

Supplementary food such as wild yam, taro, mushrooms, fern, nettles and asparagus was collected in the forests that were abundant in old days.

Social aspects in food security are often neglected. Women control and safeguard the stored commodity, determine the rate of consumption, and take pest control measures to prevent food losses. In times of food scarcity, women adjust the household and individual food consumption. Apart from reducing the number of meals, women, children and elders cut down their calorie intake. In food deficit years, families postpone marriages that involve high costs in feeding the wedding party. To prevent high expenditure on life-cycle rituals, mourning households refrain from other celebrations for one year. Costs involved in death rituals can take years to recover.

In the past, social arrangements secured food at the community level for the needy. In Kathmandu, for instance, common property and giving of alms was common in former times. Until the 1950s, there was a system called *hundi,* under which needy persons were given everyday food items. In rural areas, two food securing systems were effective: the patron-client relationship and *dharma bhakari*, a grain store catering to the poor for religious merit.

Spiritual means of storage protection and food security have remained largely unnoticed. Grain is commonly stored inside the house to protect it from weather, theft and evil spirits. However, the storeroom is not an ordinary place; the presence of deities and spirits gives it a sacred character. For many Nepalese, children in particular, this room is an eerie location arousing fear and unease, and is entered only for storing and fetching grain.

Apart from the sanctity of the storeroom, the commodity contains supernatural qualities called *saha,* meaning 'an essence or life-force' or simply 'help' or 'plenty' - a phenomenon economising the grain use, therefore, prolonging food sufficiency. Adequate *saha* prevents food shortage and famine, and acts as a multiplying, replenishing force in the storeroom. In the past the preservation of *saha* was extremely important, as the

'Dehri-making': Tharu woman of Gobardiha, Deukhuri, building a mud bin for storage of food grain. Photo: Astrid Björnsen

'Kutli-finishing': Tharu woman plastering new mud bins with a layer of clay that is believed to have insecticidal properties. Photo: Astrid Björnsen

procurement of alternative food grain was hardly possible. Hence, various rituals, traditions, ceremonies were developed for the conservation of *saha*. Lavish handling and unnecessary spoiling of grain, for instance, was considered to have a decreasing effect on *saha*, triggering the anger of the Goddess of Prosperity resulting in dwindling stocks.

Resilience at present

Perturbing natural disasters still occur today, but are accompanied by new man-made hazards. These hazards are created in the process of population growth and land encroachment, leading to deforestation and land degradation. Resilience capacity is being seriously threatened by modernisation in agriculture. Farmers encounter unexpected difficulties with field and storage pests, as the introduced improved varieties are more susceptible than the local landraces. Traditional knowledge, old practices, and proven technologies are turning obsolete in the wake of modern agriculture.

Similarly, formal schooling prevents younger generations from traditional sources of education, preparing them for non-farming professions, and finally withdrawing them from farming. Forced by these changing conditions, opportunities and needs, farmers are adapting their coping strategies.

On-farm storage ***technology*** is changing due to increased storage pest pressure. The use of low-cost dusts and fumigants for grain protection is becoming increasingly common. Fumigation is of special concern as the use of phosphine gas in traditional non-hermetic storage structures triggers pest resistance and poses health hazards to the farmers.

The new ***economic*** food securing ***strategies*** differ from the past. Livestock is loosing importance in the face of labour shortage caused by the education system. Wild foods have become scarce and are consumed in insignificant amounts. Instead, more land is being allocated for staple crops to meet the household food demands. Cash crops are becoming important sources of income in regions having access to road and market. Farmers mortgage their lands and raise cash to purchase grain during food shortages.

Moreover, a higher incidence of storage pests is altering the pattern of food allocation. More and more households sell their grain soon after harvest to avoid storage pest losses even though the prices are unfavourable at that time. In addition, high-quality grain is sold in order to buy a larger quantity of low-quality grain.

The search for food security leads more and more to options outside the household. Patron-client relationships, i.e. labour service for wealthier households, are becoming a common risk-avoiding strategy, as annual wages are independent of yield fluctuations. Children are given away as servants to reduce the number of mouths to feed. There is also an increasing trend of male migration for temporary and permanent off-farm occupation. All this leads to increasing household fragmentation and individualisation with severe impacts on social structures and safety nets. Male out-migration particularly overburdens women, who have to take up increased control of farming and family welfare.

Social arrangements such as the *dharma bhakari* have disappeared due to growing food insecurity, the general breakdown of social structures, the growing influence of individualization and the cash-based system, and the erosion of belief systems.

Spiritual means of stabilising food security and farmers' resilience capacity have been neither changed nor replaced by new strategies, but have simply lost their importance. Rituals concerning food security are still performed, yet the belief in the super-natural is declining. Rituals, however, form important links between farmers' past and present. They include ideological concerns such as the balance between human and nature, important for social stability and mental well being. Especially in times when formal schooling devalues agricultural work and local knowledge, these rituals allow the farmers to place themselves in the universe, and to attribute importance to their lives. If this feeling of identity is lost, then the farmers' capacity to maintain mental resilience will be seriously affected.

Conclusion

The fact that more and more rural households face food deficit indicates that the Nepali farmers have partially lost their resilience capacity in terms of food security. The loss of resilience is closely linked to the loss of options rendering the farming system vulnerable and sensitive to disturbance.

Farming in Nepal is clearly out of balance and the multidimensional approach of farmers to deal with environmental fluctuations, instability and food deficits requires continuous adjustment. The primary responsibility of development professionals is to enable farmers to generate diverse options enhancing their resilience capacity. Suitable options, however, need to be generated in close collaboration with farmers considering all dimensions of their livelihood. Research as a means to widen farmers' options, therefore, needs to be highly participatory, action oriented, and responsive to local needs and priorities.

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Women and drought resistant crops, crucial for disaster mitigation in Somalia. Photo: World Vision / Nigel Marsh

Resilience to disaster

Editorial

Besides more normal fluctuations in production conditions, many farmers have to cope with high impact hazards like droughts, floods, storms, earthquakes, epidemic diseases, war or economic crisis. These hazards make farming a risky activity and can become disasters resulting in loss of housing, stored food, crops, animals and even personal injury or death. There are also hazards that build up more gradually leading, eventually, to disasters with no less serious impacts. Examples of slow impact hazards are Global Warming, ecological degradation, HIV/AIDS, Green Revolution – Industrial Agriculture and economic globalisation.

Ecologists use the term 'resilience' to describe the process through which an ecosystem returns to its former state after it has been disturbed. We use 'resilience' in a broader sense, as the capacity of farmers (and other members of a community or society) to deal with disturbances and hazards by preventing and minimising losses and mitigating disaster to ensure food availability and sustain the agricultural production system. Farmers have developed many strategies to anticipate, cope with, resist, and recover from the impact of minor disturbances and hazards. When farmers begin to loose their resilience, their vulnerability increases, and so does the possibility of hazards turning to disasters. In rural areas, it is marginal people on marginal land – those with the least opportunity to build resilience in their livelihood systems – who are most affected by disaster.

Disasters, an increasing problem

Disasters are becoming a major global problem, increasing in number as well as in impact on people. In the past decade humanitarian assistance for disaster mitigation has risen sharply. For example, from 1990 – 1996, global overseas development assistance (ODA) for humanitarian assistance rose from USD 500 million to USD 6 billion – a twelve-fold increase and some 12 percent of all development aid. The interventions were in natural disasters and, increasingly, in emergencies of a complex political nature, often caused by serious deficits in governance and resulting in violent conflicts within and between states. Environmental degradation and socio-economic marginalisation are also important factors in the increase in incidence and impact of disasters. As disasters can have an enormous impact on rural livelihoods and their development, the challenge is to reduce the impact of hazards by strengthening the resilience of rural communities in pre as well as post disaster situations, the theme of this issue of LEISA Magazine.

Resilience in traditional agriculture

In traditional agriculture, high levels of resilience were achieved by complex combinations of economic, ecological, social and spiritual strategies. Björnsen and Gurung (p.6) show the wide variety of strategies used in traditional subsistence agriculture in the rugged Himalayan regions of Nepal where production is threatened by storms, droughts and floods. The available local resources and waste products are used optimally for a wide range of complementary products and services. Social arrangements and solidarity are fostered and emergency strategies are strictly followed for maintaining food security. The goddess of prosperity is worshipped i.e. for protection of stored grains against bad weather, theft and evil spirits. Uran et al. (p.16) point to the importance of biodiversity, the social and cultural relations and subsistence perspective of local society for the resilience of farming in Flores, Indonesia. This is in strong contrast to the low resilience of the large-scale plantations propagated by the government.

Animals and forests make an essential contribution to the resilience of many traditional systems. Connelly and Wilson (p.10) document the role of forest products, in particular of the dom palm, in the survival strategies of the people living in the savannahs of the Western Lowlands of Eritrea affected by drought and war. The flexibility of the farming system appears to be crucial, so that households can easily shift between different economic activities: crop production, herding, collection of forest products, craft, trade or migration labour. In the post-war period the palm forests were crucial in re-establishing a normal social and economic system. However, the government has not recognised the importance of the forests for the local people and intends to transform them into irrigated agricultural lands for export production. This has caused serious tensions between the local population and the government.

Coping with drought and floods

Shumba (p.8) reports on the research by SAFIRE in Zimbabwe on farmers' responses to drought. It shows that farmers are not passive victims. They have developed their own, indigenous preparedness and mitigation strategies based on longstanding experiences of living with drought. Examples are: water harvesting and conservation, enhancing biodiversity, storage of food, saving of money and drought tolerant varieties of indigenous crops. These indigenous strategies are often overlooked and undervalued by disaster specialists from outside. Such local adaptive strategies can sometimes be improved by combining them with contemporary scientific knowledge and an appropriate policy environment. Shumba states that the work of SAFIRE and other NGOs in Zimbabwe is showing that this can lead to more sustainable rural livelihoods.

Food storage plays an important role in traditional resilience strategies as the articles by Björnsen and Gurung (p.6), Brandt et al. (p.12) and Bakheit et al (p.13) show. Not only hardy traditional grain crops but also traditional famine food like Enset (false banana) can be stored for long periods, thus ensuring food availability during drought periods. Underground storage as used in Ethiopia for processed Enset and in Sudan for sorghum has been often overlooked by food aid programmes. Improvement of such farm level food storage systems is important to further decrease losses and to adapt these technologies to changing needs (Bakheit et al. p.13).

With the increasing impact of **Global Warming** destabilising the global climate, resilience to drought, but also to floods and hurricanes, is becoming increasingly important to farmers. Agriculture in industrial as well as developing countries is responsible for an estimated one third of Global Warming (FAO:AG21:Magazine). But, it is increasingly being recognised that sustainable agricultural practices can strongly contribute to mitigating Global Warming (Pretty and Ball p.31).

Farmers adapting to change

Society and agriculture are changing fast. Although the perturbing natural factors of the past are still active, many traditional strategies seem to have lost their significance. Population growth, modernisation of agriculture and education are mentioned by Björnsen and Gurung (p.6) as processes that seriously impair the resilience capacity of Nepalese farmers. But also other processes such as climate change, labour migration, economic crisis, ecological degradation and HIV/AIDS are forcing farmers to adapt their strategies.

Often driven by stress, adaptation and innovation has become a normal part of farming as demonstrated in the articles by Björnsen and Gurung (p.6), Uran et al. (p.16) and Holt-Gimenez (p.18). This can also be the case in post disaster situations. Sharland (p.26) and Vermaak (p.27) present interesting examples of post disaster innovation processes building on local conditions, knowledge and gender roles. Marsh (p.14) stresses that ***'It is time to celebrate the spirit of the African farmer!'*** With this he means that we should have more trust in the innovative capacity of farmers of which he gives some convincing examples. Women often take the lead in innovating and rebuilding rural livelihoods! To empower women to do so, ECTA in Nepal has developed an effective low cost methodology (Sharma p.15). Farmers' initiative and innovative capacity are crucial elements of resilience and therefore should be enhanced and strengthened.

Emergency agriculture

Provision of relief assistance to disaster victims over a number of decades has in many places resulted in the development of a dependency syndrome and a decline in self-help efforts. Relief must be provided to support agricultural recovery, but should not generate food aid dependency. This means that humanitarian assistance agencies must link with development agencies to promote rural recovery and development. This is not as simple as it sounds. The tensions in approach and conditions between food and development aid make agricultural rehabilitation the forgotten child of humanitarian assistance. Emergency agriculture is needed to end the relief phase, to encourage restoration of the management of agricultural resources, to restore the market systems, to reduce vulnerability and to build up resilience again (O'Keefe et al p.27).

Disasters can also create opportunities to capitalise on the sudden inflow of resources to promote rehabilitation and longer-term development. Often, however, this is translated in terms of market agriculture and 'improved' technologies (especially improved seeds, chemical fertilisers and implements), which are not always adapted to the specific needs and conditions of farmers. Instead, emergency agriculture should build on local capacities to manage available resources and mitigate disaster. For example, instead of only providing improved seeds, farmers can be supported to recover a number of 'cherished' varieties adapted to the local conditions. Thus is being done by the 'Rescue from the Pot' project in post-war Sierra Leone by recreating the local capacity to multiply and exchange seeds (Kent p.22). Or, instead of providing 'improved' hoes from outside the region, it is better to distribute quality steel plates, from which the blacksmiths can make the tools to the specifications of the local farmers (Sharland p.24).

Ecological agriculture

In a participatory study on the impact of hurricane Mitch in Central America on 1804 farms, conventional and alternative farmers concluded that sustainable agriculture applied by the farmers of the Campesino a Campesino movement is more resilient to hurricanes than conventional agriculture (Holt-Gimenez p.18) - a conclusion fully affirmed by FAO (p.20)! In fact, Green Revolution agriculture, also in permanent large-scale plantations, e.g. of oil palms (Uran et al. p.16), contributes strongly to the increase in ecological vulnerability of agriculture, just as large scale deforestation and over-grazing and soil mining by low external input farmers. Supporting development of LEISA therefore is an important strategy to increase the ecological and economic resilience of agriculture, mitigate disaster and guarantee food security. In Zimbabwe, organic agriculture and Farmer Field Schools appear to be effective in improving the situation of rural women-headed households affected by the HIV/AIDS disaster (Page p.28).

Public pressure needed

The Mitch study has also uncovered a conspicuous "policy ceiling" in sustainable agricultural development. Farmers concluded that the prevalent national credit, market, agrarian and research policies favour Green Revolution agriculture, deforestation and marginalisation of small farmers, rather than more resilient, ecologically sound land use. The lack of a favourable policy context, and the lack of political will on the part of national governments to create one, appears to block development of resilient and sustainable land use. Existing natural resource policies are therefore responsible for enhancing disaster or at least making it more serious. How can we improve this situation?

In Europe, the crisis around the Mad Cow Disease, and the epidemics of the animal diseases 'Swine Fever' and 'Foot and Mouth Disease' are symptomatic of the increasing unsustainability and vulnerability of industrialising and globalising agriculture. As a result, some political leaders, especially in Germany, have finally accepted that drastic policy changes are needed to prevent further disaster (Reijntjes p.36). Apparently such changes are only possible once people start to experience the impact of disaster and public pressure forces politicians to take responsibility for the agricultural production systems and the quality of food they produce.

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Coen Reijntjes

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The editors encourage readers to photocopy and circulate articles. Please acknowledge LEISA Magazine and send us a copy of your publication.

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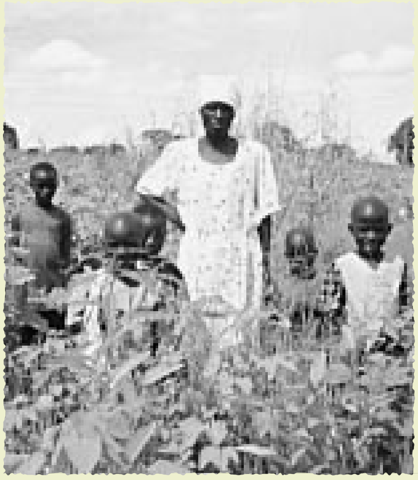


ILEIA is the Centre for Information on Low External Input and Sustainable Agriculture (LEISA) in the tropics. ILEIA seeks to promote the adoption of LEISA through the LEISA Magazine and other publications. It also maintains a specialised information database and an informative and interactive website on LEISA (http://www.ileia.org). The website provides access to many other sources of information on the development of sustainable agriculture.

LEISA is about Low-External-Input and Sustainable Agriculture. It is about the technical and social options open to farmers who seek to improve productivity and income in an ecologically sound way. LEISA is about the optimal use of local resources and natural processes and, if necessary, the safe and efficient use of external inputs. It is about the empowerment of male and female farmers and the communities who seek to build their future on the basis of their own knowledge, skills, values, culture and institutions. LEISA is also about participatory methodologies to strengthen the capacity of farmers and other actors to improve agriculture and adapt it to changing needs and conditions. LEISA seeks to combine indigenous and scientific knowledge, and to influence policy formulation in creating an environment conducive for its further development. LEISA is a concept, an approach and a political message.

18 Measuring farmers agroecological resistance to hurricane Mitch

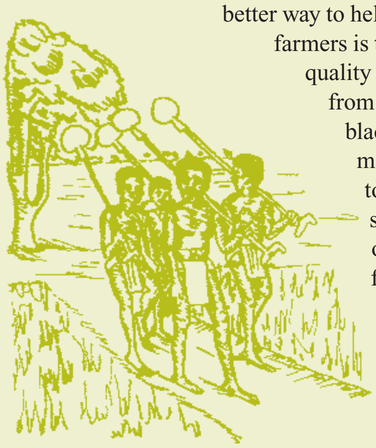
Eric Holt-Gimenez

The methodology and findings of an action research effort to measure and compare the impact of hurricane Mitch on conventionally and agroecologically farmed lands in Honduras, Nicaragua and Guatemala are presented. The study clearly shows the advantages of sustainable agriculture and farmer-led approaches. It also uncovers a policy ceiling to development of sustainable agriculture. The author states that it is due time to translate farmer-to-farmer successes on the ground into broad-based public pressure to influence national policy-makers.

24 Understanding local adaptation of tools in a relief situation

Roger W. Sharland

As people in civil war ravaged Southern Sudan have had to leave their homes in the face of fighting and famine, seeds have often become scarce and tools have been lost. In response, many mass produced East African hoes have been distributed by relief agencies. These 'improved' hoes, however, are not adapted to the specific conditions and needs of the local farmers who have a strong preference for their indigenous tools turned out by local blacksmiths. Roger Sharland discovered that a better way to help these farmers is to distribute quality steel plates, from which the blacksmiths can make the tools to the specifications of the local farmers.



DEAR READERS

By now you may have realised that we have changed the design of the newsletter and also revised its name; we now call it the LEISA Magazine on Low External Input and Sustainable Agriculture. How do you like it?

With the new team at ILEIA, presented to you in the last issue, ambitions are high and we hope to improve and expand the exchange of information on development of LEISA - agroecological approaches.

The theme of this issue is 'Coping with disaster'. We focus on the threats to production that regularly occur in the South such as drought, floods, hurricanes, war, HIV/AIDS, etc. and the possible responses to them. The articles show the importance of traditional resilience strategies, site-specific agroecological practices and farmer-led approaches to enhance the resilience of farming, leading to disaster prevention in risk-prone regions. No less important in recreating agricultural production after disaster is that relief and development agencies build on the knowledge, skill, spirit, ingenuity and efforts of the farmers themselves.

In Europe, we are witnessing how the highly industrialised agricultural system has lost its resilience. Swine Fever, dioxin polluted feed and Mad Cow Disease are now being followed by outbreaks of Foot and Mouth Disease, showing clearly how agricultural development can lead to disaster. All of a sudden the sustainability of agriculture is a hot topic of discussion and features prominently in the daily newspapers. There is a lot of consumer pressure for safe food and in some European countries, such as Germany, the politicians have now actively taken a stand for ecological agriculture – at the expense of the hitherto strongly promoted and subsidised industrialised agriculture. In which direction should agriculture develop in your country?

The editors.

LEISA

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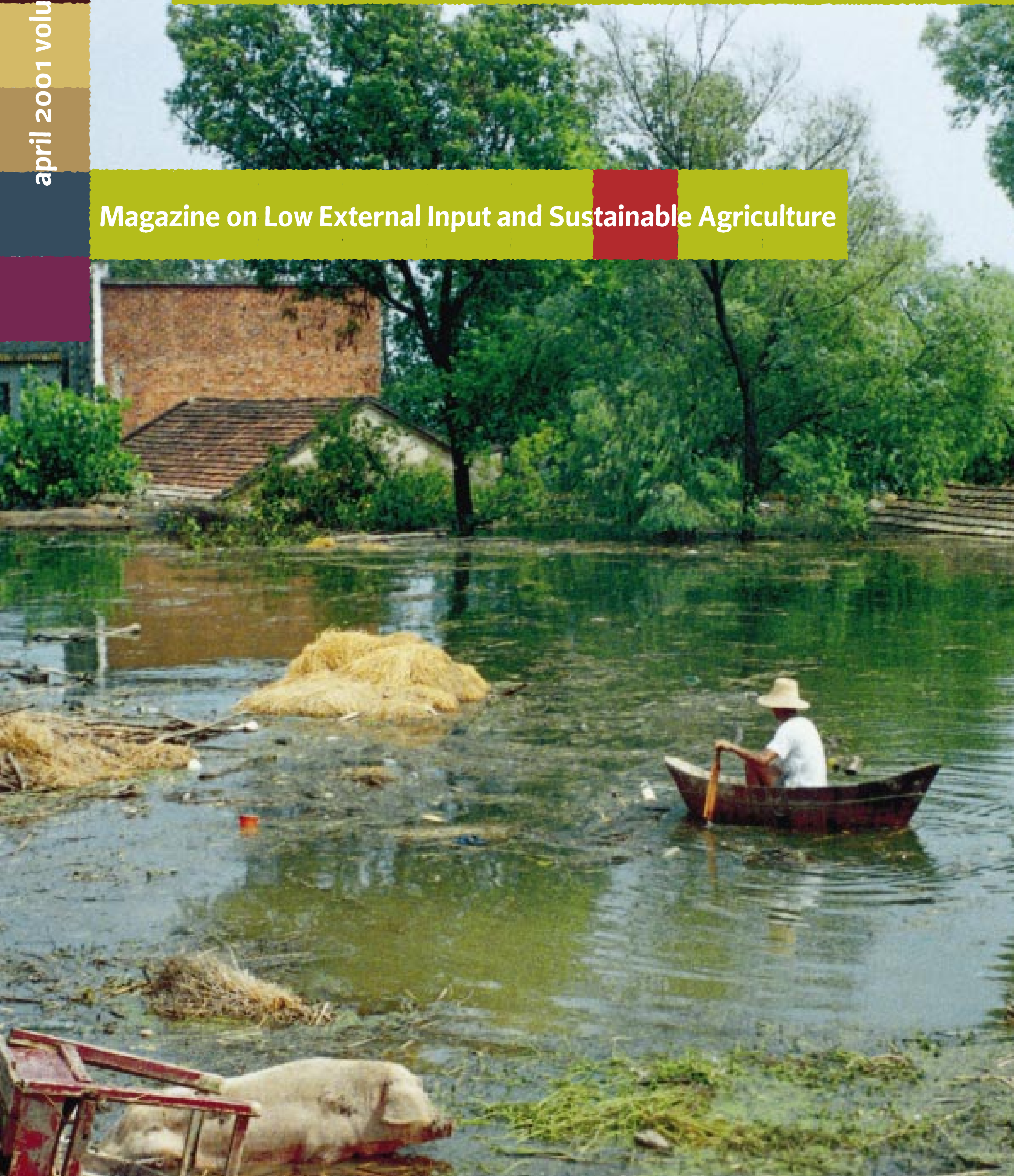


Coping with disaster

Poor information makes poor solutions

Degraded soils and low soil productivity are major constraints on the food security and income levels of small-holder farmers. Effective solutions require an integrated approach that takes biological, chemical, physical, social and cultural factors into account. It is, therefore, essential that stakeholders - international and local - know what information is available on the subject and have the capacity to use it to meet the specific needs of small-holder farmers. This was the subject of a recent *Centre for Technical Development and Agriculture (CTA ACP-EU)* seminar, where researchers, policy makers, communication specialists and representatives of NGOs and farmers discussed how information on soil fertility management could be more effectively used.

While much is known about soil and the technologies that can increase its productivity, little has been done to consolidate and make this information more accessible. There are many reasons for this:

- The results of research often remain within the scientific community and the experiences of farmer innovators remain within the local community;
- Information is lost as a result of policy shifts, re-organisations and staff changes;
- Skills and facilities to ensure systematic record keeping and documentation are inadequate;
- Responsibilities for land, agriculture and environmental issues are distributed between many different agencies and ministries making it difficult to obtain an overview of work done.

The seminar concluded that policy needs to be developed to support good documentation and communication practices. It is a matter of urgency to re-establish and strengthen the position of extension agencies and agricultural informati on services, which in many places have been undermined by structural adjustment and liberalisation programmes. This process has given international fertiliser companies a disproportionate influence over farming practices in many countries.

One speaker pointed out that *"poor people make poor soils and poor soils make poor people"*. But poor mechanisms for delivering and mediating information also mean that the poor are excluded from access to information that might provide effective and acceptable ways to increase soil productivity. The reduced capacity of extension and agricultural information services not only means that that small-holders' needs are less likely to be identified and researched but also that the media, which has the ability to reach farmers in their own language, has increasing difficulty in accessing information on agricultural and environmental issues.

CTA and other information management agencies and networks such as *AFNET* (African Network for Soil Biology and Fertility), *ILEIA* (regional and global magazines), and *WOCAT/SOTER* (an on-line biophysical information database) are all involved in collating, analysing and exchanging information on soil fertility and related issues. The conclusions and recommendations of other seminar participants suggested that priority should be given to improving the communication skills of all stakeholders, especially at the national level. More use should be also be made of local communication professionals to stimulate the flow of information in ways that will help farmers better understand local soil fertility problems and the opportunities for adopting technologies that offer appropriate solutions.

■

A full report of this seminar is available for CTA (ACP-EU), P.O.Box 380, 6700 AJ Wageningen, The Netherlands. www.cta.nl

Issue 20.2, June 2004

The next generation farmers?

Today rural communities are increasingly affected by external influence and rapid change. These processes affect the economic situation, change traditional cultures and particularly influence the younger generation. Are the communities still able to transmit the knowledge and values needed to build a livelihood in agriculture? Or is agriculture and rural life under such pressure that the older generation, perhaps even unconsciously, encourages their children to look outside farming for a future - even though this will deprive the community of one of its most valuable resources, its young people.

This issue of the LEISA Magazine will look at the situation and experiences of children and young people growing up in small-scale farming communities in the South. What livelihood opportunities are available to the younger generation? Are they prepared to make the best use of the natural and cultural resources available to them? To what extend does society at large, or formal institutions such as schools and community organisations, help young people to develop the skills they need to tackle the problems of living in, often resource poor and marginalised, rural areas? Do farmer training schemes and other development projects aimed at increasing the resilience and productivity of small- scale agriculture address the needs of the younger generation? Do boys and girls have different opportunities and needs and are these differences addressed?

Young people have always played an important role in rural life: they are strong, energetic and innovative. In the past they learned about their environment and farming from working side by side with the older members of the community. What are the options today? What are the visions of young people themselves ? What role do they play within their communities and what effect do their initiatives have on the natural resources, productivity and sustainability of the agricultural communities to which they belong?

We are interested in receiving contributions that describe initiatives and interventions that encourage and support rural children who wish to stay in the rural areas and build their future in these surroundings.

We would like to have your contributions by March 1, 2004.

You are invited to contribute to these issues with articles (about 800, 1600 or 2400 words + 2-3 illustrations and references), suggest possible authors, and send us information about publications, training courses, meetings and websites. Editorial support is provided. ILEIA offers to pay on request Euro 75.00 per article published in LEISA Magazine.

WOCAT World Overview of Conservation Approaches and Technologies

http://www.wocat.net/

WOCAT was established as a global network of SWC (Soil and Water Conservation) specialists. It facilitates more efficient use of existing know-how and, consequently, of development funds. It thus helps to optimise the implementation of appropriate SWC and to avoid duplication of effort. WOCAT's mission is to provide tools for SWC specialists to share their knowledge in soil and water management. Tools that assist them in their search for appropriate technologies and approaches, and that support them in making decisions in the field and at the planning level. WOCAT facilitates information sharing.

Saline lands

Searching expertise in bio-saline technologies? Check the website of the **Bio-Saline Project:** **http://www.undp-ausaid-biosaline.org/**
This community development project in Pakistan, coordinated by **IWASRI** (International Waterlogging and Salinity Research Institute), focuses on the utilisation of saline and waterlogged land through growing salt and waterlogging tolerant crops, trees, grasses and salt bushes. Establishing a vegetative soil cover is the first stage of soil reclamation. This vegetation (1) provides a protective cover of the soil against the harsh climatic conditions (2) allows the process of organic matter build up to occur (3) permits a more open soil structure development, and (4) encourages increased water infiltration that aids the removal of salts over time. Another option to find bio-saline experts is the databank of **Global BioSaline Network** managed by the International Centre for BioSaline Agriculture (ICBA) **http://www.biosaline.org/About.htm**

TRIOPS – Tropical Scientific Books Distribution

http://www.net-triops.de

If you are having difficulty in ordering books and publications on development issues and want to be sure your order is safely and efficiently dealt with, you may like to try TRIOPS. A family firm, established in Germany in 1789, it emerged as a publisher and supplier of tropical and sub-tropical scientific books before expanding its activities into development-orientated literature. Today, it offers comprehensive access to those seeking information on all aspects of development, including the technical, economic and social aspects of agriculture, the environment, natural resource management, trade and markets, as well as information and communications technologies. Its main customers are development agencies, scientists, librarians, research worker, development projects and booksellers. TRIOPS is a wholesaler and a book store in one so it can provide books at low wholesaler prices and give you the individual service of a book store. Its delivery service is cost effective and fast and it uses latest technologies in answering requests for bibliographies and other publication service information. In addition to its core activities it works to bring development orientated publishers together to discuss problems of associated with identifying and meeting publication needs in the South.

Wageningen International Studies Papers (Wisp'r)

http://www.gcw.nl/wispr/new/w2003_26_05.htm

The increasing salinity of the soils in the Sahel has long been acknowledged as a catastrophe for agriculture in the region. The cause of the problem is often attributed to the relatively new irrigation systems, which are believed to increase the amount of salt reaching the soil. Recent PhD graduate Piet van Asten concludes that this is not the case. Salt accumulation has more to do with the underlying bedrock, and decreased yields are more linked to a shortage of nutrients in the soil.

Seeds of promise for farmers

http://www.iaea.or.at/worldatom/Press/Focus/Chernobyl-15/farm.shtml

Farming communities in Belarus and Ukraine suffered heavily from the Chernobyl accident. Radioactive contamination of farm lands was widespread, making it hard to sell crops and foodstuffs from the region. Belarus scientists have found that some rapeseed varieties take up and store radio-nuclides from the soil in their stalks and seed coats, but not in the seeds. Growing this crop can improve the soil conditions and also yield marketable rape oil.

ACT: African Conservation Tillage Network

http://ies.uz.ac.zw/act-network/index.html

The African Conservation Tillage Network (ACT) facilitates sharing of information and experiences across sectors, disciplines and geographical boundaries among players and stakeholders involved in promoting adaptation and adoption of conservation farming principles and practices in Africa. Information is available through subscribing to their Newsletter; downloading leaflets; or through access to databases on conservation agriculture technology and cover crops. The cover crop database runs on a computer programme called **LEXSYS** (Legume Expert SYStem). This is a downloadable, searchable, database of herbaceous legumes developed by researchers in Africa, who are interested in integrating legumes into farming systems. It contains 91 data fields for each variety and the database can be searched using 47 different selection criteria.

Cover crops

Information about cover crops is widely available on the Internet. A good place to start is **Worldwide Portal to Information on Soil Health** **http://mulch.mannlib.cornell.edu/TSHomepage.html** A portal developed and co-ordinated by MOIST, and hosted by Cornell University (Ithaca, USA). This portal offers, amongst other things, links to databases on plant species including cover crops and to published information, including journals, extension material, and on-line newsletters and bulletins. It also gives a list of organisations working with cover crops: **http://mulch.mannlib.cornell.edu/TSOrganizations.html**.

CIDICCO

http://cidicco.hn/newcidiccoenglish/

CIDICCO is a NGO which has the objective of identifying, documenting, disseminating, researching and/or promoting research in the use of green manures and cover crops for small-scale farmers. Their web site contains several publications, including the bulletin "Cover Crops News". CIDICCO also manages the **Cover Crops Network** **http://cidicco.hn/newcidiccoenglish/information_network.htm**.
This is an informal network for the exchange of information on green manures/cover crops.

CIEPCA

The Center for Cover Crops Information and Seed Exchange in Africa
http://ppathw3.cals.cornell.edu/mba_project/CIEPCA/home.html
From 1998 to 2001, CIEPCA assisted researchers and development specialists to develop, target, and test appropriate cover cropping systems in Africa.

Beginning in 2002, CIEPCA was reconfigured as a web-based information centre on cover crops. It continues to provide access to on-line newsletters, Africa-based extension material and the French language cover crops electronic discussion group (EVECS-L). Extension materials on cover crops and green manures for small scale farming in the tropics can to be found on: **http://ppathw3.cals.cornell.edu/mba_project/CIEPCA/exmats/exmat.html**

Legume Research Network Project NEWSLETTERS

http://ppathw3.cals.cornell.edu/mba_project/ciepca/lrnpnews.html. The LRNP Newsletter is published twice a year by KARI (Kenya Agricultural Research Institute). In addition to reporting on network activities and coming events, the Newsletter publishes short articles on legume research, with a focus on research aimed at integrating legumes into smallholder agriculture.

IDRC

Cover crops for sustainable agriculture

http://www.idrc.ca/cover_crop/index_e.html.

This site contains research highlights on cover crops for sustainable agriculture. It also provides access to books on cover crops which can be downloaded free of charge.

A Communication and Natural Resource Management: Experience/Theory

http://www.comminit.com/stfaocommnrm/sld-8149.html

This new resource is published by the FAO's Communication for Development Group in the Extension, Education and Communication Service and was prepared as part of the Communication Initiative. It is designed to serve as a learning tool and takes the reader through a series of exercises that explore various theoretical approaches and field experiences in communication applied to different development interventions and Natural Resource Management (NRM) issues. The full text of the manual can be downloaded from this site.

Land Degradation and Development

http://www3.interscience.wiley.com/cgi-bin/jhome/6175

Land Degradation and Development is an international research journal that seeks to promote rational study of the recognition, monitoring, control and rehabilitation of degradation in terrestrial environments. The journal focuses on the causes and effects of land degradation; the avoidance, mitigation and control of land degradation and remedial actions designed to rehabilitate or restore degraded land.

Vetiver Network

http://www.vetiver.org/

The Vetiver Network is a non-profit Foundation with a mission to develop and disseminate information on the use of Vetiver grass for on-farm soil and water conservation, land rehabilitation, embankment stabilisation, disaster mitigation and pollution control.

SD Dimensions (FAO)

http://www.fao.org/sd/EXdirect/EXan0030.htm

Environmental Impact Assessment (EIA) training for sustainable agriculture and rural development: lessons and experience from Cambodia by Duffy P. The EIA training, which is the subject of this article, is meant to illustrate the importance of developing human resources through non-formal education and extension training, particularly in the protection of natural resources important to agriculture, fisheries and forestry. Environmental training is a high priority in Cambodia at present because it provides the knowledge, attitudes, and skills needed by professionals, officials and policy-makers to understand the complexities of the environment and to avoid further degradation.

GORA

http://www.aginternetwork.org/

AGORA is a portal developed by FAO to give access to agricultural scientific articles. It is aimed at users in Less Developed Countries.

IFDC

http://www.ifdc.org

IFDC is an international organisation, which aims to increase agricultural productivity in a sustainable manner through the development and transfer of effective, environmentally sound plant nutrient technology and agricultural marketing expertise. The Centre's facilities include libraries, pilot plant, laboratories, greenhouses and training facilities.

Issue 20.3, September 2004

Post-harvest management

Traditionally, researchers, extensionists and policy makers have given much emphasis to increasing crop and livestock production in the field, in order to improve farm incomes and food availability. Post-harvest handling and storage arrangements have often been neglected and not received the same level of attention. An astonishing amount of produce is lost post harvest, due to deficient transport, processing and storage techniques. It is estimated that worldwide post-harvest losses of agricultural produce are around 30%.

Taking better care and making better use of produce can enhance both farm incomes and food availability in a cost-effective way. It can also improve the quality and safety of the products because it may limit the growth of fungi or damage by insects, rats and the like. Good practices related to transport, processing and storage form the basis for improved post harvest management. Improved harvesting and packing techniques, and alternative means of transport may limit losses during transport from the field to the farm or to the market. Better and innovative methods of processing give the product a longer shelf life, making it possible to consume it over an extended period. Proper storage is very important if people have to keep products for their own consumption or if they have to keep seeds for the next crop cycle. In addition, post-harvest storage may add value to produce when it is sold, as market prices may be higher in certain periods.

Readers are invited to contribute their practical experiences on how proper post-harvest management of cereal grains, fruits, vegetables, livestock products and other rural produce have led to increased benefits for farmers. Experiences related to efficient and low-cost ways of storage, processing and transport are welcome.

Deadline for contributions is the 1st of June 2004.

You are invited to contribute to these issues with articles (about 800, 1600 or 2400 words + 2-3 illustrations and references), suggest possible authors, and send us information about publications, training courses, meetings and websites. Editorial support is provided. ILEIA offers to pay on request Euro 75.00 per article published in LEISA Magazine.

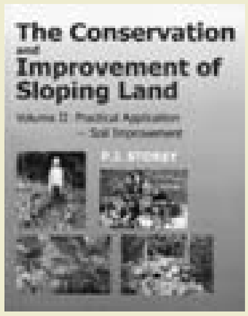
Biological management of soil ecosystems for sustainable agriculture: report of the International Technical Workshop organized by EMBRAPA-Soybean and FAO, Londrina, Brazil, 24-27 June 2002. 2003. 102 p. ISBN 92 5 104966 1 US$ 27.00. Food and Agriculture Organisation of the United Nations (FAO), Land and Water Development Division, Viale delle Terme di Caracalla, 00100 Rome, Italy / Publications-Sales@fao.org. (World Soil Resources Reports 101, ISSN 0532-0488).
This workshop was organised as a contribution to the joint programme of the Convention on Biological Diversity (CBD) and FAO. Scientists and practitioners from several regions joined efforts to review and discuss the concept and practices of integrated soil management, shared successful experiences and identified priorities for action. The workshop set out maximise the benefits (e.g. enhanced productivity and sustainability) of biological management of soil ecosystems. Based on working-group discussions, plenary sessions and existing knowledge and experiences, this report lays the foundations for the development of practical guidelines to promote on-farm research and technology development in integrated soil biological management. (WR)

Overestimating land degradation, underestimating farmers in the Sahel by Mazzucato V., Niemeijer D. 2001. 22 p. International Institute for Environment and Development (IIED), Drylands Programme, 3 Endsleigh Street, London WC1H 0DD, UK / drylands@iied.org (IIED issue paper no.101, ISSN 1357 9312).
This issue paper explores the evidence of land degradation in Burkina Faso and questions whether local farming practices are as unsustainable and environmentally destructive as many reports suggest. The paper discusses and analyses the reasons for land degradation in the region. This is followed by a discussion of local land management practices and social networks, and how they may contribute to sustainability and productivity. The conclusion is that land degradation is often overestimated because the abilities of local farmers are underestimated. Farmers have developed flexible, efficient, and effective land management strategies to deal with the limited availability of labour and external inputs, as well as the harsh environment in which they work. The challenge for future assessments of degradation is to incorporate the effect of farm management practices, including their social and institutional dimensions on soil loss, yields and nutrient budgets.(WR)

Farmers' initiatives in land husbandry: promising technologies for the drier areas of East Africa by Mutunga K., Critchley W. 2001. 108 p. ISBN 9966 896 63 5. Regional Land Management Unit, (RELMA), PO Box 63403, Nairobi, Kenya / relma@cgiar.org SIDA. (RELMA Technical Report Series no. 27).
This book is a follow-up to the 1999 publication 'Promoting Farmer Innovation' which looked at the methodology of working with farmer innovators. 'Farmers' initiatives in land husbandry' lays out case studies of 18 of the most interesting technical systems uncovered during three years of working with such innovators in East Africa. There is an abundance of illustrations and photographs. This is not just a technical manual, but also describes the people behind the initiatives. The methodology used to generate the data for the case studies was developed by WOCAT. This document is the product of collaboration between PFI, WOCAT and RELMA, which has proved to be a fruitful partnership. The book is aimed principally at field technicians and project managers in East Africa, but it is hoped that it will prove relevant to a much wider audience.

Response to land degradation by Bridges E.M., Hannam I.D., Oldeman L.R. [et al.] (eds.). 2001. 507 p. ISBN 1 57808 152 1 US$ 32.-. Soil and Water Conservation Society of Thailand (SWCTS), Bangkok, Thailand. Science Publishers, PO Box 699, Enfield, New Hampshire 03748, USA / www.scipub.net
This book provides a wide-ranging study of human responses to the causes and effects of land degradation. The background to the problem of land degradation is examined and the reasons for it described, giving the reader a comprehensive picture of the contemporary state of land resources. The driving forces that cause land degradation and impacts they have upon the environment are illustrated by case studies. Linking the two parts of the book is a section concerned with the methods for assessment and monitoring land degradation. The concluding part of the book emphasises that technological solutions are often not successful without appropriate economic, social, legal and financial conditions.

The conservation and improvement of sloping land: a manual of soil and water conservation and soil improvement on sloping land. Vol. 2 practical application-soil improvement by Storey P.J. 2003. 262 p. ISBN 1 57808 250 1 US$ 56.-. Science Publishers Inc, PO Box 699, Enfield, New Hampshire 03748, USA / www.scipub.net ; sales@scipub.net.
The author of these books is a practitioner who has realised that most of his audience cannot afford a whole library of books and written a comprehensive manual covering virtually every aspect of this subject. It consists of three volumes and this, the second volume, deals with practical aspects of soil improvement. The wide practical experiences of the author, together with his intention to write expressly for field workers make this manual to an invaluable guide for rural development workers faced with the basic problems of farmers in the developing world. The book looks at the soil, how it develops, what makes fertile soil and what spoils soil. Topics covered in the book include soil chemistry and plant nutrition, ways of recognising and treating mineral deficiencies, identifying when fertiliser use is appropriate and improving soil texture. All the well-known LEISA technologies, such as zero tillage, the use of mulch and green manure, cover crops, crop rotation and inter-cropping are described and explained. Recommended. (WR)



Optimizing soil moisture for plant production: The significance of soil porosity 2003. 124 p + CD-ROM. ISBN 92 5 104944 0 US$ 53.-. Food and Agriculture Organisation of the United Nations (FAO), Viale delle Terme di Caracalla, 00100 Rome, Italy / www.fao.org ; Publications-Sales@fao.org. (FAO Soils Bulletin No 79; ISSN 0253-2050).
This publication discusses the processes, above, within and below the soil, that enable water to move and crops to grow. It contributes to raising awareness of possibilities for better use of rainwater and improved management of soils and provides a solid basis for sound, sustainable soil moisture management. It is intended for extension staff, other technicians, and farmers' leaders. The document is made user-friendly through the inclusion of a guide containing activities and exercises described in non-technical language, and by interspersing the text with illustrations and diagrams. The complete materials of this guide are included on the CD-ROM. (WR)

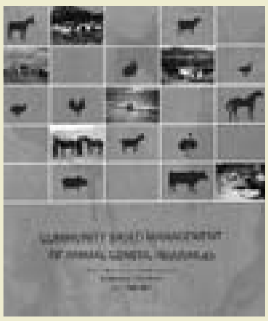
NEW IN PRINT

Land reform and peasant livelihoods: the social dynamics of rural poverty and agrarian reforms in developing countries by Ghimire KB (ed.). 2001. 112 p. ISBN 1 85339 527 7 US$ 27.50. IT Publications, 103-105 Southampton Row, London WC1B 4HH UK / orders@itpubs.org.uk ; www.itdgpublishing.org.uk.
Millions of small-scale farmers are vulnerable to hunger and poverty as a result of inadequate access to land and productive resources. This book argues that comprehensive land redistribution is key to improving rural livelihoods. A team of experts in field research, advisory work and the implementation of reform programmes, present a critical analysis of the performance of land reform efforts, and review the role of different actors in this process. The contributors scrutinise the inadequacy of the market-driven approach to land reform, which is linked to the structural adjustment policies of the World Bank. They convincingly advocate a flexible approach towards redistributive reforms as the most appropriate strategy for alleviating rural poverty. Recommended (WR).

La menace vient du nord: enquête sur le coton 2003. 69 p. Oxfam Solidarity, Vierwindenstraat 60, 1080 Bruxelles, Belgium / oxfamsol@oxfamsol.be
This folder explains the "cotton issue" in West Africa, whose poor cotton farmers will only be able to survive if the rich countries stop dumping subsidised cotton onto world markets. This case study also explores the more generalised problems of developing countries in increasingly globalised agricultural markets. (WR)

Good times and bad times in rural Java: case study of socio-economic dynamics in two villages towards the end of the twentieth century by Breman J, Wiradi G. 2002. 330 p. ISBN 90 6718 187 0 EURO 33.-. KITLV Press, PO Box 9515, 2300 RA Leiden, The Netherlands kitlvpress@kitlv.nl.
This micro-study on socio-economic dynamics in two villages along the coast of West Java, argues that since the onset of the Asian economic crisis, more than half of all households now live below the poverty level- a figure which official records have failed to identify. In contrast to the received wisdom that the villages still function as communities, the crisis has widened the gap between the rural rich and poor. This book discusses the repercussions for work and welfare in this rural area. (WR)

Community-based management of animal genetic resources: proceedings of the workshop held in Mbabane, Swaziland, 7-11 May 2001. 2003. 190 p. Food and Agriculture Organisation of the United Nations (FAO), Viale delle Terme di Caracalla, 00100 Rome, Italy / www.fao.org ; Publications-Sales@fao.org. GTZ.
This workshop was organised to develop a conceptual framework for community-based management of animal genetic resources. In the Southern Africa region about 75 percent of farm animals are kept by communal/smallholder stockowners. Animal husbandry therefore plays a key role in sustaining livelihoods of many such farmers. The sustainability of farming systems and food security is currently threatened by losses of animal genetic diversity. This workshop starts from the assumption that farmers are the custodians of farm animal genetic resources and are therefore best placed to manage these resources. (WR)



Pathways of change in Africa: crops, livestock and livelihoods in Mali, Ethiopia and Zimbabwe by Scoones I, Wolmer W (eds). 2003. 320 p. ISBN 0 85255 422 2 GBP 16.95. James Currey Publishers, 73 Botley Road, Oxford OX2 0BS, UK / sales@jamescurrey.co.uk
This book looks at the diverse ways in which cropping and livestock patterns are changing in three contrasting settings (in Ethiopia, Mali and Zimbabwe). The authors of this series of empirical case studies argue that mixed farming is not the only option for sustainable development. The book provides an analysis of the cases from this point of view. (WR)

Evaluating capacity development: experiences from research and development organisations around the world by Horton D. [et al.] 2003. 170 p. ISBN 92 9081 274 5. International Service for National Agricultural Research (ISNAR), PO Box 93375, 2509 AJ The Hague, The Netherlands / isnar@cgiar.org ; www.cgiar.org/isnar
This book is the result of a collaborative effort involving many individuals in research and development organisations from around the world. It draws together the experience and insights from six evaluation studies carried out under the umbrella of the 'Evaluating Capacity Development"(ECD) Project, co-ordinated by ISNAR.
Capacity development currently attracts a great deal of attention and considerable sums of money are spent promoting it. Yet there have been only limited systematic evaluations of such efforts, hampering attempts to draw lessons that could improve future programmes. This book is written for managers and evaluators in research and development organisations. The authors used examples and lessons drawn from the evaluation studies as a basis for identifying how capacity development efforts and evaluation can help organisations to achieve their missions.(WR)

Agroforestry by Verheij E. 2003. 85 p. ISBN 90 72746 92 9. AGROMISA, PO Box 41, 6700 AA Wageningen, The Netherlands / agromisa@agromisa.org CTA / cta@cta.nl. (Agrodok ; 16).
This completely revised Agrodok focuses on tropical agroforestry, which straddles the disciplines of tropical forestry, plantation tree crops and tropical fruit and nut crops. However, forest trees and tree crops are at the fringe of agro forestry's concern. Its main focus is on so-called "auxiliary woody plants" which do not yield a marketable product, but are multi-functional and play a supporting role in cropping systems. As well as supplying fodder and/or fuel wood these functions include providing shade or shelter, serving as support (e.g. live stakes for climbers) or protection (a hedge to keep out cattle, or – on a slope – stemming erosion. This useful manual is available once again. (WR)

Visit our website: www.ileia.org

Sand blocked water distributary. Photo: URMUL Trust

Moving in sand and time

Sushila Ojha

"There is a serpent on your chest
Oh land of dunes rise and awake
Open your eyes to reality
Leave the false illusions"

The great Thar desert covers much of Rajasthan. Receiving less than 160 mm rain annually, it is perhaps the driest region of India. It is a vast, arid, unfriendly and tough terrain with shifting sand dunes, sparse population, extreme temperatures, stunted vegetation and very little arable land. Faced with deep brackish ground water, erratic rainfall and recurring droughts local communities have developed a tradition of seasonal migration and livestock rearing. Every raindrop is valued and water harvesting has always been important. Despite these tough conditions, the desert has 12.8 million inhabitants.

Today the region is cross-cut by canals, all part of the vast Indira Gandhi Irrigation Scheme, IGNP, that bring in water from the Punjab. A vision to create prosperity in this desolate region was born in the early 1900s and became reality when, in 1948, work started on one of the world's largest irrigation schemes. Financed by the World Bank and using water from the Sutlej and Beas rivers, the scheme is still being developed. The IGNP uses 90% of the ten billion cubic metres of water diverted from the Punjab to feed its 7000 km of canals and to irrigate some 1,500,000 ha of agricultural land. The IGNP accounts for 8% of the total agricultural area of Rajasthan and has turned the state into a net exporter of food grains, cotton and groundnuts. The scheme has also brought sweet drinking water to the settlers in the command areas and to those living in the many urban centres and rural villages.

The introduction of large-scale, centralised irrigation has radically affected the area. Initially water from the canal was used for intensive flood irrigation of groundnut and cotton. Intensive mechanised agriculture using chemical fertilisers and pesticides was introduced and tenancies and share-cropping practices became common. Farmers' attitudes to the use and management of land and water changed. Traditional respect for these resources was eroded by the attractions of the cash economy and as a result the customs of water harvesting, fundamental for survival in this desert environment, have been forgotten.

1987 saw one of the worst droughts of the century and the irrigation system was unable to deliver enough water. URMUL, a NGO working in arid Rajasthan for the integrated development of the cattle rearers, realized the need to reconsider their approach.

URMUL was deeply concerned about the increase in salinity and water logging in Stage-1 and emerging dangers in Stage-2. Irrigation practices and intensive agriculture in Stage-1 area were harming the soil. Irrigation and seepage from the canals was causing water logging because the local gypsum hardpan prevented water percolating deep into the ground. Instead, excess water evaporated from the surface of the soil, leaving its salt content behind. Almost 13,000 ha of land was permanently under water in Stage-1 and 1200 ha had developed into marshy land in Stage-2. The land was ruined and farmers had to leave. Water logging, salinisation and siltation had become major problems for farmers in the command area. URMUL was also concerned about the speed with which the pastoral economy and lifestyle were changing.

In 1991, URMUL organised a workshop to assess the technical, economic and social impacts of the cash economy stimulated by the irrigation scheme. For the first time the voices of farmers, new settlers, agro-businessmen and marginalized farmers affected by the canal system were heard. After the workshop participants undertook a journey along the entire course of the main canal, from the head-works to the tail-end, to put observations made during the workshop into perspective.

Several new issues were identified:
- Social and economic disintegration
- Break up of family and traditional support systems

- Loss of village identity. Settlements were now known by the numbers of the distributaries or water channels e.g. 1 LKD means first settlement at Lunkarsar Distributory
- Obstructed or dry water courses or no supply at all in the areas at the ends of the distribution channels
- Resurgence of malaria
- Inappropriate policies for afforestation and sand stabilisation (large-scale Eucalyptus plantations)
- Inadequate health and education facilities in new settlements
- Market forces cause farmers double losses - harvest bought at low prices and agricultural inputs sold expensively
- Water disputes leading to violence and crime
- Women face new problems of social insecurity and isolation
- Malnutrition because crops grown are not part of traditional diet
- Values like social justice and equity eroded in this new context

The experiences during this journey lead URMUL to change its strategy - to one based on faith in local traditions, knowledge and skills. URMUL decided to begin work in the new Stage-2 settlements. Here, farmers were organised in *Chak samities* – a *Chak* being a group of fields irrigated by a common water outlet – to work in a participative way to find solutions to these problems.

Ensuring water

Because distribution channels followed the contours of sand dunes drifting sand could easily fill them obstructing the flow of water to the fields. After a communal problem resolution exercise it was decided to adopt the low-cost technique of covering critical parts of the open channels with locally available stone-slabs and mud mortar. Pits for trapping sediments were constructed before the covered part to prevent these tiny soil particles from settling in the covered water channels and clogging them. This cost effective, simple community managed project was very successful. It ensured water flow and enabled the farmers to grow two crops a year. With the support of the World Food Programme, the IGNP command area development authorities later took up this idea and scaled it up.

Most of the settlers had not considered it necessary to construct water harvesting structures when they settled in the irrigation scheme because they were surrounded by canal water. This meant that the first drought caused a water crisis. With little water in the dam the canals dried up and farmers realised their vulnerability. They started to reconsider traditional systems of water harvesting and began to construct *Kunds,* rainwater collection tanks, again.

Improve production

Excessive use of chemical fertilisers and pesticides in the command area had made the land infertile and yields were declining. As an alternative and to ensure rehabilitation, URMUL introduced organic vermi-compost and training in its production and use is an on-going activity. Today, it is an eco-friendly, safe and low cost option readily available to small-scale farmers. The Rajasthan Agricultural University in Bikaner has taken up the idea and is promoting it in other areas.

"*Rathi*" is an indigenous breed of cattle adapted to desert conditions. The breed has been ignored for a long time in favour of cows cross-bred with Jersey and Holsteins. However, these breeds turned out to be unsuited to arid conditions whereas *Rathi* herds had survived for centuries in the Thar desert needing little water and fodder yet providing high milk yields. URMUL is now trying to improve the *Rathi* breed with the support of National Dairy Development Board. The project has started with ten thousand milk producing families in Suratgarh and Lunkaransar in Stage-1, an area where land has been devastated by water logging.
The scarcity of fodder, especially during droughts, has always been a challenge for cattle rearers. Traditionally, fodder was harvested and stored in fodder banks. The stacking was done in a way that kept the fodder safe and edible for at least four to five years. However, with the development of the canal, this crisis management practice was ignored. The severity of the drought in 1987 encouraged URMUL to revive the fodder banks and they have now been reintroduced.

Social services

Another set of problems also needed attention. The tremendous resurgence of malaria caused an epidemic in the Western districts of Rajasthan, an area normally malaria free. This resurgence is the result of the environmental changes caused by the IGNP canal. The canal has changed the ecology and the waterlogged areas flanking the canal course have become breeding grounds for mosquitoes. In addition, 60-70% of the total malaria cases in the 1994 epidemic were caused by the deadly *Plasmodium falciparum*. Primary health care services are not available because of the scattered nature of the settlements. Therefore, URMUL trained 300 local women to be primary health workers. Most of them, although illiterate, have become experts in primary health care and they now provide reproductive and child health care which includes anti-natal and post-natal care while ensuring safe deliveries, the treatment of all primary health problems, immunization and health education. An indication of the success of this initiative is that the communities are subscribing to these health care services. Village health workers have also organized women's self-help groups (SHG). These micro-finance groups are running micro-enterprises such as community shops, fodder-banks, grain-banks and also provide for other community requirements. The SHG movement have made a tremendous contribution to empowering women socially and currently almost ten thousand women are members of SHG movement.

In order to provide some education for girls, education camps were developed and these have become popular throughout the canal area representing an alternative education and life-skills development programme. On average, one hundred girls stay together in one of these camps for six months. Away from their homes they remain in the care and supervision of specially trained teachers. The girls, who are between 12 to 18 years of age, have never been to school before coming to these camps and during their six-months stay they acquire competencies equivalent to primary level of education. In addition, they are introduced to the issues such as collective living, human values, gender-equity, health and hygiene as well as other life skills. Environmental awareness, water management, land use as well as cropping patterns suitable to local conditions are also included in their training. The success of these camps can be measured by the demand for more camps and the willingness of parents, especially from poor classes, to send their daughters to them. This activity is a long-term investment in human resource development and empowerment of women.

It is true that much of the change brought by the canal have helped raise living standards of the people in the command area. But over time it has become clear that total dependence on canal system is not sustainable. The farmers – disillusioned after their bitter experience – are again turning to the knowledge contained in their traditional customs and practices for solutions to the problems they now face.

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Selective wood harvesting from shelterbelt trees by the government, not by the farmers. Photo: Lambert Onyewotu

Shelterbelts and farmers' needs

Lambert Onyewotu, Kees Stigter, Yusuf Abdullahi and Jo Ariyo

Nigeria, with more than 100 million inhabitants, is situated in West Africa and shares borders with Niger, Benin, Chad and Cameroon. Climatic conditions vary considerably from south to north. The south has a wet, equatorial climate whereas on the northern border with Niger it is hot and (semi-) arid. Agriculture in the northern region is characterised by millet monoculture. In areas with a little more rainfall, millet and sorghum are intercropped with cash crops such as groundnut and cowpea. The use of fertilisers, pesticides, improved varieties and machinery is generally limited. The Hausa, Kanuri and Fulani are the main ethnic groups who inhabit the area. A small number of nomads, mainly Fulani, visit the region with large herds of livestock.

Deterioration

Over the last 40 years serious desertification has occurred in northern Nigeria as a result of both natural causes and human activity. In recent years, there has been a gradual decline in rainfall. During the 1960s, the average annual rainfall in the city of Kano in Northern Nigeria was 825 mm. By the 1970s it had fallen to 700 mm and in the 1980s annual averages of about 650 mm were being recorded. Although rainfall remained fairly stable during the 1990s, farming under such conditions became increasingly difficult. In addition, population pressure has increased as labour migrants returned to the area after the oil boom in the South ended. As a result holdings have become smaller and fallow periods shortened. Vegetation cover has been eliminated as trees in natural parklands have been cut down, bush burning has intensified and overgrazing has continued uncontrolled. Over-used, unprotected and exposed to sun and wind, the soils in the area have degraded rapidly.

Trying to cope with desertification

In the 1970s, and especially during the great drought of 1972-1973, the scale of human suffering was so great that passionate appeals were made for official intervention to halt desertification. As a result the Kano State Forestry Department devised a programme of land rehabilitation using shelterbelts. They established more than 20 km of rainfed multiple shelterbelts - eleven in total - of *Eucalyptus camaldulensis* at Yambawa, 75 km north east of Kano and not far from the border with Niger. The area was a strategic one. It was near an important road used by caravans and traders and many returning migrants had started to resettle there.

The shelterbelts settled drifting sand and undulations and encouraged the return of soil protecting grasses. Farmers tried to make use of the improved microclimatic and soil conditions between the belts by growing millet.

Design errors

Unfortunately the Forestry Department made its decisions alone and they did not involve any other stakeholders in the planning process. There were no contacts between Department officials and outside engineers and scientists who could have supplied useful information about how to construct shelterbelts. In addition, the Department had very poor access to the literature about previous research and experience with windbreaks.

As a result there were several design problems with the shelterbelts. In order to deal with the problem of seasonal changes in wind direction, shelterbelts were established at an angle to the prevailing winds. This diminished their wind protective functions in both the wet and the dry seasons. As a compromise, and in order not to occupy too much farmland, the belts had also been established too far apart. The usual distance between belts is about 10 times the final height of the trees. The Forestry Department, however, spaced its belts irregularly from between 15 to 25 times the estimated final height of the trees. Because the belts were so far apart, they were unable to protect all the land between the shelterbelts and much of the soil was, therefore, left unprotected against hot winds and solar radiation.

The width of the shelterbelts themselves was arbitrarily chosen as 30 m, which meant they still occupied about 20% of farmland. Better results would have been achieved if the width of the shelterbelts and the space between them had both been halved.

No participation, no benefits

The farmers disliked the shelterbelts which took up much of their agricultural land. Our early research confirmed that the shelterbelts competed with their crops for water, light and nutrients, while offering limited protection to the fields they were designed to shield. Instead of Eucalyptus trees, the farmers would have preferred indigenous tree species that could have offered food, fruits, fodder or medical products. They disliked their farmland being occupied without compensation and the fact that they were not allowed to do any maintenance on the belts, such as pruning the front branches to stop the trees shading the front rows of crops, or coppicing (cutting back) which would have provided them with fuel wood.

The heavy demand for wood for fuel and for building provides an important reason for establishing a shared management system for shelterbelts and woodlots. However, at the moment management is in the hands of the Forestry Department and farmers are still not involved. Fuel wood from the shelterbelts can be obtained through official channels, but a survey indicated that only 40% of farmers get wood through these channels.

In 1993, it was estimated that some 3000 people were affected by these shelterbelts. Labour migrants continued to return home and the Forestry Department was convinced that these ex-farmers were returning because of the shelterbelts. This however, was a serious misconception.

Repeating errors in the future?

In the late 1980s, the authors started doing research – partly farmer-managed – on the shelterbelts to find out how the situation could be improved. The results of this research enabled the development of a number of concrete recommendations. It showed, for example, that root pruning and branch pruning were necessary precautions to reduce competition between millet and trees. The farmers took to root pruning without any difficulty because they could see its benefits. However, the Forest Department did not allow them to prune the branches because fuel wood collection and sale is the exclusive right of the authorities.

Research also indicated that better crop yields could be achieved by using higher inputs of organic fertilisers in combination with either of the following:

- The better design of multiple shelterbelts,
- Planting farmer- friendly scattered trees at appropriate densities in the wide spaces between the shelterbelts;
- Replacing shelterbelts by a system of scattered trees – the so-called parkland agroforestry traditionally used in the area – but with considerably improved densities.

Shelterbelts were established too far apart. Photo: Lambert Onyewotu

The *Forestry Research Institute of Nigeria (FRIN)* has presented these recommendations and the outcome of the participatory experiments at several seminars that have been attended by government extensionists and forestry staff.

At the moment the Forestry Department does not seem to have any plans for improving the efficiency of the shelterbelts. Present policy, financial restrictions and the lack of a tradition, at the official level, of participatory approaches to these types of issues are important constraints. At present, no workable solutions to the problems associated with existing shelterbelts are being developed, and alternative options, such as parkland agroforestry to rehabilitate soil and stop desertification, are not being considered.

During the day, nomads and sedentary farmers like to use shelterbelts for shading their cattle and themselves. Photo: Lambert Onyewotu

Real change requires participation, planning, coherence and resolve

The experience of Northern Nigeria confirms that soil management and rehabilitation policies must be set in the context of wider development objectives and a well-defined direction of social change. Federal and state authorities in Nigeria have an important responsibility in this respect. In developing a policy of soil rehabilitation, farmers' input not only provides important insights but is also necessary for establishing effective and communal management systems. These systems should have enabled the involvement of returning landowners and farmers, and must now also be capable of evolving to meet the agro-ecological and demographic challenges of the region.

In addition to securing farmers' participation, special extension intermediaries should be trained and equipped to improve the flow of information between researchers, farmers and government authorities.

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Farmer Field School on nutrient management

Davies Onduru, Fredrick Muchena, Louis Gachimbi and André de Jager

The decline of soil fertility on smallholder farms is probably the main bio-physical cause of falling food production in Sub-Saharan Africa. One approach to halting this decline is Integrated Nutrient Management (INM). In Kenya, INM is being used to make the best use of local resources and to optimise the effects of external inputs. The project "*Integrated Nutrient Management to attain Sustainable Productivity increases in East Africa farming systems* (*INMASP*)" uses the Farmer Field School (FFS) approach in working with farmers to develop technologies that can contribute to ensuring reasonable levels of soil fertility and improve food security in the major farming systems in Kenya, Uganda and Ethiopia.

Agro-Ecosystem Analysis session in Mbeere District in Eastern Kenya. Photo: Davies Onduru

The INMASP approach is inter-disciplinary and involves socio-economic as well as agro-technical and environmental issues. INMASP projects seek to involve stakeholders at all institutional levels and its strength lies in stimulating an active and participatory approach to identifying farmers' needs and their experiences with soil fertility management. Farmer Field Schools (FFS) have become a key activity in working with farmers to develop and integrate INM technologies into small-scale and communal agriculture (see *LEISA Magazine* Vol 18 No 3).

Although there are over 1000 FFS in operation in Kenya, not many focus on INM or on the integration of livestock into mixed cropping systems in order to enrich nutrient cycles. Munyaka FFS is one of the schools created under the INMASP project. This FFS is situated in Mbeere, a district that lies in the dryland area of Eastern Kenya. It has been in operation for just one season and work is being done to integrate INM into local farming practices. The FFS is developing, testing and evaluating technologies based on the use of local organic resources (farmyard manure and *Tithonia* sp.) and mineral fertilisers (diammonium phosphate, DAP). The Munyaka FFS has 31 farmer members, 77% of whom are women.

Soils in the area are well drained and range from shallow to quite deep and include loamy sand and sandy clay loams, although some places are rocky and stony. Everywhere, however, there is evidence of depleted fertility with low levels of nitrogen, phosphorus, and organic matter due to erosion, limited use of inputs and poor management practices. Rainfall averages between 150-450 mm per year, with about two-thirds falling between October and November.

Smallholder farmers at the FFS site practise mixed farming. Their crops include maize, beans, cowpeas and sorghum and a number of other subsistence crops. There is some livestock - mostly indigenous breeds - including cattle, goats, and poultry.

Developing and testing interventions

During the FFS, activities to arrest soil degradation were developed through the following steps: literature review on soil fertility constraints in the FFS site; participatory identification of production resources, farming system constraints and priorities; experimental design workshop; regular FFS learning sessions on INM (special topics); Agro-Ecosystem Analysis (AESA) framework in the central learning plot; end-of-season participatory evaluation of experiments; and further data analysis for sharing with wider scientific community.

A survey was carried out to identify production resources. This included collecting details of farmers' socio-economic circumstances including the ownership of productive assets, farming practices, broader livelihood strategies, current opportunities, challenges of soil fertility management and farmers' indicators of soil fertility management. The findings of this diagnostic exercise were used to develop a FFS curriculum with farmers and to identify possible INM technologies for trials.

Soil fertility constraints were further diagnosed through soil sampling and analysis. During the FFS, the results of the analysis were presented to farmers in a clear, visual way and this stimulated a great deal of discussion. Farmers gained a better understanding of the current fertility status of their soil and in particular that levels of soil nitrogen, phosphorus and organic matter were low. Technologies jointly proposed by farmers and FFS facilitators as options for improving soil fertility included manure, mineral fertilisers, mulches, terracing, incorporation of crop residues into the soil, using leaves as fodder, agroforestry, slurry, *Tithonia* sp., composting, rock phosphate, green manuring and zero-tillage (conservation agriculture).

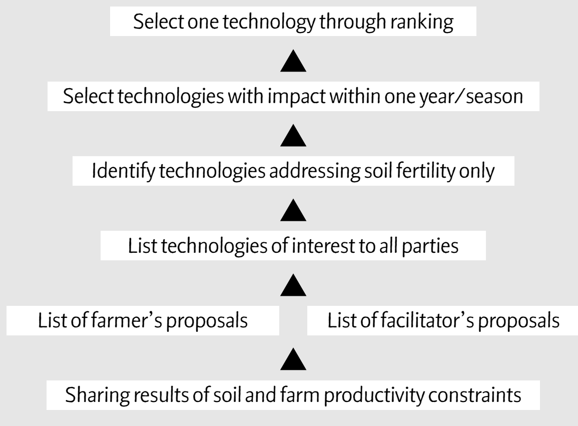

Figure 1: Process adopted for choosing technologies for experimentation

Results of surveys and assessments were discussed with farmers and used to select the technologies that would be tested in FFS central learning plot (Figure 1). The monitoring indicators to be used during the FFS were also selected. Table 1 shows the treatments that were selected through this participatory process.

Table 1: Treatments agreed upon in a PTD process in Eastern Kenya (Munyaka FFS)

Treatment	Description
T1	Farmyard manure (FYM), one handful per planting hole (16t/ha)
T2	DAP, one teaspoon per planting hole (216 kg/ha)
T3	$T_1 + T_2$
T4	$T_1 + T_2$ + Tithonia; Tithonia applied at 3.6 t/ha fresh weight

Results on the central learning plot

The FFS experience in Munyaka showed that INM-FFS not only improved farmers' analytical skills but also provided qualitative and quantitative data that could be used to evaluating the performance and impacts of INM technologies. Besides the farmers' analysis that takes place during each FFS meeting, further agro-economic analyses were done and shared with farmers in later FFS sessions.

At the end of the season, farmers' evaluation of the treatments in the central learning plot showed differences with regard to pest incidences, maize leaf colour, plant health, soil moisture retention, weed incidences and grain yields.

Treatments with combined organic and inorganic nutrient sources gave higher yields than single applications of organic or inorganic nutrient sources. The grain yields also increased with increased nitrogen and phosphorus applications. This suggests that low levels of nitrogen and phosphorus hinder maize production in Munyaka.

An analysis of the results achieved in the farmers' fields showed positive returns to labour for all studied technologies. These returns were higher than the opportunity costs (i.e. what could have been earned elsewhere). The combined application of Farmyard Manure and DAP, and Farmyard Manure, DAP and *Tithonia* sp. proved to be the most profitable practices. Although *Tithonia* grows wild in the area many farmers had not been aware of its potential in soil fertility management.

Farmers rated the combined application of farmyard manure, DAP and *Tithonia* as the best combination. They recognised that widespread adoption of this method would be limited by lack of money to buy DAP. However, a number of farmers have started collecting *Tithonia* cuttings (*Tithonia diversifolia*) from the roadside and nearby bushes to plant them within their farm boundaries.

Farmers also identified and monitored the presence of pests and beneficial insects. They found that treatments that included farmyard manure attracted a relatively high diversity of pests but also beneficial insects.

Impacts of tested INM technologies

Analysis of soil nutrients (the soil nutrient budget) showed that the amount of nitrogen removed from the soil under normal cropping practices was greater than the amount returned to the soil. In other words there was a negative balance in the soil nutrient budget. The combined application of farmyard manure, DAP and *Tithonia* resulted in a less serious loss of nitrogen than the current practice of using a single application of farmyard manure or DAP. This showed a clear benefit in using organic and inorganic inputs in combination. The synergy created had a positive effect on the nutrient depleted soils in the study site.

Communication and information

The INM-FFS have shown that they can provide a forum for strengthening linkages between farmers and other consortium partners with experience, skills and information on soil fertility management. The experience of joint learning and the effective exchange of information in the Munyaka FFS created a sense of ownership amongst farmers which is an important factor in encouraging them to put their newly acquired INM skills into practice.

Joint problem diagnosis during the FFS platforms brought Government and non-governmental organisations together to define priority problems and opportunities for research and extension. It has also provided a strong foundation for on-going cooperation and information flows and exchange. The FFS platforms have also contributed to bridging the gap between agricultural extensionists, researchers and farmers, providing a forum through which these stakeholders come into regular close contact with farmers.

Although FFS on INM is appreciated by both sexes, women in particular seem to value the approach, due to the practical, field based, learning focus as well as the social value of FFS groups.

Conclusion

No single institution can meet all the challenges involved in improving soil fertility management, which can only be overcome by building partnerships between farmers, extension agents, private sector, researchers and policy makers and, more importantly, by enhancing information exchange. Experiences from FFS in the Mbeere district has shown that INM-FFS can be used to stimulate information exchange, design and test INM technologies and increase the pace of technology adoption. The documentation and analysis of quantitative and qualitative data generated during FFS process has created room for wider sharing of FFS outputs both at the farm level, and amongst the scientific and policy communities. Furthermore, the study has shown that there is need to adapt the methodology to maximise the use of local resources (for example, *Tithonia*) and optimise application of external inputs, where available. The challenge is to bring indigenous and scientific knowledge together under one umbrella, which is usually easier said than done.

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Scenes from the Guangdong area before (left) and after (right) ecological restoration. Photo: Jianwu Wang

Agroecological restoration in Guangdong

Peter Riggs

In 1980, Guangdong Province became one of China's new Special Economic Zones, encouraging foreign investment in manufacturing and light industry. Today, the province's capital is a major banking and financial centre but agriculture continues to contribute heavily to Guangdong's GDP.

The developments of the last 20 years have, however, had a serious impact on the environmental health of the countryside and as a result on the welfare of many farming communities. Several food safety scares over the past few years have also underscored the importance of developing 'new thinking' for this vital sector.

In response, provincial leaders in partnership with Guangdong's agricultural university and its network of extension agents and consumer health specialists, have risen to the challenge.

Guangdong is now dramatically re-orienting its food production and agricultural research systems, putting long-term environmental sustainability, farmers' welfare, and the promotion of chemical-free and/or organic agriculture at the centre of provincial rural development efforts. Guangdong is skilfully positioning itself to take advantage of rising Chinese consumer awareness of food safety and quality concerns. At the same time it is also securing the position of the province's agricultural export sector under the new international rules that China must now follow as a result of its accession to the World Trade Organisation.

Guangdong has never been a "rice bowl" in the sense of committing vast acreage to growing staple grains. Rather, Guangdong has long enjoyed comparative advantage in the production of sub-tropical fruits, sugar cane, as well as farmed fish and horticulture products. The flat and well-watered Pearl River Delta region in southern Guangdong was famous for the "dike-pond" agriculture system, in which farmers devote the major share of their acreage to ponds for raising fish, particularly carp, and recycle pond wastes onto the bunds and dikes fringing the ponds to grow citrus fruits, sugar cane, pineapples, and mulberry trees for feeding silkworms. But 80% of Guangdong's land is hilly, and in this sub-tropical climate zone the soils are generally poor and easily eroded. The "Great Leap Forward," the Cultural Revolution and insecurity over land tenure in the late 1970s and early 1980s, all accelerated deforestation in Guangdong Province leading to alarming levels of soil erosion. Indeed, control of soil erosion has been a major concern of the Guangdong government for the last twenty years.

Today, Guangdong is one of China's wealthiest provinces and has the resources to deal with the alarming legacy of environmental damage caused by the policy instability of earlier periods. Increased wealth has also meant that the priorities of local consumers have shifted and they are increasingly concerned about food quality and safety.

The major agricultural policy challenge facing the province in the early 1990s can be summarised as follows: How can Guangdong meet the food production and food quality demands of international markets and a growing number of concerned Chinese consumers, whilst at the same time halting the degradation of the rural land base and reducing reliance on dangerous pesticides and chemical fertilisers?

Research and development

Two institutions have played a key role in Guangdong's agricultural transformation: the province's agricultural university, South China Agricultural University (SCAU) and the Provincial Committee For Science And Technology. Together, they have organised agricultural research and development as well as complementary research on large-scale land restoration.

By the 1980s, soil erosion had reached such alarming levels that in many cases the province opted for, or had no choice but to implement, "engineering" solutions that sought only to stabilise hillsides and watercourses. Bracken fern and pine trees were adopted as "green cover", useful for quickly reducing erosion rates, but not useful as economic crops for farmers. Gradually, the provincial institutes for geography and botany, and the university extension services, sought to integrate farming communities into land rehabilitation efforts. In the 1990s, Beijing authorised local governments in China to auction off degraded hilly lands to the highest bidders. In Guangdong, the bidders included individual farm families, local production co-operatives, or private companies. These "wasteland auctions," as they were called, again focused attention on the productivity-enhancing technologies that could be used to bring these lands into production while keeping soil erosion to a minimum. The wasteland auctions were also an innovation with respect to the rights of landholders. Now, families and enterprises could count on long-term tenure security, which made the construction of terraces both possible and profitable. Consequently, in the last ten years we have seen an immense input of labour and capital into terracing, primarily for the production of fruit trees. First amongst these fruit trees is the lychee, which has brought much prosperity to rural Guangdong.

Orchards

Guangdong accounts for a high proportion of the *global* production of lychee, a much-coveted fruit in China and amongst overseas Chinese. At a number of research stations in lychee-growing areas of hilly Guangdong, SCAU has been involved in developing organic and "high-quality" production lines. Pest management has been a particular concern and research has focused on biological control, promotion of organic fertilisers through on-farm composting, and the inter-cropping in fruit orchards of species that provide a habitat for those "natural enemy" species that keep pest numbers in check. The diversity of production settings resulting from the "wasteland auctions" has been a complicating factor in the design of appropriate extension services; yet at the same time, has helped ensure a wide range of experimental settings.

As more of Guangdong's farmers and agribusinesses become interested in integrated pest management to reduce production costs and to enhance product quality, farmers and farm managers are paying greater attention to the environment in which "natural enemies" of pests can thrive. In the past the practice of clearing all the brush and grass from orchards was widespread, even though farmers had no other explanation than that the bare soil "looked better" than an unruly ground cover. Now, farmers increasingly realise that this under-story provides a good environment for insects what can dramatically decrease the need for spraying pesticides. The new frontier for research now is whether it is possible, and whether it makes economic sense, to pursue inter-cropping of annuals (like peanuts or maize) or Chinese medicinal plants to add another source of income from orchard lands. Already, one can see areas in which trees are planted farther apart to enable this kind of agroforestry approach.

Cutting the legume Stylosanthes guianensis for decomposition on the farm. Photo: Jianwu Wang

The drive to increase soil organic content has led to two further technical improvements. The first is an increased integration of animal production into these farming systems. The excellent price that farmers obtain for lychees has allowed many of them to set up piggeries, or chicken houses, with pig and chicken wastes recycled back to the orchards. Some parts of Guangdong also have a very high adoption of household-level biogas systems, with pig wastes making the major contribution to these systems. Farmers have also found that having "free range" chickens in the orchards has helped reduce pest problems and increase nutrient cycling.

Some municipalities in Guangdong have also experimented, with some success, in recycling municipal wastes back to farms. In the worst cases, municipalities see this as a "low-cost option" for dumping garbage in areas where farmers are desperate for *any* contribution to soil organic matter. Now several large-scale municipal composting facilities are being set up. Odour control, product quality, investment, and urban-rural linkage schemes remain major challenges for these ventures. The question of how to transform urban China's growing solid waste problem, through better waste separation and composting, into a stream of benefits for farm communities is a new frontier for research and development activities.

Sustainable agriculture

Guangdong has developed the technical capacity to reorient its rural sector toward "sustainable agriculture." With South China Agricultural University as the focal point, Guangdong hopes to build the service infrastructure for organic production. There is political will at the provincial, county, and township levels to implement changes in orientation, but in most cases there is still a generally weak understanding of what is required to meet international organic production standards. In addition, there are still a number of issues that urgently need to be addressed.
One of these is water pollution. The continued over-reliance on chemical fertilisers and the increase in concentrated animal feeding operations are wreaking havoc with surface water quality. There is an urgent need to develop organic fertilisers, improve municipal solid waste management (including through composting of the organic fraction of urban wastes) and prioritise the safe handling of livestock wastes. Much of SCAU's research also focuses on the development of botanical pesticides and on the chemical interactions between insect predators and preys.

Another critical issue is the re-tooling of extension services. The move from a centrally-planned economy to a market economy has completely changed the conditions under which the agricultural extension services have to operate. In Guangdong, many extension services have been privatised. A variety of public-private partnerships might be explored, but it is crucial that the worst abuses of the "contract farming" approach found elsewhere in Asia be avoided.

Conclusion

While the immediate driving force behind Guangdong's rural-sector reorientation is a concern for the competitiveness of its agricultural products in markets increasingly concerned with food quality and safety, the goals of the reorientation are much broader than this. They include restoring a degraded land base; maintaining rural communities and reconnecting them with local cultural traditions; and combating severe surface- and ground-water quality problems. To achieve these goals, scientists and planners in Guangdong have become practitioners of *agroecological restoration*, the attempt to "reconnect food systems with ecosystems." Of course, one can see such efforts in other parts of China; but it is in this wealthy southern province where the farm-to-table market opportunities, the "knowledge infrastructure," and the political willingness to innovate have come together most dramatically. Guangdong's changing countryside may hold important answers not just for the future of agriculture in China, but also for rural livelihoods generally, in response to the challenges posed by globalisation.

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Indigenous fodder trees for rehabilitation

Blesilda M. Calub

In the hilly communities of Western Batangas, South Western Luzon in the Philippines, farm households depend largely on the sale of livestock as a source of income, and are farmers therefore highly concerned about the available fodder supply. In this area, the main farming system can be characterised as slash-and-burn or swidden agriculture. Patches of land (0.5-1.0 ha) are cleared from tropical rainforests and then planted with food crops such as corn, rice and beans. After growing crops for two to three years, the area is left fallow for four to ten years. These fallow lands are used as grazing areas and consequently do not get the chance to recover. Instead, grazing animals cause land degradation through overgrazing and trampling the land. Manure and urine return only a limited amount of nutrients to the soil. Furthermore, the fallow lands usually only provide poor quality forage. The livestock carrying capacity of these grasslands is low because of the predominance of poor quality pasture grasses such as *Imperata cylindrica*, *Themeda triandra* and *Chrysopogon aciculatus*.

Cattle and goat raisers have traditionally relied on indigenous fodder trees and shrubs as animal feed. They shifted to *Leucaena leucocephala* (ipil-ipil) when this multipurpose tree was heavily promoted in the 1970s. However, after a psyllid (an insect) attack destroyed *Leucaena* stands in 1985, farmers showed a renewed interest in the use of indigenous fodder trees and shrubs, although the remaining *Leucaena* stands continue to be utilised.

Farmers carrying fodder over long distances. Photo: Blesilda Calub

Farmers appreciate fodder trees and shrubs as they play an important role in bridging the gap in fodder supply during the critical dry months. Being perennials, trees are more able to withstand prolonged periods of moisture stress than grasses. In addition, fodder from trees and shrubs have a high nutrient value that supplements the, often poor, quality of crop residues, the normal feed during these dry months. However, harvesting of fodder trees and shrubs has often been so heavy that the trees cannot regenerate as it prevents trees from producing the seeds required for natural regeneration. Despite these problems, farmers were not inclined to plant fodder trees. They believed that, being indigenous, these trees would grow by themselves. At the same time farmers also pointed out that fodder trees and shrubs that used to grow around their homes have now receded farther into the mountain forests. They now need to travel further and spend more time gathering tree fodder.

Domestication of fodder trees and shrubs

From 1997 to 2002, a project on the domestication of indigenous fodder trees and shrubs was undertaken to address these problems. The project had an action research/participatory technology development approach. On-farm trials were conducted with farmers to help refine technologies that would fit into existing farming circumstances. Farmers participate in the programme because they liked to experiment and try out new technologies. They were also attracted to the idea of having an assured supply of fodder.

A Participatory Rural Appraisal (PRA) was conducted to understand the existing silvipastoral systems, identify the different fodder trees and shrubs and rank them according to characteristics identified by farmers and project staff. We then continued to study the “highly preferred” species, looking into propagation and nursery techniques, herbage production, cutting management and persistence studies as well as feeding value and nutrient composition.

Farmers’ preferences for tree species

The species included in the research were identified in collaboration with farmers. Farmers’ preferences for certain fodder species were based on feeding values (palatability and ability to fatten), tree growth characteristics (fast regrowth, ease of propagation and establishment) and tree management issues. For farmers it is important that the trees are tolerant of frequent cutting and the cut herbage is easy to handle.

Farmers like to plant various different species as they say that animals do not like to eat the same fodder all the time, but prefer to consume mixtures of several species. Other farmers pointed out that they prefer fodder species that serve other purposes as well. For example, they prefer to plant fodder trees that can also serve as fence or border markers or can hold soil in very steep portions of their fields.

Many farmers still want to plant *Leucaena* despite the psyllid infestation. According to them, *Leucaena* is fast growing, it can fatten animals quickly and the animals like it a lot. However, some farmers only plant *Leucaena* because they believe that it is not necessary to plant indigenous species.

Preferred planting sites

Farmers have started planting fodder trees and shrubs along farm boundaries and in backyards. Many farmers are limited to these planting sites as their farmland areas are small or because they do not own their land. But they also prefer fodder species to be near their homes to save time gathering fodder. Women in particular indicated that they prefer planting near the house so they do not have to go far for fodder or leave their homes for a long time. In addition, planting near home reduces the risk of fodder being surreptitiously collected from their trees by others. Planting along boundaries is also done to mark the borders and to ward off stray animals.

Farmers with relatively larger holdings (2-4 hectares) can plant fodder trees as hedgerows integrated with crops. Those with larger fields in steeply sloping areas have established several hedgerows of *Leucaena* or *Gliricidia*. They were pleased to see that soil gets trapped on the upper slope of the hedgerows. These farmers may also plant trees in blocks as fodder banks in areas where crop farming is difficult. This is often on steep slopes or near waterways. However, farmers will prioritise planting food crops wherever possible. In general, they only consider planting fodder trees, or some fruit trees, where the land is not suitable for food crops.

Fodder production

Some trees, such as *Leucaena, Gliricidia, Muntingia calabura, Erythrina orientali* can start producing fodder as soon as six months after planting. Other species like *Trema*, need at least nine months, or in the case of *Macaranga* and *Pipturus* 10-12 months, before they can be cut for fodder. *Streblus asper* and *Albizia saman* are very slow growing in the first three years, which makes them difficult to recommend to farmers, although they have a high nutrient content and are relished by animals. Instead of planting, farmers were advised to allow the natural stands of this species more time to regrow, so they would not die.

Depending on the tree species and soil conditions, average edible herbage yields from 90-120 day old regrowing trees is 1.5 kg dry matter per tree. At this rate, 400 trees will yield 600 kg fodder. If a 300 kg cow consumes 7.5 kg dry matter per day, it will be assured of good quality feed for 80 days. In practice, however, farmers try to extend the availability of green fodder throughout the dry season. Usually, they will give their cattle tree fodder once a day (about half of what is required) and for the rest of the day, the animal feeds on crop residues or grazes the remaining grasses in the fields. If the farmer has some spare cash, he may mix some rice bran and salt to the water. In most cases however, his animals will be mainly dependent on tree fodder to survive this critical period.

The frequency of cutting fodder or harvesting from these trees depends not only on the species but also on the season. *Leucaena* and G*liricidia* can be cut every 60 days during the rainy season but every 90 days during the dry season. *Trema orientalis, Muntingia calabura* and *Macaranga tanarius* can be cut every 90 days during the rainy season and every 120 days during the dry season. *Streblus asper* can only be cut every 4-6 months.

Farmers' management of planted trees

Trees planted on or near crop fields need to be cut regularly to keep them from shading the crops. This may cause a problem, as the trees need cutting at the beginning of the cropping season when labour is in short supply. In this area, however, overharvesting is the more pressing problem. Trees tend to be cut too frequently, when there is little regrowth and this can threaten their survival.

About 30-40 farmers in various villages continue to plant indigenous fodder trees and shrubs using seeds (for *Leucaena, Trema orientalis* and *Macaranga tanarius*), stem cuttings (for *Gliricidia* and *Pipturus arborescens*) and wildlings (for *Muntingia calabura* and also *Trema orientalis*). Some also plant *Flemingia rostrata* and *Desmodium rensonii.*

Challenges

Promoting tree planting for the purpose of rehabilitating degraded lands is not, in general, appealing to farmers. But they can be easily motivated to plant certain species such as fodder trees and shrubs that directly address their needs. Promoting fodder tree planting in degraded grazing lands is like hitting two birds with one stone. On the one hand, it helps meet livestock raisers' needs for fodder, and on the other hand, trees help alleviate degradation.

Successful adoption by farmers, however, does not happen overnight. It involves working hand in hand with farmers in analysing the root causes of their problems, identifying possible solutions, and testing these together. In addition to involving the farmers in research activities, it is useful to conduct complementary activities such as training seminars. These should not only focus on the technical aspects of growing and managing the trees but also on enhancing farmers' appreciation of sustainable resource management. On-going monitoring and evaluation with the active participation of farmers is also important.

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Table 1: Farmers' preferences of indigenous fodder trees

Botanical name	Farmers' criteria			Overall rank
	Feeding value	Tree characteristics	Tree management	
Macaranga tanarius	9	9	8	1st
Streblus asper	9	9	8	1st
Trema orientalis	9	8	6	2nd
Cordia dichotoma	8	7	7	3rd
Ficus angustissima	7	8	7	3rd
Ficus balete	7	8	7	3rd
Ficus hauili	7	8	7	3rd
Ficus spp.	7	8	7	3rd
Muntingia calabura	9	6	7	3rd
Albizzia lebbekoides	8	5	8	4th
Albizzia procera	4	8	8	5th
Pipturus arborescens	7	7	6	5th
Pterospermum obliquum	7	7	6	5th
Vitex parviflora	5	7	8	5th
Grewia multiflora	7	5	7	6th
Anaxagorea luzonensis	6	6	6	7th
Antidesma bunius	7	6	5	7th
Antidesma cordato-stipulaceum	7	6	5	7th
Bridelia stipularis	6	6	6	7th
Gardenia longiflora	6	6	6	7th
Arytera litoralis	5	6	6	8th
Garuga littoralis	6	6	5	8th
Kleinhovia hospita	6	6	5	8th
Pterocymbium tinctorium	6	6	5	8th
Grewia rizalensis	6	5	5	9th
Leea manillensis	6	5	5	9th
Pterospermum diversifolium	5	5	6	9th
Zizyphus trinervia	4	6	4	10th
Capparis micracantha	4	5	4	11th

Farmers' criteria range from 3 (lowest possible score) to 9 (highest possible score)
Overall rank ranges from most preferred (1st) to least preferred (11th)

Using weed to fight weed

Paul B. Okon and Uche C. Amalu

The most devastating weeds are usually found on farmlands degraded of fertility and they can make or break a farm and lead to a total loss of yield. Two types of grasses have wreaked havoc on farms in Nigeria: Spear grass (*Imperata cylindrica* (L) Beauv.) and Running Carpet grass *(Axonopus compresus)*. The former is most common on degraded farms in the savannah areas, while the latter is mainly found in Nigeria's rainforest zone. Currently, these grasses infest thousands of hectares, and their elimination is required in order to rehabilitate the agricultural productivity of these areas.

Weeds as allies

Local farmers in southern Nigeria know that a number of broad-leaf (dicotyledon) weeds are capable of suppressing and, in time, replacing other weeds. They have found that a plant, known locally as "*Awolowo*" or "independence weed", is able to eliminate Carpet grass on degraded farms. However, Awolowo (*Chromolaena odorata*) can also become quite a menace itself (see Box 2). The capacity to suppress grassy weeds is not unique to Awolowo. It is known that a number of cover crops like *Centrosema pubescens* and *Mucuna pruriens* are also able to do this. As broad-leaf plants they compete vigorously with the grassy weeds for light, shading these grasses with their dense canopy and eventually containing their growth.

Box 1: The burden of weeds

Weed control may be one of the most labour intensive practices in crop production. In traditional Nigerian agriculture weeding is usually done by hand. In the tropical rainforest zone, three rounds of weeding are required before the crop is sufficiently well established to smother their growth. It has been estimated that in small-scale production systems weeding consumes between 30 to 54% of the total amount of labour, depending on the crop and the level of other available resources. It takes about 280 hours of labour to weed one hectare twice. Weeds are among the most serious pests farmers have to contend with, and fields are often abandoned when weed pressure become unmanageable.

- Source: Chikoye, D. 2000. **Weed Management in small-scale production systems in Nigeria.** In: Agronomy in Nigeria by M.O. Akoroda, Dept. of Agronomy, Univ. of Ibadan, Ibadan, Nigeria. pp. 153-156.

In order to get rid of Running Carpet grass farmers collect Awolowo seeds available in the vicinity of their farms and spread them in their fields at the beginning of the rainy season. After it has become established it is occasionally cut back (a process known as *slashing*) to encourage vigorous and timely re-growth. The slashed material itself is used as a mulch to further suppress the grass. The operation is considered successful if it suppresses the grass from maturing to the seed bearing stage. Awolowo is cut back up to three times, usually during the rainy season. This practice means that farmers have to leave their land fallow for a year or more, but they consider it a small price to pay as it is preferable to shifting cultivation sites every three or four years, just to get some relief from Carpet grass. Other options such as expensive herbicide are beyond the farmer's means.

We think that Spear grass can be dealt with in a similar way. This weed is already being suppressed using cover crops in Benin, where over 14,000 farmers are using *Mucuna* species to increase maize production and suppress Spear grass. However, using Awolowo or other cover crops to get rid of Spear grass is a more difficult business. This is because Spear grass does not reproduce through seeds but through stolons or shoots at, or just below, ground level, which take root and develop into new plants. These stolons must be dried out before Awolowo or cover crops are introduced. Fields infested with Spear grass need to be ploughed twice a year in the middle of the dry season, before the seeds of broad leaf plants like Awolowo, *Centrosema*, and *Mucuna* are spread at the beginning of rains. The exposed stolons dry out and the Spear grass plant cannot effectively reproduce. Ploughing also has to be repeated the following year to ensure that no stolons survive.

Box 2: Awolowo, a "bad weed" revisited

Awolowo, also called "Siam weed" or "Independence weed", is a shrub native to South and Central America and can grow to more than three metres in height. In recent decades it has become a serious pest in the humid tropics of South East Asia, Africa and the Pacific Islands. However, some researchers and farmers have found it a useful ground cover under certain conditions. Farmers in South Cameroon have adopted Chromolaena odorata fallows in groundnut based cropping systems because of its accretion of organic carbon and plant nutrients. Its use as a natural weed suppressor is now under investigation.

However, the plant should only be used in areas where it is already common. It should not be introduced into new areas!

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Fighting to replace Spear grass (2) with Centrosema (1) and Awolowo (3) in Cross River State, South Eastern Nigeria. Photo: Paul B. Okon

Kick-starting legumes

Ken Giller

Leguminous plants must rate among the most bountiful and perfect gifts of nature. Legumes provide a large number of products, and at the same time they enhance soil fertility. The products range from beans and pulses that are the principal source of protein for the majority of the world's poor, to vegetable oil, animal fodder, poles and fuel wood. Legumes are also capable of improving soil fertility through their ability to fix nitrogen from the air making use of rhizobia bacteria in their root nodules.

Legumes add nitrogen to the soil mainly through falling leaf litter, and to a lesser extent by decaying roots and root nodules below-ground, and thus they have great potential for restoring degraded soils. The organic matter produced by legumes is generally rich in nitrogen and of good quality, meaning that it decomposes quickly and is a good source of nitrogen for other plants. The legumes best for enhancing soil fertility are those specifically grown for that purpose, namely the herbaceous green manure legumes and fast-growing legume trees. Herbaceous green manure legumes are often referred to as cover crops, as they provide a dense soil cover that can prevent soil erosion and suppresses weeds. In the case of food and fodder legumes, much of the nitrogen fixed is removed from the land with the produce.

Getting legumes going

Although legumes have a high potential to rehabilitate degraded soils, they also need good conditions to grow. Degraded soils are, by definition, inhospitable environments for plants, including legumes. Therefore, some soil improvements may be needed before the benefits from nitrogen fixation can be realised. Maximal rates of nitrogen fixation are mainly achieved under very good conditions: with irrigation under cloudless skies, and with abundant supply of other nutrients than nitrogen.

Phosphorus

When trying to establish legumes, the most common problem is shortage of phosphorus. In highly acid soils liming or adding animal manure can raise the pH and increase the availability of phosphorus. In most soils, however, the only option is adding phosphorus. Adding plant residues or animal manures will help provide some phosphorus, but mineral fertilisers are by far the most effective means. When sowing grain legumes or green manures, adding small amounts of phosphorus (20 to 30 kg per hectare) will usually be enough.

All over the uplands of South-East Asia, the invasion of *Imperata cylindrica* is a huge land degradation problem. These grasslands, covering millions of hectares of land, are man-made savannas as Imperata mono-cultures do not occur naturally. Imperata poses major difficulties for restoring the land for productive agriculture, as it is very difficult to get rid off. One option to deal with this problem is planting velvet beans. Velvet bean (*Mucuna* spp.) is a universal green manure in the tropics which can adapt easily to many different conditions. After slashing back the grass, velvet beans should be sown with abundant phosphorus so that a cover will develop rapidly and suppress aggressive weeds. One highly successful approach is to add one ton of rock phosphate per hectare, but this is only possible with external investment. Reclamation of these grasslands can also be achieved by sowing other crops such as groundnuts, but these require considerably more labour. A similar approach has been used in Western Kenya, where either phosphate fertiliser or rock phosphate have been used to establish 'improved' fallows of fast-growing trees and shrubs such as *Sesbania, Tephrosia* and *Crotalaria* species.

Despite the many claims as to the usefulness of phosphate rocks, one should be aware that the vast majority of rock phosphates cannot be applied directly to the soil. The way rock phosphates can be used will depend partly on their chemical composition. As most rock phosphate sources have been researched extensively, information should be available about the usefulness of different rock sources.

Other nutrients

Other nutrient shortages may also limit the establishment and growth of legumes. Depleted soils commonly lack potassium and sulphur. Shortages of calcium and magnesium are often associated with soil acidity, which is a widespread problem in the tropics. The toxicity of aluminium can be overcome with small amounts of lime. For example in the Mekong delta, drainage of land previously flooded with brackish water led to the formation of 'acid-sulphate' soils, where extreme acidity prevented growing legumes such as soyabean (*Glycine max*). A very elegant and simple method of dealing with this problem is using mulches of rice straw and small amounts of ash to create a favourable environment in the planting holes. This allows rhizobia bacteria inoculated with the seed to form nodules and fix nitrogen from the air. The results were spectacular, with yields increasing ten-fold from 0.3 to 3 ton per hectare.

Disappointed farmers and researchers discussing the failure to establish sunn hemp (Crotalaria juncea). Photo: Ken Giller

Tailoring and targeting technologies

The extensive literature on the rehabilitation of degraded soils by using legumes, suggests the existence of 'off-the-shelf' methods with universal acceptability. However, such research has often been done under favourable conditions and with the assumption that 'We have shown that it works so now farmers will use it!' Despite more than a century of research on green manures in the tropics, examples of smallholder farmers using such methods to regenerate their soils are remarkably rare. Extensive reviews of past experiences indicate that rapid uptake by farmers occurs only when green manures have other advantages, beyond simply improving soil fertility. Cover crops and green manures appear to spread rapidly among farmers only when they bring additional benefits such as the suppression of aggressive weeds. This

Researchers standing in a field with Mucuna. In the background a 2 m high stand of sunn hemp. Photo: Ken Giller

suggests that simply improving soil fertility does not justify the investment of labour and land in green manures. Farmers appear to be more interested in legumes that provide food or fodder as well as improve soil fertility, such as cowpea (*Vigna unguiculata*) and soyabean. These 'multi-purpose legumes' have the advantage of providing some immediate benefit in the form of products with direct economic value while also helping to improve soil fertility for subsequent crops.

In many smallholder farming systems, soil fertility may vary considerably within individual farms even on the same soil types. This generally results from concentrating available animal manure, compost and other organic inputs to fields close to the homestead. Few, if any, inputs are added to soils that are further away. Farmers understand and manage this variability: they have insufficient manure to effectively fertilise all of their land and choose to concentrate resources where they can be reasonably sure of good crop yields. A major challenge remains to experiment together with farmers to explore ways that they can release some of the manure to use as a means of kick-starting the growth of nitrogen fixing legumes in their degraded outfields, and so to bring this land back into productive agriculture. ■

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Bioremediation: decontaminating polluted soils

Peter Doelman

Healthy, fertile soil supports plant growth and crop production. One look at the quality of surface vegetation is usually enough to get a rough impression of soil health. Plants establish their roots in the top layer of the soil. Closer study of this layer shows that every gram of earth contains over one billion organisms of over 10,000 different species. These little creatures are known as microorganisms. They are soil-friendly, beneficial microbes that eat organic material and excrete minerals such as nitrates and phosphates in a continuous re-cycling process that has a direct effect on plant quality and productivity.

Microbes are responsible for 90% of biological recycling. Amongst the things they need to do their work are oxygen, water and the right soil temperature. All natural organic compounds in the soil can be recycled providing the soil has sufficient microbe-carrying capacity to encourage biodegradation.

Creating healthy soil with an active soil life ensures that geo-physical processes continue undisturbed and also that it is capable to deal with human interventions that could lead to long-term degradation. One aspect of degradation that is receiving increasing attention is the way in which soil contamination can be reversed by supporting the activity of soil organisms.

There are thousands of elements that can contaminate soil. However, only organic contaminants can be broken down by microorganisms. For this process to be effective, however, the soil must have some degree of natural fertility. If this is not the case contaminated land must be "farmed" back to health so that the microorganisms can begin their work of biodegradation.

A closer look into the soil shows the presence of millions of beneficial friendly microbes. Illustration: Loek de Moll, 2003

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Adoption of green manure and cover crops

Roland Bunch

Worldwide, green manure and cover crops (gm/cc's) have proven to be a successful technology for maintaining soil fertility and controlling weeds. The numerous advantages of gm/cc's have led to their widespread adoption in many parts of the world. In other areas, however, farmers have been reluctant to adopt these crops. Moreover, farmers are also known to have abandoned traditional systems. The question is why the introduction of gm/cc's has been a success in one area, while similar programmes have failed in others? Under what conditions can we expect small-scale farmers to be interested in growing cover crops?

Farmers clearing a field with Mucuna in Veracruz, Mexico in preparation for planting maize. Photo: IDRC

After 20 years of experience with gm/cc systems around the world, I would like to discuss the main conditions for adopting green manure and cover crop systems. The following conclusions are based on experiences with 140 different systems, involving 41 species. Sixty percent of these systems have basically been developed by farmers themselves, which shows how appropriate these systems are for farmers and how interested farmers are in them. This article summarises some of the lessons learned from my experiences with programmes and organisations that have been successful in introducing sustainable gm/cc systems.

Opportunity costs

Green manures or cover crops should be grown on land that offers farmers few other opportunities such as income, food, fodder, etc. Generally, farmers are not interested in planting something that only fertilises the soil when the same land could be used for either subsistence or cash crops.

This may seem to impose many restrictions for growing gm/cc's, but in fact we are finding more and more places and times when they can be used:

- If the gm/cc does produce a valued food, it can be grown in any way that fits into the system like any other crop.
- The gm/cc can be grown intercropped with another food for example jackbean with maize or cassava, or perennial peanut with coffee. This is presently the most popular niche for introduced gm/cc systems.
- The gm/cc can be grown on wasteland or on fields under fallow. Suitable species for these areas are gm/cc's that can survive on very poor soils, such as jackbeans, tephrosia, or particularly hardy trees. Farmers in Vietnam, for example, seed *Tephrosia candida* into their first year fallow, thereby reducing the normal five-year fallow to just one or two years.
- The gm/cc can be grown during the dry season, planted after the normal crops like the ricebean/rice system in Vietnam, or intercropped with the normal crop and then allowed to grow through the dry season such as the sweet clover/maize system in Mexico. It can also be planted as a relay crop amongst rainy season crops at the end of the wet season to take advantage of the moisture still in the soil, such as the cowpea/maize and lablab/maize systems in Thailand.
- The gm/cc can be grown under fruit trees, forest trees or almost any perennial crops. In this case, particularly shade-tolerant species, like jackbeans or *Centrosema pubescens* are chosen.
- Other small, occasional niches can be found, such as during periods of frost (lupines, such as tarwi, often do well), in extremely acid soils (velvet bean or buckwheat), or during very short periods of time (*Sesbania rostrata*).

Jackbean (*Canavalia ensiformis*) is probably the second most widely used introduced green manure and cover crop. It is resistant to drought, poor soils, insects and diseases and is capable of surviving and growing well in the worst conditions. The jackbean can be used during the dry season and in very marginal environments where crops will not grow. It has an ability to fix large amounts of nutrients and is also capable of helping wastelands to regenerate.

Cash costs

Growing green manure and cover crops should involve minimal, or no cash costs. This implies that farmers should be able to produce their own seed year after year, and that these crops should be resilient to disease or insect problems. Preferably gm/cc's should save farmers money. They can reduce the amount of money farmers spend on chemical fertilisers. In addition, they can lead to a reduction in or even a total elimination of herbicides. Some species can also be substituted for certain chemicals: the velvet bean is a wide-spectrum nematicide, and sunnhemp (*Crotalaria ochroleuca*) can be used to control grain storage pests.

Labour demand

The gm/cc selected should not lead to an increase in the amount of work farmers have to do. In fact, when intercropped, gm/cc's can save on labour because they can shade out weeds. This reduction in labour required for controlling weeds can in many cases counterbalance the labour needed for planting and cutting the cover crop. Furthermore, farmers can often be partially motivated to plant gm/cc's by the prospect of never having to plough or hoe their fields again: the technology offers the possibility of moving to a zero till system.

Other benefits

The gm/cc's chosen should provide at least one major benefit other than improving the soil. Farmers seldom choose gm/cc's because of their effects on the soil fertility. Usually, farmers are motivated by the potential of gm/cc's to support food production (which usually has a high priority) or to control weeds. The most commonly used gm/cc's, such as pigeon peas, common beans, soybeans and scarlet runner beans are grown for human food. Velvet beans (*Mucuna* spp.), usually not eaten by humans, are also popular cover crops, probably because of their ability to smother aggressive weeds and effectively control nematodes and several plant diseases.

Experiences with projects introducing gm/cc's show that systems that produce benefits other than soil improvement tend to last longer and continue after the "project" has come to an end. This can partly be explained by the fact that soil improvement is a long-term process, which is not immediately noticeable to farmers. The long time that it takes for positive results to emerge is an obstacle to the more widespread adoption of gm/cc's. Therefore, it is often preferable to promote gm/cc's for reasons other than soil fertility. Thus, whenever possible, we should choose gm/cc species that can be eaten, fed to animals or provide some other benefit which farmers need. For example, farmers grow scarlet runner bean (*Phaseolus coccineus),* intercropped mostly with maize, for the edible bean, even though they also realise its importance for conserving soil fertility.

Finally when considering the introduction of gm/cc's, the demand for the products of green manures and cover crop should also be considered. The demand may not be very great if people do not like to eat beans or sprouts, when farmers only have few animals to feed, or when they have already sufficient fodder for the animals.

Existing farming systems

Green manure and cover crops must fit into the existing farming systems. At least for the first few years these crops will be seen as much less important than food or cash crops. They will have to be adjusted to fit into the existing farming system, not the other way around.

Furthermore it is important to understand when, and to what extent farmers would prefer slow maturing tree species and when farmers would prefer fast maturing, less woody and shorter statured plants in their fields. Planting trees as improved fallow is only an option if farmers already have fields under fallow: otherwise it will be too expensive. Whether farmers would prefer a gm/cc system above a tree based system will depend on the relatively demand of the products of both systems. If farmers have rights or gain rights to land by planting trees, they will probably prefer tree-based improved fallow technologies above gm/cc's. Furthermore, many tropical crops do better with a light shade (say 20 to 30%) than with either a heavy shade or no shade at all. Thus, "dispersed tree" systems can very often be ideal for crop growth. And, of course, a dispersed tree system provides a better environment for gm/cc's than total sunlight.

In Brazil, gm/cc's are widely used by farmers with landholdings up to 100,000 hectares. On the other hand, gm/cc's are useful for resource-poor farmers as well, provided that they have sufficient land to allow the incorporation of gm/cc's without affecting the regular cropping system. If farmers have sufficient land to practise shifting cultivation with long fallow periods, farmers may not be interested in gm/cc's.

At farms with little land, the use of the land is often so intensive that there is virtually no time or place when the opportunity cost is very low. In these cases, farmers may be better off using compost or buying soil amendments.

Specific characteristics

Green manure and cover crop species should fit the available niche(s). In general, good gm/cc species should have the following characteristics: easy establishment; vigorous growth under local conditions; ability to cover weeds quickly; and the ability to either fix plenty of nitrogen or concentrate plenty of phosphorus. They should be resistant to insects, diseases,

The role of gm/cc's in rehabilitating degraded land

Green manure and cover crops can contribute to the rehabilitation of degraded lands and the restoration of wastelands in various ways. The most important impacts and effects of gm/cc's are listed below.

Increased organic matter and nutrient cycling. The organic matter from gm/cc's has, in turn, a whole series of positive effects on the soil, including making soil nutrients more accessible to crops. For example, in acid soils phosphorus may be four to five times more available to plants when surrounded by organic matter.
Nitrogen fixation. Organic matter often adds significant quantities of nitrogen to the farming systems. Many, if not most, of the widely used legumes are capable of fixing more than 75 kg/ha of N, while a few species fix a good deal more: the velvet bean can fix 140 kg/ha/crop, the jackbean up to 240 kg/ha, and Sesbania rostrata is capable of fixing 400 kg/ha.
Weed control. Intercropped with food or cash crops, green manure/cover crops are important for controlling weeds and consequently they reduce farmers' labour requirements and costs. Additionally, gm/cc's are also known to be able to control very aggressive weeds. In West Africa, for example, velvet beans (Mucuna spp.) are largely grown to control Imperata grass.
Soil conservation. The soil cover provided by the green manure/ cover crop protects the soil from erosion.
Improved soil moisture. The soil cover plus the increased infiltration and water holding capacity brought about by the organic matter, often increases the crops' resistance to drought.
Zero tillage. After a few years of heavy applications of organic matter from gm/cc's farmers can move to zero tillage systems that retain very high levels of productivity.
Control plant diseases and nematodes. Gm/cc's can reduce, and in many cases totally eliminate, the use of pesticides.

Green manure and cover crops can play an important role in the restoration of wastelands. Their use can result in such a significant increase in soil fertility that it is possible to speak not just of soil conservation, but of soil restoration and soil recuperation.

Extremely low or irregular rainfall, extremes in soil pH, severe drainage problems, or combinations of these problems, which are all too common on the farms of resource-poor farmers, will reduce the growth of gm/cc's, thereby reducing or destroying their impact. Through the years, we have learned how to overcome an increasing number of such problems, often using gm/cc's species that are particularly resistant to specific problems. However, such solutions are often achieved at the cost of reduced biomass production, reduced nitrogen fixation, and reduced additional benefits.

Nodules on the roots of Mucuna pruriens formed by Rhizobium soil bacteria. Photo: IDRC

grazing animals, bush fires, droughts, or any other problem they may have to face within the desired system. They should also have multiple uses, and should produce viable seeds in sufficient quantities for future plantings. If they are to be used for intercropping, they should tolerate shade and fit in with the cycle of the main crop(s).

Some species that have been introduced may establish themselves so successfully that they become pests. Great care should be taken not to introduce potential pests. Known candidates are common kudzu (*Pueraria lobata*), tropical kudzu (*Pueraria phaseoloides*), and even perennial peanut (*Arachis pintoi*) and perennial soybean.

The more ecological deterioration that has taken place, especially as far as soil quality and rainfall regularity are concerned, the more limited will be the selection of gm/cc species that grow well. Nevertheless, in a year or two, when these gm/cc's have improved the soil somewhat, farmers can often graduate to less hardy varieties that produce more subsidiary benefits.

Jicama (Pachyrhizus erosus) is a food crop that can also be used as a cover crop. Photo: CIDICCO

Conclusions

We have learned, while trying to apply these rules in many different situations around the world, that finding acceptable, widely adopted systems for (or preferably, with) farmers requires a great deal of flexibility and creativity. No textbook is able to tell us exactly what technology could or should be used in any particular case. We have to be open, listen to and learn from the local farmers, and then work together with them to find out which species and which systems will best fit their particular situation.

Generally, the most successful way of doing this is to first observe the local farming systems, and look for an appropriate niche: traditional crops among which gm/cc's could be intercropped, times during the growing season when lands are left idle, or perennial crops around which gm/cc's can be grown. In the absence of these possibilities, one can try growing the gm/cc during the drier seasons or as improved fallow. After identifying the best niches, one should select for experiments those species that are known to function best in those niches that will provide the benefits most desired by the farmers with the least amount of labour.

In order to introduce green manure and cover crop systems successfully, we need a much better understanding of existing systems. We need to understand the geographical extent of present systems, the rates of adoption or abandonment, and the reasons why gm/cc's have been accepted or rejected. At the moment research into finding ways that the most common gm/cc's can be used to feed different animals is a high priority. Innovative associations of gm/cc's need to be investigated as well as the associations between these and common crops. We also need to know a good deal more about the theory of inter-cropping and the mechanisms by which gm/cc can lead to zero tillage. What are the minimum requirements to move to zero tillage, and how can these be easily achieved under different conditions? New gm/cc species need to be found which can respond to farmers' needs. Virtually all of this research can and should be done in the field through participatory processes. ■

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Table 1: Characteristics of some important GM/CC species

Common name	Scientific name	Resistance to shade	Resistance to poor soil	Resistance to drought	Controls weeds	Other uses
Velvetbean	Mucuna spp.	3	3	3	4	Medicine, animal feed, human consumption (when processed)
Jackbean	Canavalia ensiformis	4	4	4	3	Human consumption (tender pods)
Cowpea	Vigna unguiculata	3	3	Some vars. 4	3	Human consumption
Pigeon pea	Cajanus cajan	3	3	4	2	Animal feed, human consumption
Tephrosia	Tephrosia vogelii or T. candida	2	4	4	2	Insecticide

4 = extremely good   3 = good   2 = fair   1 = poor

Understanding traditional terracing

William Critchley and Marit Brommer

Terracing land for rainfed agriculture has long been the basic response of farmers to the problems of cropping in hilly and erosion-prone conditions. A comparative study of conservation strategies amongst traditional, small-scale terrace farmers in Uganda, South Africa, the Indian Himalayas and upland Java has demonstrated striking similarities in their approach and techniques. The main objective of the survey was to understand how different groups of farmers perceived erosion and countered its negative effects. The reasons given by farmers for their conservation practices did not always coincide with conventional "scientific" thinking on hillside conservation, but their local practices were based on a keen understanding of land degradation processes and the need to protect soil fertility.

The survey involved farmers from areas with strong terracing traditions. It was carried out over a number of years as the opportunity arose in areas with terracing traditions in four different countries.

Four terracing systems

The most ancient terraces in the survey – well over a thousand years old – are in the foothills of the Himalayas in the State of Uttaranchal in India. Here, all cultivated land is terraced. True bench terraces, with flat beds to encourage rainwater infiltration, make it possible to use oxen to cultivate the steep slopes. Average annual precipitation is around 1750 mm, although this is erratic and highly seasonal. The terrace walls or "risers" are sometimes stone faced – when stone is available - but more often they are earth structures. The most common crops in the area are finger millet, sorghum and soya bean. On the valley floors there are irrigated terraces, but rainfed agriculture dominates the landscape and the economy.

Kabale District, in south-west Uganda has a gentle hilly landscape checkered with small plots at various stages of cultivation and divided by terrace bunds that cover every hillside. These are not old terraces, but a local 'interpretation' of a compulsory colonial ordinance passed in the 1940s requiring farmers to plant strips of napier grass (*Pennisetum purpureum)* across the slope at intervals of 15 metres to control soil erosion. What has evolved since are a series of forward sloping terraces. In 1949, an official Ugandan publication boasted that the area had reached 'a standard of soil conservation perhaps unsurpassed anywhere in Africa'. These terraces tend to have a highly fertile strip of deep soil held back by the grass barrier. This is a result not only of water erosion (rainfall is between 1000 and 1500 mm per annum), but also of the practice of hand hoeing while facing upslope, which drags the soil progressively down the slope through 'tillage erosion'.

During the cropping season the healthy crop in the rich soil behind the barriers stands out in stark contrast to the poor crop growth in the shallow soil at the top of the fields. The variation in fertility – the so-called 'fertility gradient' – is obvious. Declining soil fertility and landslides continue to be problems in Kabale.

By contrast, upland Java has relatively fertile volcanic soils. In the region around the city of Yogyakarta in south-central Java, for example, agriculture has steadily climbed up the hillsides, using terraces like stepping-stones. During the nineteenth century, under the pressure of rapid population growth, farmers began to encroach rapidly onto previously forested hillsides. As in India, farmers have traditionally terraced their rainfed holdings. In some areas government programmes have transformed what were forward-sloping terraces into benches, but in most places farmers have completed this transition themselves. The result is a landscape of bench terraces that have a slight backslope, allowing excess runoff to drain away. The rainfall is about 2000 mm per year. A wide variety of annual upland (*palawija*) crops are grown and all livestock is stall-fed, with the manure being returned to the land.

Venda is part of Limpopo province and is home to one of the very few examples of traditional small-scale terracing in South Africa. Visually it is dramatic. Most of the terraces have stone-faced walls (*mitsheto*) that have been constructed with pride and considerable masonry skill. During apartheid, Venda was designated as one of the "homelands" into which the country's black population was crowded by the government. Because these areas were generally isolated and resource poor, agriculture was marginal and land quickly became severely degraded. However, this was less noticeable in Venda, where a tradition of building houses and terrace walls with stone has existed for generations. Local farmers continue to invest enormous amounts of voluntary labour in building stonewall terraces for their main crop – maize and it is not uncommon for farmers to spend as much as 500 days per hectare creating terraces on the steeper slopes.

These four terracing systems are thousands of kilometres apart and involve different peoples, origins and problems. Over a period of eight years, the same basic questions – with some location-specific additions – were asked to farmers in these areas. Table 1 shows the responses that these four groups gave to five key questions.

The first four sets of questions were answered with remarkable consistency. Practically all farmers interviewed recognised that erosion processes were happening in their own fields, despite the terraces, and the majority in each country sample believed the problem was becoming less serious. Perhaps the most significant finding of the survey was the consistent ranking of 'soil fertility decrease' as the most important negative effect of erosion. Not the loss of kilograms of soil, but the consistent decline of its productive potential was what mattered to farmers. There was also, not surprisingly, a clear appreciation of the need to maintain terraces and to build up the terrace 'lips' (the bund or ridge directly above the riser) each season. Human activities, including overgrazing and lack of maintenance, as well as natural causes (heavy rainfall) were given as the main causes of erosion.
The main differences between the farmers in the four areas emerged in their answers to the question "What are the main sources of erosion in the landscape?" and to some of the other questions not included in the summary provided in Table 1. In Java the farmers agreed with an on-going scientific investigation in which one of the authors was involved that indicated that terrace risers were the main source of sediment in the agricultural landscape. In Venda, local people noticed and suffered from the fact that the roads had been badly designed and poor drainage was causing gully erosion. The Venda also provided an example of how local spiritual and ritual practices can influence approaches to soil conservation. The local lake – *Fundudzi* – is considered sacred. During the 1960s it 'turned red', apparently as a result of increasing sedimentation. This led the elders to intervene and mount a campaign to get people to conserve their soil better in order to maintain the integrity of the lake.

Table 1: Perceptions of erosion and conservation strategies: Surveys of small-scale upland terrace farmers in four countries

	Indonesia Gunung Kidul, S-Central Java	**South Africa** Thohoyandou District, Limpopo Province	**Uganda** Kabale District, S-W Uganda	**India** Pauri & Almora Districts, Uttaranchal
Date of survey	1994	1997	1999	2002
Number of farmers interviewed	24	20	24	15
Is erosion taking place in your (terraced) fields? If so is it a little, moderate, a lot; increasing, the same or decreasing?	Yes: 100% A little: 65% Decreasing: 70%	Yes: 100% Moderate: 55% Decreasing: 80%	Yes: 95% A little: 60% (of the 95%) Decreasing: 60% (of the 95%)	Yes: 100% Moderate: 60% Decreasing: 70%
Main negative impacts?	1 Soil fertility decrease 2 Terrace collapse 3 Loss of soil	1 Soil fertility decrease 2 Terrace collapse 2 Gullying	1 Soil fertility decrease 2 Destroys crops	1 Soil fertility decrease 2 Gullying
Conservation strategies?	1 Terraces 2 Toe-drain upkeep 3 Riser 'lip' upkeep 3 Tree planting	1 Terraces 2 Grass strips 2 Various (including. Controlling grazing/ gully checks)	1 Trash lines 2 Tree planting 3 Terraces	1 Terrace upkeep (building up riser 'lip')
Perceived causes of erosion?	1 Heavy rainfall 2 Sloping land 2 Soil type	1 Heavy rainfall 2 Ploughing up/down 2 Overgrazing 2 Burning grassland	1 Overgrazing 2 Overcultivation and no fallowing	1 Heavy rainfall 2 Some people unconcerned
Main source of erosion in landscape?	1 Terrace risers 2 Terrace beds	1 Roads 1 Hillside grazing land	1 Crop fields 2 Grazing land	1 Degraded forest 2 Barren land / roads 3 Gullies

In Uganda, crop fields were considered to be the main source of erosion. Indeed a characteristic of the area is that terrace bunds tend to collapse when the soil becomes saturated, leading to a 'domino effect' as a whole series of terraces gradually slip down the hillside. Ugandan farmers pointed out the importance of terrace bunds as boundary markers. Field-end bunds are those that are most keenly protected: if these collapse, then the down-slope neighbour receives a free gift of rich soil. In Uttaranchal, India, the farmers look after their terraces following centuries old traditions and clearly understand their purpose and value. More interestingly they perceived that degraded forest land was the cause of the dry season 'low flow' problem because it leads to reduced rainfall infiltration opportunities. They also voiced their concern about the invasion of thirsty pine trees (*Pinus roxbughii*) which had replaced the original 'moisture conserving' oak (*Quercus leucotrichopora*).

Conclusions

Despite the difficulties of making comparisons across very different cultures, using a basically common questionnaire, it is possible to draw some conclusions. For example, in these areas which all have traditions of rainfed terracing, there is a remarkable degree of consistency in indigenous knowledge and local practice. However, there are clear differences that inevitably arise from variations in production systems, landscapes, and socio-cultural traditions. Various lessons emerged from comparing the results from the four groups who took part in this survey.
First, traditions of terracing are strong in each of the locations. People are aware of the importance of their terraces for agricultural production. They appreciate the problems associated with terraces and the need for continuous maintenance. Second, while their environmental knowledge systems do not exactly match 'scientific knowledge' they generally do not clash. In fact, they can add value to the observations and measurements of outsiders, as some of the results here show. Third, there are clearly possibilities for 'cross learning' through sharing indigenous knowledge, whether this comes from long established traditions or recent innovations.

This survey was not done in a structured, pre-determined pattern. However, by taking the opportunity – when it arose over the years – and by looking at the same factors in different places, it was possible to document people's approaches to more or less common problems using similar criteria. The results show that these farmers have a clear understanding of their problems and their own ideas of how to deal with them. Such information and experiences can further encourage changes in the way soil conservation technologies are perceived and promoted by 'specialists' in different parts of the world. It is not the prevention of soil loss as such that should be the focus of soil conservation efforts – but rather the optimisation of the agricultural production on the land available to the farmer. Production and conservation go hand in hand.

■

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Healing the earth: an Ethiopian story

Million Belay and Sue Edwards

A farmer holding a faba bean plant grown with compost. Photo: Solomon Hailemariam

Land degradation is one of the most serious problems facing Ethiopia today. Population pressure and low yields are forcing farmers into abandoning fallowing and crop rotations - the system they have used for millennia to maintain their livelihoods. In Tigray, the most northern region of Ethiopia, over 85% of the population are farmers who struggle to feed their families from soils in poor condition that only produce low yields of staple crops.

In order to improve crop yield in the region, the Bureau of Agriculture and Natural Resources in Tigray (BoANR) adopted the Sasakawa Global (SG) 2000 package, which is based on high input demanding varieties and chemical fertilisers. However, the cost of these inputs is beyond the purchasing power of most farmers in the region and some of those who have used these inputs have fallen into the dept trap. In addition, prolonged use of chemical fertilisers has a number of negative side effects on the environment.

A pilot experiment

The challenge is to find mechanisms that help poor rural communities to improve the environment and their capacity to produce crops without becoming dependent on external inputs. In 1996, the Institute for Sustainable Development (ISD) in collaboration with BoANR started a project in four selected rural farming communities in Tigray. The overall aim of the project was to help establish productive agricultural systems based on ecological principles that effectively managed and used local natural resources. The main components of the project included soil and water conservation practices, compost making, and the re-establishment of vegetation.

The four communities selected for the project were Zeban Sas and Gu'emse in the Eastern Zone of Tigray, Adibo Mossa in the Southern Zone and Adi Nefas in the Central Zone. Each area has its own specific characteristics. Depending on the specific needs of each of the communities, different practices were employed. These included the construction of trench bunds, check dams and ponds; the making and use of compost; the use of manure; the planting of trees, forage and grass species; use of genetically diverse seed material and natural pest and disease management.

The performance of the organic production system developed in each of the four communities was compared with the performance of a production system based on the Sasakawa Global (SG) 2000 package in a neighbouring village. This was done in order to compare the two strategies for sustainability.

Benefits from compost

Because compost making is a new practice in Ethiopia, some efforts were required to convince the farmers try it. At the start of the project only a small number of farmers made compost. But after observing how production increased when compost was used, many farmers started to prepare and use it. Farmers also observed that the straw from crops grown with compost was more palatable to livestock and that composting had a dramatic effect on weeds.

In 1996/97 the project started in Adibo Mossa with 45 farmers making and using compost. However, by 1998 this figure had more than doubled. In Adi Nefas, farmers not included in the project started making compost on their own personal initiative without any encouragement from the project personnel.

In every project location, farmer-managed trials were established in the fields. Yields obtained from composted fields were compared with those obtained with Diammonium Phosphate (DAP) + Urea at 100 kg/ha and 50 kg/ha, respectively. The amount of compost applied was different in each site (according to availability) and varied between 5000 kg/ha in Zeban Sas and

The four communities

Zeban Sas (Eastern Zone) is located at an altitude of between 2000 and 2400 metres above sea level. Rainfall is less than 900 mm per year and temperature averages between 16° and 20°C throughout the year. The soil is sandy silt, which tends to be extremely thin, 4–10 cm deep, with little moisture holding capacity and poor fertility. Vegetation cover is sparse. Soil degradation is a pressing problem. The main crops grown by the farmers when the project started were barley with some wheat and a little tef. Approximately two-thirds of the land is used for crops and the rest as grazing land.

Gu'emse (Eastern Zone). Climatic conditions are the same as those of Zeban Sas. The farms are on a flat alluvial plain. The soil is very deep and more fertile than in Zeban Sas. The whole plain is threatened by rapidly advancing gully caused by the seasonal stream that once formed the plain. This problem probably arises from changes in the vegetation cover of the surrounding hills.

Adi Nefas (Central Zone). The site is at the foot of a steep but low basaltic mountain range. The average rainfall is around 600 mm per year. The farmers live on the flat land that consists of vertisol soils which are prone to gullying. The lower slopes of the mountain, which have better drained reddish soils but which are easily eroded because of the sloping landscape are also cultivated. These slopes have been completely deforested and their vegetation replaced by shrubs - mostly Euclea shimperi – which have a low productivity.

Adibo Mossa (Southern Zone). Located in the plain at the shores of Lake Hashenge, the only lake in Tigray. The site was chosen because of its high human and livestock population densities. The lake is in a closed basin with no outlet and needs careful protection from pollution from inorganic inputs.

15,000 kg/ha in Adibo Mossa. The yields of finger millet, barley and wheat on composted fields were comparable with those where chemical fertilisers had been applied. Tef, however, gave higher yields when grown on composted plots. The effect of compost on maize yields was variable when compared to the results achieved with chemical fertiliser. There were much higher straw yields from the composted plots in comparison to the chemically fertilised ones. The farmers welcomed this because their animals often have to subsist on crop residues during the dry season. The increased straw yields also enable the farmers to prepare more compost because there was more animal manure and increased plant material.

Soil and water conservation

Impressive results in soil and water conservation have been observed in three of the four project sites since 1997. The spread of gullies had been halted and soil has been retained that would otherwise have been washed away. Water retention and infiltration has also been improved.

Adi Nefas had been losing fertile land through a gully that started at the base of the neighbouring hillside. The farmers built a series of check dams up the gully, and in one year enough soil was captured to allow for the planting of grass and trees. The construction of check dams has been effective in Zeban Sas as well, although soil accumulation has been slower. Unfortunately, Gu'emse has not been successful in its attempts to halt a very wide gully that is caused by the run-off from a large catchment area of virtually bare hillside. An effort that involves several other communities upstream is required. Gullying has not been a problem in the Adibo Mossa site.

Water is very scarce during the dry season in Adi Nefas, Zeban Sas and Gu'emse and the farmers, with financial support from ISD, have now constructed ponds to collect water so that it is available in the dry season. The programme was expanded to 21 villages in 1999 and construction of trench bunds on farmlands and check dams in gullies was carried out in 14 out of the 21 new sites.

Planting of grass and trees

Various indigenous and some selected exotic forage grasses and legumes, as well as other trees and shrubs for construction and fuel, have been planted in and around farms and houses, on hillsides, around the newly constructed and maintained gullies and along trench bunds. This planting has been carried out in the four original sites as well as in 14 of the new sites. This has resulted in the farmers using forage trees for feeding their cattle, planting and protecting grasses and legumes for stabilising trench bunds and check dams, enrichment planting on degraded lands, and increasing the amount of biomass available for compost making and for feeding their animals.

In Zeban Sas, the success of the project showed first in the rehabilitation of approximately 30 hectares of abandoned, rocky grazing land. Having seen their grazing land restored, the farmers started working on other components so the area as a whole has now been almost rehabilitated and is green, with farmers getting their income from fattening and selling cattle.

Embedding sustainability in society

All four communities have now drawn up their own statutes to control the use of their land and renewable natural resources. These statutes set out rules and regulations that community members agree to and penalties for anyone who infringes them. The communities themselves developed the statutes, and the respective local governments have recognised these statutes and uphold them.

The regional government of Tigray has also adopted this project. This means that, if the ISD has to pull out, the programme will still continue. The regional government has spread the project to more than 2000 households in more than 83 villages. A very recent development is even more significant: the project has been taken up by the Environmental Protection Authority (EPA) of Ethiopia with support from UNDP and will now be upscaled to the national level.

Conclusion

The secret of the success of this project lies in the involvement at the planning stage of almost all of the stakeholders. Ensuring the active involvement of farmers requires providing a range of choices and alternatives for them to consider, rather than making prescriptions for improving one part of the farming system.

The project offers a range of choices and farmers adopt those that suit their ecological and social setting. Experience has shown that each village has a preference for one or two of the different components of the project. At Zeban Sas, the emphasis has been on soil and water conservation, because the area was badly affected by soil degradation. At Gu'emse and Adibo Mossa farmers adopted composting rapidly, because there was already sufficient plant material and animal manure for making this natural fertiliser.

A woman working in her compost pit in Zeban Sas. Photo: Solomon Hailemariam

At Gu'emse, check dams were not very effective in halting gullying and halting the spread of gullies is now the community's top priority.

The farmers at Adi Nefas are actively participating in all components of the project, much more noticeably than at the other sites. This is probably because of the rapid positive outcomes of making check dams and preparing and using compost. These early successes, coupled with the high population density, have given farmers a strong motivation for intensifying the use of their land in a sustainable way. ■

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From soil erosion to soil quality

Farmers' priorities may have nothing to do with agriculture. Lempira, Honduras. Photo: Jon Hellin

Jon Hellin

Throughout the tropics, smallholder farmers are increasingly forced to colonise marginal areas such as steep-lands. The consequence has been increased land degradation, loss of soil quality and accelerated soil erosion. This threat to sustainable agricultural productivity has led to considerable interest in soil conservation technologies that control run-off and erosion. Cross-slope technologies such as live barriers, rock walls, infiltration ditches, terraces, and earth bunds have been widely promoted all over the world.

Farming communities have been encouraged to adopt these technologies, but the response has been poor. Many development organisations have reverted to using direct incentives such as cash payments and food-for-work to encourage farmers to adopt soil conservation technologies. The problem with this approach is that farmers often abandon the technologies when projects end or funds dry up.

Based largely on field experiences from Honduras, this article discusses the case for a different approach to improved land management. Rather than focusing on controlling soil erosion it seeks to improve soil quality. In doing so, it not only takes farmers' concerns about productivity into account but also addresses the growing problem of land degradation.

Controlling soil erosion

The scene is all too familiar. The valley below is criss-crossed with neat green lines of honey melons destined for export to Europe and the United States. Standing on a hillside above the melon farm in Southern Honduras, I am surrounded by a mosaic of maize plots and the remains of the dry forest that used to stretch, unbroken, along the Pacific coast from Mexico to Panama. Inequality in land distribution in countries such as Honduras has meant that resource-poor farmers have few alternatives and have to work on what land is available. This is often in marginal agricultural areas such as hillsides.
Heavy rainfall and steep slopes mean that large parts of Central America are particularly prone to high rates of soil erosion. As land degrades, production falls and farmers are forced either to clear more patches of forest or migrate to the cities in search of work.

In Central America and many parts of the tropics and sub-tropics there is a danger that land degradation caused by farmers' own activities will undermine efforts to increase sustainable agricultural production. One response is investment in soil conservation technologies. In the last 30 years, soil conservation programmes have become commonplace in the developing world. Development practitioners provide farmers with technical advice, assistance and technologies designed to restrict soil loss and actively promote cross-slope technologies such as live barriers (contour hedgerows), rock walls, terraces and earth bunds.

Farmers, however, are often reluctant to adopt these technologies. Sometimes soil conservation programmes use incentives such as cash payments to encourage adoption. The problem, as shown in Figure 1, is that farmers often abandon the technology once the incentive is removed.

When farmers do not adopt recommended technologies, it is often said that this is because they are under-educated, conservative and unwilling to change. Recently, however, there has been a greater appreciation of the farmers' own situation. This has led some to question whether farmers are unwilling to follow recommendations because many of the technologies being promoted do not address their needs and real priorities.

Farmers' perceptions

Those concerned about the severity of soil erosion and the effects it can have on agricultural production are often surprised to learn that smallholder farmers often do not share the same concerns. This lack of concern about soil loss is partly explained by the fact that many farmers do not recognise that soil erosion is taking place. In Honduras it is not uncommon to hear farmers talk about 'rocks growing out of the hillside'. Soil loss rates as high as 20 to 40 tonnes per hectare per year result in an annual lowering of the soil surface by less than 0.3 mm. As farmers cannot see this erosion occurring, the explanation of rocks growing is a logical explanation for rocks becoming exposed.

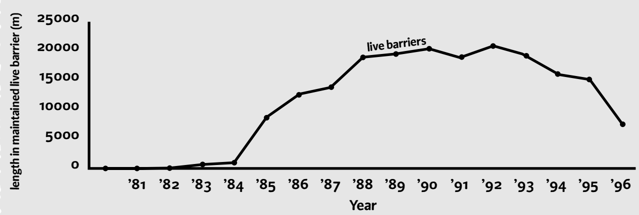

Figure 1: Adoption and abandonment of live barriers on 147 farms in La Paz, Honduras. The project lasted from 1980 to 1991 and direct incentives were provided from 1984 to 1991.

The major worry of farmers in Honduras seems to be the damage caused by pests and diseases, drought and irregular rains (see Table 1). Soil erosion is seldom seen as a threat to their livelihoods.

Deeper questioning reveals that farmers are not worried about pests and diseases or reduced rainfall as such. Their real concern is what these problems will mean to them in terms of reduced productivity. When asked about the effects of the problems identified, reduced productivity (360 responses) and hunger (46 responses) accounted for 91% of the responses.

Soil erosion and productivity

The reason why erosion control has received so much attention is the assumption that there is a direct relationship between soil loss and crop productivity. Conventional soil conservation technologies, focusing on controlling soil loss, tackle what outsiders consider the main threat to (and from) farming on sloping lands rather than the problems and priorities identified by the farmers themselves.

Yields are actually determined by a complex interaction of factors including soil quality, crop and land management systems, and climate. In countries such as Honduras, the amount and distribution of rainfall has a much more profound impact on yield than the amount of soil eroded. Given such variation in yields, farmers' 'failure' to identify soil erosion as a threat to their livelihoods seems reasonable.

By placing too much emphasis on erosion, we are potentially doing a disservice to farmers because any relationship between productivity and the soil depends more on the quality of the soil remaining on the land rather than the amount of soil removed through erosion.

A soil in good condition is well structured, allows roots to penetrate, exchanges gases and absorb rain easily. The more rainfall that is absorbed, the less erosion takes place. Erosion occurs once the soil is degraded. A degraded soil is less able to absorb rainfall and the result is greater run-off and erosion. Cross-slope technologies, such as live barriers, do little to improve the quality of the soil between the barriers. As a result, farmers seldom witness an improvement in production as a result of such soil conservation efforts. Clearly, there is a need for a new approach to soil conservation. The farmers' concerns – agricultural productivity and its sustainability through the preservation and improvement of soil quality – provides the starting point for this approach and should be given priority.

Improving soil quality

A more effective approach than focusing on cross-slope soil conservation technologies is the use of agronomic, biological and mechanical measures to improve soil quality via soil protection, the incorporation of organic matter and the use of soil organisms. These procedures directly address factors such as surface cover and soil structure, that are within the control of the land user and that can be used to rebuild the soil into a dynamic and living system. Soils that favour root growth also favour better water retention and the conservation of soil and water on the farm itself.

Improving soil structure and infiltration capacity can result in improvements in both production and soil conservation. Improvements in crop management, such as early planting, optimum density, leaving crop residues on the surface and the use of green manures (see LEISA Magazine Vol 13 No 3, p 12-14), reduce erosion, encourage water infiltration and, through improving soil quality, lead to improved crop production. A practical example of this approach is the *Quesungual* system in Western Honduras (see Box and also LEISA Magazine Vol 18 No 3, p 10-11).

Table 1: Farmers' perceptions of threats to agricultural production. Based on a questionnaire administered to 213 smallholder farmers in Honduras.

Threat	Responses	Percentage of responses
Pests and diseases	172	38
Drought and/or irregular rain	136	30
Low productivity	60	13
Quality of land (eroded, waterlogged etc.)	40	9
Availability of land	29	7
Few economic resources	7	2
Others	4	1

The Quesungual System in Honduras

The Quesungual system is an agroforestry system that is characterised by three layers of vegetation: mulch, crops and dispersed shrubs and trees. Farmers in Western Honduras used to practise a slash-and-burn agriculture. Different development organisations encouraged them to stop burning their fields prior to planting their maize crop and instead to cut the weeds, leave them on the soil surface and sow their maize seed through the mat of vegetation.

The three-tiered vegetation canopy affords ample protection to the surface of the soil and as soon as the farmers stopped burning they noticed there was hardly any erosion: the rivers were 'clean' as opposed to 'dirty' when it rained. Soil erosion control is not, however, the reason that farmers are increasingly adopting this system. The issue at stake is improved soil quality.

Having abandoned the practice of burning their fields, there are more beneficial insects and increasing levels of organic matter in the soil. The attraction for farmers is that the soil can now hold moisture much better. The result is improved production. The reduction in soil loss is a 'secondary' benefit of the system. Farmers do not see the Quesungual System as a soil conservation practice. On the contrary, it is viewed as a productivity-enhancing practice that also happens to be effective for soil conservation. This approach to land management is more attuned to the farmers' priority needs and is more readily adopted by them.

The Honduras experience shows that, although there is still a role for cross-slope conservation technologies, these should be combined with technologies and agronomic practices that lead to an improvement of soil quality. If used on their own, they are unlikely to result in improved productivity, which is the farmers main concern.

Recent positive experiences with the rapidly expanding zero tillage systems of Latin America show that when soil quality is improved, agricultural production increases and soil erosion is reduced. Fundamental policy changes are, of course, still needed to alleviate the pressure on the steep lands of Central American. These changes include more equitable land distribution and greater access to markets. However, despite numerous social, economic and agro-ecological constraints to better land management, farmers can improve soil quality through the use of technologies that enhance both productivity and soil conservation. Through such approaches Central America's hillsides can support more smallholder farmers on a more sustainable basis.

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Nitrogen fixation on a national scale

Adriana Montañez, Carlos Labandera and Luis Solari

Intensive grazing of vast areas combined with continuous cultivation of wheat, barley, maize, sorghum and sunflower under conventional tillage practices, without proper fertilisation or erosion control, have been degrading land in Uruguay ever since the first European emigrants arrived in the country in 1910. Farmers and producers abandoned the land once it became infertile and degraded and moved on to areas where soils were still productive. As a result the problem of soil depletion grew. In 1959 the government, technicians, NGOs and farmers unions started to discuss the problem. A plan for the development of agriculture - the *Plan de Desarrollo Agropecuario* – was developed. This "Agricultural Development Plan" was set up to improve productivity in the short and long terms and included all agricultural land. Special emphasis was given to the development of pasture-crop rotations.

Bacteria to the rescue

In 1960, using positive experiences with legume inoculation in Australia and New Zealand, researchers of the former Laboratory of Soil Microbiology and Inoculants (now the Department of Soil Microbiology of the Department of Agriculture) started to work on biological nitrogen fixation (BNF) involving the soil bacteria Rhizobium. These organisms live in association with specific plants, forming small nodules (swellings) on the roots. They fix nitrogen from the air into the soil and in doing so provide crops with one of the elements essential for good growth and yields.

The research group worked in close collaboration with rhizobiologists, plant breeders, agronomists, farmers and extensionists to identify, select and test native Rhizobium strains that were well adapted to specific soils and host plants. In addition, native and introduced pasture varieties that responded well to the presence of Rhizobium were selected. In collaboration with farmers, field and on-station trials were established across the whole of Uruguay to study the efficiency of established pasture-crop rotation practices, such as the use of a mix of legume and non-legume pastures in rotation with winter crops like wheat and barley, and summer crops such as sunflowers, maize and sorghum.

Improved pasture-crop rotations were established. Farmers were given technical support and benefited from a credit plan that covered 80% of any investments they made. Adoption of the BNF technology was further facilitated by the fact that it is easily applied in the field. Rhizobium bacteria, mixed with sterile soil, are fixed to the seeds by using a special type of glue, after which sowing takes place.

The livestock sector has greatly benefited from BNF technology. Photo: Federación Uruguaya de Grupos CREA (FUCREA)

A gene-bank of N-fixing and other microorganisms was established at the Ministry of Agriculture's Department of Microbiology to serve as a source of high-quality germplasm for researchers, extensionists and commercial producers. The private sector was closely involved in the development of the BNF technology investing in both the production and multiplication of the required Rhizobium strains. Today, three enterprises produce high-quality Rhizobium for Uruguay and other South American countries.

Good for the farmers, good for the country

BNF in Uruguay continues to be developed and improved and, over the last 40 years, the technology has brought considerable economic, ecological and social benefits to those who have used it. The country has saved millions of dollars through reducing imports of nitrogen fertiliser. Individual farmers have greatly benefited because Rhizobium is cheaper to buy than urea-based fertilizers. Currently one application of Rhizobium costs one US$/ha whereas one application of urea fertiliser costs US$50 per hectare. BNF technology has the capacity to fix and incorporate 250 kg per hectare of nitrogen in the soil in a very efficient way. Farmers are well aware of the benefits and as a result rotation with legumes and inoculation with Rhizobium is now being used by nearly all arable farmers.

BNF's contribution in Uruguay

- Soybean yields have increased 800-1000 kg/ha/year (a 40% increase) on land where they have not previous been cultivated and where Rhizobium is used.
- Pea producers using BNF have recorded yield increases of up to 240%.
- Each year savings in the order of 90 million dollars have been made because of farmers using Rhizobium rather than buying in fertiliser for forage legume production.

Explaining the success of BNF

This initiative is a good example of the planning and implementation of a national, government supported strategy with an ecological and multi-disciplinary approach. There was a strong functional relationship between the government, industry and farmers. The spontaneous integration of these stakeholders made it easy to define limiting factors, find solutions and apply these in short term. An aspect worth mentioning is that BNF was not an objective in itself but a valuable tool that could be used to meet the goal of improved productivity in the short and long term. While farmer pressure and government support was essential in the process, the key for success was the excellent performance of BNF technology in the field, leading to its successful adoption and the improved production systems currently in place.

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Following website provides more information on Rhizobium and its use: http://fp.chasque.apc.org:8081/microlab/LMSCI/LMSCI.htm

Little bugs, big problems

Tim Hart, Roberta Burgess and Hans Hugo

In 1999, small-scale farmers, organised in the Friemersheim Kleinboer Vereniging (FKV), purchased an under-utilised 100 hectare commercial farm near their village in the South-Western Cape (South Africa). This arrangement had been made possible through the South African Government's Land Reform Programme (see LEISA Magazine 19.3 pp 27-29). The newly acquired land had been left fallow for many years and in several places there were heavy concentrations of weeds such as Australian Black Wattle (*Acacia* sp.), Hakea trees (*Hakea* sp.) and Night Shade (S*olanum nigrum*).

Early harvests

After the purchase, the old farm was divided into two-hectare plots and distributed to the members of the FKV. Their first planting season was in 2000 when most of them cultivated a mixture of vegetables, maize and legumes. Deformities began to be noticed in some root vegetable crops by mid-2001. However, farmers observed that although crop growth was stunted in some parts of their smallholdings, the same crops did well in other areas. They immediately suspected that the condition of the soil was responsible for these irregularities. They knew they had cultivated all parts of their plot in the same way and had used the same inputs and practices. They did not know what the problem was and neither did local commercial farmers in the area.

Galls on the roots of a Honeybush plant. Photo: Tim Hart

Land with problems

During 2000, some of the farmers involved in the FKV began to work with researchers from the Agricultural Research Council Infruitec-Nietvoorbij (ARC) to establish a new economic crop, Honeybush (*Cyclopia* spp.), used as a herbal infusion and a potentially valuable export commodity.

During the sessions when researchers were training farmers and providing them with information on various aspects of Honeybush cultivation, the farmers began to talk about their crop problems especially the deformities and stunted crop growth in root and tuber vegetables. The researchers recognised that these signs suggested that there might be a high level of root-knot nematode infection in the soil of some of the smallholdings.

Soil problems explained

When the growth of some of the Honeybush plants at the trial site also appeared stunted, the researchers started to look more closely at the problem. An examination of the trial plantings revealed galls or knot-like growths on the plants' roots. Laboratory tests proved these galls were caused by root-knot nematodes. Root-knot nematodes are microscopic organisms that live parasitically in plant roots. They cause root knots or galls, which make it difficult for the plant roots to take up water and other nutrients. As a result plant growth is stunted and root vegetables such as carrots and beetroot become deformed. In this case the root-knot nematode involved was identified as *Meloidogyne javanica*. This organism can live in more than 700 species of plants, including most vegetables and a large number of weeds. The weeds that were present on the farmers' land – Australian Black Wattle, Hakea trees and Night Shade – and crops such as tomato and potato were known to be good hosts to the nematode. Many brassica species such as cabbage and cauliflower, however, are not and can be grown without problem. Working the plant material of these varieties into the soil after harvest bio-fumigates the soil and can help control the nematode population. In the absence of host plants, root-knot nematodes cannot survive for more than a year or two.

A meeting was held with interested farmers and the research team explained the effects of the root-knot nematode and suggested that crops should be planted that would not host these organisms. These crops could be planted and seasonally rotated with other crops to reduce the number of nematodes in the soil. Local commercial farmers used to rotate crops and this, together with other farming practices, may have been the reason why they had not experienced a problem with nematodes.

The farmers wanted to know how much of their land was infested with nematodes and asked the researchers to carry out a survey. Working together, farmers and researchers surveyed about 40 hectares of land over a two day period in September 2002 during which samples were taken from farmers smallholdings. Farmers were also asked about the history of their piece of land and to explain their crop planting and crop rotation practices.

When soil samples were analysed, researchers found there was a high level of infestation of root-knot nematodes on most of the smallholdings. Samples taken from land that had not yet been cultivated also showed a high presence of root-knot nematodes. Samples taken from plots where farmers had planted vegetable crops indicated even higher concentration of the pest. This suggested that their cropping practices might be making the problem worse.

This suspicion was confirmed when researchers analysed the survey data further and compared it to the data they had collected on the various cropping practices farmers had followed in the period 2000-2002. Most farmers had planted Irish potatoes – a favourite root-knot nematode host – season after season, without observing any resting period or crop rotation.

Mr Hans Hugo carrying out soil sampling. Photo: Tim Hart

Options

After the samples and the cropping practises had been analysed, three members of the research team met with each farmer on their smallholding and explained the extent of the nematode problem to them, advising them on possible strategies to reduce the numbers of root-knot nematodes in the soil. Researchers agreed that, once the farmers had selected the option that best suited their individual circumstances, they would help them draw up a proposal to obtain support and funds to tackle not only nematode infestation but also other soil health problems. In the FKV area these problems included poor soil fertility, soil borne diseases and inappropriate crop rotation systems.

Identifying locally appropriate solutions

The researchers suggested four options that could be used to restore soil health under present circumstances. Farmers could:

- Fumigate the soil with chemical soil fumigants;
- Plant marigolds and plough the plant matter into the soil before it began to form seeds;
- Plant oats on the affected soil for a few seasons to control and possibly arrest the root- knot nematode levels;
- Plant broccoli, cauliflower or cabbage and plough the plant material into the soil after harvest.

The options selected by individual farmers depended on their social and economic situation and the resources they had available. Some of farmers, for example, had access to alternative employment and income, which made them less reliant on agricultural production and better able to try out more costly and long-term measures than farmers who had no alternative source of income.

All the farmers immediately ruled out the fumigation option because of the cost and the long-term damage it could do to soil biology. They did not consider planting and ploughing in marigolds to be an appropriate strategy because whilst marigolds might control nematodes, they could not be eaten and they did not generate income. Farmers did not want options that involved spending money on external inputs or ones that would involve taking land out of production and a subsequent loss of income.

Some farmers decided to plant oats on their land because the crop could be used to feed livestock. Others were more interested in planting cabbages and other brassicas. All farmers wanted more information on the type of crop rotation systems that would reduce the nematode numbers.

While the researchers and farmers were developing a concept project proposal to address the soil health problem in an organic

Discussing cropping patterns with farmers. Photo: Tim Hart and sustainable way, four farmers started using local resources to try and develop ways to control and reduce the presence of root-knot nematode. They did not use any external inputs but relied on low-external-input suited appropriate to their specific farming needs and providing immediate benefits.

Working together

Two farmers, for example, decided to combine their resources in order to tackle the root-knot nematode problem. In 2002, they agreed to plant oats on one of their smallholdings and food and cash crops on the other. In 2003, they intend to repeat this process. In 2004, they will plant oats where the food and cash crops had been and food and cash crops on the land where oats had been planted. These two farmers are considering the possibility of getting a third farmer involved in the process. Not only is this a good strategy as far as soil health is concerned, it also encourages the conservation of soil nutrients in general.

Honeybush field with low plant density probably due to root-knot nematodes. Photo: Tim Hart

Single plot rotation

In 2002, another farmer planted oats on three-quarters of his land and used the remainder of his plot for food and cash crops. In 2003, he ploughed in some of the oats and started planting cabbages at periodic intervals. He intends to rotate his vegetable crops each season. Like his colleagues who are also using the oats rotation, he intends to practise crop rotation on a regular basis and on a larger scale once the nematode population has been reduced on the land currently under oats.

A recent soil analysis showed that where oats had been planted for two consecutive years, root-knot nematode numbers remained low, while the number of free-living nematodes, which are non-parasitic and whose presence is desirable, had increased. This strengthened the theory that oats can have a role in reducing root-knot nematode population levels.

Increasing scale

In 2001, another FKV farmer who had a four hectares plot decided to plant cabbage and broccoli on one part of his smallholding. When the results of the nematode survey showed that he had the lowest number of root-knot nematodes he made plans to continue planting these crops. At the moment he is looking at ways of improving his crop rotation strategy because he wants to scale-up his crop rotational practices and completely rehabilitate his smallholding.

Future steps

Seeing the work being done by innovative farmers, two other smallholders made parts of their farm available for experimentation. At the moment this land is being planted with cabbages and these will later be rotated with other suitable vegetable crops.

Not all farmers are interested in taking part in experiments, however. Some have said they are going to wait to see whether the project proposal is successful in generating funds and further support, while others do not see the root-knot nematode problem as hindering their particular type of farming activity. There are also farmers who, for financial reasons, cannot change their cropping pattern even though they recognise that such a step might help them rehabilitate their land.

Conclusion

It is still too early to say whether the measures that farmers are trying to develop in Friemersheim will be effective in arresting or reducing the level of root-knot nematode infestation. At this stage we are unsure what other changes might have taken place. We also need to be able to account for the changes we have observed. Structured and regular soil monitoring is needed in all the areas where farmers are trying to develop new nematode management and soil health strategies in order to assess whether soil composition and nematode levels have changed as a result of their interventions.

Structured surveys of the soil where farmers have not introduced innovative practices are also necessary. The results from these surveys must be analysed and compared to those obtained in areas where measures are being undertaken to restore soil health. This type of data will give farmers the information they need on the effects their different interventions have had on soil content and nematode numbers over time and can be used as a basis for providing advice on soil management.

The experiences of those involved in experimenting with the options available to counter root-knot nematodes is also important given the proposals to introduce Honeybush into the area as a commercial crop. The recent soil survey showed, for example, that in areas planted with Honeybush there appeared to be a doubling of the root-knot nematode population, strengthening the suspicion that the pest was attracted to these plants.

Appropriate crop management systems, based on crop selection and rotation of locally important crops might be a viable low-input solution for containing or resolving the root-knot nematode problem. As the FKV experience shows the continuation of cooperation amongst farmers and between farmers and researchers is important to achieve this goal.

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Reversing degradation

Fertility gradient on terrace in Uganda. Photo: William Critchley

Land degradation is a broad term and refers to the way in which the quality and productive capacity of the soil can be temporally or permanently undermined. It includes such processes of physical, chemical and biological deterioration as the loss of organic matter, the reduction of vegetative cover and biodiversity as well as a general decline in soil life and fertility. Degradation also results in soil compaction and erosion, a reduction in its water holding capacity and increased salinization in areas where irrigation has been poorly managed or where there is toxic chemical pollution.

Land degradation is something that most small farmers in the South are familiar with, although they may not use that term. They report that the soil is getting thinner, that there are more stones on the surface and that their soil is "tired" and "worn out". In some places production has fallen dramatically, it is difficult to find firewood and water sources have dried up. Changes in land use practices or pressure on land that make traditional farming methods unsuitable are the main reasons for land degradation in many parts of the world. Restricted access to more productive agricultural lands also force farmers to cultivate more marginal areas such as forested slopes that have low farming potential and are vulnerable to soil erosion once forest cover has been removed.

Land degradation is closely linked to farming practice and it is often suggested that small farmers and the circumstances in which they farm lead to accelerated soil erosion and the rapid deterioration of the landscape. However, most farmers depend on the land for their survival and are deeply attached to it. They do not degrade it by choice. Their main concern is to maintain its productivity and use it to support their families and provide a future for their children. Though the direct reason for land degradation may be farming practices, underlying socio-economic and political factors form the context in which this takes place. These factors include unequal access to land and resources, including income, needed to keep it in good condition.

But small-scale farmers are not the only ones who face soil degradation problems. Large-scale and intensive agriculture can often have a crippling effect on even the best agricultural soils. In this type of agriculture, the over-use of fertilisers and pesticides, heavy machinery and monocultures all contribute to land degradation. Often it is market pressures and the need to maintain a competitive position in export markets that force farmers to adopt practices that lead to soil degradation.

Although land degradation is a worldwide phenomena countries in the South tend to suffer more severely from its consequences than countries in the North. This is partly a result of geological and climatic conditions, but also because many millions of people in the South are directly dependent on farming for most of their livelihoods and income. The link between agricultural production and livelihoods is much less direct in the North, but ultimately we all need good food produced on healthy soil. Present agricultural practices threaten the resource base on which we all depend.

At present, all land suitable for agricultural production is in use. There are no reserves of good land into which agriculture can expand as it tries to meet the needs of the growing global population. The world's demand for food will have to be met by intensifying agriculture on land already in cultivation. The logical conclusion is therefore that we must take good care of the agricultural land we have, ensure that it is kept in productive condition and improve when necessary. Regrettably, this is not the case at the moment. Although it is difficult to quantify the impact of soil degradation, the estimates available are alarming.

The Global Assessment of Soil Degradation (GLASOD) has estimated that nearly 2 billion hectares worldwide or 22 % of all cropland, pasture, forest and woodland have been degraded since 1945. Of the 1.5 billion hectares cropland worldwide, an estimated 38% has been affected to some degree by human-induced soil degradation and more than 6% has been degraded to such an extent that rehabilitation is only possible with large capital investments. Recent global studies indicate that one quarter of the world's agricultural land has been degraded at a rate that has consistently accelerated over the last 50 years. Various sources suggest that between 5-10 million hectares of arable land are lost annually to severe degradation. For an overview of the regional extent of degradation, see Table 1.

Although we know that soil degradation threatens agricultural productivity in the long term, it is difficult to determine exactly how and to what extent soil degradation affects productivity or what this means in terms of declining farm production. This is because of the complexity of factors involved and the way in which they interact with each other.

Although some types of degradation are irreversible, most can be prevented and some can also be reversed. Nutrients can be added to nutrient-depleted soil, for example, or top soil can be rebuilt by incorporating organic matter or by introducing physical erosion control measures. However, rehabilitating degraded land requires much more effort and investment than introducing measures to prevent degradation in the first place.

Nevertheless, much is being done to rehabilitate degraded land and efforts by researchers, policy makers, extensionists and farmers are taking place at international, national, regional and local levels. Results at field level vary considerably and often do not bear much relation to the efforts involved. Examples here include the large-scale soil conservation activities undertaken in recent decades. Heroic efforts have gone into building erosion controlling structures such as bunds, shelterbelts and vegetative barriers with the help of incentives, only to realise that these structures were not maintained (Hellin, p. 10). While techniques may be technically relevant and effective, they may not be appropriate for the particular situation of the farmer. Farmers will, therefore, have quite clear preferences for certain measures (Belay, p. 12; Hart, p. 6). This can be taken into account if farmers are involved from the beginning and this is exactly why a number of experiences described in this edition of the *LEISA Magazine* have been successful. A very useful method of actively involving farmers at all stages of the process is the Farmer Field School methodology (Onduru, p. 26).

A good plant cover is very important for preventing soil degradation and achieving soil rehabilitation. A vegetative cover has a number of beneficial effects on soil aeration, soil moisture and organic matter content, physical characteristics and biological activity in the soil. In addition, a plant cover protects against erosion by wind and water. This makes them one of our most versatile allies in our efforts to protect the land and the reason why a number of articles in this edition deal with vegetative covers. Okon (p. 21) shows that even some weed species can be useful by describing how “Awolowo” – a well-known weed – is used in Nigeria as a cover crop in order to get rid of more aggressive weeds such as Running Carpet grass.

Although a good plant cover is necessary to protect the soil the plants used should ideally serve other purposes that clearly benefit farmers and which they appreciate. The introduction of trees and shrubs to rehabilitate degraded grazing lands in the Philippines were successful because the species selected were useful sources of fodder (Calub, p. 22).

The successful introduction of cover crops, for example, depends to a large extent on the advantages these plants offer to farmers (Bunch, p. 16). Cover crops can be quite aggressive creepers and may compete with the main crop. On the other hand, if leguminous plants are used as cover crops they add nutrients because they fix air-borne nitrogen and make it available for the crop. If soil is very badly degraded, however, even leguminous plants that will help restore the soil will have trouble growing. In such situations a number of additional measures will be required to restore soil quality (Giller, p. 19).

Soil life is very important to the health and functioning of the soil. The soil harbours a great variety of microscopic and macroscopic life. These creatures digest organic material and make minerals available to the plants, thereby contributing to plant growth. Legumes are able to fix nitrogen from the air with the assistance of Rhizobium bacteria if the right kind is present in the soil (Giller, p. 19). The presence of effective strains of these bacteria in the soil can be enhanced by reproducing them in a laboratory and mixing them with seed before sowing. This can lead to significant yield increases (Montañez, p. 9). However, some microorganisms may be noxious for crops and the presence of high populations of these organisms will affect plant growth and crop yields. The root-knot nematode in South Africa is an example (Hart, p. 6).

Farmers are not the only ones who should be involved in soil rehabilitation activities. Such efforts usually require a multi-disciplinary approach and strong collaboration between different stakeholders. This was an important factor in achieving a nation-wide adoption of Rhizobium inoculation in Uruguay (Montañez, p. 9).

Finally, efforts related to the rehabilitation of soil and land should be an integral part of regional and national (agricultural) policies. The Biological Nitrogen Fixation Programme in Uruguay was part of the national *Agricultural Development Plan* (Montañez, p. 9) and as the article by Riggs shows agroecological restoration in Guandong, China was facilitated by the formal policy developed by Guandong Province (Riggs, p. 24).

■

Table 1: Global estimates of land degradation, by region and land use (adapted from Scherr, 1999).

Region	% of land degraded				
	Agricultural land	Permanent pastures	Forests and woodland	All used land	
				Degraded	Seriously degraded
Africa	65	31	19	30	19
Asia	38	20	27	27	16
South America	45	14	13	16	9
Central America	74	11	38	32	31
North America	26	11	1	9	7
Europe	25	35	26	27	20
Oceania	16	19	8	17	1
World	38	21	18	23	14

C O N T E N T S

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Cover photo
Maize grown on steeplands in Honduras. Photo: Jon Hellin.

The editors have taken every care to ensure that the contents of this magazine are as accurate as possible. The authors have ultimate responsibility, however, for the content of individual articles.

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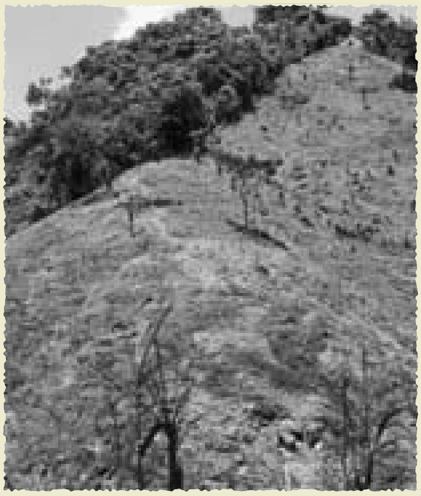

ILEIA is the Centre for Information on Low External Input and Sustainable Agriculture (LEISA). ILEIA seeks to promote the adoption of LEISA through the LEISA magazines and other publications. It also maintains a specialised information database and an informative and interactive website on LEISA (**http://www.ileia.org**). The web site provides access to many other sources of information on the development of sustainable agriculture.

LEISA is about Low-External-Input and Sustainable Agriculture. It is about the technical and social options open to farmers who seek to improve productivity and income in an ecologically sound way. LEISA is about the optimal use of local resources and natural processes and, if necessary, the safe and efficient use of external inputs. It is about the empowerment of male and female farmers and the communities who seek to build their future on the basis of their own knowledge, skills, values, culture and institutions. LEISA is also about participatory methodologies to strengthen the capacity of farmers and other actors to improve agriculture and adapt it to changing needs and conditions. LEISA seeks to combine indigenous and scientific knowledge, and to influence policy formulation in creating an environment conducive for its further development. LEISA is a concept, an approach and a political message.

Readers are welcome to photocopy and circulate articles.
Please acknowledge LEISA Magazine and send us a copy of your publication.

24 Agroecological restoration in Guangdong

Peter Riggs

Since the early 1990s, China's wealthy Guangdong Province has been trying to increase the sustainability of its rural sector. Its principal motivation was the need to keep its agricultural products competitive in both the domestic and export markets. However, other issues have also been taken into consideration including land rehabilitation, the quality of local water supply and the stabilization of rural livelihoods and cultures. This article explores the factors that have contributed to the success of these initiatives.

28 Shelterbelts and farmers' needs

Lambert Onyewotu, Kees Stigter, Yusuf Abdullahi and Jo Ariyo

As a response to desertification and long periods of drought in Northern Nigeria in the 1970s, the Kano State Forestry Department designed a programme of land rehabilitation using shelterbelts. It soon became clear, however, that the shelterbelts had design errors and had many disadvantages. Farmers had not been consulted when they had been established and this added to their sense of dissatisfaction with the measures implemented. In this article the authors use the Nigerian experience to stress the importance of actively involving farmers as well as researchers and policy makers in soil management and rehabilitation programmes.

DEAR READERS

As ILEIA approaches its Twentieth Anniversary (1984 – 2004), a number of interesting new institutional developments are taking place. First, we are delighted to welcome four new members to the ILEIA Board:

- Dr. Guido Gryseels, Director, Royal Museum for Central Africa, Belgium;
- Dr. Jan Pronk, Professor in Theory and Practice of International Development, Institute of Social Studies, The Netherlands;
- Dr. Paul Engel, Director, European Centre for Development Policy Management, The Netherlands;
- Dr. Teresa Fogelberg, Special Adviser, Netherlands Ministry of Spatial Planning, Housing and the Environment, The Netherlands.

We are certain they will make valuable contributions to the development of ILEIA's activities. Second, we have strengthened the ILEIA team in the Netherlands with two new editors: Mrs. Erika van Duijl and Mr. John Hollands. Both will work on the production of the *LEISA Magazine*. With the team complete once again we can increase our efforts to strengthen our collaboration with our partner organisations and work towards establishing new regional editions of the *LEISA Magazine*.

In February 2004 the editors of the five regional editions of *LEISA Magazine* will meet with their colleagues in the Netherlands during the annual International Editors Meeting of the LEISA Magazines. During the meeting ideas for increasing the flow of information between the regional editions of the LEISA Magazines, strategies for extending their outreach, and plans for the further development of the global LEISA network will be discussed. Our aim, as always, will be to make as much information on LEISA available to as many people as possible. This is a huge task and requires not only the full commitment of the ILEIA team and its regional partners, but also the active support of all our readers. You can help us by spreading information on LEISA to friends and colleagues – and by making sure they subscribe and get their (free) *LEISA Magazine*!

The Editors

With this edition of the LEISA Magazine we send all our readers our best wishes for the New Year and we hope that 2004 will bring you happiness and good fortune.

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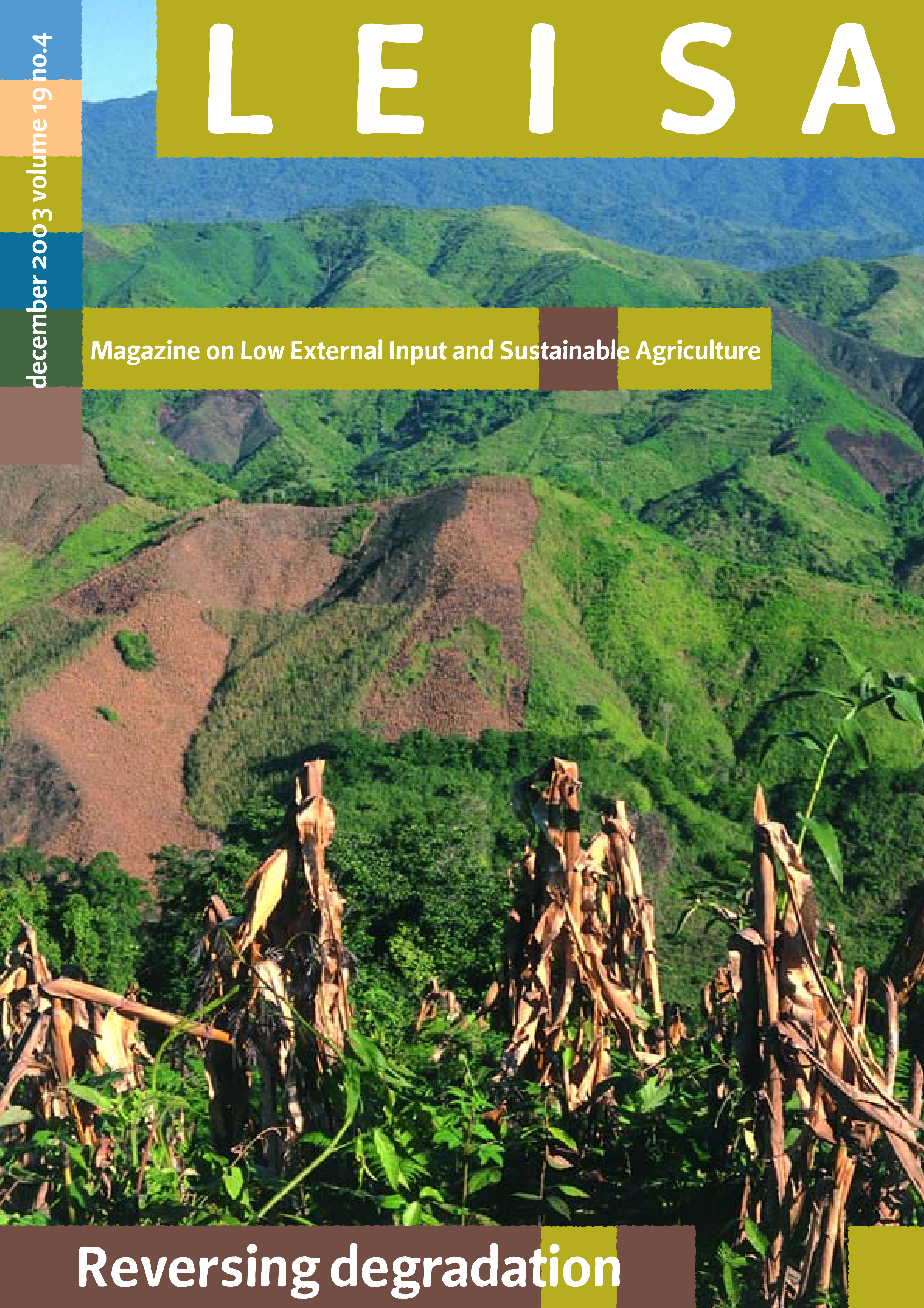
LEISA

Magazine on Low External Input and Sustainable Agriculture



Reversing degradation

Diversity on display at the first agricultural biodiversity fair in Guangxi, China. Photos: Authors

Celebrating diversity in China

Ronnie Vernooy and Yiching Song

It is market day in Guzhai township, Guangxi province, and there is excitement on the streets because the fair has come to town. No ordinary fair this, it is an agricultural biodiversity fair, the first such event ever to be seen in the province - or very likely anywhere else in China for that matter.

Many hundreds of local farmers crowd the section of the main street where the fair has been set up to view the diversity of crops and seeds on display. Others are there too - township officials, merchants, curious children, important visitors from Beijing, even a local television crew filming the action. What they see is a rich diversity - 38 crops and 107 varieties. There are 31 varieties of maize, 17 of beans, 16 of vegetables, 14 of cereals and eight root crops. Some are rare and unique to the area, such as black wax maize and mountain lily. There are also traditional herbs, spices, and medicinal plants - almost all of them landraces.

This rich array of diversity is displayed in booths just like produce at a regular market, and at each booth there is a neatly printed card giving details of the type and origin of the items laid out. Proud farmers and some researchers and extension agents attend the booths, happy to talk about their produce with anyone who asks - and many do.

The fair-goers are impressed. "I didn't know it was possible to grow so many varieties of crops here," says one. An older farmer examines the maize on display and shakes her head in wonder. "I haven't seen these seeds since the 1960s," she says. "There are seven maize varieties here that I've never seen before," responds her companion.

Throughout the day the participants - farmers, researchers, and officials - exchange many opinions, ideas, experiences, and of course seeds. In the afternoon a committee that has been assessing the wealth of diversity at the fair awards prizes to the most outstanding displays. The first agricultural biodiversity fair in Guangxi province is attended by more than 2000 people. It is a huge success - and it will not be the last such event.

Multiple functions

The fair was the culmination of a year of planning and preparation by local farmers and a team of researchers who have been working in the province since 1999 to improve the livelihoods of resource-poor farmers through participatory plant breeding (PPB) techniques. It provided an animated demonstration of the results of a project, now in a second phase, that is a joint effort by the Center for Chinese Agricultural Policy (CCAP) and the Guangxi Maize Research Institute (GMRI). This project is built on a study carried out in the 1990s by the International Centre for Maize and Wheat Improvement (CIMMYT) and is supported by Canada's International Development Research Centre (IDRC) and the Ford Foundation.

This may have been the first agricultural biodiversity fair in China, but the concept has been tried successfully elsewhere, from neighbouring Nepal to the Andean highlands of South America. The fair in Guzhai adapted the experiences of similar fairs held in other countries to the Chinese context. Its purpose was primarily to bring together farmers, plant breeders, extension agents, seed merchants, and policy makers, and to demonstrate to them the diversity of genetic resources, knowledge and ways to strengthen resource management, as well as plant breeding and seed supply. The fair also provided opportunities for the exchange of both seeds and knowledge, and a chance to explore the market demand for PPB improved varieties. Last but not least, the success of the fair gives farmers the confidence to continue to strengthen local seed development systems.

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The authors acknowledge the contribution made by Bob Stanley in crafting this article.

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Other experiences with seed fairs have been described in previous LEISA Magazines. See for example the Zimbabwean experience described by Neuendorf, page 24 of issue15.3/4, Seeds for agrobiodiversity.

Land rights in Africa
http://www.oxfam.org.uk/landrights/

Access to land, which remains for many people in Africa the ultimate form of social security, is being severely threatened. The threat comes from a combination of local and international factors, which include excessive liberalisation, the search for foreign investment, and an often-blind faith in market solutions. This online "resource bank" of documents and references contains papers and reports from Oxfam GB and its partner organisations, its allies, and land rights specialists. The aim of the resource bank is to spread greater awareness of land rights issues, to make current information widely available, and to provide a point of contact for key actors in Africa and elsewhere. The resource bank is available for people without Internet by sending an email to www.4mail@web.bellanet.org.

Land Tenure Center
http://www.wisc.edu/ltc

The Land Tenure Center serves as a global resource institution on issues relating to land ownership, land rights, land access, and land use. The Center conducts research programs throughout the world on issues such as land tenure, land use, agrarian reform, land markets, legislative drafting, registration and titling, institutional dimensions of rural development, and natural resource management. LTC's research activities emphasise collaboration with host country institutions and individuals.

MYRADA
http://www.myrada.org/index.html

MYRADA is a NGO managing rural development programmes in three States of South India and providing on-going support including deputations of staff to programmes in six other States. It also promotes the Self Help Affinity strategy in Cambodia, Myanmar and Bangladesh. Their mission is to encourage a process of ongoing change in favour of the rural poor, by enabling them to build and manage appropriate and innovative local level institutions rooted in values of justice, equity and mutual support. The core strategy is based on the belief that enabling people to build up experience in governance - through managing their own institutions - is a major factor contributing to their empowerment.

The United Nations Research Institute for Social Development (UNRISD)
http://www.unrisd.org

Poverty eradication, the promotion of democracy and human rights, gender equity, environmental sustainability and the effects of globalisation are overarching concerns in UNRISD's work. These concerns are reflected in research carried out. An overview, together with details of the projects is available on this website. UNRISD also pursues an active and varied publications programme, which includes in-house and commercially published books, special reports, programme and occasional papers, as well as newsletters on specific events and the Institute's work in general. This website provides a catalogue of their publications, and free online access to many of them.

ODI Forest Policy and Environment Group
http://www.odifpeg.org.uk/publications/

The RDFN papers, outputs from the ODI Rural Development Forestry Network, are available from this website.

MEAD-ESA (Media for Environment, Agriculture and Development in East and Southern Africa)

MEAD-ESA is a new network for journalists, editors, radio and television staff, web masters and information officers concerned with the agricultural and environmental aspects of development. At a recent meeting of national representatives in Nairobi, strategies were discussed to increase journalists' capacity to report on agro-ecological problems and ensure that articles and features dealing with these issues appear more regularly in the local media. In this way, MEAD-ESA hopes to increase awareness of the many experiences, initiatives and results of research that already exists in the public domain but which is little known to agricultural policy makers and farm practitioners. MEAD-ESA was established in Lusaka in October 2002. It has national branches in Zambia, Malawi, Zimbabwe, and Kenya. It is also associated with journalists concerned with these issues in West Africa, Ethiopia, Mozambique and South Africa. The network is open to all those interested in this area of reporting and information sharing. Contact: Parkie Mbozi, pmbozi05@yahoo.com, Aghan Daniel, bta@swiftkenya.com or chimarcel@hotmail.com

CBNRM Net, Community-Based Natural Resource Management Network
http://www.cbnrm.net

Worldwide, people working on Community-Based Natural Resource Management (CBNRM), as practitioners, managers and researchers, are talking about an urgent need for greater communication capabilities. Capabilities for networking on CBNRM would make it possible for people to exchange experiences, manage relevant knowledge, and support learning across countries, sectors, cultures, and languages; and in this way achieve better results. *CBNRM Net* is a response to this call. *CBNRM Net*'s web site provides a powerful set of broad, robust and useful networking tools aimed at linking stakeholders. As a complete, integrated, and adaptable knowledge management tool, *CBNRM Net* is presented as a service to the global CBNRM community of practise.

The Centre for Alternative Agricultural Media (CAAM)
http://www.farmedia.org

CAAM is an Indian network for alternative agricultural journalism. One of their objectives is to facilitate the media to focus on the positive efforts carried out in the rural areas. As an example of their work, the first event contributing to this objective is Harogerige Hogona Banni (Come, let us visit Harogeri). This programme will unfold the different stages of sustainable

Call for contributions to a sourcebook on participatory research and development

Contributions are being solicited for a proposed Sourcebook on Participatory Research and Development, featuring field-tested concepts and methods for enhancing local people's participation in research. The focus will be on developing-country experiences associated with managing natural resources to support agriculture and rural livelihoods. Copyright-free and highly illustrated, the sourcebook is primarily intended for fieldworkers seeking to learn and apply participatory approaches in their research activities. Development of the sourcebook is a collaborative effort by the Users' Perspectives With Agricultural Research and Development (UPWARD) Network and partners around the world (see www.eseap.cipotato.org/upward). For more details about the sourcebook and guidelines for contributions, please contact Ms. Hydee de Chavez, CIP-UPWARD, c/o IRRI DAPO 7777, Metro Manila, Philippines (email hydee@laguna.net).

development in Harogeri to the media. BAIF Institute for Rural Development in Dharwad (India) has been working effectively in 22 villages including Harogeri, in Dharwad district for six years. Through its participatory activities, BAIF has reached the poorest of the poor. The programme has helped people improve their lives, by enhancing the natural resources in their villages and adopting many other developmental practises.

The Association of Agricultural Research Institutions in the Near East and North Africa (AARINENA)
http://www.aarinena.org/
AARINENA's mission is to contribute to the enhancement of agricultural and rural development in the Region. By fostering agricultural research and technology development and by strengthening collaboration within and outside the region, the website provides a list of regional and international organisations with details.

Network, smallholder irrigation market initiative (SIMI)
http://www.siminet.org
Access to irrigation is a limiting factor to the productivity and profitability of small farms in many parts of the world. Low-cost micro-irrigation and a series of other low-cost technologies related to small-scale irrigation like treadle, rope and similar pumps, small-scale water storage technologies etc. have a good potential to allow a large number of small farm households to escape the most severe poverty by producing high value cash crops for local and more distant markets, or food during the dry season, and thus to increase household incomes and improve livelihood security. Information, resources and links related to smallholder irrigation technologies, as well as market creation for their large scale dissemination are now available on the new website of the SIMI network.

Bees for Development
http://www.beesfordevelopment.org/
This new website of Bees *for* Development is an information service at the centre of an international network of people and organisations involved with apiculture in developing countries. Beekeeping is an effective way for poor people to strengthen their livelihoods, and Bees *for* Development works to provide information to assist them.

Policy Discourses On Women's Land Rights In Sub-Saharan Africa: The Implications Of The Re-Turn To The Customary by Whitehead, A and Tsikata, D.
This article examines some contemporary policy discourses on land tenure reform in sub-Saharan Africa and their implications for women's interests in land. It demonstrates an emerging consensus among a range of influential policy institutions, lawyers and academics about the potential of so-called customary systems of land tenure to meet the needs of all land users and claimants. This article which was published in the *Journal of Agrarian Change*, vol. 3, nos.1 and 2, January and April, 2003 is available as a pdf file from the "Land rights in Africa" resource bank at:
http://www.oxfam.org.uk/landrights/Re-turn.doc

PLAAS NETWORKS:

- **Co-Govern, promoting common property in Africa**
  http://www.uwc.ac.za/plaas/co-govern/
  The website of Co-Govern: Networks for Influencing Policy and Governance of Natural Resources. This project works to strengthen networks of African researchers and land professionals, to promote exchange of experience, dialogue and analysis, and identify ways of ensuring that local practise better informs legal reforms and policies regarding CPRs.
- **Pan-African Programme on Land and Resource Rights (PAPLRR)**
  http://www.cbnrm.uwc.ac.za/paplrr
  The PAPLRR network aims to develop and articulate a pan-African voice on land and resource rights, policies and advocacy, and engage with other stakeholders at regional and international research and policy-making events.

Both of these Networks are coordinated by the Programme for Land and Agrarian Studies (**PLAAS**), School of Government, University of the Western Cape, South Africa.
http://www.uwc.ac.za/plaas/

Water policy briefing
http://www.iwmi.org/waterpolicybriefing
Challenges of Integrated River Basin Management in India, issue 3 of the Water Policy Briefing series. This paper, available online, is about tailoring water management solutions to South Asia.

LEISA issue March 2004

Underutilised plant species

It has been estimated that humans have, at one time or another, cultivated or collected more than 7000 edible plant species. Today, however, only about 30 crops form the basis of world's agriculture. Over 50% of our energy requirements are now met by just three crops: rice, wheat and maize. The continuously narrowing base for global food security limits the options available to farmers, and reduces the agricultural biodiversity necessary to provide security in resource-poor environments.

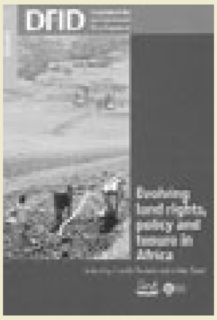
Many underutilised species are particularly useful in marginal lands where they have evolved through selection over generations to increase productivity and withstand stress conditions. These crops contribute to sustainable production and usually require less external inputs than high yielding varieties of major crops. Often they contain essential micronutrients not present in staple foods. These crops are also part of a great cultural heritage and diversity that enriches our lives. Many rural people and development organisations have recognised the importance of these underutilised and neglected species and have successfully increased their production and utilisation, thereby improving livelihoods, providing more options to small farmers and increasing diversity within the agricultural system. This issue of LEISA will present some of these successful cases. We invite articles on experiences with revival, conservation, cultivation, utilisation and marketing of underutilised plant species that are interesting to field practitioners and will make it possible to promote the use of these species.

Deadline for contributions is the 1st of December, 2003.

You are invited to contribute with articles (about 800, 1600 or 2400 words + 2-3 illustrations and references), suggest possible authors, and send us information about publications, training courses, meetings and websites. Editorial support is provided by ILEIA. Authors of published articles are entitled to a standard fee of US$ 75,–.

The common property resource digest International Association for the Study of Common Property (IASCP), PO Box 2355, Gary IN 46409 USA. Email: iascp@indiana.edu.
This quarterly publication of the International Association for the Study of Common Property (IASCP) addresses common property issues from all over the world. Besides a forum discussion on what makes institutions for the management of common-pool resources emerge and function successfully, the March issue presents a series of short articles dealing with the role of the commons in Eastern Europe's transition away from communist property systems. A digital library of the commons is available from the website: http://dlc/dlib/indiana.edu (WR)

ODI natural resource perspectives Overseas Development Institute (ODI), 111 Westminster Bridge Road, London SE1 7JD, UK. Manage, India. Email: nrp@odi.org.uk; www.odi.org.uk/nrp/
This Indian edition of the Natural Resource Perspective series is co-published by National Institute of Agricultural Extension Management (Manage) and Overseas Development Institute (ODI). The series presents accessible information on current development issues from a policy point of view. It is available in print and from the website www.odi.org.uk/nrp/ as a pdf file.



Evolving land rights, policy and tenure in Africa by Toulmin C, Quan J (eds). 2000. 336 p. ISBN 1 899825 51 7 GBP 12.50. Drylands Programme, IIED, 3 Endsleigh street, London WC1H ODD, UK. Department for International Development (DFID). (DFID issues). Email: drylands@iied.org; www.iied.org/drylands
The material in this book draws on a 1999 workshop on Land Rights and Sustainable development in Sub Saharan Africa, at which DFID brought together policy makers, researchers and civil society representatives from across the African continent. The book follows the overall thematic structure of the workshop. It examines the linkages between land reform, economic growth, and poverty reduction. It discusses the legislative and practical challenges of tenure reform and the harmonisation of customary and formal land rights in both anglophone and francophone Africa; the management of Africa's commons; opportunities for and constraints on women's land rights; institutional arrangements for securing and managing land rights; the challenges of decentralisation; and policy and implementation processes that are currently underway. The appendix provides network addresses. (WR)

Land policies for growth and poverty reduction: a World Bank policy research report by Deininger K. 2003. 208 p. ISBN 0 8213 5071 4. The International Bank for Reconstruction and Development/The World Bank, 1818 H Street, NW Washington DC 20433, USA. Email: feedback@worldbank.org; www.worldbank.org
This report aims to strengthen the effectiveness of land policy in support of development and poverty reduction, by setting out the results of recent research in a way that is accessible to a wide audience of policymakers, NGOs, donor agency officials, and the broader development community. Its main message rests on three principles: First, that providing secure tenure to land can improve the welfare of the poor, by enhancing the asset base of those whose land rights are often neglected. Second, that facilitating the exchange and distribution of land, at low cost, through markets as well as through non-market channels, is central to expediting land access by productive but land-poor producers. Third, that governments have a clear role to play in promoting and contributing to socially desirable land allocation and utilisation. This report can make an important contribution in the policy debate on land. It can provide the basis for integrating land into broader strategies and implementing specific land policies that will help increase growth in a way that benefits poor people. The full report is available online at http://econ.worldbank.org/prr/land_policy/text-27809/ (WR)

The economic role of women in agricultural and rural development: revisiting the legal environment: summary report of a seminar Kampala, Uganda 19-23 February 2001
2002. 72 p. ISBN 92 9081 2621. Technical Centre for Agricultural and Rural Co-operation (CTA), PO Box 380, 6700 AJ Wageningen, The Netherlands. Email: cta@cta.nl; www.cta.int/pubs/women/index.htm
Recognising the importance of the role women play in agricultural and rural development is fundamental to any attempt to strengthen their economic situation through improved legal rights. The legal environment provides the framework determining women's access to productive resources. The objective of this regional seminar was to raise two important issues regarding women's legal status. First, the state of current legislation and the way it treats women, an issue of lobbying for change on the part of women and raising awareness on the part of the legislators. Secondly, it addressed women's awareness of their legal rights and their ability to claim these rights, an issue of information, legal literacy and legal counselling. The seminar addressed these issues through papers focusing on the legal environment in Eastern and Southern Africa, women's entitlement to productive resources and their access to legal rights. It concluded with recommendations for policies and strategies to strengthen the legal status in rural areas in the region. With this report, CTA provides a valuable document for everyone involved in gender and rural development. The report also provides an annex with a list of website resources on the topic. (WR)

Going home: land & property issues 2000. 47 p. The Refugee Studies Centre (RSC) in association with the Norwegian Refugee Council, Queen Elizabeth House, 21 St Giles, Oxford, OX1 3LA, UK. Email: fmr@qeh.ox.ac.uk. (Forced Migration Review no 7: ISSN 1460-9819).
Housing and property restitution has emerged as one of the most important components of post-conflict reconciliation and rehabilitation. This special issue of Forced Migration Review deals with many of the difficult issues arising from schemes to restore property to returning refugees. Contributions about situations in Asia (Bhutan), Lebanon, Central Africa, Latin America (Guatemala, Colombia) and Europe (former Yugoslavian countries) make this issue to a valuable source of information on the topic. It also describes an innovative self-help project seeking to promote eventual restitution and return. (WR)

Stakeholder incentives in participatory forest management: a manual for economic analysis
by Richards M, Davies J, Yaron, G. 2003. 238 p. ISBN 1 85339 559 5. Overseas Development Institute (ODI), ITDG Publishing, 103-105 Southampton Row, London WC1B 4HL, UK. Email: itpubs@itpubs.org.uk; www.itdgpublishing.org.uk.
This manual aims to help the economic analyst assess the incentives of local forest users in a context of multi-purpose forestry. The main users will be those with a formal training in agricultural or natural resource economics, but with limited experience in applying economics in participatory forest management. What makes the manual innovative is its approach to enabling small farmers and foresters to participate in using economic tools to analyse their situation and identify solutions to their problems. Using concrete examples from Bolivia, Ghana, Mexico, Nepal and Zimbabwe, the authors give practical

advice on how to conduct farmer workshops, rapid rural appraisals, key informant interviews and household surveys that incorporate simple economic tools in ways that allow greater discussion, feedback and debate with local farmers. (WR)

Lake Mweru is our bank: a documentary on resource management of a Zambian fishery 1995. EURO 25.– STUG Video productions, P.O.Box 3011, 6802 DA Arnhem, The Netherlands. www.stug.nl

This video is a documentary on resource management, created to inform policymakers, politicians and fishery managers in Zambia about the complexity and dynamics of the Mweru-Luapula Fishery and its significance for the livelihoods of so many people. It highlights the importance of considering economic, social, political and historical aspects of fisheries management next to ecological dynamics. It provides insight into the conflicting interests of various stakeholders. The formulation of new policies for community-based management of inland fisheries could be much improved if these policies are based on the area specific problems and potentials. Such policies can only be put in practise if local ideas and initiatives for managing the fishery are taken into consideration.

Borders, rules and governance: mapping to catalyse changes in policy and management by Alcorn JB. 2000. 24 p. International Institute for Environment and Development (IIED), 3 Endsleigh Street, London WC1H 0DD, UK. Email: sustag@iied.org (Gatekeeper Series no. 91 ISSN 1357-9258)

This issue of Gatekeeper is about the role that mapping techniques and satellite imagery can play in improving local decision-making and enabling local analyses to be shared with outsiders in order to improve national level policies. Maps reveal information about conflicts, overlaps and trends in areas where rights and responsibilities are cloudy. Mapping programmes can empower civil society efforts to bring accountability and transparency to local and national governments. This paper uses numerous examples to highlight the power of maps in bringing about local change. (WR)

The future of community lands: human resources by Ndione E, Leener Ph (de), Ndiay M, Jacolin P, Perier JP. 1995. 236 p. ISBN 1 85339 248 0 (pbk): USD 28.50. GTZ Supraregional Project 'Natural Resource Management by Self-Help Promotion (NRMSH)', Wachsbleiche 1, D-53111 Bonn, Germany. Intermediate Technology Publications (ITP), 103-105 Southampton Row, London WC1B 4HH, UK.

This detailed account of the experiences of the Research-Action-Learning Group (GRAF) of ENDA (Environment and Development Activities in the Third World) in Senegal traces the history of relationships between local people and external agents, both governmental and NGO. The cases refer to tree planting on community land in the Thiès area and dam building in the Kaolack area. Differences in perception of natural resource management become obvious when tree planting in Africa is seen in the context of deforestation and afforestation in Europe: in the eyes of the Africans, trees were instruments of colonial domination. The fascinating history of development in the Thiès area, related by local farmers themselves, points to numerous indigenous projects, experiments and innovations without external assistance. The history is told from only one viewpoint; other ethnic groups in the area, such as the Fulani herders, might have enriched (and confused!) it. ENDA-GRAF makes a very honest and revealing analysis of the convoluted path of interaction between them and the various local interest groups, and uncovers the very diverse interests and power issues within each "community". Some very useful ideas for analysis of actors and motivations are given. Creative management of uncertainty and reflective analysis of failure and confrontation were important keys in the learning process by both villagers and fieldworkers. The book gives much food for thought. This publication originally appeared in French, but, strangely, the original is not mentioned. (AWB)

Water rights and empowerment by Boelens R, Hoogendam P (eds). 2002. 256 p. ISBN 90 232 3764 1: EURO 25.00. Van Gorcum, PO Box 43, 9400 AA Assen, The Netherlands. Email: assen@vangorcum.nl

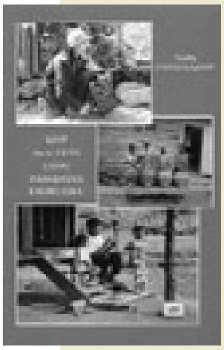
In the Andean region, local users, organised into peasant or indigenous communities, have built most irrigation systems. Commonly, they also manage their own systems collectively. This book emphasises the issues of internal water rights, within irrigation systems, but since collective rights between irrigation systems or between these systems and other types of water users are becoming increasingly important, it also includes a chapter on collective rights within the context of water management in watershed or catchment areas. Further chapters reach beyond the system level: discussing the issue of local collective rights regarding other normative frameworks, other groups of local, regional or national interest, and from the perspective of national legislation. With this book, the authors seek to contribute to the development of methodological proposals that strengthen local water control and empower peasant and indigenous communities. (WR)

Land, trees, and women: evolution of land tenure institutions in Western Ghana and Sumatra by Quisumbing AR, Otsuka K [et al]. 2001. 90 p. ISBN 0 89629 122 7. International Food Policy Research Institute (IFPRI), 2033 K Street, N.W., Washington, D.C. 20006, USA. (Research Report 121). Email: ifpri@cgiar.org; www.ifpri.org/pubs/pubs.htm

How do women's land rights change as customary tenure systems give way to individualised land tenure? While the individualisation of land rights creates incentives for poor farmers in marginal areas to adopt agroforestry, not much is known about its impact on women's land rights. This research report examines the evolution of customary land tenure institutions in areas of Western Ghana and Western Sumatra where traditional matrilineal inheritance systems have been changing. In these two areas, the authors find that individualisation of land tenure has contributed to both increased gender equity and to greater efficiency in agroforestry management. While property rights institutions are moving toward providing proper incentives for efficient natural resource management, the authors conclude that any program or legal framework that assigns rights to resources must be evaluated for barriers to women's participation. This book is recommended for professionals involved in natural resource management, agroforestry, gender and development, food policy, rural development, and property law/property rights. (WR)

Visit our website: www.ileia.org

Best practices using indigenous knowledge
by Boven K, Morohashi J (eds). 2002. 280 p.
ISBN 90 5464 032 4. Nuffic-CIRAN (Centre for International Research and Advisory Networks), P.O.Box 29777, 2502 LT The Hague, The Netherlands; UNESCO-MOST (Management of Social Transformation Programme). Email: ik@nuffic.nl; www.nuffic.nl/ik-pages; www.unesco.org/most/bpindi.htm
Indigenous or local knowledge refers to a body of knowledge, know-how and practises maintained and developed by peoples, generally in rural areas, who have extended histories of interaction with the natural environment. This publication, the result of cooperation between Nuffic and UNESCO/Most, aims to encourage researchers and policy makers to take indigenous knowledge and practises into account in all activities affecting local communities. It presents 22 best practises illustrating the use of indigenous knowledge in the development of cost-effective and sustainable strategies for poverty alleviation and income generation in Africa, Asia and the Americas. The publication includes the guidelines used to document the cases, the cases themselves and indexes to facilitate searching the information. The practises presented in this publication have also been added to the Indigenous Knowledge database, available at www.unesco.org/most/bpindi.htm (WR)

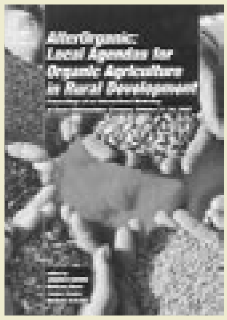


Agriculture and HIV/AIDS by Guerny J du. 2002. 16 p. ISBN 974 680 204 6. United Nations Development Programme (UNDP), South East Asia HIV and Development Project. www.hiv-development.org/publications/ewrs.asp
The impact of HIV/AIDS on the farm-household level is impressive, ranging from abandoning the cultivation of remote fields or cash crops to the sale of assets to cover medical and funeral expenses. In such a context, agricultural policies and programmes have a crucial responsibility in reducing the conditions that create vulnerability in rural populations, leading to higher risks of HIV infection. This paper argues that the agricultural sector should not attempt to carry out health work for which it is ill equipped, but concentrate on activities in agriculture. Agriculture can be developed in such a way as to increase the resilience of rural populations and thereby contribute significantly to HIV prevention. (WR)

INASP rural development directory 2003/2004 2003. 455 p. ISBN 1 902928 15 6 GBP 25-. International Network for the Availability of Scientific Publications (INASP), 27 Park End St., Oxford OX1 1HU, UK. Email: pwr@inasp.info; www.inasp.info/pubs/rd
The aim of this Directory is to provide access to a wide range of information on rural development, and particularly to promote South-South information dissemination and interchange. It contains profiles of more than 430 international, regional and national networks and organisations around the globe. Each entry provides contact details and a brief description of the organisation, highlighting its objectives, activities, subject areas of interest and geographical coverage. In addition there is often further information provided by the organisations, including newsletters, journals or online documents. The directory is also available on the INASP website at www.inasp.info/pubs/rd or www.inasp.info/south/index.html where the contents will be updated on a regular basis. CTA will make copies of the CD Rom available free of charge to its ACP subscribers. INASP also has a limited number of copies of the print version at available for organisations in developing countries which do not have access to computers with CD ROM drives.

People-oriented approaches in global conservation: is the leopard changing its spots? by Jeanrenaud S. 2002. 68 p. ISBN 1 84369 036 5. International Institute for Environment and Development (IIED), 3 Endsleigh Street, London WC1H 0DD, UK. Email: INFO@IIED.ORG . Institute for Development Studies (IDS), Sussex, UK. Email: IDS@IDS.AC.UK (Institutionalising participation series).
Local people were once considered a threat to nature and were often removed from protected areas. Today, global conservation organisations like WWF and IUCN are promoting a wide range of people-oriented conservation approaches. This publication includes the main findings of a collaborative research programme coordinated by IIED and IDS. The programme was designed to examine the dynamics of institutionalising people-centred processes and participatory approaches for natural resource management, and includes case studies in West Africa, India, Indonesia and Mexico. The authors of this publication suggest that it is important to exercise caution in claiming that 'participation' has been mainstreamed in global conservation programmes. An analysis of people-conservation narratives identifies contrasting ways in which 'nature', 'problems' and 'solutions' are framed. Beyond possible lessons for conservation agencies, this study highlights several questions and issues of wider interest to organisations involved in participatory natural resource management. (WR)

Alterorganic: local agendas for organic agriculture in rural development: Proceedings of an international workshop at Bonn-Königswinter, Germany, October 21-24, 2002 by Kotschi J, Bayer W, Becker T, Schrimpf B (eds.). 2003. 186 p. ISBN 3 8236 1403 7 EURO 10. AGRECOL, Johannes Acker 6, D-35041 Marburg, Germany. Email: info@agrecol.de; kotschi@agrecol.de; www.agrecol.de



This workshop was prepared by the AGRECOL working group on Organic Agriculture in Rural Development. The group has taken care to identify key problem areas faced by developing countries in the promotion of their organic sector, as well as important experiences from developing countries, as stimulants for focused and result-oriented discussions. Much of the discussion and many of the activities concerned with promoting organic farming in the South have been focused on marketing organic products in the North. This workshop aimed to broaden the discussion. Producing for overseas markets is only one of many reasons for promoting ecologically sound or organic agriculture in the South. This volume presents the papers contributed to the workshop and the main outcomes of the working groups and the plenary discussions, including the Bonn Declaration prepared by the participants. (WR)

Economic change, governance and natural resource wealth: the political economy of change in Southern Africa by Reed D (ed.). 2001. 168 p. ISBN 1 85383 872 1: USD 25-. Macroeconomics for Sustainable Development Programme, WWF-International. Earthscan Publications, 120 Pentonville Road, London N1 9JN, UK. Email: orders@lbsltd.co.uk; www.earthscan.co.uk
As the debate regarding the benefits and costs of globalisation evolves, this book confronts the stark realities of how economic and political reforms in southern Africa have affected the poor and the environment. It further examines the crucial role of international development and business communities in creating effective institutions for long-term, sustainable prosperity and social vitality.

Food production and HIV/AIDS

In Zimbabwe, where two-thirds of the population live in the rural areas, poverty and underdevelopment have facilitated the spread of HIV/AIDS. Throughout Southern Africa, governments have tended to see HIV/AIDS as a health problem. However, experience shows that HIV/AIDS is much more than this. Not only has the epidemic caused social and emotional devastation but it has crippled the capacity of many village communities to produce the food they need for an adequate and nutritionally balanced diet. Without reliable and varied food the population becomes more susceptible to disease and the sick deteriorate quickly. The remaining households do not have the strength and energy to meet the increasing demands made on them by the HIV/AIDS epidemic including caring for the sick and orphans at the same time as they have to take increasing responsibility for providing good food.

Poor diet leads to deteriorating health and effects both physical and mental development. In both the short and long term this can only lead to an intensification of poverty and the persistence of conditions that break people's resistance to disease. For those already infected with the HIV virus good nutrition can help delay the onset of AIDS. The sustainable production of good quality food is, therefore, basic to breaking the cycle of poverty related disease. However, food production depends on secure access to natural resources, and in many parts of Southern Africa large numbers of rural households do not have access to sufficient agricultural land or the agricultural inputs they need to grow food.

Impacts

HIV/AIDS has caused a particularly heavy death rate amongst able-bodied men and women. This is clearly reflected in the demography of rural Zimbabwe. More than 52 percent of the country's population are women and 86 percent of them live and depend on land for their livelihood. Women account for 70 percent of the agricultural population but many have no land, few resources, are illiterate and excluded from information and decision-making processes because of their weak social status. HIV/AIDS has had a dramatic effect on the lives of many of these women. In communities devastated by HIV/AIDS it is becoming increasingly difficult for them to meet their responsibilities and provide food and care.

Two systems

Zimbabwean women have no constitutional rights under customary law. This is a legacy of British colonialism which maintained the system of traditional law alongside the statutory law they introduced to support their colonial administration. For the British, both at home and in the colonies farmers were by definition men. They had little interest in the complexities and inequalities of women's land rights under customary law, even in those areas hardest hit by labour migration.

Since the early 1900s, land tenure arrangements in Zimbabwe, as in neighbouring Botswana, Zambia, Malawi, the Republic of South Africa and Swaziland have been based on British, Roman Dutch and customary law. These systems apply to different categories of women and define rights of ownership and access according to their own specific principals.

Under statutory law women can buy land on the open market but not many rural women are able to get control of land in this way. In pre-colonial times, customary land tenure arrangements offered relative security to all members of the community. Women were given pieces of land to manage in their own right either by their fathers or by their brothers and husbands. The political and economic changes of the twentieth century, however, have destabilised customary practises and gradually eroded the effectiveness as far as women's rights to land are concerned. Today, in Southern Africa where customary law puts the inheritance rights of a man's paternal relatives above those of his wife, the traditional system is often unable (or unwilling) to meet its responsibilities to his widow.

The provisions of statutory and customary law as these were developed in the colonial period were taken up in the constitution many of independent African states. Zimbabwe is an example. Whilst the Zimbabwean constitution states that every citizen has an equal right to the ownership of property, women do not have the right to land under customary law. More recent legislation passed by the Zimbabwean government has strengthened customary law and further weakened the position of women living in communal areas. Today women have no secure access to land and can never be certain that they will be able to benefit in the long term from the labour and capital they invest in land that they hold through rights that belong to their husbands or other male relatives.

Agricultural productivity suffers not only because implements and other assets often have to be sold to pay for medicine, but also because women, although they play a major role in agricultural production, may not always have the agricultural knowledge they need to carry out tasks traditionally done by men. A hidden effect of HIV/AIDS is that the transfer of agricultural knowledge between generations and from one member of the rural community to another is rapidly deteriorating. The impact this has on women's capacity to deal with agricultural problems is intensified by the fact that women generally have less access to agricultural extension services than men. While access to land is fundamental to food production, it must be combined with the knowledge and capacity to use it effectively.

■

This article has been compiled by the editors.

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Recording land rights at Ekuthuleni

Donna Hornby

Ekuthuleni, a former mission station farm owned by the Department of Agriculture and Land Affairs (DLA), lies in Melmoth on South Africa's north coast. Long-term tenants at Ekuthuleni asked the DLA to upgrade their informal tenants rights into community ownership so that land rights issues would no longer delay the development of their area. The DLA agreed, and aims to complete the process of transferring the land to a Communal Property Association (CPA) in 2003. 240 households are involved in this process.

Members of the Ekuthuleni Communal Property Association viewing a boundary map. Photo: AFRA

Some residents at Ekuthuleni wanted individual land ownership while retaining links to the Ntembeni tribe that administers them. However, this option raises problems:

- People with incomes below the poverty line cannot afford the costs of surveying and transferring property;
- Government property administration agencies (specifically Deeds and Surveys) are far away from poor, rural people and their rules and requirements difficult to understand;
- Exclusive nature of ownership can undermine household access to essential firewood, grazing, thatching, water, herbs and mud;
- Simplification of ownership rights can erode the complex rights that extend to family members in practise.

In 1998, the DLA contracted the Association for Rural Advancement (AFRA), a leading South Africaland NGO, to assess the tenure rights of people at Ekuthuleni and recommend how it should proceed with the application to upgrade them. AFRA advised the DLA to transfer the land to a communal entity, which would allow the community to develop its own constitution on how land would be held and managed. This would be less expensive to arrange as individual rights, and would ensure links were retained with the tribal authority.

AFRA offered to help the community to develop legal, affordable and accessible records of household land rights in order to strengthen the communal system and give households more security over their holdings. Records or "individual ownership documents" would provide households with evidence of their land rights and enable them to settle disputes and access credit. More importantly, they would protect holders from arbitrary eviction or loss of land rights, and give them the right to decide how to manage and use the land.

Registration

The first step in the registration process was a detailed tenure revue to establish how land was currently being allocated, subdivided and transferred. Research showed a widespread experience of insecure tenure resulting from changing practises and rules. It also showed there was local capacity to administer land allocation and rights. The next step was to find cheap ways of providing land records to households.

A stakeholder meeting including participants from government departments, academics and tenure experts met to discuss this problem. Systems and procedures for producing and maintaining records were discussed at a community workshop late in 2000. Much progress has been made on producing and presenting these records and deciding on who would be responsible for maintaining them locally. Everyone is aware that managing the process of formalising tenure requires great care because changes can threaten existing arrangements.

In Ekuthuleni AFRA is still working on ways to provide affordable and accessible records of household land rights. An advisory committee of key stakeholders that includes NGOs, CBO, and government departments directs and guides the process. A major objective is to develop and support local structures and establish links to external institutions that can help issue records, mediate disputes and assist in the evaluation of records when credit application are being assessed or disputes resolved. Project experiences are shared with other NGOs and government departments, as well as with national and international tenure experts in order to influence tenure reform in South Africa.

Recording rights in informal tenure, to ensure security and at the same time creating links to formal institutions is a complex process. In a system like South Africa, where an extremely accurate and secure formal land tenure system exists side by side with an informal tenure system that depends on an individual's ability to negotiate rights through local institutions, it is a major challenge. ■

For more information on the Ekuthuleni experience see
www.oxfam.org.uk/landrights/custten.rtf

Donna Hornby. Association For Rural Advancement (AFRA), P.O. Box 2517, Pietermaritzburg 3200, South Africa. Email: donnah@icon.co.za; afra@icon.ca.za

Community consultation and national lobbying in South Africa

Ben Cousins

South Africa's new democratic government is working on a large and ambitious land reform programme. During apartheid, access to land was determined by race. Black South Africans were removed from their lands and resettled in so-called homelands. These areas included some of the poorest and most degraded soils in the country and they became islands of rural poverty whose main function was to provide industrial labour for South Africa's farms, mines and urban areas.

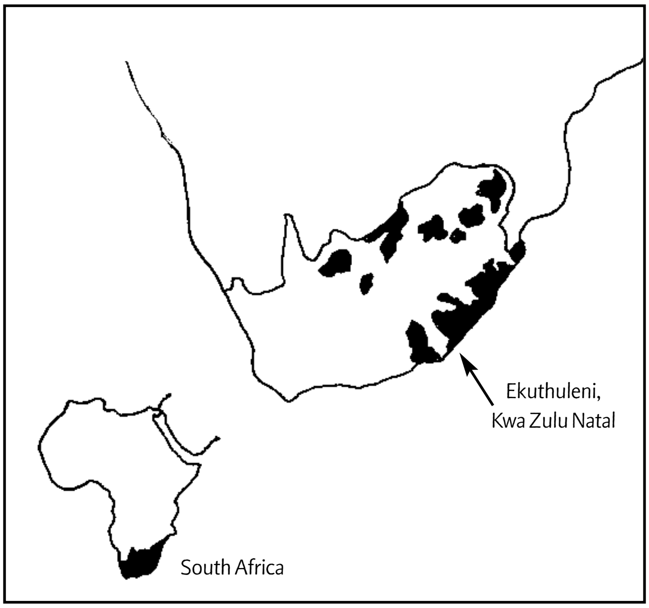

Figure 1: Communal lands in South Africa

The Republic's current land policy has three main aims: to redistribute land, to give back land taken away under racist and discriminatory practises, and to develop a system of land tenure that will give the rural population living in the homelands a greater degree of land security as well as protecting farm workers and labour tenants from arbitrary evictions.

Insecurity

Communal land has a second-class status in South Africa. Those living under these types of tenure arrangements are dependent on the local authorities – the traditional leaders – for access to land and the right to use it. Rights of occupation are not recognised and this increases insecurity. The near-collapse of land administration has further aggravated the situation and women are in a particularly difficult position.

In many places development projects have been held up because the status of land is unclear. This has had a particularly deep impact in community areas where houses, roads and other infrastructure are urgently needed. These problems have increased the tensions that already exist between traditional authorities and local administration and make it more difficult to determine how land should be allocated for development and how access to common resources such as grazing, firewood and water should be guaranteed.

A draft Bill

In August 2002, a draft Communal Land Rights Bill (CLRB) was published and the public was asked to discuss its contents. The aim of the Bill was to transfer title or ownership of land in the former homelands from the state to local communities. Before this could be done, however, communities would have to make an inquiry into lands rights in the area, organise community meetings to inform people of the proposed changes, and reach agreements on what constituted the boundaries of the community. Before transfer of ownership can be completed, the community also has to work out a set of rules that describe the land tenure rights of all individuals, households and families in the community. The community's legal right to own land can only be recognised when this has been registered. After this has been done a Land Administration Committee (LAC) must be elected to manage the property.

Under the proposed CLRB, traditional leaders can become members of the LACs, but only as advisors and they must not make up more than 25 percent of the LAC. Such groups as the *Congress of Traditional Leaders of South Africa* have protested strongly against this regulation and have demanded that the traditional role of tribal authorities in administrating land be reinstated.

LACs

In the Communal Land Rights Bill, the LACs have great power. These bodies are responsible for the land administration system at the local level. Within the community they are responsible for defining land rights and making sure they are recorded and registered. However, the draft CLRB does not make any provision for supporting the LACs either financially or institutionally. Officials will be made available if inquiries are necessary or communities need help to implement the law but this is very inadequate given the enormous and difficult task facing the LACs if the Bill is passed.

What the Bill means

The publication of the draft CLRB in 2002 has stimulated widespread public debate on communal tenure reform in South Africa. Although the government said it wanted to encourage discussion on the issues proposed in the new legislation, it has done little to facilitate this process. Instead it has been left to civil society organisations and others involved in community land reform to get discussions going on the CLRB. In recent months many activities have be organised in the communal areas to encourage the exchange of experiences and views on existing land tenure arrangements and the new legislative proposals. The National Land Committee and the Programme for Land and Agrarian Studies of the University of the Western Cape has been involved in this process through a project designed to increase people's understanding of the effect the Bill will have on their rights to access and control of land. Amongst project activities was a symposium to discuss experiences of tenure reform in other parts of Africa, the provision of capacity building support to NGOs working on land tenure issues, and advocacy and lobbying activities such as holding workshops on the Bill with a range of civil society stakeholders.

A series of seven consultative meetings were also held between November 2002 and April 2003. These meetings were attended by 700 participants from 75 rural communities in 5 provinces and representatives were chosen from the meetings to report their recommendations to the Parliamentary Portfolio Committee on Agriculture and Land Affairs.

Community views

The field experiences of NGOs and views expressed by community members in the consultative meetings suggest that the CLRB has many weaknesses. These conclusions have been confirmed by those attending the consultative meetings. Many were concerned about the negative effect the collapse of the present system of land administration has had on land security in the communal areas, and were disappointed that the draft CLRB did not go far enough in dealing with the chaotic and complex situation in which land rights would have to be administered. There was no attempt in the Bill to define the relationship between the LACs and local authorities, for example, and although the draft CLRB gave LACs far-reaching powers, it made no attempt to create a link between their work and the function of local government. Where tensions already existed between traditional leaders and local authorities it was felt that the provisions of the CLRB would only makes them worse. There was an urgent need to resolve this standoff and it should be taken into consideration in redrafting the CLRB.

Common property

The fact that the draft CLRB made no provision for managing access to and control of common resources such as grazing, mud, thatch, wood and water was seen as a very serious omission. If the new Bill does not protect these rights, the rural poor can be denied access by more powerful members of the community or by interventions from outside.

Those attending the consultative meetings also raised the complex and sensitive issue of boundaries. A major criticism of the Bill was that the boundary issue was not well covered by the proposed legislation. Under the terms of the draft CLRB, title would be transferred to the communities as a first step towards tenure reform and it would be the job of the LACs to define community boundaries. It was pointed out that serious problems could arise in situations of conflicting claims, especially if these were tribally based. Representatives from areas with experience of boundary conflicts such as Elim in Limpopo Province, where communal land borders on the three former 'homelands' of Gazankulu, Venda and Lebowa, warned that the CLRB seemed to be "returning to apartheid thinking" in basing its proposals to formalise boundaries along traditional (ethnic) lines.

Whilst defining tenure rights and granting title to land would remove one of obstacles to development, confirming old boundaries in communal areas where there was already overcrowding and land shortage would only make the situation worse. Legislation such as the CLRB could not deal with this type of problem and there was a need for more comprehensive land policy.

The consultative meetings also provided women with the opportunity to discuss the implication of the proposed legislation for their right to access and control land. It was agreed that the CLRB did little to improve women's land security. They could still be evicted from their land when their husbands died or they divorced, and no provisions had been made to include them in communal decision-making processes on land issues. The biggest weakness of the CLBR as far as women were concerned was that it did not state that land rights must be given to men AND women and that land should be allocated to women on the same terms as men.

Local action to national lobby

Concerns about the implications and possible effects of putting the CLRB into practise were widespread amongst NGOs and other organisations working with local communities on land tenure issues.

The need to discuss the implications of the CLRB provided a focus for a wider discussion on land tenure reform. It gave those who had discovered the limits of local action the chance to link up with a wider national lobby. In this way they would be better able to put pressure on government for a national policy framework and new legislation on communal land rights that was strong enough to guide the highly sensitive and complex process of land tenure reform. The consultative meetings described here give an indication of how local experiences, views and strategies can be brought to together and taken forward into a process of national lobbying and advocacy.

Alternative proposals

Discussions on the CLRB during the consultative meetings indicated that the new Bill should:

- Recognise existing occupation and use rights and give them the status of secure property rights, without waiting for a time-consuming and expensive process of transfer of title which government is unwilling to devote sufficient funds to or create capacity for;
- Ensure that measures to secure individual rights were complemented by mechanisms to support the management of common property and other resources held in common;
- Make sure people can participate in community processes as stakeholders with guaranteed rights;
- Explicitly define and secure the rights of women;
- Provide rights holders and local land administration bodies with government support as part of a wider, clearer programme of rural development.

A revised version of the CLRB is scheduled to go before parliament in August 2003. It remains to be seen whether community and civil society views will be taken into account. What has been made clear from civil society action is that consultations not only yield powerful insights into the nature of land tenure problems but can also lead to the development of potential solutions. The conclusions of meetings such as those mentioned above have shown that there is a limit to the progress that can be made on land tenure issues through local actions alone and that it is necessary to establish links with other community groups in a co-ordinated process of lobbying and advocacy at the national level.

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Traditional water management in Bali


The Subak system makes water available for irrigation in the hills. Photo: Rik Thijssen

I.G. Suarja and Rik Thijssen

The Indonesian island of Bali is famous for its unique system of irrigation. Guided and informed by religious values, it combines impressive feats of engineering with complex and elaborate social structures.

Most of the 162 large streams and rivers that flow from Bali's mountainous interior have cut deep channels into its soft volcanic rock. This has made it impossible for farmers to dam and channel water for irrigation in the usual way. Instead, they have taken to cutting tunnels through the rock, and constructing elaborate aqueducts and bamboo piping systems to carry water to the top of a series of terraced rice fields. From here it can flow, with gravity, from *sawah* (field) to *sawah*.

Community organisations called *Subak* control the water irrigation system to ensure reliable, fair and equitable distribution. Besides its technical functions, the *Subak* also provides social benefits including strengthening the possibilities of its members to maintain social contacts. This is reflected in the various communal activities undertaken in the form of task-oriented self-help groups (*seka*).

Community groups and group activities are traditionally very important in Balinese society. They reflect the significance attached in Hindu philosophy to the relationships an individual has with others members of society. This is a highly valued principal particularly in rural society.

Bali's famous *Subak* system is one of the most vital components of Balinese society. Built over the course of several centuries, it remains an integral part of Balinese life and is a product of the island's history and culture.

Subak

Irrigation is essential to Balinese agriculture because of the long dry season that extends from April to October. The elaborate system of channelling water from lakes, rivers and springs across countless *sawahs* is controlled by fully autonomous *Subaks*. Their engineering knowledge is sophisticated and the tunnels they build and maintain through the hills can be up to 3km long and 40m deep.

The distribution of irrigation water among *Subak* members is based on the principle of *ayahan.* This is the right of the *Subak* members to make use of available water resources in exchange for *ngayah* or free communal work on *Subak* activities. All *Subak* members have the same right to irrigation water. The amount of water is computed by dividing the total amount of water available by the number of *Subak* members.

A *Subak* consists of all the landowners – or their representatives - in a particular rice production area. The *Subak* is not only responsible for the construction and maintenance of canals, tunnels, aqueducts and dams, and for the distribution of water, but also coordinates the planting and organisation of ritual offerings and festivals.

Registered *Subak* members are mostly men because they are regarded as the representatives of their family. However, women are also involved in meetings as they play a major role in the various religious ceremonies.

There are about 1500 *Subaks* on Bali (1999) each with about 200 members and they cover a total irrigated area of more than 90 000 ha. The organisation of the *Subak* includes the *Paruman Subak* (General Assembly), the *Prajuru Subak* (Board), and the *Kerama Subak* (Members). The general assembly is the highest forum, and allows for open and democratic discussion among the *Subak* members, in order to create consensus on issues of general interest. The *Subak* Board is elected through the General Assembly.

Participatory management is typical in *Subak* organisations. A *Subak* head can call for meetings to discuss and decide upon issues such as maintenance work, cropping plans and the


Collective burning of rice straw to control pests. Photo: Rik Thijssen

allotment of water to members. Responsibilities and duties for *Subak* activities are equally distributed among the members, regardless of family status or social position. Obligations are in direct proportion to the amount of water *Subak* members receive for irrigating their rice fields. For example, farmers who receive one *tektek* - the amount of water necessary for one-season irrigation of rice fields with an area up to about 1 ha - are asked either to take full part in manual activities, or to provide financial compensation as specified in *Subak* regulations.

Subak organisation

- **Sedahan Agung**: the highest Subak institution, located at the office of regional income at district level. A Sedahan Agung is a regional government position with a regular government salary.
- **Sedahan Yeh**: similar to Sedahan Agung, but located at a lower hierarchy of a watershed of a river (yeh) in a district.
- **Subak Gede**: Subak organisation at a watershed ecosystem, socially organised, led by a sedahan or pekaseh gede, at sub-district level.
- **Subak**: water user organisation at a part of a watershed area, headed by a pekaseh and socially organised.
- **Tempek**: the lowest hierarchy of water user organisation at a planting area, led by a kelian. A tempek is usually an area with natural boundaries such as a creek, tall trees, rock outcrops, etc.
- **Kerama**: individual member of a Subak

Participation

Subaks are not societies for Balinese Hindu's alone. Farmers of other religious beliefs living in the *Subak* areas may also participate in the system and those farming other people's land are also included in the *Subak* system. Their 'share-cropping' contracts state who is responsible for paying *Subak* fees and this is usually the landowner.

It is possible to distinguish three types of *Subak* members. Apart from the special members, such as Hindu priests, there are 'active' members, who carry out the essential work of maintaining the irrigation systems and 'passive' members who prefer to pay for maintenance. There are also two types of meetings: the more regular, short meetings where work is divided between the 'active' members and, only if necessary, general meetings to discuss more serious issues. All members are expected to attend these.

Why cooperation?

What is the basis for this widespread cooperation? It might be thought that upstream participants in this cooperative network would be less inclined to cooperate because cooperation means they would have to leave some water for the farmers downstream and therefore would not be able to use it all themselves. However, in the particular ecology of Balinese rice paddies the flow of irrigation water affects the population dynamics of rice pests. If fields are planted randomly, rice pests can easily move from one field to the next after harvest, allowing pest populations to escalate. By coordinating planting over a wide enough area, farmers can create large fallow spaces that prevent pests from migrating between food patches. In this way pest populations are kept small. The rather low incidence of pests and diseases in the rice might, however, also be attributed to other specific agricultural practises, such as the collective burning of rice straw, maintaining water layers on fields after harvest and herding ducks in harvested fields. Even ceremonial offerings have been identified as possible reasons for pests being lured or scared away.

In short, both upstream and downstream participants gain advantages from cooperating with each other. Pest damage is reduced upstream, while downstream farmers experience less water stress.

Collaboration

Officially there is no link between the *Subaks* and government institutions and the autonomy of *Subaks* is guaranteed by their legal status defined in local Balinese regulations. However, government agencies have sometimes tried to 'use' the existing *Subak* cooperatives for their own purposes. These have included agricultural extension, introduction of new rice varieties, as well as the provision of credit for chemical fertilisers. At one stage taxes were also collected through the *Subak* heads. Most of these government 'intrusions' have back-fired and the *Subaks* have proved their resilience by surviving these attempts to hijack the community groups for reasons other than their main objective: fair and equal provision of irrigation water to farmers.

Farmers see the *Subak* as their one and only agricultural organisation. Such aspects of their agriculture as planning the time when a new crop should be planted or the use of fertiliser, for example – can be dealt with through the *Subak* if there is a clear relation with the provision or use of irrigation water. A *Subak*, for instance, decides on the type of rice to be grown, depending on the amount of water that is expected to be available. In some cases, when there are signs of water shortages, a *Subak* can also decide, as a group, not to grow rice but to plant alternative crops (*palawija*) that are less water demanding.

Resilience

Irrigation water management by community organisations on Bali has proven to be effective, efficient and durable. The *Subak* system has adapted itself time and again over the last 1000 years. Any minor conflicts that have arisen have generally been effectively solved. This capacity to resolve problems is only one of the strengths of this system that is deeply rooted in Balinese traditions.

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Women play an important role in Subak ceremonies. Photo: Rik Thijssen

Mahender Rautela: water volunteer

William Critchley, Marit Brommer and Girish Negi

Five years ago, at the age of 35, Mahender Rautela resigned from his private sector job in Delhi to come back to his home hamlet of Chhabisa, in the poor mountain state of Uttaranchal in northern India. He took up farming for an income - and dedicated himself to helping others in his spare time. Rautela joined a small group of existing part-time water volunteers. He wanted to help his community to cope with the increasing problem of water shortage. While other volunteers - elderly men - were already doing something towards the problem, Rautela felt that someone younger and more dynamic was needed to take charge of managing the water, and particularly to '*do justice to the shy ones*'.

Rautela in an irrigated kitchen garden. Photo: William Critchley

Why the streams and springs have been drying up over the last 20 years or so in the region is another story: rainfall hasn't decreased, but water levels have gone down dramatically. Some observers point to the invasion of thirsty *Chir* pine trees in place of the original oak forest, some blame increased extraction of water by pipelines upstream for urban use, and yet others criticise poor land use practises. Whatever the reason, the stream in Chhabisa where children used to swim in summer is now a trickle. The irrigated area has fallen to less than 10 percent of what it was. In the driest months –when the *naulas* (step wells) have dried up, the villagers are solely dependent on the unreliable and limited supply from the government pipelines. In areas of water scarcity, no drop of water should be wasted - but dripping taps and broken pipelines are common features in Chhabisa and other neighbouring villages. Many families in the area have to do with less than 100 litres of household water per day - a recipe for disease and poverty.

Water volunteers are a phenomenon of the last 20 years, a response of society to the growing water shortage problem. Water volunteers are now characteristic of all villages in the region and there may be between three and five part-time volunteers in a typical settlement. Rautela has become the lead water volunteer in Chhabisa. Dedicated individuals step forward informally and spontaneously, and society then accepts them on the basis of their integrity and hard work. The role of water volunteer is not limited to a particular caste, they mediate for everyone. However, volunteers do tend to come from the better educated, better off groups. Rautela, of course, has worked in Delhi, and has a comfortable home overlooking the village fields. He speaks English, which is a rarity in Chhabisa.

But what precisely is the role of these water volunteers, and how are they accepted by the community? These are questions we put to Rautela on the veranda of his cottage during the height of last summer. Vital of course is protection of water sources and outlets - step wells *(naulas),* springs *(dhara)* and pipelines. Yet what also became clear to us is that fair distribution and prudent use of limited water can make a big difference locally. So a water volunteer needs to keep his eye both 'upstream' - where the water comes from, and 'downstream' - where it is shared and used.

Rautela explains that in Chhabisa two water pipelines have been installed by the Government. The first of the two pipelines is now an ageing 40 year-old, and it is becoming increasingly unreliable. But the irony is that villagers are not permitted to 'interfere' with these, even when they break down. They are therefore continuously dependent on the slow reactions of government officials for help, which is often needed urgently. Rautela, with his fellow volunteers, now patrols the pipelines regularly for cracks in joints and dripping taps - walking, so to speak, where the shadow falls between the law and people's urgent needs. Not surprisingly, leaks are repaired quickly in Chhabisa. Rautela makes sure that this happens, even though he often needs to collect money from the villagers for tools and equipment. Officially this tends to go 'unnoticed'. The community appreciates it.

This begins to give us a clue to the character of a water volunteer. He (it is rarely a 'she' we discovered: it's basically considered to be a man's job) needs to tread with caution and sensitivity, bridging the gap between local society and government, while also helping to settle internal disputes. Conflict resolution between resource users, where common property resources are dwindling and populations are growing, is a concern worldwide. Such mediation is one key role of a water volunteer - but without the protection of an official position or the comfort of the salary that goes with it. The volunteer receives no tangible benefits. Strangely, this lack of 'officialdom' helps. That is probably because it's hard to turn away a well-intentioned, and good-natured, volunteer. Personal integrity establishes their authority within the community. Significantly, water volunteers often tend to be elected to the village *Panchayat* (village council) on the basis of their selfless deeds.

The day before we talked to him, Rautela had mediated between two families: one had allowed irrigation water to flood the ground floor of another's house. This was wastewater from the main storage tank in Chhabisa. After women wash cooking utensils in rationed amounts of water (washing clothes is not permitted here in summer), the waste is collected in an adjacent

Two of the authors interviewing Mahender Rautela in front of his house in Chhabisa. Photo: Girish Negi

storage pond with a capacity of 2 000 litres. Rautela oversees the use of that water - for irrigation of people's kitchen gardens where chillies, tomatoes, potatoes and fruits are nurtured. The area irrigated is between a quarter and one hectare , depending on the season. He supervises a rotational system: each of 14 nearby families receives the flow on a given day. These days can be 'traded' through negotiation. The flooding incident was resolved through such bargaining, arbitrated by Rautela.

Of course the key is how to attract and keep volunteers who are as effective and popular as Rautela: such volunteers are, we were told by one villager, *'as scarce as the water in this area'*. Nevertheless Rautela carries out his work with evident satisfaction, and there is no question that he, and his like, are appreciated in their communities and become trusted leaders. He has a gentle demeanour, but a firm commitment to seek for equitable access to water. Where water is limited and communities are affected it is not just scientists, or digital information highways to which we should turn, but local 'social hydrologists' as well. Their skills of applied common sense and tact can make their impact both potent and immediate. Villagers recognise this, and in return grant informal authority to such community members, to help control - and make better use of - their common resources.

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Arvari Sansad: the River Parliament

Ambuj Kishore

The Arvari is a small river in the drought prone Alwar District of Rajasthan, India. For decades, the Arvari ran dry apart from a brief flow of runoff from the monsoon rains. Now, thanks to water-harvesting efforts in the region, the river holds water all year round.

The change began in 1987, when the NGO *Tarun Bharat Sangh* (TBS) started helping villagers in Gopalpura village to construct and rejuvenate traditional earthen dams called johads (see *LEISA Magazine* 16.1, p 14-15). More than 350 johads have been built in the Arvari catchment, and the active participation of villagers in the planning, design, implementation and monitoring of water resources has led to strong feelings of community ownership. Johads are small-scale structures but they have made a large–scale impact on water conservation. The improved availability of the water in this drought prone area has greatly improved the quality of life of those living in the area. In addition, the water harvested and stored in the johads caused the water table in the entire catchment area to rise. From 1996, the Arvari river began to flow strongly again and became perennial.

The question of ownership of these improved water resources, however, has been a source of recurring conflict. The first *johads* in the village of Gopalpura were declared illegal because formally as water resources belong to the state. When the villagers planted trees in the watershed catchment they were warned they would be fined because the land belonged legally to the state revenue department. Finally, after continued resistance by the villagers, an unwritten understanding was reached with the state agencies to let the villagers manage their environment.

The next challenge came as the Arvari River began to flow and the fish came back. In 1996, villagers received notice that the state had granted a contractor a license to fish in the river. Although the villagers are all vegetarians and do not eat fish, they realised that this might set an important precedent about control over the water resources. The villagers insisted that the river was theirs, it had begun to flow again as a result of their efforts, and they were entitled to a say in its management. The result has been a drawn-out battle between them and the fisheries department.

The *Arvari Sansad,* or *Arvari parliament,* was formed on 26 January 1999 as a way of managing the river and its waters fairly and to create a united front against outside intrusion. The river parliament represents 72 villages and meets four times a year to discuss problems and to decide on the best strategies for land and water use. It has 142 members who are nominated by their respective village institutions. The parliament has framed rules for the use and protection of the river and the surrounding land that relate to water use, the type of crops grown (excluding crops with high water needs), tree felling and illegal hunting. Another issue addressed by the parliament is the increasing value of land in the area - farmers and herders are coming under pressure to sell their land to businesses that depend on water extraction. A coordination committee comprising members selected by the parliament handles the operations and ensures that the rules are observed.

Villager's efforts have resulted in the departure of the fish contractor and they also succeeded in turning away a beer company that had hoped to set up a brewery using local barley and fresh water. The members of the river parliament and their communities have gained increasing confidence in their ability to take collective action, but this has not always been an easy process. Suspicions and conflict between different castes and factions need to be managed, and the village councils maintain many traditional limitations: they still rarely include women and the landless poor.

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Forest access: policy and reality in Kafa, Ethiopia

Yihenew Zewdie

Kafa is a predominantly highland region in southwest Ethiopia. About one third of Kafa and the surrounding area is covered by tropical rain forest comprising a rich mixture of species arranged in three or more stories. The forest ecosystem makes an important contribution to the livelihoods of people in the area in a variety of ways. Tree species with several high horizontal branches, for example, are ideal for hanging cylindrical log beehives - a widespread local bee-keeping practise. The forest provides shade for coffee and a variety of commercially valuable spices that thrive when protected from frost and direct sunlight. The forests also supply rural communities with fuelwood and timber, which they use both for household consumption and for sale. There is urban demand for both wood and non-wood forest products such as honey, coffee, and spices.

This article draws on research and case studies from six forest villages in Gimbo *Woreda* (district) of Kafa Zone (Figure 1). In the case study areas, the level of income from non-wood forest products varies from household to household but averages at least a third of the annual cash income of the rural households. This income may not be sustainable due to heavy deforestation as timber production is sometimes excessive. However, it is worth noting that the considerable effort local people make to secure access to forest resources is a direct consequence of the importance of these resources to their household economy.

Land reform and access to forests

During the late nineteenth century, Ethiopia's central government expanded to control the Kafa region, replacing the Kafa kings as the dominant authority. Land and forests were allocated to local notables and wealthy and powerful outsiders. The latter were interested in extracting some of the more commercially valuable forest goods, such as coffee. The majority of the local population became tenants, who could only access forest resources through a variety of tenancy arrangements.

In March 1975, the new military government of Ethiopia (known as the *Derg*) that ruled the country between 1974 and 1991, issued a land reform proclamation that brought all land resources in Ethiopia – including farmland, grazing areas, and forest land – under the direct administration of the State. As part of the reform, grassroots level Peasant Associations (PAs) were established.

One of the tasks of the PAs was to implement the land reform and to solve land conflicts. As the land reform proclamation was decreed without adequate preparations, it came to be implemented in a hasty and haphazard way, leaving considerable space for local interpretation. In most areas, the land reform proclamation was, therefore, implemented in ways compatible with local notions of fairness and entitlement.

The involvement of the PAs in controlling access to forest resources varied. In some of the case study areas, the PA authorities saw the land reform as a means of redistributing agricultural land only. The absence of specific directives on the utilisation of forests reinforced this view - the law dealing with forest resources came into being only five years after the land reform proclamation. The villagers in these communities continued to claim forest access through locally recognised customary channels. The principles informing customary forest access included geographical proximity to the resource, proven track record of use, and ancestral claim of ownership.

In other communities, where conflicts over local forest user rights threatened the smooth implementation of the land reform, the PA authorities intervened and distributed patches of forest to needy households as their respective bee-keeping and/or coffee collection domains, although this intervention was never included in the land reform.

Neither the PA-sanctioned forest access nor the forest utilisation through customary principles were formally recognised. In "official" government thinking, forest resources were basically expected to be preserved and passed on to future generations.

In March 1990, about a year before the *Derg* fell and the government changed, the *Derg* proclaimed a halt in land re-allocation. This was also taken as an order to the PA's to disengage from allocation of forest rights.

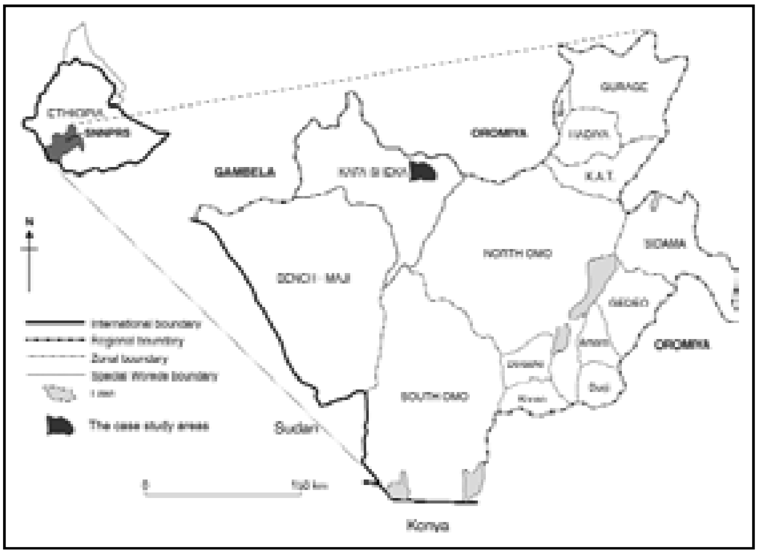

Figure 1: Map of the study areas in southwest Ethiopia

The current forest legislation

The post-*Derg* Ethiopian government (1991 – present) continued to support the state control of land resources. The current land law encourages the participation of private investment in agriculture and recognises the "holding right" of farmers to farmland. It is, however, silent regarding the natural forest from which most of the marketable forest goods are produced. The country's present forest proclamation has a strong element of forest protection, but does not spell out the villagers' rights to use the forest clearly. The proclamation makes timber processing by villagers an illegal undertaking, and introduces an element of uncertain legality to forest gathering operations such as bee-keeping and collection of wild coffee and spices. This is in direct conflict with traditional forest use practises.

The forest proclamation entrusts the Ministry of Agriculture with the tasks of controlling, protecting, and managing forest resources. The proclamation puts great faith in the role of 'forest guards', who are employees of the Ministry of Agriculture, to protect forests from fire hazards and forest use violations. In spite of these efforts, encroachment into natural forest areas is widely reported. Forest guards have neither the incentives nor the organisational backing to hinder this trend. Not surprisingly, forest resources in highland Kafa continue to be seen and utilised as village commons. This complex situation is a consequence of a mismatch between government policy, implementation capacity and grassroots realities and the informal forest access mechanisms described below should be seen as instruments developed to secure forest livelihoods within the restrictions of the local socio-cultural environment.

Wejoo and Gogoo

In the present post-*Derg* period an increasing proportion of younger households have no *direct* forest access rights. Although traditional rights can be inherited, the prevailing population dynamics make it difficult for younger families to benefit from this arrangement. All the same, local people employ a number of informal mechanisms that enable the younger generation and other sections of the population to participate directly in the local forest economy.

One of these mechanisms is *Wejoo*. Under this system, parents grant their sons trees when they come of age so that they can gather forest products for themselves and their families, and also in anticipation of their continued support in forest and food farming activities. The other informal forest access mechanism is *Gogoo* (which literally means "equal share"), a sharecropping arrangement for forest goods. Both *Wejoo* and *Gogoo* are originally traditional practises; however, they rose to prominence in recent years as mechanisms of coping with a lack of institutionally recognised forest access mechanisms.

Gogoo is a much more widespread means of forest access than *Wejoo.* Its importance as a means of forest access can be explained in terms of three main factors:

Distribution of skills

The uneven distribution of skills in bee-keeping and lumber production means that some holders of tree rights need a share partner to realise the economic value of their forest resources. In honey production, for example, those who have direct access to tree resources seek the services of skilled partners in preparing and mounting beehives on the high branches of forest trees. Harvesting is a joint undertaking and the produce is divided equally. In wood processing, the processor takes two-thirds of the income from the planks produced, while the tree 'owner' receives the remaining one-third. Wood processing is an illegal activity, although the individuals involved are well known locally. Weak enforcement of forest laws combined with uncertainties concerning villagers' continued use of natural forests has encouraged wood processing for short-term benefits, although it is an unsustainable practise.

Timing

The need for timely coffee collection among larger scale coffee growers also necessitates involvement in sharecropping. During the main harvest period (October – November) share tenants (the collectors) receive a third of the total quantity they pick. At the second coffee harvest, which mainly involves the collection of fallen coffee beans, share tenants receive half of the amount collected. Collection of fallen coffee beans is a time-consuming and a socially despised activity, which may be why the amount given to the share tenant is higher.

Stigma

There is a cultural stigma associated with the marketing of buckthorn and spices, but the increased commercialisation of these products has prompted right holders to opt for share cropping arrangements. For buckthorn, which is used as a condiment in the preparation of local alcoholic drinks, share tenants are made responsible for selling the produce that the tree right holder has gathered, and the sale proceeds are divided equally. For spices (notably, Ethiopian cardamom – *Aframomum korarima*) the share tenant is responsible for both collection and marketing, as the tree right holder usually desires to dissociate completely from the sale of spices, a low status activity. The share tenant retains half of the sales proceeds and gives the other half to the right holder.

Gogoo has been identified in particular as an important means of securing access to forest resources for younger households who have no PA-allocated or customarily recognised bee-keeping domains. Moreover, the *Gogoo* arrangement has helped resource poor farmers, including women, to generate cash income that would otherwise have been difficult to come by.

The way forward

The forest access situation in highland Kafa shows a complex combination of state tenure and *de facto* private rights of use similar to the overlapping systems of tenure that exist in much of Sub-Saharan Africa. Local people have developed forest access arrangements that have reflected the changing realities. However, lack of official recognition of locally tailored forest access rights has contributed to tenure instability and encouraged a short-term mentality in the use of forest resources, for example through illicit timber production and wood processing. Reconciling the state's position as an overall resource owner and the villagers' concern for security of forest use rights is therefore an important issue.

Policy makers need to formally recognise the forest use rights of rural households, in a manner similar to the recognition of farmland. This might facilitate the development of village-level institutional norms that would challenge destructive forest uses. Sustainable forest management demands that 'rights' to use forest resources are accompanied by corresponding farmer 'obligations' in forest conservation. The forest law should, therefore, be re-oriented to support local organisational development and forest management, rather than a blanket policy of forest protection through the use of forest guards, as has hitherto been the case. These steps should be taken as preliminary measures aimed at stabilising local forest use at a sustainable level. At the same time, it is also important to address the inequalities in direct forest access between generations, through local-level consultative processes.

The interest that even non-tree right holders such as *Wejoo* beneficiaries and share tenants in NWFP activities - have in the local forest economy is an asset that has to be seized upon for enlisting the co-operation of villagers in bringing about sustainable forest management. Extension agents and other grassroots level field workers entrusted with the responsibility of advising farmers with improved agricultural practises and natural resource conservation should recognise the multiple tenure under which forest resources are utilised. In practise this includes recognising and consulting with beneficiaries and rights holders under informal access systems like *Wejoo* and *Gogoo*.

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Resolving resource conflicts around Sherkolle Refugee Camp

Alemayehu Abebe, Solomon Hussien, Assegid Tesemma and Jan Gerrit van Uffelen

At the present time population movements have taken on unprecedented proportions. The total number of refugees alone has reached over 20 million. The majority of refugees tend to find themselves in places that are environmentally fragile, and where resources are limited. Displaced populations, like other marginalised groups, are forced to rely directly on local natural resources to sustain themselves in the short term. Poverty, the struggle to build sustainable livelihoods and lack of control over resources characterise their experience. Their daily struggle to make ends meet does not promote sustainable management. This situation often brings refugees into conflict with local populations over essential resources.

A major problem for the many refugee women living in camps all over the world is access to fuelwood. Options to ease this burden seem very limited, yet fuel is a primary household need and lack of access directly affects a household's poverty status and food security.

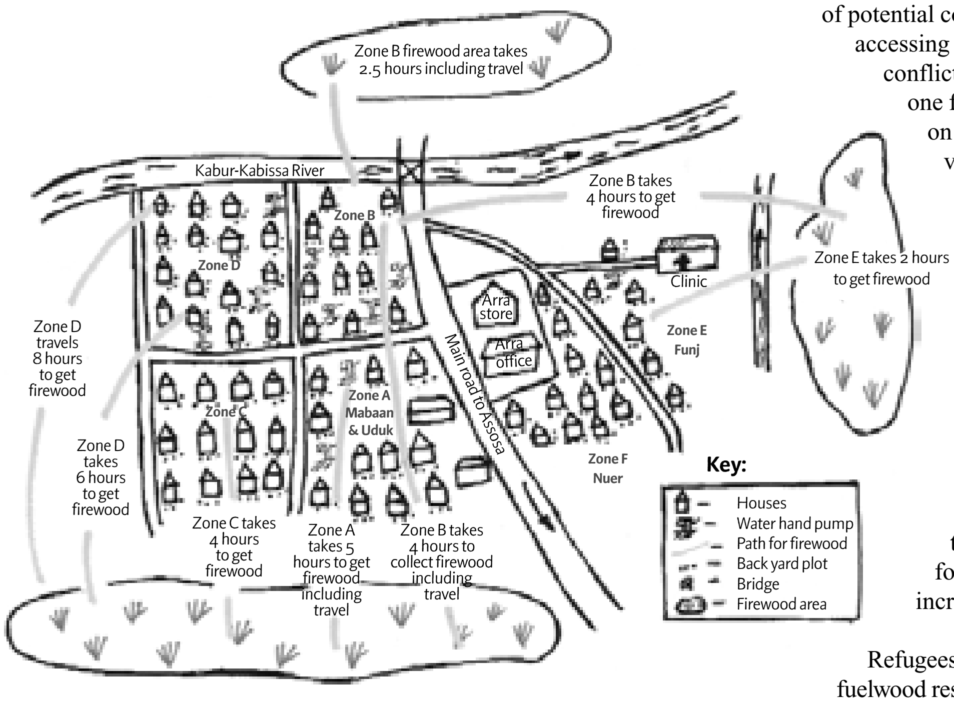

Figure 1: Resource map drafted by refugees in February 2001

So far, the United Nations High Commissioner for Refugees (UNHCR) and its government counterparts have paid little attention to the issue of access to and control over resources when locating refugee camps. Some NGOs however, are tackling these issues. In Sudanese refugee camps in Western Ethiopia, for example, ZOA Refugee Care, a Dutch international NGO working worldwide with refugees, internally displaced and disaster victims, has been working together with refugees and locals to jointly manage the natural resources on which they both depend. One of these camps is Sherkolle.

Sherkolle

Sherkolle is a relatively small refugee camp, established in 1997, which hosts around 16 000 Sudanese refugees from different ethnic tribes such as Mabaan, Funj, and Uduk who have fled fighting and insecurity in the Blue Nile province of the Sudan. The camp is located in a sparsely populated area in western Ethiopia around 50 km from the Ethiopian-Sudanese border. The area is hilly and covered with patches of deciduous and bamboo forests. The local inhabitants are the Berta communities who depend mainly on agriculture and a little trade. Berta cattle have been decimated by the tsetse fly and as a result they can no longer rely on animal traction, which has a serious impact on their agriculture.

The Sherkolle camp operates under the concept of partial self-sufficiency, meaning that 75 percent of the food needs of the refugees are covered by the World Food Programme. The refugees are expected to make up the remaining 25 percent by engaging in backyard farming on small 20 by 20 metre plots within the camp boundaries, and by engaging in a variety of income generating activities.

In 2001, ZOA Refugee Care undertook an assessment into access and control over natural resources and found high levels of potential conflict between refugees and locals in accessing fuelwood. Actual and potential levels of conflict between refugees and hosts differed from one fuelwood collection area to another, depending on the distance from the area to the nearest Berta village. High levels of conflicting interest were found in the area directly bordering the refugee camp, as the camp is set amidst local villages and the Berta did not like to see the refugees collecting fuelwood in the forests around their villages.

Sherkolle camp is organised in six zones with a different ethnic group living in each zone. A resource map drawn by the refugees in February 2001 indicated that each zone in the camp had its own fuelwood collection area. The study showed that it took the different tribes between four to eight hours for a round trip to collect fuelwood, a four-fold increase since the camp was established in 1997.

Refugees, especially older women, negotiated access to fuelwood resources in the direct vicinity of the camp by working for locals or by collecting fuelwood for them. Collecting fuelwood in areas further away from Berta villages met with lower resistance from the Berta. As travel times to these areas were much longer and the trips more demanding, they were mainly undertaken by younger refugee women. Forest guards, local Berta men employed by the local government and funded by the UNHCR to control the fuelwood collection, imposed major restrictions in these areas. Refugees were not allowed to use axes and were to collect dry wood only. If axe marks were found on the wood it would be confiscated. Paying small amounts of money to the guards or, in some instances, giving in to their demands for sexual favours would allow the women to return to the camp with their fuelwood.

The problems of unequal access to and control over fuelwood resources, as reflected in the statements made by refugee and local women, is presented in Table 1.

Table 1: Complaints of refugee and local fuel wood collectors

	Refugee (%) (n=80)	Host (%) (n=91)
It's demanding		
'It makes us very tired, it's heavy work, we suffer from the hot sun'	8.8	76.9
'Getting weak, makes me sick, body ache'	1.3	38.5
'Getting thirsty/hungry'	11.3	3.3
'It's far'	67.5	58.2
'It's difficult to penetrate the forest'	2.5	0
'We face a fuel wood shortage'	0	23.1
It's dangerous		
'I am hurting myself'	13.8	54.9
'Since we are forbidden to use an axe we have to use our hands, stones or sticks'	13.8	0
'We are afraid of the wild/dangerous animals in the forest like lions and snakes'	61.3	29.7
The system works against us		
'My axe is or will be confiscated by forest guards or the local people'	51.3	0
'I am forbidden to collect fresh fuel wood'	2.5	0
'We are caught up by the fire set by the locals'	3.8	0
'We are being checked, or send away, by the forest guards – wood at times is confiscated'	25.0	0
'I risk getting punished by the forest guards or locals, put in prison or being beaten'	2.5	0
'Fight with the locals or guards, chased out, threatened by guns'	42.5	0
'Locals ask us why we don't return to our homeland, they insult us, quarrel with us'	28.8	0
'We are being asked for money, work for locals, share our wood, being used as slaves'	27.5	0
'Being raped, asked to be their wife, have sex with men in the forest'	5.0	0

Fuelwood collection is seen as a very demanding activity by both refugee and local women. In 2001, refugee women spent an average of 28 hours a week gathering fuelwood and local women a surprising 27 hours a week, though the latter group combined it with some agricultural activities. Since the arrival of the refugees, Berta women say they find it harder to collect fuelwood. A quarter of them said they were experiencing a fuelwood shortage. Refugees consider fuelwood collection to be a dangerous business. They have to use their hands, stones and sticks to break off and split wood. Berta women complained they found it difficult to use their axes. Many of these had been acquired recently after being confiscated from refugees. Refugee women collect in far-away areas and face wild animals more often than the local women. They feel very strongly that 'the system' is against them. Restrictions are imposed by forest guards, local people (mainly men) or both.

The findings of the assessment highlighted that the system of access to and control over resources has resulted in increasing frustration and tension. The local Berta were becoming increasingly concerned about the loss of forest cover in their area. Not only was fuelwood collection becoming more difficult but their livelihoods were becoming less secure. Normally their grain supplies are sufficient to cover a six to nine month period only. After these supplies are used up they depend heavily on the wild foods they find in the forests.

The refugees for their part were frustrated and agitated by what they saw as an unfair system of resource control. It seemed just a matter of time before serious conflict would erupt. The refugees knew that this might threaten their stay at the camp and they did not look forward to returning to insecurity at home. The UNHCR and the Ethiopian government agency responsible for managing the camp only discussed issues related to the camp and its inhabitants at a regional level. Access to and control over resources was not very high on their agenda.

Only a comprehensive, community-based approach involving host and refugee community representatives, including women, could ease the tension. Fundamental for the success of such an approach would be the creation of a forum that offered a non-threatening environment, where refugees and local leaders and representatives could share and discuss their problems and start thinking about ways to encourage positive change.

A programme for change

In consultation with the local and refugee communities, ZOA Refugee Care designed the Agri-Environmental Education and Protection programme. Assessments taking into account the perspectives of the refugees and the Berta, the local and regional government as well as the perspective of UNHCR and its government counterpart have created the basis for change.
The programme is made up of the following four interrelated components:

Awareness

First, the programme makes refugees aware that the agroecology of the Sherkolle camp is different to that of their home areas. The fact that the camp is located amongst Berta villages creates an extra challenge as far as maintaining the natural resource base is concerned. Local people are made aware that indigenous and context-specific knowledge and expertise in managing natural resources is being permanently lost. For example, the Berta use fire to clear their lands. A generation ago the use of fire was subject to a complex set of rules, regulations and sanctions. Now fires often burn out of control for weeks during the dry season. Not only do these fires expose hillsides to erosion because fragile vegetation is burned, they also result in a gradual loss of biodiversity reducing both the variety and availability of wild food plants. The Berta have noticed this because wild foods form an important part of their livelihood security.

The programme provides context-specific agri-environmental education, developed in consultation with the communities. It does so via a number of avenues, including community meetings and seminars, group discussions, field 'studies', cultural awareness programmes, environmental education at primary and secondary schools and setting up school and debating clubs. Well-respected Berta and refugees are trained as facilitators to guide the dialogue on environmental and livelihood issues within their communities. Refugee and local facilitators meet once a week and they receive a one-week refresher course every three months. They do not usually work together although sometimes they go together on visits to familiarise themselves with each other's situation.

Establishing structures

A key element of the project has been the establishment of Environmental Working Groups (EWGs). The aim of the EWGs is to enable refugee and host communities to develop rules and regulations for access to natural resources, to work out natural resource management plans, and to empower community members who have the skills and interest to further develop the resources available in the area. Harmonising their different perspectives has resulted in a set of regulations that are, generally speaking, well observed by both the local Berta and the different refugee groups. Part of the work of the EWG is to make sure that people adhere to these rules and that the sanctions agreed upon are applied. The EWGs are also responsible for the progress of the natural resource management plan in their area.

Demonstrating appropriate practises

Small farmer field schools have been established and leading farmers selected and trained to demonstrate a range of appropriate sustainable resource management practises. They address the demand as well as the supply side of the fuelwood including issues such as fuel-efficient stoves, stove and fire management, mud block construction, community-managed nurseries, multi-purpose live fences, and small-scale fuel and construction wood plantations. A joint irrigation scheme has also been set-up and refugee and host farmers learn to work together to produce vegetables year round. The farmer field schools and the irrigation scheme are the responsibility of the EWGs, while ZOA provides technical expertise and some inputs.

Indigenous resource management systems

Between 1975-1991, the former Ethiopian government disengaged and replaced local leadership and management structures by a highly bureaucratic, top-down and sectorised government system. The changes were so dramatic that indigenous forest resource management systems suffered greatly. At present, the project advocates that government policies recognise and accommodate the most important elements of these indigenous resource management systems. A positive development is that the present Ethiopian government has acknowledged the potential role of community-based organisations. The EWGs fit well within that category.

Environmental Working Groups

The EWGs form the heart of the programme. They are community-based organisations that develop natural resource management plans with limited outside facilitation and assistance. Awareness-raising about resource base degradation and the demonstration of sustainable resource management practises are central to the EWGs. The older refugees in particular supported the set-up of EWGs because they recognised the approach from their own traditional resource management practises and were well aware of the need for improved management in their present environment. They were also strongly motivated by the fact that the EWGs provided a way of improving relationships with their hosts and they knew from past experience that poor relationships could compromise their stay. The younger refugees showed keen interest in more appropriate practises because they regarded them as 'modern' and representing 'a way forward'. The Berta saw the EWGs as a vehicle through which they could make their complaints and concerns about the collection of fuelwood by refugees heard. They also saw that the EWG could help them regain control over their resources, which they had lost under the former Ethiopian government.

Communities were asked to suggest candidates for the EWGs who were well respected and trusted. Those in leadership positions, such as sheiks, chiefs and church elders either took part in the EWGs themselves or publicly expressed support for candidates. ZOA's request to have at least two women selected for the EWGs met with surprise and lively discussion. In the end it proved much more difficult for the Berta than for the Sudanese refugees to have women selected for the EWGs.

Environmental Working Groups were established at three different levels. Each higher level has more decision-making, monitoring and sanctioning powers. EWGs at zonal level (in case of the refugees) or village level (the local Berta) consist of six members. They meet each week to discuss on-going issues and the progress of activities on agreed natural resource management plans. The refugee and Berta EWGs meet together twice a month to inform and discuss issues and activities. The EWGs at this level delegate individuals to represent them in the EWG at camp level. At this level the UNHCR, its government counterpart and aid agencies are also represented and overriding issues at the camp and its surroundings are discussed. The EWG at the third and highest level brings together representatives of the EWG at camp level, Berta EWGs established in villages further away from the camp and provincial authorities.

The way forward

So far the experience with Environmental Working Groups in and around Sherkolle refugee camp has been very encouraging. Awareness raising and the demonstration of appropriate practises and techniques have become more and more under the control and responsibility of the EWGs themselves.

New technologies that save fuelwood or develop fuelwood resources are being adopted. Concerns of women related to the collection of fuelwood are now taken seriously and are being addressed, for example by agreeing on safe access paths to fuel collection areas for refugee women. Rules and regulations have been agreed upon to prevent tree cutting and to access fuelwood, grazing lands and water sources. A situation that had the potential to escalate into serious conflict has been defused. The EWGs are maturing and are increasingly seen by the communities as important instruments in sustainable natural resource management. As a sign of their increasing confidence, the EWGs themselves have raised issues related to indigenous wild food plants, natural medicines and the fires that destroy many herbs and plants with medicinal properties, and the question of who can collect which non-wood forest products and when.

EWGs, nevertheless, still depend on outside assistance for facilitation and inputs. In order to be more sustainable, they need to concentrate on low external inputs and find ways of generating some income to finance their activities. However, the biggest challenge is now for the Berta EWGs to be recognised by the regional government as community based organisations that can play an important role in managing and developing natural resources. In trying to re-create indigenous resource management systems based on local reality they are taking into account environmental conditions as well as the social and political context. When it comes to the refugees, the challenge is not only to address current issues through the EWG, but to build up the interest and capacity that will enable refugees to set up EWGs when they return to their own areas to facilitate their rehabilitation and reintegration.

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A demonstration for the right to land. Photo: Movimento dos Trabalhadores Rurais Sem Terra (MST)

More than access to land: MST in Brazil

Ciro Eduardo Corrêa

Brazil is a continent in itself and has abundant natural resources. The potential that lies in its water, soil, biodiversity, coastline, diverse climate and mineral wealth is to be envied. It has one of the world's largest river basins and its people come from many different ethnic and cultural backgrounds. It is a rich and fertile country.

Yet Brazilians live in conditions that compare to the most needy in the world. Incomes are heavily concentrated. The richest 10 percent take 48 percent of annual income leaving the poorest 20 percent to share just 2 percent between them. Today, 23 million Brazilians live below the poverty line, and 52 million cannot get enough food for a balanced diet.

Analysis

The social and environmental degradation prevalent throughout Brazil is rooted in the way agriculture has developed in the country. Agriculture has always been subordinate to the logic of foreign trade, its profits generated by exploiting natural resources and the labour of the Brazilian poor. Since the time of European colonisation, extraction and later the extensive productions of export agriculture for the European market have been the main priorities.

This pattern has been sustained in recent years by advanced technological interventions. The "modernisation of agriculture" has enabled Brazil to maintain its present agricultural export strategy, which is based on extensive *latifundio* (estate) land-holding patterns, export-oriented commodity production and sub-human labour relations. In Brazil today one percent of rural household own 47 percent of the country farmland while more than 12 million people live in landless destitution. At the same time 166 million hectares of arable land lies unused in large estates. Small farmers make up 80 percent of the countries rural population yet they own less than 18 percent of the available farming land.

A drastic reduction in the demand for farm labour has intensified poverty. In the last ten years more that five million jobs have been eliminated by mechanisation in the sugar plantations alone. In 1984, hundreds of thousands of hectares of agricultural land was lost through the creation of the Itaipu dam, the largest dam in the world. In the cotton and coffee plantations 65 percent of the labour force have no formal working papers and work 14-16 hours for US$2.00 a day. As a result there is a constant exodus from the countryside to the already overcrowded cities. In the last 30 years 20 million people have left the rural areas for the towns. In 1903, when Brazil's total population numbered some 17.4 million 80 percent of its population lived in the rural areas. A hundred years later Brazil has a population of 175 million people and 80 percent live in the overcrowded urban areas. Staple food is scarce and although agribusiness ensures that Brazil has a favourable export surplus, it still imports such basic items as beans, rice, and wheat. In 1990, Brazil imported US$1 billion worth of basic foodstuffs. Today, it imports US$10 billion.

Agrarian reform is fundamental to the social, economic and political transformation of Brazil and there is an urgent need for an extensive and large-scale re-distribution of land. The political and economic geography of the country needs to be changed and land given a real social function.

Organising the landless

The struggle for land has dominated Brazil's history. The *Canudos* resistance movement and the *Contestado* war in the late 1800s and the Peasant Leagues and MASTER movement of landless farmers from in the 1950s and 1960s are typical of actions taken by rural workers to access land and improve their working and living conditions. *Movimento dos Trabalhadores Rurais sem Terra (*MST) is part of this tradition.

MST is one of 35 people's organisations fighting to get agrarian reform onto the political agenda. Established in 1984, it is active in 23 of Brazil's 27 States. More than 1.5 million people are involved in the MST, and it has managed to provide access to land for some 300 000 families who now live in 1600 settlements. Another 80 000 claimants are still living in camps while negotiating the legality of their claims. The process of land occupation and the struggle to secure tenure rights is a complex, hazardous and sometimes violent process. MST supports groups in occupying land and in their efforts to negotiate and formalise legal ownership. When claims are recognised, MST works with the new settlers to establish communities in which agroecological and social reform guide development.

The wider activities of MST touch all aspects of community life including education, health, cultural identity, environmental education, leisure, sports and jobs. As an organisation MST tries to introduce men and women to a fairer, more fraternal and egalitarian way of life. Over the years it has developed it own methods and ways to help people organise their struggle and while winning land is important, its wider objectives are to initiate a process of agrarian reform that will not only re-organise the land tenure but also contribute to deeper transformations in the society as a whole.

Taking care of nature

MST's struggle for agrarian reform is, in fact, a struggle to preserve life and nature. MST has always tried to increase the awareness of landless workers of the important role they play in preserving nature. In general, the areas chosen for agrarian reform tend to be areas that have been devastated and degraded by inappropriate and exploitative estate management. In MST settlements, the major challenge has, therefore, been to regenerate the environment and ensure that there is enough environmental education to encourage sustainable practises. Considerable effort is invested in elaborating ways to sensitise and educate families to the need to promote reforestation, build seed beds and nurseries for native and exotic trees, preserve the river banks and springs, build ecological corridors, work towards the collective management of forests and develop settlement patterns that encourage soil and water conservation.

With a growing awareness of the importance of agroecology, MST has also introduced new production and consumption patterns into its settlements. Healthy, pesticide- and chemical-free food is cultivated, a wide diversity of plant life is encouraged, and animal varieties that are best adapted to local conditions are reared and bred. In addition MST is involved in strengthening the local economy, ensuring that settlers do not become dependent on any single product and trying to establish links to wider regional markets where there are other potential sources of income.

Activities

Since 1997, MST has accumulated much experience in agroecology and forestry. Many settlements produce and market organic rice, soybeans, peanuts, cassava, corn, cashews, coffee, bananas, peaches, chickens and pigs.

Together with other social movements in the *International Via Campesina*, the MST is involved in the *Campaign for Seeds as the Heritage of Peoples in the Service of Humankind*. The objective of this campaign is to confront the global process of privatising biodiversity in which a few major trans-nationals are taking over life on the planet and turning nature into a commodity. MST has undertaken activities to recover local seed varieties focusing on corn, rice and beans, crops that are basic to the food security and animal husbandry of its settlements. In the municipality of *São Miguel do Oeste*, in the southern State of Santa Catarina, for example, 48 varieties of corn have been recovered and an additional 18 corn varieties and five bean varieties are being bred. During the last harvest, 80 metric tons of seed was collected. This was enough to secure supplies for local families and provided a surplus for further distribution.

For several years, MST has been building up the agroecological production of horticultural seeds through BIONATUR and today they are the only suppliers in Brazil producing and distributing such seeds. BIONATUR grew out of the need to confront the monopoly that multinationals have established over the seed market. It was first established in Rio Grande do Sul, a state in the far south of the country and subsequently expanded to other regions of Brazil. BIONATUR works exclusively with horticultural varieties. There are no hybrids. The result of these activities has been to enhanced the regional distribution of seed and today these are being cultivated as near as possible to the regions in which they were obtained. In 2002, BIONATUR produced and marketed seven tons of seeds from 32 different varieties. By 2008, it expects to be marketing 15 tons of seed from 56 different varieties.

Another important activity has been the biodiversity management project in the settlements of *Pontal do Paranapanema* in the south-eastern State of São Paulo. Here MST enabled gene flow between three areas of native forests classified as Interior Atlantic Forest. These forests cover 33 000 hectares, 400 hectares and 300 hectares respectively and are home to many small farmers. The project consisted of planting exotic and native species in the areas belonging to farming settlements in order to enhance gene exchanges amongst the various species of animals and plants in the three forest areas. Over time a migratory corridor for animal species (in particular birds and insects) has been created and the transmission of genetic material from the native trees that make up these ecosystems has been greatly facilitated. From a social perspective, these islands of biodiversity – which also contain multiple-use agroforestry groves – will support the improvement and diversification of farming activities in rural allotments located between the forest fragments.

In the same region, Ribeirão Bonito, some 123 families are involved in a project known as *Abraço Verde* – the Green Embrace. The main aim of this project is to plant a belt of native and exotic trees between the forest and the areas used by farmers for crop and cattle production in order to halt degradation. From an economic and social point of view, the sustained exploitation of the Green Embrace has provided a new source of income for these rural communities, and has helped to reduce conflicts over access to fauna and flora.

Challenges

The MST faces many challenges. One major difficulty is that agrarian reform is still seen as a way to compensate the landless and to relieve social tensions, rather than as policy to restructure land tenure. Therefore, MST has adopted a broad agenda in which it commits itself to lobbying for public policies that reflect not only a concern for the value of rural spaces and the preservation of the landscape but also guarantees the well-being and rights to land of those who live in the countryside.

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Access denied: the Brazilian land issue

Luc Vankrunkelsven

From the time the Portuguese established themselves in Brazil in the sixteenth century, the country has been ruled by an economic elite whose power lies in land. A major piece of legislation enacted in 1850 - the *Lei da Terra* - recognises two forms of land use in Brazil: *propriedade* (possession) and *posse* (right of use or usufruct).

Lei da Terra defined land in capitalistic terms as a commodity to be bought and sold, making it possible for a small minority to establish control over the countryside. As a result, when slavery was abolished and impoverished immigrants started to enter the country in the late nineteenth century, most of them could only claim users' rights to land. Known as *posseiros* or "farmers without papers" their heirs still depend on usufructory rights granted by private and company landlords.

Green counter revolution

Demand for fair land redistribution has increased steadily in Brazil in recent decades. However, the military dictatorship (1964-1985) and the United States wanted no "communist-type" land reform. Instead they encouraged the Green Revolution - a counter revolutionary answer to the cry for justice. Super seeds, pesticides and large subsidies were made available and resulted in a new gold – soya. But family farms drawn into soya monoculture were unable to compete with the large estates. *Posseiros,* without papers and rights were driven from their farms and joined the hundreds of thousands of farm labourers who, having lost their jobs because of mechanisation, joined the massive exodus to the cities.

Churches and resistance

During the military dictatorship the churches were the only places where people could organise and many civil society movements emerged from the grassroots of the Christian community. Amongst these was the trade union CUT (*Central Unica dos trabalhadores)* and the PT (*Partido dos trabalhadores)* - both established by the present socialist President of Brazil Luiz Inácio Lula da Silva – as well as the *Comissao Pastrol da Terra* (CPT), *Movimento dos Trabalhadores Rurais sem Terra* (MST), women's organisations and human rights groups. The CPT, CUT and MST were particularly important actors in agricultural politics.

The organisations involved in land issues such as the CPT, CUT and MST support each others efforts. CPT is a service of the Catholic Church. It helps farmers and farm labourers as well as the urban poor and their organisations in their struggle to hold on to or acquire land. In some of the provinces where the MST is less strong CPT organises land occupations.

The trade union CUT works with farmers, farm labourers and urban labourers. Since 2002, several alliances such as *Federação dos Trabalhadores da Agricultura Familiar da Região Sul* (*Fetraf-sul/CUT)* have been formed. CUT has established a number of cooperatives on *assentamentos* (redivided land), particularly in *Mato Grosso do Sol,* the north and the north-east.

One of the organisations most specialised in the fight against unfair concentrations of land is the MST. MST has a strong international reputation and this status is reflected in its website which is available in six languages. Since the late 1990s, MST has broadened its perspective to include agroecological issues.

Land reform through the market

In 1998, then-president Fernando Henrique Cardoso launched "land reform through the market". With financial support from the World Bank, local banks provided money to farmers so they could buy land from estate owners. Farmers, in fact, were paying for the land reform which was their right and richly compensating estate owners at the same time. The effect of Cardoso's programme on small farmers was disastrous: land prices rose and many went bankrupt, unable to pay back their loans. Even so, in this way, 80 000 farmers gained access to land. Cardoso's approach raised considerable discussion in Brazil and within the landless movement. Lack of credit eventually put an end to this neo-liberal approach to the land problem.

Lula and land reform

Since January 2003, when President Lula came to power, there has been more hope of a strong land redistribution policy. Lula is closely associated with the fight for land reforms. One of the priorities of his government is the *Zero Hunger Programme* in which the family agricultural model has been given a central place. The question for all those concerned with the politics of land reform in Brazil is whether "Lula" will be able to stay out of the landowners "clutches".

For its part the landless movement currently follows a double strategy: it puts government under pressure by encouraging land occupation yet it is also ready to engage in dialogue. On 2 July 2003, the President met several representatives of MST. These amicable discussions were not greeted with enthusiasm by the country's estate owners.

Future direction

The land issue continues to be a life or death struggle. In the first 6 months of 2003 alone, 31 farmers have been murdered. Whilst the landless movement demands that a national plan for land reform be drawn up which would ensure one million farm families will receive land rights by 2006 and an immediate solution is found to the problem of the 120 000 farm families living in camps, landowners are organising themselves to hold on to their (il)legal possessions. In this highly volatile situation it is difficult to predict the direction land reform will take in Brazil.

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A full version of this article is available from ILEIA.

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Less influence means more work for women. Photo: Ramesh Sharma

Accessing livelihoods through shared farming

Seema Tripathi and Shiraz Wajih

In eastern Uttar Pradesh, more than 90 percent of the economy is based on primary production. The area has a high population density with some 1200 persons per square km. Land is divided each generation between the sons of the family and this has lead to very high land fragmentation. The average land holding is now extremely small and around 70 percent of the families have access to less than 0.4 ha. This includes the 10-15 percent of families who are landless and work as agricultural labourers, cattle rearers, or as wage labourers in nearby towns.

This article is based on a study conducted in some villages in Gorakhpur district where the Gorakhpur Environmental Action Group (GEAG) is active. However, it reflects the general situation in eastern Uttar Pradesh. In the villages studied 60 percent of the land holdings are smaller than 1ha and farmers with larger holdings are considered to be better off. Only about 5 percent of farmers own more than 2 ha of land and this, in combination with other sources of income through employment or running small businesses, makes them relatively wealthy.

Land reforms have not helped much in this area. Laws such as the *Land Ceiling Act* that limits the amount of land that can be held by one individual, have only benefited small farmers in those areas where there are land holdings of more than 10-15 ha available for redistribution.

Livelihoods in the area are largely dependent on land-based activities, and opportunities continue to shrink as population and land fragmentation increases. The adoption of high input agriculture, including the use of hybrid seeds and agrochemicals, has lead to increased costs and a reduction in crop diversity. This means that the economic margins in farming are becoming very small.

Markets and government purchase centres give priority to larger quantities of produce, which also disadvantages small producers both in terms of sale and price. As a result many small farmers often have no option but to migrate to the city.

Increasing labour costs and decreasing gains have also created problems for larger farmers. Absentee landlords who live and work outside the region, large landowners and families with older or physically less able members are not able to manage their own farms. Nevertheless, they want their land to be used and if possible to receive some income or products - food, fodder or fuel - from their fields. At the same time, there are a large number of smaller and landless farmers who have agricultural skills, but no way of earning a livelihood.

These two groups of people have developed a tradition of sharing their resources for mutual benefit. Where the resource base is shrinking this is a considerable help to resource-poor farmers. Share cropping has become a viable and acceptable mechanism for generating income for deprived communities.

Sharing resources

The history of present share cropping arrangements can be traced to the Zamindari abolition days in the 1950s. During this time, land titles and the right to transfer land was handed over to farmers. This changed the nature of negotiations as far as land use and payment of revenue was concerned. Previously, farmers ("*asami*") paid the revenue to collectors ("*zamindari*") for the use of land. Today, share cropping arrangements are agreed between farmers themselves. There has been no significant change in land ownership in the area since then, although hierarchical divisions (land being split between sons) and land consolidation (small plots belonging to one holder being brought together to create larger areas) have continued.

Currently, approximately 30 percent of the agricultural land in the villages studied was being worked under share cropping agreements. Some 45 percent of the smaller and resource poor farmers depend on share cropping for their livelihoods (see Figure 1).

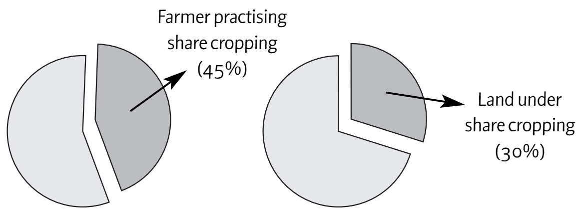

Figure 1: Percentage of farmers practising share cropping and land under share cropping in the study villages

There are three main kinds of share cropping systems:

Adhiya

Land is cultivated by resource-poor farmers who share inputs and outputs with the landowner on a 50-50 basis. In this system, the landowner provides land and one or more of inputs (oxen, labour, fertiliser, and seed). The produce is shared equally. This is the most common practise in the area and causes very little conflict. This arrangement is also common amongst farmers with equal status.

Honda

In this system, the land is hired on fixed terms by a resource-poor farmer. The fixed terms include the type of crop to be grown and how much of the harvest should be used to pay for the land. The landowner only supplies the land. All other inputs are provided by the share cropper. In some cases, the land owner provides a loan in kind (fertilisers and seed) or cash. This loan has to be repaid in addition to the share of the harvest agreed upon. At present, as share cropping becomes more common, landless people have started to compete for these arrangements. Under *Honda* , the element of exploitation is stronger, as the share cropper is responsible for any loss or damage caused by rainfall or other natural disasters. More conflicts occur under these arrangements.

Share croppers harvesting a field, Gorakhpur district. Photo: Ramesh Sharma

Rehan

In this arrangement, land is leased at an agreed price for an average period of one to three years by a resource-poor farmer or group of farmers. The amount of cash involved in this system is relatively high and normally cash crops are grown on this type of land.

Other arrangements

In addition to crop-based sharing arrangements, resource poor farmers rear cattle - but more often pigs and goats - on a shared basis. The farmer cares for the animal(s) and also provides them with fodder. Offspring from these animals is shared on a 50-50 basis. Similar sharing arrangement also exists for fruit trees, where the resource poor farmer takes the tree at an agreed price, looks after it and harvests and sells the fruit. The income generated is shared between the owner and the farmer in accordance with the agreement between them.

Access and control

Share cropping mechanisms have evolved around the principal of mutual interest. The involvement of both partners can be seen in different farm activities. Table 1 provides an overview of the power relationship between farmers and landlords in share cropping situations. The column "Influence" shows who has a say in decision making, and the column "Control" indicates who has the final word. For example, when decisions about the choice of variety have to be made farmers and landowners discuss this together. However, if there is a difference of opinion it is the landowner who decides.

The preferred crops for share cropping are paddy, wheat, sugar cane, maize, groundnuts and vegetables. The landowner and the farmer usually have different preferences about which crop to grow. Labour intensive cash crops are generally preferred by the landowner, whereas farmers usually prefer crops that provide safer returns and require less labour. Share cropping arrangements are mostly agreed between a male farmer and the landowner. This means that women involved in working these fields have even less influence on decision making than is normally the case in family farming. For them, share cropping usually means more work.

The agreement between landowner and share cropper is bilateral and in a conflict situation, decisions are controlled by the land owner. However, as the system of share cropping has become more prevalent and socially accepted, generally agreed and uniform rules have emerged. The land owner is morally bound to adhere to these rules. However, there is nothing that can stop landowners from taking other decisions. If a conflict of interests arises, resource poor farmers are at a disadvantage. However, in the absence of other viable livelihood options, the system of share cropping provides large numbers of resource poor farmers with access to a livelihood.

Effects on farming systems

The crops grown on shared land and farmers' own land do not differ very much. However, on closer inspection it becomes clear that farmers give priority to their own land when implementing LEISA techniques. GEAG has been dealing with both types of land and has found that it is on farmers' own land that effective LEISA models have been developed. Farmers incorporate organic compost and bio-fertilisers and practise principals of diversification on their own land because these practises ensure long-term benefits from the extra labour and precious organic inputs invested.

Conclusion

In the prevailing situation of landlessness and a complete lack of alternative livelihood options in the villages, the shared farming system has brought land controlled by comparatively better-off farmers who are unable to farm it fully back into agricultural production. More importantly, although such arrangements can be exploitative, they provide a source of livelihood to significant numbers of people.

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Table 1: Influence of landowners and farmers on different farm activities

Activities	Influence	Control
Choice of variety	landowners, farmers	landowners (sometimes farmers)
Use of fertiliser	farmers	farmers (sometimes landowners)
Use of pesticides	landowners, farmers	landowners (sometimes farmers)
Irrigation	farmers	farmers (sometimes landowners)
Type of crop	landowners (sometimes farmers)	landowners
Type of products produced	landowners, farmers	landowners, farmers
Decisions on labour and other investments	farmers (sometimes landowners)	landowners (sometimes farmers)

Lake Mweru is our bank

Nettie Aarnink and Paul van Zwieten

Lake Mweru lies in the Luapula valley on the borders of Northern Zambia and the Democratic Republic of Congo. Its fishery provides food, employment and income to about 400 000 local people and supplies 40 percent of the fish sold on the Zambian market. Families in the area have a long history of combining fishing with cassava farming. However, since the early 1900s there has been a steady growth in fish trading between the lake and the towns and copper mines of Zambia and the neighbouring Congo. This has lead to a heavy exploitation of the lake's fish resources and a strong inter-regional trade that increasingly overshadows the traditional local economy.

In contrast to the early 1970s when most of the fish caught were consumed locally, 70 percent of today's catch is either salted, dried or marketed fresh outside the region. Rapid population growth especially in the towns has created a big demand for fish and the recent liberalisation of the Zambian economy has made it easier for commercial interests to enter the Mweru fish market. This has resulted in considerable new investment in large vessels, fishing gear, and the development of freezing plants.

Government

Officially the Mweru-Luapula fishery is State property but in practise, it is a common resource open to everyone. The local Department of Fisheries (DoF) at Nchengele is responsible for "promoting sustained fish production and increasing food availability and employment opportunities based on the sound exploitation, management and conservation of fish stocks". However, it is difficult for the DoF to carry out its tasks because it does not receive the funds and manpower it needs from central government. The weakness of the DoF and its inability to enforce conservation regulations has increased the problems of local fishermen who are finding it more and more difficult to adapt to the ecological and economic changes that have taken place in the fishery as a result of the heavy, unregulated exploitation of fish resources.

Local economy

The local farmer-fisher communities are made up of members of the Lunda, Bwila and Shila tribes but there are also many migrants who have been attracted to the area by its fish. Today, there are three categories of fishermen working on Mweru-Luapula. First, the owners of powerful large vessels that have the capacity to fish the lake for long periods of time, salt fish on board and act as a floating market for smaller fishing boats. Second, there are those who have earned enough money to invest in a plank boat equipped with several types of nets and a small crew, and there are the local, subsistence fishermen who set their traps along the shores of the lake and in the swamps and tributaries of the Luapula River. It is this last group of fishermen who are most at risk from the heavy and largely uncontrolled commercial exploitation of Mweru-Luapula.

Livelihood fears

Local people depend on fish for their livelihood. It is their main source of protein and fishermen usually reserve part of their catch for their families. Fish is their major 'cash crop' and is shared, bartered, and given in tribute. It 'pays' wages and settles bills. It also ensures the social and political security of the local fishing communities.

Those whose day-to-day survival depends on fish are becoming increasingly anxious about the future. Fish catches have been in

steady decline. In the late 1950s, fishers caught between 11 and 12kg of fish per 100 meters of net per night. Today, this has fallen to less than 3kg. Older people remember the huge catches of the past when young fish were thrown back into the lake to mature. Now undersized fish (*mponde nshima)* are routinely marketed.

To some extent the cassava gardens managed by the women of the household shield local families from the uncertainties of fishing. Once matured, cassava can be harvested when needed. It is, therefore, an important source of food and income and can be bartered for fish and other necessities when catches are low, nets are stolen, or when the families are in difficulties because a fisherman is sick or dies. However cassava is only one part of a fish-dependent livelihood system in an area where there are very few other sources of income.

Stakeholders

Local shopkeepers also depend on the lake. If their customers are unable to catch or sell fish there is no money to spend. Most of the shopkeepers in Mweru-Luapula started their businesses with capital they earned from fishing, trading in fish, or working on the boats. Apart from providing essential commodities, shopkeepers are important sources of credit to the local fishing communities.

Traditional authorities have also an interest in the lake. Tribute and other customary dues are paid in fish or with earning from the fish trade. Tribute is an important part of local life and is seen as a token of respect. It ensures good relations between fishers and the traditional authorities who still have considerable power. Although the official mandate to manage the fishery is in the hands of the DoF, fishermen and traders know that chiefs have the power to ‘punish’ fishers who break traditional law by confiscating their fish or gear, that they can refuse to grant traders permission to enter their areas, and that they have the right to discourage inappropriate fishing practises.

Everyone has a stake in fish. Photo: Nettie Aarnink

Stakeholder action

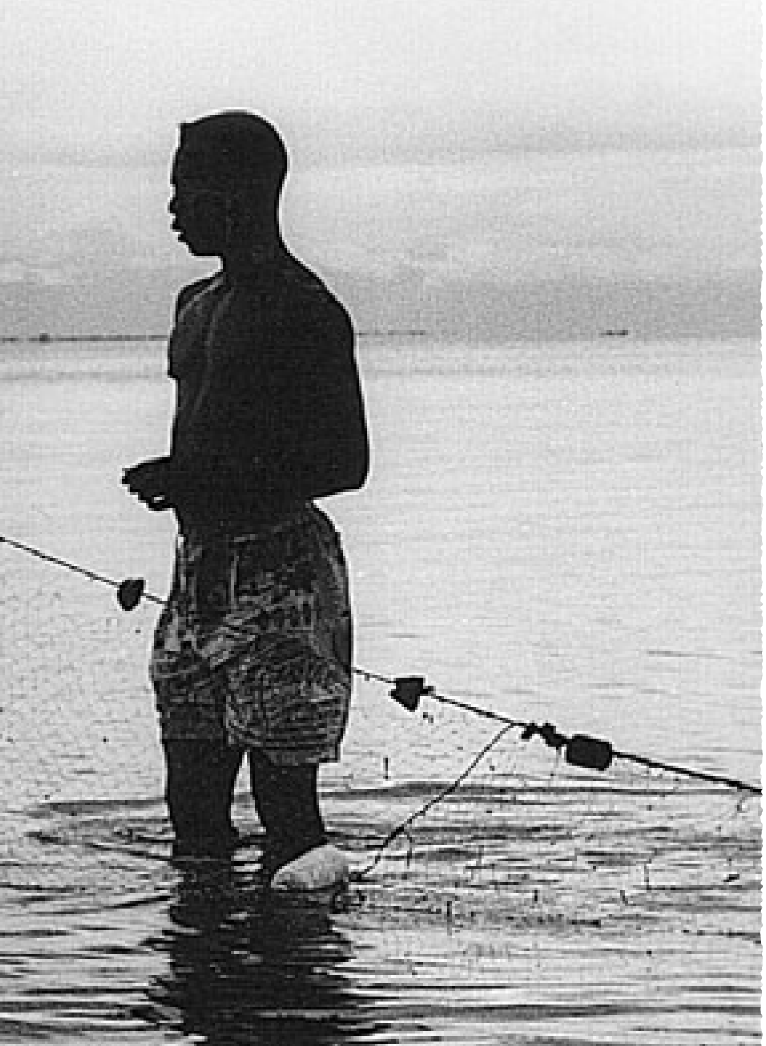
Those with a stake in the fishery have not accepted the growing threats to their access and control of resources passively. Some local fishermen have set up fishers associations to combat net theft, destructive fishing practises and lack of support from local authorities. The first associations started in the north of Lake Mweru in the 1980s and followed the constitutions developed by Congolese fishermen. Gear registration systems were set up to protect nets and other equipment and in some places monitoring systems were established to track down stolen nets. Association members complained openly to government about their declining catch. They demanded better local management and enforcement of conservation measures by the DoF. They also wanted local councils to use some of the money collected by taxing the fish trade to provide better services and infrastructure. At the same time some associations took the initiative to educate their members about the value of conservation and the importance of obeying DoF regulations.

Other stakeholders, such as local business people and traders, also demanded better control of the fishery and action against competition - especially the freezing companies who they say “milk our fish”. While shopkeepers pressed government to make funds available to enforce existing regulations and stop industrial fishing practises, consumers turned to their chiefs with complaints about the scarcity and high price of fish on the local markets, and women traders demonstrated against the closed season because it deprived them of their only source of income.

Conservation dialogue

In the early 1990s, in an effort to increase its effectiveness, the DoF changed its approach from trying to enforce government rules and regulations, to looking for more participative ways of involving stakeholders in the management of the fishery. This was a difficult and complex process for, although most of those fishing on Lake Mweru realised the consequences of heavy and unregulated fishing and respected the DoF as the “father” of the fishery, this did not encourage them to follow conservation measures. In the struggle for survival and the race for fish and a share in fishery-related profits the most common course of action was to ignore traditional and statutory regulations.

The DoF attempt to get local support for a more community-based management began with activities that aimed at helping stakeholders understand the background and objectives of the conservation process. This involved meetings and discussions

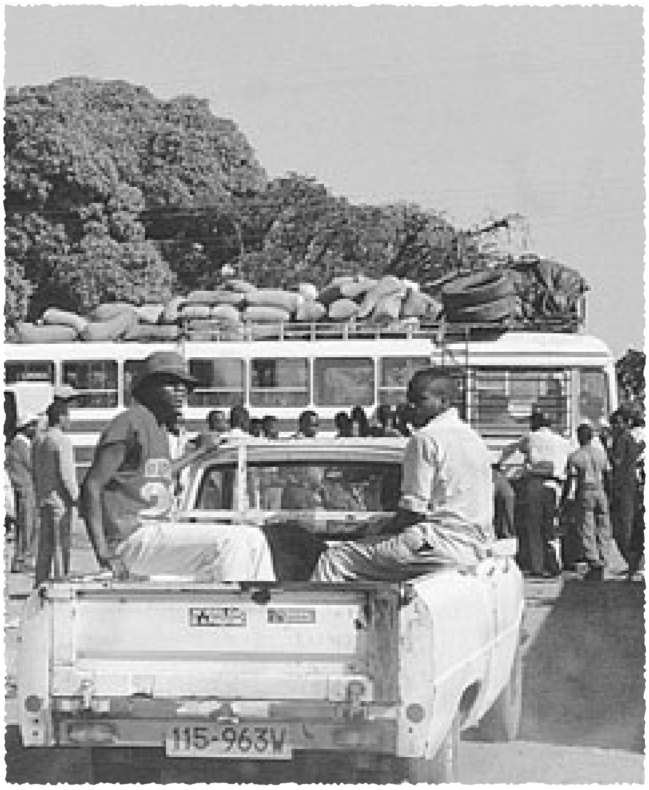


Fishermen on the shores of Lake Mweru. Photo: Nettie Aarnink

with fishers and their loosely organised and scattered fishing associations, and with traders, local business people and traditional leaders.

In 1992, as part of this conservation dialogue, the DoF organised a meeting for fishers and chiefs at which the management of the Mweru-Luapula fishery was discussed in an open and critical way. It became clear that past efforts at conservation, particularly dissatisfaction with the way in which the closed fishing season had been arranged, played an important role in people's attitude to rules and regulations. In pre-colonial times the opening and closing of the fishing season had been clearly accompanied by rituals and ceremonies. However, during the colonial period and later the country's fishery policy, including regulations relating to conservation, had often been applied in harsh and discriminatory ways or manipulated for political and economic ends.

Meetings and discussions, as well as joint field visits by staff and fishers and educative activities such as theatre, documentaries and pamphlets helped the DoF to get a clearer picture of the perceptions and concerns of different stakeholders. During participatory training and learning sessions, fishers made it clear that if stakeholders were to be involved in managing the fishery and in working out acceptable rules that were fair to everyone, the DoF should make sure they were enforced.



Fish continue to stimulate a thriving transport business. Photo: Nettie Aarnink

Towards co-management

The experience and information exchanged during these meetings showed the DoF that there were initiatives being taken at the local level that could be developed further in a process of community-based management. Better and more frequent communication would lead to more information about social practises, strategies and resource users and how they control, exploit, monitor or protect the fishery. As a result of the conservation dialogue process some DoF staff began to change their attitude to stakeholders and became more prepared to involve them in the conservation effort. The Nchelenge Fisheries Coordinating Committee, a management platform that included the district council secretary, the manager of one of the freezing companies, DoF staff, fishers, traders, marketers and chiefs was set up with these co-management objectives in mind.

To some extent stakeholders in Mweru-Luapula agree that the fishery should be state-regulated, provided rules are fair, applied to all, and are enforced strictly and transparently. But they also have to meet their daily needs for food and cash. Customary and social obligations have to be honoured. For many fishing families the need for short-term security may outweigh any sense of obligation to keep to externally imposed regulation that promise to protect future fishery resources but which clearly cannot be enforced.

Rethinking the balance

In Mweru-Luapula a weak DoF, a mixture of customary and statutory regulations and many, often conflicting stakeholder interests, encouraged stakeholders to ignore conservation measures. However, as the stakeholders meetings showed, there was a basis for developing a dialogue between the DoF and key stakeholders. The experience of the Nchelenge DoF has shown that in order to develop acceptable management strategies that balance the interests of local communities, commercial actors, and traditional and local authorities the DoF should:

- negotiate with all stakeholders to strike a balance between economic, social and ecological concerns
- increase its understanding of local perceptions and initiatives in management and monitoring.
- explore and monitor local ideas, strategies and initiatives. and understand how people at various levels cope with uncertainties or respond to new (external) developments.
- inform the Zambian government about initiatives for new policy, legislation and fishery management based on current trends.
- advocate an international, harmonised management framework with the Democratic Republic of the Congo, an issue strongly advocated by fisheries officers, fishers and local leaders in Zambia and the Congo.

If the DoF can maintain a fully participative approach to managing the Mweru-Lualpula fishery, keep the confidence and trust of key stakeholders and receive adequate support from central government, it may be able to succeed in developing conservation measures that provide security for local fishermen and, at the same time, create opportunities for a well-regulated exploitation of the fishery potential of the lake.

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Improved well with hand pump owned by Salato Women's Group. Photo: Laura Lemunyete

Securing access to water in Ngurunit

Laura Lemunyete

Ngurunit location lies in the foothills of the Ndoto mountains in the semi-arid environment of Northern Kenya. The local Samburu and Rendille pastoralists live in scattered villages and depend on their livestock for milk, meat and other products. Water is a problem for both humans and livestock. Though many riverbeds cut through the foothills, most have no surface flow except during the twice-yearly heavy rains. The main river, which is also fed by some mountain springs, can sometimes flow for three to four months at a time but then becomes progressively drier further and further up the mountain like the other riverbeds.

These dry riverbeds provide most of the water for livestock and people when wells are dug at strategic points. During and after the rains water can be drawn from shallow holes dug in the riverbed. After the rainy season, when the area dries up, more extensive wells are dug deeper and deeper as the water level in the riverbed drops. These can reach up to 30 or 40 feet deep.

Traditional wells

In the past, wells were dug in the riverbed or in areas where water accumulated. During the rains, these were usually destroyed and re-dug in the dry season. Traditionally, those who dig and maintain the wells are considered the owners. As this is laborious work, only the men are involved and they are recognised as the sole owners of the wells. Those who have not dug their own wells and women in general have access to wells under traditional rules.

The owner of the well has first priority, first for his livestock and then for his family's needs. Afterwards, if there is water, others can use it for their livestock. Women and children are the last to get water. As the dry season progresses, traditional rules start coming into play and people must respect the owners of the wells and the complex schedules regulating water access. Directly after the rains when there is plenty of water, women can get it from anywhere along the riverbeds by digging shallow holes and do not have to rely on the deeper livestock watering wells.

Problems

During the rains and immediately afterwards, everyone has easy access to water. However, when it starts to dry up problems arise. These include women and children having to walk long distances to existing wells and then waiting for the livestock to be watered. During times of drought when there is very little water, this can mean waiting into the night for the well to recharge because it has been emptied by a large herd. Sometimes they get no water at all.

Common problems associated with the traditional system of well construction and use, especially when water is scarce are:
• School children having to wait to get the water they need to take to school for cooking and cleaning, thus missing classes.
• Women having to wait for hours for household water, sometimes even into the night.
• In dual purpose wells (livestock and human) water is easily contaminated making it unhealthy for human consumption.
• Households that are not able to dig their own wells, especially women-headed households, become dependant on the good will of well owners.
• Digging and maintaining traditional unprotected wells requires much labour because they collapse when it rains.
• During times of severe drought people resort to stealing water at night and well owners must guard their wells to ensure their livestock get enough.

Solutions

From April 1996 to April 1997, there was severe drought in Ngurunit and wells up to 30 or 40 feet were dug in the main river bed because all other sources were dry. Women and children were hard hit. When the rains came and water became easily available again, the community, especially the women, decided to deal with the problem of water access.

One group, Salato Women's Group, started looking for ways to build their own wells. They used funds from various sources including their profits from craft sales, a grant from a development organisation and some assistance from a church group in America. In 1998, they started to build two wells next to their group plot. The well for their group livestock was finished in mid-1999. The other well was covered and fitted with a hand pump donated by a German aid programme in 2000. Once dug, both wells were protected with cement to prevent them collapsing.

These wells were the first in the area to be owned by Samburu/ Rendille women rather than by individual men. Having separate wells for livestock and humans and especially the covered household well also set an example for hygiene. Although owned by the women's group, all households in the surrounding area could access the covered well.

The Salato Women's group was successful in building the wells because they had funds to hire labour. Women generally do not have their own property. Since coming together as a group, they had been able to get funds they could not have accessed as individuals. Over the years, the group's activities earned the respect of the men. As the group started to earn an income and build connections to outside assistance, men's attitudes started to change. They were willing to help them dig their wells and appreciated being paid.

The Salato women's decision to build wells fitted into the general pastoralist perception of the importance of water resources. Men in the area were able to support this choice because they also benefited from the wells, even if they did not own them. In Ngurunit, water scarcity is relative. There is water in many of the dry riverbeds if wells are dug deep enough. The major constraint is the labour needed to dig the well, hence the ownership rules. When a women's group was able to get resources to dig more wells, men were prepared to welcome this development.

From mid-2000 when the Salato Women's group second well was completed, the attitude towards water and access to water began to change in Ngurunit. The community started to try and get funds to build covered, hand pump wells that women and children could use for household needs. One well was built for the primary school so children would no longer have to wait for long hours at individually owned livestock wells. A second woman's group also raised funds and built their own well to provide water for their tree nursery and their families.

In 2002 there was a drought. Even so, with some rationing, the availability of hand pump wells meant that everyone was able to meet their needs with less waiting and trouble than under the traditional well system. That year Salato Women's group also raised funds for a preventive health practises project. They built three more covered hand pump wells in villages that were farther away from the main riverbed. With clean water nearer to home, the group succeeded in reducing the workload of the women and young people who no longer had to walk long distances for household water.

By March 2003, Ngurunit sub-location had eight community hand pump wells for household water, five of them owned solely by women's groups. In addition there was also the original livestock well built by the Salato group in 1999.

Plans

The success of the hand pump projects and the empowerment of the women who own some of them, has shown there are workable solutions to the problem of water scarcity in this semi-arid area. Some outlying areas that now depend on the Ngurunit wells but do not have appropriate places for hand pump construction, are working on their own solutions such as rock rainwater harvesting systems and protected water pans. In Lebendera, Meingati Women's Group is the driving force behind developing their own community water sources. After seeing the success of the Salato Women's group in accessing water, they have realised that men were not the only ones who could control water, and that to care for their households, women also need secure access. In the villages of Illaut and Arsim, women's groups are also trying to get enough resources to develop wells for community use.

Women in the Ngurunit area are becoming increasingly independent in their access to water. In addition to the important changes in water access and control, the successes of the various women's groups in securing water has affected other aspects of their lives as well. Through the support and actions within women's groups, they have been able to gain control of many assets they did not have in the traditional system. These include ownership of livestock and group plots for income-generating activities and an increased capacity to run business enterprises such as beadwork and marketing local commodities and livestock products both on a group and individual basis. Any resistance men may have shown to these changes in the traditional pastoralist system has been largely neutralised by the clear benefits that these activities have brought to the community and individual households.

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Land tenure and resource access in West Africa

Most West African countries depend heavily on natural resources for income, employment, livelihood, and export earnings. The legal and administrative measures that determine the access to and control over natural resources are, therefore, very important to enable improvement of long-term productivity, stimulate investment, encourage fair access and make it possible to avoid conflict.

In recent decades there has been rapid population growth and increased urbanisation and labour migration throughout West Africa. Some areas, such as the coastal countries along the Gulf of Guinea, have experienced heavy urbanisation. In other areas, pressure on farmland as a result of migration of people and cattle from drier to wetter parts has caused problems. These patterns are expected to continue, leading to land scarcity and a reduction in the size of holdings. Urban populations are expected to triple by 2030 creating an increasing market for food produced in the agricultural hinterlands.

West Africa's agricultural and ecological zones range from moist forest in the south to arid deserts in the north. Their history and socio-economic characteristics have resulted in many different systems for managing resources. However, there are issues common to all countries.

Common issues

Throughout West Africa contradictions exist between customary tenure and government laws and regulations (statutory tenure). However, customary tenure remains the most important system through which people regulate access to land and other resources. Customary tenure is based on the values and norms of each social group and this gives legitimacy to local decision-making.

Customary systems

In most customary systems land cannot be bought and sold freely. Despite this restriction, customary practises do not seem to have hindered investment in the small-farm sector. However, customary systems do have drawbacks. Powerful groups, for example, may use their position to access key resources, or try to sell land that is traditionally considered community property. In some customary systems the rights of socially marginal groups, including women and certain castes are poorly guaranteed. Also many governments do not recognise the legal power of customary authorities to regulate and administer land. As the interests of communities and groups in West Africa change this affects customs and practises of resource management. In addition, as commercial opportunities increase many customary tenure systems are tending to evolve towards individual rights.

Statutory systems

The state controls land in statutory systems and has the power to decide rights and titles. Statutory systems are based on state authority and are enforced by government to serve state interests. Statutory and customary systems have different ways of deciding on issues of access to resources. For this reason statutory systems are not always accepted at village level. As land becomes scarce and its value increases, problems caused by the differences between customary and statutory law can lead to growing insecurity. In West Africa, other factors such as Islamic law and the impact of development projects can increase the difficulty of reaching decisions on the issues of rights to resources.

Effective and just implementation of customary and statutory laws and practises depends on clear definitions of the relationships between the two systems. One way to achieve this could be to define the areas in which statutory law applies - such as in peri-urban areas - and let the customary system apply outside these areas.

Registration

In West Africa, ensuring land tenure security is seen as a way of encouraging land users to invest in agriculture. At present less than 5 percent of land is in individual ownership under statutory law. Most of this land is in towns where its relatively high commercial value makes it worthwhile for owners to invest in registering title. However, experience shows that there are serious difficulties associated with land registration in West African conditions:

- Land registration is expensive for the state, requiring the maintenance of a centralised system for land survey and administration.
- The mapping and registering of title to many small plots and maintaining and updating registration is extremely difficult. In practise, widespread land registration is very time consuming and difficult. Legislation permitting or requiring registration is widely ignored.
- Once land is registered, informal, unregistered land transactions still continue along customary lines and registers quickly become out of date.
- Local elites and private investors generally have privileged access to formal registration systems and can exploit them to the disadvantage of customary rights holders.
- Survey and registration fees, illiteracy and bureaucratic processes discourage poorer rural people from registering land.
- Registration campaigns cannot deal with the full range of customary rights and they frequently undermine the security of women, other subsidiary rights holders, and community claims to common resources leading to increasing disputes and insecurity.

However, registration programmes may be useful in certain cases. For example, where customary systems have broken down or are very weak or where the value of resources has increased, leading to conflicts and disputes.

Other approaches

Registering individual rights is not the only way of regulating access and control to land and some other methods are being tested in West Africa. They include community land-use planning projects, such as *gestion de terroir* approaches where decisions on land and natural resource allocation are made at village level and accepted by government. Finally, farmers are also developing more informal ways of securing land tractions (rental land, sharecropping, or even sale) by involving witnesses and putting agreements into writing which are then signed by the village chief or even a local level administrator.

Conflict management
As resources become scarcer and more valuable, competition between users intensifies. It is therefore important that procedures and mechanisms are developed to resolve conflicts and disputes. Places where serious competition is likely to develop include peri-urban and wetland areas and regions that attract agricultural migrants. Relations between farmers and herders are likely to become tense as village cattle herds expand, grazing areas contract, fodder becomes scarce, and fields start blocking cattle tracks. In such situations customary systems for resolving conflict, where they exist and are still effective can be elaborated as a step towards dealing with disputes.

Common property resources
Common property resources remain important. Access to fuel wood, common grazing, the availability of non-timber forest products, fish resources and construction timber are important to most rural communities. Nationalisation measures by various governments and a lack of any recognition of villagers' rights in certain West Africa countries has meant that many common property resources are unregulated and open to all. In addition, resource use has altered because of interventions that have undermined existing management systems. Forests have been demarcated as government reserves, public boreholes have opened up grazing areas to all-comers, and traditional fishing regulations have been over-ruled by new projects and regulations. Common resources are under pressure, particularly in densely populated areas where a decline in fallow has reduced the amount of bush land available for forage and has lead to an increasing assertion of individual rights to grazing and other resources.

Will it be possible, in future, for different users to agree on ways to manage common resources in the interests of long-term productivity, and will government be able to give sufficient power to local communities to enable them to negotiate and enforce controls on access to resources? Recent pilot projects have shown that such measures as the joint management of forest areas, and local management agreements between villagers and the government have considerable potential.

Pastoral livestock sector
The pastoral sector is critically important in many parts of West Africa and continues to be an important source of income and export earnings in drier areas. It is now recognised that the continued viability of the pastoral sector in the semi-dry areas of the savannas and the Sahel depend on herds being able to move as freely as possible between grazing areas and sources of water. They must also have access to dry season grazing because rainfall and forage resources are not enough to allow herds to remain in one place for long.

Pastoralism, in contrast to farming, is not recognised by most West African states as productive land use. This complicates the issue of pastoralists' rights in statutory law. It undermines security in pastoralist communities and makes it more difficult to deal with the problem of grazing areas being converted into agricultural land. Further, if pastoralists cannot use crop residues because farmers are using them for their own herds, grazing areas are reduced through cultivation and transhumance routes are blocked, it will be impossible to maintain a productive, mobile livestock system.

Future
In West Africa policies are being discussed to tackle these problems. These include decentralisation, clarifying customary and statutory tenure systems, and encouraging debate at local, national and sub-regional levels.

Given the diversity of most West African countries, the development of national policies on land and natural resource management must take local conditions into consideration. Several West African governments follow decentralisation policies that involves central government giving more power and responsibility to regional or district administrations and elected bodies. Land tenure administration should, if possible, be carried out at the lowest level of management leaving the higher levels of government to take on issue lower levels can not handle. This is the principal of subsidiarity. The idea behind this approach is that, by electing local representatives, local interests and needs are better served and contact between local people and the administration will improve.

West African states have limited financial and administrative resources making it difficult for governments to become heavily involved in managing land at local level. However, government remains responsible for providing the principles and framework that guide decision-making on issues of tenure and access to resources and ensure that local organisations are transparent and accountable.

West African governments already support a number of initiatives related to land tenure and access to resources. National governments can draw on these to encourage local debate on the policy options available in land tenure. Public consultation is particularly important in countries preparing new land tenure legislation. Experiences such as *gestion de terroir* can provide useful insights into how community-based natural resource management works. Lessons can also be learned from initiatives to establish the co-management of forest and wildlife resources and programmes to improve the management of conflict.

Finally, the exchange of experiences between countries not only strengthens the capacity to analyse and solve land tenure problems, it also allows trans-boundary issues to be taken into account. At this level regional bodies such as CMA-AOC, CILSS and ECOWAS can provide representatives from West African countries with opportunities to discuss common problems in developing policy for land tenure and natural resources management.

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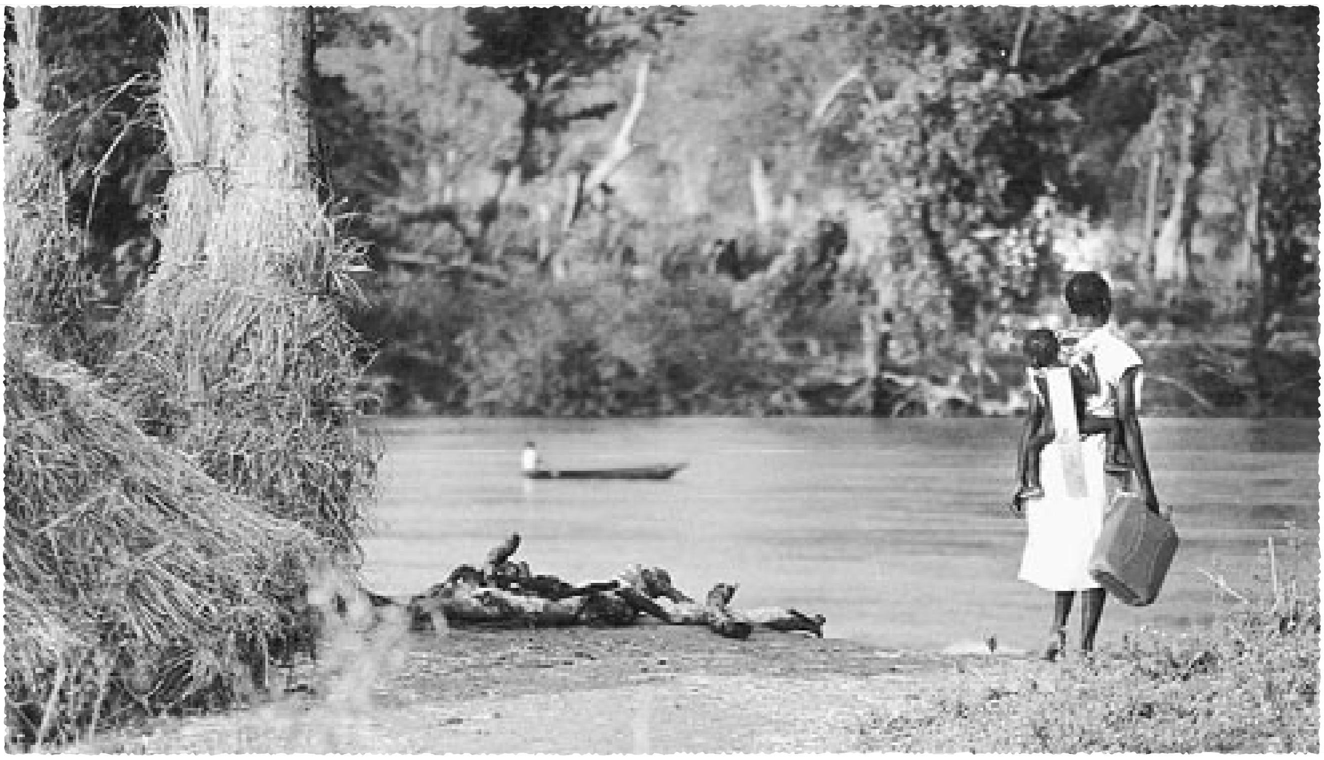
Adapted for publication in the LEISA Magazine from the IIED Drylands Programme report ***Land tenure and resource access in West Africa: issues and opportunities for the next 20 years,*** *IIED, January 1999, with the kind permission of the IIED Drylands Programme.*



Access to grass, fuelwood and water. Photo: Jan-Gerrit van Uffelen

Access to and control over resources

Editorial

Access and control over land and other natural resources is regulated through many different systems and arrangements. Whether these systems are formal or informal, statutory or customary, restrictive or open, they all play a major role in rural livelihood security.

History, values and beliefs are reflected in the way societies organise their systems of agricultural production and natural resource management. They determine the extent to which farmers and other rural community members have the right and power to secure the resources they need to ensure food security and income. They also have an important influence on the political climate in which resources are managed and regulated.

Security

Security in access to resource use is essential to sustained agricultural production. Without long-term security farmers find it difficult to invest in improvements that only produce returns over many years. Farmers must feel confident that they will be able to benefit from their efforts. Secure land rights provide them with the opportunity to accumulate wealth and to ensure it is transferred between generations. They often have a very strong bond with the land they farm, land they may have inherited from earlier generations and would like to hand over to the next generation in good condition. Where the future is uncertain, people may make short-term, exploitative or destructive decisions about the use of natural resources (Zewdie p 21).

Securing access to land for food production represents a particular problem for many women living under systems of customary law. In Southern Africa, for example, the effect of HIV/AIDs in the rural areas has resulted in increasing numbers of farm households headed by widows. Many of them have been dispossessed of land and agricultural assets under customary laws that invest land rights in the husband and his heirs. Without security of tenure women's capacity to produce food and care for their families is being seriously undermined (see the article on p 30).

Secondary access to land and other resources is not only a problem that confronts women. Other marginal groups such as herders, migrants and refugees often have serious problems in negotiating access to resources, as the article on the Sherkolle refugee camp clearly demonstrates (Abebe p 18).

In the rare situations where there are few limits to available resources, secure access is not a problem. As soon as land and other resources become scarce, however, either in real terms or because of restricted access, rights have to be regulated in ways that are acceptable to most of the community and give users enough security to invest efforts in sustainable management practises.

Different arrangements

There are many different ways in which access to land and other resources can be organised. These include freehold, leasehold, sharecropping and rental arrangements. There are also systems of usufruct in which the owner – whether this is the clan, traditional leaders or a landlord - grants rights to use the resource for a limited period of time. Access arrangements depend on many factors and are influenced by local conditions such as population density, the availability of land, its productivity as well as the socio-political context and history of the community concerned. In some societies, land use is egalitarian as most community members have equal access to land. Usually, however, access to land depends on social status gender and power structures, where the most influential in the society control most of the land and the poorer members work it under certain specified conditions.

All systems that do not depend on repression and the use of force to maintain themselves need the acceptance and support of the majority of their members. In addition, those responsible for enforcing them must have enough power, legitimacy and political will to do this effectively. Such systems provide a relative level of security – people know what the rules are today and what they are likely to be tomorrow. Systems that are deeply embedded in the culture and values of a community and continue to provide benefits for their members can be resilient enough to survive for centuries. An example is the *Subak* system of water management in Bali (Suarja p 25). However, some customary systems are also characterised by deeply entrenched biases against certain groups such as women and migrants.

The resilience of traditional arrangements for managing resource rights can also be seen in situations where new legislation has been imposed on local communities but can only be weakly or incompletely implemented (Aarnink p 10). In Africa it has been estimated that less than 10 percent of land is being administered under statutory law. Most of it continues to be regulated under customary provisions and in many countries these have yet to be formally recognised by the state. In West Africa, this has resulted in an ill-defined and sometimes contradictory relationship between statutory and customary law (IIED p 6). Some African countries are currently trying to give statutory status to customary practises, but this is a complex process and difficult to implement. This can be seen in the article on South Africa's efforts to introduce communal land rights legislation (Cousins p 27).

Change
Changes in access to land and other agricultural resources have, historically, often provoked violent and far-reaching reactions because not only do they affect economic security but also deeply disrupt cultural and spiritual life.

Customary systems of natural resource management that have evolved gradually over time are vulnerable to radical economic and political change. In rural communities in many parts of the world traditional rights and obligations were undermined by the imposition of colonial law and settler practises. In countries like Brazil, such interventions continue to have far reaching consequences (Vankrunkelsven p 15).

In areas of continuous population growth where pressure on agricultural resources fuels rapid economic and social change, conflicts and disputes over land and other resources are common. This is particularly so in peri-urban areas and in the agricultural hinterland of large cities, where expanding markets open up promising commercial opportunities. In such situations there is the danger that those with custodial powers and responsibilities in the traditional system may start to use them to their own advantage, ignoring the communal nature of the resources involved. In societies where the gap between rich and poor is widening an increasing number of the dispossessed are left to share a decreasing and frequently degraded resource base. The consequences of ineffective access to the political system has lead those without land to organise themselves in popular movements to force a more equitable land policy (Corrêa p 16).

Resourceful people
In situations where governments are either unwilling or unable to meet their responsibilities for the management of resources that are under their control, rural communities often look for practical solutions. The role of informal leaders can be very important in such circumstances. This can be seen, for example, in the article on the experience of Rautela, the water volunteer, who helps his community make better use of all available water resources (Critchley p 23).

In some cases, people have come together to improve the resources available, such as the pastoralist women of Ngurunit who took the initiative to collect funds and organise the digging of wells so they had a reliable and safe water supply (Lemunyete p 8). When communities improve access to resources such as water this can lead to a need to re-define rights of ownership and use. This was the case in the Arvari river where local initiatives to revive traditional small water-harvesting structures resulted in renewed river flow. The communities subsequently had to defend their rights to the water and fish production created as a result of their efforts, against outside interests (Kishore p 24).

For those who do not own or have access to their own resources, having the capacity to negotiate the right to use land and other necessities is critical. Share cropping is a strategy often used by landless and other marginal groups who find themselves without access to local resources (Tripathi p 13).

Understanding the dynamics
Access to and control over resources is about power, and there are usually winners and losers when change occurs. Many development projects that deal with agriculture and natural resource management do not pay enough attention to assessing or understanding the issues of rights and tenure before starting project activities. It is often assumed that development interventions will automatically benefit the community at large. Without proper management and channelling of resources this is unlikely to be the case. This is particularly the case with projects that considerably increase the value of resources.

Destitute nomads from Mali came to Christine Wells in Burkina Faso in search of pasture but found a wasteland. Photo: FAO/ F. Botts

This issue of the *LEISA Magazine* focuses on rights to renewable natural resources. However, it should be remembered that other resources are also necessary for a sustainable and responsible agriculture. Today, in many communities, the effects of poverty and unregulated social change have created barriers that inhibit communities from maintaining access to local knowledge and the richness provided by their traditional cultures and beliefs. Ensuring control over the way these human resources are protected and developed remains to be explored in later editions of the *LEISA Magazines.* ■

CONTENTS

LEISA
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Regional editions
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The Latin American edition in Spanish can be ordered from LEISA Revista – Peru, A.P. 18-0745, Lima 18, Peru. Contact: Teresa Gianella-Estrems.
Email: leisa-al@amauta.rcp.net.pe
LEISA India
The Indian edition in English can be ordered from AME, No. 1583,17th Main Road, JP Nagar II Phase, Bangalore 560 078, India. Contact: K.V.S. Prasad.
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The Indonesian edition in Bahasa can be ordered from Veco Indonesia, JL Letda Kajeng 22, Denpasar 80234 Bali, Indonesia. Contact: Rik Thijssen.
Email: leisa@indo.net.id
AGRIDAPE
The West African edition in French can be ordered from IIED Dakar Senegal, PO Box 5579, Dakar, Senegal. Contact: Awa Faly Ba.
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Cover photo
Local Berta women collecting fuelwood not far from Sherkolle refugee camp. Photo: Jan-Gerrit van Uffelen.

The editors have taken every care to ensure that the contents of this magazine are as accurate as possible. The authors have ultimate responsibility, however, for the content of individual articles.

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ILEIA is the Centre for Information on Low External Input and Sustainable Agriculture (LEISA). ILEIA seeks to promote the adoption of LEISA through the LEISA magazines and other publications. It also maintains a specialised information database and an informative and interactive website on LEISA (**http://www.ileia.org**). The web site provides access to many other sources of information on the development of sustainable agriculture.

LEISA is about Low-External-Input and Sustainable Agriculture. It is about the technical and social options open to farmers who seek to improve productivity and income in an ecologically sound way. LEISA is about the optimal use of local resources and natural processes and, if necessary, the safe and efficient use of external inputs. It is about the empowerment of male and female farmers and the communities who seek to build their future on the basis of their own knowledge, skills, values, culture and institutions. LEISA is also about participatory methodologies to strengthen the capacity of farmers and other actors to improve agriculture and adapt it to changing needs and conditions. LEISA seeks to combine indigenous and scientific knowledge, and to influence policy formulation in creating an environment conducive for its further development. LEISA is a concept, an approach and a political message.

Readers are welcome to photocopy and circulate articles.
Please acknowledge LEISA Magazine and send us a copy of your publication.

10 Lake Mweru is our bank

Nettie Aarnink and Paul van Zwieten

Since the 1970s, there has been increasing competition for the fish resources of Lake Mweru, Zambia. This has led to serious conservation problems. The Department of Fisheries found it increasingly difficult to implement the existing rules and regulations to prevent overfishing. It decided to involve local stakeholders in the process of establishing acceptable and enforceable conservation measures. One of the tools used in this process was the highly successful video *Lake Mweru is our bank.* (see page 33).

27 Community consultation and national lobbying in South Africa

Ben Cousins

A proposed Communal Land Rights Bill is being discussed in South Africa. The legislation makes provisions for formalising customary land law. This article looks at the implications of these discussions for the bill and draws the conclusion that only by establishing strong links between local action and national advocacy activities can the voices of local communities be heard.

DEAR READERS

As you read on the back cover of the last issue, the LEISA Magazine is now available in five different editions and four different languages, thanks to our partner organisations in Latin America, India, Indonesia and West Africa. This represents a major step forward for the exchange of information on LEISA and we are very excited to see the different issues develop, each with their own character. ILEIA's new website is under construction and will be launched towards the end of the year. It will carry the information and articles from the five editions, thereby making a lot of LEISA material available in one place. We hope it will become a useful resource and a platform for information exchange.

Another major step for ILEIA is that we are now setting up our own offices after almost 20 years in Leusden. From the 1st of October 2003 we will be located at Zuidsingel 16 in the centre of Amersfoort, the Netherlands. Our new postal address is:

PO Box 2067, 3800 CB Amersfoort, The Netherlands
Telephone +31 33 467 38 70, Fax +31 33 463 24 10

Our email addresses remain the same: ileia@ileia.nl and subscriptions@ileia.nl. Our old postbox address will also remain in use for the coming year, so you do not need to change our address on the subscription card.

We hope you enjoy this issue on access to and control over resources.

The Editors

LEISA

september 2003 volume 19 no.3

Magazine on Low External Input and Sustainable Agriculture

Rights and resources

Spherical water tanks

Gedion Shone

For resource poor smallholder farmers in water scarce areas, even small volumes of stored water for supplemental irrigation can significantly improve a household's economic position. The Regional Land Management Unit (RELMA) in Eastern Africa has been promoting spherical water tanks for harvesting rainwater from roofs and other surfaces, similar to the ones promoted by the Gansu Research Institute for Water Conservancy (GRIWAC) in China. Demonstrations and trainings on water harvesting conducted by RELMA inspired the Ethiopian Minister of Agriculture to arrange an exchange visit with GRIWAC in Gansu province.

Advantages of using spherical tanks compared to other shapes:
- The water pressure is evenly distributed within the tank and the tank therefore requires less reinforcement
- A spherical shape has a smaller surface area than square one and thus uses less building material
- The bottom part is directly supported by the ground, further reducing the need for heavy reinforcement materials
- Easy to construct
- No evaporation takes place as the tank is closed.

In order to reduce construction costs, the tanks are built with locally made clay bricks and mortar. The walls are lined with a mixture of cement and clay on chicken mesh and finished off with a *cement nil* water-proof coating. These tanks are less expensive to build than the conventional concrete structures, and experience has shown that they can be built by local masons with only basic building skills. It generally takes only one session of practical training for local masons to master the construction method.

Three types of spherical tanks - semi-circular submerged tank, underground spherical tanks and partially underground spherical tanks - have now been tried out in Ethiopia, Uganda, Kenya and more recently in Tanzania. The size and shape of the tanks can be adapted to local needs. In the Machakos district of Kenya, for example, where arable land is very scarce, the tanks are dug in such a way that the only soil surface that cannot be cultivated is the manhole opening at the top. These tanks are used to irrigate kitchen gardens, enabling farmers to diversify their sources of income. Micro-irrigation schemes are promoted together with commercially available, low-pressure drip irrigation systems. Cheap drip kits (for example, the Chapin bucket kit, see *LEISA Newsletter* Vol 14.1 p 29) save water and labour, and are increasingly being adopted by farmers.

■

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Construction of a spherical tank in Mbarara district, Uganda. Photos: Gedion Shone.

LEISA Magazines!!

Regional editors and ILEIA staff

In May this year, the editorial teams of all five LEISA Magazines met together in the Netherlands for their international editors' meeting. When the members of the teams from Africa, India, Latin America, the Far East and Europe left, they all felt a strong sense of common identity and purpose and a determination to increase their capacity to ensure that the information, experiences and the growing number of dynamic examples of LEISA in practice will continue to be collected and published regularly.

Establishing new regional editions of the LEISA Magazine is one of the key elements in the ILEIA programme 2002-2006. In 2001, the *ILEIA Newsletter* celebrated its seventeenth anniversary and became the *LEISA Magazine*, a global quarterly already supporting two regional magazines – *LEISA India*, published by the AME Foundation in Bangalore, India, and *LEISA – Revista de Agroecologica,* produced and distributed in Latin America in the Spanish language.

In 2002, with more than 20,000 subscribers and supported by an evaluation that strongly recommended the launching of new regional editions by regional partner organisations, our donors decided to support this development. Two new regional magazines have already been launched and the ILEIA web site is being developed into an easily accessible interactive platform, where information on sustainable agriculture and LEISA approaches to rural development can be collected and retrieved.

The first of the new magazines – *SALAM* – appeared in Indonesia in December 2002. Published by VECO Indonesia, and relying upon their extensive network of collaborating partner organisations, it drew together experiences of low external input agriculture relevant to Indonesian farmers. *SALAM* was exceptional in that it set out a new strategy. Its editors scoured the ILEIA archives for articles relevant to the small-scale farmers of the Indonesian archipelago and, having translated them into Bahasa Indonesia, published them alongside articles they had collected on Indonesian experiences of LEISA.

In May 2003, the fifth LEISA magazine *AGRIDAPE* appeared in the French language. Produced by IIED, Senegal, it focuses on West and Central African French-speaking countries and is supported by the *Technical Centre for Agriculture and Rural Cooperation* (CTA). Launched at the recent meeting of the Global Forum for Agricultural Research (GFAR) meeting in Dakar, Senegal, it was seen by representatives of farmers' organisations, NGOs and agricultural research institutes as a breakthrough in the language barrier that makes exchange between those involved in LEISA in English- and French-speaking Africa difficult. Appropriately, some of the first editions of *AGRIDAPE* will deal with topics of particular concern to the dryland areas of West Africa: water harvesting, access to scarce resources and the restoration of degraded lands. It is clear that many regional experiences await publication and, if the growing number of subscriptions is anything to go by, *AGRIDAPE* is well on the way to becoming standard reading amongst those concerned with agricultural sustainability and environmental issues in the region.

Paulo Petersen of AS-PTA Brazil joined the LEISA editor's meeting to explore the possibility of establishing a Portuguese language version of the LEISA Magazine. While his contribution highlighted the political and economic specificity of the Brazilian experiences with LEISA, it also illustrated that farmers around the world have much in common when they confront the consequences of the global agricultural crises. It was the global dimension of LEISA that formed the theme of the two study days organised for the editorial teams while they were in the Netherlands and it this theme that will guide the documentation, analysis and publication of experiences with LEISA in the LEISA magazines in the coming four years.

The international editors' meeting is held twice a year. The following meeting will be held in Peru in 2004. For further information on the proceedings of this meeting, themes of forthcoming editions and other activities see www.ileia.org or contact ileia@ileia.nl.

Issue 19.4, December 2003

Rehabilitation of degraded land

Developing economies, growing populations and intensified agricultural practices have all contributed to increasing pressure on land resources. Economic growth and intensified, large scale production often leads to the most productive land being used for larger commercial plantations, pushing small farmers onto degraded lands. How can small-scale farmers go about maintaining the land they depend on for survival and increasing its productive potential? How can productive soils be conserved in the face of increasing pressures, and how can sodic, saline, eroded, or toxic soils be rehabilitated to a fertile condition? This issue of LEISA will deal with practices that contribute to maintaining productive soil and rehabilitating land that has been degraded. Please contribute your experiences, ideas and solutions!
Deadline for contributions is the 1st of September, 2003.

You are invited to contribute with articles (about 800, 1600 or 2400 words + 2-3 illustrations and references), suggest possible authors, and send us information about publications, training courses, meetings and websites. Editorial support is provided by ILEIA. Authors of published articles are entitled to a standard fee of US$ 75,–.

World Water Forum
http://worldwaterforum.idrc.ca
Participants of the eight-day Third World Water Forum made more than 100 new commitments on water. This important event was held in Kyoto, Shiga and Osaka, Japan, March 16-23, 2003.

ADB Water for All
http://www.adb.org/Water/help.asp
The Asian Development Bank *Water for All* website provides information on water policies and case studies from different countries in Asia. It also provides information on events and gives references and links.

WCA InfoNET
http://www.wca-infonet.org
The WCA infoNET information system is a growing database of information on water conservation and use in agriculture. It was launched to the public in August 2001 and is managed by the International Programme for Technology and Research in Irrigation and Drainage (IPTRID), hosted by FAO. This site includes documents, data, computer programs, discussion groups and links to other relevant websites.

CSE rainwater harvesting
http://www.rainwaterharvesting.org
This rainwater harvesting website is an effort by the Centre for Science and Environment (CSE) India to provide targeted information and contacts for researchers, planners, NGOs and journalists on water issues. It provides practical information from different parts of India on different aspects of water harvesting, including technical information and case studies.

Water Policy Briefings
http://www.iwmi.cgiar.org/waterpolicybriefing/index.asp
The *Water Policy Briefing* series presents new perspectives and solutions to water problems in developing countries. Each briefing is based on peer-reviewed research that challenges policy makers and planners to think differently about the way water is managed for agriculture. The series has grown out of research conducted by the IWMI-TATA Water Policy Program in India, which recommends solutions to India's water crisis. It is now being expanded to provide more general policy recommendations.

InterWATER the gateway to water and sanitation organizations all over the world
http://www.irc.nl/interwater/
Inter*WATER* offers information about more than 650 organisations and networks in the water supply and sanitation sector, mainly for developing countries. You can search for an organisation by name, acronym, location or description. There is also a list of key international organisations and UN organisations. Each organisation has a short description, contact details, e-mail and website address, and related sites where applicable.

UNESCO Water Portal
http://www.unesco.org/water/
The UNESCO Water Portal is a gateway to information on freshwater available on the World Wide Web. The site provides links to the current UNESCO and UNESCO-led programmes on freshwater and will serve as an interactive point for sharing, browsing and searching websites of water-related organisations, government bodies and NGOs, including a range of categories such as water links, water events, learning modules and other on-line resources.

Global Water Partnership
http://www.gwpforum.org/servlet/PSP
The Global Water Partnership is a working partnership among all those involved in water management: government agencies, public institutions, private companies, professional organisations, multilateral development agencies and others committed to the Dublin-Rio principles. Today, this comprehensive partnership actively identifies critical knowledge needs at global, regional and national levels, helps design programs for meeting these needs, and serves as a mechanism for building alliances and exchanging information on integrated water resources management. The mission of the Global Water Partnership is to "support countries in the sustainable management of their water resources."

International Institute for Land Reclamation and Improvement (ILRI)
http://www.ilri.nl
The core business of ILRI is to disseminate knowledge that will facilitate the improved and sustainable management of land and water in developing countries. ILRI undertakes applied research on the sustainable development of irrigated agriculture. The results of ILRI's research are published in the series of ILRI publications and in papers, scientific journals, and conference proceedings. ILRI has also been conducting annual post-graduate courses on irrigation and drainage for scientists and field engineers in mid-career.

World Water Council
http://www.worldwatercouncil.org/
The World Water Council is an international water policy think tank, dedicated to contribute to improved management of the world's water resources. The mission of the World Water Council is to promote awareness and build political commitment on critical water issues at all levels, including the highest decision-making level, to facilitate the efficient conservation, protection, development, planning, management and use of water in all its dimensions on an environmentally sustainable basis for the benefit of all life on earth.

International Commission on Irrigation and Drainage
http://www.icid.org/
The International Commission on Irrigation and Drainage (ICID) is a NGO based in New Delhi, India. The mission of ICID is to stimulate and promote the development of agriculture in managing water and land resources for irrigation, drainage, flood management and river training applications, including research and development and capacity building for achieving sustainable irrigated agriculture.

IRRISOFT Database on Irrigation and Hydrology Software
http://www.wiz.uni-kassel.de/kww/irrisoft/irrisoft_i.html#index
IRRISOFT is an Irrigation and Hydrology Software Database, which provides information on irrigation and hydrology software and links to servers containing the software packages and further information. Numerous irrigation programmes, written by individuals or groups, are available as public domain, shareware or commercial software. The objective of IRRISOFT is to give an overview of the irrigation and hydrology programmes available and to facilitate their retrieval and distribution by opening up download facilities or by e-mail order through the World Wide Web.

Sustainable agriculture, training of trainers: a resource book 2002, International Institute of Rural Reconstruction (IIRR), 351 p. ISBN 1 930261 055 US$ 20 (inclusive CD-Rom). Available from: IIRR, Y.C.James Yen Center, Biga, Silang, Cavite, Philippines and ETC EcoCulture, PO Box 64, 3830 AB Leusden, The Netherlands. Email: Bookstore@iirr.org; www.iirr.org

This resource book is designed for trainers in sustainable agriculture. It has been developed in response to the need to increase the capacity of sustainable agriculture training institutions to impart and share sustainable agriculture concepts, principles and experiences. It brings together IIRR's 40 years of training experience and the results of a five-year Training of Trainers project on sustainable agriculture. Produced in 2002, the resource book and accompanying interactive CD offer a complete set of materials, training session guides, handouts and illustrations useful for training on all aspects of sustainable agriculture. The materials are also useful to those either involved in or planning training programmes. The resource book is divided into two parts. The first part reflects on key considerations in sustainable agriculture training, while the second part focuses on training programme development and management.

Bringing the food economy home: local alternatives to global agribusiness
by Norberg-Hodge H, Merrifield T & Gorelick S. 2002, Zed Books and the International Society for Ecology and Culture (ISEC), Foxhole, Dartington, Devon TQ9 6EB, UK. ISBN 1 84277 233 3. Email: zed@zedbooks.demon.co.uk; www.isec.org.uk

This book shows how a shift towards local food economies would protect and rebuild agricultural diversity. It would give farmers a bigger share of the money spent on food, and provide consumers with healthier, fresher food at more affordable prices. It would reduce transport, greenhouse gas emissions, and the need for toxic agricultural chemicals. It would lessen the need for storage, packaging, refrigeration and artificial additives. It would also help revitalise rural economies and communities in both the industrialised and the developing world. Because it benefits the farmer, consumer and the economy as well as the environment, local food is a powerful solution-multiplier, one that we cannot afford to ignore.

The environment and zero tillage
by Saturnino HM, Landers JN (eds), 2002, APDC, SCLRN, 144 p. ISBN 85 865006 01 x. Available from: APDC, 712 Bloco C Loja 18, Brasilia, DF, Brasil Cep 70760-533 and FAO Viale delle Terme di Caracalla, 00100 Rome, Italy. Email: apdc-DF@terra.com.br; www.fao.org

All over the world it is recognised that erosion is responsible for the degradation of fertile soils, water resources and biodiversity and has undermined the economic viability of farms, regions and whole countries. Zero tillage provides an effective answer to these problems (see *LEISA Magazine* Vol 18.3). The evolution of zero tillage is a story of farmer persistence and empowerment, community resource management and farmer-private sector-government partnerships, which have engendered a new philosophy for truly sustainable agricultural systems at high production levels. Zero tillage is not just an alternative planting method, it represents a change in agricultural thinking, an approach that takes the whole system into consideration and focuses on integrated crop rotations, the maintenance of surface residues with cover crops, the integrated management of weeds, pests and diseases, rational fertiliser practices, watershed management and other environmentally sustainable practices. This handy well-illustrated booklet presents the experiences of more than five million large- and small-scale Brazilian farmers who have used this conservation method on more than 14 million hectares. The booklet is not a practical handbook on zero tillage, but rather presents a well-argued case for the approach. (CR)

Food and feed from Mucuna: current uses and the way forward. Proceedings of an international workshop by Flores M & Eilittä M et al (eds), 2002, International Cover Crops Clearinghouse (CIDICCO), 411 p. ISBN 99926 24 02 7, Available from: CIDICCO, PO Box 4443, Tegucigalpa, Honduras. Website: www.cidicco.hn

Mucuna, the Velvet bean, has been well researched and broadly promoted as an alternative method of restoring and maintaining soil fertility in a wide range of agro-ecological conditions in the Tropics. However, it has not been widely adopted at farm level. The objective of the workshop was to intensify efforts to encourage the introduction of Mucuna, assess the state of knowledge on how Mucuna can be used for food and feed, identify bottlenecks to its greater use as food and feed and make recommendations for research and extension efforts. The report brings together workshop contributions. It begins with an overview of Mucuna and the papers are presented according to session: Mucuna as a food, Mucuna as a feed for ruminants, and Mucuna as a feed for non-ruminants. The workshop confirmed that Mucuna could contribute to the sustainability and productivity of tropical smallholder farming. (WR)

Participatory monitoring and evaluation (PM&E) with pastoralists: a review of experiences and annotated bibliography by Bayer W, Waters-Bayer A, 2002, ETC and GTZ, 88 p. ISBN 3 8236 1309 X. GTZ, PO Box 5180, 65726 Eschborn, Germany. Website: www.gtz.de

This report reviews documented experiences on participatory monitoring and evaluation with pastoralists and other livestock-keepers. It is divided into two parts: an analytical assessment and an annotated bibliography. Key websites for further information are given in an annex. The review refers to many training reports, guides and plans for establishing participatory monitoring and evaluation. There are not many examples of the actual implementation of systems that give balanced attention to the concerns of both pastoralists and other actors, and a number of reasons for this are suggested. The report emphasises the importance of this kind of evaluation for building the capacity of local people. (WR)

Ants as friends: improving your tree crops with weaver ants
by Van Mele P, & Cuc N.T.T, 2003, CABI Bioscience, 67 p. ISBN 958 97218 2, Available from: CABI Bioscience, 6 Bakeham Lane, Egham, Surrey TW20 9TY, UK. Email: CPM@cabi.org; www.cabi-bioscience.org

This manual teaches us how weaver ants can help farmers save money. It provides practical tips for making optimal use of the beneficial weaver ant in protecting fruit and other tree crops and is based on improved insights into underlying ecological principles. In this colourful and attractive manual, the authors have brought together a rich collection of scientific and farmers' knowledge. The authors have succeeded in writing a clear and practical guide on how to make use of the weaver ant as a crop protector. The manual will be particularly valuable for NGO workers, extension staff, students and all those engaged in communicating science to farmers. (WR)

Visit our website: www.ileia.org

Water harvesting and soil moisture retention

by Anschuetz J et al. 1997. Agrodok Series 13, 92p. Price: Euro 8.25. Available from: Agromisa, PO Box 41, 6700 AA Wageningen, The Netherlands and the Technical Centre for Agricultural and Rural Cooperation (CTA), PO Box 380, 6700 AJ Wageningen, The Netherlands. Email: cta@cta.int

This practical booklet, part of the Agrodok series, describes how rainfall and runoff water can be used to greater effect in agriculture. Many techniques are described briefly and clearly. The water-harvesting techniques covered in this booklet are particularly relevant for arid and semi-arid areas and the section on soil moisture retention contains information valuable for sub-humid regions. (IHG)

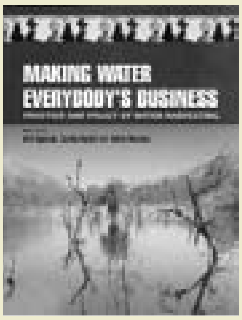
Making water management everybody's business: water harvesting and rural development in India

by Agarwal A. & Narain S. 1999. International Institute for Environment and Development (IIED), IIED Gatekeeper series, 20p. ISSN 1357 9258, SA87. Available from: IIED 3 Endsleigh Street, London WC1H 0DD, UK. Email: sustag@iied.org

This advocacy booklet about water harvesting in India provides arguments and examples of successful rainwater harvesting experiences. India only uses a small part of its water. It currently faces a water crisis, despite being one of the wettest countries in the world. Reviving rainwater-harvesting systems can restore ecosystems and contribute to rural development. The authors argue that the only way this can be done is to deepen systems of participatory democracy and expand participation at the village-level as much as possible. (WR)

Making water everybody's business: practice and policy of water harvesting

by Agarwal A, Narain S & Khurana I (eds.) 2001. Centre for Science and Environment (CSE), 456p. Available from: CSE, 41 Tughlakabad Institutional Area, New Delhi 110062, India. Email: cse@cseindia.org; www.cseindia.org



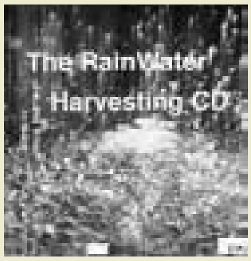
After the enormous success of "Dying wisdom: rise, fall and potential of India's traditional water harvesting system, The state of India's Environment, Fourth citizens' report" (1997), that gave a detailed account of India's traditional water harvesting systems, CSE has published this impressive new book. It continues the work begun in "Dying wisdom" and goes on to describe new examples of traditional rural water harvesting systems. It also gives many examples of communities that have undertaken water-harvesting programmes in recent years, including examples of water harvesting from outside India. Urban water harvesting programmes and new technologies for safeguarding the quantity and quality of water are also discussed. A central argument is that it is not simply low rainfall that causes water shortages, but a heavy reliance on surface and groundwater. It is here that the revival of traditional water harvesting systems becomes important. Another issue dealt with in the book is the tendency to see the government as being responsible for providing water. The authors argue that communities must take water management into their own hands and become involved in the provision and protection of water resources. (IHG)

Waterlines: International Journal of Appropriate Technologies for Water Supply and Sanitation

ITDG Publishing. Available from ITDG, 103-105 Southampton Row, London WC1B 4HL, UK. Email: itpubs@itpubs.org.uk; www.itdgpublishing.org.uk

This quarterly journal published by ITDG is the only international journal that deals with developments in low-cost sustainable water supply and sanitation in the South. It is written for professionals, project managers, policy makers, trainers and field workers.

The rainwater harvesting CD



by Hartung H 2002. The Technical Centre for Agricultural and Rural Co-operation (CTA); CD-Rom; ISBN 3 8236 1384 7. Available from: CTA, PO Box 380, 6700 AJ Wageningen, The Netherlands. Email: cta@cta.nl

Rainwater catchment systems have a long history that stretches back thousands of years in many parts of the world. Recently, increasing attention has been given to the importance of rainwater collection in rural areas. Programmes on harvesting rainwater focus on securing water for domestic use and agriculture, preventing floods, and protecting communities from the effects of drought. This CD-Rom contains reports from a selection of projects, together with many background documentation and case studies, including a CTA study visit to Kenya in 2000. The documents section contains selected articles from the magazine "Waterlines" and the proceedings of the 1999 and 2001 rainwater harvesting conferences. With this CD-Rom, CTA sets out to contribute to the growing body of literature on rainwater harvesting, which, hopefully, will help make it unnecessary for "any single village in any single part of the world to remain short of drinking water". (WR)

Water harvesting: indigenous knowledge for the future of the drier environments

by Oweis T, Prinz D, Hachum A. 2001. Available from: International Center for Agricultural Research in the Dry Areas (ICARDA), 36 p, ISBN 92 9127 116 0, US$7. Available from: ICARDA, PO Box 5466, Aleppo, Syria. Email: icarda@cgiar.org; www.icarda.cgiar.org.

This publication brings together knowledge and experience of water harvesting gained by ICARDA, national research groups, and advanced institutions over the years and presents them in non-technical language. It emphasises the techniques most suitable for the steppe areas of West Asia and North Africa and discusses some of the principals that apply to drylands everywhere.

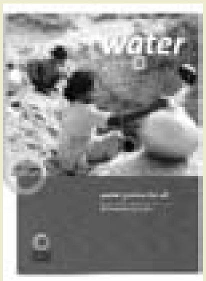
Keep it working: a field manual to support community management of water supplies

by Bolt E, Fonseca C, 2001, International Water and Sanitation Centre (IRC), IRC Technical Paper Series 36, 172 p, ISBN 90 6687 030 3, Euro 24. Available from: IRC, PO Box 2869, 2601 CW Delft, The Netherlands. Email: farmer-water-training@fao.org; publications-sales@fao.org; www.irc.nl

This useful manual is written for staff working directly with communities to help them establish or improve water supply management. Governments cannot and should not manage all rural water supply systems. Rather they should create an enabling environment in which communities can manage their own systems either alone or in partnership. Communities are the ones who are most aware of the nature of local demand, possible conflicts and the water resources available. They are also ones who are best able to judge the extent to which the various users will be able to contribute to operation and maintenance activities. The first section of this manual contains 20 fact sheets related to the different elements of sustainable water management. The 29 participatory tools described in the second part of the manual are designed to facilitate communication and community-based decision-making processes. The manual also provides 16 checklists that can be used to assess things like the way the water supply system works or cost recovery in operation and maintenance activities. There are clear links between the different parts of the manual. This makes it easy to use at community level. It also contains useful addresses, references, websites and discussion lists. "Keep it working" is one of a series of IRC publications on community water supply management and is also available in Spanish. IRC has more interesting information on its web site: www.irc.nl/manage (WR)

Water-wise rice production by Bouman BAM, Hengsdijk H, Hardy B, Bindraban PS, Tuong TP, Ladha JK(eds.) 2001. Proceedings of the International Workshop on Water-wise rice production, 8-11 April 2002, Los Banõs, Philippines. 356p. Available from: International Rice Research Institute, DAPO Box 7777, Metro Manila, Philippines. Email: irri@cgiar.org; www.irri.org

Together with Plant Research International of Wageningen University and Research Centre (WUR-PRI, the Netherlands), IRRI organised a thematic workshop on Water-wise Rice Production from 8-11 April 2002 at IRRI, Los Banõs, Phillipines. The objectives of the workshop were to present and discuss the state of the art in the development, dissemination, and adoption of water-saving technologies at spatial scales ranging from field to irrigation system. 75 participants from 12 countries came together at the workshop, which resulted in the creation of the International Platform for Saving Water in Rice (IPSWAR; www.irri.org/ipswar/about_us/ipswar.htm). The platform is intended as a mechanism to increase the efficiency and coherence of research on water savings in rice-based cropping systems in Asia.



Water justice for all: global and local resistance to the control and commodification of water 2003, Friends of the Earth International, Issue 102. Available from: Friends of the Earth, PO Box 19199, 1000 GD Amsterdam, The Netherlands. Email: info@foei.org; www.foei.org

Water justice is central to this brochure from Friends of the Earth International. The arguments and 15 case studies from all over the world criticise the commercial approach to water management of some international organisations and governments. (WR)

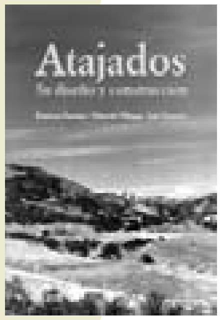
The River Senegal: flood management and the future of the valley by Adams A. 2000. International Institute for Environment and Development (IIED), Drylands Programme, IIED Issue Paper No.93, 27p, ISSN 1357 9312. Available from: IIED, 3 Endsleigh Street, London WC1H 0DD, UK.

This study by the IIED Dryland Programme describes the management of the Senegal River valley and the agricultural policy associated with it. The enormous investment made in two dams has not brought the promised development. It has in fact destroyed production systems that supported some degree of balance in subsistence crop production. The farmers, herdsmen and fishermen of the valley have had no part in the decisions affecting their future and as a result agriculture in the valley is in serious difficulties. (WR)

Participatory training and extension in farmers' water management 2001, FAO, Land and Water Digital Media Series 14; CD-Rom; ISBN 92 5 104636 0. Available from: FAO, Viale delle Terme di Caracalla 00100, Rome, Italy. Email: farmer-water-training@fao.org; publications-sales@fao.org; www.fao.org

This CD-Rom provides guidelines, procedures and relevant material for the development of a participatory training and extension programme. It is aimed at technical staff, extension workers and other stakeholders who are working with farmers to take charge of water management at field and scheme level and to help them adopt sustainable and appropriate water technologies. The programme is particularly relevant to irrigation management transfer programmes that help water users' associations to operate and maintain farmers' irrigation systems. It is also useful for smallholder irrigation programmes involved in guiding farmers in the adoption of efficient water control technologies. The interactive menus and cross-references in the documents provide quick and easy access to training guidelines, farmers' training manuals and a considerable amount of relevant training and audiovisual material and web links. (WR)

Atajados, su diseño y construcción by Tammes B, Villegas E, & Guamán L. 2002, Plural Editores, ISBN 99905 62 41 5, US$ 8. Available from: GTZ, FDC, KFW and Plural Editores, Rosendo Gutiérrez 595, Casilla 5097, La Paz, Bolivia. Email: plural@caoba.entelnet.bo

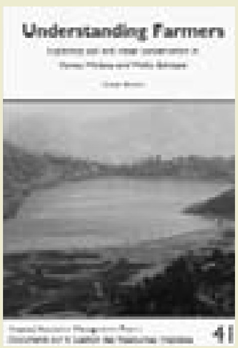


This is a manual about building an "Atajado". Atajados are small water reservoirs used in Bolivia to catch rainwater. Water collected with this technology is used for cattle, irrigation and domestic purpose. Recently Atjados have been revived in the valleys of Bolivia and this experience is the subject of the present manual. The new Atajados are slightly larger than the traditional ones and are often machine built. The manual describes how they are designed, developed and constructed. It also discusses how they can be used and problems that might arise. The book is accompanied by a diskette containing computer software to calculate soil removal for the construction. Available in Spanish only. (WR)

Understanding farmers: explaining soil and water conservation in Konso, Wolaita end Wello, Ethiopia by Tesfaye Beshah, 2003, Erosion and Soil & Water Conservation Group, Wageningen University and Research Center (WUR), 245 p. ISBN 90 6754 691 7. Available from: WUR, Nieuwe Kanaal 11, 6709 PA Wageningen, The Netherlands. Email: office@SEC.TCT.WAU.nl; www.dow.wau.nl/eswc

The study is also available in French "Documents sur la Gestion des Ressources Tropicales" (Tropical Resource Management Papers) ISSN 0926 9495 41.

This study deals with soil and water conservation behaviour among farmers in Ethiopia and was carried out at farming system, watershed, household, farm and plot levels. It provides insights into how farmers have reacted to externally introduced soil and water conservation technologies within and across farming systems. Their responses were analysed in terms of their knowledge and attitudes to soil erosion. The study pinpoints the different ways that farmers and outsiders see the problem of soil erosion, an element missing in most external interventions. Understanding farmers is seen as the entry point to promoting the sustainable management of natural resources. Suggestions for improvement are provided, based on study findings. The author hopes that his study will challenge research and development and extension professionals in Ethiopia. (WR)



Growing rice on raised beds

Donald E. Van Cooten and Andrew K. Borrell

Rice farmers in Eastern Indonesia are facing an uncertain future. The area is characterised by a monsoon rainfall pattern, but the wet season is often short and unreliable. Periods of intense rain often cause waterlogging and flooding and can be followed by periods of two weeks or more when no rain falls. Because of this, rice crops fail much too often.

Permanent raised beds are a potential alternative to present rice growing systems. By using water more efficiently, the risk of crop failure may be reduced. In addition, other crops can be grown on the same plots in rotation with the rice, creating a more diverse and secure system.

Crops other than rice can be grown on raised beds in the wet season. Photo: Author.

Permanent raised beds

The idea of growing crops on raised beds is nothing new to Indonesian farmers. In many parts of Indonesia after harvesting rice, farmers plant vegetables on raised beds so that they can be irrigated from the furrows without the risk of water logging. Each season, a lot of work is put into creating these beds after the rice has been harvested only to destroy them again in order to flood the following rice crop.

On the island of Java, farmers use a similar system, called *Surjan*, which combines upland crops and rice in one field. The system is established by moving the soil from one half of the field and placing it on the other half to form raised fields. Rice is grown on the low part and upland crops on the raised part. This system allows farmers to grow crops other than rice in the wet season. However, a lot of work is required and the soil needs to be deep enough to establish the system.

A major breakthrough came with the discovery that rice does not need to be flooded to grow well (this is also an important concept in the Systems of Rice Intensification (SRI) approach, see *LEISA Newsletter* Vol 16.4 p 12). Experiments with permanent raised beds have shown that flooded rice varieties can produce similar yields on permanent raised beds as in flooded paddies, while using much less water.

Trials in West Timor

In West Timor, upland crops are traditionally grown in swidden gardens on the hillsides in a slash-and-burn system, and flooded rice is grown in the valleys in the wet season. In recent years, however, both these systems have come under pressure and no longer provide food security.

Swidden gardens have been cultivated in the area for hundreds of years. Crops like cassava, maize, pigeon pea, and pumpkins do not need as much water as rice. They are grown on the hillsides because the more fertile lowland areas waterlog in the wet season. However, yields from these slash and burn gardens are limited by a lack of rain, poor soils, weeds and erosion. An increasing population has meant that farmers have to return to the same plot of land too soon, and the fallow period is not long enough to restore soil fertility. To reduce the risk of crop failure, farmers may cultivate three or four swidden gardens with distances of 5 to 10 km between gardens. This increases the chance that at least one field receives enough rain at the right time for a successful harvest, but it also increases the labour and time required to walk between these gardens.

Flooded rice (*Oryza sativa*) is grown in the valleys. Large amounts of water are needed and yields are very vulnerable to water shortages. If there is not enough water at the beginning of the wet season, land preparation can be delayed. If there is not enough water while the crop is growing, yields can be low or even fail completely. If the wet season ends too early and the rice plants have not yet filled the grain, the grains can be empty or only partly filled at harvest time.

During the 1998-1999 wet season an on-farm experiment was conducted in the village of Oenesu in West Timor. Five hectares were developed with a combination of small and large raised beds (see Box). Traditional upland intercrops and fodder species were planted on the large beds. Soybeans and rice (*Oryza sativa*) were planted on the small beds.

In the wet season, the rice and upland crops planted on the raised beds utilise the available rainfall. In the dry season, if irrigation water is available, it can be supplied to the furrows at a constant rate, maintaining the water level about 0.1 metre below the bed surface. An alternative to this system is to supply water at regular intervals, for example twice weekly, to rice grown on raised beds within bunded fields. If there is no water available for irrigation after harvesting the wet season crops, drought-resistant crops like sorghum, pigeon pea and cassava, or quick-maturing crops, like mung beans and millet can be planted and left to grow on the moisture stored in the soil.

Two types of raised bed

Small beds: Small beds are at least 30cm high from the bottom of the furrow to the top of the bed. They can be 60cm to 1.5m wide, depending on the soil type. These beds are suited to the cultivation of lowland rice and soybeans in the wet season. These crops do not need very much soil above the water in the furrows to grow well.

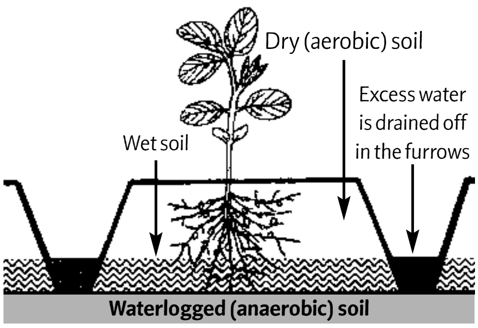
Large beds: Large beds are at least 2m wide and at least 50cm from the bottom of the furrow to the top of the bed. They are suited to the cultivation of upland crops, fodder grasses and trees, as these plants need a greater volume of soil above the waterline to grow well in the wet season. Large beds can be formed around the field boundary. They can also be formed at regular intervals in the field to prevent the small beds being washed away during heavy rain.

The rice on these beds gave a similar yield to the traditional rainfed flooded system. Grain yields were 1.5 to 2 ton/ha, including the furrows. The farmers had never seen soybeans grown in the wet season before. They thought that only rice would grow in the wet season. But the most outstanding result was that the yield of the intercrops was so great that they had to get people from the next village to help them harvest it. They had never had such a bountiful harvest. The beds are permanent so the farmers can use them each year.

Potential benefits

Earlier planting
A major constraint to wet season rice in Eastern Indonesia is delayed planting when there is not enough rain to puddle the soil before sowing. If planting is delayed at the start of the season, the crop is likely to experience drought at the end of the season. On permanent raised beds, water is not needed to puddle the soil before sowing. Rice seed is sown into the top of the beds at the beginning of the wet season in the same way as upland rice.

More efficient water use
While the rice is growing, water is stored in the furrows to reduce evaporation and seepage through the soil. Permanent raised beds also provide excellent drainage during heavy rainfall. Furrows between raised beds and on-farm dams can capture water without causing water logging. This means there is more water available to the crop during dry periods. After harvesting the rice, drought-resistant crops like sorghum, pigeon pea and cassava, or quick-maturing crops, like mung beans and millet can be planted and left to grow on the moisture stored in the soil.



Less walking
Growing rice and upland crops on raised beds enables upland swidden gardening and rice cultivation to be combined in one field. More efficient use of water on the permanent raised beds means that widely dispersed gardens are no longer necessary.

Greater flexibility
Raised beds give farmers the flexibility to choose between a variety of crops at short notice, because no pre-season or crop-specific land preparation is necessary.

Diversification
Raised beds enable farmers to grow a range of crops in the same field. Various traditional intercrops have been successfully grown on raised beds. A combination of grain, legume, tuber, fodder and fruit species can be grown in the wet season and, more importantly, the total yield and the nutritional value of this combination is far greater than that achieved with rice monoculture. Crops are harvested over a long period, so that food is available throughout the year. The eroded upland cropping areas can be reforested with a range of perennial species to provide food, fodder, firewood, building materials and medicines, since the basic food and cash crop requirements of subsistence farmers can be met from intensive lowland production on permanent raised beds.

Crop rotation
Crops can be rotated to control weeds, to reduce the build up of pests and diseases and to reduce the need for external inputs. Including legumes such as soybeans in the crop rotation can help fix nitrogen and reduces reliance on inorganic fertilisers. Incorporating the crop residues can also improve the organic matter content of the soil.

Important considerations

A major limitation to implementing a raised bed system is the initial labour required. Extra labour is needed to till the soil and form the beds during the dry season. Drains also need to be dug so that the excess water does not wash the beds away. Organisations that have expertise and access to credit need to work with farmer groups to implement the system. Although the initial inputs are high, the total yields from the system are higher than rainfed, flooded rice and farmers save labour in subsequent years. It should, therefore, be possible to repay initial inputs within a few years.

To plan a balanced, low-external input system it is important to consider environmental factors such as the species to be used, soils, and crop rotations. The on-farm trials showed that rice grown on raised beds can yield the same as rice grown in flooded conditions. However, other rice varieties, for example, traditional upland rice varieties that can withstand periods of water stress, may be better suited to the raised bed system. Permanent raised beds are suited to areas where water is limited but, because of the high clay content of the soil, crops become easily waterlogged when it rains. Soils that are rocky, shallow or do not hold their shape, are not suitable. Factors such as fertility, organic matter content and pest and disease control should be taken into careful consideration when planning crop rotations.

Growing rice on permanent raised beds is still a relatively new technology. The many different factors that contribute to its success or failure have not yet been fully defined, and many factors, such as soil type, are locally specific. Therefore, it is important to first try the raised beds in a small area. The beds can easily be introduced in stages, for example, by first building wide bunds around the rice fields that can be planted with upland crops, to reduce the risk of failure.

■

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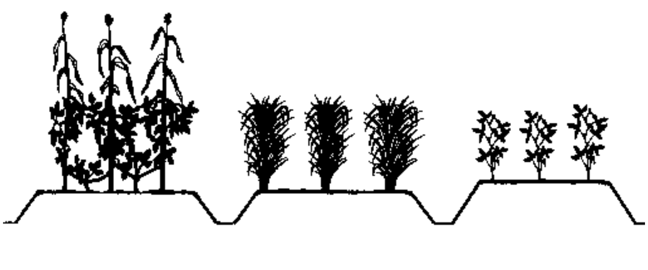

Flood Control in Taiwan

A typical retention pond in the upper reaches of a watershed. Photo: Author.

K.F. Andrew Lo

Taiwan is a mountainous island country, often confronted with floods and droughts. Torrential typhoons are responsible for an annual rainfall of some 2500 mm, which often leads to massive soil movement, concentrated runoff and large peak flows that cause a lot of damage downstream. Efforts to control these floods have focused on controlling the water flow at the bottom of the watershed using large and costly engineering structures. In the Wudu watershed area, however, a different approach has been tried. Small-scale water harvesting structures have been installed in the upper reaches of the watershed in order to reduce the runoff.

The case of the Wudu watershed

In the Keelung River Basin, Wudu watershed, a low impact development concept was integrated into the flood protection programme with the aim of reducing the flood hazard down stream.

Scattered small-scale runoff retarding structures such as pits, pools, farm ponds and dugouts were installed throughout the watershed to promote the infiltration of runoff water. The runoff retardation structures installed in the upper and middle reaches of the watershed proved to be very effective in reducing the flood burden downstream. With a conventional check dam constructed down stream, a flood peak reduction of 20 percent could be expected. With small-scale retarding structures installed throughout the watershed, a flood peak reduction of 30 percent was achieved at considerably lower cost.

The infiltration enhancement structures and retardation ponds will intercept large volumes of runoff, but a large amount of sediment is also delivered with the water. As the sediment will rapidly reduce the capacity of the infiltration structures, some changes in land use are necessary. For example, providing forest cover around the structures can reduce runoff volumes by up to 50 percent. Sediment reduction is even more significant and can reach as much as 95 percent. This result shows that proper land use and soil conservation measures are essential to ensure maximum runoff interception and minimum sediment load reaching the retardation structures.

The collection of runoff upstream will increase the availability of water resources for farmers downstream. This water can be used for irrigation, livestock, aquaculture, the introduction of high yielding cash crops or the reclamation of wastelands. It also provides other indirect benefits. These include depressing flood peaks, diminishing soil erosion, providing large sediment storage space, and improving the operation of reservoirs and channels.

In Taiwan, the upstream parts of a watershed are usually government owned and often forested. In heavily populated cities located in the downstream river basin areas, acquiring land for public infrastructure becomes increasingly difficult as property values rise. Upstream runoff retardation measures are the most feasible flood mitigation solution for future urban storm water management.

Lessons learnt

In rainfall-abundant watersheds with steep terrain, torrential rainstorms often result in accelerated soil erosion and runoff, causing irreversible damages downstream. Storm water collection using small infiltration enhancement structures and retention ponds has proven to be extremely effective in runoff reduction and flood control. Storm water is controlled in the upstream parts of the watershed, along with the disaster-bearing sediment load. Although small-scale runoff retardation facilities may not be able to prevent large storm runoff events, they may reduce the problem considerably. Besides flood control benefits, increased infiltration and runoff storage will increase the availability of water resources. ■

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Cisterns are vital to people in areas where no other source of fresh water is available. This one from NW Egypt is supporting people, livestock and home gardens. Photo: Theib Oweis.

Farming where there's no water

Theib Y. Oweis and Ahmed Y. Hachum

The drier environments of the West Asia and North Africa (WANA) region, called *albadia,* are characterised by extreme water scarcity, degraded lands and declining livelihoods. These areas have a fragile natural resource base, with very low rainfall and poor vegetation cover. Without appropriate interventions, *albadia* environment will continue to deteriorate and can generate very few benefits for its already poor population. This article presents three cases of interventions that have successfully improved living conditions in this extreme environment.

Background

The climate in *albadia* is extreme, with cold winters and very hot summers. Rainfall, the main source of fresh water, ranges from 50 to 250 mm annually, and is highly variable both in time and space. It falls in sporadic and intensive storms and causes substantial runoff. As a result, a crust is usually formed on the soil surface and this limits infiltration and intensifies runoff. Runoff water generally flows to salt sinks where it is lost to evaporation. It causes soil erosion and further land degradation.

Land tenure in *albadia* is a major constraint to development and varies from one country to the other. In Syria, *albadia* are largely public lands, but other forms of land tenure also exist, such as rented and private land ownership. Most of *albadia* in Jordan is private tribal land. Due to lack of appropriate land tenure systems in these countries, communal land is used as common property, where overgrazing is a common practice and little attention is given to sustainability.

In recent years, traditional migratory pastoralist communities have gradually been transformed into more sedentary communities. The change in lifestyle has resulted in a decline in the traditional, communally managed rangeland system. It has also put pressure on adjacent lands and there is an increasing demand for water for sanitation, home gardens, and supplemental irrigation for subsistence agricultural production. Where groundwater is available, some marginal grazing lands are even used for conventional agriculture.

Albadia in Syria and Jordan have traditionally supplied most of the meat and milk products for these countries. Increasing consumer demand for sheep, meat and milk in combination with rapid population growth and inappropriate government policies have stimulated the growth of the sheep population. This means that more feed is now required than *albadia* can sustainably produce. Mismanagement has resulted in land degradation, a decline in biodiversity and increasingly insecure livelihoods. *Albadia* still has a much higher potential than its current output. Proper management of available natural resources would help improve people's livelihoods and reverse land degradation.

Indigenous practices of rainwater harvesting provide a sound basis for improved resource management. Moreover, innovative techniques of water harvesting built on traditional knowledge can reduce cost and provide people with tools for improving the rangelands as well as their income and livelihoods. Following are three examples of interventions that build on traditional technologies.

Contour bunds and ridges

Mehasseh is a very dry area in southern Syria. It has a mean annual rainfall of less than 150 mm. Vegetation cover is poor and land degradation due to overgrazing is a major problem. In 1995, a water-harvesting project based on traditional technologies of contour bunds and ridges was started, with the objective of improving land management and the livelihoods of the people living in the area.

Half a metre high *contour bunds or ridges* were constructed along the contour lines some 5 to 20 metres apart. The first metre along the upper side of the ridge is allocated for cultivation, and the remaining area between the bunds make up the catchment. Contour ridges are one of the most important techniques for supporting regeneration and new plantations of forages, grasses and hardy trees on the gentle to steep slopes in *albadia.*

The key to the success of these systems is to locate the ridge as precisely as possible along the contour line. Otherwise, water will flow along the ridge, accumulate at the lowest point, and eventually break through and destroy the whole down-slope system. Surveying instruments suitable for small-scale farmers can be used for contouring. The simplest method is a transparent, flexible tube 10 to 20 m long, fixed on two scaled poles. The tube is filled with water so that the two water levels are clear on the scale. Two people can trace the contour by adjusting the position of one of the poles so that their water levels are the same.

To avoid contouring difficulties, an alternative is to develop smaller semi-circular and trapezoidal bunds in staggered rows across the slope. Earthen bunds in the shape of a semi-circle, a crescent, or a trapezoid are formed facing directly upslope. Spacing should allow a sufficient catchment area so that each bund can collect the required runoff water. Water accumulates at the lowest spot on the upper side of the bund, where plants are grown. Cutting the soil to form the bund creates a slight depression directly above the bund. Runoff is intercepted in this depression and stored in the plant root zone. The distance between the two ends of each bund varies between 1 and 8 metres, and the bunds are between 30 and 50 cm high. These bunds are used mainly for the rehabilitation of rangeland and fodder production but they are also used for growing trees, shrubs and field crops.

In Mehasseh, a comparative trial was carried out on two adjacent areas. Both areas were planted with Atriplex (*Atriplex halimus*) shrubs. Water harvesting bunds were built on one site, and an adjacent field without water harvesting bunds was used as a control. In 1997, there was 160 mm of rain. On the site with bunds, runoff accumulated on the upper side of the bunds and was harvested. On the site without bunds, water flowed downstream to salt sinks and was lost. The bushes planted in the field with bunds had a survival rate of over 90 percent, whereas the survival rate for the untreated site was less than 10 percent. The next three years were very dry, with an annual rainfall of less than 60 mm. The few surviving shrubs on the site without bunds died during the first year of drought. The shrubs supported with water harvesting bunds survived the three consecutive years of drought and are still growing vigorously.

The project was considered a breakthrough in this fragile environment. It now forms the basis for a national project based on this low cost technology.

Small runoff basins for fruit trees in Jordan,

This technique is sometimes called *negarim.* The runoff basins consist of small diamond- or rectangular-shaped grid plots, each surrounded by low earth bunds. They are oriented along the slope so that runoff flows to the lowest corner, where the plant is placed. The usual grid size is 50 to 200 square metres. They can be constructed on any gradient. They are most suitable for growing trees but can also be used for other crops. When they are used for trees, the soil should be deep enough (over one metre) to hold sufficient water to sustain the plant for the whole dry season.

The arid land of Jordan receives about 160 mm of rainfall annually. No economic crop can be grown with this amount of rainfall, and farmers in the area depend on livestock and other forms of agriculture using a steadily decreasing amount of groundwater. In 1987, a project was launched to diversify farmer's production by introducing tree crops in combination with water harvesting. The introduction of the *negarim* system to support fruit trees was a great success. Plots of 50 to 100 m^2 were constructed on deep soils and almonds and olive trees were planted in the winter season. Polymers were added to the planting pit of the tree in order to increase the water storage capacity of the soil, so that enough water is kept for the long dry summer. All trees planted survived and grew satisfactorily over the seasons and are still growing. The production was so satisfactory that farmers started adopting the technology. Generally, they were successful, but some problems emerged. These were usually associated with the selection of land, for example if the soil was not deep enough, or the species used was sensitive to drought. It is important that the location and crops are properly selected for this technology to be successful.

Semi-circular bunds in the Syrian badia after a rainstorm. Photo: Theib Oweis.

Cisterns in north western Egypt

Cisterns are an ancient and indigenous rainwater harvesting system, used mainly for supplying human and animal water needs in water-scarce areas. They are usually subsurface reservoirs, with a capacity ranging from 10 to 500 m^3. In many areas, for example in Jordan and Syria, they are small and dug into the rock. In north western Egypt, however, farmers dig large cisterns (200–300 m^3) in the earth deposits underneath a layer of solid rock. Water is used not only for human and animal needs but also for growing cash crops in home gardens. The rock layer forms the ceiling of the cistern and the walls are sealed with plaster. Modern concrete cisterns are now being constructed in places where there is no rocky layer.

Along the north west coast of Egypt where there is an average annual rainfall of about 150 mm, there is no other source of freshwater. Runoff resulting from a few major rainstorms in winter is directed into cisterns from adjacent catchments, or through channels from remote areas. The runoff from the first rainfall event of a season is usually diverted away from the cistern to reduce the likelihood of pollution. Settling basins are usually provided at the cistern entry points to reduce the sediment inflow. In addition, farmers clean the cisterns once every year or two. A bucket and a rope are typically used to lift water. However, there are several problems associated with using the cisterns including the extent of the catchment area, the capacity of the reservoir, the cost of construction and maintenance and the low water use efficiency in agriculture. A project was started in the area to overcome these problems by providing technical and financial support to the local communities in order to improve the management of these systems. Three interventions were found to substantially improve the efficiency:

- Clearing, cleaning and smoothening the catchment area improved the collection efficiency and water quality significantly.
- The cistern's seasonal water capacity was more than tripled through efficient management, without increasing the actual size or cost. Hydrological studies showed that the cistern could be re-filled at least three times during the rainy season and before the last storm of the season, which would fill it for the summer. Farmers were encouraged to use the water from the first and second filling for agriculture and to preserve the third filling for human and animal consumption during the summer. The availability of manual pumps and low cost pipes helped to make the task easier.
- The water use efficiency was improved by providing a small kit of materials and introducing a few changes in the agricultural production system at the home garden level. For example, placing high value crops such as seedlings and vegetables in plastic houses became popular and provided additional income to the farmers without requiring much additional water.

Although the cisterns of Egypt are a very special water harvesting system, the case illustrates the importance of careful water management very clearly. With careful management, harvested water can be efficiently used and the impact of the harvested water can be substantially increased.

Implementation and management

Micro-catchment systems such as contour bunds and ridges and runoff basins are usually within the boundaries of individual farms. This is a simple and low-cost approach, although farmers may experience some difficulty with elements that require precision, such as following contour lines or determining maximum slope. The community should be involved in implementing water-harvesting systems. It is especially important that the community is involved right from the planning stages of any programme.

New systems should be inspected often, especially during the first one or two rainy seasons. Micro-catchment systems should be inspected after every runoff-producing rainstorm so that any minor break in bunds can be promptly repaired. Special attention should be paid to earthen dikes and bunds, water storage facilities and their spillway, and diversion structures. Treated catchments and water harvesting structures should be protected against damage by grazing animals. Silt and rubbish should be removed from the catchment area, from the harvested water and from storage facilities.

These experiences, and many others, show that the productivity of rainwater in the drier environments can be substantially increased when appropriate water harvesting techniques are implemented.

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A typical family living in Albadia. This is in northen Syria in an area called Khanaser. Photo: Theib Oweis.

Holding the Rain

Ivan Yaholnitsky

In Lesotho, agriculture consists of subsistence farming and involves extensive mono-cropping with very few external inputs. Livestock graze freely over communal pastures and barren or harvested fields. As a result, much of Lesotho suffers from chronic land degradation and soil collapse. This has led to the loss of biodiversity, declining agricultural productivity, depletion of nutrient balances, falling water tables, flash flooding and an increasingly dependent and poor rural population. Despite the innovations and considerable personal efforts of individual farmers, Lesotho still imports 85 percent of its food, and large parts of the country are turning into desert.

BBCDC

Bethel Business and Community Development Centre (BBCDC) is a rural development and education institution located in the Senqu Valley in the Mohales Hoek district of Lesotho. BBCDC aims to help build up the capacity of young Lesotho men and women so they can contribute to rural and urban development in their region.

View of the Phamong Valley from Mt Moorosi, Lesotho, 2000. Photo: BBCDC.

The Centre is situated on degraded pasture land typical for this area of Lesotho. It was established in 1993 and was immediately confronted with severe weather challenges. The annual average rainfall of 500-600 mm tends to fall very irregularly and in the early years there were frequent droughts. When the rains finally came, the streams filled up quickly despite the parched earth, highlighting the low capacity of the soil to absorb water. Famine was only averted through the intervention of the World Food Programme (WFP).

When BBCDC, in partnership with WFP, began a road construction programme in 1995, it came to understand the importance of drainage and run-off mitigation. Small dams and swales (see Box) were constructed at several locations along the roadway to control water flow, but because no one assumed ownership of these structures, they quickly silted up and lost much of their impact. However, the experiences of this programme made BBCDC aware of the importance of water.

Restoring the land

Inspired by theories drawn from permaculture, BBCDC decided to use ecology to restore the environment and started a programme to systematically develop the BBCDC campus. Soils on the campus were extremely compacted and despite some grass cover, were largely sealed, cemented and anaerobic. This was obvious to anyone digging swales or involved in excavating the building foundations.

New swale construction. Photo: BBCDC.

In order to halt the flow of storm water into the campus and to collect run-off from compacted areas like roads and paths, BBCDC students and staff constructed an extensive system of swales and diversion drains. Almost all the swales were dug by hand using picks and shovels, and simple A-frames or line levels were used to survey them. In the beginning the going was tough. Each swing of the pick dislodged a lump of clay-like rock. Once the rain came, things speeded up and deepening and extension of the swales required less effort.

Restoration required very careful landscape design. Rain falls at intensities of up to 100 mm per hour during summer in Southern Africa, whereas infiltration rates are perhaps 1 to 4 mm per hour on unimproved land. In the uppermost reaches of a watershed or micro-shed, the "stacking" of water and subsequent run-off lasts only a few minutes during high intensity rainfall.

The swales worked magnificently and a dynamic process of restoration and accelerated biological activity was set in motion. Storm water not only carries away soil, but also organic debris such as leaves, grass and manure. When storm water is diverted from the roads and tracks used by animals, swales act as a nutrient pump and trap. Vigorous pioneer plants growing more than two metres high do not always impress visitors, but their root systems do a great deal of beneficial work. Besides breaking through plough pans (the layer of compacted soil below the reach of the plough blade) and opening up the soil, they also provide essential organic matter for mulching and composting.

An evolving farming system

At the same time as more fruit trees were planted and became established, the swale system grew, matured and became more resilient. As conditions improved, BBCDC started to develop the farming system into a more sophisticated system characterised

Swales

Swales (or earth bunds) are the cheapest and simplest earthworks for water harvesting and storage. Swales are dug along contour lines or in flat areas and are designed to store water in soil and sediment by intercepting overland flow and enhancing groundwater recharge. Soil can hold thousands of times more water than tanks or dams, and water which infiltrates the soil in a swale is stored three to five metres deep, where it is available to trees. A good swale system can handle 200 percent of a village's runoff. A well-designed succession of five to seven swales can actually create a spring from stored groundwater. Swales become increasing efficient as they age and tree roots develop and humus accumulates. To encourage vegetation to re-establish itself quickly and to derive the maximum benefit from tree roots and humus, it is important that swales are smooth and have the right shape.

A system of small closely spaced swales keeps water flows small, their velocity near zero and minimises their destructive force. This is one reason why swales need to be surveyed accurately. The most important principal is that they should slow, spread and sink water.

by intercropping, mixed orchards and forage production. Over the years, intercropping between the fruit trees in the orchard has altered the structure of the soil and increased its infiltration capacity.

The large fields along the west side of the campus have been subdivided into smaller fields marked out along contour lines; and various market gardens have been developed all over the campus in the corridors between the swales and tree plantings. Many of these sheltered gardens enjoy a noticeably better microclimate. They are more productive and are also more responsive to irrigation and intensive management. All the fields on campus are now being converted along these lines.

Multiple water sources

To get through stretches of drought, BBCDC steadily invested in multiple water sources and in pumping, storage and delivery systems. At present, sources of additional water supply include rainwater tanks, a hand dug well, a spring, a groundwater dam, and a small pond constructed at the highest point of the campus. In 1998, BBCDC constructed a sand dam on a stream on the eastern side of the campus. It is working as planned and has helped raise the water table and made more water available for irrigation. Plans are being made to scale-up this initiative and build three more sand dams along a 5 km stretch of the stream. These dams will be located at points that make gravity flow irrigation possible.

At the moment water is lifted by a diesel pump installed near the groundwater dam, a solar pump installed in the well, and a gravity-driven hydram at the spring. Water is stored in stone masonry tanks for gravity flow irrigation of fields and gardens. Rainwater is also collected from the roofs of six buildings. The total water storage capacity on the BBCDC campus is now about 110 000 litres, of which 45 000 litres is rainwater collection from roofs. Water can be delivered to fields through a combination of flood, sprinkler and drip irrigation systems. During dry weather, swales can be flooded to water forage and fruit trees. The diesel pump can either fill storage tanks or operate up to 20 sprinklers. Drip irrigation sets are used on small market gardens and fed by gravity from the storage tanks. Grey (domestic waste water) and black (sewage) water from the school is also used to support the growth of ornamental plants and trees on the campus.

Restoration ecology and the community

As the capacity of BBCDC has grown, it has been able to increase its outreach activities in the surrounding community. In June 1996, BBCDC began a two-year "landscape design" extension programme with drought mitigation funds from the European Union. In the first year, BBCDC formed a partnership programme in the village of Ha Teboho with a number of families that volunteered to take part. Individual homesteads were swaled and gardens were terraced. The programme provided for the transportation of stones for constructing terraces, surveying, fruit trees and hand tools. Money was also provided to run workshops on surveying, land degradation, composting, and horticulture. These workshops were learner-centred and participatory and included discussions, presentations, fieldwork, skill building, group work, planning exercises and site visits. The local community responded enthusiastically.

This approach was proactive, beneficial and direct. The 1997, the programme went on to build on these successes and began to promote the fencing of home gardens and orchards. More co-operators from the village of Ha Teboho joined the programme and two years later the programme was extended to another three villages. By 2002, BBCDC was working with six villages in the Phamong Valley.

The resources available for this programme are modest and average less than US$5,000 per annum. A next step is the extension of this effort to the broader landscape, fields and pastures.

Conclusions

Energy and water balances on the BBCDC campus have certainly improved over the last decade. The water collected by the swales has triggered vegetation growth, proving how effective landscaping (such as constructing swales) and bioengineering (the engineering work done by plants) can be. Although we cannot influence the timing or distribution of rainfall, we can prepare carefully for the day when it does rain and try to ensure that as much rainwater as possible stays where it falls. This water must be stored and guided carefully through the landscape. If this is not done, all the pumps and tanks in the world will be of little use.

A groundwater dam is one of the multiple water sources available to the BBCDC campus. Photo: BBCDC.

Creating water storage to halt or slow down overland water flows is essential, because good moisture infiltration takes time. In regions of chronic degradation, water is a destructive force because the natural collection system provided by living plants has been destroyed. An aggressive strategy of water collection is, therefore, an important first step in the rehabilitation of degraded land.

BBCDC's work with local communities has been successful because the local communities recognise the risks and consequences of existing practices and have actively participated in the process of rehabilitation. While development agencies, extension services and participatory learning and action (PLA) methods help, they are no substitute for communities that are eager to learn, innovative and open to change. BBCDC made progress because its interventions were based on a commitment to create a culture of learning and innovation in which local communities felt a sense of ownership in the improved systems they were working to develop and maintain.

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Farmer innovations in water harvesting

Deborah Duveskog, Charles Mburu and Åsa Forsman

The farm of Alex Ole-Pere is often described as an oasis in the desert. From afar you can see a large Bluegum (Eucalyptus) tree, which would not normally survive in this dry climate. As you approach his farm, there are trees visible on the plains where typically the only vegetation is Acacia bush. Alex is one of the farmers identified as an innovator in the "Promoting Farmer Innovation in Farmer Field Schools" (PFI-FFS) programme in Kenya. His simple yet ingenious idea of a rainwater reservoir to capture run-off water from the surrounding mountains has been spread to other farmers in the area. In addition, his plot now serves as a water reserve for surrounding farmers and pastoralists in the dry season.

Spreading innovations

Africa has enormous resources of rich traditions, untapped knowledge and promising innovations relating to soil and water management. A large number of farmers experiment with soil and water conservation techniques on their own and spontaneously try out new practices, without the direct support of formal research and extension. Like the invention of Alex Ole-Pere, many of these small-scale initiatives have the potential to benefit other smallholders if they are applied on a wider scale. Farmers in drylands often suffer from extension systems that do not function well because of the large distances involved and the marginal nature of arid areas. This often leads to the failure of recommended technologies. Instead of relying on technologies that are often inappropriate and introduced from the outside, there is a real possibility in dryland Africa to build on local resources of knowledge and traditions, and the inventiveness that comes from necessity.

In East Africa in recent years, increasing attention has been paid to capturing local knowledge and initiatives and disseminating this information to other farmers. For example, UNDP and FAO have been working since 1997 to increase the recognition given to indigenous knowledge in agricultural extension by supporting farmer-to-farmer knowledge sharing and the identification and dissemination of local innovations (see Box).

Innovation initiative in East Africa

The Promoting Farmer Innovation (PFI) process is a 10-step guideline to identifying and disseminating farmer innovations. It was developed by a UNDP supported project in 1999. The project was piloted in Kenya, Tanzania and Uganda with the aim of identifying farmer innovators. The ideas of these innovators were disseminated through farmer-to-farmer extension and farmer exchange visits. In Kenya, an ongoing initiative supported by UNDP and FAO known as the "Promoting Farmer Innovation in Farmer Field Schools (PFI-FFS)" project has merged the PFI process with the Farmer Field School (FFS) approach to participatory extension. The objective of the initiative is to facilitate increased interactions between innovators and FFS groups and in this way to stimulate the process of innovation and discovery among farmers. Innovators are identified by FFS extension staff and are often included in the FFS as group members, guest speakers or resource persons. Alternatively, the FFS groups go on study visits to see the innovations.

About 250 farmer innovations have now been identified within the Kenyan PFI-FFS project. Around 40 percent of innovations are related to the efficient use of water resources, including water harvesting, small-scale irrigation and other ways to use surface water efficiently.

Dam building

Alex Ole-Pere is a Maasai who lives in a semi-arid area in southern Kenya. Although the district receives up to 600 mm of rainfall per year, this rainfall is highly erratic and unpredictable. The risk for crop failures due to drought is high. People in the area traditionally depend on livestock, but as it gets harder to sustain large cattle herds on grazing land that is gradually shrinking, more and more people have started to turn to crop production. Alex realised that every rainy season a lot of water from the nearby mountains seemed to be wasted as it raced towards the rivers. He came up with the idea of collecting this rainwater by building a dam. He built a reservoir close to his homestead and constructed a diversion from a local waterway. The diversion directed the flow of water from the stream into the reservoir. The dam, which is about 20 by 30 metres wide, was built by digging out the earth and putting it on the outside of the reservoir.

Alex Ole-Pere next to his reservoir. Photo: Åsa Forsman.

Water collected in this way is used for irrigating vegetables and tree seedlings. While most of the area around Alex's farm appears barren because trees and bushes are continually being cut for firewood, Alex plants more and more trees every season on his plot. Apart from sustaining the crops and trees on Alex's farm, the reservoir also serves the larger community. *"My neighbours normally come to fetch water from my dam in bad times. They can take both for their families and for their livestock. I have enough"*, he says proudly.

Earth banks

Agnes Mughi is a farmer in a very dry zone of Mwingi district. Her farm was suffering from water scarcity and she decided to do something about it herself. The area where Agnes lives is often affected by drought and the soil is compacted and eroded. However, her farm now appears green and productive all year round, in sharp contrast to the surrounding area. By using her own creative ideas, Agnes tamed the floods from a nearby seasonal stream by digging a series of earth banks across the direction of flow in the valley bottom above her plot. The banks, which were about 30 metre long and about 2 metres wide, slowed the floodwater down, giving it more time to infiltrate into the ground. This meant that there was an increase in soil moisture on her farm and the water level rose in the well she had dug in the centre of her plot. The well now provides clean drinking water for Agnes's family and neighbours as well as water for irrigating vegetables.

Like many other farmer innovators, Agnes Mughi is experimenting with a number of different approaches to enhance the productivity

Agnes Mughi's productive farm.

of her land. Her second innovation is a bio-pesticide made from dried chilli peppers, neem leaves and local aloe.

Agnes is a part-time social worker, and a role model for other local women. She has great strength of character and believes strongly in what she has to offer. In Mwingi district she has frequently been invited by Farmer Field Schools to explain her innovations to other farmers.

Rainwater harvesting

Peter Olochoki Letoya's first innovation came when he moved to a much drier area in East Mau. He realised that he needed to do something about the water shortage that was distressing his crops and threatening the livelihood of his family. Three years ago, he had the idea to collect rainwater runoff from his rooftop and store it in underground reservoirs. Since then, his reservoirs have been full. Today, it is clear that his idea has been a success but in the beginning he was afraid it would not work.

"When I first started to dig the holes for the reservoirs, I was hiding behind the house so that the neighbours would not see me. I did not want people to think I was crazy", he recalls.

Now that Peter Olochoki Letoya's rainwater harvesting technique has proved to be functional and efficient, his neighbours are no longer suspicious and some of them have started to adopt his method on their own farms. Working together with other farmers in the PFI-FFS project, Peter has been able to spread his ideas to other farmers and families outside of his community. He often gets visits from other farmers and farmers groups who want to learn how to harvest rainwater from rooftops. He has also benefited from visiting other innovative farmers and has been inspired by their ideas.

The tank that Peter Letoya invented is built underground by excavating soil and lining the sides of the pit with plastic sheets to avoid seepage. The top of the tank is covered with cedar posts. He chose cedar as a covering material because it does not rot easily and is not damaged by insects. Peter's tanks have attracted much attention in the area because in comparison with the common tank structures recommended by district engineers that are made out of concrete, they are very cheap to construct. *"My tank is about 10 percent of the price of the normal tanks found in this area"*, he says.

Peter Olochoke Letoya now has three underground rainwater reservoirs. These range in storage capacity from 1000 to 2500 litres. His family uses one for drinking water and the other two for watering trees and bushes on their land. At present he is thinking about collecting rainwater in an elevated tank so that he can start working with drip irrigation.

Another of his ingenious ideas is to use banana trees as nurseries for sugar canes. Peter discovered that the layers of spirally arranged, overlapping leaf bases in the stem of the banana tree form "pockets" that contain water. He placed some sugar cane cuttings in the pockets in the stem and these grew very quickly. In addition to the water from the banana tree, the improvised sugar cane "nursery" also receives moisture every morning from the dew that condenses on the banana leaves. Once they have grown roots, Peter plants the sugar cane cuttings in his fields.

Conclusions

Today, a significant proportion of poor people who depend directly upon the natural environment live in water scarce regions. All over the world, smallholders need water for their agriculture, livestock and households. Small-scale water solutions seem to be a key for enhancing food productivity for poor farmers and pastoralists in dry areas. Local innovators like Alex Ole-Pere, Agnes Mughi and Peter Olochoki Letoya can be found everywhere in Kenya and many other countries too. The challenge is to find ways of encouraging their inventiveness and originality so that their ideas can be developed and shared with other land users.

Peter Olochoki Letoya's rainwater harvesting system.
Photo: Åsa Forsman.

Findings from the PFI-FFS project show that there is a real possibility for bringing together external and indigenous sources of knowledge in agricultural extension activities. Initial results of the PFI-FFS programme suggest that farmers show a higher level of adoption when new technologies are introduced by fellow farmers rather than by extension workers and outsiders. East African farming conditions are very diverse and therefore require solutions appropriate to the local context. By capturing local innovations and promoting indigenous knowledge in extension and development activities, sustainable solutions can be found and scaled up.

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A full paper of on the PFI-FFS initiative is available at www.eseap.cipotato.org/upward

Reflecting on farm pond development

Michiel Verweij

Many initiatives have contributed to developing farm pond technology in Bolivia. Over time, different stakeholders have come together to scale up this technology. Strong organisation at community level has helped rural people to influence this process.

Ponds are not new in Bolivia. In the past, they were associated with large-scale cattle ranches in the lowlands of Santa Cruz. However, traces of traditional ponds are also found all over the semi-dry inter-Andean mountainous region between 1000 and 3000 m. These ponds were simple, mostly used for watering livestock, and usually had a storage capacity of less than 500 m^3. They were constructed by individuals or local organisations and remained a local initiative.

PDAR at work

Pond building first appeared on the institutional agenda in the 1990s, when the Programme for Alternative Development (PDAR) began promoting the technology as a way of improving production and stimulating social organisation. PDAR wanted to prevent subsistence farmers migrating from Cochabamba to the coca producing areas. Regional government departments, local NGOs and private enterprises were mobilised to implement the project.

Self-help and community participation were key to PDAR's strategy. Peasant farmers took up the idea of building ponds to harvest rainwater and worked hard to convince engineers to try them out. Ideas emerged to divert floodwater from the seasonal streams to a series of ponds in the valleys and several of these pond systems were built, including the well-known example in the Oloy community (see *LEISA Magazine* Vol 17.3 p 43).

Most of the ponds constructed by PDAR were simple 'holes in the ground' and many had serious construction and management problems. A few years after construction, only 25 percent of ponds were still working at full capacity and many had collapsed or were abandoned. An evaluation in 1992 recommended that if ponds were built for individual families, maintenance and operational problems would be avoided. By making their own financial contribution to pond building, families would also gain a greater sense of ownership. Better designs and construction guidelines were also required.

Maturing initiatives

CORACA, a farmers' organisation in Aiquile, began working with farm ponds in the mid 1990s. Together with the University of Cochabamba, they studied the successful experiences of Oloy to see how ponds had benefited farmers' families and their communities. They found Oloy had developed a flourishing fruit and vegetable production that complemented traditional cattle rearing farming systems well. New (informal) organisations and groups had been created to deal with water management, production, credit and commercialisation and, by exchanging experiences with other communities, Oloy had become a resource community for pond farming in the region.

The confidence generated by the Oloy experience encouraged more NGOs, local governments and farmer organisations to start implementing farm pond projects. Rural people in the Andean region are organised in farmers unions (*sindicatos agrarios*) with tiers at local, regional and national level. In many cases, these unions provided the organisational entry point for water harvesting activities.

Although different organisations had different working methodologies and pond designs, there was some exchange of ideas between them, such as encouraging farmers to make a 10 to 30 percent contribution towards their ponds. Some organisations chose to build ponds for collective use, but as these often encountered problems of ownership and maintenance - individual ponds proved a better option. The quality of pond infrastructure remained a problem in family ponds because of the need to keep costs low.

With the introduction of the Popular Participation Act (*Ley de Participacion Popular*) in 1994 and political decentralisation at the administrative level, peasant farmers became more able to participate and influence district development policy. A proportion of the central government budget was now available at local level. This meant that local politicians and organisations came under pressure to make the districts more productive, while the rural population became increasingly active in demanding support from local government.

Lobbying got ponds onto the local and regional development agenda and very quickly political parties realised the political potential in the movement. NGOs started to link up with local government to access funds and material available locally to support the pond programme. Organisations like CORACA, for example, made strategic alliances with district governments and started to work with private contractors.

In 1998, Cochabamba experienced an earthquake. Funds made available for reconstruction also stimulated a larger institutional irrigation effort. A technical unit was formed to work with local organisations implementing projects at field level. Standards for the design and implementation of ponds were developed because experience had shown that there was a need for higher technical and administrative standards. As a result, the quality of ponds increased although, problematically, costs also increased significantly.

Acceptance

As ponds and pond farming became more widely known, they became better accepted. The subject now has a formal status and is included on the curricula of universities and training centres. It is also firmly established on both local and regional political agendas.

Communication and collaboration between communities, local government and local development organisations has improved considerably during recent years and pond farming is now seen as a useful initiative to work on together. The next joint effort should be to adapt the pond technology to make it cheaper. Bolivia's experience of pond farming has shown that no matter how relevant a technology may seem at the time of project implementation, there is always room for improvement. It is important to return to a project area to evaluate and learn from the long-term results.

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Managing Water Together

Mona Dhamankar

Today, many villages in India are facing severe water scarcity. Erratic rainfall and poor soil and water management, including relentless ground water extraction has led to cycles of droughts and ongoing water scarcity. As a result, there is renewed interest in rehabilitating the small, traditional water harvesting and irrigation systems that have existed in India for centuries.

Here we describe the efforts of a community and their government to take 'rehabilitation' beyond technical interventions, to include farmer participation and coordination of the efforts of different institutions. Over the past two years, people in the community have not only demonstrated a capacity to understand and analyse their own problems, they have also invited several partners with different resources to join them in their efforts to rebuild their water resources.

The setting

The Marathwada region of Mahrashtra is a drought-prone area in Western India. Almost 80 percent of this region is under rain-fed agriculture. Aurangabad, one of the largest districts in the region, receives on average around 700 mm of rainfall per year. For the past three to four years, farmers in the district have been forced to meet their needs with only 50 percent of average rainfall. Most of the "talukas"(units of civil administration within a district) have been declared permanent drought-prone areas and even talukas with a reasonable rainfall pattern have been struck by famine in recent years.

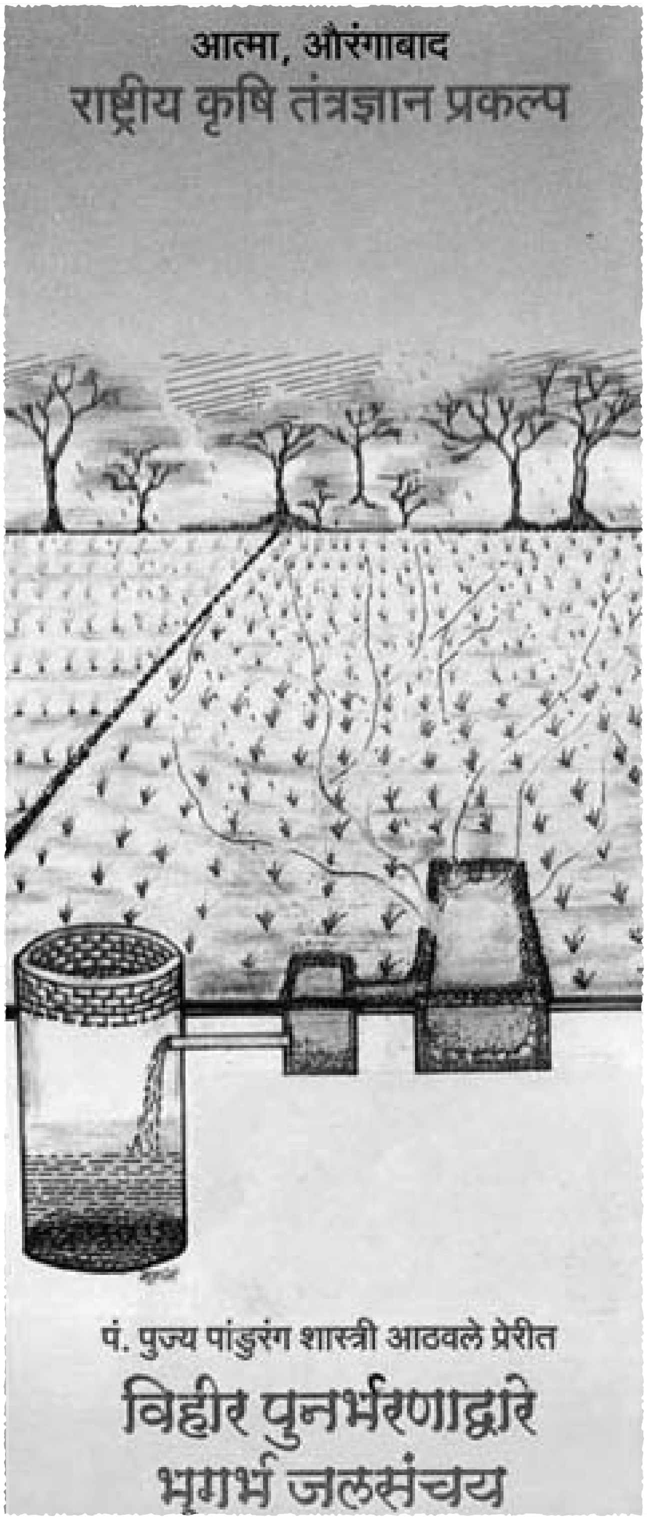
The majority of farms in the area are small and medium sized. Around 55 percent of the farmers can be categorised as smallholders, with an average land holding of up to two hectares. Medium-sized farms are between two and five hectares, of which between one and two hectares is irrigated. The rest is rain-fed agriculture. Most of the large farms have been divided between family members in order to take advantage of government schemes and subsidies for smallholder farmers. Most farmers labour on their own farms and find hiring tractors more efficient and more economical than hiring agricultural labour.

Inspired by a farmer

While documenting indigenous technical knowledge in the area, officers of the Agricultural Technology Management Agency (ATMA) met a farmer called Shri Vasant Katbane. Shri Katbane had tried out the two-pit well recharging technology in 1985, and went on using it for about ten years with only nominal maintenance expense.
Satish Shiradkar, Deputy Project Director of ATMA, Aurangabad, describes the origins of the programme:
"*It all started on 24 July, 2001 in a brainstorming meeting called by the Divisional Commissioner of Aurangabad to address the severe drought problems of the district. Several government officials and NGO representatives were present when our Project Director Mr K V Deshmukh shared information about a successful well recharging experiment carried out by a farmer in Dhangaon in Paithan Taluka eight years ago….*"

"At first everyone was apprehensive, but when our District Collector showed interest, we organised an exposure visit-cum-workshop to see Shri Katbane's well. He was the only farmer in the area who had enough water to irrigate a Rabbi (winter) crop in a dryland area. As several senior government officials and progressive farmers came along, the visit got a lot of media attention, and also generated curiosity among farmers in neighbouring villages. In all, over 2000 people came for this workshop in August, almost at the end of the monsoon season."

After the initial visit-cum-workshop, ATMA officers conducted block-level meetings with village heads to share the technology. A prominent social activist and expert on water management joined ATMA in their efforts to motivate farmers in *Garaj,* one of the most water-scarce villages in the district. The farmers here took up recharging works as a group activity and, as a



Diagrammatic representation of two-pit technology.

result, 52 out of the 102 wells in the village were recharged. The people provided their labour and an initial investment to meet the cost of pipes, and the agriculture department provided technical inputs. The village was fortunate to receive the last monsoon showers in September and early October and these filled the recharged wells to the brim. Careful use of the artificially recharged water made it possible to give protective irrigation to the existing Kharif (summer) crop, and also offered farmers the opportunity to irrigate an additional 50 hectares. They were convinced of the benefits of the technology.
ATMA officers recorded the performance of the 52 wells, and their observations formed the basis for launching a more comprehensive 'water resource and agriculture improvement management' programme - the *Amrutdhara Jal Abhiyaan*.
This programme was designed with the help of people who volunteered their time, labour and met the initial costs of the interventions. In April 2002, a start was made with 114 villages and about 50 of them became focus villages for the programme. ATMA provided an inventory of other simple, low cost technologies (see Box).

Amrutdhara Jal Abhiyaan programme components

1) **Well recharging for agricultural purposes**
2) **Rooftop rainwater harvesting**
   Individual pucca houses
   Government buildings
3) **Revitalising existing structures**
   Collective de-silting
   Sluice gate management
4) **Soil and water conservation works**
   Plantations on farm bunds
   Loose boulder structures
   Low-cost water harvesting structures e.g. farm ponds, check bunds
   Continuous Contour Trenches
   Kisan nurseries
   Soak pits
   Kitchen gardens
5) **Improved crop management**
   Vermicomposting
   Sendriya Sanjivani (improved organic fertiliser)
   Zero Energy Chambers to store vegetables and fruits
6) **Integrated pest management (Cotton)**
   Trap crops
   Pheromone traps, Light traps
   Neem sprays
7) **Livestock development**
   Improved fodder varieties cultivation
   Better management practices
   Mass de-worming and pest management
8) **Village level information centres**

Revitalising existing structures

Throughout the area, tanks and ponds have been the mainstay of rural communities for centuries. Aurangabad has around 390 structures, with an estimated irrigation potential of 20 000-22 000 hectares. These structures include a large number of nala bunds (tank-like small water harvesting structures) percolation tanks, and small and medium irrigation tanks constructed by the State Irrigation Department. In most cases the tank beds are silted up, reducing the storage capacity far below their potential by about 40 percent. Prolonged siltation had also resulted in the reduced carrying capacity of canals. The government, which is constantly short of resources, has not been able to invest in maintenance and repair. Some farmers do limited maintenance work before the irrigation season begins, in the parts of the canal closest to their fields, like cleaning out weeds, grass and other foreign matter. However, they do not undertake to de-silt the tanks or canals, strengthening the canal walls or deepening their beds.

Well recharging in Panvadod village, Tal. Kannad. Photo: Mona Dhamankar.

In spite of realising the importance of these structures, farmers are hesitant to voluntarily manage them because of the high royalty that must be paid for the silt, and the cumbersome formalities needed to get permission to use it. This problem was discussed in the initial meeting of *Amrutdhara Jal Abhiyaan* stakeholders, where the District Collector promptly agreed to waive the royalty if the farmers came forward to de-silt the tanks and carry the silt to their own farms at their own expense. Government officers from several departments set the pace by contributing a day's work (shramadan). This motivated the farmers, and up to now around 375 water bodies have been de-silted through collective action.

Water harvesting through well recharging

Through the process of revitalising the existing water-harvesting structures, the farmers realised that silt was nothing but their own fertile soil that was being carried off with the rain. Whenever it rained, the villagers saw the runoff in the streams and rivulets that flowed through the village. They decided to use that water for recharging their dry wells and asked the agriculture department to help them. ATMA provided information about the Swaydhay well-recharging system (see Box).

Well Recharging

(inspired by social reformer, Shri Pandurang Shastri Athawal, founder of the Swadhay Parviar movement)

The well-recharging system is very simple. Two percolation pits are dug next to a well. The large pit is approximately 2.4 x 1.8 x 1.8 metres and the small one is 1.2 x 1.2 x 2.4 metres and is built along the slope of the larger pit, about 3 metres away from the well. The smaller pit is filled with stones, gravel, and coal, which act as a filter. A cement pipe (23 cm diameter) fitted with a wire mesh filter is fixed at the bottom of the smaller pit. This pipe opens into the well. Rainwater that collects in the larger pit, flows into the smaller pit and is filtered clean before it flows into the well through the pipe. The silt that accumulates in the pits can be used in the fields. In this way, soil is conserved as well.

This technology became immensely popular because it was low cost. At an initial expense of Rs.1500-2000 (US$ 25-30) towards labour (approximately 3-4 person days) and pipes, the farmers reaped benefits throughout the year. Annual maintenance too was negligible at Rs.100. Data from Garaj village, Aurangabad district (2002) indicated that production increased substantially in areas where well recharging was taken up in comparison to those where it was not. Rabbi sorghum increased from 6.5 to 9.3 quintals/ha, wheat from 9.6 to 16.3 quintals/ha and cotton from 6.1 to 10.7 quintals/ha.

Shafiyabad's Water Budget

While working on soil and water conservation measures, the people realised that however much water they collected, it would not be enough if they did not pay very careful attention to how it was used. It was not enough to harvest rainwater and promote viable agriculture packages. Location-specific land-use planning modules were also required. Shafiyabad was one of the first villages to act on this understanding.

Until ten years ago, farmers in Shafiyabad cultivated sugar cane and bananas. Almost every farmer had a pump fitted to his well and drew water relentlessly. Over the years the groundwater was used up, and in recent times these crops are nowhere to be found. The people joined the Abhiyaan in the hope of rejuvenating their water resources, and promised to use their resources sensibly. In consultation with the Agriculture Department they prepared a 'water budget'. They appointed a committee that helped each farmer work out his/her own requirements. Crops that needed more water were discouraged and replaced with perennial crops and new varieties with short gestation periods.

Stakholders inspecting a farm pond. Photo: Mona Dhamankar.

Thereafter, the water requirement for the entire catchment area, including that for livestock, was worked out and displayed on the wall of the gram panchayat office in the centre of the village. Several other villages have now followed suit and prepared their own water budgets.

Looking ahead

Though only a few of the programme activities are described above, almost all components of the programme have been implemented with the same zeal and participation. The spirit and enthusiasm with which all stakeholders participated gave it a momentum comparable to a peoples' movement, with a promise to redefine the future of agriculture in the region.

A farmer taking his bumper cauliflower crop to the market. Photo: Mona Dhamankar.

Besides improved agricultural productivity, the programme has also produced a cadre of efficient *barefoot* technicians and trainers for water resource development interventions. These farmers are being invited by other neighbouring villages to help them design their own interventions. In the rest of the district, the traditional institutions for managing water harvesting structures are starting to revive spontaneously, and there is a community-wide dialogue on ways of sustaining and enhancing the water retention. About 15 villages have taken up water resource development activities on their own, and have approached the agriculture department for technical guidance.

The *Amrutdhara Jal Abhiyaan* officially ended in March 2003. As a strategy to maintain the tempo of work and sustain farmers' interest, the 50 focus villages are now part of a larger government-sponsored watershed development programme. For the first time, the state government's Employment Guarantee Scheme is taking up soil and water conservation measures that require higher investments and 1-2 years of consistent support.

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There is no surface or ground water on the plateau. People had to carry water from the deep gully. Photo: Author.

Drought-proofing villages in Gansu Province

Zhu Qiang and Li Yuanhong

The semi-arid Gansu Province is one of the poorest and driest areas in China. Droughts and dry spells are extremely common in this mountainous area, where people depend primarily on rainfed subsistence agriculture. Since the late 1980s, a project for supplying water for domestic use and irrigation has been developed in the area. A simple and affordable rainwater harvesting system combined with an integrated approach to improving agricultural production has effectively improved the lives of Gansu farmers.

Background

In the mountainous Gansu Province over 90 percent of the population live in the rural areas. In this area of primarily subsistence agriculture, most farmers have traditionally relied on the unfavourably distributed rain. Two-thirds of the rain falls between July and September each year, often in the form of heavy thunderstorms. Only about 20 percent of the rain falls in the spring, when crops need water most. It is only possible to grow one crop per year.

The main crops grown in Gansu are wheat and maize. In the middle Gansu, spring wheat is the main crop, but recently maize grown with plastic mulching has been widely adopted owing to its higher yield and adaptability to the natural rainfall. This is sown in late April and harvested in late September. Plastic mulch is essential for growing maize in this area as it raises the soil temperature, which allows the crop to mature. In the eastern Gansu, winter wheat and maize are the two main crops. In the mountainous areas, cows and horses are used as draught animals for sowing, ploughing, and tillage. Harvesting is done mainly by hand.

Water resources in the area are scarce. Most of the river runoff is salty and cannot be used for drinking or irrigation. Groundwater is also very limited and of poor quality. Owing to the mountainous topography and geological condition, it is difficult and expensive to divert water from other watersheds. Drought occurs frequently. Studies in Gansu show that heavy drought, reducing yields by more than 30 percent, has occurred in 11 out of the last 40 years.

Under these adverse conditions, yields are as low as 1000 kg/ha in a normal year. In dry years, yields do not even cover the cost of seed. Without irrigation, it is impossible to grow most cash crops. As a result, the annual family income from a little less than one hectare of land is between US$500-US$750. The poor productivity of land has forced farmers to reclaim as much ground as possible even on steep slopes. This has caused more soil erosion and land degradation and this in turn has had a negative effect on agricultural productivity. The environment has deteriorated rapidly. Inadequate drinking water supply, food insecurity, low income, serious soil erosion and a deteriorated environment have become common features in the area.

Taking action

Experiences in the past decades have shown that water is a key factor in the struggle to change basic conditions in the area. Rainwater harvesting (RWH) is the most effective way for the local people to get water. People in the area have a long tradition of harvesting rainwater for domestic water use, but the water collected was far from sufficient to meet the domestic demand for water, let alone the water needs of agricultural crops.

Since 1988, the Gansu Research Institute for Water Conservancy (GRIWAC) has undertaken a project for Research, Demonstration and Extension of RWH, aiming at improving the efficiency of rainwater utilisation and working out RWH technologies suitable to local conditions. The Project was very successful in supplying water both for household and crop use. By the end of 1994, about 40 000 rural households had built their own RWH systems.

When it is raining, the ditches can lead water collected from the road and hill slope to the two rows of tanks. The tank water is used to irrigate crops and trees on the lands below. At the right below, land is sheeted with plastic films to prevent erosion and raise soil temperature. Photo: Author.

In 1995, a once-in-sixty-year drought occurred. Millions of people suffered from thirst and almost all the summer wheat died. Because of the successful experiences of the GRIWAC RWH project, the local government decided to initiate a "**1-2-1**" rainwater harvesting project, aiming to solve the drinking water problem for one million people in the area. In this project, government and donors supported each household with cement equivalent to US$50 to enable them to build **one** collection field, **two** underground tanks and to irrigate **one** piece of land with rainwater to develop the courtyard economy enabling them, for example, to plant vegetables or fruit trees in the courtyard, raise animals and poultry and process agricultural raw materials. By the end of 1996, there were 1.2 million beneficiaries of this project.

The apple orchard yields around 40 percent more on average with supplemental irrigation. In dry years, the increase is even higher. Photo: Author.

In 1996, a follow-up RWH Irrigation Project was initiated, starting with pilot projects at 12 sites with different natural and social conditions. The project was later extended to a much larger area. By the end of 2001, using the methods recommended by GRIWAC, there were 2.2 million newly built storage tanks which made possible the supplemental irrigation of 236,000 ha of land. At the same time, the beneficiaries of the domestic water project had increased to nearly two million people.

Benefits

The 15-year experiences of RWH in Gansu have proved that RWH not only can provide safe and cheap water for domestic use, but can also increase production by providing supplemental irrigation to crops. Crop yields have increased by around 40 percent in a normal year and by much more in a dry year.

With water in their tanks, farmers can diversify their cropping systems. Before the project, the only foods available at the family table were potato, onion and cabbage. Now, many crops that are sensitive to water stress can be grown, like cucumber, tomato, eggplant, pepper, tobacco, and herbs. Simple greenhouses have also been developed to grow vegetables and flowers. Water collected from the roofs of greenhouses can meet 40 percent of the water needed to have three harvests of vegetables. The remaining 60 percent of water needs to come from other catchments. The simplified green-house built with bamboo and steel rods and covered with plastic films costs about US$1000, while the annual net profit can be up to US$350-US$500. At this rate, investment can be recovered in 2 to 3 years.

When land productivity improved, farmers started to participate more in the Land Conversion Programme initiated by the State Government. This programme encourages farmers to plant less fertile land with trees and grassland species to improve the ecosystem. Irrigation with rainwater is a precondition for the establishment of new vegetation.

The RWH system

The RWH system consists of a rainwater collection field, tanks for water storage and water supply and irrigation facilities. Less permeable surfaces of existing structures are used for rainwater collection. In the RWH system for domestic water use, tiled roofs and concrete lined courtyards are used to produce cleaner water. Paved highways, country roads, threshing yards and sport grounds are used for collecting rainwater for irrigation purposes. Sometimes, hilltops or slopes are lined with concrete slabs to increase runoff.

Traditional underground tanks, known locally as *Shuijiao* and *Shuiyao,* are the most common types of water storage. The total investment for each *Shuijiao* is about US$120, of which US$50 is subsidised by the government. The remaining investment is supplied by farmers in the form of labour, local materials and some cash.

The tanks usually have a bottle shape with a diameter of about 3-4 m and a depth of 5-6 m. Irrigation tanks usually have a capacity of 30-50 m^3. A concrete, dome-shaped top with a thickness of 10-12 cm helps to sustain the soil weight and the load on the surface. A hole in the centre acts as both a water outlet and a manhole. The bottom of the tank is made of 10 cm thick concrete.

The underground tank has the advantages of preventing evaporation loss and maintaining a low temperature, which helps to maintain water quality. Each tank is used for the supplementary irrigation of one Chinese *mu* (approximately 670 m^2). One such structure generates two water applications of approximately 20mm each, enough to mitigate one dry spell during the growing season.

Water for domestic use is usually supplied by hand pump. The limited amount of rainwater available for irrigation is applied sparingly to crops, using the principle of limited irrigation. This means that water is applied in limited amounts during a few critical periods of crop growth. For this purpose, a lot of experiments have been conducted to determine the best time to provide the different crops in the area with supplemental irrigation. The most commonly used methods are very simple,

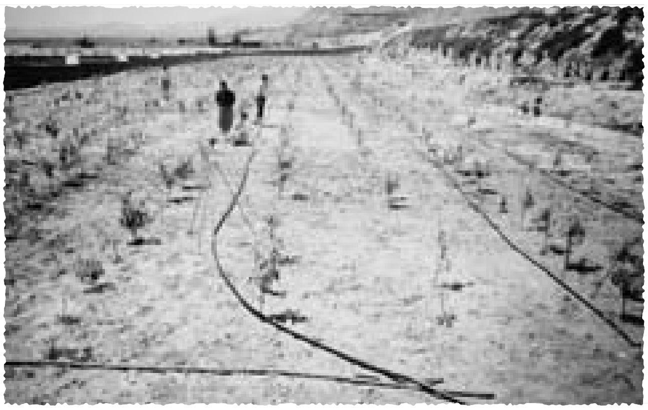
A ditch diverts water collected on a paved highway to a tank, which provides supplemental irrigation to the crops. The crop in the photo is maize. Photo: Author.

affordable and effective. For example, irrigation when the seeds are being planted or supplying water through the holes in the plastic sheeting. If farmers can get support or a loan, they also use drip irrigation and mini-sprinkling for high value crops.

Drought-proofing villages

Luoma Village is located in the northern part of Huining County, one of the 592 key impoverished counties in China. The annual rainfall is only 250 mm. There are 65 households in the village, which has a population of 323. Before the RWH project, the annual food production per capita was less than 300 kg, and annual income per capita was less than US$50. Local people had no water supply for domestic use.

This village was chosen as one of the pilot RWH projects in Gansu Province. From 1996 to 1998, the village built 330 *Shuijiao*s, 130 for the domestic use, 65 for the courtyard economy and the remaining 195 for field irrigation. During the recurring droughts between 1999 and 2000, the RWH system not only ensured water for domestic use and animal husbandry, but also provided enough water for the supplemental irrigation of 22 hectares of land.



Drip irrigation of fruit trees. Photo: Author.

Now that they have water, farmers have changed their cropping system by planting maize instead of summer wheat. Maize can produce much higher yields than wheat in this area owing to a longer growing period and a higher adaptability to natural rainfall patterns. However, it requires more water and heat in order to mature properly. Annual yields have now increased from 975 kg/ha of wheat to 3950 kg/ha of maize. Annual food production has increased by 144 percent and income per capita has increased by 187 percent. Even in years of severe drought, households have enough to meet their food needs.

Simple greenhouses have become very popular. Photo: Author.

Villager Luo Zhenjun's family was one of the poorest in the community before the project. His family of four harvested only 800-1000 kg of wheat in a normal year. During the RWH project implementation, he built six Shuijiaos with total storage capacity of 120 m^3. Using water from the RWH system, he now plants 0.4 ha of plastic-sheeted maize each year, yielding 6000 kg/ha/yr. Using supplemental irrigation, his small orchard doubled its production.

With more tank water available, he now keeps two pigs and 17 sheep, nine more sheep than before the project. His total food production has increased from 900 kg to 3675 kg per year, and his annual net income has increased from US$190 to US$700.

Experiences

The great success of the RWH project in Gansu is considered to be the result of the wide participation of the farmers and the firm support of the government. The main experiences of the project in Gansu can be summarised as follows:

- Household ownership of RWH system is the key factor to the high degree of motivation shown by farmers. Unlike the key water projects owned by the State or big enterprises, which farmers regard as "welfare", most of the RWH systems belong to the households themselves.
- Both the farmers and government can afford the inputs for the RWH system. The high profits gained from the RWH system means that investments can be recovered quite quickly.
- RWH is a tradition of the local people, but it has been updated with appropriate modern technology. This meant that farmers were more ready to accept it.
- With a little assistance from villager technicians, farmers can build their own RWH system. This decentralised approach of the RWH project suits the natural and social conditions of this mountainous and impoverished area.
- Proper preparation, organisation and management of project implementation are also important success factors. Demonstrations were very important in showing the benefit of the projects to both farmers and decision makers. From the very beginning, GRIWAC helped thousands of "scientific households" to build RWH systems that provided good examples for both the general public and the politicians. Research on the technical and economic feasibility of the RWH project was carried out over a 3-year period before the project increased in size. Technical guidance and training courses at different levels were also essential elements in the implementation of the project.

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What we have learned

Roland Bunch and Gabino Lopez

This article looks back on seven years of action-research with small farmers by COSECHA, a Honduran NGO (see *LEISA Newsletter* Vol 16.1 p 22). The purpose of this research was to develop water management technologies that could be adopted by individual farmers cultivating one hectare or less.
We decided on this goal in part because a lot of research has been done on larger, multi-family systems, but there seemed to be a lack of research on technologies that an individual family can adopt spontaneously. We limited ourselves to technologies that cost less than US$50.00/technology/farmer, and have worked hard to lower costs even further. Our work has been carried out in the hillside environment where most Honduran small-scale farmers live.

The technologies described here are not necessarily in their final form. We hope that all of them can, in time, be modified so they work better and cost less. They are already very popular with farmers and we welcome any experiences or suggestions that people might have to improve them.

Priorities

During our years of research, we have learnt some valuable lessons about people's priorities for water use. At first, we thought that people used the water they managed mainly for their grain crops. How wrong we were! In fact, the first priorities are domestic: water to drink, wash and bathe. Then comes their animals and water for irrigating perennial home gardens, and more valuable crops, such as fruit orchards or commercial vegetables. Only then do they use water to irrigate their basic grain and root crops.

Looking at this list, we can understand why women are so interested in water. It also helps us understand why the first micro-tank built for any family can best be located near their home. In the Latin American context, we have found that of all the work we have done in agricultural development, it is our work with water that has attracted the attention of women the most. Women are interested in water for domestic use and to water their animals and irrigate their home garden. These activities are usually their responsibility. Of course, women are also concerned that there are enough vegetables and crops for subsistence despite irregular rainfall. However, in most Latin American countries, the production of basic grains is not their direct responsibility, and they are happy to keep it that way.

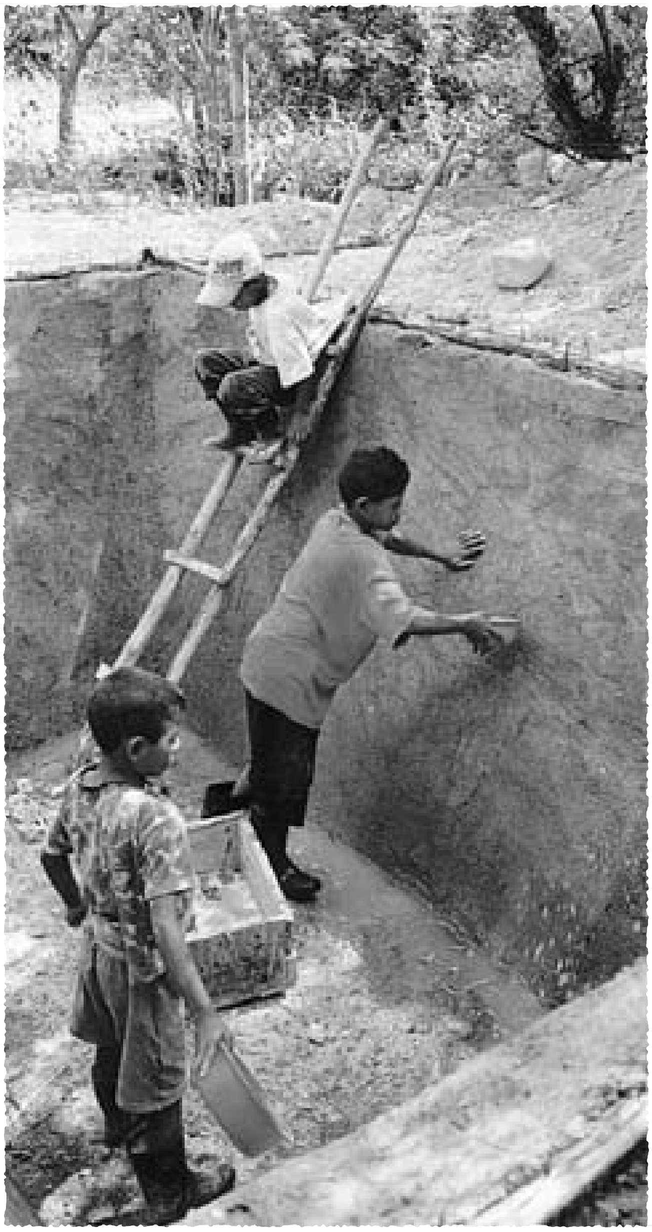
Sources of water

There are far more sources of water than most people think. We have gradually realised that many sources we previously thought useless have turned out to be very valuable. As we learned how to recycle household water, and as we have developed pumps that are less expensive, we have come to realise that twice as many people in the area have access to water sources than we originally thought.

One of the most important lessons we have learned is that almost any water source, no matter how seemingly insignificant, may become very useful. For instance, many water sources that flow only during the rainy season may be all a farmer needs, if the primary purpose of the water is to save crops from unexpected droughts during the rainy season.

Farmers can even use water sources that have so little water that they do not flow, but simply drip or ooze. If the farmer has a microtank and an appreciable amount of water collects over a period of time, this is also a useful source. In one Honduran example, there are five families that get all their domestic water from a "spring" where the water barely oozes out of the soil.

Access to different water sources can be important. In Honduras, farmers have lost interest in making microtanks where they can only fill the tanks with harvested rainwater. However, they remain very enthusiastic about microtanks where they also have access to some other source of water. This is because a microtank that is only fed by rainwater will only fill up and be used two or three times during the year. Farmers who have a more constant source of water and can keep their microtank filled throughout the year may well fill the tank and empty it again every three days, using as many as 100 tankfuls each year. Thus, farmers with an additional source of water will find it easier to repay their initial investment in the tank.



Lining the microtank, Sabannah Grande. Photo: Anita Ingevall.

Reusing household water

With local materials and less than a day's labour, a farmer can make a small, soil-surface filter that will make grey water (carrying dirt and soap) safe for crops. A normal 5-member family produces about one oil drum per day of soapy water. Filtered, this water will usually mean a good piece of land near the house can become useful again. With this much water, a woman can often increase the size of her perennial home garden by 50 or even 100 percent, and perhaps grow enough vegetables for the family throughout the year.

To build a filter, one needs only river sand, gravel, used firewood and some old pieces of used plastic (or a bag of cement). The filter is made by digging about 50cm into the soil. It can be lined with cement, but a cheaper approach is to line it with several layers of old, used plastic bags. Equal amounts of first gravel, then river sand, and pieces of burnt firewood from the kitchen are then placed in the filter. The firewood acts as a charcoal filter and must be replaced about once every six months, depending on the size of the filter and the amount of water going through it. From the filter, the water should go to some sort of storage unit, although this might be quite small (about one cubic metre) if the filter is the only source of water for the tank.

Farmers particularly appreciate water harvesting when they also have another source that, for instance, requires a hand pump. In this case, the microtank is filled most of the time by pumping water, but farmers are very happy to have the rains fill up the microtank whenever possible.

Transporting water

In most cases, water is not directly available in the place where it is needed, but has to be transported from the source to the household or the field. This is often very resource demanding and can be a major constraint to increased water use.

Traditionally, water is either carried in containers or transported from the source to a storage tank in ditches. A simple polyurethane hose can replace the ditches. It is usually much less expensive, and is also preferable because it is easy to use and can follow the topography of the land more easily, for example, dropping a certain vertical distance and then climbing the same distance. All of the farmers in the Sabana Grande area choose to use a hose rather than a ditch. The hose also loses less water along the way, it does not deform the land it passes, and it can be moved easily from one place to another. If the hose is buried, it is more difficult for people along the way to steal water. However, the hose is also more vulnerable to vandalism than a ditch.

Pumps are often needed to get water uphill from the source. Although we worked with "washer pumps" for several years, we recently learned of a pump that could be made with a small amount of PVC pipe and a few plastic and metal fittings that are available in most hardware stores, plus two marbles. It is a simple suction pump much like those on top of spring water bottles, but much more durable. It is simple enough for nearly any farmer to make. The total cost of the materials for a pump is about US$40, and it is capable of lifting water 30 vertical metres.

This pump has become extremely popular among farmers who have water sources just below their farm plots. It takes a good deal of effort to pump the water, but most farmers are still thrilled to be able to make such a pump. For those who can afford a more efficient system, we are presently working to fit two such pumps to a treadle, so that a farmer can use his or her legs, thereby pumping twice as much water for a longer period of time. With such a system, we estimate that one person could lift enough water to irrigate a half-hectare of land some 25 vertical metres.

The pumps can be used to lift water from storage tanks, from rivers and streams, and from springs. They are not only easy to make, but very light, so they can be carried home each evening, in order to avoid theft. One of them is enough to allow one person to water a large vegetable garden (20 by 30 metres), or about fifty trees.

Storing water

Storage is the heart of any water system. Unfortunately, it often represents the most costly part of the system. It has become increasingly clear that by far the most efficient way of ensuring that our crops have sufficient water is to store rainwater in the soil itself. It is far cheaper to double or triple the infiltration of water into the soil, thereby almost doubling the water-holding capacity of the soil, than it is even to build a medium-sized microtank. How? Basically, by increasing the organic matter content of the soil.

Microtank in use during the dry season. Photo: Anita Ingevall.

The impact of even a fairly small amount of organic matter in the soil is often greatly underestimated. Research in Southern Africa, for instance, showed that contour hedgerows halved the amount of water flowing down a hillside during rainstorms even before they started having a terracing effect. The main reason for this was the large quantity of organic matter that had fallen under the hedgerows, making that strip of soil much more porous and thereby increasing the infiltration rate under the hedgerows dramatically. Thus, our first line of defence against drought must be green manure/cover crops, intercropping, agroforestry practices, and anything else that will increase the organic matter content of our soils.

Microtanks are still important for storing additional water. COSECHA has been able to get the cost of building microtanks down through the use of local materials, such as clay, river sand and rocks, plus only one bag of cement for each cubic metre of capacity. Such microtanks are totally impermeable to water and, with a little shade, suffer virtually no evaporation losses. There has been a problem with a few of them cracking, but only when the choice of location was not good - either the surrounding soil was leaking water, or the soil was a very heavy clay that cracked when dry. Small cracks can easily be repaired.

When we first began working with water management, we thought farmers would prefer to make a series of microtanks of about 0.5 to 1.0 cubic metres in capacity, thereby simplifying the distribution of the water. Rather than taking that approach, farmers have universally preferred to make just one tank, usually of about 5 to 7 cu metres in capacity. In a few cases, tanks of up to 25 cubic metres have been built.

Care must be taken to avoid the possibility of children falling into the microtanks and drowning. Most families put the tanks on their own land near the house, so that other people's infants will not have access to them. If they have children themselves, they keep the microtanks well covered, for example with tree branches, old pieces of plastic or roofing tin.

Health is another serious issue that should be considered when building microtanks. Standing water can cause health problems in the tropics, especially in Africa. The major concern in Central America is the possible spread of both malaria and dengue fever by mosquitoes. If farmers have a continuous source of water, they need to completely empty the microtank at least once a week. When the water is held longer in the microtank, problems can arise. Honduran farmers have found a number of promising solutions. For example, common cooking oil produces a film on top of the water, killing the mosquito larvae. Neem (*Azadirachta indica*) and mother of cacao (*Gliricidia sepium*) leaves can also be crushed up and thrown into the water to control mosquito larvae, and frogs and fish can be kept to eat the larvae. We need to experiment more with each of these solutions in order to make sure they are effective.

Using water

At first, farmers are often not worried about using their newly acquired water efficiently, unless they have to pump the water or the quantity of water available is very limited. They usually prefer sprinklers, because they are easy to use. As they begin to irrigate larger and larger plots, however, they become more concerned about using water efficiently.

The most efficient way to irrigate crops is drip irrigation. Farmers in Honduras have developed or tried out at least three drip systems, but the most popular by far is a simple system that involves passing wooden screws through an ordinary PVC hose at regular intervals. One side of the hose holds the screw tightly in place, while the other side is only partially penetrated by the screw, allowing the water to leak out. This allows farmers to take the screw out when the hole is plugged up by water-borne impurities, and adjust the screw to regulate the flow of water out of the hole. Because it uses an ordinary hose, this system is less than half as expensive as any other system we know about.


The suction pump is light and can be stored at home. Photo: Anita Ingevall.

Conclusions

The initial technology we share with farmers has to have a rapid, recognisable impact on yields if it is to be adopted. Even though we believe that the technologies should be as simple as possible, in the case of water management we must also work with the farmer's soils to improve fertility, water infiltration and water-holding capacity, as well as to provide the shade needed to reduce evaporation and transpiration. Applying water to hard, impenetrable, infertile soil exposed to the tropical sun will often have little impact on yields. It is, therefore, important to consider soil conservation measures, as well as measures to improve the organic matter content of the soil such as green manure or cover crops, as an essential component of water management.

Working with water is not easy, because programme extensionists and farmers often need to learn a great deal about a new subject, and because of the need to work with soil improvement at the same time. Nevertheless, the results can be tremendously heartening.

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We are happy to send the plans and designs for any of the above technologies to anyone who requests them. We can be contacted at the address or email provided below.

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Soil management in semi-arid savannas

Joseph Mwalley and Johan Rockström

In Sub-Saharan Africa, 40 percent of the farmland is located in semi-arid and dry sub-humid savannas. These areas are characterised by extreme rainfall variability and high intensity rainstorms. Rainfall ranges from 400 – 900 mm and is concentrated in short 3 – 4 month rainy seasons, when all the crops are grown. It is in these farming systems that most resource poor farmers make their living, and it is here water harvesting can make the largest contribution to livelihood improvements.

Surprisingly, despite the frequent occurrence of water scarcity, in most years there is more than enough water to potentially produce a good crop. The problem is that large volumes of water are lost through surface runoff, soil evaporation and deep percolation, because of a combination of land mismanagement and the intensity of tropical rainfall. On average, 70 – 85 percent of rainfall leaves the farmer's field without contributing to crop growth. In hot and dry tropical climates conventional ploughing, where the soil is turned, contributes strongly to the rapid loss of organic matter, compaction of soil and soil crust formation. Conservation Farming, also known as Conservation Agriculture or Conservation Tillage, may offer an opportunity to reverse this development. This article presents experiences from farmer-driven trials with conservation agriculture techniques in Tanzania.

Minimum or no-till farming systems have now been adopted on a large scale by farmers in Latin America, North America and parts of Asia. These farming systems rely strongly on organic mulch to help maintain infiltration and water holding capacities. This requires an environment that can support considerable biomass growth. In semi-arid savannas, the biomass to secure year-round mulching is simply not available. In these areas, therefore, Conservation Farming takes a different approach. The goal is still to minimise the disturbance of the soil but instead of applying minimum or zero tillage, farmers use rippers and sub-soilers to open parts of the soil for rainfall infiltration. Conservation Farming in this context is a water harvesting system that integrates soil improvement and water conservation.

Farmer-driven technology adaptation

In north-western Tanzania, on the semi-arid savannas of Arusha, Arumeru and Babati districts, decades of ploughing have resulted in severe land degradation and in places even the desertification of previously fertile land. Commercial farmers in the region have adopted Conservation Farming practices over the last decade, abandoning disc ploughing in favour of tractor drawn chisel ploughs, in order to harvest water and to save on diesel costs. However, no affordable conservation tillage options have been available to smallholder farmers. In 1998, the Soil Conservation and Agroforestry Pilot Programme Arusha (SCAPA) established a farmer-extension partnership to introduce, adapt and build capacity on simple low-cost Conservation Farming practices.

Initially, farmers were highly sceptical. Abandoning the plough, the very foundation of farming, was a completely alien idea that seemed very drastic. However, due to the agrarian crisis facing farmers in the area, they were very receptive to new ideas. Sessions were held with farmers to discuss water flow in agriculture and the causes of runoff, with a particular emphasis on the effects of soil compaction and organic matter depletion due to ploughing and removal of crop residue.

Farmers were then introduced to the principles of Conservation Farming. New implements were demonstrated, including an animal drawn ripper (see Figure 1) and a sub-soiler. Conservation Farming was explained and discussed with the farmers, addressing the impacts of Conservation Farming on timing of operations, weeding, fertility management, mulching, cover crops, pest management, harvest and post- harvest management.

The farmers wanted proof that this new farming practice really worked. As a result, the farmers designed a number of Conservation Farming production systems for testing. On-farm experimental plots were set up on 8 – 10 farms, testing three major production systems: (1) Conservation Farming based on animal drawn ripping, using a sub-soiler only the first year on seriously degraded soil; (2) Conservation Farming based on a manual system using hand hoes to dig small planting pits; and (3) conventional animal-drawn mouldboard ploughing (farmers' usual practice).

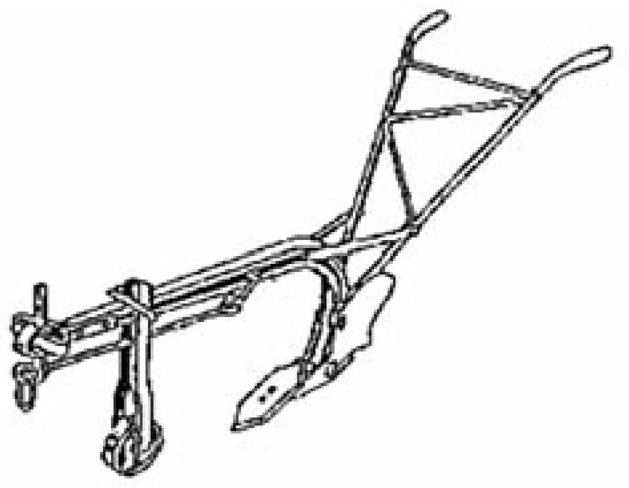

Figure 1: The animal-drawn Magoye Ripper, attached to the normal plough frame used by farmers.

Farmers were very keen on knowing the effect of improved water harvesting through the change in tillage practices, and also the effect of combining water harvesting with soil fertility management, where Conservation Farming enables better spot application of manure and fertilisers along the planting furrows created by the ripper. To do this the farmers decided to test each tillage system (conventional ploughing and Conservation Farming practices) both with and without fertiliser application.

In order to investigate the effects of a cover crop, a Conservation Farming with *Dolicos lablab* trial was added to the experiment. This is a favourite cover crop with farmers and the beans are sold on the markets in Arusha. On the Conservation Farming demonstration farms, rainfall was monitored by the women participating in the trials and labour needs were documented. Because ripping requires less draught animal power, it enables land preparation before the onset of the rains – a critical opportunity in semi-arid regions where 25 percent of a season's rain may fall during the first few rainstorms. Therefore, all the Conservation Farming systems were dry planted. Manure and locally manufactured rock phosphate was applied in the permanently ripped planting lines. Low amounts of nitrogen fertiliser (30 kg N/ha) were applied twice: once before planting and again as a top dressing 4 – 5 weeks after the crop emerged.

Weeding is a major concern in Conservation Farming systems, in particular during the first years. Without ploughing to suppress the weeds, weed control posed a dilemma for farmers. Weed control was discussed at length, and finally it was agreed that the favoured solution was to add an additional third weeding late in the season in order to avoid weed seeds falling onto the soil. Farmers did not consider using herbicides, which are seen as too expensive.

Yields and water productivity increases

Each season yield results were discussed and analysed with the farmers. Yields were expressed in the number of 90 kg bags produced per acre, which is the yield measure best understood by the farmers in the area. Experiences were shared and adaptations made to the trials. The farmer's conventional practice (ploughing only) resulted in an average yield of 1.6 t/ha, which is actually a higher yield than the 1 t/ha generally experienced in the region by smallholder farmers. Water harvesting alone – where the plough is abandoned in favour of ripping without soil nutrient management – resulted in a 60 percent yield increase to an average of 2.5 t/ha. Interestingly though, water harvesting alone did not give the strongest yield increase, and it was only when soil fertility management was combined with water harvesting that the full effect of Conservation Farming adoption was experienced, with a 240 percent yield increase to an average of 3.9 t/ha. Farmers were very excited about the synergy effect between water and nutrient management. The importance of both factors was clearly shown by the fact that addressing soil fertility alone – ploughing with fertility management – resulted in a roughly similar yield level (2.8 t/ha) to that obtained with water harvesting alone (2.5 t/ha).

Manual pitting resulted in approximately the same average yield as the animal drawn system (3.5 t/ha). To farmers, this was the preferred system. The reason is that manual pitting is cheap, does not require oxen or new implements, and above all gives the farmer full control over the use of precious inputs such as seed, manure and fertilisers, as these can be placed carefully at perfect depth in each planting pit. Farmers agreed though, that the pitting system was very labour intensive compared to the ripping. Ripping saved on average 50 percent of the labour needs compared to conventional ploughing.

More crop per drop

It is clear to the farmers that the primary benefit of Conservation Farming as it is practiced among the pilot farmers in Tanzania, comes from the increased amount of water that reaches the root zone of the crop. Farmers claim that no surface runoff is observed from properly ripped fields, while even in terraced fields (all trials were conducted on fields with good soil conservation measures in place), runoff occurs on ploughed soil. For the farmers Conservation Farming has become the answer to the common concern of "what to do between the terraces" since they experience that despite successful adoption of soil conservation measure, there has been little impact on yields.

The rainwater harvesting effect of Conservation Farming can be quantified by estimating the amount of crop produced per drop of water. Only 2.6 kg of grain is produced per mm of rainfall in the current farming system, based on ploughing and poor soil fertility management, compared to 7.4 kg/mm of rainfall for the Conservation Farming system. This indicates that the crop's capacity to take up water from the soil has increased. It is likely that soil evaporation has also been reduced as a result of a more vigorous crop cover.

Gender sensitive

Improving crop yields and the amount of crop per drop of water is important, but one of the most essential benefits of Conservation Farming is improved timing of operations and the savings in labour achieved. Ripping is only done along permanent planting lines. The 80 cm space in-between the rows is left undisturbed. This translates into a large reduction in the amount of traction needed. Ripping also enables off-season land preparation. The present practice is that farmers wait until the soil is moist before ploughing. This means that essentially all water from the initial rainfall events are lost through evaporation, and that ploughing is done on wet soil, which increases the problem of compaction. Also, this practice hits hard on poverty stricken female-headed households as these farmers do not have their own oxen but rely on neighbours for ploughing. Ploughing is carried out after the owner of the oxen has finished ploughing, which may already be late. The crops of these woman farmers, therefore, have a very late start. Ripping changes things entirely.

Now women farmers can borrow oxen during the dry season, and prepare the land well before the onset of the rains. Dry planting of seed will give the crop an important head start, which may mean the difference between total crop failure and getting a harvest. As the number of female-headed households is increasing rapidly due to the HIV pandemic, this is a significant improvement in farming practices.

Conservation Farming enables planting well ahead of rains and high rainfall infiltration. This is illustrated here by a well-established maize crop under CF practices (to the left) and a late planted conventionally ploughed maize (to the right). Photo: Johan Rockstrom.

Sustainability

The Tanzanian cases presented above show that Conservation Farming is a very important water harvesting strategy in efforts to upgrade semi-arid rain fed farming systems. Similar experiences have been recorded in Kenya and in Zambia. Tractor driven sub-soiling among smallholder farmers in the neighbouring Babati district, south of Arusha, has also shown a progressive increase in yield levels and improved rainwater harvesting over the last decade.

The long-term challenge is to build up soil quality through wise tillage combined with the proper management of cover crops and mulching. At present farmers in the semi-arid savannas of sub-Saharan Africa have great difficulties in securing a mulch cover, due to the combined effect of high competition for crop residues, free post-harvest grazing and the use of residues for

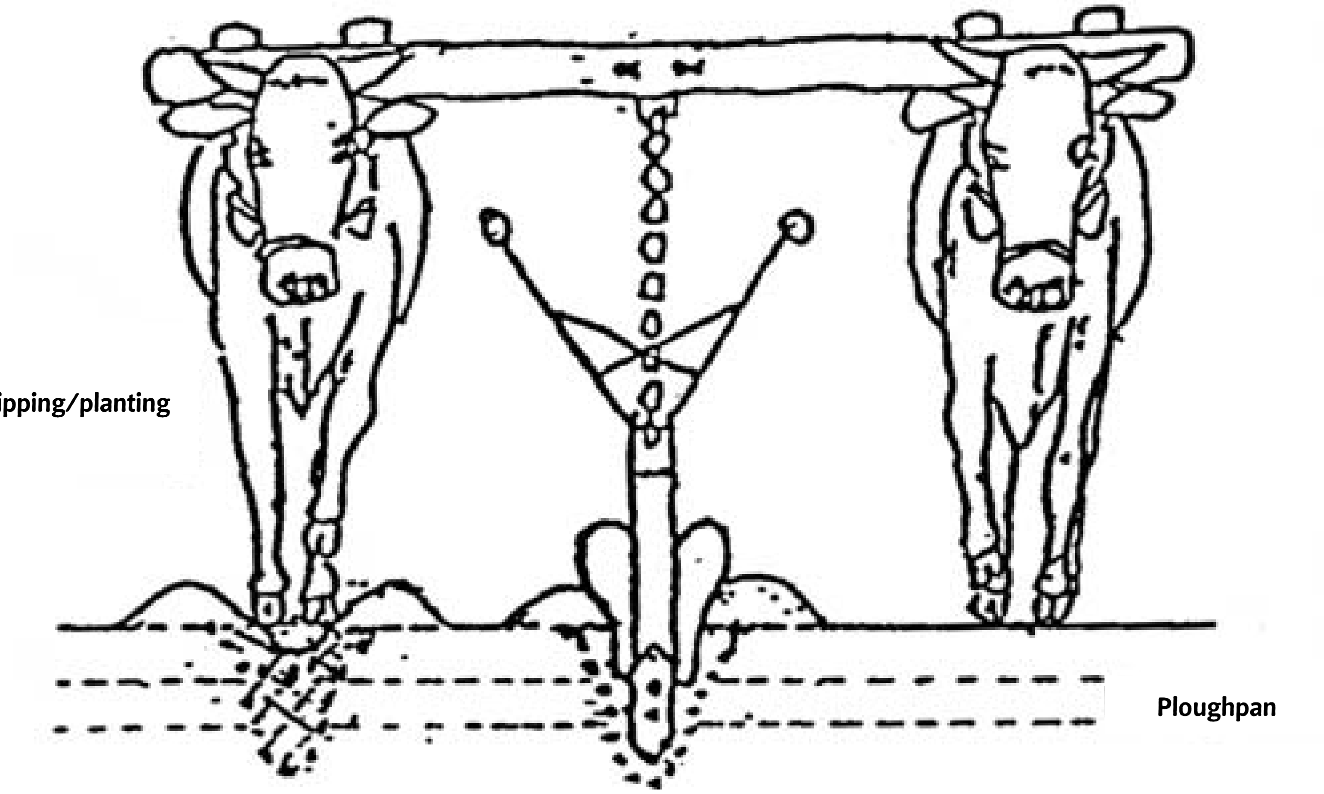

Figure 2: Oxen carrying out ripping.

fuel and construction, low inherent biomass growth, long dry seasons, up to 8 months with no rains, and high termite activity. Still, it is absolutely necessary to try to incorporate a (preferably leguminous) cover crop into the system in order to secure a progressive build-up of soil properties. The mulch is also the key to suppressing weeds and conserving moisture. Weed infestation is one of the major concerns raised by farmers. Animal drawn cultivators have been introduced for weeding and work well but are expensive to buy. So far, it seems clear that persistent weeding during the first 3 – 4 years will be necessary in order to progressively reduce weed infestation.

Conservation Farming is much more than just a change of implements. Abandoning the plough changes every component of the farming system. This is why a systems approach is required where all aspects of water, soil, and crop are addressed. Farmers and extension workers need capacity building in order to deal with the implications of a full shift from present plough-based farming to Conservation Farming. Particular emphasis should be given to training women as most of the critical management aspects of successful Conservation Farming concerns timing, weeding, soil fertility management and the post-harvest management of residue – tasks mostly performed by women. Tillage is important, but a relatively small step. However, it should be noted that a serious effort is needed to train oxen to walk in straight lines during ripping. Ripping is done with a wider yoke than ordinary ploughing in order to secure a line spacing of 75 – 80 cm, which means that oxen do not have a furrow to follow or a neighbour ox to lean on.

Rippers and sub-soilers are new implements that are not readily available on the market. Resource poor farmers need access to not only good quality implements but also affordable ones. This is a major bottleneck at present, even though there are good signs of progress.

In Kenya local *Jua-Kali* implement manufacturers have been trained to produce local Conservation Farming equipment. In Tanzania and Zambia there are several workshops producing implements for commercial purposes. In both Kenya and Uganda, the Food and Agriculture Organisation of the United Nations (FAO) has recently supported two Technical Cooperation Projects to promote manufacturing and to encourage Conservation Farming practices. These are promising developments, which may turn out to be the initial steps in an agricultural revolution for smallholder farmers in Sub-Saharan Africa, and perhaps a major water harvesting development in drought prone savannas.

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Improving soil moisture with conservation agriculture

José Benites and Antonio Castellanos

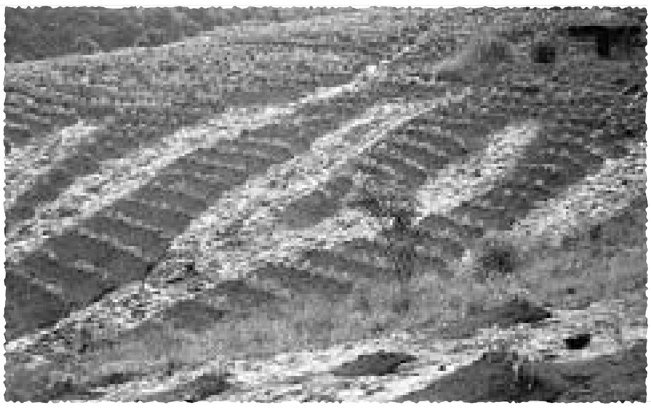
Irregular or insufficient rainfall can be a serious limitation to agricultural production, causing low yields and even crop failure. This is particularly true in drylands, where productivity levels are generally very low. In most cases, a great deal can be done to improve the efficiency of rainwater use. Conservation Agriculture is one way of improving soil moisture management.

Soil moisture management

A significant cause of low production and crop failure in rainfed agriculture is lack of water in the soil. This is caused by a combination of low and erratic rainfall, and poor utilisation of the water that is available. Soil moisture management is, therefore, a key factor when trying to enhance agricultural production.

Increasing the amount of water stored in the soil can result in:
- Improved yields (if there are also enough nutrients)
- Reduced risk of yield losses due to drought
- Recharge of groundwater, securing the water level in wells and the continuity of river and stream flows.

As little can be done to increase the amount of rainfall or the number of rainfall events, we should focus on improving the capture of rainfall, the availability of water in the soil and water use efficiency in rainfed agricultural lands. This means that the amount of water that enters the soil (infiltration) must be increased and that the moisture lost through runoff and evaporation must be reduced. Increasing soil cover and better soil management can help achieve this. Soil should be disturbed as little as possible, there should be permanent soil cover and the amount of organic matter should be increased.

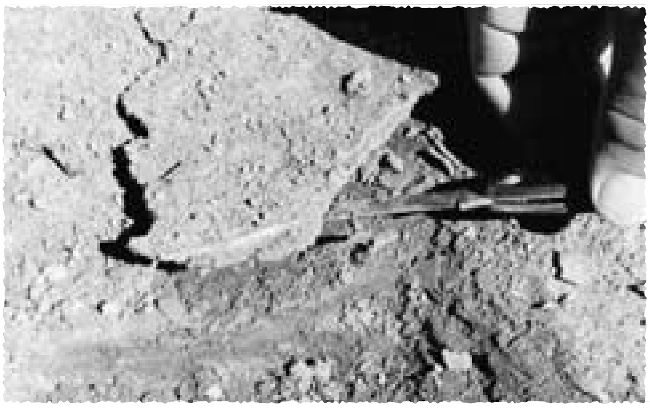


Sub-surface compaction by continuing tillage has resulted in structural degradation and runoff. Photo: T.F. Shaxson.

Treasure hunting in drylands

When rain falls on the soil surface, part of it will infiltrate into the soil to replenish soil water or flow through to recharge the groundwater. Another part will run off as overland flow, and the remainder will evaporate directly from unprotected soil surfaces and from plant leaves.

The amount of water that can be held in the soil and made available for crop use is not only determined by the amount of rain that falls, but also by the chemical and physical properties



A thin surface crust caused by raindrop impact on a bare soil with poor structure. Photo: T.F. Shaxson.

of the soil. When most people think about soil, they think about the solid part. But the pore spaces or the structure of the soil are just as important.

Soils differ in their capacity to hold water and make it available to crops. This depends on:
- Soil texture (the proportions of sand, silt and clay)
- Soil depth (shallow soils hold less water than deep soils)
- Soil structure (pore spaces)
- Organic matter content (more organic matter means more water is held)
- Biological activity (earthworm holes, for example, greatly increase the possibility for water to enter the soil).

Pore spaces

The number, size and connections between pore spaces play a crucial role in determining the amount of water that can infiltrate into the soil, and the amount of water that the soil can absorb, hold and supply back to plants.

It is important to have many interconnected pores of a wide range of sizes, particularly at the soil surface. This improves infiltration, reduces runoff and benefits crop growth.

The number, size and connections between soil pores vary according to the type of soil and the way it is managed. Little can be done about the type of soil, but good land management can have a great impact on restoring, improving and protecting soil porosity. This in turn will increase available soil water content, and the interconnected pores will minimise any potential risk of waterlogging.

Crop water stress

Crop water stress develops when the plant cannot extract water from the soil through its roots as fast as it loses moisture from the surfaces of its leaves. To ensure that the crops will be able to utilise the available rainfall, we must understand the causes of poor soil structure, at the surface as well as below the surface.

At the soil surface, the impact of raindrops on a bare soil surface can decrease porosity through the formation of surface seals and crusts. These limit the rate of infiltration, leading to increased runoff. Runoff is responsible for soil erosion and peak-river flows. However, it is a consequence of soil degradation, not a primary cause. Physical structures like contour banks do slow down runoff and protect the soil from erosion, but do not resolve the problem of soil degradation as they do not increase the porosity of soils.

Any traffic in the field, such as machinery, ploughing, or the impact of human feet or animal hooves, can put pressure on the sub-soil, especially when the soil is in a moist condition. Pressure destroys pore spaces, in particular the interconnected pore space. The soil becomes compacted and water infiltration and storage capacity is reduced. Plant roots have difficulty in penetrating compacted soil and their root systems do not develop well.

Tillage, in particular turning over the soil by ploughing, can also lead to a decline in soil fertility. It decreases organic matter content and has a negative effect on soil biological activity, for example by destroying the burrows of earthworms.

The role of Conservation Agriculture

The four basic principles of Conservation Agriculture can help achieve and maintain an absorptive and biologically rich soil. These four principles are:

Maintaining permanent soil cover

Permanent soil cover, either plant residues or growing crops, protects the soil surface from the negative effect of raindrop impacts. It reduces crust formation and susceptibility to erosion, and enhances porosity on the soil surface. It also reduces direct water loss through evaporation from the upper layers of the soil and establishes better conditions. It also maintains a continuous food supply for soil organisms – from microbes to earthworms.

Minimising mechanical soil disturbance

Reducing or stopping tillage means that the soil is not disturbed and that the moisture loss and soil compaction that follows tillage is avoided. This increases the infiltration and percolation of water through the soil, leading to better root development and crop growth. Decomposition of organic matter and subsequent loss to the atmosphere is also reduced. Sometimes a once-only de-compaction is required to bring the soil back into a better starting condition. One of the most important impacts of minimising soil disturbance is that it improves the living conditions of beneficial organisms and so enhances their activity. Crop roots and soil organisms are responsible for the creation of a network of interconnected pores. These organisms undertake biological tillage and improve soil structure. In addition, biological activity ensures that crop residues are incorporated into the soil.

Controlling in-field traffic

It is vital to ensure that in-field traffic follows permanent tracks. In this way soil compaction is restricted to defined areas, year after year. When this is combined with zero or reduced tillage, the rest of the field is free of compaction. Soil porosity and water infiltration are maximised, earthworms and other soil animals prosper and organic matter is not lost but becomes closely bound and integrated with the soil. The overall impact is a productive soil system, able to carry crops through dry conditions because of the enhanced soil water store, the deep rooting of the crops, the biological activity and the high content of organic matter.

Crop rotation

The use of crop rotation and cover crops helps to increase soil organic matter, reduce erosion and bring biological diversity back to the soil. The rotation of different crops, with their different root systems, optimises the network of root channels in the soil, leading to increased water penetration, increased water holding capacity and more water being available for crop use, to deeper soil depths. Crop rotation also enhances biological diversity and helps reduce the risk of pest or disease outbreaks.

Monitoring soil moisture

We cannot know in advance how much rain will fall during the growing season. It is possible, however, to find out how much plant-available soil water is present before sowing the crop. Knowing how much plant-available water is present in the soil can help in making a wise decision about which crop to plant.

Measurements of soil water content can be made with a variety of equipment but most farmers will have to make an estimation based on the feel and appearance of their soil. This will vary with soil texture and moisture content, but with experience soil moisture can be estimated to an accuracy of about five percent.

Alternatively, a soil moisture probe can be used to determine the amount of water that is available for plants. This is estimated from the depth of insertion of the probe. Again, it has to be interpreted with knowledge of the soil texture.

Different rates of infiltration under zero tillage (left) and conventional tillage (right). Photo: Bruce Radford.

Conclusion

The four basic principles of Conservation Agriculture work together to create a soil that has a greater capacity to absorb rainwater. Although there is no single recipe to suit all conditions, Conservation Agriculture improves the physical and biological condition of the soil. A soil that is porous, absorptive, and rich in organic matter and biological activity is able to support maximum crop production for every drop of water it receives.

■

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Using every drop of water

Editorial

Water is an essential resource – it forms the basis for life on earth. Water is also important for production, not only in agriculture but also in many industrial processes. In addition, it is used to remove waste products from cities and industries. Growing populations, rapid urbanisation and increasing industrial and agricultural production are combining to increase pressure on this precious and finite resource. At the same time, climate change is beginning to affect the global pattern of rainfall, and will probably lead to even higher temperatures and lower rainfall in tropical areas. Many warn that we are facing a global water crisis. A number of international initiatives are being developed to promote awareness and get water issues onto the political agenda (see Networking p 35).

A girl waters her family's garden (Mozambique). Photo: FAO/M.T.Palazzolo.

As water is increasingly needed for so many different purposes, the huge proportion of water required for agricultural production is increasingly challenged. During the Green Revolution, heavily subsidised water-intensive technologies were promoted to support modernised agriculture, including large-scale groundwater development and the introduction of modern irrigation techniques and pumping technology.

Looking back on 50 years experience with these approaches to water management, it is possible to see that in many parts of the world not only have they had negative environmental impacts, but they have led to an erosion of knowledge about other more appropriate and sustainable systems of water management.

Most of the world's farmers make their living from rainfed agriculture, which is practiced on 80 percent of the arable land worldwide. Approximately 40 percent of these farmers live in water-scarce tropical landscapes, with highly unreliable rainfall and high evaporation losses. Droughts are common, but even more common are dry spells - short periods of water shortage during the growing season of a crop that can cause yield reduction or even crop failure. Despite these challenges, it is clear that rainfed agriculture will have to contribute substantially to the world's future food needs.

Small-scale water solutions can help improve the lives of smallholder farmers considerably. When they are introduced, water harvesting systems are rarely used for only one purpose. Farmers' first priority is always to secure the supply of domestic water (Bunch and Lopez p 11). Farm ponds, earth dams and sub-surface tanks, even if originally designed for supplemental irrigation of crops or full off-season irrigation of vegetables, will generally also serve as source of drinking water and water for livestock during periods of water scarcity (Duveskog *et al* p 22).

Water harvesting opens new livelihood options for resource poor farmers in vulnerable environments. Subsistence farmers, who invest in water harvesting systems with a storage component, often diversify their farming system to include the production of some cash crops, such as vegetables for the local market during off-season periods when prices are high (Qiang and Yuanhong p 14). This diversification increases the resilience of farm households, as they are better equipped to cope with periods of climatic hazards such as droughts and floods that can entirely destroy their staple food crops.

Adding water to rainfed systems in water scarce regions can help improve production where it is most needed. In this issue, the examples of smallholder water harvesting practices show a wide range of systems for water conservation including runoff farming, stone bunds, terracing, micro basins, mulching, flood water harvesting systems to reduce risks of erosive storm flows, and storage systems for supplemental and full irrigation.

Nothing new

Water harvesting is nothing new. For thousands of years, systems designed to increase the amount of water for crop production have been used in the semi-arid and arid tropics. The first water harvesting techniques are believed to have originated in Iraq over 5000 years ago. Many civilisations have developed water harvesting practices and for some, they have been the basis for their survival.

With the promotion of modern agricultural practices, conventional irrigation and pump technology, traditional technologies have gradually been abandoned. Much traditional knowledge has been lost. Recently, farmers and development agencies have started to pay more attention to traditional technologies and how they can contribute to modern water harvesting projects (Oweis and Hachum, p 26).

Catching water where it falls

In water-scarce farming systems, erratic rainfall cause droughts and dry spells. The only way to manage these successfully is to make sure that the rain that does fall is efficiently stored in the soil, or to collect runoff for productive use. In many areas, even where water is scarce, there is enough available to produce a good crop, provided the water is used efficiently (Mwalley and Rockström, p 8).

In order to be productive, water needs to get to the roots of the crop. This can be achieved by "catching" the water where it falls and making sure it infiltrates into the soil, through simple mechanisms such as earth banks, bunds, contour terracing or swales (Duveskog et al p 22, Yaholnitsky p 24, Oweis and Hachum p 26).

Market garden under drip irrigation. BBCDC, Lesotho, 2000. Photo: BBCDC.

Collecting and storing rainwater is a simple and effective way to make water available. It is wiser to collect runoff flow as close as possible to where the rainfall falls, instead of letting it flow – often in an erosive journey – downhill and then lifting it back up again. Rainwater for irrigation does not need to be as clean as water for domestic uses and can be collected from all kinds of catchments including roofs, roads, and fields. Storage systems vary and many are described in this issue (for example Qiang and Yuanhong p 14, Shone p 17, Bunch and Lopez p 11, Dhamankar p 18, Oweis and Hachum p 26).

Improving yields

Water harvesting has tended to be promoted as an isolated technique of improved water management. In water-scarce tropical agro-ecosystems, however, water is not necessarily the most limiting factor for improved crop yields: soil fertility is often just as limiting. Almost all articles in this issue clearly show that optimal yields cannot be achieved by simply supplying more water to a crop. Combining water harvesting with other methodologies for improved water and soil management can have a synergy effect with large added value to the farming systems. Therefore, successful water harvesting practices should involve an integrated approach to soil and water management.

Conservation Agriculture (also known as Conservation Farming or Conservation Tillage) practices, through minimum disturbance of the soil and the addition of organic matter from cover crops and mulch, improve soil biology and structure, allowing plants to use water more efficiently (Benites and Castellanos p 6). In participatory trials with Conservation Farming practices for smallholder farmers in Tanzania, crop yields of maize more than doubled when Conservation Farming practices to increase rain infiltration into the soil were combined with soil fertility management (Mwalley and Rockström p 8).

In hot tropical climates, huge amounts of water are lost to evaporation (50 to 80 percent of rainfall). Integrating various types of mulch management in water harvesting systems can help to reduce evaporation, as shown by Bunch and Lopez (p 11).

Issues of scale

Water harvesting can be done at field level or at the level of larger catchment areas. Small-scale, local innovations do not need to remain isolated incidents. Duveskog *et al* (p 22) describe the experiences of three farmer innovators in Kenya who have been identified as part of a programme to share the experiences of farmer innovators through Farmer Field Schools.

At the larger scale, runoff water is often seen as a nuisance to be removed, for example through cut-off drains and culverts. Instead, such runoff can be carefully managed to contribute to production. Even small-scale structures can help improve water management throughout the wider ecosystem. For example, in tropical areas with steep slopes where intensive rainfall generates storm floods, small-scale water harvesting structures can be effectively used to slow down surface runoff and let it infiltrate to recharge groundwater. This not only conserves soil, it also generates a lasting water supply for wells downstream (Lo p 29).

Water harvesting systems often operate on a scale beyond the farm. As soon as water harvesting systems include the diversion of runoff flow from gullies or the storage of water in small dams for gravity fed supplemental irrigation, skills are required to design the systems in an appropriate way (Verweij p 21). There is still very limited human capacity among service-providing institutions, such as extension services, to promote and assist farmers in adopting water harvesting systems that operate beyond farm level. There is still a considerable need still to train trainers in design and sustainable promotion of water harvesting systems.

Social issues and water management

Small micro systems can be fully contained within one household and within the farm. If the catchment area, the storage and the water utilisation all take place within the farm, the system is directly controlled and managed by the farmer. When moving to larger systems, such as rainwater harvesting on communal areas or dam building, the issue of access and rights to the water becomes important. Larger systems require a social organisation that is able to regulate the use of the water efficiently and equitably to the participating households, and that can ensure that all members carry out their responsibilities relating to maintenance and management. To further complicate matters, local organisations and communities will often come into contact with government regulations and institutions if they try to utilise public resources. There are also issues of conflicting interest between upstream and down stream water users, as well as competing interests between agriculture and water use for other purposes.

In this edition of LEISA Magazine, we have not dealt with these issues, but have focussed on techniques and basic ideas that can be of help to the individual farmer. In the following LEISA Magazine we will take a closer look at the complicated issues of access to and control over land and natural resources.

■

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- *LEISA Newsletter* 14.1, July 1998. **Challenging water scarcity**.

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Demonstrating a suction pump promoted by COSECHA, Sabannah Grande, Honduras. Photo: Anita Ingevall.

The editors have taken every care to ensure that the contents of this magazine are as accurate as possible. The authors have ultimate responsibility, however, for the content of individual articles.

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CONTENTS

In the dry sub-humid savannas of Sub-Saharan Africa, it is surprising to realise that despite the frequent occurrence of water scarcity, in most years there is more than enough water to potentially produce a good crop. The problem is that large volumes of water are lost through surface runoff, soil evaporation and deep percolation, because of a combination of land mismanagement and the intensity of tropical rainfall. In hot and dry tropical climates conventional ploughing, where the soil is turned, contributes strongly to the rapid loss of organic matter, compaction of soil and soil crust formation. Conservation agriculture may offer an opportunity to reverse this development.

Today, many villages in India are facing severe water scarcity. Erratic rainfall and poor soil and water management, including relentless ground water extraction has led to cycles of drought and water scarcity. As a result, there is renewed interest in rehabilitating the small, traditional water harvesting and irrigation systems that have existed in India for centuries. This article describes the efforts of a community and their government to take 'rehabilitation' beyond technical interventions, to include farmer participation and coordination of the efforts of different institutions.

ILEIA is the Centre for Information on Low External Input and Sustainable Agriculture (LEISA). ILEIA seeks to promote the adoption of LEISA through the LEISA magazines and other publications. It also maintains a specialised information database and an informative and interactive website on LEISA (**http://www.ileia.org**). The web site provides access to many other sources of information on the development of sustainable agriculture.

LEISA is about Low-External-Input and Sustainable Agriculture. It is about the technical and social options open to farmers who seek to improve productivity and income in an ecologically sound way. LEISA is about the optimal use of local resources and natural processes and, if necessary, the safe and efficient use of external inputs. It is about the empowerment of male and female farmers and the communities who seek to build their future on the basis of their own knowledge, skills, values, culture and institutions. LEISA is also about participatory methodologies to strengthen the capacity of farmers and other actors to improve agriculture and adapt it to changing needs and conditions. LEISA seeks to combine indigenous and scientific knowledge, and to influence policy formulation in creating an environment conducive for its further development. LEISA is a concept, an approach and a political message.

Readers are welcome to photocopy and circulate articles.
Please acknowledge LEISA Magazine and send us a copy of your publication.

14 Drought-proofing villages in Gansu province

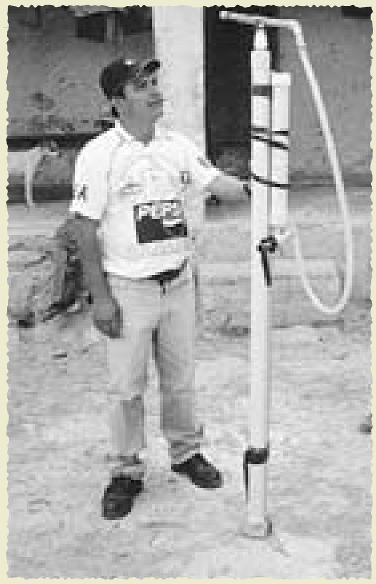
Zhu Qiang and Li Yuanhong

The semi-arid Gansu Province is one of the poorest and driest areas in China. Droughts and dry spells are extremely common in this mountainous area, where people depend on rainfed subsistence agriculture. Since the late 1980s, a project for supplying water for domestic use and irrigation has been developed in the area. A simple and affordable rainwater harvesting system, combined with an integrated approach to improving agricultural production, has improved the lives of Gansu farmers.

11 What we have learned

Rolando Bunch and Gabino Lopez

This article looks back on seven years of action-research by COSECHA, Honduras, with small farmers. The aim of the research was to develop simple, economical water management technologies that could be adopted by individual families. The technologies described are not necessarily in their final form, but they are already very popular with farmers.



DEAR READERS

Water is an essential and precious resource upon which our ecosystems and agricultural production depend. As population increases and urbanisation intensifies, the present mismanagement of water together with the effects of climate change have caused many to warn that we will soon have to come to terms with a global water crisis. For many farmers, however, the water crisis is already a feature of daily life. Farmers and those living in dry areas face water shortage daily as they try to meet their personal needs and the needs of their agricultural systems. As soils and ecosystems in many parts of the world continue to be degraded, water becomes an increasingly scarce resource.

In this issue, we try to illustrate principles that can help increase water efficiency and make more water available for agricultural production. We also take a closer look at some of the technologies available to small farmers. We have consciously left out many of the important social issues surrounding water management, as we hope that many of these will be highlighted in the September issue of LEISA, which deals with access to and control over resources.

The Editors

LEISA

june 2003 volume 19 no.2

Magazine on Low External Input and Sustainable Agriculture

Using every drop of water

Visiting a coffee plantation with the IJAT'Z farmers.

Visit to Central America

In November 2002, Teresa Gianella, Editor of LEISA Revista de Agroecologia, *and Anita Ingevall, Director of ILEIA, travelled together in Central America. The purpose of the trip was to present the* LEISA Revista *magazine to the region and to make contacts for future information exchange. Teresa and Anita had the opportunity to meet and discuss with farmers, technicians and NGO representatives in El Salvador, Honduras and Guatemala.*

Here we only have room for a brief account of one of our visits in Guatemala. We also have other stories to tell from our visits in Guatemala, El Salvador, and Honduras. We have fond memories of all our visits and promise to share more of our experiences in future LEISA magazines, and on our web sites.

Visit to the coffee farmers assisted by IJAT'Z

Coffee is the most important agricultural product for the Mayan farmers on the slopes of San Lucas de Toliman, three hours from Quetzaltenango in Guatemala. Coffee has been grown in Guatemala since the 18th century, but over the past few decades it has been promoted intensively as an export crop, with packages of inputs and technology provided to farmers to increase their yields. Unfortunately, these technologies had negative effects on the agro-ecosystem and on farmers health. Over time, yields declined and higher inputs of agro-chemicals were required to maintain production.

In San Lucas de Toliman we meet Guillermo Campa, Germán Xep Ajcalon and Inocente Jacinto, some of the Mayan farmers who are involved in IJAT'Z. IJAT'Z started as a reaction to the problems the farmers were facing. German tells us that when he became ill from the pesticides he was using, he started to think that there must be another way of farming. He also remembered older people telling him about the traditional Mayan agriculture. German decided to try and find more information. He got in touch with a few of the oldest farmers who still remembered the old ways and started to experiment on his own.

More than ten years later, IJAT'Z has become a training and promotion centre for the local farmers association, where they share their experience in ecological coffee growing with other members of the association. Our hosts were all local farmers, who are available to provide advice and training to other farmers who wish to grow ecologically, particularly organic coffee.

We were able to visit the coffee plantation of one of the participating farmers. The coffee was growing in the shade of a variety of fruit trees. Between the coffee and fruit trees grew a variety of green manure crops, as well as plants for erosion control and for increasing water retention. Minimum tillage is also practiced. The farmers said that their vision was to create "a forest of food". Guillermo pointed out that management is one of the most important aspects of farming "One must be very conscientious about pruning, incorporating green fertilisers, maintaining the plant cover and managing pests".

The number of coffee farmers adopting ecological methods is increasing, not only because of the health benefits but also because it improves their economic security. Diversified crops ensure food security for their families, and agro-chemical free coffee can be sold at better prices. The elimination of agro-chemicals in the area also means less pollution in the water courses. To make the change to ecological farming, the farmers associated through IJAT'Z drew up their own project proposal and obtained the assistance of a small grants programme (SGP-GEF-UNDP) in Guatemala.

The initiative taken by these farmers has not been an instant success – their commitment and persistence in innovating has carried them through a number of difficulties and it is finally starting to pay off. We were very impressed by their commitment and enthusiasm.

Thank you...

We are grateful for the co-operation of all the technicians and NGO staff who welcomed us and gave us the opportunity to gain valuable experience in getting to know the rural areas of Central America, the hazards and challenges they deal with and their progress. Special thanks to the farmers who made time to see us during their very busy working day.

Teresa Gianella-Estrems
Anita Ingevall

Issue 19.3, September 2003

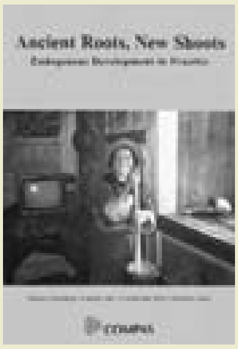
Access to and control over resources

Around the world, many different systems and arrangements determine who has access to and control over land and other natural resources, and under what conditions. Systems of access and control range from formal to informal, from traditional to very new, from collective to private. Arrangements change and evolve over time, in most cases moving towards increasing privatisation and formalisation. Resources regulated by these systems include not only land but also resources such as trees, water, grazing and manure. Water users associations, Joint Forest Management, tree pattas, private land deeds, and share cropping are just some examples of mechanisms that communities and societies develop to regulate their resource use. How do these systems work, and why? This issue of LEISA will try to bring into focus some of the practical aspects of different systems for access and control. We invite you to share your experiences.
Deadline for contributions is the 1st of June, 2003.

Issue 19.4, December 2003

Rehabilitation of degraded land

You are invited to contribute to these issues with articles (about 800, 1600 or 2400 words + 2-3 illustrations and references), suggest possible authors, and send us information about publications, training courses, meetings and websites. Editorial support is provided by ILEIA. Authors of published articles are entitled to a standard fee of USD 75,-.



Ancient roots, new shoots: endogenous development in practice by Haverkort B, Hooft K (van 't), Hiemstra, W (eds). 2002. 264 p. ISBN 1 84277 335 6. ETC/Compas, PO Box 64, 3830 AB Leusden, The Netherlands. Zed Books, 7 Cynthia Street, London N1 9JF, UK / zed@zedbooks.demon.co.uk
The present global problems of poverty, ecological destruction and loss of cultural diversity call for innovative solutions. Experiences indicate that the cultural identity and initiatives of local people can provide important keys to sustainable rural development. This book describes the processes whereby the present-day diversity of knowledge and cultures has emerged. It presents a number of field experiences of endogenous development, or development from within, in Sub-Saharan Africa, Asia, South America and Europe. By building on local needs and resources, innovative methodologies have been developed to understand and experiment with indigenous practices, and to find synergy with modern knowledge systems. The activities include identifying development niches, retaining benefits within local areas, maximising local control, and making selective use of external resources. With a good balance of theory and practice, this book can be immensely useful to development practitioners, researchers and policy makers, especially in the field of rural development, agriculture, natural resource management and health.

Silent invaders: Pesticides, livelihoods and women's health by Jacobs M, Dinham B. 2003. 342 p. ISBN 1 85649 996 0; GBP 14.95. Pesticide Action Network (PAN), Eurolink Centre, 49 Effa road, London SW2 1BZ, UK / admin@pan-uk.org ; www.pan-uk.org
This book brings together 30 case studies and scientific papers that show the effects of pesticides, particularly on farming communities and agricultural workers. It gives details of pesticide hazards and explanations of the toxicity manifested. It focuses specifically on the dangers they present to women. Silent Invaders shows the importance of studying impacts on both women and men, taking account of gender divisions of labour, of the imbalances in the economic and political realities of women and men's lives, and of the clear physiological differences between the sexes.

The final section provides details about community action to overcome pesticide hazards, ranging from community-based pesticide monitoring in Indonesia, Malaysia, Korea and other Asian countries, to the establishment of a free local health care centre for victims of the Bhopal gas disaster, and to a successful community and trade union campaign in the UK to have Linden banned. The section details practical strategies (including FFS) for sustainable agriculture that can help farmers manage pests while reducing their reliance on hazardous pesticides. Recommended (WR).

Planning for country : Cross-cultural approaches to decision-making on aboriginal lands by Walsh F, Mitchell P (eds.). 2002. 203 p. Jukurrpa Books, PO Box 2531 Alice Springs, Northern Territory 0871, Australia / press@iad.edu.au.
Pictures and stories speak a thousand words. This message emerges from this volume of experiences from central Australia. The editors have created a wonderful reading journey with dozens of evocative pictures, striking photos and stories about well-tried methods. It is clear from their selection of experiences and focused editing that both authors are themselves skilled in participatory planning.

The book opens with a context-setting description of Aboriginal people in central Australia. This helps the reader understand some of specific issues about the Aboriginal context and implications for planning. A section on participatory planning highlights key ethical questions, such as misappropriation of Aboriginal information and Aboriginal language and "high English". This is followed by a series of frequently asked questions that are both thought provoking and practical.

Methods are also discussed in the book. The authors discuss conflicts, problems, and the considerable time and negotiation that are present in all multi-stakeholder participatory planning processes. The stories offer innovative solutions to problems that many others will recognise from their practice. (IG)

Milk producer group resource book: a practical guide to assist milk producer groups by Draaijer J. 2002. 86 p. Food and Agriculture Organization of the United Nations (FAO), Animal and Health Division, Viale delle Terme di Caracalla 00100 Rome, Italy / www.fao.org
This book is part of a series of practical field guides produced by FAO for people working in small-scale dairying in developing countries. Milk producers can increase their income and utilise their skills and resources better if they work in groups. It promotes the organisation of small-scale milk collection and processing as a sustainable, income-generating activity for household food security. It also seeks to provide a means for improving the safety, quantity and quality of milk and milk products available for consumers in developing countries.
This book aims to play a role in poverty alleviation in developing countries, in a gender sensitive and sustainable way. Participation is a key pillar of the strategies promoted throughout the book without gender, age, race, social class or any other bias. The intended readers are (future) leaders of milk producer groups, extension workers, project staff and group promoters who are working to set up milk producer groups, and those developing already existing groups at village level in rural areas.

Traditional use and availability of aquatic biodiversity in rice-based ecosystems; 1. Kampong Thom Province, Kingdom of Cambodia by Balze, T, Balzer P, Pon S. 2002. CD Rom. ISBN 92 5 104820 7. Food and Agriculture Organization of the United Nations (FAO), Viale delle Terme di Caracalla 00100 Rome, Italy / www.fao.org; Matthias.Halwart@fao.org. (Traditional Use and Availability of Aquatic Biodiversity in Rice-based Ecosystems no 1).
This CD-Rom contains the report and annexes of a case study of Tonle Sap (the Great Lake) ecosystem and ricefield fisheries in Cambodia. More than 100 aquatic species (fishes, reptiles, amphibians, crustaceans, molluscs, insects and plants) collected in rice fields and used daily by rural households are presented. The species descriptions and photos are linked to information on collection tools and methods, uses and traditional knowledge. In conclusion, the authors caution against measures threatening aquatic organisms such as pesticide use, clearing of flooded forests and destructive fishing tools, and outline promising approaches for the sustainable management and use of this rich aquatic biodiversity.

Community IPM website
http://www.communityipm.org/index.htm
This site includes many very useful documents and teaching materials related to Farmer Field Schools. It was originally created as an activity of the FAO Programme for Community IPM in Asia. The site is being maintained as an archive of information relating to the groundbreaking work carried out by government agencies, NGOs and farmer groups that were associated with the FAO Programme. The Community IPM website is managed on the principle of "information for all", meaning that anybody can visit the site and download the content.

CGIAR task force on Farmer Participatory Research for Integrated Pest Management (FPR-IPM)
http://www.ciat.cgiar.org/fpr-ipm/inicio.html
A forum for people and institutions interested in fostering farmer participation in research and development of Integrated Pest Management. Visit the file library to download the FPR-IPM proposal and documents contributed by the FAO-Intercountry Rice and Vegetable IPM, CIP/CARE, UPWARD/CIP and ISNAR. These include case studies, evaluations of impact and press releases. If you have case studies or other documents relevant to farmer participatory research for IPM or other approaches to sustainable agriculture, send them to be posted in the file library.

ECOPORT
http://www.ecoport.org/
This Internet portal provides resources and databases on ecology, including information about pests. There is a lot of information available though it is not organised in a very user friendly way. Navigate this site via the columns on the left.

Soil Productivity Improvement through Farmer Field Schools
http://www.fao.org/ag/agl/agll/farmspi/default.stm
The Land and Water Development Division of FAO has just launched this web site on Soil Productivity Improvement (SPI) through Farmer Field Schools (FFS). It provides information on FAO's pilot programme on SPI-FFS. Specifically, it aims at promoting the exchange of information and experiences on the development and implementation of FFS for enhancing and sustaining soil productivity. The site is targeting those involved in developing participatory or FFS land management and conservation programmes, resource persons and senior extension officers as well as agricultural development specialists.

IPM forum
http://www.cabi-publishing.org/IPM/links.htm
This CABI site provides a wealth in links and background material on IPM, included teaching material.

The Communication Initiative
http://www.comminit.com
This website aims to improve strategic communication thinking on development issues, expand dialogue, debate and review of key communication issues and programmes. The work of The Communication Initiative is primarily in support of communication practitioners in developing countries, management staff in local, national and international social development organisations - including NGOs, government, bilateral aid organisations, foundations and academic institutions

Capacity Development Resource Book
http://magnet.undp.org/cdrb/
This resources book presents the lessons from four decades of technical cooperation -and the fundamental changes that UNDP has instituted to capitalise on the potential contributions of capacity development. These processes are designed through facilitative and participatory approaches, and they are responsive and accountable to national priorities and objectives. These characteristics renew the main goals of development co-operation: long-term sustainability and an enabling environment that facilitates human development. This document is available in English, French and Spanish (pdf) and also in English, in html format.

Global IPM facility IPPM expert database
http://www.wisard.org/wisard/clients/ippm/index.htm
This is a directory of experts in Integrated Production and Pest Management (IPPM) from all over the world, including experts on FFS. This joint initiative aims to enhance the access and use of expert knowledge in local and intermediary organisations dealing with IPPM issues.

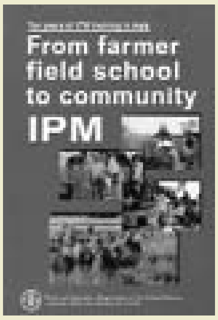
CM-Training Resource homepage
http://www.eseap.cipotato.org/Training-resources.htm
This Integrated Crop Management (ICM) Training Resource for potato and sweetpotato is a compilation of training guides and modules developed within a range CIP projects. It contains both technical background information on the various components of ICM, and methodological guidelines for facilitating farmer learning. These guides and modules can be downloaded, modified and used as needed, provided that reference is made to the original document. The site is managed by a task force of the ICM Working Group.

Links for development change in Natural Resource Management
http://nrm.massey.ac.nz/changelinks/
An on-line resource guide for those seeking to improve the use of collaborative and learning-based approaches.

Participatory Training and Extension in Farmers' Water Management
http://www.fao.org/ag/agl/aglw/farmerwatertraining/default.htm
This site provides training material for participatory training in farmers water management. It aims to provide tools to introduce effective water management technologies and practices, to put farmers in charge in water management, and to establish effective support services. All the material can be downloaded and is also available on CD-Rom. CD-Roms can be ordered by email from farmer-water-training@fao.org

Visit our website: www.ileia.org

Farmer Field Schools: From IPM to platforms for learning and empowerment. Users' perspectives with agricultural research and development. 2003. 83 p. CIP-UPWARD, Los Baños, Laguna, Philippines. ISBN 971 614 023 1.
This publication features highlights of the **International Learning Workshop on Farmer Field Schools: Emerging Issues and Challenges**, held in Indonesia on 21-25 October 2002. It synthesizes global experiences in FFS, derived from 30 case and thematic papers, as well as the outputs of the small-group and plenary discussions. The key lessons, issues and challenges cover the following: 1) Adaptation of FFS from rice IPM to other crops, systems and constraints; 2) Application of FFS for research and development, training and extension, and other learning purposes; 3) FFS institutionalisation, scaling-up and policy development; and 4) FFS monitoring and evaluation. This publication is the first in a series of workshop outputs, which also include a volume of papers and a CD-ROM documentation of the activity. To obtain a copy of the publication, contact Dr. Dindo Campilan, cip-manila@cgiar.org or visit www.eseap.cipotato.org/upward.



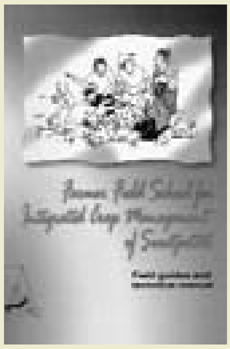
From farmer field school to community IPM: Ten years of IPM training in Asia by Pontius J, Dilts R, Bartlett A. 2002. 106 p. FAO Community IPM programme. FAO regional office for Asia and the Pacific, 39 Phra Atit road, Bangkok 10200, Thailand / www.fao.or.th/Publications; Doris.vonWerner@fao.org; Chongyao.Shen@fao.org
This is a comprehensive account of integrated pest management (IPM) as a farmer-centred and local need-responsive approach, developed on the rice farms of South-east Asia to tackle the risks arising from the excessive pesticide use promoted by the Green Revolution. The FAO programme owes it success to the pioneering Farmer Field School (FFS) approach that was first tried with Indonesian paddy farmers in early 1990, and has since become a model for farmer education in Asia, several parts of Africa and Latin America. More than 2 million rice farmers in Asia have taken part in over 75 000 farmer field schools between 1990 and 1999, boosting their yields and incomes, cutting down the use of chemical pesticides and improving the ecological health of their fields. Above all, it has given them greater control over their livelihoods and greater confidence to face up to new challenges. The publication includes step-by-step instructions on organising and running farmer field schools, along with detailed case studies of farmer field schools in South-east Asia and several personal experiences of farmers who have gained from the programme. A separate section outlines the IPM programme activities in Bangladesh, Cambodia, China, Indonesia, Nepal, Sri Lanka and Viet Nam.

Making farmers better decision-makers through the farmer field school by Rola AC, Provido ZS, Olanday MO, [et al]. 1998. 28 p. ISBN 971 560 013 1. Regional Center for Graduate Study and Research in Agriculture (SEAMEO), College, Los Baños, Laguna, Philippines. SEARCA www.searca.org/SEARCA/publications/books3.html
Farmer Field Schools (FFS) were established to introduce farmers to discovery-based learning in dealing with pest management in particular, and good crop management in general. Their ultimate goal was to improve farmer's decision-making abilities to cope with both biotic and abiotic stresses. This publication describes a village-level case study in the Philippines that measured the educational, economic, and efficiency impacts of the FFS. This four-season study compares decision-making between FFS graduates and non-FFS farmers. (WR)

New ways of developing agricultural technologies: the Zanzibar experience with participatory integrated pest management by Bruin GCA, Zeeman F. 2001. 167 p. ISBN 90 6754 624 0. Wageningen University and Research Centre. Technical Centre for Agricultural and Rural Cooperation (CTA), PO Box 380, 6700 AJ Wageningen, The Netherlands / cta@cta.nl
This work shows that FFS can function in an East African context if certain conditions are met. See the review in issue 18(1).

Facilitating sustainable agriculture: participatory learning and adaptive management in times of environmental uncertainty by Röling NG, Wagemakers MAE. 1998. 318 p. ISBN 0 521 58174 5. Department of Communication and Innovation Studies, Wageningen Agricultural University, Wageningen, The Netherlands. Cambridge University Press, The Edinburgh Building, Cambridge CB2 2RU, UK.
This still-impressive information source examines the implications of adopting more ecologically sound agricultural practices, at the level of both individual farmers and large-scale agro-ecosystems. The emphasis is on human and social aspects, learning through participatory approaches, and appropriate institutional support and policy structure. Examples from around the world are provided. (WR)

Farmer field school for integrated crop management of sweetpotato; field guides and technical manual by Fliert E (van de), Braun, AR. 1999. 101 p. ISBN 92 9060 216 3. International Potato Center, Regional Office for East and Southeast Asia and the Pacific (CIP-ESEAP), PO Box 929, Bogor 16309, Indonesia, UPWARD.
Highly fluctuating prices and a weak bargaining position provide little incentive for sweetpotato farmers to produce high yields. Nevertheless, comparison of yields and profits obtained by farmers in Indonesia showed a tendency for farmers who produced higher yields to earn higher profits. This suggests that farmers can increase profits by increasing their yields through better crop management, and by learning to estimate what the yield is likely to be before entering into negotiations with a trader. How can farmers knowledge and skills be developed so that they can improve their crop management and business capacities? This book gives an answer to this question. Integrated Crop Management (ICM) is presented as an alternative way to tackle these constraints, and FFS as a way of learning about ICM. Approximately one third of the field guides and the technical manual delve into crop protection topics, including numerous full colour photos, suggested training exercises and data recording forms, brought together by cartoon-style drawings. This publication is available in English, Indonesian, Spanish and Vietnamese, and the English version can be downloaded from the ESEAP ICM-Training Resource homepage at www.eseap.cipotato.org/Training-resources.htm



Learning integrated crop management for sweetpotato 1997. CD-Rom with video. International Potato Center, Regional Office for East and Southeast Asia and the Pacific (CIP-ESEAP), PO Box 929, Bogor 16309, Indonesia *UPWARD. http://www.eseap.cipotato.org*
This video examines common constraints faced by Indonesian farmers who grow sweetpotato. It was produced to promote ICM to sweetpotato farmers and to motivate them to attend ICM farmer field schools.

Participatory technology development for agricultural improvement: challenges for institutional integration by Lizares-Bodegon S, Gonsalves J [et al]. 2002. 110 p + CD-Rom. ISBN 1 930261 06 3. International Institute of Rural Reconstruction (IIRR), Y.C.James Yen Center, Biga, Silang, Cavite, Philippines / www.iirr.org; Bookstore@iirr.org, ETC Ecoculture.

This workshop report focuses on the insights, lessons and recommendations derived from formal presentations, analysis of cases, poster sessions, small group discussions, and individual contributions. The workshop aimed at the institutionalisation of PTD in the following settings: research institutions, civil society actors such as farmer organisations and NGOs, extension development agencies, and multi-stakeholder platforms. Each of these settings has a chapter in the report with issues, lessons and recommendations on PTD. The annexes provide abstracts of 19 case studies from all over the world, as well as the PTD framework. The workshop report is also available on CD-Rom, which is useful. It is a pity that the CD-Rom contains only the basic text of the report and one chapter of a related study. IIRR missed an opportunity to provide an extensive information source without much effort. (WR)

Farmer field school on integrated soil management: facilitator's manual. 1998. 218 p. Farmer-Centred Agricultural Resource Management Programme (FARM), FAO-RAP, Maliwan Mansion, Phra Atit Road, Banglumpoo, Bangkok 10200, Thailand / FAO-RAP@fao.org.

The Farmer Field School (FFS) approach on Integrated Soil Management (ISM) has been successfully experimented with at field sites in China, Philippines, Thailand and Vietnam. This facilitator's manual was developed on the basis of these experiences. The objective of the manual is to assist facilitators by providing a basic framework and materials on FFS-ISM. The training materials can help farmers to make their own decisions, to organise themselves and their communities, and to create a strong working network with other farmers, extension workers and researchers. The manual is meant for field-based extension officers, farmer leaders and field-level development workers and their trainers and co-ordinators. It contains a large number of FFS-ISM exercises on general FFS-related topics and a selected range of soil management topics. (CR)

Way out of the woods: learning how to manage trees and forests by Mele P van (ed). 2003. 143 p. ISBN 1 872691 67 6 : EURO 50.-. Marnix Book store, Nederkouter 109, B-9000 Gent, Belgium / info@marnixbooks.be

This book is an account of how the success of forestry and agroforestry projects in three countries (Nepal, Kenya and Bolivia) depends on understanding biological, social and cultural diversity and applying this knowledge to meet the needs of rural people. "Way out of the woods" explores the roles that scientists and rural people play in finding a way to sustainable management of trees and forests. New ideas come from existing knowledge articulated with the help of researchers or local facilitators. This knowledge illuminates the path out of darkness, the metaphorical place in the woods, where the ability to see forward and beyond the trees is restricted. The solutions to sustainable management lie in using local and scientific knowledge and the case histories show how simple approaches can provide new solutions to old problems. An important lesson is that this can only take place if actors trust each other and communication between groups is open.
Profit of the sales of Way Out of the Woods is directly invested in the Centre for Agro-Ecology and Development, the Nepalese NGO who contributed one of the chapters of the book. More information on their activities can be found at http://www.alternatives.org.np/

The group promoter's resource book: a practical guide to building rural self-help groups by Groverman V, Cook J, Thomas G (eds). 1994. 112 p. Food and Agriculture Organization of the United Nations (FAO), Viale delle Terme di Caracalla, 00100 Rome, Italy.

This resource book is now available in electronic version, in English, French, Spanish and Arabic. It shows how group promoters can help men and women in rural communities to join together and work to improve their income and living conditions. It presents a participatory approach in which group promoters play a key role. Their task is to help the poor to form sustainable self-help groups and undertake income-generating activities. http://www.fao.org/sd/2001/PE0303_en.htm

IPM farmer field schools: a work in progress by Quebral, NC. 2002. 54 p. University of the Philippines, Los Baños, 4031 College, Laguna, Philippines.

This publication is based on a Philippine study that centred on the transfer of rice IPM principles to coconut ecosystems. The 15-month study had three objectives: to identify some of the constraints to institutionalising the IPM farmer field school approach, to advise on the social and technological issues arising from the FFSs, and to test research and extension methodologies compatible with IPM concepts. The report provides an evaluation of the project with an overview of constraints and recommendations to overcome them. (WR)

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January 12 - July 23, 2004
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P.O. Box 88, 6700 AB Wageningen, The Netherlands
e-mail: secretariat.icra@wur.nl web site: http://www.icra-edu.org

FFS for tree crops

James Mangan and Margaret S. Mangan

Since 1997, Farmer Field Schools (FFS) have been developed in Indonesia for Integrated Pest Management (IPM) in five tree crops - cashew, cocoa, coffee, pepper and tea. Applying the FFS approach to IPM for perennial tree crops has required several adaptations, including changes in content and duration of the FFS, and in the methods employed in Agro-Ecosystem Analysis (AESA). This article is based on our experiences with the IPM Smallholder Estate Crop project (IPM-SEC project) and the SUCCESS Project to control Cocoa Podborer (CPB).

Adapting to perennial ecosystems

The five tree crops mentioned above are perennials. Tree age before complete renewal varies from crop to crop and even from farmer to farmer, but averages around 20 years. The rice ecosystem, where the FFS approach was developed, undergoes destruction and hence catastrophic change during harvest. But the perennial ecosystem remains fundamentally unaltered, particularly in the case of continuously harvested crops like cocoa, which produces fruit throughout the year and cashew, which has three flushes per year. Tea also grows leaves continuously throughout the year. Of these five perennial tree crops, only one - coffee - can be said to have a significant period during which no flowering and fruiting takes place. This means that any pests are presented with two conditions not present in an annual crop like rice or cotton: a continuous food supply and a dependable habitat.

As a consequence, certain mechanical practices are not possible with perennials. One example is the practice of "ploughing down" after a clear harvest, which results in the drastic

Some IPM constraints and opportunities for various tree crops

IPM method	Conservation of predators and parasitoids	Augmentation of natural populations of predators and parasitoids	"Classical" Biocontrol (introduction of exotic predators and parasitoids to control introduced pests)	Mechanical/ Cultural methods for pest control	Use of pathogens for biological control
CASHEW	Excellent control of Lawana sp., Machaerota rostrata (both Flatid Homopterans) and Cricula trifenestrata by natural enemies; good control of Helopeltis by weaver ants and spiders and other natural enemies	Augmentation of Aphanomerus sp., an egg parasitoid of Machaerota rostrata, may be possible		Pruning and cutting back canopy so trees do not touch each other prevents expansion of Helopeltis	Trichoderma can control root rot; Synnematium can control Flatid pests; Beauvaria attacks Helopeltis.
COCOA	CPB has too few natural enemies; good potential for control of Helopeltis and Apogonia with weaver ants; encouraging black ants (Dolichoderus spp.) may reduce Helopeltis and CPB	Some possibility of control of CPB by release of Trichogramma spp., and Goryphus mesoxanthus, but no functioning insectaries		Continuous flowering and fruiting means there is no seasonal die-off of CPB. Pruning, sanitation, bagging pods, frequent harvesting and fertiliser diminish CPB	Trichoderma can control Phytophthora; Beauveria bassiana 725 can be effective against CPB; Beauvaria attacks Helopeltis.
COFFEE	Coffee Berry Borer (CBB) has few natural enemies. Zeuzera coffea, a branch borer, has parasitoids and some predators. Weaver ants may provide some protection against CBB, but there are as yet no experimental results on this.		Complete seasonal harvest prevents establishment of CBB parasitoid Cephalonomia stephanoderis, first introduced in 1989. Ample populations of Coccinelid Curinus, introduced in 1986 to control jumping lice in the lamtoro bean now limits green and white scale in coffee.	Simultaneous flowering and fruiting has not resulted in a CBB die-off; little is known about alternative hosts during the fallow period.	Beauvaria bassiana 615 can be effective against CBB
PEPPER	Lots of jumping spiders and robber flies; a parasitoid Spathius piperis can control the branch boring weevil Lophobaris; as aresult disease, not pests, is the main problem.	Use of green cover crop, Arachis pintoi, to provide refuge for beneficials	Within Indonesia, the parasitoid Spathius piperis may need to be introduced to certain islands like Bangka, where it has not been observed to occur.	Pruning of affected branches can help control the branch borer, Lophobaris piperis	Trichoderma can control Phytophthora
TEA	Loopers are parasitised by Tachinid and Ichneumonoid parasitoids, but there is not a very rich range of spiders feeding on Helopeltis.			Cutting out bushes infected by Ganoderma pseudoferreum, trenching around infected area and applying sulphur	Ganoderma can be controlled by Trichoderma; Beauveria attacks Helopeltis.

Coffee (two level)

Cashew (older tree)

Cacao (pruned to reduce CPB)

reduction of a pest, for example rice yellow stemborer in China or cotton pink bollworm, through destruction of its food supply and habitat.

Pest difficulty

The "natural" condition for perennial ecosystems is one in which the pest is always present in the cropping system. Some tree crop pests are difficult, others less serious. Each crop requires its own observation techniques, its own cultural/mechanical practices, and has its own particular pests and diseases. The most difficult pests, such as Cocoa Podborer, spend all of their larval life inside the fruit to be harvested, invulnerable to natural enemies and pesticides while they are inside. Leaf eaters are a less serious problem (except on tea). There are two reasons to reassess the seriousness of tree crop pests. First, we need to know the true pest impact if we are to figure out mechanical or biological controls. Second, we need to overcome the tendency of pest protection bureaus to exaggerate the danger of minor pests, as this can distort the decisions resulting from weekly AESA.

Ecological IPM began with rice, whose pests all have a rich array of natural enemies, both aquatic and terrestrial. By the start of the FAO IPM Programme, a substantial body of research already existed on the role of natural enemies in the control of the chief rice pest, Brown Planthopper. Compared with rice, very little research on the ecosystems of perennial crops has been done in Indonesia. Tree crops also lack the aquatic element of the rice ecosystem, which provides many beneficial insects and spiders. More research is needed on the habits and biology of the most important pests and beneficials - but lack of research cannot prevent us from proceeding with IPM control methods that work.

AESA in high trees and vines

AESA includes observation of pests, natural enemies, neutrals such as detritivores, disease, and plant nutrition, which should all be taken into account when making a decision on pest management. In rice, this observation is carried out weekly in ten randomly selected spots (hills) throughout the field. It involves the entire rice plant from roots to the tip of the flag leaf. Each tree crop, however, requires its own approach to AESA and its own frequency of observation. Pepper and coffee usually undergo AESA once in two weeks, whereas cashew, cocoa, and tea require weekly observation.

Tree canopies are also much more difficult to observe than rice plants. Some cashew trees grow to more than ten meters high. Some coffee canopies are two-tiered. Ladders are required for AESA on cashew, high coffee, and pepper vines. This also entails some risk - during training, one facilitator trainee fell from a tree.

More complete canopy observation using a ladder should be carried out on one tree in every three, but this is just a rule of thumb. Budding branches in cashew, fruits in coffee and cocoa, and leaf condition must be observed, especially for disease. Roots require inspection for fungus or nematodes. In this way, AESA delivers more information about the ecosystem than any scouting method for simply counting pests.

Adjusting the FFS training season

In the SUCCESS Cocoa Podborer (CPB) project, the content of the FFS was changed radically in order to deal with a single pest. The FFS format was changed to emphasise knowledge of one major pest and the cultural methods that will best control it, instead of knowledge of the entire crop ecosystem through AESA. This adaptation involved shortening the FFS to just seven meetings, five of which were field-learning meetings. In terms of content, four cultural methods for control of CPB were emphasised: frequent harvesting; pruning to open the canopy; adequate use of fertiliser; and crop sanitation. These changes were in large part driven by donor desires to reach all Sulawesi Cocoa farmers with the new technologies.

In perennial agro-ecosystems, there are solid reasons for doing full season training for IPM: ecosystem changes can be followed throughout the crop season, including the outcomes of pest simulation experiments. However, a full season for coffee, including all cultural practices, would be a whole year long if all methods were done in season. This is far too long and costly to be practical. Other crops do not need such a long season. In the IPM-SEC project, a standard FFS length of six months was decided upon for bureaucratic and budgetary reasons, and this is adequate for all crops. Duration was set at 20 sessions for all FFS, regardless of the duration from flowering to harvest.

Assessing the trade-offs

Each crop has its own particular pests and diseases, and requires its own observation techniques and cultural/mechanical practices. Adjustments and changes in the FFS approach had to be made accordingly.

The FFS approach of involving farmers in participatory field learning activities remains a powerful one. In adapting the approach, however, a number of trade-offs are involved. In the case of the SUCCESS project, the adaptations meant exchanging open-ended field experimentation – the classic FFS approach – with teaching a few specific mechanical methods for pest control. The impact of training is still positive and effective, but other consequences of these tradeoffs need to be evaluated.

■

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A full version of this paper is available at www.eseap.cipotato.org/upward.

Towards self-financed farmer field schools

Farmers conducting field observations on groundnuts. Photo: James Okoth

James Robert Okoth, Godrick S. Khisa and Thomas Julianus

The effectiveness of Farmer Field Schools often depends on their financial sustainability. This article looks at several innovations for financially sustainable FFSs that were developed by the East African Sub-regional Pilot Project on Integrated Production and Pest Management Farmer Field Schools, and are now being taken up by a number of other FFS programmes. The cornerstone of these innovations has been the evolution of an initial grant system (semi-self financed FFSs) into an educational revolving fund (self-financed FFSs), supported by the proceeds of commercial plots that are managed alongside the study plots. Involving farmers right from the start has been crucial in successfully implementing these innovations.

Semi-self financed FFS

The semi-self financed FFSs were initiated in 1999 with the introduction of the grant system, in which farmer groups wrote simple proposals for grants to run their FFSs. Figure 1 provides a flow chart of steps in the development of a semi-self financed IPPM FFS. Step One is for a group to submit a proposal in response to an announcement that grants are available. Grant forms include guidelines and application forms for groups. Currently, IPPM FFS grants require that the group have three officers (Chairperson, Treasurer and Secretary) of which at least one is a woman (in mixed gender cultures). Groups must have a multi-signatory savings account and agree to record keeping and audits, and the grant must be used for at least one high value crop and a food crop. The group may also include other topics such as IPPM for poultry. An indicative budget is provided for partial guidance, but it is also stated that extension staff should be paid based on officially published rates, although these can be negotiated. The grant form provides space for background, justification for grant and activities, work plans and budget, and should include the signatures of all group members as well as the local agriculture officer.

Once the grant is approved, Step Two is to transfer the grants to the groups. Typically this is a combination of materials and cash or cash alone. Materials such as flip-chart paper, crayons and other stationary are more cheaply available (or only available) in large cities, so it is more efficient to provide some materials. Cash is provided in at least two instalments over the season, depending on the length of the FFS (for example, annual crops are usually 4-5 months, soil and perennial crops are 12-18 months). The size of the grant for IPPM FFSs is typically US$100 to US$400 per season of study. The grant reporting must include bookkeeping, maintaining receipts and accepting an audit. Grants can in some cases be transferred electronically to accounts, and in other cases they are provided in cash. In many cases the opportunity to handle and control funds has led to increased ownership with farmers providing co-financing as well.

In Step Three, payments to field school facilitators are made directly by the field school group at pre-agreed rates. If the facilitator lacks technical skills, is a poor facilitator or even has inappropriate social skills (arrogance and top-down approaches are leading problems), the group may “release” or “fire” the facilitator – and this has indeed been known to happen.

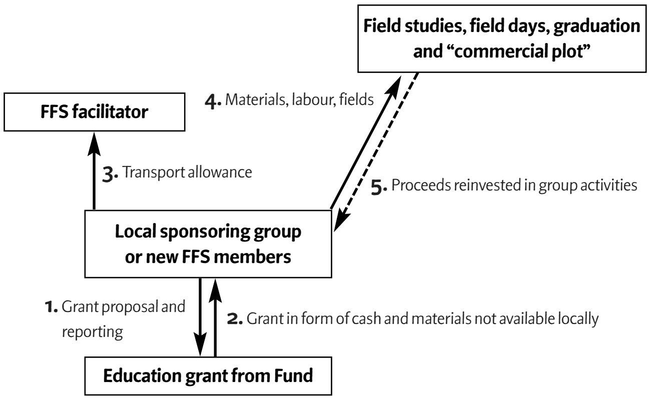

Figure 1. Semi-self financed field school with capital provided by grant and group proceeds reinvested into group activities.

Facilitators receive important feedback from this! If the facilitator does not show up or shows up in an inappropriate state (for example, drunk or late), the group can withhold payment. On the other hand, the facilitators usually receive payment on the day they travel – a far better situation, they feel, than filling out paperwork and waiting for a delayed payment, as is typical of most extension travel allowances. Groups may also request that information on special topics such as soils, nutrition, or environment be delivered by specialised staff, in which case they use the grant to pay transport for the specialist.

IPPM FFS participants also arrange their own field study plots (as shown in Step Four in Figure 1). The study plots are typically 0.2 to 1 ha. in size, and include various educational features – such as comparison trials between IPPM and conventional practices, fertility management methods, and new variety testing. Groups in Western Province, Kenya were the first to begin the “commercial plots” which are larger fields that the group manages together in order to raise more funds. These groups converted the “snack” budget line to field inputs to get started. This has now been institutionalised and it is recommended that all groups have commercial plots. The land arrangements depend on local conditions and include the use of village land, as well as donations from larger landowners and the sharing of crop produce with owners. It is the responsibility of the participants to provide the land and the labour for both the study fields and commercial plots. It is the responsibility of the facilitator to provide a profitable educational activity, including bringing in socially important issues such as HIV/AIDS, women's reproductive health, and soil fertility management.

In Step Five, proceeds from the FFS plots are re-invested in the groups own account. This has now become possible because all grant-recipient FFSs must have their own accounts and means of managing them. The funds are used by the group for further study, and the purchase of animals or other activities. Each group is also requested to assist in training one other group, and farmer-led field schools are quite successful.

As a result of this grant process, groups have shown a very high level of ownership of the FFS process. Many FFSs enjoy a high level of matching funds, material inputs provided by the community and participants, and display an increasing ability to manage funds and activities on their own. Groups become more independent of extension services, and they are also better partners for the extension services – even though many extension services still have difficulty seeing this. The process of applying for grants, making work plans and budgets, organising fields, paying facilitators and managing funds, enables groups to organise themselves to continue on their own. Although FFS grants are intended to support a group for a set time period, many field school participants go on to develop longer-term associations due to the cohesion, trust and joint fund-raising ability developed during the FFS period. The grants provide capital to groups and catalyse new ways of working together. Case studies from various beneficiary semi-self financed groups indicate that if well guided, the groups are able to recover the whole grant after a couple of seasons. As a result, self-financed FFSs are emerging, where the grant has been transformed into an educational revolving loan.

Self-financed FFS

Although semi-self financed IPPM FFSs partially solve at least one issue some of the problems of maintaining the sustainability of farmer groups, extension officers need a new set of funds each season to keep the programme expanding year after year. Thus, new ideas have been sought by IPPM facilitators and farmers, resulting in the self-financed model. The basic difference between this model and the semi-self financed FFS is that the group is the recipient of revolving funds, rather than a grant. The loan-requesting group must agree – by group contract – that they will return the operational costs of the IPPM FFS to the revolving fund. The concept is similar to revolving seed funds, in which one kilogram of seed provided at the beginning of the season is repaid with one or more kilograms of seed at the end of the season. In the case of self-financed field schools, operational costs are pre-financed and the group returns the operational fee at the end of the season through funds raised in the field plots and educational fees.

The model allows very resource-poor farmers to participate, as they are able to help generate funds for the FFS fund by contributing their labour during part of the season. It is conceivable and perhaps even more effective, that instead of cash repayment, farmers could replenish the fund with in-kind contributions.

Operational guidelines are currently being developed on the best way to implement the educational revolving fund, taking into consideration key concerns like the security of the revolving fund from local "leakage" and the problem of payback during drought or flood. The second issue is more problematic, but it is felt that either farmers will have to pay with educational fees, or the repayment could be reduced in proportion to typical yield losses seen in the field. The rationale for the guidelines is the need to come up with an operational framework that can blend into the existing structures such as FFS networks, the extension system, political structures and civil organisations with minimum overhead costs. So far, the FFS networks provide the most suitable structure for handling the revolving fund.

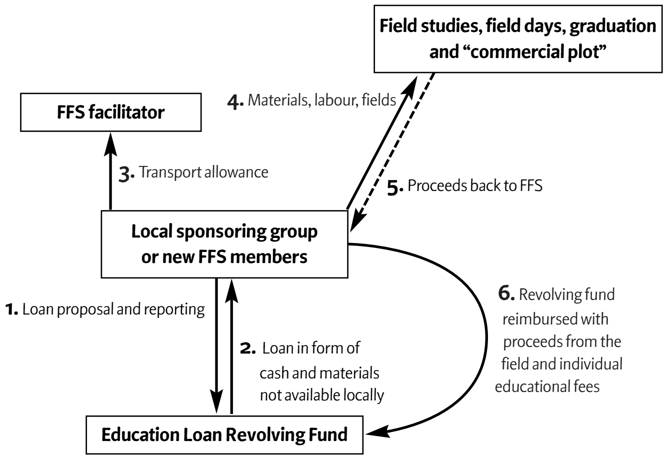

Figure 2. Self-Financed Field School with capital provided by revolving fund. The group reimburses the fund at end of season.

A major concern is the issue of reputation. The model requires that farmers trust the knowledge and teaching ability of IPPM facilitators before signing the contract. Unfortunately, the top-down programmes of the past have given many extension systems a poor reputation, so this may be a very serious problem. Retraining of extension staff into IPPM facilitators with technical and facilitation skills has helped, but the farmers long-term experiences with extension services may be difficult to overcome.

One positive development is the increasing interest of local governments and some NGOs in the approach, to the extent of committing some of their meagre funds to sponsoring the establishment of FFSs. As a result, the FFSs are recognised as a major channel for community development. Similarly, rural micro-finance institutions are also using the FFSs as an entry point for group loans. In Uganda, Village Banks have been established by private sector promotion centres in the three pilot districts, where the FFSs are able to buy shares and acquire simple loans. The same Centres provide financial management skills to the groups. In Kenya some farmers have began pulling together resources and funding FFS activities, the so-called self-sponsored Farmer Field Schools. This level of confidence in the FFSs indicates a very bright future, which will be strengthened more by the self-financing approach. ■

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Gender field schools

Mansour Fakih

Since it began in 1989, the majority of participants and facilitators in the successful Indonesian IPM FFS programme have been men. Some efforts have been made from the beginning of the programme to include women, but with limited success. While there are now more women trainers and women participants involved in IPM FFS than in the beginning, evaluations of the IPM Network still indicate that the experiences of women in IPM FFS are different of those of men. Many of the women engaged in IPM felt “there is something missing”, something that has not been understood or addressed. They wanted to see a move from “women’s involvement” to gender equality.

Going one step further

As a result of the ongoing perception that FFSs in Indonesia are still not gender equal, a special programme is now being introduced into IPM activities. This programme is firmly rooted in the participatory approach and aims to make all those involved in IPM FFS aware of what gender discrimination is, and why and how it occurs.

This requires a supportive policy framework, as well as a commitment from the programme staff to integrate gender issues. The National IPM Farmers Association stated its support and established a policy framework for the programme in 2001, providing the necessary framework for the first National Gender Workshop.

The first National Gender Workshop, organised by farmers, concentrated on developing a strategy, a plan of activities and a curriculum that would support a wholly participatory approach to mainstreaming gender into IPM FFS activities. At the same time, farm-level discussions were initiated. Farmers involved in IPM FFS agreed to take part in gender training and curriculum-building activities, as well as to collect information on gender issues that could later be discussed and analysed.

A core team was recruited from amongst women facilitators who were experienced in FFS and interested in gender issues. A gender-training curriculum was set up, using the FFS approach, to introduce and explore the concept of gender inequality in rural communities. The curriculum focused on the actual incidences of gender injustice and sought to inventorise the social and political factors underlying gender inequality. Strategies for effectively collecting information on gender issues and clarifying what gender inequality means at farm level were discussed extensively, and farmers were given a key role in collecting data and in developing family case studies. Farmers enthusiasm for the initiative resulted in a strong process of farmer-initiated knowledge development and gender analysis.

Key questions

Farmers and the core team of facilitators met in field-based provincial and district workshops, where they developed tools that could be included in the first curriculum. During these workshops, insights were gained into how to raise gender consciousness in rural areas and within the IPM network.

Two key questions raised during these workshops were: “Why do we want to introduce gender into IPM?” and “What is in it for

Towards a gender sensitive approach

In 1990-91, during the first cycle of the National IPM programme, it became clear that women had more limited access to and opportunity to benefit from IPM training than men. In addition, Indonesian women often feel less competent than and inferior to men, which can hamper their active involvement in training.

This had serious implications for the IPM programme. Women make up 50% of the farm labour force in Indonesia, and in rice growing areas such as Central Java, agricultural tasks are shared equally between men and women. Not only are women involved in transplanting, weeding, routine observation of the crop, supplying food to hired labourers, harvesting, threshing and selling the harvest, they also have the important task of managing the household money.

In addition, a significant number of women head farm households in Central Java, either because their husbands are migrant labourers or because they are alone. Women with a lower socio-economic status are heavily represented in the female-headed household group. In general, they have low levels of education and tend to be overlooked in development programmes.

The fact that women farmers in Indonesia are often “screened out” of FFSs is a direct result of the inclination of local officials to automatically select male heads of households for IPM training. They also tend to select men from high and middle - income groups. This not only prevents women from participating in IPM FFSs, it also means there is little “trickle over” of knowledge because men in these socio-economic groups often do not farm themselves – they usually hire labour – and they have very little contact with women of lower socio-economic status.

Domestic and educational factors also play a role. Women have household tasks that make it difficult for them to consistently follow weekly FFSs for an entire session. In some sections of Indonesian society, women feel less competent than men and this can inhibit them in group learning situations. For example, in Central Java, it was found that when women were selected for FFSs they participated actively in all activities except those involving group presentations.

Women are not deliberately excluded from IPM training. As one official put it “I just never thought about the issue”. No specific attention had been given to identifying the social conventions and cultural practices that limited women access to agricultural development programmes until, in 1989, the National IPM programme and the local NEO IPM programme, coordinated by World Education, developed a training preparation process that specifically addressed the issue. Gender analysis and needs identification were carried out with farm communities and village officials and by 1995, results showed that in all parts of Indonesia women’s participation in IPM FFS had increased by an average of 15%.

The National IPM programme concluded that women’s involvement in IPM FFS could be enhanced by a training preparation process prior to the FFS, strengthening the role of farmer trainers and extension officers, and emphasising women’s leadership development. After 2001 and on the bases of these experiences, policy was initiated that lead to the development of Gender Field Schools.

Source: Fliert, E, van de and Proost, J. (eds.), 1999. Women and IPM: crop protection practices and strategies, KIT, Amsterdam, 1999. Email elske.vandefliert@fao.org.vn men?" The answer to the first question revealed the depth and complexity of the gender inequality. Women responded in direct and emotional terms. "We are second-class in our own culture" and "We are just followers". They showed they were well aware of the fact that discrimination was accepted as normal *because* women were regarded as second-class people. The question "What is in it for men" was answered during the course of the workshop. Participants concluded that tackling gender issues did not imply an attack on men's status, but could have a direct benefit for the family and community by strengthened women's confidence, self-esteem and status. Exploring problems in the context of gender inequality also opened the way for effective solutions.

In discussing gender inequality, workshop participants made a clear distinction between the biological definition of sexual difference and the socio-cultural concept of gender that included culture-specific roles such as the male breadwinner and the female homemaker.

FFS for gender - Gender Field Schools

The participatory approach chosen for integrating gender in the IPM movement places farmers, both men and women, at the centre. It is a long-term, process-oriented activity. Farmers use their own experiences to identify what exactly gender inequality and discrimination meant to them and they use these insights to make adjustments to their own IPM programme. The members of the core gender team also become the facilitators working with the first farmers groups on gender.

Gender Field Schools have become the basis for efforts to "mainstream" gender in the IPM network in Indonesia. Participants follow five basic steps towards a more in-depth understanding of gender issues in their community.

- The first step is gender training, to raise awareness of gender issues and enable farmers to conduct participatory gender research.
- The second step is data collection. The farmers use their training to identify gender issues in the farmers household and community and collect data on these issues. The data collected are grouped into five categories: access; participation; control; benefit; burden and level of violence.
- The third step is the Gender Analysis. The facilitator helps the farmers analyse the data collected. Farmers come to understand the way local perceptions of gender affect women's lives.
- The fourth step is to plan for action to reduce and eliminate the identified inequalities between women and men.
- The fifth step is monitoring and evaluation. The evaluation helps to identify the activities that will increase women's access to, control over, and benefits from the IPM programme, and expand women's participation in the IPM farmers organisations, programmes and processes.

The development of core groups to pioneer the process of gender mainstreaming in the IPM networks is considered crucial in the process. To start with, the farmer communities to be involved in Gender Field School experiments are carefully selected. For the time being, eight GFS groups have been started, all of them with farmers groups that have previously been involved with FFS for IPM. The GFS are farmer-run and farmer-financed.

After a GFS is conducted, a Farmers Family Crisis Centre (Tim Pembimbing Keluarga Petani-TPKP) is established. The Centre is located in the IPM farmers community. It is hoped that the Centres will help to lower divorce rates, and minimise domestic violence and other forms of discrimination against women. So far, eight such Centres have been established.

Group dynamics execises in a gender field school in Ciamis District, West Java. Photo: FIELD

Lessons learnt

From the experiences of the farmers IPM network in trying to integrate gender into their development programme, it is clear that if such initiatives are to be successful, farmers must be fully involved and the farming communities participating in the Gender Field Schools experiments must be carefully selected. It is also important that the farmers have prior experience with FFS. Other lessons learnt include:

- Integrating gender into development programme cannot be induced from outside. It requires a process led by farmers themselves, both men and women.
- Gender mainstreaming needs political will and the commitment of the leadership of the IPM programme. A strong effort and appropriate mechanisms are needed to integrate gender into the national IPM structure, and into the activities of the National IPM Farmers Association.
- Gender mainstreaming is a process of education, research and action. Capacity building is therefore essential. Capacity building support has been provided to the farmers to conduct gender data collection and for the creation of an information system, through a participatory approach. The capacity building process should include enabling farmers to establish their own vision, mission and strategies, as well as the organisational structure for mainstreaming gender.

Conclusions

So far, the efforts to mainstream gender have increased the capacity of the IPM farmers networks to integrate gender into their policy, planning and monitoring. The IPM project staff have increased their awareness about their roles in the gender mainstreaming process. The experiences gained through this process of gender mainstreaming can contribute not only to the FAO-IPM project, but also to other groups who are pioneering the field of gender equality in rural areas. ■

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A full version of this paper is available at www.eseap.cipotato.org/upward

Prabhavati poses with the low cost composting model she developed.
Photo: Ramesh Sharma

The greening of Self Help Groups

Seema Tripathi and Shiraz Wajih

Self-help groups (SHGs) for women living in the Terai of Eastern Uttar Pradesh are moving beyond the usual SHG goal of helping women improve their socio-economic status. These groups are also being utilised to mobilise their members as agents of change and advocates for not only gender issues, but also sustainable agriculture. Farmer Field Schools have played an important role in the capacity building aspect of this "greening" process, which has involved bringing together many different extension and support mechanisms.

Self-Help Groups

The plains in the Terai region, at the foothills of Nepal Himalayas, have good rainfall and fertile alluvial soil. The majority of farmers can be categorised as small or marginal, with average land holdings of less than an acre (about 0.4 hectare). Agriculture is the main source of employment and livelihood in this region.

The area has a feudal background with a caste-dominated society. Rural women of the region have very limited access to credit, information and extension services, in spite of their major contribution to agricultural activities and their ever-increasing responsibilities as their men migrate to the cities. To help empower these women, Gorakhpur Environmental Action Group (GEAG) initiated the formation of women self-help groups in 30 villages in Gorakhpur district. Self Help Groups were originally started in Bangladesh as an innovative and "self help" approach to savings and credit, and have proved effective in empowering rural women.

The GEAG SHGs have grown from three groups in 1996, to a total of 310 groups by mid-2002, with approximately 4500 women members in 30 villages. Most SHGs range in size from 10-18 members and 73% of these groups belong to the category of oppressed classes (Dalits) and small-marginal farming families. The group members make a monthly deposit ranging from Rs. 10 to 20 (roughly US$0.20-0.40c). SHGs have their accounts in a nearby bank. GEAG has ensured a commitment that these banks will provide a loan to the SHGs of up to 4 times their original deposit.

SHGs in a village federate themselves to form a "Sangha". This organisation is entrusted with the responsibility of nurturing SHGs and making collective efforts for the development of village. The self-help groups and the federation, besides facilitating credit flow for consumption and productive purposes, have played a pivotal role in creating a self-sustained agriculture production support system.

Greening the groups

SHGs have been promoted not only as appropriate institutions to help women improve their socio-economic status, but also as a means to mobilise them as agents of change and advocates for gender issues and sustainable agriculture. GEAG has consciously developed the capacity of these groups through a "greening" process, to equip them with appropriate, sustainable technologies, conceptually as well as technically. These "greened" SHGs have been working to promote and disseminate LEISA techniques and practices, and to establish self-sustained, community-owned extension systems. The groups have spearheaded the ecological agriculture movement and become extension agents of green technologies.

So far, approximately Rs.1,200,000 (roughly US$24,000) have been lent by the bank and repayment is almost 100%. The savings and loans obtained are used for agricultural production activities such as purchasing seeds, developing vermicompost, buying agricultural equipment and marketing. This has helped to ensure the women have direct control over these productive resources.

SHG Members adopting LEISA practices

LESIA Practice	Number of SHG Members
Bio-pesticide (cow urine, neem products, tobacco, ash etc)	3100
Composting (pit)	2500
Tree plantation	750
Vermicomposting	432
Liquid compost	528
Nadep compost	238
Seed treatment	940
Seed production	580

The major components of the greening process are as follows:

Farmer Field Schools (FFS)

To facilitate sharing of experiences, innovations, ideas and the dissemination of technical know-how on LEISA techniques, FFSs have been operationalised. The FFS have gained popularity amongst farmers not only from the project villages but also from other neighbouring villages. They are run by experienced farmers, who have extensive practical knowledge of the topics covered. Occasionally, experts from outside are also invited. On average 40 farmers, mostly women, participate regularly in monthly FFS sessions. FFS are managed by the SHGs/*Sangha*, who also decide on the place and topics, on the basis of the felt seasonal demand. There is one such FFS for every five villages in the project area.

Agro Service Centres (ASC)

In order to ensure the availability of quality inputs such as seeds, vermicompost, bio-fertilisers, bio-pesticides, and treadle pumps (low-cost, manually driven pumps for irrigation), and to facilitate direct marketing of these inputs, Agro Service Centres have been established. These ASCs, established in the clusters of 5 villages, are controlled and managed by the women's self-help groups. Soil samples are also collected in these centres for analysis in a small laboratory established by GEAG. This laboratory makes the necessary recommendations on LEISA approaches.

Master Trainers (MT)

A number of interested farmers have become Master Trainers, after receiving intensive training in facilitation techniques and communication skills. The Master Trainers are selected by the SHGs/*Sangha*, according to their background expertise and the specific needs of the area. As the Master Trainers live in the villages, they are always available and also ensure ongoing interaction with SHGs.

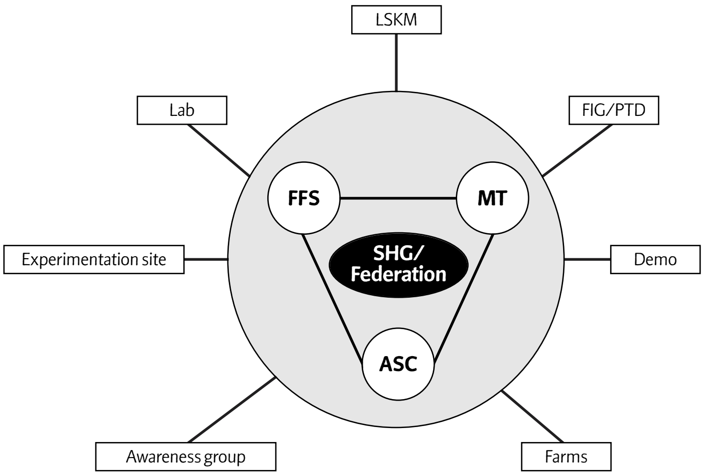
There are usually two Master Trainers in each village, and they organise regular training sessions in the village according to the felt demand. These MTs are also invited by other NGOs and projects to contribute their expertise. Tijia Devi, for example, an illiterate woman farmer from Awadhpur village, was invited as a resource person for training sessions organised by CARITAS for its Project Managers in Madhya Pradesh. There are several other examples where farmer MTs have helped orient people towards, and convinced them of the viability of LEISA techniques using the examples of their personal field experiences.

Extension System through the SHGs

The three major components of the "greening" process mentioned above are inter-linked and interdependent. However, there are also a number of other support mechanisms linked to this LEISA promotion system:

- **Laghu Seemant Krishak Morcha (Small-marginal Farmers Forum):** Farmers are unionising in this forum to advocate their interests and promote LEISA, at village, district and state levels.
- **Farmer Interest Groups (FIG) and Participatory Technology Development (PTD):** Farmers with specific needs, problems and interests (such as landless farmers, vegetable growers, seed producers, livestock farmers) are being organised to facilitate more focused interventions and linkages. These Farmer's Interest Groups are formed by members from different SHGs who share a common interest. Non-SHG farmers who share the same interest are also welcome. In the Sardarnagar area they are involved in seed production and collective farming, while in Campierganj most of the interest groups are involved in vegetable growing and livestock rearing. The FIGs are also developed around common problems such as pest and fertility management, and finding solutions through participatory technology development.
- **Demonstration farms:** Farmers have taken the lead in developing their own farms. These are integrated with households and livestock and function as demonstration models of LEISA farming.
- **Experimentation site:** GEAG has provided land where farmers can experiment, take risks and innovate.
- **Awareness Group:** Selected women from different SHGs, as well as interested men, have come together and formed a cultural group to promote LEISA through local culture, for example, through street plays.
- **Soil Health Laboratory:** Through the SHGs, farmers can get their soil samples tested in the laboratory established by GEAG and get necessary advice.

Participants preparing for a field demonstration at a Farmer Field School. Photo: Farrukh Khan



The SHG extension system

Looking ahead

Extension of LEISA practices through women Self-Help Groups has been effective and meaningful. It has ensured that women have access to information, techniques, institutions and the means to experiment with new techniques. Women are able to do better within their recognised roles through the skills acquired and the confidence gained during this process. At the same time, gender-mainstreaming efforts have enhanced their position and contributed to their emancipation. They are now able to unionise and advocate for their rights in a traditionally male-dominated society. Their enhanced control over resources and increased decision-making capacity, backed by the skills they have acquired, have given a meaningful dimension to low-external-input agriculture in the area. The adoption of LEISA practices has significantly reduced the use of high-cost external inputs like chemical pesticides and fertilisers, thereby increasing the net gain to small and marginal farming communities. ■

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Women farmers making drawings of their field observations from an onion field. These drawings are used afterwards for group presentations. Photo: Hans Feijen.

The Egyptian experience with FFS

Jaap van de Pol

In Egypt, implementation of the Farmer Field School(FFS) approach has posed a number of challenges. This article describes the development and adaptation of FFS in the Egyptian setting, from the initial Farmer Learning Groups (FLGs) through to the more recently established FFSs in Fayoum Governorate, which follow the original FFS concept more closely.

In 1996 and 1997, two Egyptian-German projects started implementing the first Egyptian FFSs for IPM in cucumber, tomato, citrus, mango and cotton. These projects used the basic FFS concept as it was originally developed in Asia, but several modifications were necessary for the approach to function in the Egyptian context. Soon after introduction, the FFSs were renamed Farmer Learning Groups (FLGs). More than 15,000 FLGs, involving 175,000 farmers, have now been organised.

Farmer Learning Groups

When the two projects started to implement their first FLGs, the Egyptian agricultural extension culture was dominated by a high involvement of government in the agricultural production of a limited number of strategic crops, and this is to some extent still true today. For these strategic crops, the government extension units assist farmers with all kinds of support including inputs, marketing and advice. To be able to provide this support, the government established a huge extension organisation between 1978 and 1982, resulting in a very high density of agricultural extension workers. One village extension worker for 130-150 farm-households was, and still is, quite common in Egypt.

Since 1984, the Egyptian government has been working towards greater liberalisation. It therefore welcomed the initiative of the two Egyptian-German projects to increase the involvement of the farmers in agricultural extension. The extension organisation, however, was used to a technology transfer approach - the participatory approach was something quite new. Only a few NGOs in Egypt had obtained some experience in participatory extension. Most of the government field staff and farmers had never experienced working with each other in a "participatory" atmosphere.

Village extension workers were trained as facilitators in a one-week basic training course on Principles of Participatory Extension, and a two-week advanced course on Participatory Extension and Communication Skills. However, a number of challenges presented themselves in implementing the FLGs. When the Egyptian-German projects asked the village extension workers to mobilise farmers for the FLGs, it turned out to be very difficult to organise groups of 25 farmers. Most of the extension workers were used to working only with individual farmers. They started by inviting 15 farmers, but regularly ended up with less than 10 farmers per session. It also turned out to be difficult to organise sessions of 3-4 hours. Farmers were used to officials visiting them. In addition, they were used to the government making it attractive for them if they were asked to participate in an extension activity. Therefore, it was difficult for the FLG facilitators to ask the farmers to invest more than two hours of their time.

Second, the frequency of meetings needed to be modified. In the FLG on vegetables and cotton, the farmers met on a bi-weekly basis, and in the FLG on mango and citrus they met on a monthly basis. As a result, the FLG facilitators spend only a third of the time (14-16 hours) with the farmers compared with their colleagues in the "original FFS" (40-50 hours). Finally, the facilitators found it difficult to offer the farmers principles instead of practices. As members of the governmental extension organisation, they were used to giving farmers the official technical advice on crop cultivation, and farmers were used to receiving clear recommendations from them. This meant that the FLG sessions became focussed on understanding the official agricultural recommendations, instead of educating farmers to become better decision-makers in their own farming system. Farmers hardly carried out any field experiments during the FLGs and most FLG sessions turned into discussion sessions. As a result, most of the educational impact of the FFS approach was lost. An evaluation concluded that the main reason for this was that at all levels, insufficient time had been invested in training, because of pressure to reach large numbers of farmers rapidly.

From FLG to "real" field schools?

Two years after the two Egyptian-German projects started to implement their FLGs, the Egyptian-Dutch projects in Fayoum Governorate started piloting the FFS approach. Making use of the experiences of the two earlier projects, greater priority and more time was given to training the first group of facilitators and to the development of the FFS curricula. Only a few FFSs were established, following the original FFS concept as closely as possible. In 2001, after two years of piloting, the real scaling-up of the number of FFSs in Fayoum started, and the projects were joined together in the Fayoum IPM Project. It is planned to establish 1500 FFSs by the end of 2004.

The FFS facilitators, selected from amongst government extension officers, now receive intensive training. After an introductory training of two weeks, the facilitators continue to receive 2-3 days training per week for one full year. During the other days, they facilitate FFSs under the supervision of a senior facilitator. Besides learning about technical topics, the training pays considerable attention to how to facilitate these technical topics during the FFS sessions. After one year, the facilitators still receive one day training per week, mainly from their colleagues. During these training days, a lot of observations and ideas from field level are channelled back to project management. Most of the modifications and adaptations made in the FFSs were based on these observations and ideas received from the field.

Most of the adaptations made to the FFS concept are a result of the cultural and social characteristics of the local farming communities and the Egyptian extension organisation. The FFSs in Fayoum meet weekly, like the original Indonesian FFSs for field crops like cotton, tomato, and beans, but for fruit crops they meet on a monthly basis. The FFS curriculum focuses on IPM, but is placed in the context of a broad range of crop management topics. Field-crop FFSs last for one year, following a cropping cycle of two or three crops. Fruit-tree FFSs follow a two-year programme. Separate FFSs are held for female farmers. The number of farmers participating in a FFS on field crops is on the average between 22 for men and 25 for women. In the FFS on fruit crops, the average number is 15.

Men farmers discussing the results of their Agro-Ecosystem Analysis in mango during their FFS on fruit crops. Photo: Hans Feijen.

The Egyptian-Dutch project has still not managed to increase the average length of a FFS session. As in the FLGs, the FFS sessions in Fayoum do not last for more than two hours. The main reason for this is that the facilitators find it difficult to do practical things with the farmers during the sessions. The social structures and customs in the local farming communities make it difficult for the facilitators to organise practical group activities. If something practical needs to be done, for example in the study field, it will be done after the FFS session and/or by hired labour. Further, the project is still looking for suitable "group dynamic activities" and "icebreakers". Most of these activities, developed in Asia, do not work in Egypt. The Arabic-Egyptian culture differs too much from the Asian cultures.

Women farmers performing Agro-Ecosystem Analysis in a field with recently transplanted camomile, a popular medicinal/aromatic crop in Fayoum, grown by women farmers. Photo: Hans Feijen.

The process of adapting the FFS in Fayoum has also included adding new elements. Because farmers need education on IPM in relation to more than one crop, the FFSs started to deal with more crops and crop rotations simultaneously. To be able to do this, the total length of an FFS was extended to one full year. Further, a very broad interpretation of IPM was chosen. This broad interpretation of IPM gives the facilitators the possibility to include all crop, pest, soil and water management practices in the curriculum of the FFS. This broadening of the FFS curriculum has made the FFS a more complete tool in agricultural extension.

Although the FFSs in Fayoum differ in a number of characteristics from the "original FFS concept" they are certainly "real" FFSs. They follow the main FFS principle of educating farmers to become better decision-makers. That this is really happening, can be concluded from cases where farmers have continued meeting each other after graduation from the FFSs, and continued to implement some farmer experiments. Further, the farmers attendance during the FFS sessions does not drop during this long period of one year. With 50-52 sessions, in total 100 hours of training, the FFSs in Fayoum are twice as long as the "original" FFS. Farmers are willing to invest their time because they are learning what they like to learn during the field schools, and consider the FFS to be their own activity.

A lot can be learnt from the modification and adaptation process of the FFS concept in Egypt. Starting with the same "original FFS concept" in mind, the process went different ways, resulting in different products. Important lessons learned from these experiences are first, that in an environment where there is little or no experience with working in a participatory atmosphere, it is very important to pay a lot of attention to the training of facilitators and development of the FFS curriculum. Second, the adaptation process of the FFS approach to the local circumstances has to be a joint activity of farmers, facilitators and project management. ■

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Picturing Impact!

John Pontius

Over the years, many participatory approaches have been used by the staff of IPM projects in Indonesia to examine the results of IPM activities. The most recent, a photo study in the Ciamis district of West Java, was carried out by Farmer Study Groups to learn about the impact of Community IPM on poverty in farming communities.

A total of three villages were selected for the study, one in each of three different sub-districts, Padaherang, Lakbok, and Cikoneng. By 1999, the final year of the national IPM farmer training project, there existed in all three sub-districts:

- Government trainers who had conducted FFS;
- Farmer IPM trainers who had conducted farmer-to-farmer FFS;
- Groups of FFS alumni conducting field studies;
- IPM trainers who had facilitated technical and planning meetings for alumni at the sub-district level.

Farmer Field Schools for Integrated Pest Management (IPM) began in the Ciamis district in the early 1990's, but there have been no nationally funded IPM activities in Ciamis since 1999. However, numerous activities have been funded or supported by the district governments, by FAO's Community IPM programme, and by the National IPM Farmers Association. Two field workers from Ciamis District Agriculture Services, who were part of the national IPM farmer training project, have been coordinating the support from these organisations and providing technical support to the activities of FFS "alumni" (graduates of the field schools) in the area.

Farmer Study Groups were formed over the last two years as action research groups for FFS alumni. The FSG have become the organisational foundation for FFS alumni in the villages, as they work to establish farmer-led community IPM programmes. The members of the FSG have been conducting various field studies in vegetable and rice production systems. One of the primary concerns of the groups is soil ecology. As a consequence, the groups have worked on issues related to composting and organic soil amendments. The three FSGs have also been assessing the effectiveness of SRI (System of Rice Intensification). The groups have been trying to increase the numbers of farmers applying IPM approaches in their villages. Although there are similarities among the three FSGs, their activities have varied due to the differing social and ecological conditions. These groups and their members are the driving force for Community IPM in their villages.

CINTA ALAM FARMER STUDY GROUP
Sidaharja Village, Lakbok Sub-district

Marsim and Samini are members of the evaluation team

This is rice straw. Before we had IPM, this straw was burned. Now the straw is being composted or turned under. Also we have learned that using a cangkul for field preparation is better for the soil than using a tractor. And once the land is prepared we spread ash. These things help the fertility of our soil. Marsim

This is the yard of my neighbour, a non-alumnus. You can see eggplant, chillies, and cassava. My neighbour used to let this land go to waste. Now, having seen what alumni are doing with organic fertiliser and their back yards, my neighbour is copying them and planting empty ground with vegetables and using organic fertiliser. Now my neighbour has a "living store" that helps with daily needs and provides some income. Marsim

This photo shows the study plots of our Farmer Study Group, Cinta Alam. We have planted vegetables and are using organic fertiliser. The plots help to provide an example for other folks and we learn about growing vegetables and using organic fertilisers. The idea is to help us increase our incomes. Our meeting place is in the background. Marsim

FSG Cinta Alam organised advocacy led to the repair of this irrigation ditch in our village. This ditch was broken and caused our homes to flood. Alumni have helped the whole village by their advocacy to local government to get support to repair this ditch that provides water to over 25 hectares of rice fields. To do the job, 6 million rupee was needed. We collected US$ 2 million from farmers. Negotiations led by Bapak Sukendar, a Farmer IPM Trainer, between alumni and the Public Works Department led to their contributing the other 4 million. The houses next to these ditches use to be continually flooded. The fields didn't get enough water. Now, with the repairs, the fields will get water and the houses stay dry. Samini

Methods

Participatory evaluation should set out to capture the perspectives, voices, preferences and decisions of the least powerful stakeholders related to a given project. In the case of Community IPM, this means farmers. Photographs can be used to help the individual, group or community reflect on itself (Freire 1989).

For the study, five members from the FSG in each of the three villages were selected to become members of the evaluation team. They were mostly the newer members of the FSGs, and their task was to conduct the evaluation study in each of their villages. In brief, the teams were asked to take photographs that showed the impact of IPM on poverty in their villages. Each team member wrote short explanations for the photographs that he or she made.

The study took place in three stages. The first stage was a four-day workshop with three objectives: establishing a perceptual focus for the study among team members; reviewing IPM activities in the villages and what members perceived as the results; and familiarising the evaluation team members with the cameras that they were to use.

During the second stage of the study, team members returned to their villages. Each participant carried a roll of film and a battery for the camera. There was one camera per village and it rotated among the five evaluation team members in each village. Each person had the camera for a day and each could take as many pictures as they wanted up to the capacity of the role of film that they carried (36 photos).

The third stage of the study was a follow-up workshop. During this workshop, team members:

- wrote an accompanying text describing the photographs and made "IPM impact albums";
- analysed their results and made team presentations on the impact of IPM activities on poverty in each village;
- discussed and presented their conclusions about what they learned during the study;
- developed action plans for their FSGs;
- evaluated the study process that they had experienced over the last several weeks.

Below are a few of the photographs and accompanying explanations made by the evaluation team. In a very real sense, each of these photographs portrays the impact of IPM activities.

Analysis and Conclusions

During the follow-up workshop, each village evaluation team was asked to present an analysis of the impact of IPM on poverty in their village based on the data that they collected during the study. Discussion followed the presentations and the teams went on to note that in general, community IPM activities had led to greater creativity, independence, lowered costs and improved incomes.

Growing pesticide-free rice and vegetables with organic fertilisers allows alumni to make ponds in their fields that can be used to produce fish. This provides additional income. Samini

This is the kitchen in Bapak Parijan's house. He uses the ashes from the cooking stove to enrich his soil. He learned in his FFS that wood ashes could be used to create better soil, increase soil fertility, and fight pest and disease in his plants. Nasiman

TURANGGA FARMER STUDY GROUP
Mangunjaya Village, Padaherang Sub-district

Mafahir, Nasiman, Iin Suryanih and Sakiman Holil are members of the evaluation team

This is Bapak Zakaria and his wife. He is an IPM Farmer Trainer and has become the head of his hamlet. He has been a part of Turangga's activities and he is now using ground that was once empty to grow chillies. He uses compost to help improve his soil. Iin Suryanih

A creative farmer makes use of his land by planting mung beans after rice. This yields beans and green fertiliser is made from the leaves of the mung bean plant. These farmers are drying mung beans. Mafahir

The following quotes are further examples of their analysis.

IPM activities have increased creativity among farmers. The teams cited examples including the following:

- "*Trichoderma*, which is an antagonist of *fusarium*, can be used effectively in chillies. Because we want to apply IPM and avoid using pesticides we are forced to be creative to find alternative approaches to pest control."
- "The FFS opened my eyes. Because my family was able to analyse its daily needs and could determine how to try to fulfil those needs by, among other things, using our yard for a vegetable garden, we have been able to improve ourselves. I learned about these things in my FFS."
- "Making use of used plastic bags and plastic ware as pots for planting vegetables"
- The use of inter-cropping and organic fertiliser.
- The use of open land and yards for vegetables and fish ponds.
- "Producing and using "bio-lahang" lowers our dependence on commercially produced decomposers."
- "Before IPM, all farmers were planting certified seeds which were unsatisfactory, now we produce our own seeds which have better rates of germination and higher yields."
- "The application of rice-fish practices."

This creativity has led to either decreased costs or increased incomes, while decreasing dependence on others for inputs and meeting daily needs. Included in the examples presented by the team as evidence of this are:

- "IPM and not using pesticide increases our confidence in using rice-fish culture. The fish will be able to survive. This increases our income."
- "Our studies of SRI in which IPM and soil ecology principles are applied show increased yield rates."
- "Using cow urine to control oteng-oteng (a chrysomelidae beetle) in cucumbers and mustard greens has lowered production costs."
- "Composting of cheap and available organic materials to produce organic fertiliser is a way to overcome the high costs of chemical fertilisers."
- "Producing and using "bio-lahang" lowers our dependence on commercially produced decomposers."

The benefits from IPM activities are not limited to only alumni, but are accessible by all in a village. Examples of this that were pointed out by the team included:

- "Our irrigation ditches were causing problems. For six years in a row, every rainy season there would be flooding. Our group organised activities to lobby local government for repair of the ditches in 1998-1999. These activities resulted in repairs being made (work organised and completed by farmers). The repairs have lowered flooding and fields that once couldn't be planted can now be planted."
- "The use of open land and yards for vegetables and fish ponds. This has lowered dependence on others for vegetables and increased incomes. Many who have not attended an FFS now use these practises. This is just one example of how everyone in a village has access to IPM knowledge."

Produce your own seeds! In the bags are seeds that I have saved. After we studied the problem of seed quality, it turned out that farmers can produce higher quality seeds than we can buy. IPM farmers are not anxious to buy from others. Sakiman Holil

Ibu Uli is collecting rice husks. She uses the rice husks to make compost and she also sells the husks for additional income. Iin Suryanih

This photo shows that composted land is easy to prepare and you can find lots of eels there. The tractor in the picture is working a field that has been heavily composted over several years. The boys are catching eels uncovered by the plough. Sakiman Holil

TIRTA BUMI FARMER STUDY GROUP
Budiasih Village, Cikoneng Sub-district

Yakub Syah, Euis Holisoh, Aleh Soleh and Jarot Indraloka are members of the evaluation team

Our decomposer is made from "lahang" (sugar palm sap), slices of banana tree trunks, and water. Tirta Bumi tested the decomposer against a product called EMBIO, which is quite expensive. Biolahang is the equal of EMBIO. Yakub Syah

During the first workshop, the team developed a "Farmer Poverty Framework" of conditions that they felt arise because one is poor. According to them, poverty leads to:

- Limited opportunities for learning both for children and adults.
- Limited access to a balanced diet.
- Limited scope for work.
- Reduced living conditions.
- Decreased self-regard.
- Increased discrimination.

The framework can be used to determine whether and in what ways Community IPM activities have affected or could affect these conditions. The data show that FSGs and community IPM support a wide variety of activities, from farmer research to advocacy. The data also show how these activities affect the conditions identified in the "Farmer Poverty Framework".

The major conclusion of the evaluation team was that IPM has helped to alleviate poverty in their villages. Besides this major conclusion, the evaluation team concluded that there were some definite benefits in doing this study both for them and potentially for their village:

- "We learned how to use a camera and this is important because we can continue to document the IPM activities in our village."
- "We have analysed and summarised our data and now have a document to show other people in our villages, as well as being able to tell them what we discovered about the impact of IPM."
- "We have been able to discover what is being done in the village because of IPM and can describe the impact of IPM on poverty in the village. This is important for at least two reasons. We can evaluate our activities and improve them. We can raise the awareness of others regarding the importance of IPM in the alleviation of poverty."
- "We understand the characteristics of poverty, its causes, and what arises because of poverty. This will help us to discuss poverty with others and find ways to alleviate poverty."
- "We will be better able to provide leadership in the village related to poverty because the study has motivated us to follow-up on activities that have had the greatest impact on poverty in the village. The study has increased our awareness, confidence and determination."

■

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I took this photo of a goat shed at the edge of the rice field to show how farmers have made it easy to have manure on hand to compost for their fields. Euis Holisoh

The farmer in this picture is watering his plants with a mixture of cow urine and water. Cow urine can keep away hama kutuh daun. Urine replaces pesticide. Aleh Soleh

It used to be that farmers were told what to do by the extension worker. Now we have learned for ourselves how to do such things as reproducing trichoderma. It used to be that only the agriculture department lab made this. Euis Holisoh

By not using pesticides we can create a healthy agro-ecosystem. This makes it possible for farmers to diversify by raising fish in combination with rice or vegetables. Jarot Indraloka

Evaluation in FFS: a burden or a blessing?

Kim Groeneweg and Jorge Chavez Tafur

Looking at the many training and extension programmes currently taking place in the rural areas of Peru, there is not one that does not include the word "evaluation" as one of its activities. On paper, all projects and programmes evaluate many of their activities and resources. In practice, however, the picture is not so clear or straightforward: evaluations are perceived as being very difficult and complex. So much so, that often they simply do not take place.

A short field survey, carried out as part of the FFS process initiated with an FAO IPM-FFS Project in Peru, showed many of the limitations all FFS actors face around the processes of monitoring and evaluations. The following five most significant limitations and difficulties could be identified:

- ***Lack of time and resources*** of FFS facilitators
- ***Lack of ownership*** giving facilitators limited possibility to control and influence the process.
- ***Little experience and capacity*** for monitoring and evaluation, and this experience is limited to the use of quantitative indicators.
- ***Little diffusion or use of what is found*** - evaluation results are seldom published and reports are not distributed.
- ***Negative perception of evaluations*** by field workers who often see them as "control-tools" applied by those in charge.

Trying out PM&E

In this context, the FAO project tried to identify whether and how monitoring and evaluation could become beneficial to FFS trainers and their organizations. It did so by trying out different Participatory Monitoring & Evaluation (PM&E) processes, hoping to throw off the image of evaluation as a burden. PM&E was seen not as a structured set of steps and activities, but rather as a multifunctional toolbox containing guidelines, methods and tools to facilitate participatory assessments, interactions and understanding between the actors involved. In short, the process implemented showed that PM&E is useful to: strengthen institutional involvement; learn and improve performance and link different actors.

A poem presented as part of a final FFS evaluation. Photo: Kim Groeneweg.

Strengthening institutional involvement

The FAO IPM FFS project offered the FFS methodology for potato and cotton cultivation to several institutions, as an alternative to their usual agricultural extension and training activities. However, after a complete training process and implementation phase, many of the decision makers were still not convinced about the effectiveness of the FFS methodology. Many of the "bosses" had very little notion of their field workers' new activity. The achievements of facilitators in their FFS were rarely discussed in staff meetings, neither were they included in the institutions' reports or analyses. Consequently, facilitators received very little assistance from their own institutions.

In order to strengthen the involvement of the whole institution in FFS activities, the project's Board of Directors was asked to evaluate the FFS methodology and to give their opinion on the project's achievements. An evaluation plan was designed jointly with all representatives, requiring their direct involvement in the process. The members of the Board identified their own indicators based on what *they* considered a "good" project should contain. Later, in a full day visit to the field, these Directors implemented their plans, "evaluating" according to their indicators. Returning from the field, they all sat together to analyse and present their results, trying to come to collective conclusions. Their visions, opinions and conclusions were presented the next day to a group of FFS facilitators. This provided an opportunity to exchange perceptions and experiences; to jointly reflect upon the strengths and limitations of the methodology; and to develop a common understanding between decision makers and FFS facilitators.

This brief experience demonstrated that evaluation can be an effective way of provoking interest and involvement, even in those situations where knowledge and interest are initially modest. It showed that actors feel appreciated when their help and opinion is asked for, and moreover, it provided valuable information on the institutions' perceptions, interest and values. After having evaluated the FFS methodology, the members of the Board who participated in the evaluation showed much more interest in and appreciation of the methodology. At the same time, the project workers gained a much better idea of the Board's point of view.

Improving immediate performance

Two main evaluation activities are common to all FFS training processes. The most significant is Agro-Ecosystem Analysis (AESA). This is based on a series of field and crop observations carried out during the whole cropping season. Farmers are trained in various AESA tools, which enable them to make informed decisions on crop management. A second integrated evaluation approach is the "ballot box", an exercise involving tests that measure farmers understanding and abilities before and after an FFS training season. This is usually based on relevant, practical agro-ecology such as crop growth strategies, weeds, insect pests, the damage they cause and their natural enemies.

In both AESA and the "ballot box" exercise, evaluation is considered an essential element for farmer learning. It is accepted that field evaluations improve farmers capacities. So why not utilize evaluation to improve the capacities of facilitators and other actors involved in FFS? This was tried in the context of the IPM-FFS project, with the objective to ensure quality throughout the whole FFS implementation. Evaluation was considered part of a process rather than a separate activity. Facilitators were encouraged to evaluate *every* FFS session, to reflect on their own performance and carefully prepare each new session. In addition, PM&E tools were elaborated to strengthen the analyses of IPM, crop production and experimentation results. This meant focusing on evaluation not only immediately after harvesting, or at the final session of the FFS training process, but at each stage of the training process, as a continuous activity included in each FFS session.

In a short training session on participatory methods, all facilitators designed PM&E plans for their field schools. Each plan identified clear objectives for evaluation, including who should participate and what inputs were required. A set of indicators were selected to be discussed and analysed with the participants, including for example yields, costs, quality of product and the presence of pests. Issues of immediate relevance were discussed in every meeting, such as those related to the facilitator's performance, the topics discussed, the whole learning process and interest showed by participants. Practical methods and tools were also used that could be easily applied in farmer communities such as matrix scoring, role plays, songs, poems, letters and drawings.

Both farmers and trainers expressed their satisfaction at being able to exchange opinions and discuss items of importance in a relaxed and entertaining way. The methods enhanced not only the interactions between facilitators and farmers, but also reinforced the interfaces between farmers themselves. Facilitators emphasised that PM&E improved their relationship with farmers and provided them with valuable feedback. This left them feeling a lot more secure about their performance and motivated to improve their FFS. At the same time, farmers felt appreciated and enjoyed this dynamic way of evaluation.

Linking actors

PM&E tools and methods were also used to create platforms for discussion between the different actors, both to validate the FFS methodology and to stimulate interaction. Various types of workshops were organised with the participation of representatives of the different institutions, facilitators, farmers, and members of the FAO Project.

In every workshop, members of each group were invited to define the most important aspects to be evaluated. This showed clearly that each actor or group of actors had different backgrounds, interests, and expectations, which did not always coincide with the FFS principles. A thorough analysis was needed to gain an understanding of these different backgrounds and objectives, and to determine the type of benefit that the FFS methodology could provide to the specific actor. It was noted that with indicators of their own choosing, each actor found it easier to analyse both the process and the results achieved through the FFS. Farmers appreciated the opportunity to express their opinions, analyse the achievements and limitations of the methodology and identify future plans. These workshops made both the project and actors aware of the different perspectives of those involved, opening a door for increased co-operation and common work.

Participatory Monitoring & Evaluation in the FFS cycle

COMMUNITY AND PARTICIPANT SELECTION

- ▶ Baseline study (needs and problem analysis using PRA tools)
  Mapping of farmers practices provides material for final evaluation
- Introduction of the FFS methodology to the community
- Selection and inscription of participants

PREPARATIONS

- Elaboration of curriculum, official FFS agreement and time-schedule
- Training norms, group forming and identification of role of host team

GETTING STARTED

- ▶ Pre-ballot box test
  Evaluation of participants knowledge, to adapt training and monitor advances
- Analysis and design of FFS
- Analysis of soil health and fertility and selection of seed
- Field preparation
- ▶ Introduction of record keeping for all expenses
  Tool for analysis of field production results (cost-benefit analysis)

IMPLEMENTATION OF FFS TRAINING SESSIONS

- Opening
- Review and evaluation of agreements
- ▶ Agro-ecosystem analysis (AESA)
  Decisions on pest management made based on field evaluations
- Special topic
- Group dynamics and energizers
- Agreements and compromises
- ▶ Evaluation of session
  Decisions on content and process are based on evaluations with all participants and trainers at the end of every FFS session

HARVEST AND ANALYSIS OF FIELD RESULTS

- Analysis of production and ICM
- ▶ Evaluation of FFS process and activities
  Participants develop indicators for analysis of field results, the process and activities,using PRA tools & baseline study data
- ▶ Post-ballot box test
  Final test to assess participants' advances which can provide a basis for planning follow-up activities
- Planning of future activities
- Closing ceremony

Limitations

Various constraints and limitations were also identified in the use of PM&E. First of all, the methodology is relatively unknown, and it usually requires those involved to change some of their attitudes. Undoubtedly, this also means changes in the institutional policies and M&E methods and tools currently applied, something that is not likely to happen overnight. It should be mentioned, however, that within the existing systems there are many possibilities for this approach, as more and more development organisations and fieldworkers share a positive view and express a need for *participatory* methodologies.

A recurring problem is that few facilitators have the necessary skills. Therefore, intensive training is recommended in rapid and practical methods and tools for PM&E. Assistance is also required for strategic planning to develop location- and actor-specific PM&E mechanisms. Considering FFS practitioners lack of time and resources, development of easy, fast, dynamic, time and cost-effective PM&E methods is necessary.

Conclusions

The activities implemented showed that PM&E enhances involvement by inviting key actors to evaluate activities, leading to an increased sense of ownership. PM&E activities strengthen participation, raise awareness of the current situation, and enhance the willingness to continue participating. They encourage dialogue and motivate actors to look closely at the situation and develop an opinion. Interaction and understanding between the different actors is stimulated through the creation of platforms for dialogue.

As with other kinds of evaluation, time and resources are limited. There is still, therefore, a need for simple and fast methods, and specific training programmes are required. PM&E requires clear and well-defined objectives to avoid unnecessary and ineffective work, which, not surprisingly, is perceived as a heavy burden. Efforts should be made to include evaluations as an integral part of FFS implementation, rather than a separate activity.

PM&E encourages learning, as it generates feedback and self-reflection. It motivates FFS facilitators and farmers to improve their activities and skills because they themselves identify what is achieved. They become aware of their own strengths and weaknesses, and of the results of their actions. Hence, PM&E enhances peoples self-esteem, confidence and motivation to improve their activities undertaken. In contrast to conventional evaluations, PM&E has the *power to empower*.

■

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Women farmers learning how to measure trees. Photo: Hukum Singh

Community forest management and FFS

Hukum Singh

Sharada Devi forest has been protected and used by local communities under community forestry arrangements since the 1980s. Here, as in many other parts of Nepal, the rights and responsibilities for forest resource management have been successfully transferred to the local Forest User Group (FUG). However, although the condition of both forest and water resources have visibly improved under these arrangements, the flow of products from the community forest is far below its capacity for sustainable production. Community forestry has succeeded in protecting the forest, but has failed to provide the expected benefits to users. The main reasons for this are a tendency to over protect community forests, and a lack of forest management support to the FUGs. Recent initiatives to set up Farmers Forest Management Schools (FFMSs) have attempted to address these issues.

What are Farmers Forest Management Schools?

Farmers Forest Management Schools (FFMS) are fora for group learning. The FFMS aim to add value to community forestry practices by developing ways of managing the forest to ensure that it yields substantial benefits to its users. FFMSs bring farmer users and forest management practitioners together to explore ways of combining the principals of formal forestry science and technical forest management with local community experience and knowledge. Together, they are able to develop methodologies for active management of community forest areas. Through training and joint action, the formal science of the facilitator and the knowledge of local farmers interface to become a new body of knowledge. With these insights, FFMS can facilitate a process of negotiation that can result in new plans and principals for forest management (see table p. 14).

Sharada Devi Forest User Group

The case of the Sharada Devi Forest User Group illustrates one set of experiences in integrating FFMS into community forest practices. The Sharada Devi FUG is located in the middle hill district of Kabhre Palanchok, about 25 km east of Kathmandu, at an elevation of 1500m. The FUG had been registered with the District Forest Office since 1993 and has been granted authority to manage the forest. Prior to this, community forestry practice was based on traditional institutional arrangements.

The Sharada Devi community forest covers about 44 hectares. It lies above the village and consists mainly of *Schima castanopsis* (Katus-Chilaune) forest. The principal tree species are *Schima wallichii* (Chilaune), *Castanopsis tribuloides* (Musure Katus) and *Myrica esculenta* (Kafal). The forest is mostly at a young stage with vigorously growing saplings. However, in terms of stocking levels and volume of timber, it is in a moderate to poor condition.

Most of the 152 households affiliated to the Sharada Devi FUG are farm households but some farmers also have off-farm employment and businesses. Most households depend directly on drinking water sources found in the forest area. Local people have observed that both the forest and the water sources have improved since they were formally handed over to the community.

The FUG in Sharada Devi is represented by an elected executive committee consisting of 13 members, including two women. Negotiations and compromise among village-level political parties has resulted in all major political parties being represented on the committee. The only group without representation are the lowest caste, the Dalits.

Piloting FFMS in Sharada Devi

The idea of using the FFMS approach originated during a national level training workshop for forest rangers and project staff organised by the Regional Community Forestry Training Centre (RECOFTC).

Good training is an important aspect of FFMS, and therefore capacity-building for facilitators and selected users from the FUGs was the first step. A training workshop was organised for 16 men and women from the FUG who were interested in taking part. Facilitation training for the FFMS was carried out through a process of questioning, brainstorming and field practice, and included the development of action plans.

Consultations then took place with the FUG committee, and an informal FFMS group was established.

With help from the Nepal-Australia Community Resource Management Project (NACRMP) and RECOFTC, the FFMS began to experiment with different silviculture options. Three trial plots were established and the way the forest regenerated under various thinning intensities was observed and analysed. The trials had three specific objectives. First, to establish an appropriate cutting regime and determine how frequently, when and with what intensity *Schima-Castanopsis* forest should be harvested in order to maximise fuel wood production. Second, to demonstrate the effects of different forestry management practices to FUG households and third, to introduce FUG members to innovative forest management practices.

As data became available, project staff helped those involved in the experiment to record their results in a register (see box). Although this way of recording data and assessing results was foreign to most households in the FUG, they were also able to observe directly the effects of different treatments on the experimental plots.

Some findings of the FFMS trials in the Sharada Devi Forest

- Farmers observed that tree growth in the coppice system (vegetative re-growth from tree stumps) was many times better than in control (protection only) systems.
- Kali Mayal had the fastest growth rate, followed by Musure Katus, Chilaune, Kafal and Phalaat.
- Musure Katus had the highest vigour in terms of capacity to produce the maximum number of shoots.
- Musure Katus grew better in a coppice under a standard system than in a coppice with clear felling. Chilaune performed well in a coppice where there was a clear felling system. Phalaat performed equally in both systems.
- The shorter the stump height, the better the health and growth of coppice shoots.
- The appropriate girth size (or circumference) of the stump was between 25 cm and 50 cm for all species.

Positive impact

The men and women taking part in the FFMS reported that the most successful part of the programme had been the collection of data on forest growth. Working closely together, they observed the rate of growth of different species of trees, analysed the data and verbally presented the results of what they had learned to the members of the FUG Committee. The group assemblies were used to inform other members of the FUG how experiments were progressing.

During the trials, many non-FFMS members passed by the experimental plots to see what was going on. Some of those who had initially criticised FFMS participants for destroying the forest in the name of their experiments later made it clear they valued the results, and suggested that other trial plots should be established to investigate other aspects of forest management. During the trials, the FFMS participants carried out most of the activities. Project staff provided support during the application of different treatments, and when measurements and data analysis were being carried out.

The results of the Sharada Devi FUG FFMS trials provided the group with information relevant to the development of appropriate community forest management practices for their region.

However, despite farmer enthusiasm for the trials, there are very real challenges when it comes to translating the results into practice. Although RECOFTC and some of its collaborators have clear objectives as far as FFMS are concerned, the continuation of the FFMS process is far from certain once project staff have withdrawn their support. Although the Sharada Devi FUG trial plots indicated ways in which the availability of fuel wood could be maximised, these insights have yet to be incorporated into the formally approved forest management operational plan for the FUG.

Challenges

The value and innovative aspects of the FFMS have been acknowledged, and to some extent absorbed by some of the participants and service providers in experiments such as those conducted in Sharada Devi. In practice, however, the full

Potential added value of the FFMS to Community Forestry (CF)

Elements	Current practice of CF	Possible added value to CF
Regime type	Protection only	Sustainable production
Management Objective	Subsistence – fulfilment of basic needs	Considers both subsistence and commercial production of forest products
Management mode	Passive management, focusing on selection felling of dead, diseased and dying trees	Active management, focusing on timber and non-timber forest products
Source of knowledge and technology	Based on farmers experience and local knowledge	Both local knowledge and formal forestry knowledge
Emphasis on communication	Among community members only	Between community members and outsiders
Model of Technology Transfer	Training, publications, extension materials	Demonstration, observation, memory, verbal
Main role of facilitator	Capacity building of local institutions	Capacity building of local institutions, and also facilitators' own capacity building working together with communities
Who is involved?	Committee & local elites	Committee, user groups, facilitators & community
Who generates the technical information?	Outsider facilitators, forest technicians and professionals	Facilitators and users together
Who implements the programme?	Facilitators train the users, and users implement programme	Both facilitators and users learn together and users implement the programme
Who monitors the programme?	Service providers	Both users and service providers

potential of the approach has yet to materialise. Following are some of the challenges that can be identified from the experiences of the Sharada Devi FUG in implementing FFMS.

First, the on-site training was conducted by outsiders and little attention was given to strengthening the FUG itself. Project staff from RECOFTC were required to train under-paid and overburdened middle-level managers in the skills they needed to facilitate the FFMS process. However, creating new knowledge and developing good facilitation skills does not necessarily mean that these managers will provide the sort of support a community needs to manage its forest resources in a sustainable way. In addition, not all facilitators will be equally effective, and some will be more committed to setting up FFMS sites than others. This means that the process of developing a methodology for forest management using the FFMS approach must take into account the need to strengthen the capacity of local institutions such as the FUGs, and the need to ensure that appropriate institutional changes take place at government level.

Second, a broader uptake of the FFMS approach has been hindered by a lack of information. Currently, information and publications on the FFMS training approach, methods and process is limited and only accessible to very few people, even at the level of service providers such as the District Forestry Office. In addition, most of the literature on FFMS is published in English. Access to this type of information is therefore limited to those in donor-funded organisations who can read and write English. Equally important, no materials have been developed so far for illiterate community members.

Third, very little attention has been given to organised training, demonstrations and exposure visits on FFMS for community members. In those FUGs where FFMS are being initiated, very few people are actually involved in planning, designing and implementing FFMS. Those who are involved are usually committee members or persons selected by the committee. The majority of FUG members do not know how selections are made, what an FFMS is or what it is designed to do.

Finally, social issues including the exclusion of the Dalits and women from FUGs and FFMSs needs to be adequately addressed. The issue of social exclusion has been raised by many different development organisations, and is discussed during facilitator training. In practice, however, Dalits and women are still excluded in many cases. This implies that they are excluded from planning how forest products should be extracted, setting prices, and deciding when to harvest and how the harvest should be distributed. In defence of the FFMS, it has been argued that the FFMS in Nepal is still a pilot programme, and that marginal groups can be included later when the programme is better established.

Opportunities

Despite the challenges mentioned above, the experiences of the Sharada Devi FFMS also show that FFMS have had a positive impact, and that there are opportunities for developing the approach further.

The need for a production-oriented regime is now widely accepted among professionals and community members, and there is a consensus that the current focus on forest protection should be changed to one of active management. Some FUGs have begun to manage their forests in order to optimise their productive capacity. Visits by FUGs and professionals to FFMS sites have resulted in FFMS being facilitated in an increasing number of areas. Lessons continue to be learned from those sites where FFMS are more established.

There is considerable donor support for community forestry projects in almost every district in the hills and also in some districts in the Terai region. This means there are human and financial resources available to carry out forest management activities so that the condition of the forest resources, and the people who depend on them, can be improved. More than 11000 FUGs have been established throughout Nepal, and many of them are functioning well and are willing to adapt to active forest management. There is also an enabling policy environment. Community forestry legislation is in place and FUGs have their own operational plan that allows them to carry out harvesting operations and to market forest products themselves.

A Forest User Group harvesting their forest. Photo: Hukum Singh

Conclusion

Experience has shown that during the process of developing the concept of FFMS, a number of basic challenges must be faced. Facilitators must have enough institutional and organisational support to enable them to work consistently and effectively. Also, fundamental issues such as appropriate follow-up training, and making forestry officials in general more aware of the potential of FFMS, must be dealt with, as well as constraints of time and finance that can inhibit facilitator effectiveness. On another level, the policy and legislative environment and current practices – including procedures for drawing up and ensuring compliance with operational plans for timber production – must all be taken into account when new approaches are being negotiated.

Today, in addition to the District Forest Offices, there are many service-providing organisations, including bilateral projects, NGOs, local organisations and the FUG federation, who are willing to support the community forestry programme. Synergies between their competencies, roles and responsibilities can be utilised to convert the current protection-oriented regime of the community forests into a sustainable production regime. FFMSs have a role to play in this process, as the Sharada Devi experience has shown. ■

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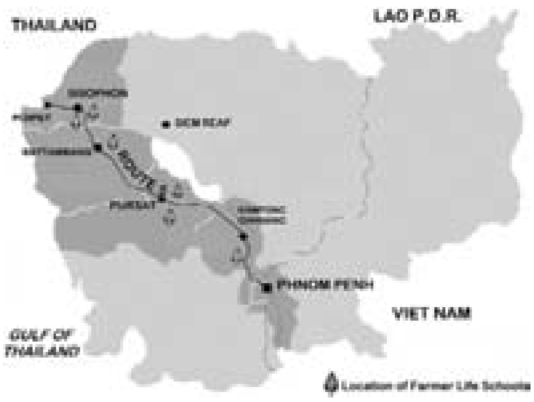
Farmer Life Schools in Cambodia

Polo Yech

National Route 5 in Cambodia is part of the Trans-Asia highway linking India, Thailand, Cambodia and Vietnam. Since the border between Thailand and Cambodia reopened in 1998, traffic and cross-border trade has increased rapidly, along with a corresponding increase in the mobility of people along its route. The highway is being upgraded to further increase the flow of goods, services and people. Unfortunately, as the movement of people along the route increases, so does the spread of HIV/AIDS.

Cambodia is one of the major centres of HIV/AIDS infections in South-east Asia. The epidemic is having a devastating effect on rural populations that already live in poor conditions. In addition, the situation has created a population highly vulnerable to diseases such as HIV/AIDS. HIV can develop rapidly.

To tackle the rapid spread of HIV/AIDS, and the increasing vulnerability of the rural population to chronic illnesses, the UNDP South-east Asian HIV Programme and the FAO Community Integrated Pest Management programme decided to develop a pilot programme based on Farmer Field School community strategies. The learning principles and processes of IPM FFS were successfully applied to HIV/AIDS work, and they are now being used to strengthen the resilience of farming communities to HIV/AIDS through “Farmer Life Schools” (FLS). Importantly, FLS are organised through a network of farmers who have completed IPM FFS, and who are motivated to work on other issues affecting their livelihood.



Location of Farmer Life Schools along Route 5.

Empowering communities

The goal of FLS is the mobilisation and empowerment of farming communities to reduce vulnerability to HIV/AIDS and other threats to people’s livelihoods. Health issues are approached in a holistic way - HIV/AIDS is seen as only one part of the issue of chronic illnesses that affect farming families in the region.

FLS aim to:

- Strengthen farmers understanding of how their socio-economic vulnerability leads to risk-taking behaviour;
- Prevent adverse social and economic effects from HIV/AIDS and other threats in farming communities in the project areas; and
- Establish a farmer network to better address local issues in the interests of sustainable farm livelihoods.

From FFS to FLS

IPM FFSs are potentially an excellent entry point for a wide range of community development activities. The discovery-based learning approaches applied in FFS can help farmers to gain a deep understanding of ecological concepts, as well as their practical applications. This approach to identifying problems and alternatives for solutions has been developed to help understand the agro-ecological principles underlying IPM. However, the same processes can be easily translated to HIV/AIDS and other livelihood issues. FLS approaches help to develop farmers critical thinking on the relationships between human behaviour and important livelihood issues, much like the study of field ecology helps to understand relationships between plants and the other organisms which affect their growth.

Farmer Field School	→	Farmer Life School
Crop Ecology	→	Human Ecology
Integrated Pest Management	→	Integrated Livelihood Management

From Farmer Field Schools to Farmer Life Schools

What is a Farmer Life School?

Farmer Life Schools are based on a non-formal, experiential learning process, similar to the FFS. Often, the FLS is a natural follow-on activity from a previous IPM FFS. A FLS consists of a group of about 20-25 farmers who meet somewhere in the village, one morning a week for 18 weeks.

The curriculum design of the FLS follows the same general processes used in the ecology-based FFS, but with a different content. While the main learning context in an FFS is the field, the FLS is based in the community, addressing the complex range of issues related to farmers livelihoods. Each weekly meeting consists of a defined set of activities: Human Ecosystem Analysis (HESA), presentation of the HESA, a special topic and group dynamics.

Human Ecosystem Analysis

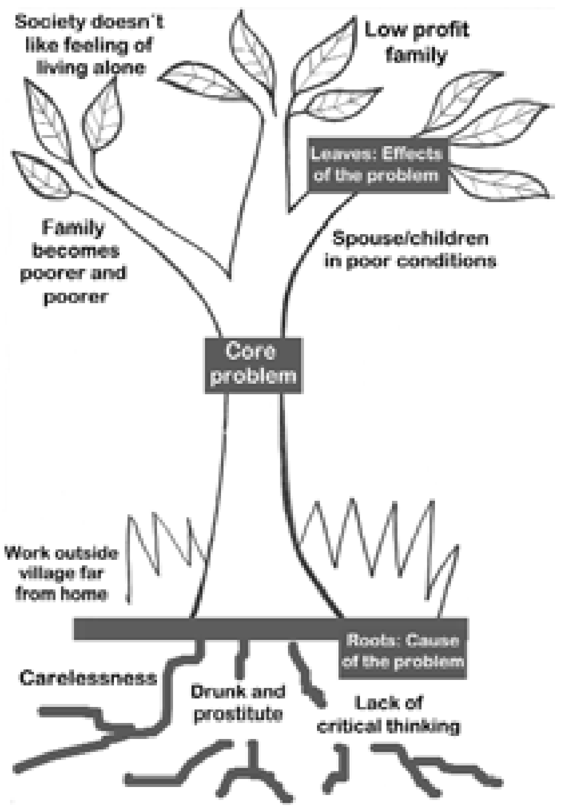
In FFS, farmers learn through the process of Agro-Ecosystem Analysis (AESA) and field experiments. It is a discovery-based learning method using field observations, discussions, and analysis, sharing among different groups and making appropriate decisions to manage their crops better.

Human Ecosystem Analysis is a similar process developed for the FLS, and it is used during each weekly meeting. In HESA, the farmers research issues related to their daily lives. They prioritise issues and select families for further investigation in smaller groups. They share their findings and select topics to study in-depth to achieve a more holistic understanding of the way people live and the factors that contribute to or detract from a healthy life. From this, they can make decisions on how best to eliminate risky behaviour (in the case of HIV/AIDS) or other threats, and adjust their lives so they are healthier and more peaceful. The HESA process is used as a basis for group discussion and decision-making as well as individual decision-making. Discussions identify factors that support or do not support positive behaviour and usually include topics in six categories: health, family economy, family education, social relationships, environment, and culture. The topics selected for discussion during the HESA process depend on the farmer's needs and interests.

An important HESA process is the observation and interviewing of selected families within the community. Usually, three families are identified for further investigation of each issue raised by the group. Participants are divided into three smaller groups to observe and discuss these issues with each of the three families. They try to help understand the root causes of the issues being examined, as well as their present and future impacts on the family. Farmers use a problem tree method to discuss and analyse issues. They then discuss what alternatives are available to resolve the problems faced by the families. Farmer Trainers play a key role in facilitating this process, and provide appropriate inputs/suggestions to the person interviewed to improve his or her life situation. No specialists or experts are involved to offer solutions or strategies.

After each group has compiled their findings and drawn their conclusions, they make presentations and share them with other groups. Then they discuss together to compare the root causes and the impacts of each issue on the different families. The interviewees are informed of the discussions and suggestions of the group.

The HESA promotes learning, critical thinking and analysis by farmers of real life situations in their own communities. They learn from the different lives and experiences of people in their community, and use this knowledge to help strengthen the livelihoods of other families. Through improved understanding of how various factors impact upon their lives, they become willing to make changes to reduce risky behaviour which might lead to chronic diseases such as HIV/AIDS, and plan to achieve healthier and more peaceful lives.



Copy of a problem tree analysis used during the HESA process of a FLS.

Special topics

After the presentation of the HESA, farmer participants discuss and select topics for further investigation and study. The topics can include health, problem cycles, ageing, human needs, daily behaviour of farmers, resources in the community, life skills, communication related to farmers living in the community, farming, marketing, and other social issues. These topics contribute to increasing farmers knowledge, awareness and realisation of what they need to do to improve their livelihoods. Group dynamics activities are also included in the curriculum to help participants relax and develop closer trust and friendship.

Follow-up activities

The end of the FLS is not the end of the learning process. Farmers need to continue to increase their knowledge and the capacity gained from the FLS. After the FLS, the graduated farmers and farmer trainers still meet regularly to discuss and review the decisions and the action plans they have developed. They discuss future plans to improve their life skills related to health and agriculture. They often initiate training or exchange visits, or start farmer groups or associations to build their networking capacity and help reduce poverty.

Impacts

Some of the impacts from FLS include:

- Farmers develop the ability to identify and analyse issues facing their communities, including the threat of HIV/AIDS.
- Farmers become aware of the possible consequences of risk-taking behaviour related to HIV/AIDS infection and other public health threats. This leads to a reduction in risk-taking behaviour.
- Farmers become trained and develop skills in leadership, networking, training, planning and organisation, to the benefit of their communities.
- Farmers initiate activities to help their communities after the FLS. Examples include the establishment of self-help groups or farmer associations (e.g. savings account, research group on rice, vegetables or animal rearing).

Important lessons learnt

FLS provides farmers with an opportunity to learn in a way that relates directly to their own lives.

They help farmers to become more positive towards change, to express their feelings and to share experiences with each other. Before the FLS they always felt shy and kept problems to themselves. They never discussed these with others, not even with their family members.

The FLS helps farmers to form an informal network with its own identity - an identity they create themselves. These activities will become increasingly important in the future fight against poverty, HIV/AIDS and other social problems affecting their communities.

They also provide farmers with the chance to take charge of their futures, rather than waiting passively for help from outsiders once a threat has arrived.

Farmer Life Schools are making a valuable contribution to the sustainable livelihoods of rural communities.

■

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Field schools for Kenyan dairy farmers

B. Minjauw, H.G. Muriuki and D. Romney

In the Central and Rift Valley Provinces of Kenya, approximately 90% of rural households are agricultural and of these, 73% have dairy cattle. Studies in Rift Valley Province have shown that smallholder farmers consider the major constraints to increased dairy production to be endemic diseases, particularly tick-borne diseases (TBD), and inadequate supplies of feed resources.

Currently, over 1000 Farmer Field Schools (FFS) on integrated pest management (IPM) and/or integrated soil management are being successfully implemented in Kenya - and many more in Africa as a whole. Can the FFS methodology be developed for similarly complex issues like animal production and health, where responses to interventions may not be as fast?

A sub-group prepares their AESA presentation. Photo: Bruno Minjauw

In 2001, the DFID/FAO project on Farmer Field Schools for livestock began adapting and testing the FFS methodology for animal health and production, focusing on smallholder dairy farmers. Ten pilot FFS have been established in five different agro-ecological zones in Central, Rift Valley and Coastal Provinces of Kenya. In implementing these FFS, Agro-Ecosystem Analysis (AESA, see Gallagher page 5) is adapted to make animals the focal point, and participatory technology development (PTD) techniques are utilised to address livestock-related issues. The project is also developing approaches and methods to test and introduce integrated methods to control tick-borne diseases and helminth infections, and to improve animal husbandry practices and the efficiency of utilisation of available feed resources within the crop-dairy system. These activities contribute to the ongoing DFID Smallholder Dairy Project (SDP).

Initiating FFS for livestock

All facilitators were trained during a two-week training of trainers (TOT) course. This was run as a learning workshop, where participants learned the basic principles of the FFS and at the same time used them to develop specific examples of activities, tools and techniques suitable for smallholder dairy production systems.

Facilitators trained in FFS approaches worked with established groups to prioritise the main constraints to improving the efficiency of milk production, using participatory techniques (pair-wise and matrix ranking). Issues highlighted for all groups were similar and included, in order of priority: 1) feeding strategies; 2) fodder establishment and conservation; 3) calf rearing and mortality; 4) diseases (tick-borne and mastitis); and 5) water management and breeding. Equal priority was given to the last two issues. Based on the results of this exercise, individual grant proposals were prepared by each group, including a detailed work plan with a corresponding budget.

A grant of US$600 was deposited in an account controlled by elected members of the FFS group to cover the cost of field activities and the cost of facilitation (the transport and lunch allowances for the extension worker). Management of this budget empowered the farmers to control activities covered by the FFS and ensured that the extension services offered responded to farmers actual priority problems and needs. The FFS groups usually meet on a weekly basis, but some vary their frequency to once every two weeks. The main participatory techniques used, including Agro-Ecosystem Analysis and Participatory Technology Development, were adapted to suit the specific needs of learning about livestock issues. For livestock FFS, understanding the impact of animal health on productivity and how to control disease occurrence, is of major importance.

Activities

Since the main objective of the FFS is to develop farmers learning skills, rather than to increase knowledge on a particular technical issue, record keeping and accurate observation are important components. Agro-ecosystem analysis is designed to improve observation skills and to develop decision-making skills, and this technique is utilised to record and observe the results of the PTD experiments. This observation process forms the basis for understanding the interactions between livestock and other elements of the ecosystem, as they relate to the problem or technology being studied. For example, where the subject is expected to have a direct outcome on the animal, such as a feeding or health management practice, the AESA is focused on the animal.

Measuring girth for the evaluation of body life weight. Photo: Bruno Minjauw

In practice, farmers are divided into small groups and they observe an animal from one of their farms. Observations are guided by a checklist that includes general information such as the life history of the animal, parameters defining the level of production, and observations describing the health status of the animal. Each group presents their results in a standardised format

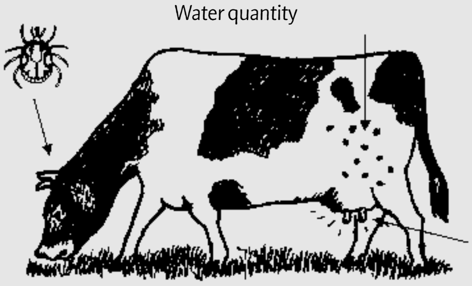
Aesa number
Week/date
Sub-group name

GENERAL INFORMATION
Breed
Name/tag
Sire name and breed
Dam name and breed
Date of birth and
Age
Time of observation
Weather condition
Last treatment: date and drug used

OBSERVATIONS
Hair/coat
Body condition
Rumination
Respiration
Temperature
Ecto-parasites
Discharges
Dung
Urine
Wounds
Movement/temperament
Eyes condition
Mucus membrane colour
Lymph nodes
Housing and shading conditions
Presence of other animal/insects
Noises

PARAMETERS
Body weight
Last weight
Weight gain:
Daily milk yield
Milk yield status: (improving or decreasing)
Number of calves
Date of serving
Date last calving
Pregnancy status
Calving interval

Feed quality
Feed quantity
Supplement
Water quality
Water quantity



RECOMMENDATIONS
How to improve the AESA records
- Parameter to be included
- Quality of observation

What needs to be done to improve productivity?

Which treatment should be used?

Example format for the AESA in Dairy FFS.

to the rest of the school. These findings are then discussed, allowing farmer-to-farmer information dissemination as well as an evaluation of progress.

The establishment of the PTD process is one of the biggest challenges in livestock FFS. Indeed, while it is relatively easy to design a comparative study for integrated pest management in crops, the high economic value of cattle does not permit experiments that might involve any risk or even short-term losses in animal productivity. Therefore, one of the objectives of the on-going livestock FFS project is to establish the kind of technology development that can be performed without any risk or detrimental effect, while still allowing farmers to experiment with new technologies. Three types of "PTDs" have emerged from on-going activities:

1) Classical experiments: Although livestock are the focus of livestock FFS, many of the activities of the livestock keeper are crop-related. This is particularly the case for fodder production and grazing improvement. "PTDs" include:
- Establishing alternative sources of fodder. A range of fodders are planted using different planting methods, treatments and/or different fertiliser regimes.
- Preservation of fodder using different techniques such as silage making and a box baler for hay.

2) Comparison of existing farmer practices: Observation and evaluation of the different practices of farmers, within and outside the FFS group, provides the opportunity for farmers to address issues that do not lend themselves to experimentation because of the high risk in terms of animal well-being or high costs for implementing the experiment. Examples include:
- Tick control: comparison of efficacy of different acaricides and/or of different application regimes.
- Vaccination efficacy: comparison of disease incidence in immunised and non-immunised animals
- Comparison of milk quality and losses due to milk spoilage in relation to the quality of the milk parlour infrastructure.

3) Ex-post analysis: In ex-post analysis, farmers compare actual experimental results with practices that were used before. Results may be quantitative, if records are available from the past or from similar situations, or qualitative, where farmer perceptions are evaluated. This also includes the "Stop and Go" method, where the treatment is stopped and re-introduced several times to show its effect, using an animal as its own control. Examples include:
- Water availability: the amount of water available to the dairy animal is changed according to the calculated needs. Milk production using the new regime is compared with previous records of production using the old regime.
- Genetic material: artificial insemination is used to compare calf birth weight with other calves or with expected weight.
- Prophylactic programme: a programme of preventive treatment is applied to a group of cattle and their performance is compared with previous productivity and with neighbouring herds. This could include de-worming, a trypanocide and/or vaccination against prevalent diseases.

Presentation during a field day of fodder conservation techniques. Photo: Bruno Minjauw

Not every problem can be easily dealt with using a "learning by doing" approach. Some problems, such as those relating to contagious diseases, for example, are not suitable or too dangerous for experimentation. Others may be too abstract to be demonstrated physically, such as the importance of epidemiological status or immunological reactions, and these can be addressed in special topic sessions where issues are discussed. Since the facilitator cannot be an expert in every subject, he or she will help the farmer group to invite the right person to talk about the subject chosen by the farmers. This empowers the FFS group to contact other organisations such as NGOs or national or international research institutes. Special topics can also include livestock and non-livestock related issues, giving farmers the chance to access the information that addresses their priorities at a particular moment. For example, talking to the community about trypanosomiasis when the village is threatened with a cholera outbreak is unlikely to be addressing a priority issue. Advice about cholera control will certainly be more relevant.

Conclusions

If scientific research is to achieve a real impact on farm productivity and livelihoods, new methodologies for dissemination of information have to be developed. Participatory approaches, which facilitate farmer demand for knowledge, give them the opportunity to choose, test and adapt technologies according to their needs. Through participation in FFS, farmers develop skills that allow them to analyse their own situation and adapt to changing circumstances. The ILRI livestock FFS project, funded by the DFID Animal Health Programme, is testing and adapting a participatory method to create a sustainable relation between farmers, extension officers and research institutes. These relationships are thought to be a fundamental tool, allowing scientists to collect appropriate data and to transform developed technologies into products adapted to farmers needs.

Using the FFS approach, the project is developing an innovative process through which farmers adapt existing technologies and try out new ideas. These ideas are developed through interactions between farmers, scientists and extension workers. This unique relationship is an excellent platform for epidemiological studies using participatory methods, to disseminate information on disease prevalence, to design relevant participatory technology development, and to introduce more successful disease surveillance and control strategies.

Recording general information for the AESA. Photo: Bruno Minjauw

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PTD practitioners: back to school?

Rik Thijssen

Farmer Field Schools (FFS) and Participatory Technology Development (PTD) are both participatory approaches for promoting sustainable agricultural development. They both work towards improving farmer decision-making capacity and stimulating local innovation. But what are the differences? Are these approaches overlapping or complementary? And what can they learn from one another?

FFS were developed in the late 1980s to train Indonesian rice farmers on integrated pest management (IPM). They were developed in response to the Green Revolution. The aim was to re-educate farmers in agro-ecology and develop their critical thinking, based on the knowledge already available about rice ecosystems. Farmer field schools focused on bringing this knowledge and understanding to farmers through group learning, based on adult education principles.

PTD was also developed in the late 1980s. The concept arose out of the ideas and "best practices" of small NGOs and the farming systems research and extension movement. PTD refers to a process of joint experimentation by development workers and farmers. The aim is to combine the best of local and external knowledge, and work together to generate and disseminate agricultural innovations.

Connecting and expanding knowledge

During an ethno-botanical study in Taropo Village on Sumbawa Island in Indonesia, a local farmer explained about a plant species known as "pupuk" (fertiliser). As he pulled out the small, clearly leguminous shrub, the many root nodules were very evident. The study team asked the farmer why this plant was named "pupuk". He said that "pupuk" had the ability to improve soil fertility and this species was, therefore, valued during fallow periods. We also checked with this farmer if he knew what the function of the root-nodules was. Without any hesitation, he claimed that they were for water storage. Small farmers possess a good deal of wisdom and experience, with which they manage to survive and produce for their families. But they do not know all of the components and processes that play key roles in agro-ecosystems.

What would be the added value if the farmer from Taropo Village knew about the nitrogen-fixing capacity of root nodules of "pupuk"? First, it validates the local observation that this plant species can play a role in soil fertility improvement. It could also provide the farmer with information that explains other indigenous knowledge held by the community, or contradicts certain local beliefs. Farmers could, for instance, draw a link to other species with root nodules, and thus widen the range of locally available species with potential for soil fertility improvement. The monitoring aspect of FFS, using indicators, could provoke some comparative studies, where farmers evaluate the real potential of different species. Finally, based on an increased awareness and understanding of a phenomena that is not obvious or easily observable, a farmer like the one from Taropo Village could become a valuable contributor to a team working on agricultural technology development.

Contrasting elements

PTD activities include:

- Critical analysis of community-managed changes in the agro-ecosystem;
- Identification and use of indigenous technical knowledge;
- Reconstruction of successful local innovation;
- Self-organisation and
- Self-implementation of systematic experiments.

These can sometimes be difficult to accommodate in the FFS setting. This is mainly because of the creative limitations of a "school" set-up, and the time limits on FFS imposed by a project approach. Not least, limitations are imposed by the attitude of many FFS-facilitators: they can be teachers, but they are not necessarily capable facilitators of a participatory approach, as intended in the PTD philosophy.

The crucial contrasting elements between the two approaches - FFS and PTD - could be summarised as follows:

- *Perception of "participation"*: while PTD promotes a bottom-up learning environment based on indigenous knowledge, FFS provide a more traditional teacher-student setting for learning about knowledge held by outsiders.
- *Attitudinal changes*: where PTD seeks major changes in attitudes of researchers and extensionists, FFS could be seen as the most effective way to accommodate the existing attitudes of these professionals.
- *The learning process*: although both approaches are largely based on self-discovery activities, FFS set "fixed" learning targets, while PTD is an open-ended process.

Conclusion

Clearly, the basic concepts of the two approaches are complementary, and the FFS approach provides fertile grounds for PTD. It is, however, important to distinguish between enhancing the basic knowledge of farmers so that they can experiment according to their specific circumstances (FFS), and agricultural technology development by or with farmers (PTD).

FFSs fill gaps in local knowledge, conduct holistic research on agro-ecosystems, and increase awareness and understanding of phenomena that are not obvious or easily observable. Their strength lies in increasing farmers skills as agro-ecosystem managers. The strength of the PTD-platforms lies in their systematic evaluation of locally acceptable, technological alternatives, as well as their ability to influence the research agendas of formal research and extension systems.

Growing interest in both FFS and PTD by a wide range of financing and implementing organisations reflects an underlying perception that they form viable new alternatives. Both approaches will evolve further, and their development should be carefully managed so as to draw on their underlying synergy. In order to fill the basic knowledge gaps that still exist, PTD groups can borrow from the FFS principle of educating farmers on agro-ecological components, patterns and processes. In turn, FFSs should pay more attention to revising the attitudes of agricultural development professionals to enable them to become more involved in PTD work.

■

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A full version of this paper is available at www.eseap.cipotato.org/upward

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An Indonesian training coordinator demonstrating techniques for catching insects during a lesson on IPM in Gambia. Photo: FAO/A. Proto

Fundamental Elements of a Farmer Field School

Kevin Gallagher

In general, Farmer Field Schools (FFS) consist of groups of people with a common interest, who get together on a regular basis to study the "*how and why*" of a particular topic. The topics covered can vary considerably - from IPM, organic agriculture, animal husbandry, and soil husbandry, to income-generating activities such as handicrafts. FFS are comparable to programmes such as Study Circles, religious studies at a church, mosque or temple, or specialised study programmes for any skill. The FFS, however, are particularly adapted to field study, where specific hands-on management skills and conceptual understanding is required.

So what are the essential elements of a FFS? Below is a list of elements that commonly appear in successful FFS programmes:

The group

A group of people with a common interest form the core of the FFS. The group may be mixed with men and women together, or separated, depending on culture and topic. The group could be an established one, such as a self-help, women's, or youth group. Participatory technology groups, for example, sometimes undertake a season of study in FFSs before starting their research. The FFS tends to strengthen existing groups or may lead to the formation of new groups. Some FFS groups do not continue after the study period. The FFS is not developed with the intention of creating a long-term organisation - although it often becomes one.

The field

FFSs are about practical, hands-on topics. Study Circles and other study methods do not take place in the field, as they are about more theoretical topics. In the FFS, the field is the teacher, and it provides most of the training materials like plants, pests and real problems. Any new "language" learned in the course of study can be applied directly to real objects, and local names can be used and agreed on. Farmers are usually much more comfortable in field situations than in classrooms. In most cases, communities can provide a study site with a shaded area for follow-up discussions.

The facilitator

Each FFS needs a technically competent facilitator to lead members through the hands-on exercises. There is no lecturing involved, so the facilitator can be an extension officer or a Farmer Field School graduate. Extension officers with different organisational backgrounds, for example government, NGOs and private companies, have all been involved in FFS. In most programmes, a key objective is to move towards farmer facilitators, because they are often better facilitators than outside extension staff - they know the community and its members, speak a similar language, are recognised by members as colleagues, and know the area well. From a financial perspective, farmer facilitators require less transport and other financial support than formal extensionists. They can also operate more independently (and therefore cheaply), outside formal hierarchical structures.

All facilitators need training. Extension facilitators need season-long training to (re)learn facilitation skills, learn to grow crops with their own hands, and develop management skills such as fund-raising and development of local programmes. Computer literacy is often included in the training of facilitators, especially for preparing local training materials, budgets and project proposals. Email is also becoming more widely available. Once the facilitators have completed their training and are leading the FFS process, it is easy to identify capable farmers who are interested in becoming facilitators. Farmer Field School graduates are usually given special farmer facilitator training (10-14 days) to improve technical, facilitation and organisational skills.

A typical FFS session in the original Indonesian setting

8:00	Opening (often with prayer) Attendance call Day's briefing of activities Stretching exercises
8:30	Go to the field in small teams Make observations that are noted by the facilitator and one other person in the group records. Facilitator points out interesting new developments
9:30	Return to shade. Begin making agro-ecosystem analysis (see box) drawing and discuss management decisions.
10:15	Each team presents results and the group arrives at a consensus on management needs for the coming week.
11:00	Short tea/coffee/water break
11:15	Energiser or group building exercise
11:30	Special study topic or second crop/livestock study. This could include nutrition, or chicken or parasites, or something else of special interest to group.
12:30	Closing (often with prayer).

The curriculum

The FFS curriculum follows the natural cycle of its subject, be it crop, animal, soil, or handicrafts. For example, the cycle may be "seed to seed" or "egg to egg". This approach allows all aspects of the subject to be covered, in parallel with what is happening in the FFS member's field. For example, rice transplanting in the FFS takes place at the same time as farmers are transplanting their own crops - the lessons learned can be applied directly.
One key factor in the success of the FFSs has been that there are

no lectures – all activities are based on experiential (learning-by-doing), participatory, hands-on work. This builds on adult learning theory and practice. Each activity has a procedure for action, observation, analysis and decision making. The emphasis is not only on "how" but also on "why". Experience has shown that structured, hands-on activities provide a sound basis for continued innovation and local adaptation, after the FFS itself has been completed. It is also one of the main reasons that farmer facilitators can easily run FFSs - once they know how to facilitate an activity, the outcomes become obvious from the exercise itself.

Activities are sometimes season-long experiments - especially those related to soils or plant physiology (for example soil or variety trials, plant compensation trials). Other activities in the curriculum include 30-120 minutes for specific topics. Icebreakers, energisers, and team/organisation building exercises are also included in each session. The curriculum of many FFSs is combined with other topics. In Kenya, for example, the FFSs follow a one-year cycle including cash crops, food crops, chickens or goats and special topics on nutrition, HIV/AIDS, water sanitation and marketing. FFSs for literacy are also promoted where there is a need.

The programme leader

Most FFS programmes exist within a larger programme, run by government or a civil society organisation. It is essential to have a good programme leader who can support the training of facilitators, get materials organised for the field, solve problems in participatory ways and nurture field staff facilitators. This person needs to keep a close watch on the FFSs for potential technical or human relations problems. They are also the person likely to be responsible for monitoring and evaluation. The programme leader must be a good leader and an empowering person. He or she is the key to successful programme development and needs support and training to develop the necessary skills.

Financing

FFSs can be expensive or low-cost, depending on who implements them and how they are conducted. When carried out within a World Bank-type programme, they are usually expensive, due to high allowances, transportation costs and several layers of supervision (about US$30-50 per farmer). Obviously, the greater the distance that facilitators need to travel to get to the field, the higher the cost of transport. Transport is one of the biggest costs in any extension programme. When the FFS is carried out by local organisations and farmer facilitators, initial start-up costs may be moderate, but the running costs will be much lower (about US$1-20 per farmer). A trend in East Africa is to manage small commercial plots alongside the FFS study plots, so that the FFS can actually raise more funds than it uses for inputs and stationary (Okoth p. 27).

Final word

Farmer Field Schools are not difficult or mysterious. However, they are meant to empower through education on skills and concepts (how's and why's) and therefore, require an empowering environment. The basis for a successful FFS starts with the programme's culture of operation - from a nurturing and empowering programme leader and good facilitators, to transparent budgets and open management. FFSs are not difficult to set up if there is a commitment to, and faith in farmers' and facilitators' ability to learn locally and apply learning to local problems themselves. ■

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For more information on Study Circles and "4-H" groups, please see the following websites: www.studycircles.org and www.fourhcouncil.edu.

AESA in a typical FFS for rice

The basic format of an IPM Farmer Field School consists of three activities: agro-ecosystem observation, analysis, and presentation of results; a "special topic"; and a "group dynamics" activity. The Agro-Ecosystem Analysis (AESA) is the FFS's core activity, and other activities are designed to support it.

The agro-ecosystem analysis process sharpens farmers skills in the areas of observation and decision-making, and helps develop their powers of critical thinking. The process begins with small group observation of the IPM and non-IPM plots. During the observation process participants collect field data such as the number of tillers per hill, the varieties of insects and their populations and samples of insects and plants. These data are collected from ten rice hills. The facilitator is present throughout the observation to help participants in their observations.

Following the field observation, the farmers return to the meeting place and, using crayons, draw what they have just observed in the fields on a large piece of newsprint or poster paper. The drawings include:
a) pests and natural enemies observed in the fields (pests on one side, natural enemies on the other);
b) the plant (or animal) indicating the size and stage of growth, along with other important growth features such as the number of stems/tillers, the colour of the plant and any visible damage;
c) important features of the environment (the water level in the field, sunlight, shade trees, weeds, and inputs).

All members of the small groups are involved in the creation of the drawing and data analysis. While drawing, farmers discuss and analyse the data they have collected. Based on their analysis they determine a set of management decisions to be carried out in the field. A summary of these management decisions as agreed by the group is also included in the drawing.

One member of each small group then presents these findings and decisions to the larger group. After this brief presentation of results there is time for open questions and discussion. Good large group discussions often involve posing alternative scenarios, for example, questions such as "What would you do if...." This cycle of presentation, question, answer and discussion is repeated until all the small groups have presented their results. Agro-ecosystem drawings from previous weeks are kept on hand as a reference and as material for discussion later in the season.

The role of the facilitator is central to the EASA process. In the field, they will guide participants to see what they may not have seen before, such as tiny predators or changes in soil. To ensure a balanced and participatory discussion, a good facilitator understands that the more participants talk, the more they learn, and encourages discussion rather than lecturing. During presentations, the facilitator ensures that all participants have an opportunity to present during the season, and that the group covers all the important issues. The facilitator needs farming and technical skills and needs to know how to ask good questions, guide participants through exercises and ensure that sound management decisions are taken by the group by introducing new information when appropriate.

FFS: beyond the rice field

Editorial

IPM Farmer Field Schools (FFSs) for rice farmers in Asia have been immensely successful. Since the Indonesian National IPM Programme initiated the first FFS in 1989, the approach has reached over two million rice farmers. These farmers have increased their yields and incomes, reduced pesticide use, and use inputs such as water and fertiliser more efficiently. They have gained the knowledge and practical experience necessary to manage their agro-ecosystems sustainably. They use their knowledge and understanding to innovate and solve their own problems, and share their knowledge with their neighbours. FFS graduates have become leaders in establishing sustainable agricultural systems in their villages.

The success of the IPM FFS in Asia has attracted the attention of development workers - and donors - around the world. As with every successful approach, there is a strong movement to copy and adapt it to other situations. The FFS concept has been developed far beyond IPM in rice. FFS now exist in over 30 countries around the world, encouraging farmer learning in areas as diverse as dairy farming (Minjauw *et al* p. 8), conservation agriculture (for example see LEISA 18.3, pp.18-19), and even community health (Yech, p. 10). These approaches do not all fit the original FFS model exactly. Adaptations are necessary to meet the needs of different topics (such as IPM in tree crops, Mangan p. 30) or to adapt to different cultural situations (for example in Egypt, Van de Pol p. 22).

This issue of LEISA looks at the development of the FFS concept beyond rice IPM and into a seemingly limitless realm of possibilities for assisting and educating farmers. But how far can the concepts and principles of the Farmer Field School be developed and modified, and what are the core elements that need to be maintained to reproduce their original success?

A new blueprint for agricultural development?

The IPM Farmer Field School has become a model approach for farmer education in Asia and many parts of Africa, Latin America and the Middle East (LEISA 17-3, pp. 18-21). The FFS have many standard features, each of which contributes to their success. The schools usually comprise season-long regular meetings with a set pattern of activities, including Agro-Ecosystem Analysis (AESA), presentations and special additional topics, as well as group building activities. Gallagher (p. 5) describes the elements that appear commonly across successful FFS programmes.

But Farmer Field Schools are no blueprint. A FFS is a learning activity, not an institution - although FFS often give rise to new organisations, groups and networks through a process of building capacity and developing connections between people with common interests. FFS are often combined with other approaches, and can be integrated into existing groups and extension services. For example, Tripathi and Wajih (p. 14) describe the role they play in the "greening" process of bringing the topic of sustainable agriculture to women's self-help groups in India.

The challenges of expansion

Every new adaptation and expansion, and every move away from the original setting involves a trade-off. The original IPM FFS's in Indonesia were developed in a specific context. For example, considerable knowledge on rice pests and the rice ecosystem was already available. The FFS were developed to encourage farmers to learn about ecology and gain knowledge that would enable them to control pests and manage their rice ecosystem productively, but not necessarily to develop new knowledge. In some areas, however, there is a need to develop new, locally specific knowledge and technologies. One such example is the CIP sweet potato programme (see Sources, p. 32). In such cases, approaches such as PTD can add a new dynamic dimension to a FFS programme (Thijssen p. 17).

The process of developing critical thinking, introduced in IPM FFS, can be utilised to address other topics, for example through Farmer Life Schools (Yech, p. 10). Although the topic is quite different from IPM, the way of thinking is easily translated from "agro-ecosystems" to "human ecosystems", because the participants have previous experience with FFS for IPM. A greater challenge is to initiate an IPM FFS successfully in a different cultural setting, for example in Egypt (Van de Pol, p. 22).

FFSs are suitable for rapidly scaling-up new programmes. The basic curriculum is well developed, and farmer graduates can become farmer trainers, as the hands-on nature of the training means that farmers can easily facilitate the learning activities. However, the manner in which the scaling-up process is developed, particularly the initial training, can be critical to the success of the project. The FFS approach needs to expand from a well-trained nucleus of facilitators who have a good understanding of the concepts involved, as well as the skills to facilitate FFSs effectively (Van de Pol, p. 22).

As with other agricultural extension activities, the cost of FFS becomes a major issue as the approach becomes more widespread. Innovative solutions to this issue have been developed by a FAO/IFAD project, based on pioneering work by women's groups in their project area. Okoth *et al* (p. 28) describe the self-financing methods developed by this project.

Many different groups now call their activities "FFS", and fears are beginning to emerge that they may be making major trade-offs that lower the quality of the approach. Initiators of the Farmer Field School movement fear that the term "FFS" may become jargon to add to project documents, without those involved fully understanding the basis for a successful FFS programme. One of the most interesting aspects of this issue is the range of different perspectives presented on the basic question, "What makes a Farmer Field School a Farmer Field School?" These views are based on different experiences in different environments, with different limiting factors. It could also be asked, if a programme has a beneficial impact, does it really matter whether it fulfils all the criteria for a "real" FFS?

These questions may have more than one answer, and need to be addressed and guided by those involved, or wanting to be involved, in farmer education. Farmer Field Schools, like any other approach, are a tool, and their effectiveness depends on both the context and the way in which they are used. They are, however, a very special tool. They cultivate a critical, holistic and creative way of thinking. The process of learning about ecology leads farmers to a greater understanding of the inter-connectedness of their environment and the broader impacts of the decisions they make. Such understanding leads to empowerment.

■

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Farmer Field School in Fayoum, Egypt. Photo: Hans Feijen

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The editors encourage readers to photocopy and circulate articles. Please acknowledge LEISA Magazine and send us a copy of your publication.

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National Route 5 in Cambodia is part of the Trans-Asia highway linking India, Thailand, Cambodia and Vietnam. Along its route, the movement of people is steadily increasing – and so is the spread of HIV/AIDS. Farmer Life Schools, based on Farmer Field School community strategies, are now being developed along Route 5 to mobilise and empower farming communities, and reduce vulnerability to HIV/AIDS. These schools are often a natural follow-on activity from a previous IPM FFS. They carry out Human Ecosystem Analysis, including observation and interviewing of selected families within the community, and discuss the alternatives available to resolve health issues faced by these families. Through improved understanding of how various factors impact upon their lives, the farming communities are able to make changes to reduce risky behaviour which might lead to chronic diseases, and plan to achieve healthier and more peaceful lives.

A common point of concern for those considering FFS as an extension mechanism is the cost. This article describes several innovations to improve the financial sustainability of FFSs that have been developed and introduced by the East African Sub-regional Pilot Programme on Integrated Production and Pest Management (IPPM). The cornerstone of these innovations has been the evolution of the original grant system (semi-self financed FFSs) into an educational revolving fund (self-financed FFSs), supported by the proceeds of commercial plots that are managed alongside the study plots. Local governments, NGOs and rural micro-finance institutions are now becoming more and more interested in the approach, and in Kenya some farmers have even begun gathering resources together to fund their own FFS activities, the so-called self-sponsored Farmer Field Schools.

ILEIA is the Centre for Information on Low External Input and Sustainable Agriculture (LEISA) in the tropics. ILEIA seeks to promote the adoption of LEISA through the LEISA Magazine and other publications. It also maintains a specialised information database and an informative and interactive website on LEISA (**http://www.ileia.org**). The web site provides access to many other sources of information on the development of sustainable agriculture.

LEISA is about Low-External-Input and Sustainable Agriculture. It is about the technical and social options open to farmers who seek to improve productivity and income in an ecologically sound way. LEISA is about the optimal use of local resources and natural processes and, if necessary, the safe and efficient use of external inputs. It is about the empowerment of male and female farmers and the communities who seek to build their future on the basis of their own knowledge, skills, values, culture and institutions. LEISA is also about participatory methodologies to strengthen the capacity of farmers and other actors to improve agriculture and adapt it to changing needs and conditions. LEISA seeks to combine indigenous and scientific knowledge, and to influence policy formulation in creating an environment conducive for its further development. LEISA is a concept, an approach and a political message.

22 The Egyptian experience with FFS

Jaap van de Pol

Implementing the Farmer Field School approach in the Egyptian context has posed a number of challenges. The traditional approach for Egyptian extensionists has been one of technology transfer, and the hands-on, participatory focus of the FFS has required a change of mindset. Many aspects of the traditional IPM FFS have needed to be rethought to make the approach work in the Egyptian setting, and a lot can be learnt from these experiences. Lessons include the importance of training, and the need for the adaptation process to be a joint activity of farmers, facilitators and project management.

24 The greening of Self Help Groups

Seema Tripathi and Shiraz Wajih

Self-help groups for women living in the Terai of Eastern Uttar Pradesh have been used not only as appropriate institutions to help women improve their socio-economic status, but also to mobilise them as agents of change. The process of "greening" these groups towards sustainable agriculture has brought together many different extension and support mechanisms, including agro-service centres, master trainers and Farmer Field Schools.

DEAR READERS

Farmer Field Schools have proven to be a very effective tool for cultivating farmer learning and empowerment. In particular, they encourage farmers to develop their critical thinking, and this leads to greater self-sufficiency. FFS can also be integrated with other approaches, and they facilitate the scaling-up of successful experiences. As the FFS approach becomes increasingly popular, however, new issues and challenges emerge, such as maintaining quality in their implementation, and ensuring that the core principles of the approach continue to be reflected.

These were the issues addressed by an international learning workshop held in Indonesia in October 2002, "Farmer Field Schools - Emerging Issues and Challenges". Organisers included the Rockefeller Foundation, the International Potato Center (CIP) through the Users' Perspectives With Agricultural Research and Development (UPWARD) Network, and Farmers for Innovation in Ecological Livelihood and Democracy (FIELD) Indonesia. This issue of LEISA highlights the important contribution of the workshop to the ongoing international debate on extension approaches. In many cases, the articles presented here are shorter, modified versions of the original workshop papers. More information on the workshop, including full versions of all papers presented, can be found on the UPWARD website at www.eseap.cipotato.org/upward.

The Editors

Correction

The previous issue of LEISA magazine, Women Managing Change, provided an incorrect email address for Laura Lemunyete, author of the article "Developing camel products: pastoralist women and PTD" on page 20. The correct email address is lemunyete@wananchi.com

LEISA

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Magazine on Low External Input and Sustainable Agriculture

Learning with Farmer Field Schools

Linking Natural Resources, Agriculture and Human Health: Case Studies from East Africa

Hugo Li-Pun, Johann Baumgaertner, Juergen Greiling, Hiremagalur Gopalan, Mohammad Jabbar, Victor Mares, John McDermott, Martin Odiit and Mohamed Saleem

Past attempts to alleviate the problems of poor farmers engaged in mixed crop-livestock production have generally focussed on the design and diffusion of new technologies targeted on specific components of the agroecosystem. Unfortunately, such piecemeal efforts have had little impact in the developing world, including the East African highlands, the main focus of this report.

In the case of human health, the traditional R&D approach has tended to be narrowly sectoral. The health of people has been separated from that of crops, animals and the environment, with different disciplines and institutions concentrating on different constraints. Despite the progress reported, improvements to human health have fallen far short of expectations. A key limitation of the sectoral approach is that it does not consider interactions among priority human health conditions and their socio-economic and ecological determinants, such as poverty, malnutrition and degraded natural resources. Nor does it account for the close associations between people and livestock, as in the case of human sleeping sickness and bovine trypanosomiasis, both vectored by tsetse flies.

If future development efforts are to have significant, long-lasting impact on the people they are intended to help, they must be based on a firm understanding of the complex links among the environment, natural resources, agriculture, food security and human welfare. Furthermore, the ensuing interventions must not be limited to technological solutions. Rather, they must include better policy formulation, health and education, and the building of local community assets.

In recent years, participatory and multidisciplinary research methods have begun to make inroads in many parts of the world. For example, several international programmes are attempting to address agricultural productivity and resource sustainability issues through so-called ecoregional research. These efforts involve various mixes of partners: international agricultural research centres, advanced research institutions in industrialised countries, national agricultural research systems in developing countries, non-governmental organisations and funding agencies.

Below we describe recent experiences of two research centres with a global reach: the International Livestock Research Institute (ILRI) and the International Centre of Insect Physiology and Ecology (ICIPE). Both are currently conducting research in the East African highlands, based on holistic, participatory methods. Each centre's strategy integrates activities intended to improve food security and nutrition, human and environmental health, asset building and farm income, through natural resource management (NRM) and higher crop and livestock productivity. Computer modelling is one of the research tools used to assess the potential impact of using better methods to manage soil nutrients, graze and feed animals, enhance livestock health and control tsetse flies and other vectors.

A smoky home environment. For lack of alternatives, Ethiopians often burn dung for household cooking. This reduces indoor air quality and contributes to high incidences of upper respiratory disease. Agroforestry and woodlots could provide better domestic fuel, leaving precious manure as fertiliser for crops and pastures. ICIPE photo: Shifa Ballo.

Human health in the highlands

Widespread poverty, malnutrition and disease, along with low farm productivity and degraded natural resources, are major problems in the East African highlands. For example, in Ethiopia, which makes up 60% of the 3.5 million square kilometres of highlands, per capita annual income is a little over US$100. Some two-fifths of the rural population live in absolute poverty and one-third are malnourished. Nearly two-thirds of children suffer from protein-energy malnutrition, sometimes with irreversible damage to cognitive development. Deficiencies in micronutrients, particularly vitamin A, iron and iodine, are also commonplace.

Poverty and malnutrition are aggravated by large-scale resource degradation such as soil erosion, nutrient depletion, deforestation and the decline of pastureland, all of which undermine agricultural productivity and food security. It is estimated that half of the Ethiopian highlands' arable lands are moderately to severely eroded. If the erosion rates of the 1980s persist, over 7 million ha of crop land could be lost by 2010.

The burden of ill health in sub-Saharan Africa is twice the global average and life expectancy lags some 25 years behind that of people in the wealthiest nations. In the East African highlands, a region with a population of 150 million, women and children are especially at risk of ill health. This is due not only to malnutrition but also to the fact that these family members are more closely connected with unhealthy household environments. Indoor air pollution from burning wood and dung, for example, causes acute and chronic respiratory diseases. Women and children are also at high risk from insect-borne diseases such as sleeping sickness, malaria and dengue fever. A major reason is that the sites where they collect water and wash clothes tend to be insect-breeding areas as well.

Among the vector-borne diseases, malaria (transmitted by female anopheles mosquitoes) is the most important health risk. As for human trypanosomiasis, or sleeping sickness, the epidemic levels of the 1930s have returned, with the case load now estimated at 300,000 per year. Unsafe water supplies and limited access to clinics and health posts, combined with domestic and environmental health hazards and poorly developed communications, contribute to high incidences of disease. Zoonotic infections spreading from animals to people are also of increasing concern in the region.

Livestock as leverage

Mixed crop-livestock systems are common in the highlands. While grain yields have shown modest increases in the past two decades, they are still under 2 tons per hectare. This is due to the low usage of agricultural inputs such as fertilisers, as well as to damage by pests and plant diseases.

Farm animals play multiple roles in these systems, providing food and income, as well as farm inputs such as draught power and manure for crop production. Manure is also used as fuel. Livestock are a family's most important and flexible marketable asset. They can be sold in times of need, particularly when crops fail.

The beneficial role of livestock in intensifying production, alleviating poverty and malnutrition, and conserving natural resources has not been adequately exploited. Livestock productivity remains well below potential due to insufficient and poor-quality feeds, along with animal diseases. Available forage in sub-Saharan Africa is currently insufficient to meet needed livestock output, with protein being in even shorter supply than total energy. The amount of available pasture land is declining, as crops encroach on traditional dry-season pastures. Mineral fertiliser is needed to boost the supply of quality feed from both pastures and cropland.

Infectious diseases, particularly those transmitted by tsetse flies (*Glossinidae*) and ticks (*Ixodidae*), pose a constant threat to livestock. Cattle deaths related to trypanosomiasis are estimated at 3 million head annually, mainly young animals. Up to one-quarter of pre-weaning calves succumb. Sick animals have lower milk and meat yields and fewer offspring. Crop production is indirectly affected as there is less draught power for ploughing and less manure for fertiliser. This results in fewer crop residues and by-products for animal feed.

In the Ethiopian highlands, livestock are a farm family's most important and flexible marketable asset. Milk and meat are also important sources of protein and micronutrients. ICIPE photo: Shifa Ballo.

The consumption of even small amounts of meat and milk products improves human nutrition and makes people, especially pregnant women and young children, less susceptible to diet-related diseases.

The consumption of even small amounts of meat and milk products improves human nutrition and makes people, especially pregnant women and young children, less susceptible to diet-related diseases. Animal products are rich in micronutrients, such as vitamins A and B12, iron and zinc. These are essential to good child health and the development of cognitive and motor skills. What's more, agriculture and food-based approaches to combatting macro- and micronutrient deficiencies may be more sustainable than chemical supplementation such as consumption of vitamin A tablets.

Nutritional benefits of greater agricultural production, particularly dairy, depend partly on mothers' knowledge of nutrition. Since that knowledge is currently low among poor farmers, effective nutrition education is required. However, better education and family health in turn depend on community participation and empowerment. Stakeholder participation in the diagnosis of constraints and in the design and implementation of solutions is essential to the success and sustainability of development efforts.

ILRI's experience

Over the years, ILRI's research in the Ethiopian highlands on several component technologies has shown the potential for improving human welfare through increased crop and livestock productivity, better NRM and related interventions. Here are some examples:

- Vertisols are an under-exploited soil resource because of waterlogging. Animal-powered drainage equipment (called a broad bed maker, or BBM), combined with improved wheat technology (better varieties for early planting, fertiliser and agronomic practices), can increase wheat yield from less than 1 ton per ha to over 2. Besides helping alleviate the country's perennial food deficit, the drainage technology also significantly reduces soil erosion compared with traditional vertisol management.
- Modification of the BBM for row planting via a seeder attachment resulted in a large saving in seeds. The technology required 90 to 110 kilograms per hectare, compared with 150 to 250 kilograms for traditional broadcasting. Tillage and planting tests during the onset of the main rains showed that the time required to establish a crop via minimum tillage was about one-third that needed with traditional methods.
- On-farm studies have shown that improved dairy technologies (better breeds, feeds and management) can significantly increase production and income, and improve household nutrition and food security, particularly of women and children.
- Results from a study of grazing pressure suggest that a no-grazing strategy does not help conserve biodiversity or improve

soil quality. Recycling nutrients through manure ensures sufficient biomass production for regulated grazing and provides soil with a protective cover. Using dung for fuel aggravates the negative nutrient balance in the soil and depresses biomass production.

- An adoption study regarding multipurpose trees showed that farmer-to-farmer diffusion through seed sharing – a good indicator of potential for further adoption – has been occurring. The species selected by farmers varied with biophysical factors such as altitude and rainfall. Most farmers were using the trees for fencing, fuel and construction.

Given the limitations of development strategies based on component technologies or organized by sector, ILRI and its partners carried out a three-year project using a participatory “agroecosystem health” approach to assessing the sustainability of crop-livestock production systems. The overall aim of this work, based in Ginchi, a community of the Awash watershed, is to improve human health and nutrition through better management of livestock and natural resources.

After a 1998 workshop to refine the methodology, researchers gathered detailed biophysical and socioeconomic information on the Ginchi micro-watershed. They used a variety of methods, such as on-farm trials, site surveys and participatory rural appraisal. Then, together with members of the target community, they defined indicators of agroecosystem health, related to factors such as household food security, disease incidence, gender-related equity, soil erosion and biodiversity.

A bioeconomic model, based on Ginchi field data, was designed for *ex ante* assessment of the impact of improved crop and livestock technologies and NRM strategies on economic, ecological and food-production sustainability. It has allowed researchers to evaluate both short- and long-term impacts (up to 12 years) of technology and policy interventions. In a nutshell, this “dynamic” model quantifies the tradeoffs involved when farmers attempt to increase or maximise one of three factors: their income, their food self-sufficiency, or the sustainability of their farming system (by reducing soil erosion).

Results of modelling

The modelling reveals strong tradeoffs between the attainment of food self-sufficiency, high income and reduction in soil erosion. For example, with the application of fertiliser to teff and wheat in an otherwise traditional production system, farmers’ cash incomes would rise by 50% from a currently low base. However, annual soil losses would be 31 tons per hectare, which is still higher than the permissible level for the highlands.

Under a scenario involving the introduction of a set of new technologies – such as higher-yielding crop varieties, agroforestry methods, and techniques to reduce soil waterlogging – the modelling results are quite different. It would be possible, over 12 years, to increase cash income tenfold and decrease aggregate soil erosion by 20%. Moreover, farm outputs would be sufficient to provide a minimum daily intake of 2,000 calories per adult.

However, farmers would be increasingly dependent on livestock for manure, draught power, milk and cash flow. And the use of agroforestry methods and zero grazing would demand a longer planning horizon – which would be feasible only if farmers had more secure land tenure than at present.

The results of the modelling have been shared with farmers in the watershed and district extension agencies as an aid to resource-use decision making. They will also be extrapolated to other regions.

Trypanosomiasis in Uganda

ILRI and partner agencies have also begun investigating ecosystem-centred ways to fight rhodesiense-type trypanosomiasis in neighbouring Uganda. Major outbreaks occurred in 1976-82 and 1984-89. Since then, there have been roughly 1,000 cases per year. The population of the affected area of 7,000 square kilometres is a little over 2 million and more than half these people live on less than US$1 a day. Small-scale crop-livestock farms predominate. Indigenous zebu cattle, which provide rural people with milk, meat, traction and savings, number about 500,000.

The goal of this three-year project, targeted initially on six high-risk communities, is to improve human health through a mix of trypanosomiasis-control interventions, in the areas of NRM, policy, social dynamics and public health. A major ILRI partner is the Livestock Health Research Institute (LIRI), part of Uganda’s National Agricultural Research Organisation.

The research is participatory and transdisciplinary, drawing on expertise in epidemiology, geographic information systems, ecology and systems analysis. It combines the practical problem-solving approach of rural Africans with the best of systems analysis tools developed by researchers.

With community help, the research team has discovered that the incidence of sleeping sickness is higher where human populations are less dense and where people live close to bushland, woodland and swamp vegetation. Through village-level planning workshops, people now have a better understanding of common problems and priorities. Although the risk of sleeping sickness is a shared concern, they recognise that, more generally, poverty and ill health are crucial constraints to farming and other daily activities. However, they also lack resources including knowledge of best practices and access to farm implements to improve their situation.

People, particularly those who live far from roads and services, feel cut off from sources of help. This same isolation makes them appear to have lower incidences of sleeping sickness simply because their cases are less frequently reported to health care workers. The initial participatory collaboration suggests that by engaging in this research, villages affected by sleeping sickness are beginning to develop community action plans to lift themselves out of poverty and into a state of better health.

ICIPE’s experience

The BioVillage Initiative is an integrated NRM project designed to improve human health and alleviate poverty in rural Ethiopia. Recently launched by ICIPE, it responds to a community request following a successful tsetse control operation in the country’s southwest.

The tsetse control system, established with community participation, was based on mass trapping of flies. As in ILRI’s tsetse and trypanosomiasis control work in nearby communities, the programme resulted in a significant reduction in the incidence of farm animal disease. While farmers saw the value of the technique for improving livestock health, they also noted its limitations as a means of addressing human health problems and poverty. In fact, the farmers stressed that in order to plough fields and grow crops for human food, animal feed and income, both oxen and men need to be healthy. They also recognised that a healthy farming community can engage in other income-generating activities such as bee keeping.

Hence, it was agreed that a comprehensive programme for farm animal and human health management was needed as a way to

Tsetse flies transmit trypanosomiasis to both people and livestock. Photo: ICIPE.

Farmers stressed that in order to plough fields and grow crops for human food, animal feed and income, both oxen and men need to be healthy.

Catching tsetse flies in Ethiopia. Photo: Andreas Schriber.

solve the most urgent problems of rural development.
The resulting management scheme is built on three elements: fly and disease control, sustainable management of natural resources, and community participation.

Fly and disease control
The BioVillage Initiative builds in part on the experience of African rural communities whose housing for people and livestock has apparently been designed to divert malaria-transmitting mosquitoes from human hosts to animal hosts. The traditional straw-thatch design is kept in the new system, but improved to reduce insect access to houses.

The disease control and resource management measures are also designed to minimise breeding sites for mosquitoes and filth flies, thus improving health and sanitation. In addition, the BioVillage Initiative incorporates zero grazing methods as complementary means of protecting cattle from tsetse flies.

Natural resource management
The programme aims to reduce the need for external inputs, particularly energy and fertiliser. Biogas digesters are used to extract energy from organic waste and manure, and the slurry is transformed into organic fertilisers through composting. The loss of nutrients such as nitrogen is minimised by separating urine from other organic waste and processing it separately. An expert from the Swiss Federal Institute of Technology provides the BioVillage Initiative with advice on organic waste processing, including composting.

Besides providing the fertiliser needed to make cropping systems more productive, such waste management techniques also reduce the breeding sites of disease vectors. In addition, the resulting supply of biogas reduces the need to collect firewood for cooking purposes and conserves local trees which may also supply fruits and pest-control materials. The use of biogas also promotes a healthier household environment by reducing disease-causing indoor pollution caused by wood burning.

The BioVillage community intends to make use of the biogas energy to pump water from the ground to the village. Easy access to clean drinking water is an important contribution to human health and helps free up time for income-generating activities.

Community participation
Local participation is essential to the project. Community members assist with the design and construction of demonstration sites for the health and NRM components and participate in training courses. They also transfer technologies to neighbouring villages. The farming communities interact with project management via an ICIPE staff member who serves as BioVillage manager.

Concluding note: The special role of women
Livestock play a central role in environmental protection, food security, and human health and welfare in the African highlands and, indeed, in most developing countries. They are critical for asset building, soil-nutrient cycling and climatic risk buffering, and they constitute a sustained and irreplaceable source of macro- and micronutrients, especially for women and children. In designing interventions for mixed farming systems, researchers and their partners need to understand the complex interactions between people, livestock, crops and the environment. An ecosystem approach to human health provides a valuable perspective in this regard.

Both individually and collectively, women are key repositories of knowledge about the nutritional value of livestock products. This role should be recognised and enhanced by encouraging women to actively participate in the design, implementation, monitoring and evaluation of educational and other programmes aimed at income generation and better family nutrition and health. At the same time, sustained investments in R&D are needed. These too should take into account women's vital contribution to agricultural production, thus making the ongoing search for solutions especially relevant and widely applicable to the realities of developing countries.

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Testing a child's cognitive and motor skills, in Ginchi, Ethiopia. In degraded agroecosystems, mental development is impaired by malnutrition, disease and poverty. This can undermine agricultural sustainability and therefore the next generation's prospects for a healthy livelihood. See page 17. ILRI photo: Don Peden, in collaboration with the Ethiopian Health and Nutrition Research Institute.

International Forum on Ecosystem Approaches to Human Health, Montréal, Canada, May 18-23, 2003

The goal of the Forum is to stimulate discussion on ecosystem approaches to human health, the evidence from the field, and the relevance of these approaches to improving well-being. The Forum offers the opportunity for researchers, policy makers, practitioners and civil society representatives from around the world to share knowledge, and for institutions to consider strategies for further progress. For more information, contact IDRC. E-mail: ecohealth@idrc.ca.

Forum themes:

- Definition and conceptualisation;
- Successes and challenges through case studies;
- Links between research results and policy development;
- Institutionalisation of ecosystem approaches to human health research and practices.

Further exploration

Many information sources address the links between human health and ecosystem management. The web sites listed below, some operated by organizations that participated in the consultation reported in this special supplement to LEISA, generally provide easy access to public domain materials.

IDRC's web site, **www.idrc.ca**, provides a wealth of on-line information about research for development. The Centre's ecohealth link is **www.idrc.ca/research/xecohealth_e.html**. Readers with access to e-mail but not to the World Wide Web can send an e-mail to **www4mail@web.bellanet.org** leaving the subject line blank, but including the URL of the web page of interest in the body of the e-mail message. For more information on this service, see **www.bellanet.org/email.htm**. UNEP also maintains an extensive web site at **www.unep.org**.

The web sites of most of the international agricultural research centres that contributed to this supplement can be reached through the gateway site of the Consultative Group on International Agricultural Research (CGIAR): **www.cgiar.org**.

The International Society for Ecosystem Health (ISEH) – **www.ecosystemhealth.com** – is a useful source of information on approaches to understanding ecosystem health. The Special Programme for Research and Training in Tropical Diseases (TDR) – **www.who.int/tdr** – is an independent global programme of scientific collaboration. It helps co-ordinate, support and influence global efforts to combat a portfolio of major diseases of the poor and disadvantaged. World Neighbors, at **www.wn.org**, works with the rural poor in 18 countries in Asia, Africa and Latin America to strengthen the ability of individuals and communities to solve their own problems of hunger, poverty and disease. Information on mercury contamination in the Amazon can be found at **www.unites.uqam.ca/cinbiose**. This is the home page of the Centre d'étude des interactions biologiques entre la santé et l'environnement (CINBIOSE), based at the University of Québec at Montreal (UQUAM).

A hill-tribe child from northern Thailand is given a medical exam. Soil and medical specialists have teamed up to improve community health through better natural resource management in areas where shifting cultivation is practised. Nearly all the 50 or so children in one study group were malnourished, though not severely. See page 29. Photo: Prasong Tienboon, Chiang Mai University.

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Summary of workshop discussions

An emerging consensus on ecosystems and human health

Participants from diverse professional and cultural backgrounds met in working groups to discuss human health in relation to the degradation and management of agricultural, coastal and urban ecosystems. Consensus emerged on two broad questions:

Can an ecosystem approach help improve human health where you work and live?

The consensus was "yes". While an ecosystem approach cannot cure acute illnesses, it can make the environment more conducive to good human health and well-being. To arrive at this conclusion, participants covered several topics. These included definitions and concepts of ecosystems and human health, the role of people within ecosystems, and the methodological approaches to analysis, understanding and management of ecosystems.

Defining an ecosystem

An ecosystem is a geographically coherent area that includes all living and non-living things along with the myriad of interactions among them. In the human development context, living things include people and their cultures. Human activity often leads to changes in infrastructure such as roads, dams, buildings and fences that make up many of the non-living things. Ecosystems are not isolated or static entities; rather, they interact with adjacent areas. Through phenomena such as climate, migration and global trade, they also affect and are influenced by more distant regions of the world. An ecosystem's boundary is an arbitrary characteristic assigned by people for specific purposes. An ecosystem can be a very small area, such as a field, pond or household, or a much larger one, such as a watershed or ecoregion. The biosphere itself is an ecosystem. Large ecosystems consist of many smaller ones nested within them. Their inhabitants and other stakeholders have differing perceptions of boundary locations, and these depend on their unique and ever-changing world views.

Desirable characteristics of healthy ecosystems include stability, resilience, rich biodiversity, minimal human health risks, and a flow of goods and services conducive to human well-being.

The consultation emphasised agroecosystems, but participants noted that ecosystem concepts also apply to cities and towns, where people and elements of human origin dominate. Urban livelihoods are less dependent on the internal natural environment, and poverty and violence are common. Distinguishing constraints to human development are lack of water, sanitation, shelter, air quality, green space and other basic services. Governance and cultural diversity are often more complex in urban ecosystems than in rural agroecosystems, and economic and political forces are more influential. Drawing a boundary around an urban ecosystem is difficult. Inclusion of peri-urban areas may be useful. Because many urban centres are located on the edge of rivers, lakes and oceans, urban and coastal ecosystems can overlap.

Coastal areas represent zones in which land and fresh or saline water bodies meet and influence each other. Most participants focussed on areas lying by the sea. The amount of ocean or land area to be included is arbitrary and participants agreed that how the boundaries of such ecosystems are defined depends on the nature of the human health issues to be addressed. The distinction between urban, agricultural and coastal systems is often murky. While large numbers of people do not normally inhabit the aquatic or marine portions of the coastal ecosystems on which they depend, human activity nevertheless greatly affects the health of marine and aquatic resources. The state of these resources, in turn, can either promote or constrain human well-being.

Workshop participants debated whether ecosystems reflect the inherent structure of nature or are primarily constructs of the human mind. The latter view was the consensus. Scientists are unable to identify and describe the life cycles, demographics, ecological roles, physiology and genetic variation of every life form in even relatively small ecosystems. The classification of plants, animals and microbes is a culturally specific phenomenon, limited by our observational capacity. Science itself is an outgrowth of a subset of the world's cultural practices. Although people are components of ecosystems, there was much debate over their importance. From a human health perspective, people are clearly most important. Their attributes dominate our understanding of the community and its environment. However, one can argue that plants, water and air are more important because without them people cannot survive. Balancing the two is an ethical issue that society must address.

Defining human health

The participants acknowledged that human health is a broad concept, covering much more than the absence of disease. It includes adequate nutrition, as well as social, mental and spiritual well-being. Within an ecosystem context, both individual and population health are important. Communities have culturally specific norms that spell out what is meant by "quality of life". The concept of health evolves as societies change.

Defining ecosystem health

This is the state of an ecosystem with respect to its long-term capacity to satisfy demand for the range of goods and services required by its current and future human inhabitants and also by more distant consumers. Healthy ecosystems have the capacity to mitigate or absorb the harmful effects and by-products of human activity so that the well-being of both its residents and people living elsewhere is not jeopardised. Particularly in urban ecosystems, people depend heavily on externally produced goods, and they face a growing challenge in managing accumulating pollutants and industrial and human wastes generated by their activities. Given the broad definition of human health, some participants felt that ecosystem health is an anthropocentric concept with human health as the driving goal. Desirable characteristics of healthy ecosystems include stability, resilience, rich biodiversity, minimal human health risks, and a flow of goods and services conducive to human well-being. The participants recognised the need to find suitable indicators for these. The maintenance of ecosystem health standards imposes constraints on any human development that relies on resource exploitation and consumption. Indeed, it may force a shift in development thinking from consumption to service and social capital building.

Applying an ecosystem approach to human health

This demands an integrated effort by professionals in many disciplines, along with representatives of the communities who stand to gain or lose from future ecosystem management. Inclusion of policy makers, government and development workers influences the institutional, policy and financial environment in which human development takes place. Together, these individuals are able to increase their understanding of the complex web of causal factors affecting the priority health issues that residents of ecosystems face.

Researchers now realise, however, that these biophysical, socio-economic and cultural systems are so complex that our ability to accurately predict their behaviour is at best very limited. Nevertheless, joint recognition of this complexity provides a tool for conflict resolution and community-based natural resource management. It enables people to prioritise technologies, policies and changes in their livelihood behaviours that can “nudge” the ecosystem toward positive change. An iterative process of stewardship is needed to ensure a continuing cycle of assessment of ecosystem health and human well-being, reflection, priority setting, action and re-assessment, leading to a better quality of human life over the long term.

Based on your own experience and on this UNEP-IDRC consultation, what do you see as the most important challenges in applying an ecosystem approach to improve human health?

Having agreed that an ecosystem approach to health is useful, the working groups highlighted challenges that must be met to make it work:

Understanding and managing complexity

No single human being can grasp the full reality of the complex sets of interacting factors that mould human and ecosystem health. Bringing teams of diverse people together is essential. The disciplines in which expertise is required include ecology, natural resource management, climate change, public health, economics, sociology, anthropology, governance, law, policy and ethics. And community participation should reflect the various social strata within the target population. The transdisciplinary process of building a new understanding of the interactions among the ecosystem’s non-human elements, as well as between those elements collectively and human well-being, is a daunting task. Success will come from integrated and shared work and learning in which participants are equal partners, rather than from attempts to achieve some kind of absolute understanding. The challenge is to recruit a new generation of research and development workers and communities who are prepared to go beyond their traditional horizons and practices to find flexible solutions to complex problems.

Transforming the institutional environment

Our systems of governance and learning are founded on reductionist principles which assume that we can achieve sustainable development by solving many small development problems in isolation. Financial support systems reinforce this sectoral approach to R&D. They constrain institutions’ capacity to work outside legislated mandates. Different levels of government may end up working against each other because the geographic scales and development objectives they are addressing are different. Government actions often respond to the status quo in power relations among people. As a result, the poor have no influence, receive few benefits, and therefore remain poor. The challenge is to transform the institutional environment to create greater opportunities for research and human development using an ecosystem approach. Greater funding for ecosystems research is needed. New approaches to policy can allow people to benefit equitably from the results. Balancing some people’s demands for short-term goods and services from an ecosystem with longer-term needs to conserve vulnerable habitats and biodiversity will test policy-making, regulatory and enforcement processes.

Building the awareness and capacity of stakeholders

Participants emphasised the challenge of raising awareness and understanding of the ecosystem approach among all stakeholders. People need to see the potential health benefits of applying preventative measures that take into account the web of ecological, social and economic forces at work in their communities. This awareness is especially important where poverty and marginalisation exclude certain groups from the formal health care system. Increased acceptance of the ecosystem approach by individuals with political and financial power is a prerequisite to progress. Even one individual (such as a government minister or a village clergy member who is not on board) can undermine successful development based on ecosystem approaches. Training and stakeholder consultations, reinforced by public awareness and institutional support, are needed to continually raise collective capacity to improve the quality of life within the community. Patience with the process is needed. ■

FUTURE℠ HARVEST

Many of the collaborative projects discussed in this consultation report are conducted by one or more of the 16 Future Harvest centres supported by the Consultative Group on International Agricultural Research (CGIAR).

Future Harvest is an international non-profit organisation. It is dedicated to raising public awareness of the close links between agriculture and other global issues such as military conflict, water and land shortages, loss of biodiversity, the spread of human disease, climate change and poverty. The organisation believes that agriculture itself, based on good science, holds solutions to many of the compelling problems facing the world today.

Future Harvest promotes a hopeful vision of the future – a “green and prosperous earth that provides abundance, health, and peace to its peoples.” It cautions, however, that this can only be achieved if we devote attention and resources to scientific research for food, the environment and the world’s poor.

For more information, go to www.futureharvest.org

Ecuador: Pesticides, Health and Changes in Potato Technology

Health/agroecosystem links

How do pesticides affect the health of farm families who grow and eat potatoes? What are the effects of pesticide-related behaviour in the household? Can health be improved and agricultural productivity maintained by training farmers to handle pesticides more safely and use integrated pest and disease management techniques?

Research organisations

Instituto Nacional Autónomo de Investigaciones Agropecuarias (INIAP), Ecuador; International Potato Center (CIP); McMaster Institute of Environment and Health (MIEH), Canada; Programme for Appropriate Technology in Health (PATH-Canada); University of Montana, USA.

Background

In the Andean valleys of Ecuador's Carchi Province, about 8,000 growers account for 40% of national potato production. They are among the country's heaviest pesticide consumers. Using backpack sprayers, they apply methamidophos and carbofuran to control foliage-damaging insects and the tuber-damaging larvae of Andean weevils. Two fungicides, maneb and mancozeb, are also widely used to combat late blight.

Earlier Canadian research linked to this project revealed that pesticides were applied an average of seven times during crop growth. It also showed that farm people had significantly more nervous-system disorders, such as impaired motor skills, than non-farmers. Skin disorders were also common. The pesticide poisoning rate of 171 per 100,000 population was similar to the highest rates recorded elsewhere in the developing world. Direct skin contact with pesticides during mixing, leaky sprayers and lack of protective clothing during application explain some of the health problems. However, different factors may account for ill health in other members of the farming community. These include contamination from pesticide residues on potatoes prepared and eaten in the home, as well as household storage of pesticides and washing of work clothes.

Project description

This research covers the health component of a major ecoregional project by CIP, INIAP and the University of Montana. That project has developed and tested a multidisciplinary model, based on Andean potato farming, for integrated assessment of the sustainability of agricultural production systems. Field-based surveys of crop production, household practices, poverty levels, dietary habits and the nutritional status of farm family members generated the necessary information for the model. The model quantifies how farmers' methods and decisions (such as those related to pesticide use) affect crop productivity, farm incomes, the environment and human health. Then, using statistical techniques, it aggregates those effects at the regional level for policy analysis – for example, to decide on pesticide subsidies or disincentives, or to formulate extension strategies. The project's conceptual framework makes it possible to link results from individual disciplines, thereby producing "second level" results from the combined analysis.

Florescent dye on a person's hands reveals traces of pesticide. Exposure has serious adverse effects, both neurological and skin-related, on potato farmers in Ecuador. Photo: CIP.

The health component of the research focusses on 40 farm families in two micowatersheds of Carchi, taking into account gender differences. It attempts to answer several questions. First, do differences in food preparation methods, diets and other household practices affect neurobehavioural function? Second, can participatory programmes for men and women change potato production and household management methods in a way that decreases pesticide exposure, thereby improving health? Third, what are the tradeoffs between human health, food production and environmental protection in the broader region? Finally, how would safer use of pesticides and integrated pest/disease management affect those tradeoffs?

Results and conclusions

Exposure to pesticides has serious adverse effects – neurological and skin-related – on local human health. In turn, health disorders undermine farmers' ability to make efficient farming decisions. Farmers with higher neurobehavioural scores had lower production costs per hectare and thus higher productivity, consistent with better managerial capacity. Farmers would be both healthier and more productive if use of the pesticide carbofuran were reduced. Productivity gains from improved health outweigh losses from reduced pesticide use.

Males are exposed to pesticides mainly through preparing and applying pesticides in the field. For women, exposure occurs mainly in and around the home where pesticides are often stored and where work clothes impregnated with pesticides are washed. Exposure of children is mostly accidental – for example, when they are helping their parents. Children age 5 and younger are the age group with the highest number of hospital-treated cases of pesticide intoxication. Pesticides are also used frequently by other household members in suicide attempts. As pathways of pesticide exposure differ according to gender and age, the project has tailored protection strategies to each group at risk.

Tradeoff analysis suggests that safer pesticide handling and use of IPM to cut carbofuran use could reduce the pesticide's adverse health effects by 50% or more without reducing potato production. A key policy implication is that education and extension programmes are less costly than taxes on pesticides as a way to reduce the health burden of pesticide use and make the ecosystem more sustainable.

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Report contributors: **Donald Cole** (MIEH) and **Charles Crissman** (CIP).

The rectangle near the map's centre indicates the methylmercury study area along the Tapajós River.

Brazil: Mercury Poisoning in the Amazon

Health/agroecosystem links

What role do gold mining, crop-related deforestation and soil erosion play in methylmercury contamination of fish in the Brazilian Amazon and poisoning of local people who eat fish? What ecosystem management practices might reduce overall levels of mercury in the environment?

Research organisations and partners

Université du Québec à Montréal (UQAM), Canada; Federal University of Pará, Brazil; Federal University of Rio de Janeiro, Brazil; the Grupo de Defesa da Amazônia, Brazil; the Biodôme de Montréal, Canada.

Background

The presence of mercury in the food chain and its absorption by people are universally recognized as health hazards. Once mercury is released into rivers, lakes and other aquatic environments, bacteria can transform the mercury into its organic form, highly toxic methylmercury. In this form it can be absorbed by aquatic fauna, increasing in concentration (biomagnifying) as it moves up the food chain to fish and then to humans.

One of the best known cases of methylmercury poisoning was discovered in 1956 in communities near Minamata Bay, Japan, where mercury discharged from a chemical plant accumulated in fish. Thousands of people who lived in the area and ate fish and shellfish from the bay developed what came to be known as Minamata Disease.

A number of studies have reported on mercury contamination of fish in some rivers of the Amazon. People who live along those rivers and depend on fish for a major part of their diet have relatively high levels of mercury in their hair, an indicator of mercury exposure. For years, the use of mercury to extract gold from river sediment and soil, a method still in use, was thought to be the source.

Project description and results

Concerned about the effects of mercury on human health in the Amazon, scientists from the Federal University of Pará and UQAM teamed up in 1994 to explore the problem further. Their focus was Brazil's Tapajós River, where thousands of miners have panned for gold over the last 30 years. In the following six years, understanding of the behaviour and toxicity of mercury in Amazonian ecosystems increased. Now researchers are turning their attention to ecosystem approaches to reducing exposure to this heavy metal.

To determine mercury levels, the team collected and analysed water, river sediment and soil at intervals along the river, starting at gold mining sites and ending hundreds of kilometres away. They also analysed hair, blood and urine samples from fish-consuming villagers who live near the river and conducted simple co-ordination and visions tests to determine the health impact.

The researchers expected mercury levels to drop as distance increased from mining sites. Instead, concentrations were relatively constant along the Tapajós River, even hundreds of kilometres downstream from the sites. Thus, the scientists suspected another major source of mercury.

Analysis of riverbed sediments, sampled in half-centimeter increments, showed the most recent layers contained 1.5 to 3 times more mercury than layers deposited 40 years ago. This was true even of sediments 400 kilometres downstream of the gold mining sites. Sampling and analysis of nearby soils revealed high mercury concentrations throughout the soil profiles, down to a depth of 1 metre. The researchers concluded that deforestation had allowed rain to erode the surface layers of the watershed's soil, followed later by erosion of deeper strata. Indeed, in some areas along the Tapajós River, up to 15 centimetres of soil have been lost. Further study revealed that subsurface leaching of mercury from the land to the river also contributes to mercury accumulation in the aquatic environment. Deforestation and the whole process of erosion have led to the transfer of high mercury loads from the land to the aquatic ecosystems. Finally, the researchers now suspect that mats of floating macrophytes (large aquatic plants) are key sites of transformation of inorganic mercury into the toxic methylated form.

The explanation of mercury contamination based on deforestation and soil erosion is consistent with the recent history of the Tapajós River basin. Some 40 years ago, immigrants from northern Brazil began colonizing the area beside the river. They slashed and burned the trees in preparation for cropping and other activities.

Hair samples from adults in the village of Brasilia Legal contained an average of 15.9 parts per million (ppm), well below the threshold considered safe by the World Health Organization.

The WHO threshold of 50 ppm is based on the lowest level at which previous studies have reported the first clinical signs of mercury poisoning in adults. Further tests on the villagers showed, however, that their co-ordination, manual dexterity and certain visual functions had declined. The researchers concluded that mercury can damage human health even at levels well below accepted international safety standards. Testing also revealed that the mercury levels in people were highest during the rainy season when lots of large carnivorous fish were available.

Researchers are working with local people, including a women's group in Brasilia Legal, to design and implement intervention strategies. One set of activities, including study of the links between fish diet and mercury content of hair, aims to reduce the consumption of fish with high mercury content (see text below). For example, there are a number of species of edible herbivorous fish that could be promoted for human consumption. Other work focuses on identifying possible sites and mechanisms of mercury methylation in the Tapajós River. Limiting the proliferation of patches of floating macrophytes, through shoreline forest conservation and restoration, is one strategy under investigation.

Future directions

Over the longer term, the project team hopes to scale up both research and interventions to the regional level. Proposed activities aim to shift family agricultural practices toward better land management to protect and restore these important Amazonian ecosystems and improve the quality of life of the region's poor farmers.

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Report contributors: **D. Mergler** and **M. Lucotte** (UQUAM), **R. Davidson** (Biodôme de Montréal). Further information: http://www.unites.uqam.ca/cinbiose/; www.idrc.ca/reports/read_article_english.cfm?article_num=168; www.idrc.ca/media/mercurypoisoning_e.html.

"Eat fish that don't eat other fish"

Since 1994, villagers from the town of Brasilia Legal have actively participated in the IDRC-funded study of mercury on the Tapajós River. In 1995, about 100 people provided hair samples for mercury analysis and underwent testing for nervous system functions. Although hair mercury levels were below those considered "safe", results showed dose-effect relations, with fine motor movements and vision decreasing with increasing mercury levels.

After a workshop and discussion, the villagers agreed on a short-term solution. People would alter their diets to reduce mercury absorption but still maintain fish consumption. "Eat fish that don't eat other fish" became the slogan since mercury levels are lowest at the bottom of the food chain.

In 2000, hair samples provided by 45 people from the original 1995 group were analyzed for mercury. The results were highly encouraging: hair mercury levels had decreased by more than one-third. While people were eating exactly the same amount of fish, they had reduced the proportion of carnivorous species in their diet.

Eastern and Southern Africa: AIDS and Food Security

Health/agroecosystem links

How does HIV/AIDS affect food production and security, agricultural labour patterns, and agroecosystem management in African countries hit hardest by the epidemic? How and where is food insecurity leading to further spread of HIV infection? What importance should national agricultural R&D institutions accord to the links – in both directions – between HIV/AIDS and agriculture? In which types of agroecosystems are people's livelihoods most at risk? What can R&D institutions do to support local responses to the emerging threats?

Research organisations

International Service for National Agricultural Research (ISNAR); Institute of Tropical Medicine, Belgium; agricultural R&D and public health organisations in Malawi, Tanzania and Uganda; other selected research institutions within and outside the region.

Background

There is growing evidence that, without decisive action, HIV/AIDS will reverse human development gains achieved in recent decades in parts of sub-Saharan Africa. Infection rates are increasing faster than expected just a few years ago. In at least seven countries – Botswana, Lesotho, Namibia, South Africa, Swaziland, Zambia and Zimbabwe – 20 percent or more of adults are now infected with HIV. Once concentrated in towns and cities, infection is now widespread in rural areas and more prevalent among African women than men. AIDS and its associated diseases, especially tuberculosis, are now the leading causes of both adult and child deaths in Africa.

AIDS affects many aspects of rural life. In severely affected agricultural areas, there is evidence of declining labour availability as people fall ill and die and as family members, particularly women, devote more time to caring for the sick. Family finances are under severe pressure since assets often have to be liquidated to pay for medical and funeral expenses. And as sick family members return to villages from the cities to be cared for by their families, there is an added burden on rural households. In some cases, children are removed from school to make up for farm labour shortages.

AIDS degrades agricultural systems, impoverishes those whose livelihoods depend on them, erodes the agricultural knowledge base, and shifts survivors' farming behaviour to shorter-term objectives. The epidemic's spread is exacerbated by food insecurity and by the inability of rural people to make a living where they live. One common response is to leave the home community in search of work. Particularly when they move alone, migrants are often at increased risk of HIV infection. Once infected, they may in turn increase the risk for others in the areas into which they move. Chronic rural unemployment and insecurity may also contribute to attitudes that favour risky sexual behaviour. Diversification of livelihood opportunities in and around agriculture may help reduce vulnerability to HIV infection. Conversely, agricultural production and development that induce people to migrate may inadvertently increase this vulnerability.

AIDS is now widely viewed as a developmental crisis, yet the capacity to act lags behind. A few organisations have supported the coping strategies of AIDS-affected households – for example, by

Blood samples are prepared for HIV testing at a medical microbiology laboratory in Kenya. Previously concentrated in towns and cities, AIDS and HIV infection are now taking a heavy toll on rural communities in Eastern and Southern Africa. A new study led by ISNAR aims to help national agricultural research organisations cope with the problem. IDRC photo: Gerry Toomey.

providing lighter farm implements that can be handled by women and children. However, most agricultural R&D organisations in the region have been slow to respond. The toll that AIDS is taking on these organisations' own staff further limits their responses.

Project objectives and methodology

The overall aim of this recently launched project is to prevent and mitigate the impact of AIDS on agricultural systems and on the livelihoods of those who depend on them. The research will help fill critical gaps in current knowledge of the reciprocal links between HIV/AIDS and agricultural development and how agricultural R&D institutions are responding to the problem. It will enable such institutions to set and act on realistic priorities for response, in collaboration with communities and other partners.

The research strategy is based on a layered framework of analysis that supports research priority setting at various levels. The project results should help agricultural research organisations address a number of interrelated questions: Is the actual or potential impact of AIDS within the institution's mandated area sufficiently great to warrant taking AIDS into account? If so, what level of resources should be allocated to the problem? In light of local disease prevalence and other factors, which specific agricultural systems should be targeted and with what type of assistance?

The project will focus initially on three severely affected countries: Malawi, Tanzania and Uganda. Country teams, drawn from key agricultural R&D and public health institutions, will conduct research (literature reviews and field studies) to characterise and analyse the impact and response aspects of AIDS. They will then work with concerned agricultural R&D institutions in the participating countries to transform the findings into priorities for action. The teams will share information and lessons. A group of experts from within and outside the region, working in agricultural and public health research and in R&D planning and management, will support the teams.

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Kenya: Agroecosystem Management for Community-Based Malaria Control

Health/agroecosystem links

How does rice irrigation affect human health? What are its links with domestic water supply and sanitation? Can new options for water and livestock management cut malaria transmission? Which types of intervention are socioeconomically feasible?

Research organisations and partners

CGIAR Systemwide Initiative on Malaria & Agriculture; International Centre of Insect Physiology and Ecology (ICIPE); International Water Management Institute (IWMI); World Health Organization Panel of Experts on Environmental Management for Vector Control (PEEM); College of Agriculture and Veterinary Sciences, University of Nairobi, Kenya; Kenya Agricultural Research Institute (KARI); Division of Vector-Borne Disease (DVBD), Ministry of Health, Kenya; National Irrigation Board (NIB), Kenya; Kenya Medical Research Institute (KEMRI).

Background

Every year, malaria kills around two million people, 90% of them in Africa. About three-quarters of Africans live in areas of highly endemic but stable transmission. Another 18% inhabit areas where malaria transmission is seasonal and unstable. The latter areas are particularly vulnerable to deadly epidemics.

Malaria control has centred on two strategies: treating sick people with drugs that target the plasmodium parasite, and using insecticides to eliminate the vector mosquitoes. These methods are not only very expensive for most African countries, but also increasingly ineffective as mosquitoes and malaria parasites continue to build resistance to insecticides and drugs respectively. The risk of environmental damage from insecticides is also a growing concern.

As demand for rice grows in Africa, so does the proportion of cultivated land brought under irrigation. These schemes provide a favourable breeding habitat for malaria-bearing anopheline mosquitoes. In a recent survey to assess the knowledge and perceptions of farmers in a rice irrigation scheme, all 104 families interviewed ranked malaria as their main health problem.

The deteriorating malaria situation in many African communities urgently demands new lines of attack to complement existing control measures. Farm-level strategies for managing water and livestock have the potential to lessen human exposure to mosquitoes while making the ecosystem more sustainable.

Project description

This $1\frac{1}{2}$-year project aims to improve the health and economic well-being of communities in irrigation schemes. It will do this through the design of improved agroecosystem management practices that also reduce malaria and other health risks. The research will contribute to the development of an agroecosystem intervention model that can also be used elsewhere in Africa. The research results will feed into the design of farm-based malaria control measures which will be assessed for their social and economic feasibility before being promoted. The measures focus on two strategies: water management (for example, intermittent irrigation) and the use of livestock (particularly cattle) to divert blood-seeking mosquitoes away from people. Cattle are dead-end hosts for malaria parasites. However, since opinions differ about the exact role of livestock in malaria transmission, the researchers will first attempt to clarify this link.

Researchers are conducting their core studies within the Mwea Rice Irrigation Scheme, about 100 kilometres northeast of Nairobi, Kenya. Nearly half the settlement's 13,640 hectares is used for paddy farming, while the rest is devoted to subsistence farming, grazing and communal activities. The tenant population, dispersed in 36 villages, comprises 3,100 families. Malaria transmission in this area is low but stable, with a parasite prevalence of less than 20%.

Researchers have begun the work with a health risk assessment aimed initially at determining whether rice irrigation increases or decreases health risks. This study takes into account a variety of socioeconomic, environmental and institutional factors. The main ones are age, sex, education, occupation, income, religious and cultural affiliation, family size, nutritional status, water management practices, location, and the role and effectiveness of public health agencies. In parallel, the researchers are documenting and assessing the mixed crop and livestock production systems of the Mwea Scheme. Their aim is to identify opportunities for enhancing nutrition and income generation. Malnutrition generally lowers people's immunity to disease, including malaria. In the Mwea region, the staple diet of cereals is rich in calories but deficient in essential micronutrients available in livestock products, grain legumes, vegetables and fruits.

More efficient use of local resources could enhance the productivity and sustainability of the crop/livestock production system. Farmers would thus have a good mix of consumables, cash and further inputs for the farm enterprise such as draught power and manure. Having cattle near households may not only help divert mosquitoes away from people and provide animal protein but also contribute significantly to an increase in home-garden production.

Mwea villagers will contribute to all phases of the research, from data gathering and analysis, to design and implementation of action plans. Participatory rural appraisal methods will be used throughout the project. Since women are often more vulnerable to environmental hazards than men, yet have less decision-making power over the domestic environment, much of the research project's data gathering and analysis will be gender-specific. ■

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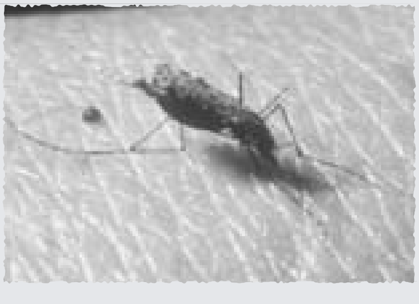

An anopheles mosquito, transmitter of malaria. Using pesticides to control mosquitoes is expensive and harmful to the environment. Moreover, insects continue to build resistance. IDRC photo: P. Wijeyaratne.

Thailand: Shifting Cultivation and Health of Karen Hill Tribe Families

Health/agroecosystem links

How do shortened fallow periods in shifting cultivation affect soil fertility, rice productivity, food supply and consumption? What is the link between management of this agroecosystem and farm families' nutritional status?

Research organisations

International Centre for Research in Agroforestry (linked to the CGIAR Alternatives to Slash and Burn Initiative); Chiang Mai University Department of Pediatrics, Thailand; University of British Columbia Department of Forest Sciences, Canada.

Background

The Karen and Lua hill tribe farmers of northern Thailand have practised shifting cultivation for centuries. They clear forest plots by slashing and burning, plant crops such as upland rice for a year or two, then abandon the land. Traditionally, the fallow period was a decade or more, allowing land to regain fertility. In recent decades, though, population growth, natural resource policies and changes in land tenure have resulted in much shorter fallow periods – in some instances less than six years. There are fears that the new production cycle threatens soil fertility, upland rice productivity and food supplies. In 1992, local Thai authorities reported, for example, that only about 50% of minority hill tribe families in Mae Chem District had a sufficient rice supply. Switching from slash-and-burn to permanent rice paddy farming also presents problems. These include environmental and health hazards from agrochemicals, increased production costs, and potential loss of plant biodiversity in fallow fields.

Project description

The project is investigating links between ecosystem management under shorter-follow production and the health of the Karen farmers in the village of Mae Hae Tai, Mae Chaem District. The 4,000 square kilometre watershed of Mae Chaem is a benchmark site for the System-Wide Alternatives to Slash and Burn Initiative of the Consultative Group on International Agricultural Research (CGIAR). The researchers are examining rice productivity, food supply and consumption, taking into account the special role of women as gardeners, food collectors and preparers. Links between rice productivity and soil fertility are also being analysed. Health workers are assessing the nutritional status of local families, who in turn participate in data review and help design interventions to solve health and ecological problems. Resulting indicators of health and ecological status will allow researchers to assess and compare conditions in other communities, including those involved in long-fallow and permanent (as opposed to shifting) agriculture. Their findings will support Thai policy making in the areas of land use transformation and health promotion in the country's northern watersheds.

Results* to date, preliminary conclusions, future directions

Under the health component of this three-year project, researchers assessed about 100 Karen people, half of them adults, half of them children. Results showed all of the children were at risk of vitamin A deficiency. The prevalence of anaemia among children was 15% but this was not due to vitamin B12 and folic acid deficiencies, nutritional factors often associated with anaemia. (Vitamin B12 deficiency is common in vegetarians; the children in the study group, however, were all non-vegetarians.) Low iron reserve was observed in 63% of the children. Based on weight-for-age, nearly all the Karen children examined were classified as malnourished, though not severely. In addition, more than half had parasitic infections. Among the 49 Karen adults assessed, only a few were obese, whereas about one-fifth, mostly women, were underweight.

Ecological field studies of crop productivity and the role of nutrients in forest-fallow shifting cultivation revealed an average upland rice yield of about 1 ton per hectare for the1999 cropping season. Rice productivity, however, is subject to year-to-year fluctuations due to the spatial variability of soil fertility in shifting cultivation fields and to local climate. During the six-year rotation (one year of cropping, followed by five years of fallow), soil changes included an increase in soil organic matter and total nitrogen due to the addition of litterfall, but a decline in pH, available phosphorus, extractable potassium, calcium and magnesium due to the diminishing effects of ash. Standing tree, shrub and herb biomass increased gradually over the fallow period. The second-year rice experiment with fertiliser trials revealed that nitrogen and phosphorus were the two most deficient nutrients in the system.

The current fallow period of five years appears long enough to maintain annual rice yields. However, any further reduction could threaten soil fertility and thus the relative sustainability of the system. The reduced duration of fallow (compared with a fallow period twice as long in some neighbouring systems of shifting cultivation) has resulted in a substantial drop in the biomass of fallow fields. It also threatens the survival of some tree species found in the late stages of longer fallows.

The results show shifting cultivation has provided stable rice production over the years. However, rice is low in protein and the observed malnutrition among Karen children may be due to insufficient consumption from other food groups. It is a common hypothesis among development workers that longer fallows supply non-rice products that may be nutritionally important.

A next step is to determine rice deficiency/sufficiency by assessing consumption at the household level. Researchers will also examine whether malnutrition is worse under short- versus long-cycle systems and whether major shifts in food sources have resulted from this change in production.
Other local food sources, such as wild and domestic animals and plants, will be studied to determine their nutritional contribution to local diets.

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* Health-related results are unpublished data from the ECONUT Project, Chiang Mai, Thailand.

Peru: Health, Biodiversity and Natural Resource Use on the Amazon Frontier

Beyond abstraction. A Peruvian child gets a close-up view of water-borne parasites. Photo: Tamsyn Murray.

Health/agroecosystem links

How do the hydrological cycle, market access, ethnicity and the use of natural resources in slash-and-burn farming, fishing, cattle ranching, oil palm production, hunting and gathering influence food availability, disease levels and the nutritional status of local people?

Research organisations and partners

International Center for Tropical Agriculture (CIAT); Ucayali Ministry of Health, Peru; Universidad Nacional de Ucayali (UNU); Instituto de Investigaciones de la Amazonia Peruana (IIAP); Asociación de Mujeres Campesinas de Ucayali (AMUCAU); Federación de las Comunidades Nativas de Ucayali (FECONAU); Organización de Mujeres Indigenas de la Amazonia Peruana (OMIAP), Peruvian Ministry of Fisheries (DIREPE); Universidad Peruana Cayetano Heredia (UPCH); Instituto de Investigación Nutricional (IIN); British Institute of Tropical Medicine, University of Liverpool; Programme for Appropriate Technology in Health (PATH Canada); University of Guelph, Canada; University of Waterloo, Canada.

Background

The Ucayali Region of the Peruvian Amazon is home to 370,000 people and covers 100,000 square kilometres. In the 1940s a road was built between Lima and the city of Pucallpa on the Ucayali River, a major tributary of the Amazon. This hastened settlement of the region. Now, about 80% of the population lives either in Pucallpa or along the road to the capital.

Despite Ucayali's rich biological diversity, remote communities struggle to meet basic needs. They also face a barrage of nutritional and health problems. With an estimated two-thirds of rural households living in absolute poverty, human deprivation is the norm here, not the exception. Chronic malnutrition affects over half of rural children under 5. Anaemia and vitamin A deficiency are widespread and cases of malaria, dengue fever and persistent diarrhoea are on the rise. People in the region make a living from a mix of enterprises: cropping, fishing, logging, ranching, plantation operations, hunting and gathering. While it is widely accepted that slash-and-burn farming and unregulated logging accelerate deforestation, it still isn't clear how these diverse livelihood strategies affect household health and income, or whether health and earnings are related. Yet, answers to these questions underpin the design of viable development options for the people of this vast region of forest margins.

Project description

Ucayali is a benchmark site for the Alternatives to Slash and Burn Initiative of the Consultative Group on International Agricultural Research (CGIAR). It provides a valuable opportunity to understand a complex natural and human environment from an agroecosystem perspective. Research findings here may also have applications in other forest margin areas. The research is participatory and interdisciplinary, drawing on local knowledge as well as scientific expertise in nutrition, health, anthropology, agronomy, natural resource management, fisheries, forestry, ecology, rural planning and economics. The underlying conceptual framework, developed during earlier studies in Ucayali, is referred to as the adaptive methodology for ecosystem sustainability and health, or AMESH for short.

The project team spatially mapped the mix of ecological resources available to the rural population and conducted household surveys to define food production, consumption and family income patterns. In addition, basic mortality and morbidity rates were measured. This work included field tests for anaemia, parasitic infections and water quality. The research has involved 345 families in eight communities, representing a cross-section of production strategies, ethnicity, ecosystem types and market accessibility. Work was timed to record seasonal variations in production and food availability due to the annual hydrological cycle and the 8 to15 metre rise in river levels. Using three time periods and data sets, researchers analysed cycles of food production and availability, disease outbreaks and nutrient intake. This allowed for more targeted and effective interventions.

In addition, the research team used participatory methods to explore the role of local beliefs and knowledge in the selection of food and treatment of illnesses and to identify community health priorities. This information was used to formulate local definitions and indicators of health that aided development of community action plans and evaluation of Ministry of Health rural programmes.

Results, conclusions and interventions

Based on 18 months of fieldwork and initial data analysis, the researchers reached several conclusions. First, health is multidimensional. Ecological factors, resource diversity and soil fertility influence natural resource use patterns; these in turn affect nutrition and food security. Changes in vector habitats and water quality affect disease transmission. Economic factors such as labour supply, distance from markets, and access to credit influence income and access to health and educational services. Cultural differences among colonists affect social cohesion in young settlements, and lack of appropriate local knowledge undermines their ability to exploit the diverse resources available to them. Further analysis will determine which factors, or combination of factors, are most important to human health.

Second, the ever-changing ecology of the flood plain and upland terraces, as rivers flood and recede, dictates patterns of human migration, disease, nutrition, food security and resource use (as in fishing, hunting and agriculture). Interventions to promote sustainable resource use for better health and nutrition should take advantage of annual flooding rather than being drowned economically by it.

Third, the issues facing different groups vary considerably. For example, families living in the flood plain benefit from an abundant supply of fish and game, yet their health is undermined by parasitic infections due to poor water quality and sanitation caused by flooding. Food security and nutrition are therefore less of an issue than poor health status. In the upland terraces, high fish prices, scarcer game and longer cropping periods lead to seasonal food insecurity each year. Development initiatives need to accommodate such differences.

Fishing on the Ucayali River. In the Peruvian Amazon, the cycle of river flooding and receding waters strongly influences human health, migration and the availability of food such as fish, game, wild plants and cultivated crops. Photo: Tamsyn Murray.

Finally, extensive and diversified patterns of resource use, although recommended, will eventually fail if there is no landscape-level mechanism to regulate and monitor communal resources. On the Amazon frontier, the absence of government and non-existent or precarious land ownership result in an institutional and political vacuum. In addition, physical demarcation of land on the flood plain is often impossible due to changing river configurations. To maintain human health and the ecosystems that support people, an institutional, political and legal framework is needed – one that avoids narrow sectoral approaches and top-down management. Community-based management is one option for allowing different user groups to jointly negotiate long-term plans for sharing resources.

The project team is working with communities and health officials to design local action plans. These centre on interventions such as health and nutrition education programmes, testing inhabitants for parasites and anaemia, water purification, small-scale food production projects, and the introduction of improved hygiene and sanitation.

Besides generating useful data, the project's participatory methods stimulated community involvement in health improvements. For example, the impact of having mothers, fathers and children view their own parasites through a microscope far surpassed the information value of stool sample analysis. Parasites were no longer an abstract concept discussed only by Ministry of Health professionals; they became real aspects of villagers' daily experience with poor water quality and diarrhoea. In each community, villagers were immediately mobilised to find solutions to water contamination and parasite transmission.

At the regional level, project results are helping the Ministry of Health to adjust its health and nutrition programmes. An interdisciplinary course on ecosystem approaches to human health is also being designed for the National University of Ucayali.

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Sri Lanka: Agroecosystem Management for Human Health in the Uda Walawe Irrigation Scheme

Health / agroecosystem links

How do changes in agricultural water management and cropping patterns affect the breeding of disease-bearing mosquitoes, the availability of water for domestic uses, and the need for agrochemicals? What management options can make the use of water for agriculture more efficient while protecting human health and the environment?

Research organisations and partners

International Water Management Institute (IWMI); Mahaweli Economic Agency, Sri Lanka; Regional Agricultural Research Center, Department of Agriculture, Sri Lanka; Anti-malaria Campaign (AMC), Sri Lanka; University of Peradeniya, Sri Lanka; Brace Centre for Water Resources Management, McGill University, Canada.

Background

Ironically, the use of irrigation to produce enough food for basic human health and nutrition has often intensified other threats to health. These include increased transmission of malaria, Japanese encephalitis and schistosomiasis. In many irrigated areas, pesticide poisoning is also a big problem due to high pesticide use without the necessary safety precautions. Drinking water can be affected when irrigation systems are rehabilitated. For example, when canals are lined, there if often less recharge of shallow wells, leading to an increase in cases of gastrointestinal disease. Irrigation schemes can also affect regional water balances and sometimes have unintended ecological repercussions downstream, such as destruction of wetland biodiversity.

At the same time, irrigation development can help improve health. In many parts of the world, including Sri Lanka, irrigation canals and other structures are important sites for bathing and doing laundry, thus enhancing hygiene. As emphasis in the irrigation sector shifts from building large new schemes to rehabilitating existing ones, there are opportunities to design changes in irrigation management that promote both human health and sustainable food production.

Women are the main providers and managers of domestic water in most rural areas of the developing world and play a major role in agriculture. However, irrigation still tends to be a male-dominated activity. Irrigation policies and practices that neglect the key role of rural women in water use and management may pose unnecessary risks to overall family health and place a disproportionately large burden of illness on women and children.

In 1963, the Sri Lankan government launched the Uda Walawe Irrigation Scheme in the country's south. About 15,000 hectares in the Walawe River basin have been developed. A key aim of the Mahaweli Authority of Sri Lanka (MASL), which controls the scheme, is to use water more efficiently so that a further 6,000 hectares can be brought under irrigation. The strategy centres on rehabilitating canals, managing water better and introducing non-rice field crops that need less water.

Recognising the need for a broad perspective on ecosystem management, MASL asked IWMI in 1997 to help assess options for better water management at three levels: farm, irrigation system and basin. With support from the Japanese Bank for International Cooperation and the Council of Agriculture and Irrigation Associations of Taiwan, IWMI began research on drip irrigation for bananas, alternate wet and dry irrigation (AWDI) technology for rice, and the water balance at the basin level.

While crop diversification and intensified production through irrigation can alleviate poverty, environmental and human health problems also need to be addressed. For example, the resurgence of malaria and numerous cases of pesticide poisoning have alarmed both community members and public health officials in recent years. Such problems have raised questions about the sustainability of the whole irrigation enterprise. With IDRC support, the research project is therefore also examining health and environmental issues to identify options for improving human health in the Uda Walawe Irrigation Scheme.

Project description

The hypothesis of the health research component of the overall project is that irrigation management can be altered to improve human health, with minimal impact on agricultural performance. AWDI technology, for instance, can help control mosquito breeding in rice fields while conserving water. Similarly, IPM could lessen farmers' dependence on pesticides. This might not only improve agricultural productivity and alleviate groundwater pollution, but also cut the number of suicides related to easy access to toxic substances.

The methodology centres on four activities: investigating mosquito ecology and disease transmission; establishing the link between irrigation water management and groundwater quality and availability in shallow wells; estimating the need for agrochemical inputs for alternative crops and water management methods; and evaluating the potential for using IPM methods. The research draws on expertise from several disciplines and is broadly participatory in that scientists work closely with local communities, women's groups, NGOs, universities and government agencies.

The data needed to assess ecosystem management options for improved health come from several sources. For example, a geographic information system is being used to map malaria incidence. The information is broken down by environmental factors such as the extent of irrigation, other land uses, soil moisture and vegetative cover. And for their analysis of agrochemical usage, the researchers are drawing on existing sales data and conducting farm surveys.

The analytical results will be integrated to generate a basin-level estimate of changes in vector breeding, agrochemical use and groundwater fluctuations under different scenarios of irrigation management. Throughout the process, the researchers are paying special attention to the role of women in water management and to the effects of policies and practices on them. ■

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Bathing in a recently lined irrigation canal in Sri Lanka's Uda Walawe Irrigation Scheme. While the concrete lining may reduce the availability of water in shallow wells, the canal has become more attractive for activities like bathing and doing laundry. The lining prevents erosion, making for cleaner water. Photo: Ronald Loeve, IWMI.

Rice field preparation in the humid forest zone of Côte d'Ivoire. Shallow puddles are often the only breeding sites available for malaria-transmitting mosquitoes. Photo: Olivier Briet, WARDA.

West Africa: Irrigation, Water Management and Vector-Borne Diseases in Rice Farming

Health/agroecosystem links

Does expansion of irrigation and other water management strategies for rice production increase malaria transmission and the associated burden of disease in rural communities?

Research organisations

West Africa Rice Development Association (WARDA); Institut d'Économie Rurale (IER), Mali; École Nationale de Médecine et de Pharmacie, Mali; Institut National de Recherches en Santé Publique, Mali; Institut Pierre Richet – Organisation de Coordination pour la Lutte contre les Grandes Énemies (OCCGE), Côte d'Ivoire; Centre Universitaire de Formation en Entomologie Médicale et Vétérinaire, Côte d'Ivoire.

Background

Rice production and consumption have gone up rapidly in West Africa in recent decades and growth in demand is likely to remain above 5% a year. Evidence suggests that rice availability and prices strongly influence the welfare of the region's poor. Rice in West Africa is no longer a luxury but a staple, especially for the urban poor. Within the region, expansion in the cultivated area of irrigated rice is the main source of production increases. The "upland/inland swamp continuum" environment of the forest and savanna zones accounts for about 80% of the cultivated rice area of West Africa and 75% of production. This environment includes both rainfed and irrigated rice systems, while the more northerly Sahelian systems are irrigated.

Overall production trends raise serious questions as to whether environmental degradation (particularly in fragile upland ecosystems of the savanna) and malaria transmission will accelerate. On the environmental side, WARDA concluded some time ago that to meet regional food requirements and protect vulnerable uplands, lowland rice cultivation should be promoted. If agroecosystem management strategies are also to contribute to prevention and control of diseases like malaria and schistosomiasis, more information is needed on the socio-economic, ecological and environmental aspects of the differing rice systems and on the epidemiology of these diseases.

Project description

The project focuses on the Sahelian and savanna/forest regions where rice is grown, with Côte d'Ivoire and Mali serving as the venues of research. Institutions in these two countries are major scientific partners. Key objectives are as follows: to characterise the irrigated rice agroecosystems of the Sahel, as well as the rainfed and irrigated lowland-valley rice systems of the upland/inland swamp continuum (savanna/forest), in relation to health risks; to identify social, biological and other factors affecting the potential of agroecosystem management for vector control; and to assess health risks posed by malaria and schistosomiasis along a north-south transect through Mali and Côte d'Ivoire. The research is expected to increase various groups' awareness of the links between rice farming and health. These groups include rural communities, donors, policy makers and health and agriculture specialists.

Results to date and preliminary conclusions

Rice irrigation in the West African Sahel substantially boosts anopheline mosquito populations. However, the larger number of vectors does not appear to result in higher transmission of malaria in that region. Although malaria transmission and incidence during the dry season (rice-growing cycle) are higher in the irrigated zone than the unirrigated, rainy season (and consequently annual) transmission and incidence are much higher in the unirrigated zone. Relatively few of the abundant anopheline mosquitoes are infective in the irrigated zone. This is most likely because few mosquitoes live long enough to allow the malaria parasite to mature. In addition, the high biting rate on alternative hosts such as cattle probably reduces the chances of malaria parasites being transmitted to people. Very high bed net use (virtually 100% year-round) in the irrigated zone, stimulated by the high number of nuisance bites, may also play a crucial role. Attempts to control mosquito populations could reduce nuisance levels and, consequently, bed net use, which could have the unintended effect of increasing malaria transmission. Promotion of insecticide-impregnated bed nets could substantially reduce malaria, especially in the unirrigated zone.

In the savanna zone, irrigation leads to a higher anopheline population and to a second period of malaria transmission associated with rice production. Despite this, malaria transmission to children is similar in villages either having no irrigated rice or having two crops per year. Strangely, malaria transmission is lower in communities having only one rice crop. These observations suggest that irrigation may not, by itself, increase malaria transmission. Other factors likely explain reduced malaria in areas with only one annual crop. The researchers observed that introducing cultivation of irrigated rice had strong impacts on social organisation, economic status of households and intra-household relations (distribution of tasks between men and women). These factors in turn affect the capacity of farmers to recognise and react to early symptoms of malaria, or to adopt protective measures.

Surprisingly, less food is available to people in villages with two rice crops than in those with only one. People complain it is more difficult to feed their families with food they have produced themselves. This may be linked to greater difficulty in transporting food products from the uplands to the lowlands, to a transfer of the responsibility to feed the family from men to women (forcing women to sell rice to pay expenses previously assumed by men), and to better crop care in single-crop environments. ■

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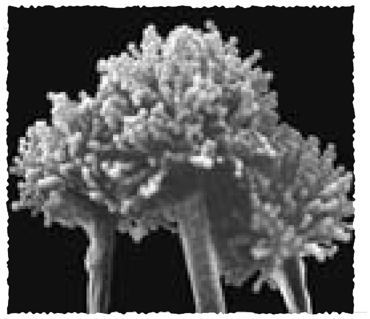
Groundnut seed contaminated with *Aspergillus flavus*. The fungus produces aflatoxin, the most potent chemical liver carcinogen known. Photo: ICRISAT.

Ecology of Mycotoxins in Maize and Groundnuts

David Miller and Wally Marasas

Exposure to mycotoxins present in food and feed crops has long been recognised as a serious threat to human and animal health. And, according to a 1996 United Nations report, "Freedom from mycotoxins in food ... is an indicator of sustainable development." Nevertheless, the sheer pervasiveness of the problem in developing countries, along with the cost of potential solutions in a sea of competing priorities, has led to a certain degree of pessimism on the part of agricultural and health authorities. Radical solutions that take into account the needs and conditions of developing countries are urgently needed.



A magnified view of *A. flavus* conidiophores and conidia. Photo: ICRISAT.

The combination of aflatoxin with hepatitis B and C is synergistic, raising more than tenfold the risk of liver cancer compared with each agent attacking alone.

Mycotoxins are chemical substances naturally produced by a modest number of species of fungi that grow on crops either in the field or in storage. In sub-Saharan Africa, two important crops are commonly contaminated: maize and groundnuts – major food crops and cash earners for millions of small-scale farmers. The best known of these chemical substances is aflatoxin, produced by *Aspergillus flavus*, found in both maize and groundnuts. More recently, fumonisin, produced by *Fusarium verticilliodes*, was discovered in maize in southern Africa. Exposure to these mycotoxins may occur simultaneously. In animal studies, the effect of aflatoxin is promoted by the concurrent presence of fumonisin. In humans, interaction between the two toxins is not understood.

Multiple health risks

For centuries, farmers in Central America reduced their exposure to aflatoxin, knowingly or unknowingly, by treating their maize with lye. Unfortunately, this procedure did not accompany maize on its eventual journey to Asia and Africa and is in any case not feasible where water is in short supply.

The exposure of people and animals to aflatoxin and fumonisin presents multiple health risks, both proven and probable (Cardwell, 1999). Aflatoxin, which damages DNA, is the most potent chemical liver carcinogen known. Many people in developing countries are infected by hepatitis B and C which are probably even more potent liver carcinogens. The combination of the two agents, aflatoxin with hepatitis B and C, is synergistic, raising more than tenfold the risk of liver cancer compared with each attacking alone. Acute aflatoxicosis occurs in poultry, swine, cattle and people. At lower but chronic exposures, aflatoxin may damage the liver, lower appetite, promote diarrhoea, inhibit growth and suppress the immune system. Recent studies conducted in West Africa are shedding light on the potential for aflatoxin-induced immune suppression in humans.

Fumonisin interferes with critical lipid pathways affecting cell function including the transport of critical vitamins such as folate. In laboratory animals, this toxin is a weak, non-DNA-damaging "complete carcinogen", but it is a powerful cancer promoter. While the effect of fumonisin on human health is poorly understood, the presence of this mycotoxin was discovered during studies of the exceptional rate of oesophageal cancer in part of the Transkei. So, despite the lack of direct evidence for a causal link, epidemiology studies associate fumonisin with this type of cancer. And recent laboratory studies suggest that fumonisin causes birth defects by damaging folate receptors.

Mycotoxins can also harm human health in other ways. First, domestic animals such as poultry and swine are very sensitive to aflatoxin and deoxynovalenol, respectively. The presence of these toxins in the poorest-quality leftover grain, which farmers feed to their livestock, reduces animal productivity and therefore the family food supply. The resulting protein-energy malnutrition increases disease prevalence, further undermining people's ability to cope with mycotoxin exposure. Second, the loss of income from lower animal production leads to greater poverty, thus reinforcing the conditions conducive to poor human health.

Contributing factors and research priorities

Improper storage is understood to enhance mycotoxin concentrations in maize and groundnuts. Evidence suggests that in sub-Saharan agroecosystems, mycotoxin-producing fungi in the soil invade plant roots, particularly when the host plant is stressed by short-term drought. Soil degradation, inappropriate farming practices and choices of crop varieties may affect the quality of the subsequent crop.

The presence of mycotoxins in the poorest-quality leftover grain, which farmers feed to their livestock, reduces animal productivity and therefore the family food supply.

There are indications that poor rural people who consume stored, homegrown maize and groundnuts are among the most affected. Crops handled by government agencies may be better inspected and thus safer for consumption. In some cases, farmers sell their high-quality produce, keeping mycotoxin-contaminated food for their own consumption. Furthermore, because the poor rarely have the luxury of diversifying their diets, their exposure to mycotoxin-laden crops is often greater than that of the reasonably well-off.

In 1997 and 2001, the Joint Expert Committee on Food Additives published evaluations of aflatoxin and fumonisin, respectively. This is a committee of the World Health Organization and the Food and Agriculture Organization of the UN, and decisions of JECFA are referenced by the World Trade Organization. According to JECFA, nearly all Africans would for some or all of their lives be exposed to aflatoxin levels known to affect population health. Again in Africa, the average exposure to fumonisin is estimated to exceed the tolerable daily intake and for about 10% of the population it is exceeded by three times. No estimate was made of the effect of concurrent exposures.

Urgent action by researchers is needed on several fronts:

- Observation of human diets in high-risk communities, to assess levels, seasons and sources of exposure to mycotoxins;
- Evaluation of health impacts of mycotoxins, particularly in food-insecure communities that depend on degraded soils for sustenance;
- Definition of social and economic structures that differentially expose one or more sub-groups to mycotoxins;
- Studies of soil ecology with a view to preventing mycotoxin-producing fungi from invading crop roots.

Because the poor rarely have the luxury of diversifying their diets, their exposure to mycotoxin-laden crops is often greater than that of the reasonably well-off.

While we think we know what tolerable levels are, in Africa there is no meaningful possibility of achieving them in the near term. So a further priority is to determine what interventions are necessary to make an intolerable situation better.

In the decade from 1985 to 1996, IDRC made important contributions to a number of technical and policy-development initiatives on mycotoxins in developing countries. These included collaborative R&D in China and significant multilateral policy work on mycotoxins in Southeast Asia (with Australia), in South America (with the International Maize and Wheat Improvement Center), and in Africa (with Denmark). These initiatives have created national capacity and helped to foster the development of key research efforts among researchers in many countries.

Other projects have also been funded and are under way. They include a critical study of the impact of aflatoxin on infectious disease, supervised by Chris Wild at Leeds University and Kitty Cardwell, formerly of the International Institute of Tropical Agriculture; studies of analytical methods for mycotoxins developed by Maya Pinereo (FAO); and a project to understand the factors that affect the formation of fumonisin in maize, involving researchers all over the world, including David Miller's group at Carleton University. We are looking for resources to do critical studies on birth defects and oesophageal cancer in South Africa and develop effective interventions. ■

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Integrating from Below: Community Capacity Building

Peter Gubbels and Jagdish Ghimire

Evidence is mounting that integrated approaches to sustainable rural development are more effective than conventional ones that tend to view ecosystem components in isolation. Community health cannot be separated from issues surrounding the natural resource base on which most rural livelihoods depend. However, there are few guidelines on how social, economic, health and environmental factors can be pulled together into a coherent analytical framework for planning, executing and assessing rural development interventions.

Here we present a few results and lessons from World Neighbors' (WN) experience in formulating and applying an integrated approach to rural development. WN's gradual adoption of this approach resulted from "people-centred" problem solving rather than from any response to preconceived agendas about demographics, resource conservation or health. Our analysis indicates that for marginalised rural communities, the issues of livelihood, food security, natural resource use, family and community health, reproduction and family size are inextricably linked. Moreover, with suitable guidance and support, rural people are capable of analysing the multiple ways in which ecosystem components interact with community health. Based on collective learning and holistic analysis, rural people can choose concrete actions that lead to significant and sustainable improvements in their health.

"Integration" and "integrated development" have too often been viewed as a challenge of vertical delivery of services whereby gaps between disciplines, sectors and institutions must be bridged from above. In contrast, World Neighbors is concerned with "integration from below". We focus on processes of participatory diagnosis and learning which lead to mutually supporting community activities that reflect local priorities and capacities. The example below is from Ecuador.

A comparative study in Ecuador

In 1992, a small health and family planning clinic in the town of Guaranda, in Ecuador's Bolivar Province, was on the verge of closing down. Set up to serve rural Quechuan Indians, it had too few users to justify keeping its doors open. Then, between 1993 and 1997, a unique research project helped turn the situation around. Today, the clinic provides more than 18,000 consultations a year and has more than 2,500 users of family planning services.

The research tested a simple hypothesis: integrated community development, responding to local priorities such as food production and security, natural resource management (NRM) and public health, will lead to greater well-being and more widespread use of family planning than an approach based on family planning alone. To conduct the study, World Neighbors partnered with the Center for Medical Guidance and Family Planning (CEMOPLAF), a non-profit maternal and family planning organisation providing health services in 21 provinces, over half the country.

Twelve rural communities participated in the study. Six were involved in an integrated community development programme. This included a range of services and activities in the areas of sustainable agriculture, NRM, public and reproductive health and family planning. The other six received only reproductive health and family planning components. In both sets of communities, two instructors trained local volunteers as health promoters. The volunteers then replicated the training in their communities via mini-workshops.

A baseline survey of a random sample of 400 families was conducted. Male heads of household responded to agricultural questions while women of reproductive age answered health questions. Three years later, the same communities were surveyed again, this time based on a random sample of 480 families. This allowed the researchers to compare the attitudes, practices and outcomes among farm families in the two sets of communities.

Health and agricultural setting

Despite CEMOPLAF's success with other groups, its record with indigenous rural people was poor. Yet indigenous areas typically have the highest levels of fertility and unmet need for reproductive health and family planning services. Quechuan resistance to such services stemmed in part from suspicion about the motives of outsiders, rooted in the genocide of the Spanish conquest. In some areas, religious authorities also discourage family planning.

The proportion of women who received professional assistance during child birth was only 20 to 40%, and only about half the women brought their children to the health centre after delivery.

The baseline survey revealed significant health problems in both sets of communities. Roughly half the children were afflicted with diarrhoea and 60 to 70% had respiratory problems. The proportion of women who received professional assistance during child birth was only 20 to 40%, and only about half the women brought their children to the health centre after delivery.

Communities participating in the integrated programme were historically more under-served and more rural than those in the health-only programme. At the study's outset, knowledge of birth control methods was much lower in these communities (35%) than in the health-only communities (65%). Family planning use was modest in the health-only communities (25%) and low (12%) in the integrated-programme communities.

Erosion, loss of soil fertility and reduction of farm size due to population growth adversely affected family food security. This stimulated seasonal migration of males, shorter fallow periods and cultivation of steeper slopes. Drought followed by heavy and excessive rainfall also contributed to soil erosion and other degradation of natural resources.

The interventions

The health-only programme initially focussed on promoting oral contraception and condom use through community-based distributors. Then, in response to community requests, it expanded in the second and third years to include other services in areas such as nutrition, breast-feeding, diarrhoea, and respiratory and reproductive-tract infections.

The integrated programme consisted of a somewhat broader initial health offering, plus an agricultural/NRM component. The latter included soil and water conservation based on protective barriers composed of native and exotic trees; the use of cover crops and green manures; farmer experimentation with varieties of wheat, barley and potato; production of vegetables; and livestock improvement.

Research results

Family planning acceptance in the communities involved in the integrated programme grew more than threefold, from 11.6% in 1993 to 41.1% in 1996, while in the health-only communities, it remained more or less constant at roughly 25%. Interventions related to NRM and crop production stressed the use of local resources rather than external inputs, as well as the prevention of environmental degradation. In the integrated programme, changes were seen in farmers' knowledge, attitudes and methods in these areas. Awareness of the importance of conserving resources, especially soil and water, increased. The proportion of farmers using erosion-prevention techniques more than doubled from 23% to 50% and the proportion planting green manure to improve soil fertility increased from 0 to almost 40%. There was also a marked increase in fallow period, with 40.6% of participants leaving their land fallow for 5 to 6 months, compared with 6% at the outset.

Observations and lessons

Based on the study results, CEMOPLAF plans to extend the integrated approach to its other clinics serving rural indigenous people in Ecuador. It will also undertake more rigorous research and evaluation to examine processes by which communities adopt new practices. In the meantime, though, it is possible to draw some conclusions and lessons from the initial study.

Putting community priorities and livelihoods first

Integrated programmes to improve human health in the context of agroecosystem management succeed best when they respond to community priorities such as child health and survival, food security, food production and natural resource management. This approach builds local trust and inspires confidence. An intervention that does not speak to immediate needs is unlikely to evolve to address secondary needs.

Rural families in the study area faced tremendous economic pressures due to soil degradation, population growth, the shift from subsistence to cash crops, and other factors. They were looking for more sustainable forms of stewardship for the natural resources on which their livelihoods depend. A key strategy was to develop interventions linking short-term economic benefits to longer-term human reproductive and ecosystem health.

Building community capacity and leadership

Strengthening community organisation, leadership and capacity to identify and diagnose problems, plan and implement development activities, and monitor and evaluate results was a critical aspect of the Bolivar programmes. In many Quechuan communities, local organisation and leadership were already quite strong. However, for the first time, communities began developing their own annual plans, including health, agricultural and NRM objectives. These were used to evaluate progress at the end of the year.

Taking gender into account

Sixty-four percent of the Bolivar study participants were women, due to the growing level of male seasonal migration and consequent increase in women's livelihood responsibilities. Devising ways to increase women's participation in agroecosystem management, community structures, leadership and decision making was an important aspect of the intervention. Through this approach, women gained self-confidence and organisational capacity. A gender-sensitive approach also demanded that men be included in community and reproductive health education. Increasing the exposure of men to health issues was facilitated by combining health and agricultural activities in an integrated programme.

Identifying links between natural resources and reproduction

Alternative methods of soil and water conservation, organic composting, cover crops, green manures, agroforestry and experimentation with techniques based on local natural resources all strongly appealed to the Quechuan communities. These methods directly addressed the survival of their agroecosystem and way of life. The Bolivar programme included education about how reproduction and population growth are linked to the state of natural resources – concepts well-understood and discussed by the participants.

Concluding note: The broader picture

World Neighbors' experience in several countries suggests that successful programme outcomes depend on innovative inter-agency partnerships, sometimes at multiple levels of the agroecosystem. In the case of Ecuador, a large national health service organisation agreed to step outside its traditional domain to promote innovations for agriculture, income generation and resource management at the farm and community levels. World Neighbors played a crucial role by providing methodological, technical, capacity-building and funding support. In other countries such as Indonesia, where interventions focussed on community participation in forest management, it was necessary to set up even broader stakeholder networks involving universities, NGOs, government agencies at different administrative levels, and local communities.

In general, interventions at multiple administrative and geographic levels make the job of brokering a multi-stakeholder process of research and decision making more complex and time-consuming. Strong leadership, vision, flexible funding and considerable institutional change are required. Nevertheless, a broader ecosystem management approach, whatever its potential benefits, is simply not practical if it becomes mired in costly and protracted research and negotiation among stakeholders. In all instances, it is essential to help communities quickly pinpoint and alleviate immediate pressures on local livelihoods rather than waiting to understand the full complexity of the agroecosystem. This is the entry point for "integrating from below", for building the self-confidence and long-term capacity of rural community groups and other stakeholders to diagnose and solve problems of human health.

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Since good health includes people's capacity to achieve their goals, an ecosystem approach to health must be participatory. Here, a women's focus group meets to gain a better understanding of local diets and nutrition in the Peruvian Amazon. CIAT photo: Yolanda Malqui.

An Ecosystem Approach to Health

David Waltner-Toews and James Kay

What is health?

In the public mind and even in the professional literature, medicine is often confused with the broader notion of human health and the various ways to achieve it. Medical approaches usually depend on hierarchical lines of authority, normal science, clinical diagnosis, and authoritative treatment. In contrast, health promotion requires, among other things, holistic, post-normal science driven by participation and activism. This wider perspective acknowledges the existence of health conflicts that cut across ecological and social perspectives. It also calls for constant renegotiation of these tensions through democratic and power-balanced processes. In some instances, biomedically oriented research may actually undermine health by disempowering the communities it studies.

The definition of health offered in the 1946 preamble to the constitution of the World Health Organization (WHO) has shown itself to be surprisingly resilient. Good health, according to WHO, is "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." This definition has been modified, criticised and widely discussed, and alternatives have been proposed. Discussion has focussed on the notion that "well-being" includes the capacity of people to achieve desirable and feasible goals and to adapt to environmental change and stress.

In the context of ecosystems, human health is a positive characteristic of human communities. It implies both the availability of resources and access to them. Specific positive outcomes include food security, good nutrition, low levels of disease, reproductive capacity (including women's control over the spacing and number of children), a sense of well-being, and access to knowledge, information and power. These outcomes must be seen in light of water, land and energy use, social and economic organisation, and other factors. Thus, health is a social construct negotiated in the context of our best understanding of the constraints and opportunities provided by the ecosystems of which people are an integral part.

Why do we need a new approach to health?

Despite WHO's view that health is more than the absence of disease, conventional health research has tended to choose specific disease outcomes and view them as the result of a linear chain of events. For example, water pollution from untreated sewage leads to diarrhoea in the children who drink the water. But this analytical approach is unrealistic.

A more complex and realistic view might identify certain kinds of economic activity, which, although possible causes of pollution, also generate money to improve nutrition and the public health infrastructure. Completing a commonly found feedback loop, the diarrhoea afflicting the people who consume the water undermines their efforts at improvement by decreasing their energy to work and siphoning money away from education and productive activity. This feedback may be complicated by the fact that men are engaged in the activities that generate income, and women and children are the ones who suffer the major consequences. Under this view, resolution of health-related issues – disease, education, nutrition, livelihoods – requires us to go beyond traditional health sector concerns and pay attention to the ecological and socio-economic context.

Good health, according to the World Health Organization, is 'a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.'

Thus, health for some may create ill health for others, either in this generation or the next. Disease treatment programmes, based on increased use of drugs for example, may generate new diseases that are drug resistant or that fill the ecological niche vacated by the organism being attacked. Conversely, programmes entirely unrelated to the conventional health sector, such as agriculture and dam building for electrical power, have major, usually contradictory, effects on human health. Conventional programmes aimed at creating environments that promote health are thus simplistic and, if they achieve their goals, they do so by accident rather than design. The ecosystem approach was developed to make interactions explicit.

What is the ecosystem approach?

Among the various strategies for dealing with complexity and decision making, the ecosystem approach has demonstrated the most promise, in terms of both its theoretical base and practical uses. It was developed and elaborated primarily in the context of environmental management in the Great Lakes Basin of North America and the design of related sustainability indicators. The ecosystem approach represents a view of ecological interactions which is complex in the full technical sense and leads to what some have called post-normal, democratic and/or participatory science.

Sustainability does not result from adopting a package of technologies and practices, but from establishing a process of learning and investment in local governance.

According to the Ecological Committee of the International Joint Commission, in "the ecosystem approach there is not one material ecosystem to which our definitions must conform. Rather, the human actor must accept responsibility for erecting definitions and be prepared to change them when the purpose of the description changes." Some authors generalise this view to an understanding that any complex system is subject to interpretation from different legitimate perspectives and, hence, that problem resolution cannot depend only on objective technical or scientific expertise. Rather, drawing on various bodies of accepted knowledge, stakeholders must negotiate a continuing series of resolutions within basic ecological constraints. Thus, sustainability does not result from adopting a package of technologies and practices, but from establishing a process of learning and investment in local governance.

Indeed, according to Kay and Schneider (1994): "If we are truly to use an ecosystem approach, and we must if we are to have sustainability, it means changing in a fundamental way how we govern ourselves, how we design and operate our decision-making processes and institutions, and how we approach the business of environmental science and management." And, we would add, how we approach human health issues.
In practice, the ecosystem approach brings together two major strands of activity, one focussed on systemic research-based descriptions, the other on social involvement (Kay et al., 1999).

Challenges facing an ecosystem approach

There is a need to understand the interactions between the socioeconomic and ecological aspects of ecosystems. Human and biophysical variables interact through feedback loops, many of which are non-linear and hard to track, making the prediction of long-term outcomes very difficult if not impossible. These feedback loops demonstrate that ecosystems are dynamic and self-organising and that their states can change in sudden and unexpected ways. Some types of feedback result in cross-scale conflicts (e.g., between individuals and communities) for which there may be no technical solution. For instance, a human population living within ecological constraints requires not only new births to bring in fresh ideas and ensure genetic renewal, but also a certain mortality rate to make room for the newcomers. There may thus be irreconcilable differences between what is good for an individual and what is good for a community.

Multiple models of reality (specified by gender, ethnic group or economic class, for example), together with the dynamic nature of the reality we are observing, are difficult to express in quantitative models or mathematical equations.

Reality can be described from different perspectives and at different temporal and spatial scales. There is no single scientifically acceptable description of the complexity of socio-ecological systems. Governance structures and other power-related factors strongly influence which ecosystem issues – water flows, food production, human health, and so on – will be judged worthy of attention. They also determine the scale (individual, household, community or global) at which the issues are likely to be dealt with. One's perspective, whether as a scientist, villager, bureaucrat, woman, man or member of a particular class or ethnic group, determines which aspects of reality are seen as background and which as foreground.

Visions of the future

For any complex system, the formulation of problems and the design of solutions depend on the perspectives chosen. Since good health by definition includes people's capacity or power to achieve their goals, an ecosystem approach to health must be participatory. And because we are concerned with ecological sustainability, that approach must also be explicitly anchored in a systemic understanding of the elements and relationships that determine how the complex world we live in self-organises and changes over time. These two dimensions of the ecosystem approach – participation and systemic understanding – must converge in visions of desirable, feasible futures and lead to governance, management and monitoring activities for achieving them.

Part of that work is to evaluate the synergies and tradeoffs raised by each scenario. For example, while dam construction provides electric power and flood control, which may lead to better overall nutrition in the community, it also creates a habitat for diseases such as schistosomiasis and malaria. An ecosystem approach to human health emphasises synthesis, stakeholder negotiation, and the resolution of such tensions across ecological and social perspectives.

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Ecological Millennium: Setting the Bottom Line

David Suzuki

This is an abridged version of Dr. Suzuki's plenary address to the Canadian Conference on International Health. For the full text, see www.idrc.ca/ecohealth/suzukispeech.pdf.

At a time when science and technology dominate our lives, it is ironic that we need the great wisdom of traditional people around the world to remind us that the earth is our mother. Not only is it horrifying to contemplate our current assault on her, it is also obvious that the damage we are inflicting on her will have enormous repercussions on us, her children.

In graduate school at the University of Chicago, I was taught, and I later taught my students, that science is the most powerful way to know the world around us. It allows us to push back the curtains of ignorance, to reveal the deepest secrets of the cosmos. Through science, we can gain control of nature and the rest of our surroundings. Through science, I believed, life would get better and better for human beings around the world. In the years that followed Sputnik, science indeed exploded. We were overwhelmed with the success of that growing scientific community.

When I returned to Canada in 1962, I was shocked at the abysmally low level of support for science in this country. The only thing that saved me was a large American grant I received to study in Canada. Then, I was asked to do a television show. I was at the University of Alberta in the genetics department, and I jumped at the opportunity. I thought it was a great chance for me to communicate with people about why science is important and that, if I did this well enough, maybe in the long run I would get a bigger grant. It was out of self-interest that I wanted to demystify science.

David Suzuki, geneticist, broadcaster and environmentalist. Technology, population growth and a "mono-culture" approach to economics, he says, have turned human beings into a powerful and dangerous super-species. Photo: Al Harvey.

But I was distracted by someone I had never met, a woman named Rachel Carson, who wrote *Silent Spring*. Her book came out in 1962, the very year I did my first TV programme. I think anyone who read the book was never able to look at the world again in the same way. Carson put out a very powerful warning about technology. The case she focussed on was pesticides, but it could be taken as a symbol of all technology.

The cost of technology

Technology is powerful. We love technology because we invent it to do things for us. But our knowledge about how the world around us works is so limited that we can't anticipate what the costs may be down the road. Carson pointed out that we had better pay attention to the fact that for any technology we will always have to pay a price. As you all know, the environmental movement grew explosively as a result of her book, and only 10 years later the United Nations held its first world conference on the subject, in 1972. Many of the issues that we still face today were raised at that meeting in Stockholm: population growth, pollution, species extinction. And major scientists were there: Margaret Mead, Paul Ehrlich and Barry Commoner, for example. They were there warning us about the crisis we faced.

After Stockholm, we had constant reminders of the fragility of the environment – the dioxin spill in Seveso, Italy; the Union Carbide accident in Bhopal, India; the Exxon Valdez oil spill in Prince William Sound; and the Chernobyl nuclear reactor fire. We kept learning about new phenomena that we did not know existed in 1962 or 1972. We have since learned about ozone depletion, global warming and endocrine disrupters.

The year 1988 was the high point of environmentalism around the world. You may remember U.S. presidential candidate George Bush saying, "If you vote for me, I promise I will be an environmental president." Now we know how shallow election promises are. The same year, the U.K.'s Margaret Thatcher was filmed walking around a park in London, picking up litter and saying, "I'm a greeny too, I care about the environment." And in Canada, we had a new Prime Minister, Brian Mulroney. To show his born-again environmentalism, he raised the Ministry of the Environment into the inner cabinet.

So, we had reached an apex of concern about the environment and we coasted into 1992 for the largest-ever gathering of Heads of State in human history at the Earth Summit in Rio. The summit was meant to signal that, from that point on, humanity was taking a fundamentally different path, that the environment could never be ignored in any decision we make, whether economic, social or political. *Sustainable development* became the rallying cry.

Stark warning

As if to emphasise the importance of the Earth Summit, in November of 1992 a remarkable document titled *World Scientists' Warning to Humanity* was released. It was signed by more than 1,600 senior scientists from around the world, including more than half of all living Nobel Prize winners. It begins like this: "Human beings and the natural world are on a collision course. Human activities inflict harsh and often irreversible damage on the environment and on critical resources.

If not checked, many of our current practices put at serious risk the future that we wish for human society and the plant and animal kingdoms, and may so alter the living world that it will be unable to sustain life in the manner that we know. Fundamental changes are urgent....”

As a group, scientists tend to be cautious in making public pronouncements. Yet here we have a group of leading scientists saying we are on collision course with the life support systems of the planet. “No more than one or a few decades remain,” the warning continues bleakly, “before the chance to avert the threats we now confront will be lost and the prospects for humanity immeasurably diminished. We the undersigned, senior members of the world’s scientific community, hereby warn all humanity of what lies ahead. A great change in our stewardship of the Earth and life on it is required, if vast human misery is to be avoided and our global home on this planet is not to be irretrievably mutilated.” They said we may have as little as 10 years to avoid absolute catastrophe.

While the document was stark and terrifying, what was even more terrifying to me was the lack of response by the world press. Canada’s so-called national newspaper, *The Globe and Mail*, did not cover it. Nor did our national radio and TV network, the Canadian Broadcasting Corporation (CBC). Major American TV networks, *The New York Times* and *The Washington Post* didn’t bother to report it either. So, when half of all Nobel Prize winners tell us we may have as little as 10 years to avoid catastrophe, the media decide this isn’t newsworthy. What do they consider newsworthy? The historically trivial O. J. Simpson trial, the death of Princess Diana, and Bill Clinton’s relationship with Monica Lewinsky.

Rachel Carson, environmentalist and author, Maine, USA, 1962. The global environmental movement grew rapidly after the publication of her book Silent Spring. Photo: Erich Hartmann / Magnum Photos.

As a group, scientists tend to be cautious in making public pronouncements. Yet here we have a group of leading scientists saying we are on collision course with the life support systems of the planet.

Prioritising economics and the environment

Only a year after the Earth Summit, we had another election in Canada. *The Globe and Mail* editorialised that there were only three issues of concern to the Canadian electorate: the economy, the economy and the economy. While the economy has emerged in the 1990s as the dominant feature affecting our lives, the environment appears to have disappeared as a high priority. Was the whole thing a hoax? Was Rachel Carson really what Monsanto and the other chemical companies said at the time – just a frustrated old woman without scientific credentials? Was all of the concern in Stockholm in 1972 and then in 1988 a fabrication of environmentalists? Or, heaven forbid, were politicians and business people so responsible they took care of it and it’s no longer an issue? Of course, the answer to all those questions is no. Why is it, then, that in 1999 we are failing to heed serious warnings that we are on a collision course with our planet – warnings not from eco-terrorists, neo-Luddites or “do-gooders”, but from leading scientists?

An obvious reason we haven’t been able to assimilate the problem and act on it is that we are a fundamentally local species. We observe the world around us through our five senses. If we can smell, see, taste, feel or hear it, we know it’s real. But when issues are global, they are really beyond our capacity as individual people to sense them. We haven’t evolved sense organs that can tell us directly that the ozone layer is being depleted or even that it’s up there. We can’t detect that greenhouse gases are increasing in the atmosphere. We can’t sense dioxins and PCBs in our food or water. As biological creatures who evolved in a world radically different from today’s, we are no longer able to sense the real dangers confronting us. And the changes in our world have happened absolutely explosively.

Population growth and the global economy

As a distinct species, *Homo sapiens* may have existed for about half a million years. If you plot that time span on a graph, where the X axis represents time and the Y axis total human population, for 99% of human existence there were less than a billion people on earth. It took a long time, almost the entire half million years, to reach one billion people, around the year 1830. It’s only in the last pencil-width of time that you finally begin to see the curve inflect up.

In my lifetime, the planet’s population has tripled to 6 billion. Where it took nearly half a million years to reach a billion people, we are now adding a billion people every 12 to 13 years. The curve is now leaping straight off the page. As you well know, in a finite world, nothing can continue that way and it will come down. The only question is, will it come down by hitting a ceiling and then plunging? Or will it go up, and then curve gently back as we deliberately bring it down?

It’s not just our numbers and our technology that have made us so powerful. We have very recently cloaked ourselves in a concept called the global economy.

At the very time human populations are skyrocketing within a single generation, technology has grown even faster. Virtually the entire history of modern technology is encompassed in the last 100 years – from cars, to planes, to space, to nuclear energy, to computers, to birth control pills. While we are already the most numerous mammals on earth, each of these technologies gives us much more muscle power than any other species. Each human being so equipped can now attack the planet. We have become what I call a super-species. No other species has ever had the capacity to alter the biophysical features of the planet – a capacity we have developed in an incredibly short period of time. But it’s not just our numbers and our technology that have made us so powerful. We have very recently cloaked ourselves in a concept called the “global economy”.

The mono-culture of the global economy

Economics is a construct. Human beings have had economies for thousands of years and these have varied from place to place. But today we are being “mono-cultured” with a single notion of economics – the global economy – which is equated with progress. While no one is against progress, economic globalisation is based on the idea of growth going on indefinitely. For me, there are many reasons why this represents the greatest threat we now confront. But first, some background.

The great discovery of the 1960s in my area of genetics occurred when scientists began looking at individual genes within populations of a single species. They discovered, to their amazement, that rather than being highly homogeneous, single genes were tremendously diverse. It was called genetic polymorphism. The reason for that diversity, we understand now, is that throughout the evolution of life our planet has never been static. The poles have reversed and then reversed back again. The sun has increased in intensity by 25% since life began on earth 3.8 billion years ago. We have had continents colliding with each other. We have had warming periods and ice ages. Tremendous changes have happened. Life gets its resiliency from the constant presence of genetic differences. As the environment changes, some gene combinations have better survival ability under the new conditions. Life has evolved by maintaining tremendous diversity. But it’s more than just genetic diversity. Species diversity, ecosystem diversity and, in the case of humans, cultural diversity have also been the key to our long-term survival.

Monoculture is the spreading of a single genetic strain or a single species over a wide area. We have found in agriculture, fisheries and forestry that monoculture runs counter to the principle of diversity-based adaptability. It makes life vulnerable to change. And so it is with human cultures. Human cultures have flourished on this planet because of their diversity and because they are intimately tied to local areas. Our diversity has let us live in the Kalahari Desert, the Amazon rain forest and the Arctic.

But we are now mono-culturing the planet with a single economic idea of progress and development. I submit that this is unbelievably dangerous, because it makes us vulnerable to the questions: What if it’s wrong? What if conditions change and can no longer support that single notion? As a biologist, I see this as the fundamental threat posed by globalisation – the mono-culturing of our planet. If you look into economics itself, you find it is a fundamentally and unbelievably flawed system.

Economics and indefinite growth

Hazel Henderson, a leading futurist in the United States, says conventional economics is a form of brain damage. She is absolutely right. In an introductory economics course, one of the first things a professor will do is throw up a slide of the economy. Economists love this because it looks scientific – lots of arrows back and forth, raw resources, extraction, processing, manufacturing, wholesale, retail. While economists claim economics is a science, it isn’t. It is a set of values that tries to present itself as science. In principle, if you know what all the arrows represent, you can tweak them with an incentive here or a disincentive there, thus “managing” the economy.

But then a student asks: “Excuse me, Professor. Where in that economic diagram is the ozone layer? Where do you put the deep underground aquifers of fossilised water? Where do you put topsoil?” You know what the answer is? “Oh, those are externalities.” But if we externalise the real world on which we depend, then the economic construct has nothing to do with reality. You might as well be on Mars. You ensure the development of a system that will trash our planet.

To compound the insanity of conventional economics, economists actually believe that human beings are the greatest thing to hit this planet. They believe our creativity will solve all problems. They believe that if we run out of resources, we’ll find substitutes, or that we can simply go to the moon or Mars to get whatever we need. They believe there is no limit to human inventiveness. So economics is based on the idea that we can have steady growth forever. But in a finite world, nothing can grow indefinitely.

If you don’t have steady growth, conventional economics considers it an absolute disaster. Imagine a company going to a bank and saying, “We’ve got 10% of the clothing market in Canada and we’re very happy. We’re making a profit. We don’t want the firm to grow any bigger. We’ve got a plant and we turn out product, but we need a loan to upgrade our equipment.” You know what the banker will say: “No way you’re going to get a loan. You’re dead.”

Banging into natural limits

In our crazy economic system, if you’re not growing, you’re considered dying. But as Stanford ecologist Paul Ehrlich says, “There are only two systems on the planet that believe in steady growth forever. That’s economics and cancer cells.” In our belief in the necessity of steady, endless growth, we have turned the economy into our highest priority. But what kind of a society judges its politicians and its government on the basis of how well they’ve done with the economy? What about the living conditions of the frailest, most vulnerable people? That’s the criterion of success I want for my government.

But no, the economy and the Ministry of Finance, with its big budget, are considered everything, while the biosphere and the Ministry of the Environment are seen as representing just a tiny sliver of the economy. That’s our mentality. I have had politicians and business people tell me over and over again, “Listen, Suzuki, if we don’t have a strong, growing economy, we can’t afford a clean environment.” Of course, the reality is exactly the opposite. The biosphere is everything. The only legitimate issue is how big the economy can grow before it begins interacting with natural limits and breaking down parts of the biosphere. Many biologists believe we are long past having to worry about that. The economy is already banging into limits and surpassing them. We see the degradation around the world. Unless we recognise that the biosphere encompasses everything and that it can't grow, then economics and economic growth will continue to be the destructive agents that they are today.

The biosphere is everything. The only legitimate issue is how big the economy can grow before it begins interacting with natural limits and breaking down parts of the biosphere.

The point here is that we human beings have changed very suddenly. We have changed in terms of our numbers and technology. We have changed with regard to our notions of economic progress and globalisation. And we have changed as consumers on the earth. Taken together, these shifts mean we are now affecting our planet in a profound way.

The problem with science

Let me return to the history of the environmental movement for a moment. For me, Rachel Carson's book was a warning. As I began my television career in 1962, my focus switched from wanting to expound on science to a desire to explore the ecological consequences of human activity. Through the 1960s and 1970s, at the very time environmentalism was on the rise, science and technology were exploding. A statistic you've probably heard is that 95% of scientists in all of human history are alive today and publishing papers. We have had enormous benefits: new materials, oral contraception, computers, space research, genetic analysis and so on. But the crisis for me was that, despite the scientific explosion, it was clear that life was not getting better for most of humanity, and the earth itself was showing signs of tremendous stress. So, while I believed science would improve everyone's lives, I could see this was not actually happening. When I asked myself what was wrong with what I believed, I realised that the great strength of science – what makes it unique as a way of knowing – was also its fatal weakness.

Science focusses on a part of nature. Whether it's a root, an atom or a subatomic particle, we try to bring a part of nature into the lab. We try to control everything impinging on it and measure everything coming out of it, thereby gaining a profound understanding of that fragment of nature. That's called reductionism. Ever since Isaac Newton's time, we have assumed that the cosmos is like a giant clockwork or machine. By reducing nature to its elementary parts, we thought we would eventually be able to fit them back together again, like a giant three-dimensional puzzle, and recreate the universe. Reductionism, then, has been the driving force of the scientific endeavour. But 20th century physics showed that Newton was dead wrong, that the universe is not simply a clockwork mechanism. Unfortunately, most people in the areas of human development, biology and medicine simply haven't got it yet. They are still in that reductionist mode of Newtonian times.

What physicists found was that when you remove a part from nature, you lose sight of the context within which it was interesting. You lose any sense of the rhythms and the patterns within which it operated and made sense. You destroy the very fabric of meaning that you wanted to study in the first place. You may be able to describe isolated pieces, but when you put them together, they do not add up to the sum of their individual properties. They interact, with synergistic effects. As Nobel laureate Roger Sperry from Caltech said many years ago, "There are emergent properties that come from the combination that you can't predict or anticipate on the basis of their isolated parts." So you're really snookered. There's no way you can look at the most elementary particles and have any understanding of what the behaviour will be as you climb up to higher levels of complexity. Science, then, in its most reductionist state, is virtually useless when it comes to providing us with the kind of information we need for understanding and control.

Managing the planet without a blueprint

I am sure you are going to hear about health management, water management and air management. All kinds of people claim to be able to manage different aspects of the natural world. I tell you we haven't a clue.

If you want to properly manage something simple like a shoe factory, you need an inventory of everything in your factory and a blueprint that tells you how everything in that inventory interacts. With that knowledge, you should in principle be able to manage the factory indefinitely. But how well can we manage the planet? How many species are there? We have named a lot of animals and plants and of the animals so far identified, the most abundant, successful and ubiquitous are insects. It's estimated that, for every human being, there are at least 200 million insects. So, long after we're gone, there will be plenty of life flourishing – insect life.

Naming is not knowing

A few years ago, Terry Erwin of the Smithsonian Institution went down to the Amazon rain forest. He put a sheet of plastic on the forest floor and blew a fog of insecticide into the canopy. Almost every one of the insects that rained down on his sheet had never been seen by a human being before. On that basis, he estimated there are about 30 million species on earth. Since that time, the estimate has come down and the consensus figure now seems to be 10 to 15 million. How many species of plants and animals have we identified? About 1.4 to 1.6 million. (The reason for the disparity is that different scientists may classify the same organism independently and give it a name.) So, if there are 10 million species, we know less than 20% of the diversity on the planet. That's just the plants and animals. When it comes to micro-organisms, we have not got a clue.

When a scientist names an organism, that just means someone sitting in a lab has given a dead specimen a name. It does not mean we know how many individuals are out there, what they eat, what their life cycle is, how widespread they are, or how they interact with other species. As for basic biology, "We probably know less than a fraction of a fraction of 1% of all species on earth in any kind of detail," says Ed Wilson at Harvard. If we know so little about the living world, how can anyone have the temerity to say we can manage it?

You can't manage communities of organisms when you know so little about their makeup. When foresters tell me we can manage forests, I just laugh. That's because when they talk about "forests", they really mean plantations. Everyone knows that a plantation is a fundamentally different entity from a forest. No human being or company has ever grown a forest. Only nature and time do that.

Log tagging in Malaysia. Communities of organisms, such as forests, cannot be "managed" since we know so little of their makeup. "No human being or company has ever grown a forest," says Suzuki. "Only nature and time do that." IDRC photo: N. Kumar.

In reflecting on the difficulty with science, I could see that science did not have even the elementary information that would allow us to begin managing the world around us at these different levels of complexity. How, then, could we deal with our problems? Ever since Rachel Carson, I had always thought about this in a simple-minded way. The problem was that human beings take too much stuff out of the planet and put too much waste back into it. Solution: regulate how much and what we take from our surroundings, and how much and what we put back into it, and then enforce those regulations. That was my simple-minded way of looking at it. The problem with this solution is that we don't know enough to be able to regulate how much and what to take out, or how much and what to put back.

Bombs, DDT and CFCs

I want to remind you of nuclear power. When we found a way to release energy by splitting or fusing atoms, we had no idea there was such a thing as radioactive fallout. Fallout was discovered after the Second World War when scientists exploded a bomb in Bikini and then discovered radio isotopes. We did not know there were gamma rays that could knock out electrical circuits over wide areas. We did not know that nuclear winter could result from atomic explosions.

Then there was DDT which was later found to kill insects. Great invention. Great discovery. But nobody knew at the time that DDT sprayed over a broad area would be bio-magnified through the food chain and concentrated hundreds of thousands of times in the breasts of women and in the shell glands of birds. Biologists only discovered the phenomenon of biomagnification when eagles began to disappear.

When CFCs were created, they were hailed as a great discovery – inert compounds, great carriers for aerosol sprays. Only when millions of tons of CFCs were liberated into the air did we discover their scavenging effect on ozone in the upper atmosphere. For me, then, the crisis was this: How can we manage new technologies, new ideas and new chemicals, when we have so little knowledge of how the world works?

How can we manage new technologies, new ideas and new chemicals, when we have so little knowledge of how the world works?

Our ecosystem, our self

An important insight for me came in the late 1970s when we did a film on the fight against logging in the Queen Charlotte Islands. This western-most archipelago off Canada is the home of the Haida people who call the land Haida Gwaii. Macmillan Bloedel had been working there for years and there was a strong movement to stop the logging. I went there and interviewed a young artist named Guujaaw, now president of the Haida Nation. I said to him, "A lot of the loggers are Haida. So it's good for your community. You have high unemployment. What's wrong if they are logging? And with MacMillan Bloedel in the islands, millions of dollars come through your communities. And you yourself, Guujaaw, you're not a logger. Why are you fighting against the logging?"

He answered, "Well, of course, if they cut the trees down, we'll still be here. But then we won't be Haida anymore. We'll just be like everybody else." With that simple statement, I suddenly realised that here was a radically different way of looking at the world. Haida don't see themselves as ending at their skin or their fingertips. To be Haida is to be intimately connected with the land, the air, the water, the fish, the trees, the birds. Their history, their culture, their very reason for existing are tied up in the land. Ever since that interview, I have been a student. I have travelled around the world meeting indigenous people wherever I can. Everywhere it's the same. However impoverished, dysfunctional or oppressed indigenous peoples are, you find a fundamentally different sense of connection with the land. As I reflected on that, I realised they are absolutely right.

The earth is our mother. They say we are all created from the four elements: earth, air, water and fire. They are right – literally.

Before you think I have totally freaked out and gone to some New Age place, let me say that I mean this in the most serious scientific way. We are the earth itself. We have been framing the whole environmental issue the wrong way. It's not that the environment is "out there" while we are "over here" and we have to manage our interaction with the environment. We literally *are* the earth. We *are* the environment. Let me show you what I mean.

We are air
The first thing a baby needs when it leaves its mothers body is a breath of air. From that point on, we human beings need air 20 to 40 times a minute until our last gasp. I love speaking to children about air. I say, "You don't think about the air you are breathing. Try this. Take a deep breath, hold it and don't take another breath for five minutes." Within seconds, of course, your body will begin to tell you that you need air. You can't even make yourself go unconscious by holding your breath. Your body won't let you. But because air is invisible, we don't think about it. When air rushes into our lungs, it sticks to the surface lining the 300 million alveoli. And when you breathe out, about half the air remains so your lungs don't collapse.

My point is that you can't draw a line between where air ends and you begin. We literally are the air because we're stuck on it. It's the physical substance in which all of us are imbedded. It connects all of us here together, along with trees and worms, snakes and spiders, and everything else that shares the air. Air is a magic binding material I call a sacred substance.

We are the earth in a most direct way, and yet we use the soil as a garbage can.

We pride ourselves in being an intelligent species. Yet what intelligent creature would proceed to use this vital element, this sacred air, as a toxic dump? We seem to have this crazed idea that if we put all our toxins into the air, they will be diluted away. When you get to be my age, you have taken at least 300 million breaths deep into your body and filtered it! Whatever we put into the air comes right into us because we are the air!

We are water
We all know that human beings are over 60% water by weight. We're basically big blobs of water with enough organic thickener added so that we don't dribble away on the floor. The trouble with the human body is that it leaks water all the time. It comes out of our skin, our eyes, our mouth and, of course, down below. We're losing water all the time. So we have to keep topping up.

Where do you think the water to replenish ourselves comes from? It doesn't just come out of a local well. It cartwheels around the planet through the hydrological cycle. The water in our bodies has come from all of the planet's oceans, from the canopy of the Amazon rain forest, from the Canadian prairies, from the steppes of Russia. Water, like air, is another glue that holds us together. Again, we use water as a toxic dump but assume we will not be affected.

Canada sits right next to one of the greatest bodies of fresh water in the world, the Great Lakes. I am astonished by the fact that most people in Toronto now buy bottled water. They pay more for it than for a comparable amount of gasoline. We in Canada have more fresh water per capita than any other country in the world. And yet I don't hear a peep or a squawk over the fact we have so fouled this resource that we don't trust the drinking water from our own taps. What a horrible situation!

We are soil
Every bit of the food we eat was once living. We're basically a compost heap for the carcasses of the plants and animals we have consumed. We take them into our mouths and we make them into our bodies. Those organisms come from the earth, from the soil. We are the earth in a most direct way, and yet we use the soil as a garbage can. It seems to me that is what you're going to be deliberating about here. Ecosystem health? We are the ecosystems of the planet. And the state of those ecosystems will be our state for heaven's sake. This isn't brain surgery; it's the fundamentals.

We are fire
Every bit of the energy that allows us to grow, move and reproduce has come from the sun, via the chemical energy captured by plants. All the energy that we consume, whether it's from hydro-electric sources, coal, gas or wood, has come from the sun. It is captured sunlight that we liberate again.

We are the earth. And it seems to me that when you define the issue that way, there is no separation. Whatever we do to the earth, to our mother, we do to ourselves – in the most direct way. It seems to me that the idea that we need an area called ecosystem health is absurd. Why do we need that? Health is the health of our ecosystem, as well as ourselves. That should be what all health is. There is no way of separating us.

A sacred balance
These ideas are laid out in a book I wrote for my foundation called *The Sacred Balance: Rediscovering Our Place in Nature*. While I defined the basic elements of earth, air, fire and water, I also said that we are social animals and that the problems we face as such are every bit as important as those of the environment.

As social animals, our most fundamental need is love. We see this in the lives of children growing up in Rwanda after the massacres, in Romania under Ceausescu, and in Cambodia and Bosnia. Children who may be fed, clothed and sheltered, but who are denied love, are fundamentally crippled, physically and psychically. To maximise the opportunity for love, we must ensure strong families and strong local communities. This means promoting full and meaningful employment, working toward justice, security and equity, and alleviating poverty and hunger. For me, those issues are as fundamental as stopping clear-cut logging and working against mega-dams.

We are also spiritual creatures. Never have we needed spirit more desperately than we do now as we enter the new millennium. We have to know that there are forces out there beyond our understanding. All other forms of life are genetically related to us through evolution. They are not commodities or resources; they are our kin. We have to know that there are sacred places on the planet that we would never think of touching or changing. Even though we all have to die, I believe that nature, which gave us birth, will persist after our passing. We are biological creatures, social creatures, and spiritual creatures. It seems to me that if we do not respect and fulfill those needs, then we are not fully human.

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A rural school in the Philippines. Climate change and inadequate child nutrition are seen as factors undermining positive advances in global health care over the years. Photo: Gerry Toomey.

Managing Agroecosystems for Better Human Health

Don Peden

Health promotion versus risk reduction

We human beings are intimately bound, even biologically, to our food-producing environment, to the natural resources that surround us. So we should not pretend, as we have often done in the past, to be dispassionate observers of agroecosystems, as if they were so many goldfish bowls. Like soil and water, plants and animals, bacteria and fungi, we, along with the infrastructure we have built around ourselves, are integral and dynamic components of these complex systems.

This paper sets out the rationale for a more holistic approach to two normally separate domains of research – human health and agriculture. The latter is meant to include the natural resource management (NRM) practices of farmers, fishers, foresters and other land users in rural areas. We also present evidence for a simple but far-reaching hypothesis: Good agroecosystem management has the potential not only to reduce health risks but also to intentionally, actively and cost-effectively promote human well-being.

The paper draws on the experience and results of several research projects supported by Canada's International Development Research Centre (IDRC). These projects, some of which feed into larger initiatives funded by other donors, are carried out by various centres of the Consultative Group on International Agricultural Research (CGIAR) as well as some non-CGIAR groups.

Past agricultural research has, of course, sometimes included human health components. Studies of the nutritional content of food, pathogens in farm products, and the harmful effects of pesticide overuse are a few examples. Similarly, health research, especially in toxicology, occupational health and epidemiology, has sometimes been agriculture-specific. However, these investigations have scratched only the surface of health-agroecosystem interactions and have not yet fully bridged the continuum represented by them.

Many other connections – biophysical, but also social, economic and policy-related – need to be examined and better understood. Without such knowledge, scientists and development promoters, mandated to alleviate poverty through information and technology, risk doing harm as well as good. What is the value of, say, helping boost crop production for improved food security if the end result is to undermine other aspects of the health of the very people who were supposed to benefit?

Agroecosystems and their interactions with human health are intricate and rarely amenable to simple linear analysis. In fact, they are sometimes said to be unpredictable, which suggests that the idea of "agroecosystem management" may be an oxymoron. Nevertheless, the interests of our partners in developing countries demand that new research attempt to create synergy between agricultural practice and health practice, rather than merely studying the two in isolation or preventing them from getting in each other's way.

Agroecosystems defined

Among the world's varied ecosystems, agricultural ecosystems occupy a dominant position. They cover 30% of the world's land mass, and farmers, the primary stewards of agroecosystems, manage more area than any other group of people.

An agroecosystem can be defined as a geographically and functionally coherent domain of agricultural activity, including all living and non-living components and the interactions among them. Determining its precise physical boundaries is rather arbitrary and depends on the purpose of the analysis. The system may be a single farm, a rural community or microwatershed composed of many farms, or a major watershed. Or it may be an entire region broadly defined by climate, vegetation and other ecological traits – as in the case of tropical forest margins or savannas.

Because agroecosystems are strongly affected by external forces, they are not closed systems. People migrate into and out of agroecosystems. Purchased inputs like seed and fertiliser are brought in from other areas. Trade means that food enters and leaves the system. Soil erodes off hillsides, washing downstream into neighbouring ecosystems, sometimes disrupting water supplies and navigation. Human and plant pathogens, in some cases vectored by insects, may invade from outside regions causing sporadic epidemics of disease and then fade. Or they may be seasonal, in step with temperature and water cycles.

Parallel paths to holism

The ecosystem approach to human health is deeply rooted in the events and debates of the last century that eventually led to the notion of sustainable development. The compartmentalisation of agricultural sciences into specialties focussing on narrowly defined production problems made the Green Revolution possible. Exploitation of the world's biological and energy resources, in the form of germplasm, soil organic matter and chemical fertilisers, triggered a global production boom and averted widespread famine. The overall benefits, however, were unevenly shared by the world's regions. And then, of course, the unforeseen but negative consequences – such as soil degradation, loss of biodiversity, pesticide abuse and pest resistance – began to take their toll.

These trends led scientists and non-scientists alike to rethink approaches to agricultural development. Farmers, researchers, governments and development workers now face the double task of continually boosting food production to meet growing demand, while mitigating or reversing the damage done to the natural resource base. Recognition of the immense challenge ahead has led, over the past two decades, to more holistic thinking about the interconnections between production and natural resource use and conservation. The rise of integrated pest management (IPM) is a good example.

The evolution of human health research and practice followed a similar pattern. Advances in sanitation, health education, nutrition, immunisation and drug therapy drastically reduced the incidence of infectious diseases during the 20th century in industrialised countries, and to a lesser extent in developing countries. The eradication of smallpox is among the most widely recognised of these achievements. Much progress depended on specialised applications of medical science, often centred on diagnosis and prescription in a clinical setting. That approach, based on a rather restricted set of specialist disciplines, tended to isolate people from the physical environment of their daily lives. Despite the notable progress, the benefits have not been shared equally among countries and social groupings. And, globally speaking, infectious and communicable diseases are still the most common cause of death. In sub-Saharan Africa they account for 70% of the burden of illness.

As with the problem of pesticide abuse and pest resistance in farming, the health sector faces the challenge of the growing resistance of disease vectors and pathogenic organisms to pesticides and antibiotic drugs. Climate change and inadequate child nutrition are other factors now seen as undermining positive advances made in global health care over the years.

Increasingly, the limitations of clinical medicine have been balanced with preventative public health care concepts. There has been a shift to a broader view of human health – one that goes beyond the biology and chemistry of people and medication, to take account of the human living conditions and ecosystems that influence health. This trend parallels the development of IPM in agriculture. It is being pushed by the fact that most developing countries cannot afford expensive health technologies, especially drugs, and are therefore looking for cost-effective alternatives to promote public health. Here, ecosystem management has much to offer.

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Holistic thinking has emerged in both the agricultural and health sciences. Each area now recognises that the sustainability of research benefits depends on understanding the complex interactions between the behaviour of people and the ecosystems in which they live. Each also recognises that human health is conditioned by poverty, which in turn is accentuated by stresses on those ecosystems.

These messages were brought home in Agenda 21, the action plan of the 1992 Rio "Earth Summit". Agenda 21 subsequently became a focal point for IDRC thinking and support to research in developing countries. In fact, the Centre's Ecosystem Approaches to Human Health (Ecohealth) Program Initiative, under which the projects reported here are funded, took important cues from that action plan.

Here it is important to distinguish between the more traditional environmental health approach to research and the ecosystem (or "ecohealth") approach. At its most basic level, the former has to do with identifying interactions between a specific human health indicator, such as the incidence of cancer, and a contaminant in the environment, such as dioxin. An ecohealth perspective, in contrast, is transdisciplinary and takes account of system complexity and multiple determinants of health.

Health in international agricultural research

Agricultural professionals, whether scientists or farmers, today devote much attention to promoting the health of livestock, crops and agroecosystems. Arguably, these people are in a health care profession, but one in which non-human species are the direct beneficiaries. This more recent model of "the agriculturalist as doctor" contrasts with the often prevailing view that agriculture's mission is simply to produce more and better food and to make sure it is readily available in times of need.

With the growing interest in IPM following the Green Revolution, agricultural "medicine" has shifted even further, from an emphasis on curative use of chemicals to the adoption of multiple preventative interventions – a situation not unlike what is happening in public health. Yet within the context of mainstream agricultural research, human health continues to simmer away on a back burner. For the most part, efforts are directed toward mitigating the negative impact of intensified agriculture on people while advancing plant and animal husbandry to maintain production. Little effort has gone into the design of methods for explicitly harnessing the power of agroecosystem management to actually promote human health. As primary stewards of the agroecosystems that sustain most human life, agricultural professionals nevertheless have the opportunity and responsibility to do so.

Human health, however, has emerged as a development objective in several international agricultural research centres and partner institutions. The short case studies near the end of this consultation report describe projects in which IDRC has had some involvement. The research spans a range of countries, regions, agroecosystems, health problems, time and space scales, disciplines and methodologies. The R&D partnerships formed under these projects bring together various mixes of international and national research institutions, NGOs, universities, government health agencies, women's and community organisations, and most important, local farmers and other rural people.

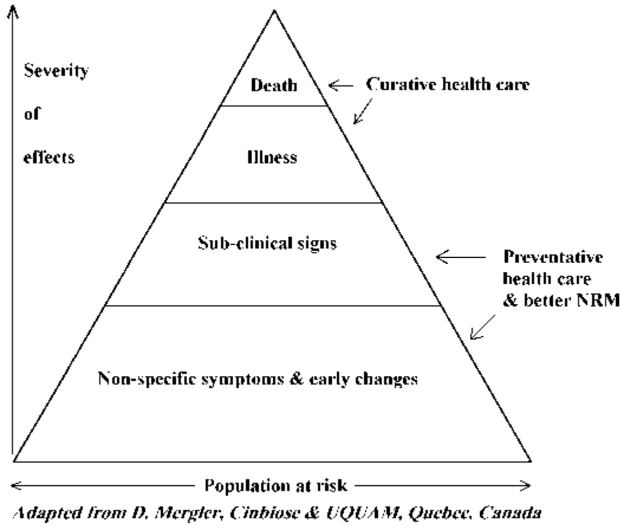
While each of the research activities can stand alone as a unique and important contribution to R&D for the developing nations, when viewed together they yield a bigger and more intricate mosaic of the interactions between health and ecosystem management. The following sections outline factors common to some or all of the projects, as well as some differences.

Health as a local priority

Evidence from many projects shows that the rural poor demand quick payoffs from research. The value they place on meeting immediate needs, especially good health, often outweighs the value assigned to the promise of future benefits from better NRM and agricultural development. But short-term goals are not necessarily at odds with those pursued over a longer time frame. Indeed, they may reinforce each other, intentionally or not.

The U.K.'s Department for International Development (DFID) says that a human livelihood is sustainable "when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base." Such resilience and attention to the future health of the natural environment are only possible if the people engaged in those livelihoods are already in good health. And once better NRM practices begin to enhance livelihoods, it is much easier for those people to maintain their good health and their livelihoods.

The case study of mercury exposure in the eastern Amazon, as well as the project on health, biodiversity and NRM use in the western Amazon's forest margins, demonstrate the catalytic effect of tying longer-term agricultural objectives to health improvement. In both cases, increased understanding of the health implications of local NRM helped sustain local interest in the research.



The concept of the "pyramid of health" demonstrates the importance of preventative public health care and natural resource management (NRM). For many health problems, only a small proportion of the population suffers clinical symptoms, including life-threatening conditions, that require curative care.

Transdisciplinarity

To varying degrees, the researchers have gone beyond the traditional boundaries of their disciplines to embrace a new, more holistic paradigm centred on the complex ecosystem within which human health thrives or atrophies. They have attempted to balance integrative thinking with the continued need for reductionist inquiry.

For example, efforts in Thailand to find sustainable soil management systems and to understand the health status of rural children in shifting-cultivation communities relied on traditional soil science and medical methodologies. The soil study results suggested that fallowing for as little as five years, a current practice among some hill tribe farmers, is sufficient for sustainable rice-based cropping. However, from a human health perspective, this production system may not be fully sustainable. As the researchers note, diets with little food-type variety may not provide the nutrients required for children to grow, develop and realise their full potential in life. To obtain adequate nutrition, people may need secure access to an area of land larger than that suggested by a narrow analysis of upland rice production systems alone. Bringing soil sciences and land tenure issues together with child health research requires a new integrative understanding of the agroecosystem. This is something that no single discipline can achieve on its own.

In Ethiopia, national and international researchers integrated information on market economics, nutrition and NRM. This allowed them to create a transdisciplinary model that quantifies the tradeoffs among soil conservation, food security and income-generating land management strategies. In the lower Amazon, Brazilian researchers integrated knowledge on fisheries, aquatic ecology, toxicology, slash-and-burn agriculture, and human health and nutrition to develop a more holistic understanding of the complex interplay of ecosystem management and human health. This learning process is going on in many settings around the world. As researchers gain insights into the dynamics of human health within an agroecosystem context, they are revealing new ways by which better NRM can be explicitly used to deliver improved health to the rural poor.

Participatory methods

An agroecosystem approach to NRM and human health quickly recognises that local people are simultaneously both the subject of study and key decision makers and actors who must eventually buy into any recommended interventions. All of the on-going projects considered in this review sought greater participation of local people in various stages of the work: setting research priorities, executing field research, choosing appropriate local interventions, and negotiating shared responsibility for NRM with various levels of government.

Gender and social groupings
All the research activities recognised that women, men and children, as well as socially distinct sub-classes, occupy different life spaces or ecological niches within their respective agroecosystems. In many cultures, women are responsible for family health care, but men have decision-making power when it comes to the use of land and other natural resources. Research in Sri Lanka demonstrates that men, who manage irrigation, often overlook women's needs for reliable and safe supplies of domestic water. Yet when women function as heads of households, their actions are more likely to reflect the need to maintain family health.

The project in Ecuador demonstrated that while men are often more exposed to toxic chemicals during spraying of potatoes, women are at high risk from washing farm labourers' contaminated clothing. And in South Africa, where women make up the majority of the rural poor, research suggests they are more at risk from diets highly contaminated by mycotoxins.

All the research activities recognised that women, men and children, as well as socially distinct sub-classes, occupy different life spaces or ecological niches within their respective agroecosystems.

Power struggles over land and other resources often aggravate disparities among social or ethnic groups. In Southeast Asia, marginalised hill tribes have lost access to traditional land and, with shorter fallow periods, consume less substantive and less diverse diets. Heavy reliance on rice may end up undermining the sustainability of community livelihoods.

Sub-clinical and non-specific symptoms of poor health
Exposure to mercury in the Amazon, to the insecticide carbofuran in the Andean highlands, and to mycotoxins in Africa reveals the potential impact of health risks that cause previously unrecognised and often non-specific symptoms of declining health (see Pyramid of Health illustration). In all three cases, there is growing evidence that the rural poor in particular suffer from nervous system degeneration and from other conditions such as cancer, birth defects and immunosuppression. Apart from these studies, the scientific literature shows that schistosomiasis and malnutrition also contribute to immune system suppression. Immunosuppression caused by agroecosystem-based factors may well be a significant factor in the high morbidity and mortality rates associated with infectious diseases in sub-Saharan Africa, South Asia and tropical America.

Ecosystem uniqueness
The research projects demonstrated the uniqueness of each study area or ecosystem. Conclusions about one system may not be applicable elsewhere, even where two ecosystems have a superficial resemblance.

A clear example arises from the three studies that consider irrigated rice production and malaria. In the West African Sahel, evidence suggests that under certain conditions, the introduction of irrigation may reduce malaria transmission. But in Kenya and Sri Lanka, researchers believe the reverse is true. In the Peruvian Amazon, the high Andes of Ecuador, the irrigated rice systems of West Africa, and the tsetse-prone areas of eastern Uganda, researchers emphasise the importance of understanding spatial and seasonal variations as ecosystem-based determinants of human health.

Tradeoff analysis
When the aims of ecosystem management are incompatible or not fully complementary, tough choices must be made. If the local development agenda includes better human health, higher agricultural production and cash income, and sustaining the ecosystem's capacity to deliver ecological services, then decision makers, including farmers, must be able to evaluate the tradeoffs.

Fortunately, there are modeling tools for this. In the highlands of Ethiopia, research indicates that, with currently available knowledge, inputs and technology, the land cannot provide sufficient calories to maintain people while simultaneously safeguarding and replenishing soil fertility. A viable strategy may be to produce high-valued agricultural products for the market and use the earned cash to buy inputs such as fertiliser, as well as nutritionally adequate food. The investigators question the tradition of depending on manure for fuel. While alternatives are not readily available, this practice prevents nutrient recycling, leading to further soil degradation, food insecurity, malnutrition and declining human health.

In Ecuador, researchers question the value of using pesticides on potato crops grown by poor farmers. Their work substantiates studies on irrigated rice systems which suggest that, under some conditions, the value of the production lost by not using pesticides is outweighed by the health costs that are avoided.

Often, the costs and benefits of increased production or changes in health and the environment are not equally shared by different segments of the community. One ethnic or economic group, for example, may have advantages over another. Similarly, consumers outside the agroecosystem, such as city dwellers, are spared the production-related health costs that rural producers must bear in the course of their work. The need thus arises for policy interventions to balance the tradeoff between health and food production and to ensure that the well-being of poor farmers and farm labourers is not jeopardised.

Impact of health on farm productivity
Most of the research described here focuses on how agroecosystem management affects health. A new study on HIV/AIDS in Africa, however, highlights the devastating effects of ill health on rural people's livelihoods, particularly labour-intensive farming and natural resource use. Sick people cannot work nearly as well as healthy people. And even healthy people must spend time caring for the sick, dying and orphans, and organising and attending funerals. The financial toll exacted by health care and burials puts enormous stress on families. The loss of educated or otherwise knowledgeable people also undermines the transfer of know-how, further reducing productivity.

Apart from HIV/AIDS, other aspects of poor health undermine agricultural productivity. Malnutrition, the subject of several of the IDRC-supported studies, reduces vigour and the human capacity to learn, thereby thwarting a community's ability to transform natural resources into food and other products. Studies of potato cultivation in Ecuador indicate that long-term exposure to pesticides actually decreases farmers' individual productivity.

Ecosystem management for human health

To remain healthy, people need a varied diet. For many of the rural poor in developing countries, the sole source of such variety is the natural resources that surround them. While reductionist science may produce specific high-quality products such as crops with enhanced micronutrient content, research rarely considers the total range of food products seasonally available within an agroecosystem and needed for good nutrition. And rarely is the menu of food sources matched with gender- and age-specific requirements. Similarly, relatively reductionist environmental health research has tended to focus on one-to-one links between a particular health hazard and a limited set of health indicators. To varying degrees, all the projects discussed here have attempted to move beyond these traditional approaches to health research.

Targeting human health improvement through NRM interventions is a clear trend emerging in the CGIAR centres and like-minded research organisations. Agroforestry, for example, is now seen as one means to improve dietary diversity, cutting over-reliance on staple carbohydrates like upland rice. In the Brazilian Amazon, it may also help reverse mercury contamination of aquatic food chains over the long term by controlling soil erosion.

Researchers on a project in Uganda believe better NRM targeted on livestock may help reduce the scourge of sleeping sickness. And in two highland settings, in Ethiopia and Thailand, livestock are seen as key contributors to enhanced nutrient recycling to maintain higher levels of food production. Animal products, in addition, provide essential nutrients such as vitamins A and B12, often lacking in people forced into a carbohydrate-heavy vegetarian diet.

Three CGIAR centres are experimenting with modified management of livestock, vegetation and irrigation schemes to help control malaria and other vector-borne diseases. Another, hoping to reduce HIV transmission, is looking at the promotion of agroecosystem-based opportunities in people's home areas to discourage labour migration. In South Africa, a team is attempting to improve soil and crop management as a way to reduce human exposure to aflatoxins and fumonisins. For example, restoring soil fertility may make host plants less susceptible to invasion by mycotoxin-producing fungi.

Conclusion: Integrating research on NRM, poverty and human health

The similarities and differences among the research projects and results described above exemplify the profound interdependence of human health, poverty and agroecosystem management. What is needed is a common framework to clarify the complementary roles that NRM and health researchers can play.

Consider the pyramid of human health (see illustration). In any human population, and for many health problems, a small number of individuals exhibit acute clinical symptoms. These are the problems that most medical professionals attempt to heal. When they fail, many patients continue to suffer and some die. However, a much larger number of people suffer from early sub-clinical changes and exhibit non-specific symptoms. These are rarely reported and are often untreatable by the health care system. They require preventative approaches that go beyond the current domain of most public health agencies.

Conventional curative medical services are expensive to deliver and focus on the needs of the minority, namely those who have clinical signs of illness and access to medical care. In places, evidence suggests that further investment in curative health care may actually lower health standards by diverting resources away from the preventative non-medical measures that are better able to deal with widespread non-clinical threats to human health.

In future, we can expect that health delivery will no longer be the monopoly of classic "western style" health professionals. Many preventative interventions are needed to promote better health among the majority of the population represented by the lower half of the pyramid. Recognition of this creates an important role for agricultural professionals. Agroecosystems contain most of the fundamental determinants of human health, particularly those that affect the rural poor. While agricultural R&D often make significant contributions to improving human health, ignorance of the human health consequences of NRM can undermine those gains. However, better understanding of the complex nature of human health within agroecosystems can pave the way for active delivery of preventative NRM and agricultural interventions that help achieve consciously formulated human health objectives.

More than lack of cash, to be poor means to suffer several or many deprivations at once – lack of access to health care, natural resources, credit, farm inputs, safe housing, knowledge, information, education, quality food and labour. Poverty leads many people to migrate in search of employment. This can expose them to additional health risks and contributes to the breakdown of social capital. To maximise cash income for immediate needs, poor and often marginalised farmers tend to forgo investments for long-term maintenance of soil productivity. They put added pressure on common property resources such as grazing areas and woodlands. And they frequently sell the highest-quality produce, leaving their families to depend on nutritionally inadequate food that may also be contaminated.

The low farm productivity and unsustainable land management practices that emerge from poverty and poor health reinforce the factors that compromised human well-being in the first place. The momentum of the poverty cycle is thus maintained. To break that cycle in poor rural communities of developing countries requires a multi-pronged attack on ecosystem degradation and related threats to human health.

This paper has scratched only the surface of existing knowledge about the interconnectedness of NRM, human health and poverty. Individually, the projects described here could easily be overlooked by policy makers and others charged with rural development. Together, however, they convey a more persuasive message: Expanded inquiry into additional causal links between human health and agroecosystem management could significantly contribute to the alleviation of rural poverty around the world.

■

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Ecosystem Disruption and Human Health

Supplement to LEISA Magazine
March 2002

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Consultation on Ecosystem Disruption and Human Health
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Cover photo
A woman in Mali carries home her treasure from the river. Water is a universal necessity to be used, conserved and respected. But it is just one of many ecosystem components which, for good or ill, combine to influence human health.
CIDA photo: Pierre St-Jacques.

Views expressed in this report are those of the authors. They do not necessarily reflect the official policies or positions of the International Development Research Centre (IDRC), the United Nations Environment Programme (UNEP), or the Centre for Information on Low External Input Sustainable Agriculture (ILEIA). Papers presented at the consultation have been summarized and edited for publication.

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C O N T E N T S

Bare-faced risk. A farm worker without a protective mask and clothing sprays a crop. Around the world, pesticides pose a serious health hazard, not only to those who prepare and apply them, but also to women and children in and around rural households. A report on page 25 looks at the health effects on potato growers in Ecuador. CIDA photo: R. Lemoyne.

Fishing on the Tapajós River in the Brazilian Amazon. Deforestation and soil erosion along the shoreline have led to a buildup of poisonous methylmercury in fish. Local communities and researchers, however, have solutions to the problem. See page 26. Photo: Jean Lebel.

What is UNEP?

The mission of the United Nations Environment Programme (UNEP) is "to provide leadership and encourage partnerships in caring for the environment by inspiring, informing and enabling nations and people to improve their quality of life without compromising that of future generations."

UNEP was established in 1972, after the Stockholm Conference on the Human Environment, as the environmental conscience of the United Nations system.

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D E A R R E A D E R S

In 1950, the world population was 2.5 billion. By 2001, it had swelled to 6.15 billion and, of course, is still growing. Our sheer numbers, along with technology applications, have given humankind more than ever before the capacity to disrupt the often delicate balance among the various elements that make up our planet's ecosystems. But we are also gradually improving our understanding of that balance and how it can be harnessed to promote human health and other aspects of sustainable livelihoods.

Canada's International Development Research Centre (IDRC) and the United Nations Environment Programme (UNEP) have been working together for some years to improve human health through better stewardship of the earth's ecosystems and natural resources. In late 1999, the two agencies co-hosted a consultation on the subject in Hull, Canada, under the umbrella of the Canadian Conference on International Health. The consultation brought together more than 75 participants from academic institutions, non-governmental organisations, international centres and national governments. They examined health in three types of ecosystems: agricultural, urban and coastal.

The following summary report focusses specifically on agroecosystems, the type of environment that received the most attention during the consultation and which is of special interest to LEISA readers. Since the meeting, the "ecohealth" projects supported by IDRC and UNEP have progressed and new insights have been gained. The overview paper, by Don Peden, has been updated to include some of these developments. It is based on an October 2000 presentation to a meeting of the Consultative Group on International Agricultural Research (CGIAR), in Washington.

17 Linking Natural Resources, Agriculture and Human Health: Case Studies from East Africa

Gulley-forming erosion in Africa. Soil degradation, a threat to food production and rural nutrition, is a growing problem in many parts of the world. Half the arable land of the Ethiopian Highlands, for example, is thought to be moderately to severely eroded. A research project there analyses tradeoffs between higher farmer income, food self-sufficiency and soil conservation. See page 17. IDRC photo: Neill McKee.

The keynote address was delivered by David Suzuki, well-known Canadian geneticist, environmentalist, writer and broadcaster. His words are a blunt, but meticulously illustrated warning that human beings are on a collision course with the life-support systems of our planet. A major part of the problem, he argues, is the conventional economic thinking that continues to promote indefinite growth and the "mono-culture of the global economy". He also stresses that paying attention to spiritual and social needs, especially love and a strong sense of community, will be as important to humanity in the new millennium as fulfilling biological needs and solving environmental problems.

This report also summarises other consultation papers on key topics: the origin of, and rationale for, an ecosystem approach to health; the benefits of livestock production to human health and ecosystem management; participatory methods and community capacity building; and the threat of mycotoxins in food. All but the first of these draw on specific case study materials. Complementing those examples are brief descriptions, beginning on page 25, of eight research projects from around the world.

IDRC and UNEP hope this special supplement will stimulate new thinking and research on how ecosystem approaches can benefit human health in both the South and the North in the coming decades. Both organisations thank ILEIA for its collaboration, as well as the many scientists and other professionals who contributed to this publication and to the innovative research it describes.

Klaus Töpfer
Executive Director, UNEP

Maureen O'Neil
President, IDRC

What is IDRC?

The International Development Research Centre (IDRC) works with researchers to help find practical long-term solutions to social, economic and environmental problems in developing countries. In particular, support is directed toward developing the indigenous research capacity necessary to sustain policies and technologies that can build healthier, more equitable and more prosperous societies.

IDRC was established in 1970 by an Act of the Parliament of Canada.

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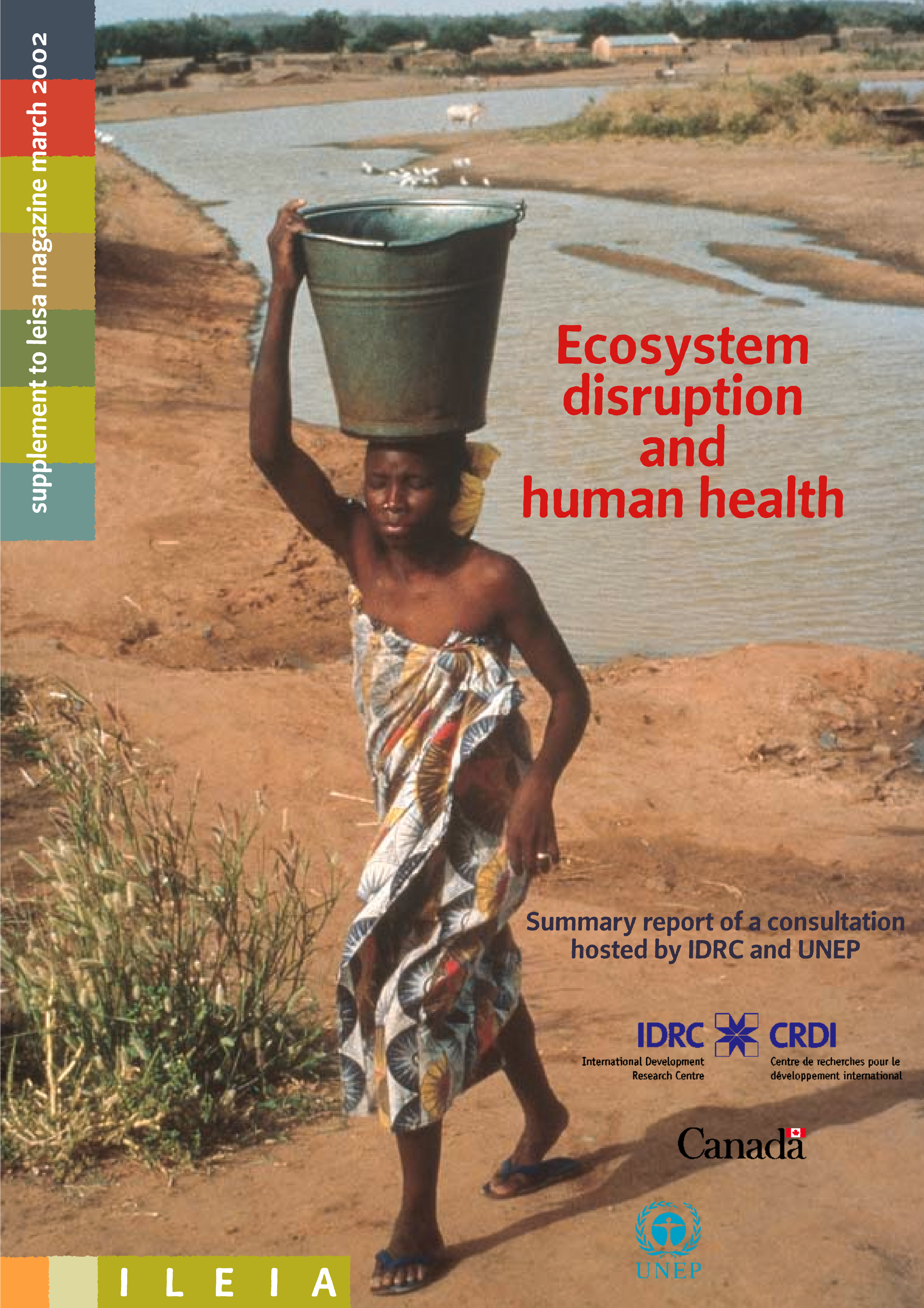
IDRC CRDI
International Development Research Centre
Centre de recherches pour le développement international

Canada

supplement to leisa magazine march 2002



Ecosystem disruption and human health

Summary report of a consultation hosted by IDRC and UNEP

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International Development Research Centre
Centre de recherches pour le développement international

Canada

UNEP

ILEIA

On-farm training on intergrated weed control. Photo: Eric F. Wirsiy

Reaching women

personal reflections

Eric F. Wirsiy

I have had the opportunity to work as extension officer in my country, Cameroon, for the Ministry of Agriculture and also for an NGO, the Mount Cameroon Project (MCP). During my years of service I witnessed a lot of things that kept agricultural knowledge out of the reach of women, despite their role in agriculture.

Sometimes, the needs of women can be quite different from project objectives. A group of women in a village in the Mount Cameroon region, after undergoing schooling on biodiversity conservation for a couple of years, suddenly found project staff talking farming. This was a welcome relief. But the approach used did not actually seem to be addressing the real needs of the women, as evidenced by the reaction of the women to a training workshop organised to introduce vegetable farming as a way of diversifying production and farm income. Whilst a service provider employed by the project was providing the training, a parallel project initiated by the women was going on. The women wanted improved planting material (cassava) and a technician to assist them in establishing a cassava plantation.

They complained the project had sidelined them for too long and they now needed to take their destiny into their own hands. In the past they would accept to go and sit in any workshop, despite many other pressures on their time - but this time they said: 'No sir, if you want to help us this is what we need. These are the skills and materials we need.'

I am, by this, not questioning the raison d'etre of conservation projects, but wondering aloud why farmers spend endless hours attending meetings rather than acquiring skills on how to improve their agriculture, which is their main occupation and livelihood source. As a result of inadequate diagnosis of the real needs of the farmers, or as a result of top-down approaches where project goals mask the real needs of the people, projects derail women from agriculture and involve them in project activities to the detriment of their farming activities.

Effective communication is essential, but in my experience there are many obstacles to overcome in communication with women. Illiteracy is one of the major barriers. Agriculture in Cameroon is mostly carried out by older women, who are in most cases uneducated. This poses a big challenge to frontline extension staff. For effective communication with local people, mastery of the native dialect is a prerequisite for extension workers. This condition is most often not met.

When women attend public meetings or events they play a passive role, as women in most cultures do not talk in the midst of men. They can only talk in women's gatherings. These gatherings are rare and hardly ever have anything to do with agriculture. They come together to discuss small savings and other issues, but not farming. It becomes difficult to diagnose the real needs/priorities of women, and development workers most often have to discern them.

To solve the problem of labour shortages, some women are now organised into 'work groups'. Farm work is done on a rotary basis from one member to the other on specific weekdays. These groups could potentially be exploited so that women can benefit from the training most often received by the men. Such attempts usually meet with opposition, however, as the women on whose farms work had been scheduled find part of their allocated time being diverted to something else, and they are the losers.

To overcome this problem, some agricultural extension workers have introduced group farms, so the women can devote a day to work on the group farm where no one will be cheated. On these group farms women are now taught useful farming skills and sensitised on HIV/AIDS. The group farms have their limitations but have been very useful in reaching out to women without the male dominating effect. Discussions in a group plantain farm have often resulted in an exchange visit to a members' maize farm, where a problem is assessed and discussed at length. Supporting the women to group themselves without the men is therefore a way to reach out to this vulnerable set of farmers.

In general, it is more appropriate to approach already existing women's groups than try to form others, particularly if the men will infiltrate their ranks in a new group. Experience with mixed groups has shown that women tend to get lost inside these groups.

Instead of separating agricultural production and conservation, there is the need for the introduction of the type of agriculture that is sustainable from the economic, social and environmental perspective and which takes into account the time shortage already being experienced by women.

To conclude, there is a need to get a critical mass of the women empowered. To achieve this, extension and development project staff must carry out a proper diagnosis before scheduling activities with women. More focus has to be placed on creation of purely women groups at all levels. A holistic approach to development is best. Conservation cannot work if the livelihoods of the people are not assured, and agriculture is for now the only viable livelihood source in our villages.

■

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Capacity for development : new solutions to old problems

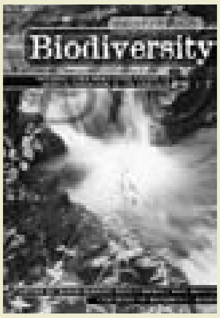
by Fukuda-Par S, Lopes C, Malik K (eds). 2002. 283 p. ISBN 1 85383 919 1 GBP 17.95. United Nations development Programme (UNDP). Earthscan Publishers, 120 Pentonville Road, London N1 9BR, UK / www.earthscan.co.uk ; earthinfo@earthscan.co.uk.

The technology revolution of the 21st century should be used to empower poor countries, not leave them further behind. This book reminds us that this process has to begin with developing local knowledge and local capacity. “Capacity for development” brings together innovative and well-supported studies of technical co-operation and its potential to build sustainable capacities in developing countries by enhancing the knowledge, skills and productive aptitudes of their populations. The authors analyse the issues from three perspectives: capacity and development; ownership; and knowledge; and present a range of views from practitioners, academics and policy-makers about what has gone right with technical co-operation in recent years, what has gone wrong , and how to do it better and perhaps very differently. (WR)

Perspectives on pastoral development : a casebook from Kenya

by Birch I, Shuria HAO. 2001. 160 p. ISBN 0 85589 467 8 USD 12.95. Oxfam / www.oxfam.org.uk. (Oxfam development casebook). OXFAM Publications, 274 Banbury Road, OX2 7DZ Oxford, UK.

With this casebook, OXFAM provides a study of the Wajir Pastoral Development Project, in a remote area near the border of Kenya and Somalia. This project, with an integrated approach to poverty reduction and with a strong emphasis on community participation, concerned the efforts of marginalised groups to develop pastoral associations to represent their own interests. The authors assess the projects’ success in supporting sustainable livelihoods, together with livestock keepers and with people who have lost their animals. They describe how the project has devised ways of responding to emergencies (such as drought and conflict) as part of a longer-term development agenda, and how it has built the capacity of local institutions to influence national policy on the future of pastoral development.(WR)



Protecting biodiversity : national laws regulating access to genetic resources in the Americas

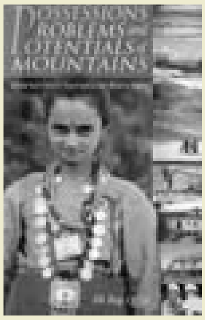
by Bass SP, Muller MR (eds.). 2000. 105 p. ISBN 0 88936 900 3. International Development Research Centre (IDRC), Canada. . ITDG Publishing, 103-105 Southampton Row, London WC1B 4HL, UK / itpubs@itpubs.org.uk.

Some of the most diverse collections of flora and fauna in the world are found in the Americas. Colombia alone carries over 50 thousand different plant species. This precious resource, however, is quickly dwindling. Pharmaceutical and biotechnology companies are tapping genetic resources in the Americas at an ever-increasing rate, and habitat destruction has pushed many species to extinction or to the brink of extinction. This book addresses one of the most fundamental aspects of this important issue: the lack of adequate national laws regulating access to, and compensation for, the use of local genetic resources. It compares existing laws and policies across a range of countries in both the industrialised and developing worlds. It also presents legal viewpoints, conclusions, and solid recommendations for future action. “Protecting Biodiversity” is a useful reference book for all experts and organisations in the field of conservation of genetic resources. (WR)

South-South workshop on smallholder dairy production and marketing : opportunities and constraints : held at NDDB, Anand India 13-16 March 2001 2002.

CD Rom. ISBN 92 9146 115 6. International Livestock Research Institute (ILRI), Addis Ababa, Ethiopia / www.ssdairy.org ; ilri-information@cgiar.org.

With these proceedings on CD-Rom, ILRI provides all the workshop papers and other interesting information about the workshop. To be able to use this beautiful information source you need a rather sophisticated computer. Fortunately the information is also available on internet at www.ssdairy.org. The workshop objectives were to facilitate information exchange and discussion amongst smallholder dairy research scientists and development specialists from Asia and sub-Saharan Africa, and to share the successful and unsuccessful experiences gained. Papers were contributed from 16 countries and covered themes like: trade regulations, dairy policies, market institutions, livestock services, and research and extension. (WR)



Possessions, problems and potentials of mountains : special reference to Nepal and its far-western region

by Ojha ER. 2002. 69 p. ISBN 99933 1 959 7 Rs 275.00. EKTA Books, Thapathali, Kathmandu, Nepal / ektabook@mos.com.np.

With this booklet, Ek Raj Ojha reviews the most crucial possessions, problems and potentials of mountains of the world, particularly in developing countries, with special reference to Nepal. Ojha highlights especially the value of the human resource and the special nature their relationship with the mountain ecosystems on which they depend. The ideas presented in lieu of recommendations can provide a useful supplement to the visions of many individuals and institutions working towards sustainable mountain development. (WR)

Strengthening livelihoods : exploring the role of beekeeping in development

by Bradbear N, Fisher E, Jackson H (eds.). 2002. 122 p. ISBN 1 898807 01 9 GBP 22.- Bees for Development, Troy, Monmouth NP25 4AB, UK / info@beesfordevelopment.org www.beesfordevelopment.org.

Beekeeping projects have often focused on strengthening physical resources (for example providing hives or processing equipment), rather than strengthening human and social resources (for example training in how to handle bees, making secondary products, in accessing markets). It is relatively easy to provide equipment. Supporting, facilitating and training beekeepers requires that experts understand people’s own perspectives on development. This book contributes to our understanding of important human aspects in rural development. The case studies from Africa, Asia, the Caribbean and Latin America, gathered in the Symposium held in 2000, provide important information on how small-scale beekeeping can contribute to livelihood security. Several case studies also pay attention to the role of women in beekeeping. (WR)

Naïve art by Adrie Martin

Dimitra Project: Rural Women and Development (FAO)

http://www.fao.org/dimitra/

Dimitra is an information and communication project which aims to highlight rural women's contribution to their community and their country. It is implemented by the Food and Agriculture Organization of the United Nations (FAO). The project joins a large network of local partners in Africa and the Near East and works to encourage and support the exchange of good practices, ideas and experiences. The Dimitra database is accessible on this website in English and French. It contains profiles on organisations based in Europe, Africa and the Near East which have projects or programmes involving or concerning rural women and development.

Honeybee database of innovations

http://www.honeybee.org/jsp/search/catdisplay.jsp

Honey Bee Network is a network for knowledge-sharing at grassroots level. The database of innovations and contemporary/ traditional innovative practices from around the world can be searched freely or by picture-category (including a wide range of categories from implements, crop protection and water management to artisan and education innovations). The lefthand column of the HoneyBee sitemap at **http://www.honeybee.org/lang/en/sitemap.html** will lead you to other interesting aspects of this network, like the ideas bank and innovator forum).

GROOTS network: grassroots organizations operating together in sisterhood

http://www.groots.org/index.htm

GROOTS operates as a flexible network, linking leaders and groups in poor rural and urban areas in the South and the North who work towards improving opportunities for women. It's activities include support for exchange visits among member groups, support for grassroots women's groups to document local strategies, and working towards helping women have more say in local decision making and policy development.

FAO website on gender and food security

http://www.fao.org/gender/

This website contains a wide range of documents and other resources. The start page is divided into a number of thematic areas which provides an overview of the topic and describes lessons learned. At the bottom of each section under "subcategories" is a list of relevant studies and training materials, some of which are available electronically. All of these documents can be ordered.

International Agricultural Centre (IAC): building capacity for sustainable development

http://www.iac.wageningen-ur.nl/

The IAC, part of Wageningen University and Research Centre, works to build capacity for sustainable development in the agriculture, food, rural development and natural resources management sectors. The IAC provides advisory services, training, seminars, action learning projects, network development and knowledge management to optimise organisational and individual learning. Information about capacity building services can be found on this website, or contact IAC at P.O. Box 88, NL 6700 AB Wageningen, the Netherlands. Email: iac@iac.agro.nl

Connecting women globally for social change

http://www.iwtc.org/

The International Women's Tribune Centre (IWTC) website has many gender and development-related resources, links and publications. In particular, the first page has links (click on pictures) to different sources of gender-related resources such as the UN *Women Watch* (including a good practices database and gender training material), *Mapping the World of Women's Information Services* (a database with over 350 women's information centres and libraries from more than 125 countries); the INSTRAW *Gender Awareness Information and Networking System (GAINS)*, and links to NGOs working on gender issues, by region.

Gender and Rural Development

http://lnweb18.worldbank.org/ESSD/essdext.nsf/22ParentDoc/Gender?Opendocument

This site of the World Bank represents an on-going effort to promote systematic integration of gender concerns into rural development activities. The site aims to reach practitioners working in gender and rural development at global, national, and grassroots levels. It contains tool kits, case studies, publications and links related to gender and rural development.

Women Farmers: Enhancing Rights and Productivity

http://www.zef.de/zef_englisch/f_veranstalt.html

This website has a list of papers available online that were presented at a workshop hosted by the German Center for Development Research (ZEF) in 1999. Topics covered include gender issues related to access to land and other resources, extension, information dissemination and technologies and innovation as well as relevant policies.

Gender Arena

http://www.genderarena.com/genderarena/homepage.htm

This is a resource website and gateway into gender/feminist academia and research on the web. The website includes links to new and existing book titles and online catalogues; links to online and offline journals, and links to professional organisations as well as news and information.

Visit our website: www.ileia.org

Who milks the cow? Gender and development in livestock farming by Richter M. 1997. 202 p. ISBN 3 88085 517 X. German Agency for Technical Cooperation (GTZ), PO Box 5180, 65726 Eschborn, Germany. (Schriftenreihe der GTZ ; 261).
Women play a very important role in animal husbandry - they are owners of livestock and they process and sell animal products. However, women are seldom part of the target group of livestock farming projects. This manual presents information on the roles of men and women, and provides suggestions for a gender-oriented approach in animal husbandry projects, especially from the perspective of raising the efficiency and sustainability of livestock projects. It offers assistance in concrete case design. Besides animal husbandry, the methods and procedures can be transferred to other areas of rural development. (WR)

Women and IPM : crop protection practices and strategies by Fliert E (van de), Proost J (eds). 1999. 108 p. ISBN 90 6832 710 0 : DFL 29.00. Royal Tropical Institute (KIT), PO Box 95001, 1090 HA Amsterdam, The Netherlands, e-mail: kitpress@kit.nl; Intermediate Technology Publications (ITP), 103/105 Southampton Row, London WC1B 4HH, UK, e-mail: itpubs@itpubs.org.uk.
This book builds on contributions made to the symposium on Gender Issues and Crop Protection, which was part of the 13th International Plant Protection Congress held in the Netherlands in 1995. It became clear at the Symposium that most contributions related to integrated pest management (IPM) and that this was probably not by chance. Day to day crop management is often women's work, so that the close monitoring required for IPM may follow naturally in this category. IPM cases are presented from Bhutan, Vietnam, Indonesia, Costa Rica, Honduras, Zanzibar and Ghana; other chapters deal with pesticide hazards and the role of women in the new agricultural economy in Russia. The cases provide a clear analysis of specific situations relevant top women's role in crop protection, and recommend strategies for change - such as making IPM extension and training programmes more accessible to women. The concluding chapter provides a broader view on the presented cases, including a plea for a new kind of external structuring of decision making, using mechanisms such as Farmer Field Schools. (WR)

Secondary farmers of secondary crops? Women and rootcrop livelihood in the Philippines. UPWARD. 2002. 250 p. ISBN 971 614 020 7. FAO-RAP Project, CIP-UPWARD, c/o IRRI DAPO Box 7777, Metro Manila, Philippines. Email cip-manila@cgiar.org
This publication is the output of an FAO-supported project which aimed to assess roles, opportunities and constraints faced by women farmers in sustainable rootcrop livelihood, and identify implications for household food security and genetic resources conservation in the Philippines. The volume includes eight case papers of rootcrop livelihood in the Philippines, and five synthesis papers that summarize the lessons, issues and future challenges emerging from the empirical cases. The main research objective of the project was to assess women's roles and contributions, however the case papers view gender dimensions of rootcrop livelihood as part of/within the broader social dynamics of households and communities. In particular, the case papers report on the relationships between and among male and female members, both adult and children, of individual households. This unique project provides a basis for rethinking the conventional view of rootcrops as secondary crops, and women as secondary farmers. (EK)

Transfer of tropical tuber crops technologies : means, modes and methods by Anantharaman M, [et al]. 2001. 71 p. Central Tuber Crops Research Institute (CTCRI), Sreekariyam, Thiruvananthapuram 695 017, Kerala, India / director@ctcri.ren.nic.in ; www.ctcri.org. (Technical Bulletin Series 35)..
Tuber crops, mainly grown in diverse, risk prone areas play a significant role in the livelihood of people living close to the subsistence level in India. As low cost energy producers, these crops have great potential in meeting the food security of the small and marginal farmers. CTCRI has taken up the transfer of tuber crop technologies. it has not only implemented the existing frontline extension projects but also evolved and executed its own transfer of technology projects to educate the tuber crops farmers. The methods, results and experiences of CTCRI are reflected in this booklet, a useful practical guide for extension workers. (WR)

Empowering women and fighting poverty : cocoa and land rights in West Africa 2002. 8 p. downloadable. International Food Policy Research Institute (IFPRI), 2033 K Street, N.W., Washington, D.C. 20006, USA / http://www.ifpri.org/pubs/pubs.htm.
These IFPRI papers on women and cocoa in Ghana provide case studies of how land rights, poverty and food security are related and how changes in the position of women can contribute to improving the livelihoods of the whole community. Cocoa production is particularly good for female farmers - cocoa can be grown on marginal land, and it prevents soil erosion, making it a good crop for poor farmers who do not have access to fertile land. Poor female farmers are often in this position, and cocoa helps them make most of the land available to them. This study from IFPRI showed that families and communities benefit greatly when women are involved in cocoa production in Ghana and other parts of West Africa, and that with government support, women's progress towards greater empowerment can have a dramatic and positive effect on reducing hunger and poverty. (WR)

Himawanti : women of the Hindu Kush-Himalayas by Bhatia A (ed.), Limbu P, Meyangbo P. 2001. 78 p. ISBN 92 9115 412 1. International Centre for Integrated Mountain Development (ICIMOD), G.P.O. 3226, Kathmandu, Nepal / icimod@icimod.org.np ; www.icimod.org.
With this grassroots publication, ICIMOD provides useful information on rural women in the Hindu Kush Mountains. HIMAWANTI, the Himalayan Grassroots Women's Natural Resources Management Network, has organised workshops and collected the information on women's needs, concerns and problems with natural resource management in the different countries in the region. This book is an important resource for every expert in development and every politician with interest in rural development, because it shows the point of view of the rural women themselves. The text is in three languages, English, Hindi and Nepali, the illustrations are from Param Meyangbo. (WR)

Women and farming : property and power by Shortall S, Campling J. 1999. 175 p. ISBN 0 333 66466 3. MacMillan Press Ltd, Houndmills, Basingstoke, Hampshire RG21 6XS, UK.
Sally Shortall from Queen's University Belfast, is a researcher in the fields of rural development policy, women on farms, and change in farming. This book looks at women on family farms in Ireland. It argues that farming culture affords more power to men than to women, because men and women on family farms have different relationships to property. Traditions and

customary practices sanction the transfer of land from father to son, thus restricting women's access to property. Economic power follows from property ownership, and this in turns leads to political, ideological and organisational power. Access to property is regulated by farming culture, and discriminates against women.

Power plays a central role in this study, because "to talk of power is to imply the possibility for change". The different chapters consider the transfer of land between men, the changed role of women in the dairy industry in the nineteenth century, women in farming organisations, women in agricultural education programmes, and the role of the state in shaping the lives of farm women. This book provides a good example of how gender is interwoven in European agriculture and what changes are required to come to a more equal distribution of power between the sexes. (WR)

Are we not peasants too ? : land rights and women's claims in India by Agarwal_B. 2002. 30 p. Gender, Family, and Development Population Council, One Dag Hammarskjold Plaza, New York, NY 10017, USA / seeds@popcouncil.org ; www.popcouncil.org/publications. (SEEDS no. 21, 2002).
"Seeds" is a pamphlet series about innovative and practical program ideas, developed to address the economic roles and needs of low-income women. This issue of Seeds, about Land rights and women's claims in India, provides information on why land is important for women, on obstacles that prevent women's access to land, and on possibilities to improve women's access to natural resources. Independent access to land is becoming increasingly important for women as marital and kin support erodes, and female-headed households multiply. This clearly written and informative issue is available free. (WR)

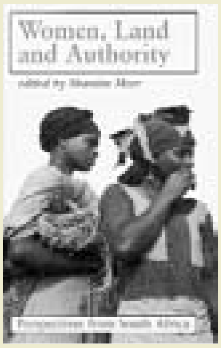
Tools for agriculture: a guide to appropriate equipment for smallholder farmers introduction by Ian Carruthers and Marc Rodriguez. 1992. 238p. ISBN 1 85339 100 X. Intermediate Technology Publications Ltd, 103-105 Southampton Row, London, WC1B 4HH, UK. Russel Press, Nottingham, UK.
This book provides a practical guide to small-scale farming equipment. Information has been selected from more than 1200 manufacturers in over 90 countries, and appropriate equipment is presented in ten fully-illustrated chapters, each progressing from the smallest manual implements to engine-powered tools, to make reference easy and logical. The ten subject areas (field power; soil preparation; sowing, planting and fertiliser distribution; pest control and operator safety; harvesting and threshing; crop processing and storage; water lifting; transport and materials handling; livestock husbandry and health; and beekeeping) are each introduced by a specialist, who sets the range of available tools against a background of good farming practice, and discusses the factors which should be weighed up when making a choice. Sources of further information and indexes of manufacturers and equipment are also provided. (EK)

Agricultural implements used by women farmers in Africa 1998. 129 p. ISBN 92 9072 008 5. International Fund for Agricultural Development (IFAD), via del Serafico, 107, 00142 Rome, Italy / ifad@ifad.org.
This research study was conducted in Burkina Faso, Senegal, Uganda, Zambia and Zimbabwe. A qualitative research technique was used with discussions and interviews with 1500 women and men farmers and 52 key informants in government and non-government institutions. The study gives a good overview of the problems and constraints small farmers, especially women, experience in areas of relatively poor agriculture in sub Saharan Africa.

Among the groups consulted it was generally felt that women needed different tools to men and that manufacturers should differentiate between the two sexes, as they do with bicycles. Many of the groups stated that the hand-hoe imposed strict limitations on production and that they would never make any progress without access to animal traction. However, the spread of this technology is slow and in some countries it can be limited by cultural factors such as taboos against women working with cattle. The study concludes that there is no simple solution to improving the production tools and implements used by women but it concludes with some recommendations on actions required from governments, NGO's and development agencies. (WR)

Gender and organisational change : training manual by Groverman V, Gurung JD. 2001. 154 p.. ISBN 92 9115 295 1. International Centre for Integrated Mountain Development(ICIMOD), GPO Box 3226, Kathmandu, Nepal / www.icimod.org ; distri@icimod.org.np.
This ICIMOD training manual has been developed to increase gender awareness in the Hindu Kush-Himalayan region. Most institutions involved in agriculture and natural resource management have not formally incorporated gender concerns into their research, extension and training programmes, which leads to the widespread exclusion of rural women from participation in research and extension activities.

The manual consists of three parts. The first part is an introduction to gender concepts in order to understand gender-related organisational change. The second part addresses the process of organisational change and the third part covers the skills required by facilitators of processes of organisational change and gender. With these three steps the book is a useful guide for larger organisations that want to increase gender awareness internally. This manual lacks a fourth and crucial step - how to reach grassroots organisations. It does not provide insights or tools to reach rural women with research and extension activities.(WR)



Women, land, and authority : perspectives from South Africa by Meer S (ed.). 1997. 160 p. ISBN 0 85589 375 2 USD 15.95. Oxfam National Land Committee, South Africa. OXFAM Publications, 274 Banbury Road, OX2 7DZ Oxford, UK.
This book reveals the circumstances of tenure and rights of access to land in a changing South Africa, from the perspective of women. Through several pioneering surveys and case studies, it explores women's attitudes to land and related resources, and examines conditions of housing, labour and subsistence for women. What emerges is a sharp sense of transition and crisis and a pressing need for women's organisation, to ensure that development and legislation are informed by the priorities of women. This book, an initiative of the Gender Task Group of the National Land Committee, aims to get these issues on the national agenda and contribute to the fledgling policy debate around land reform. (WR)

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Issue 19.2, June 2003

Water harvesting, water conservation and small scale irrigation

Water is a precious resource that is essential to the life and health of farmers, animals and crops - and it is becoming steadily scarcer. Many see a global water crisis looming on the horizon, and as competition increases for water from households, industries etc., the huge proportion of water used for agriculture, although essential for food production, is increasingly challenged.

This issue of LEISA focuses on small-scale solutions for harvesting, conserving, storing and using water at the local level. What can be done to manage the local ecosystem to conserve water, for example land preparation and ground cover for moisture retention and increased infiltration? How can rainwater be harvested on a small scale? What is the best way to catch and store water? And how can it be efficiently applied to crops? We invite you to share your experiences and solutions with LEISA readers.

Deadline for contributions is the 1st of March, 2003.

Issue 19.3, September 2003

Access to and control over resources

Around the world, many different systems and arrangements determine who has access to and control over land and other natural resources, and under what conditions. The way these systems work, in law and in practice, is one of the main determining factors in the livelihood security of small farmers.

Systems of access and control range from formal to informal, from traditional to very new, from collective to private. Arrangements change and evolve over time, in most cases moving towards increasing privatisation and formalisation. Resources regulated by these systems include not only land but also resources such as trees, water, grazing and manure. Water users associations, Joint Forest Management, tree pattas, pastoralists using agricultural land for grazing, private land deeds, communal use of land, share cropping etc., are just some examples of mechanisms that communities and societies develop to regulate their resource use. How do these systems work, and why? This issue of LEISA will try to bring into focus some of the practical aspects of different systems for access and control. We invite you to share your experiences.

Deadline for contributions is the 1st of June, 2003.

Issue 19.4, December 2003

Rehabilition of degraded land

You are invited to contribute to these issues with articles (about 800, 1600 or 2400 words + 2-3 illustrations and references), suggest possible authors, and send us information about publications, training courses, meetings and websites. Editorial support is provided by ILEIA. Authors of published articles are entitled to a standard fee of USD 75,-.

A Nepalese woman carrying her spade.
Photo: F. Mattioli (FAO)

Land in the hands of women?

Renate Schüssler

Land issues are issues of power. This is apparent not only in the unequal distribution of land, and the concentration of huge production areas in the hands of a few big landowners and multinational trusts. It also becomes very clear in light of the inequities between men and women in terms of access to land. This inequality is a violation of one of the central principles of Human Rights: the principle of non-discrimination.

Work but no rights - traditional limitations on women's land rights

Women in rural areas have traditionally fewer rights and fewer income opportunities than men, often because of patriarchal and conservative thinking, according to which the man is perceived as the main productive working force. Independently of how much women are active in agrarian production, their work is normally perceived as part of family and household management. For example, rural women in Latin America work 14 hours a day. In spite of this, their contribution to food security is hardly acknowledged as work. Due to the pressure for export-orientated production, land available for food production is increasingly difficult to access or provides low yields. It is becoming more and more difficult to cultivate food in sufficient quantities for the family, and production for the world market does not generate sufficient income for the purchase of household food. Because of this, women often eat less than their share in order to feed the rest of the family.

Women produce a considerable part of the world's food: 80 to 90% in African sub-Saharan states, 50 to 90% in Asia and 30% in Central and Eastern Europe, according to FAO. Despite this high contribution to agrarian production, in most cases women do not control their own land. Kenya constitutes an interesting example, as 98% of its women work full-time in the agrarian sector, but only 5% of these have land ownership titles.

Women and agrarian reforms

Demands for redistribution of land, supported by large agrarian reform movements, have during the last century led to the implementation of agrarian reform measures in various countries. Considering the difficult situation of small peasant and landless families, agrarian reforms should be a means to carry their call for social equality. For many governments, however, reforms are merely a means of social pacification. Despite sometimes-progressive agrarian reform legislation and considerable successes in some countries, in many places the measures did not reach far because of weakness in implementation - a lack of political will. In a number of countries only about 10% of the rural population benefited from changes in land ownership.

The demands for agrarian reforms were generally based on prevailing social injustice. This injustice, however, was analysed mainly on the basis of "social class", seldom according to other criteria such as gender or ethnicity. Therefore, agrarian reforms have been gender blind for a long time. More recently, gender and access to land was considered in several countries, but with varying impact. As a result of mobilisation of women from different organisations and movements, some success could be registered in the 1990s regarding an improved *formal* recognition of women.

Example Latin America
Women deprived in agrarian reform

Comparatively, women have benefited to a minor extent from the Latin American agrarian reforms. The reasons for this are juridical, structural, ideological, cultural and institutional. Agrarian legislation has sometimes been amended with an explicit reference to the formal equalisation of women, but details hide a different reality. For instance, the legislative language was used in a discriminatory way; no priority was given to women who were in charge of a household on their own; widespread non-marital living communities were left out; and very deprived target groups lacked recognition. When land redistribution was based on a point system, it proved to be either directly or indirectly discriminating.
For instance, it was directly discriminating in Brazil and Costa Rica, where male beneficiaries were attributed higher point numbers. It was indirectly discriminating in Chile and Columbia, where a higher education level gave a person more points, which deprived women because of the discrimination in the education system.

In order to ensure that also women benefit from land redistribution measures, it is necessary to develop workable strategies based on these experiences.

Participation of women in land redistribution

In order to enable women to directly benefit from land redistribution measures, different approaches have been tried. An important point is that women, accordingly to their life situation – as single women, single mothers or as spouses - obtain rights' security and a certain amount of negotiation power. It is necessary to issue ownership titles in the name of women or women's collectives. Models with different aims have been introduced into some national legislation, including (compulsory) joint land distribution to couples independent of their family situation, i.e. the registration of land property in both names.

Example Latin America – joint land distribution

In most of the Latin American countries, it was for a long time only possible to register land to one person. The compulsory joint land distribution for married and unmarried couples addresses on one hand the demand for rights' security, and on the other acknowledges the fact that in many Latin American countries, non-marital living communities (uniones de hecho) are widely spread. Between 1988 and 1995, agrarian legislation in only five countries provided for joint land distribution. Joint land distribution was compulsory in Nicaragua, Columbia and Costa Rica, and optional in Brazil and Honduras. After the Beijing Women's World Summit of 1995, other countries (Peru, Dominican Republic, and Guatemala) joined this legislation due to the growing influence of women's movements. Empirical observations suggest that because of these measures, the proportion of women among the beneficiaries has increased considerably.

Acknowledgement of the high proportion of single mothers, and the number of children in a household should be considered during the land distribution processes. Because of the unequal starting situation, it is not sufficient to give women the *same* rights as men.

Example Philippines – the same rights

The Comprehensive Agrarian Reform Law (CARL) guarantees rural women the same rights: "All qualified members of the agricultural workforce must be guaranteed and assured equal rights to ownership of the land, an equal share of the farm's produce and representation in advisory or appropriate decision-making bodies". The amended civil legislation code of 1988 guarantees the same ownership rights to men and women. Moreover, women should enjoy the same access to all government and private programs allocating credits and non-material resources, and be treated in the same way for agrarian reform and land settlement programs. Concretely however, 86% of agrarian reform measure beneficiaries are men.

In order to counter unjust, historically conditioned structures, some women's organisations demand the introduction of compensatory measures. This kind of so-called *affirmative action* appears only exceptionally in agrarian legislation.

Example South Africa – affirmative action

In South Africa, women were one of the target groups favoured in land reform processes. "Redistribution will give priority to the following: - to the marginalised and to women in need". Equality of rights, along with social justice and economical feasibility, is one of three principles of the South African land reform. In order to enable women to benefit from the land reforms, the government offers 20,000 rand that they can obtain individually. If the women are married, they can apply jointly with their husbands. Both names are registered together and appear on the beneficiaries' list. The low implementation rate of the South African land reforms, however, shows that the elaboration of progressive legislation is a fundamental requirement, but does not constitute a guarantee for real change in ownership structures that are favourable for women.

To what extent compensatory measures really improve the conditions of women, has to be assessed based on concrete results. A permanent monitoring system should be developed in

Bolivian marketplace. Women produce large part of the world's food, but in most cases do not control their own land. Photo: FIAN

order to make sure that the successes obtained are sustainable. In fact, vulnerable groups are often affected by counter-reforms or by the increasing orientation towards market mechanisms and economical liberalisation that is implemented today in many countries.

Peruvian peasant woman sowing seed. Photo: J. Van Acker (FAO)

Women and land markets

Experiences from countries in which large agrarian reform measures were implemented show that women have *benefited directly* only to a small extent. Would the women be better off within the frame of the new market-led reform processes, based on a neo-liberal logic? Market-oriented land reforms, such as those promoted by the World Bank and others, contribute partly directly, partly indirectly to the standstill of agrarian reform processes. The idea is that land redistribution shall be regulated by market mechanisms: peasants who fulfil certain criteria can apply in land banks for credits, in order to purchase land. The traditionally marginalised groups are excluded from the start, as they do not satisfy the required criteria. Many peasants who bought land this way have incurred high debts: many of them have been forced to re-sell their land. To make matters worse, the state is retiring from its role in supporting production by providing access to markets, seeds, training and technical advice.

In the 1990s, mainly thanks to the pressure of women's and Human Rights organisations, women in Latin America have benefited more from the entitlement programs than in previous agrarian reform programs; and the participation of women is proportionally higher, even though it is still drastically behind their male counterparts. Because of the general changes in agrarian policies, land redistribution processes came to a standstill, which means that in absolute figures, fewer women have received new land than previously.

Moreover, women are discriminated against on other grounds, in land markets or in a market-led land reform process . Women have very few income and ownership opportunities and little access to credit. The reasons for this are, among others, discriminating inheritance conditions, cultural responsibility for the very time-intensive but not income-generating reproductive work, and the gender specific segmentation of the work market, where women generally earn less than men and so-called typical female activities are much lower paid.

Example from the Philippines

In traditionally organised big farms, the whole family is generally employed but only the man receives a salary, paid jointly for the whole family.
In capital-intensive plantations, the men run the machines, whereas women are given ordinary and so-called "easy" work, which is generally lower paid.

Women have weaker negotiation power in land markets, and they generally have to pay more money for less productive land plots. Therefore it appears that even land markets are not gender neutral: the most important way for men to gain access to land is the purchase of land, while for women it is inheritance.

However, access to land is not the only determining factor. Other conditions, such as production conditions, are also decisive for the successful use of the land and the ability to keep the land over time This refers to the questions of the access to means of production, to education and technical assistance and to the market conditions under which the products can be sold. Particularly because of the 1990s' neo-liberal counter-reforms, small peasants are often forced to resell the land they had purchased before.

Finally, a liberalisation in land policies and the further retirement of the state has meant that compensatory measures and favouring of especially vulnerable and marginalised groups, especially women, has been abandoned. Many women's organisations therefore still demand land redistribution policies based on social criteria that not only take into account the category of gender, but also have a compensatory effect on other forms of social, regional and racial discrimination. Land markets do not constitute an alternative to agrarian reforms, as through them, land redistribution loses its function of social equalisation. Under conditions of structural injustice, justice cannot be introduced by mere equal treatment – compensatory measures are necessary.

Aims and demands of the International Agrarian Reform Campaign

The aim of FIAN's and La Vía Campesina's Global Campaign for Agrarian Reform is to support the struggle of landless and small peasants to gain access to land, water and agrarian productive resources, on the basis of the Human Right to Adequate Food. The Campaign constitutes an important forum for overcoming unequal ownership and production conditions that are not gender neutral.

To achieve greater gender democracy, it is important to pay special attention to gender perspectives in all forms of land redistribution, entitlement programs and accompanying measures. A central point is that the same starting conditions (formal equalisation) are created, and the same results (real equalisation) are achieved. This implies compensatory measures.

With this background, the International Agrarian Campaign of FIAN and La Vía Campesina campaign for the implementation of an agrarian reform based on Human Rights and creating an agricultural environment which:

- gives poor small peasants control over land, seeds and water, so that they can live in dignity;
- allows the production of food that is safe and free from genetic modifications for all;
- guarantees sustainable means of production in order to preserve the food basis of coming generations;
- strengthens the rights of rural women and other deprived groups;
- guarantees food sovereignty;
- strengthens rural communities.

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Women farmers in Don Yieng apply organic fertiliser to their organic soyabean crop. Photo: Rebecca Eisses

Organic farming and gender roles in Northern Thailand

Rebecca Eisses and Jutamart Chaikam

High external input agriculture was first introduced to Thailand on a large scale under the First National Economic and Social Development Plan, which was developed under the auspices of the World Bank in 1961. Modern agricultural equipment, inputs and concepts were spread throughout the country by the newly established Department of Agricultural Extension and Bank of Agriculture and Agricultural Co-operatives. The Plan emphasised high yielding varieties of exportable cash crops to improve the national economy.

Small farmers, the green revolution and the global economy

The introduction of high external-input agriculture into Thailand has, for some crops, increased yields and reduced labour requirements and has allowed the production of certain non-indigenous crops that might otherwise be too difficult to grow. High external-input agriculture has not, however, generally improved quality of life for small farmers in Thailand. The purchase of external inputs can trap farmers into a debt cycle that is almost impossible for them to escape. The use of pesticides further leads to noticeable deterioration in farmers' health as well as that of the agro-ecosystem. In some cases, farmers who have been improperly trained in the use of pesticides, combined with an ineffective regulatory system, also put the health of consumers at risk.

More than these physical effects, the entry of Thailand's small farmers into the global economy has completely revolutionised the countryside. Farmers who were once largely self-sufficient and owners of their own time and resources now adhere to the adage "time is money". If the time and labour they once spent weeding their crop has now been reduced by herbicide use, for example, they must now use that time in an economically efficient manner. This is necessary mainly to earn cash to service their (usually) unsustainable debt. This change in the village economy has had particular implications for women's agricultural roles in many communities.

Under the new economy, there are two main ways in which women's roles have been marginalised. In areas far from an urban centre or with little seasonal labour demand, the introduction of labour-saving technology such as pesticides and chemical fertilisers (especially herbicides) has meant that women's role in crop production is now reduced to planting and harvesting. This often means that women have more time to devote to reproductive work and women themselves consider their situation improved. However, since in most Northern Thai households women are responsible for a significant proportion of productive work, in some cases women will find productive work elsewhere, such as factory work or day labour on other peoples' farms, or else the men will find a permanent job off-farm, leaving their wives solely responsible for agricultural production (although perhaps not in control of it). In areas close to an urban centre with a demand for seasonal labour, men leave the village, usually after planting the dry season crop, and return in time to help with the harvest. This is often done in order to earn cash to finance the inputs needed for the dry-season crop production.

Organic production – an alternative?

The Chomrom Phupholid Kaset Insee Jangwad Chiang Mai or the Chiang Mai Organic Producers Association (COPA) consists of farmers who are committed to using organic production methods to ensure environmental sustainability and to protect their own health and the health of consumers. In addition, they make their own inputs such as compost, bio-extract and botanical pesticides from locally available materials found in the forest, on their farms, or in their communities in order to reduce costs and increase self-reliance. The COPA works with consumer groups and has set up alternative markets in the city of Chiang Mai to sell members' produce at a fair price.

In order to become a member of the COPA, a village group must pass through a series of four trainings: sustainable agriculture concepts, sustainable agriculture techniques, a study tour, and finally a session on gender roles. In the COPA's experience, adoption of organic farming significantly increases labour requirements compared to conventional farming. Women often shoulder the increased labour to a greater degree than men. The gender session serves to sensitise men to the importance of reproductive tasks and the time women need to spend doing them. In most sessions, the men are quite surprised to see how much time it actually takes to prepare meals, wash clothes, care for elders and children and the other "invisible" tasks that women perform every day. Some families choose not to join their village organic farming group because the men are unwilling to help with the reproductive work, but many remain convinced of the value of organic farming and choose to divide productive and reproductive work within the household more equitably.

Women's importance in the COPA is expressed in their participation in both traditional and non-traditional roles. For example, the traditional role of women as marketers of farm produce is largely restored through the COPA's revolving markets, a role that was superseded by men with the introduction of cash crops sold to middlemen. All members of the revolving market, of whom 57 out of 60 are women, meet every month to set prices for their produce, thus avoiding competition between members on the basis of price. Women also add value to organic produce through processing, making and selling both traditional Northern Thai products such as *khao khaeb* made from rice flour and non-traditional products such as strawberry jam. Female members of the COPA serve as trainers and spokespeople, as well as in administrative posts. (So far, there has never been a female president of the COPA but the present vice-president is female and some of the member village groups have female presidents.)

Organic vegetables produced by COPA members. Photo: ISAC

The socio-economic benefits of organic agriculture

A study on dry-season soybean production by the Don Jieng Organic Farmers Group, a member of the COPA, provides a concrete example of some interesting socio-economic benefits derived from organic farming. Most men in Don Jieng do seasonal construction work in the city of Chiang Mai after planting the dry season soybean crop in late December of each year. They return in mid-April for the Thai New Year festival and soybean harvest. In the meantime, women are responsible for pesticide and chemical fertiliser application to the soybean crop, usually consisting of one or two herbicide sprays, one or two insecticide sprays, and one broadcast application of chemical fertiliser. In addition, the women become solely responsible for the care of elders, children, and livestock, as well as their regular household activities. The men who work in the city earn the cash they need to pay for the inputs for their soybean crop, to service debt and to pay for other things requiring cash such as school fees. However, since they need to rent accommodation and pay for food, they often do not return with a significant amount of money. (Indeed, due to the informal nature of the work contracts, sometimes they are not paid at all). Labour migration has also been a mode of spreading HIV/AIDS from the city to rural areas. Out of a total village population of approximately 500 people, more than 20 people in Don Jieng have died of AIDS (this figure is, of course, hardly comparable to the situation in many African countries and is in fact lower than the regional average rate of infection, but is still a significant amount for a rural village).

Members of the Don Jieng Organic Farmers Group who were growing their dry season soybeans organically did not have time to work in the city due to the increased labour requirements of their organic crop. At the same time, because their input costs were so low, it was not necessary for them to work in the city. Members of the group, especially women, felt that the social benefits of having the men stay in the village outweighed the lost opportunity to earn cash in the city. However, since the organic soybean crop was more profitable than the conventional soybean crop, due to a higher selling price, they were not at an economic disadvantage compared to the conventional farmers in the village. After a single year, membership of the Don Jieng Organic Farmers Group doubled, in part due to the socio-economic benefits of their organic soybean crop.

Linking with others

The COPA is still only a small organisation comprised of a very small proportion of the farmers in Chiang Mai province. However, it is a member of the Alternative Agriculture Network (AAN), which links like-minded NGOs and peoples' organisations around Thailand to lobby for changes in government policy. The AAN was successful in having sustainable agriculture included in the 8^{th} National Economic and Social Development Plan, an inclusion that has had implications for Ministry of Agriculture and Cooperatives research and extension. This also resulted in the Ministry committing funding to a Pilot Project to Develop Sustainable Agriculture for Small-Scale Farmers. Funds under this project are administered regionally by farmers' organisations, including the COPA.

Through its community radio program and co-operation with NGOs and GOs in farmer-to-farmer extension and advocacy for sustainable agriculture, the COPA and its members are known around the country and even internationally for their work. Women continue to play a role of ever-increasing importance in the COPA, both through the revival and celebration of traditional roles like food processing and marketing, and also through non-traditional roles such as training, administration and community politics.

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Economic change and gender relations

planning in the Pearl Lagoon Basin

Orinoco children: A younger generation with changing attitudes
Photo: Jesse Hill

Denise Lapoutre

Why and how do gender relations change? Rapid appraisal methods, which mainly focus on tangible information, may not be sufficient to understand these questions. Based on experiences with development processes near the Pearl Lagoon Basin of Nicaragua, this article highlights the need for participatory, gender-based research as a basis for development planning, particularly in situations of turbulent change.

In the Pearl Lagoon Basin in the Southern Autonomous Region of Nicaragua, thirteen small farmer-fishing communities are in a state of economic flux and social despair. A major reason has been the shift from an economic model based on a combination of subsistence production and wage-labour, to a market economy. The shift began in the seventies, when foreign companies in the area started to withdraw from their unsustainable exploitation of the area's natural resources, taking with them the opportunity for wage labour. A second reason that further exacerbated the situation was the abandonment of subsistence production.

The present situation is one of rapid change, driven by an influx of cheap commodities from foreign countries. The communities' lack of experience with entrepreneurship, as well as traditional economic laws and quality standards that do not meet the demands of an international economy, mean that transition to a new sustainable production model will not be easy. Moreover, this change takes place in a setting where local structures are dominated by men and patriarchal ideologies.

The Garifuna fisherwomen's cooperative

In 1995, the University of the Autonomous Regions of the Caribbean Coast of Nicaragua (URACCAN) started an Integral Development Project for the Pearl Lagoon Basin. The project contains different components that address integrated community development as a process of dynamic interaction between cultural, social, economic and productive dimensions.

One of the target groups, the fisherwomen's cooperative of Orinoco village, is with 70 members one of the bigger organisational units in the area. When I came to work at URACCAN-Bluefields in February 1997, the only activity of the cooperative was the letting of its motorboat. A rapid assessment revealed that almost none of the members were actually involved in fishery-related activities or had any ambition to be involved. Instead, they were almost exclusively interested in raising chickens. This surprised me, as Garifuna women were known to be fishers as well as farmers. In 1991, 60% of Orinoco's fishers were still women. And why produce chickens, when outside the community people buy *Pollo Tiptop*, the frozen ones?

Research

With the community, we started a Participatory Rapid Rural Appraisal (PRRA) focusing on production. The main conclusions were the following:

1) The community has abandoned the production of at least sixteen basic food and cash crops. The major reasons for abandoning agriculture were:
   - The civil war, when people avoided the fields out of fear.
   - The lack of technical and financial support required to rehabilitate farming.
   - Fishing, especially after the introduction of the gill nets, has become more lucrative then agriculture.
2) While men and women used to fish and farm together, now few women participate. Women still engage in fish-processing and in the shrimp harvest;
3) The food security crisis could be solved. Access to credit would make it possible to produce what is now imported, and to export to outside markets.

Not taking into consideration culture, customs, needs, wishes, attitudes, etc., the inhabitants automatically took a Marxist position: With improved economic opportunities, cultural habits would change and improve. All change was expected to come from outside: Credit and a market would be the keys to prosperity. A random sample of people's reactions: "Everyone does whatever he likes, because nobody gives any help to Orinoco"; "The community doesn't develop because there is no work"; and, "With access to credit and access to a market we all would be working the fields".

After considering the results so far, I felt we were not ready to start participatory planning. The reasons behind the changing production model were not fully explored and the changes in division of labour and access to production resources by gender were taken for granted. A second research phase became necessary. URACCAN students visited one out of every ten households, interviewing men and women of different age groups. Subjects were firstly the changing livelihood systems, including personal behaviour at household, communal and (inter)national family systems. Secondly we questioned the sustainability of

Orinoco's production model and women's, men's and young people's ideas and habits by asking the interviewees to comment on three statements:

1) Orinoco is changing into a 'bedroom community': People are abandoning the fields, over-exploitation of fishery resources is leading to reduction of food and income and dependency from migrant remittances is growing;
2) Women used to be more dedicated to productive activities than they are now;
3) The new generation likes quick earnings. Investing money, time and energy in agriculture and cattle is old-fashioned.

These questions and their answers were eye-openers for the community members themselves. Until now they had been worried about the reduction in agricultural and fisheries' production per unit effort, but they had never wondered why the behaviour of women or youth had changed and what the consequences of these changes would be for the future economic and social well-being of the individual, the household and the community. The results also led to clues for discussions on gender.

Community discussions on gender dynamics

One outcome of the investigation was the revelation that more than half of the households are receiving migrant remittances from family abroad. For a quarter of the families, these are the main source of income. Discussing this point eventually led to greater awareness of the vulnerable position of women. When we asked what happens when an eighteen-year-old boy leaves his girlfriend behind for a couple of years, everybody started to laugh. It is commonly agreed that Orinoco's young men are not monogamous. Although other kinship relations than marriage play a role in a woman's subsistence strategies, the situation of poverty makes the husband's contribution crucial to subsistence. We discussed the fact that in a sample of 24 women all but two learned to farm or to fish or both, but only one of them is currently farming and four sometimes go fishing. What does this mean for Orinoco's daughters, who are growing up without learning any productive skills?

We also discussed why women might be retiring from productive activity. Since the introduction of gill nets, fishing is considered to be men's work and too hard for women. A suggestion that the increased profitability might be a determining factor for changing gender roles was rejected. Regarding women's (non) involvement in agriculture, several additional observations were made: that women today are lazier, that beliefs have changed - men should support the family and women should stay at home, and that women nowadays have fewer rights than they once did.

By comparing two generations, we were able to see how withdrawal from fisheries and agricultural labour is advancing. Almost none of the young people dedicate themselves to productive activities. The elders describe them as 'dreamers', 'preferring sports and drinking over work', 'confused about the progress of modernity', 'vicious', and 'without patience'.

Another discussion dealt with the breakdown of social networks. A conclusion was that in the Pearl Lagoon area, where traditions of barter and mutual help are breaking down, helping others with work, food, money or means of production has a gender-related price. Women appear to have limited ways to obtain cash and to exchange services and products. It was concluded that although women have less access to cash than earlier, they now have to pay for services and for using means of production or transport owned by men, things that used to be free of charge. Women feel their need for money is urgent. They do manage part of their husband's earnings, but they are generally unaware of his total income. Some women make a little money from baking bread and cake or from commercial activity. Most have a few chickens for subsistence or exchange.

Design and implementation of plans

After the community members gave feedback on the conclusions, they were able to design a long-term development plan with gender perspective for the community and a women-focused, short-term strategy.

The community stressed the importance of traditional culture for a prospering Orinoco. Revival and ownership of the traditional culture, particularly by youth, would lead to constructive attitudes towards community building. The cultural revival should extend beyond cultural activities to traditional productive and commercial activities, and this could be a focus for the socio-economic or women's component in its first phase.

The women's cooperative, supported by participants of other components of the project, made a plan for starting the production activities. In 1999 we started a credit fund managed by the community, for the cooperative to run a shop and to sell fish and shrimps bought from the fishermen. Credit was also given to individual women organised in small groups for commercial activities such as a shop or a guesthouse, cattle breeding, agriculture and horticulture. Professionals and URACCAN students provided technical assistance where needed. The high level of repayment, in a region where a culture of not refunding credit dominates, reflects the commitment of the beneficiaries - undoubtedly enhanced by the extensive identification and planning process. In the next phase, a start was made with product diversification (new crops, reforestation, pig breeding, eco- and cultural tourism etc) and the introduction of non-traditional economic activities for women.

Conclusion

Rapid Rural Appraisal methods are very useful for analysing transforming productive models, including the roles of women and men. However, they are not enough and had to be complemented with more extensive research. *After combining information on people's participation in productive work and their share in the benefits of production, their income and expenses (by age and by gender) with knowledge of their norms and perceptions (by age and by gender),* we had a rich input for discussions on community development, household development and women's development. This in turn paved the way for a participatory design of gender-sensitive development plans. The Garifuna women still face many difficulties, but they are regaining territory while developing traditional production. No longer was the solution for the precarious situation of decreasing agricultural activity, impoverishment and perceived overexploitation of natural resources only to be found in the generation of credit and new market perspectives. Instead, members of the community related the negative spiral and changing economic circumstances to changing cultural habits and preferences with gender dimensions and treated them as such. No longer do Orinoco women see breeding chickens as the only alternative to domestic work. ■

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Small change crops
the marginalisation of women farmers' priorities

Carine Pionetti

In India, as in many other countries, agricultural planning and policy are largely based on 'gender-blind' data. There is no systematic effort to identify and comprehend differences in strategies, responsibilities and concerns between men and women farmers in agricultural domains like soil fertility, weed management, seed production, agrarian rituals, access to technical advice, inputs and credit, marketing of produce. Considering that women undertake 70% of all agricultural work in many parts of India, the lack of a gender-desegregated analysis is concerning. Moreover, it constitutes a major barrier to evaluating the impact of new technologies and policies on women farmers.

This article aims to provide insights into the different meanings and values attributed to crop diversity by women and men farmers in the semi-arid Deccan Plateau. Based on a wide range of participatory discussions and exercises conducted with small farmers between 1999 and 2002 in several parts of Andhra Pradesh, these observations demonstrate that gender plays a critical role in Indian agriculture.

Keeping in view the multiplicity of situations which, together, make up Indian agriculture today, we look at three farming contexts, located on different points of an imaginary continuum going from primarily subsistence farming to largely commercial farming: Shamshuddinpur (Medak District), Satmoori and Pipri (Adilabad District), Bhoraj (Adilabad District).

Shamshuddinpur

Located in interior parts of Medak District, Shamshuddinpur is characterised by diversity-based dryland agriculture, both in the *kharif* (spring) and *rabi* (winter) seasons. Regardless of their socio-economic situation, virtually all farmers follow a mixed cropping system. *Jowar* (sorghum), the main crop, is grown in association with pulses like pigeonpea, greengram, blackgram, cowpea, fieldbean, chickpea and a range of dryland oilseeds including groundnut, mustard, safflower, linseed, and niger. Minor millets (foxtail millet, little millet, etc.) are also grown on very poor soils and commercial crops like sugarcane, ginger and green vegetables are cultivated on a handful of irrigated fields.

Irrespective of gender, everyone in Shamshuddinpur acknowledges the importance of crop diversity in meeting food, fodder and fuel needs, evading the risks inherent to dryland farming, optimising scarce moisture, and minimising costs of cultivation. Yet of all farmers, small women farmers are perhaps the most resourceful in making the most out of crop diversity on their land. They see a clear connection between crop diversity in their fields and grain diversity in their kitchen, a key asset in preparing nutritious meals, food offerings for the deities, festival delicacies, and herbal remedies. Although there is no outright rejection of marketable crops on women's part (cash crops like castor, coriander, chillies, bishop's weed or turmeric are grown in very small quantities by most families in Shamshuddinpur), there *is* a strong sense that these should not be grown at the cost of crops that meet more immediate and vital needs.

Intra-species diversity is still high in this part of the Deccan Plateau. In Shamshuddinpur, for instance, ten local varieties of sorghum, six of pigeon pea, and three of chickpea are still grown today. When opting for a given combination of varieties, women farmers call upon a great deal of know-how, planning skill and strategic thinking. Laxshmamma, from the village of Chillamammadi some 30 km from Shamshuddinpur, explains that by growing two or three varieties of chickpea or pigeonpea, she increases her chances of storing the harvest as foodgrains for home consumption. The underlying logic is that her husband is less tempted to go and sell small quantities of different varieties in the market than a larger volume of a single variety. Small women farmers, then, can take recourse to elaborate strategies in order to keep as much control as possible over food grains produced on their land. Yet overall, in Shamshuddinpur, men do not downplay the value of crop diversity as they do in other parts of Andhra Pradesh.

Satmoori and Pipri

In Gound adivasi (tribal) village of Pipri, in Adilabad district, there is a stark contrast in the depiction of farming practices by women and men. Men farmers eagerly speak of the cash crops that are now widely grown in the village, under rainfed conditions: hybrid cotton, hybrid sorghum, tomatoes, and chillies. The picture they convey is one of a largely commercialised agriculture, with inputs and outputs travelling in and out of the village. Women farmers, on the other hand, feel more inclined to speak about the food crops they grow on their land: pigeonpea intercropped with cotton, chickpea after a crop of rice, sesame on the border of sorghum fields, rows of fieldbean amongst sorghum plants.

Similarly, in Satmoori, an adivasi village in the same district, farming is based on a mix of food and cash crops with maize, sorghum (*jowar*) and cotton as the main crops (in terms of acreage). In 2001, a group of 22 women of all ages took part in a participatory exercise on the relevance of crop diversity to dryland agriculture (Table 1). Interestingly, the matrix they prepared reveals a very low consideration for cotton compared to all other crops on their part. Yet cotton is presently gaining ground in many parts of Adilabad District (as well as in other Deccan regions). Sorghum, considered by women farmers to be a crop of vital importance, is losing ground to the commercial crops. Men, being the main recipients of external advice, inputs and credit, are generally more inclined to expand the area under commercial crops; many women say that their husbands insist on moving towards cash crops.

Bhoraj

Agriculture in Bhoraj, a village located close to the town of Adilabad, constitutes yet another scenario. Cash crops like cotton and soybean dominate. Hybrid sorghum and pigeon pea are grown for direct consumption and for sale.

In this context of commercial agriculture, there is a clear demarcation between cash crops and so-called '*chillar pantalu*', meaning 'small change' crops, which do not bring in a sizeable income. These crops encompass most of the pulses (except pigeon pea) and oilseeds to which Shamshuddinpur and Satmoori women farmers attribute so much importance.

Although men openly discredit minor food crops in Bhoraj and in neighbouring villages, women have not entirely given up on them. One of their practices consists in going into cotton fields soon after germination, carrying seeds of field bean, green gram, black gram or roselle *(Hibiscus sabdariffa),* and sowing these wherever a cotton seed has failed to germinate. Even though crop diversity has been almost entirely sidelined in the present cropping pattern, women are not deterred in their determination to see pulses and oilseeds grow on their land. This is true not only of small women farmers, but also of large farmers. Gangamma, who belongs to a high caste family farming 30 acres, explains that she too tries to grow small amounts of green gram and black gram wherever she can. Yet, it is also significant that it took two hours of discussion for her to say that she was growing these crops and storing a few kilos of these seeds in small plastic bags. This would indicate that she had internalised the idea that it is worthless to grow ‘small change crops’.

Women and crop diversity

The demise of crop diversity can be seen as a metaphor for the marginalisation of women’s agenda in agriculture. “Small change” crops are suited to dryland conditions, grow without any extravagant need of inputs, and meet the food and fodder requirements of the household. As a woman farmer from Pipri said “If we only grow cotton, where is the fodder for our cattle going to come from?”. Yet, most agricultural extension officers, scientists, breeders, rural bank managers and even policy-makers pay no attention to the concerns of women, especially when they are ‘merely’ poor farmers. The entire agricultural support system is geared towards men farmers who can be more easily persuaded to adopt new seeds and technologies and to spend money on chemical inputs.

In the emerging paradigm of agriculture, which is spreading like wildfire in many parts of India, commercial crops are equated with modernity, and there is very little room for diversified cropping systems. As local dealers become the main suppliers of inputs, credit and advice, and the main outlets for the crop, women’s domain of expertise in agriculture drastically reduces. The recurring allegation made by men farmers that “Women don’t know anything about farming”, in villages like Bhoraj, is but one sign of this alarming trend.

Cosmetic changes in policy (like creating ‘niche areas’ for women, such as poultry-raising or sericulture) and initiatives that fail to address the contradictions of the dominant paradigm of agricultural development (like micro-credit schemes for poor rural women, that leave the problem of indebtedness via money-lenders unexamined) are not what is called for. A profound change of attitude towards women farmers is needed, and a shift in the way agricultural policies are conceived and implemented.

Finding out what women know about farming, and why their knowledge has been devalued, is a crucial step. There must be a sustained effort by extension workers, scientists and policy-makers to understand women’s practices and perceptions about agriculture, including cultural, social and symbolic dimensions.

In domains that are typically women’s responsibility, like seed saving, weeding, and cooking, it is vital that women’s concerns be allowed to emerge and inform policies. Small women farmers, for instance, have a preference for crop varieties that are suitable for mixed cropping, that can be saved as seed for next season, that require low levels of inputs and that produce enough fodder for their cattle. Unless these factors are given due consideration, there is a great chance that agricultural policies will continue to undermine women’s agenda instead of strengthening it.

Finally, issues of control and access to resources (e.g. land, water, and seed), credit and markets need to be scrutinised with a special attention to gender. Unless women’s control over productive resources is reinforced, through individual or collective approaches, it is doubtful whether women farmers will be able to continue contributing to agriculture with the same talent, aptitude and dedication that many Indian rural women still display today. ■

Had the women farmers whom I approached not shared their words, concerns and sensitivity with such openness and spontaneity, this article could simply not have been written. I wish to especially acknowledge the affection and inspiration received from a few vibrant women, farmers and cooks: China Narsamma (Pastapur), Samamma (Bidakanne), Kamlamma (Shamshuddinpur), Lakshmamma (Chillamammadi), Swarnamma and Cheichamma (Algole), Anjamma (Timmapur), Modhubai (Satmoori), Posani (Bhoraj). I also wish to thank Deccan Development Society (Medak District) and the Dhan Foundation (Adilabad District) for making this research possible.

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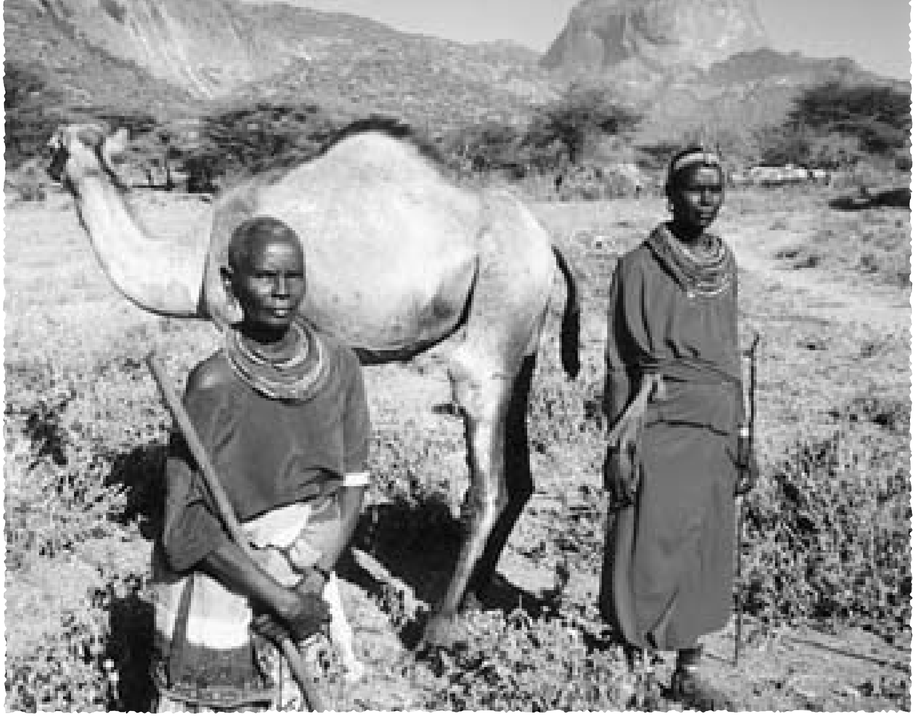
Table 1. Representation of crop diversity by women farmers of Satmoori

	Food value	Fodder	Ambali	Soil fertility	Oil	Ritual	Green veg.	Sale price	Moisture need	Expense	Cost of seed	Crop rank
Sorghum (jowar)	■■■	■■■	■■■						■■■	■■		1
Rice	■■■	■■■		■■■		■■■				■■	■■	1
Cowpea	■■■	■■		■		■■■	■■	■	■	■■■	■	2
Green-gram	■■■	■■		■		■■■	■■■	■■	■■	■■	■	2
Sesame	■	■			■■■	■■■		■			■■■	2
Black-gram	■■■	■■■		■■■			■	■■		■■	■	2
Field bean	■■	■■■					■■			■■■	■■■	2
Red-gram	■■■	■■■					■■■				■■	2
Maize	■■■	■■■	■■								■■	3
Little millet	■■					■				■■■	■■■	3
Foxtail millet	■									■■■	■■■	3
Soyabean				■■■	■			■■■		■		3
Chickpea	■	■■■				■	■		■■■		■■	3
Roselle	■				■■■		■■			■■■	■■	3
Cotton								■■■				4

N.B. Ambali is a liquid porridge made from a millet, an important part of the summer diet.



Adiya Leruso (right) passing on her camel's first calf to group member Melieyou Lepasore. Salato group members receive benefits enabling them in turn to benefit others. Photo: Laura Lemunyete

Developing camel products

pastoralist women and PTD

Laura Lemunyete

Salato Juu and Salato Chini Women's Groups are sister groups operating in the Ngurunit area of Northern Kenya. The community of Ngurunit comprises Rendille and Samburu Pastoralists. Ngurunit's main economy is based on livestock production under the pastoralist system. Agriculture is very basic due to water constraints and very few alternative activities have been developed in the area.

Salato Juu/Chini Women's Groups consist of 104 members who formed together as sister groups in October 1995. Their main goal is to work together for the improvement of each member's life together with their families and wider community. Over the years Salato Women's Groups have been involved in a number of activities. These activities include making and selling handicrafts, running a tourist camp/conference centre, participating in making a calendar to raise funds for community preventive health projects as well as other activities that assist them to reach their goal.

Salato Groups' principle partner is PEAR Group (Participatory Education, Awareness and Resources Group), a Community Based Organisation operating in Samburu District. This organisation specialises in promoting, motivating and assisting in the implementation of community development projects.

The camel project

The main incentive for forming into groups was to increase food self-reliance through the implementation of a camel project. The groups started submitting proposals in 1996 and were successful in finding a donor through HPI (Heifer Project International). Activities started officially in January 1999. The project involves every group member acquiring a milking camel, as an ecologically sound livestock species suited to the Ngurunit area that is able to produce milk even during dry seasons. This aims at increasing each household's food self-reliance and possibility of income generation through the sale of camel products. Connected with this project are elements of livestock management training, encouraging ethno-veterinary knowledge through use of medicinal herbs and plants, group dynamics and leadership training, literacy promotion and environmental awareness raising and conservation. PEAR Group assists in the implementation and management of the camel project activities.

Through the camel project, the women of Salato Women's Groups received 103 mature female camels and 4 breeding bulls. The first lot was received in March 1999 and the last arrived in April 2000. By the end of that year, the camels were starting to give birth and many families started benefiting from the milk. Family nutrition improved and milk sale gave a bit of income. The group members were also seeking better ways to use the milk, both collectively and individually, as a source of income and increased food security. It was through this desire to increase the value of their product that they became involved in Participatory Technology Development (PTD) research on meat and milk preservation for food security and income generation. This PTD research is done at community level in co-operation with EU/ KARI (Kenya Agriculture Research Institute), and PEAR Group is involved in the project as facilitator.

The meat and milk preservation project is based on available academic research on this subject and, through the support of technical personnel and community facilitators, attempts to establish practical methods that local pastoralists can use for food security and income generating activities. Salato Groups were selected for the pilot phase of the project from February to June 2001. During this time they were able to start organising several preserved meat and milk product enterprises and start to explore the possible avenues of food security products such as camel milk cheese, dried milk and ghee (clarified butter).

From July 2001, the project continued in a more formal phase concentrating on infrastructure development (dairy and meat processing houses), marketing and continued product development for food security. More emphasis was also put on the health of the milking animal as it relates to milk production and dairy product quality. A dairy building was completed in April 2002 and a meat-processing house was finished in May 2002. KARI provided technical experts to work on the food security and health issues. Donors from the Finnish Embassy assisted the Salato Groups to equip the dairy with a solar system, a bag sealer and a cream separator. A refrigerator was also given that only needed some maintenance and repair. The

Group members, facilitated by PEAR Group, continued to adapt the technical processes and income generation products to their situation.

The project was renewed again for the year 2002/2003. The goal of this year is to establish regular markets for both milk and meat products, finish supporting infrastructure like fencing, water tanks and latrines, improve literacy and management ability of the group members, explore ways of adding value to animal products like the hide and to enhance the sustainability of the project to allow it to continue without external input.

Successes in the meat/milk preservation project

Through their involvement with the Meat / Milk Preservation Project, the members of Salato Groups have begun to see several positive changes start to take place in their abilities as members of a group, and as individuals, to improve their food security on a household basis and increase their income generation. Through the group dairy enterprise, a market has been created for individual milk sales. After processing the milk, the profits from the sale of the products, fermented milk, ghee, milk sweets and dried cheese, in turn are put into the group account and are available for grants and loans to the members for starting private business enterprises or assisting in educating their children.

The Participatory Technology Development side of the project has been successful in developing several important food security items that the group members are producing for household level use. The traditional method of extracting milk fat from cow milk does not work on camels because of the structure of camel milk. With the cream separator technology introduced, the production of ghee (clarified butter), which by the local methods for cow milk is very labour intensive, is made much easier and can be made without destroying the skim milk component. From the skim milk a dried, brined camel cheese or a processed milk sweet can be made. The cheese is easily stored for up to 6 or 8 months without spoiling and is added to maize meal porridge or maize as a very nutritious protein source. The milk sweet can be stored for up to 4 months and is added to tea or eaten alone. These products are made during the times of milk surplus and can be easily stored in local home conditions. These technologies go very far in providing alternative systems of food security by preserving a normally very perishable product.

Besides using it for their own income generation activities, the group dairy is also devising a way to provide this separation technology to the wider community during times of milk surplus, so that the fat can be stored for the dry season. So now, families that have camels as their source of milk can also benefit from making ghee.

One added benefit that the group members are realising from this project is through the creation of a fund from part of the income, to provide subsidised camel drugs for the group members when their camels require them. A major expense of owning camels is the high cost of drugs required to keep the camels healthy and productive. Many of the group members have very little cash income and find providing drugs for their camels a major constraint to their production. With the advent of the dairy project, the group members were able to set in place a system of milk donations on a weekly basis when their camels are lactating. The milk is then processed to improve the value and sold along with the other income generation products. The money from the camel milk sales is then put into the drug fund and used to buy drugs for the group camels. These drugs are provided to the members very cheaply, (less than 25 % of retail price), thereby assisting the group members to keep their camels healthy and increasing overall production.

Challenges for the Future

In terms of the meat side of the project, traditional methods of preserving the meat have been improved to create products that can be marketed for income generation. Tanning of the hides is also being explored so that a value-added product can be sold for more money than the raw skin can get. Some success has been achieved, but the PTD process is still going on to develop marketable products.

Marketing in general, of both the milk and meat products, is an ongoing challenge for the Group and the organisations working with them. While several markets have been established and several potential markets are in the process of being opened up, the women are still eagerly working on better, more marketable products that will enhance even further their income generation opportunities.

Group members at the dairy separating cream from camel milk. Photo: Laura Lemunyete

In terms of food security, the Salato Group members continue to raise awareness on the products that they have developed in the context of the project. While some of the group members have started to adopt the products on a household level, there is still a lot of work ahead for the group to spread the technologies to the wider community and other neighbouring communities. This challenge they are taking on with much enthusiasm and energy.

While the PTD methods have already resulted in several good products, the Salato Group members have learned that technology development is an ongoing process and they continue to seek new and better ways of preserving their meat and milk products. They have seen the positive outcomes of the project in increased income and other benefits like the camel drug fund and increased food security. This gives them the heart to continue in their search for ways to improve the lives of their families, their fellow group members and their community. ■

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Gender mainstreaming
lessons from a Mexican NGO

Woman planting vegetables and herbs. She is participating in a project called "Manejo Integral del Solar" (integrated garden management) promoted by EDUCE. Photo: Maria de las Mercedes Rocha

Maria de las Mercedes Rocha, Teresa Munguía, Emma Zapata, Verónica Vázquez and Beatriz Martínez

In the 1970s, the relationship between gender and environmental issues began to receive increasing attention in the development context. The literature started to analyse the impact of environmental change on gender relationships, as well as the role of women in natural resource management. In 1984, these issues formally became part of the international agenda, when the United Nations Programme for the Environment supported a move to strengthen the participation of women in environmental planning. Likewise, both at the Earth Summit of Rio de Janeiro in 1992 and at the International Women's Conference held in Beijing in 1995, explicit references were made to the need to design environmental programmes with gender focus, in order to increase women's access and control over resources. Non-Governmental Organisations (NGOs) have played a very important role in the process of designing and implementing such programmes. Sustainable development with gender focus has become an important challenge for Latin American NGOs.

"Gender mainstreaming" means that all activities conducted by the NGO must have a gender dimension. In other words, every programme and project should be aware of different gender needs, and target them explicitly. For example, projects related to family health and nutrition are usually targeted at women, but with no consideration of their individual needs. Thus, the gender approach has been incorporated in a partial and fragmented way, if any, and the social transformations required to achieve gender equality are not encouraged. Women should not be seen as a resource for development, but rather as subjects of their own development.

EDUCE

EDUCE (Education, Culture and Ecology) was founded in Mexico in 1989 and was legally registered as an Asociación Civil (non-profit organisation) in 1992. EDUCE defines itself as a non-profit institution with no political affiliation, which is mostly devoted to the promotion of sustainable regional development. EDUCE works in several geographical areas of the country. In this article we will focus on the region of Los Chenes, located in the Municipality of Hopelchén, Campeche. This municipality has approximately 31,000 inhabitants, most of them Maya speakers. They are engaged in subsistence agriculture (corn and beans), domestic animal production, apiculture and the extraction of chicozapote latex (a resin obtained from the chicozapote tree *Manilkara zapota*, which has now largely been replaced by plastic).

EDUCE Campeche is formed by an interdisciplinary team, consisting of a group of specialists in the fields of communication, economics, rural development, agronomy, environmental studies, education, anthropology and accounting. Their goal is to foster regional development and to improve the quality of life of the local people through the implementation of productive, environmental and educational projects. The team uses a participatory methodology that promotes community involvement and project generation and implementation at grassroots level.

Working on gender issues

In Campeche, EDUCE has five programmes in 14 communities of the Municipality of Hopelchén. The projects resulting from the programmes are developed with the community through participatory methods. In some communities, there is more than one project. This article will discuss three of the five programmes that EDUCE operates in the region.

The first programme is Sustainable Management of Natural Resources (SMNR), which takes an agroforestry approach. The major purpose of this programme is to train and organise people for sustainable production, so that produce can be locally consumed or sold, thereby promoting regional development. 393 men from 13 different communities participate in this programme.

The second programme is called Integral Backyard Management (IBM). This programme has three components: vegetable (home gardens); animal (chickens and pigs); and technological (dry toilets and alternative water management systems). The programme is designed to encourage food self-sufficiency and contribute to disease prevention and environmental protection. Among the programme's specific objectives is the empowerment of women. 220 women from six communities participate in this programme.

Rural Agro-industries with Women (RAIW) is the third programme. It works with five groups of women, all at different stages in their training. These groups are engaged in honey production, bread making, preparing jams and marmalades, making handicrafts and handling a community corn mill. These projects have been designed to offer women some income-generation activities as well as productive, organisational, administrative and commercial skills. The programme also attempts to empower women through these activities. 34 women participate in these projects.

As can be seen, there is a clear separation between the projects involving men and those involving women. This separation reflects the division between the public sphere (the family plot) and the private sphere (the backyard). Similarly, the female income-generating activities promoted are an extension of traditional female roles, in that they involve the preparation of food. In other words, traditional views of men's and women's work have predominated in project design and implementation. According to the NGO personnel, these projects were developed through participatory methods and they reflect the gender division of labour that dominate in the region. Thus, EDUCE has found itself immersed in the dilemma of respecting the women's own processes and preferences which, from the institutional perspective, may reproduce gender inequality. This situation has arisen more than once in other parts of the world, and it is worth reflecting on ways in which NGOs can deal with it. EDUCE has responded with a variety of measures, which are described below.

Firstly, the NGO has not lost sight of the fact that the opportunities created by and for women, albeit traditionally female, also open the way to other types of processes. It is hoped that, as a result of their participation in these projects, women will become aware of their roles in society and their rights as women. In order to make this happen, EDUCE is combining the productive and organisational activities with gender awareness workshops, which focus on empowerment, citizen participation and female identities. Attendance at these workshops is voluntary. Approximately 55% of the women from the IBM and the RAIW programmes attend this type of training. The results will be described shortly.

EDUCE has also tried to involve the entire family in backyard activities and invite men to join IBM meetings. The strategy has generated greater awareness among women and some male participation. However, the idea still persists among the male population that working in and around the home is women's responsibility and that men have nothing to learn at meetings led by women. This situation has made EDUCE realise that male identities also need to be changed. This led to the organisation of a first workshop on masculinity issues, with EDUCE male personnel and community organisers. However, when similar workshops were held with community men, the process was halted by the groups themselves.

The creation of mixed groups (made up of both men and women) has also been part of EDUCE's strategy for changing the traditional sexual division of labour. However, in this case it is the women themselves who have refused to join a mixed group, because they have come to value only-women spaces. EDUCE has decided to respect such decision and allow the women themselves to come to the situation where they will be willing to join mixed groups, something which has already started to happen among community organisers. Similarly, some women's groups have moved from traditional female spaces towards the public sphere, by taking part in negotiations with the municipal government regarding a regional programme of sustainable development.

Women participating in a gender workshop of the project "Manejo Integral del Solar", promoted by EDUCE. Photo: Maria de las Mercedes Rocha

We now turn to the views of the Maya women themselves, on what working with EDUCE has meant for them. Those who have participated in gender awareness workshops in a regularly have started to see the workshops as a need because "they are very nice and we learn many things". These women are beginning to make decisions on their own and enjoy feeling confident in themselves. The most frequently mentioned workshops during the interviews were those dealing with women's rights and reproductive health; domestic violence; citizen participation; and self-esteem. Some of the women are clear about what they can achieve as women's collectives and are happy to know their rights: "Now we already know how to defend ourselves, (we know) that we have rights as women, we do value what we are, we know how far we can go".

It is hardly surprising, considering the working dynamics of EDUCE (where women have received gender awareness training and men have not), that the women show greater progress than their partners. This can be seen in the fact that the sexual division of labour inside the family has not been modified. In other words, the women continue to be responsible for all domestic work, despite their growing presence in income-generation activities and the public sphere. If women have to attend a meeting, their husbands will look after their children (something which men did not do previously), but they will not do any housework. However, in spite of their double working day, women hold on to their participation in public spaces. They also believe that productive and reproductive work should be shared by both men and women, although they have not been able to achieve such distribution of labour in their own homes.

Interestingly, women who do not attend the gender awareness workshops do not show any change in their perception of traditional gender roles. The differences between those women who attend and those who do not are clearly evident in their ability to express ideas. Those who attend the workshops demonstrate more ease in articulating themselves. This suggests that EDUCE is on the right track, but the need still exists to persuade more women and men to join this type of training.
In fact, of the 254 women who are taking part in the programmes, only about half are attending the gender awareness workshops.
If we add the number of men (393) participating, the percentage of people who have challenged the traditional gender roles is only 18.5%, and the vast majority is female.

Nevertheless, it is important to recognise the efforts being made by EDUCE to integrate the activities of women and men, as well as the success of the gender awareness workshops for some Maya women. More initiatives will have to take place along these lines in order to continue walking in this direction.

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Woman Animal Health Worker vaccinating cattle. Photo: Anthra

Women and livestock
Creating space and opportunities

Nitya S. Ghotge and Sagari Ramdas

In India almost 70% of the farming community are involved in livestock rearing, especially those living in the more ecologically and economically fragile areas of the country. In most communities, women are responsible for the day to day care and management of animals. The poorer the community, the greater their role; responsibilities naturally also increase in communities where women head households. While the activities performed by women may appear to involve very low skill levels, such as the cleaning of sheds, they are however most critical to the survival, health and production of the livestock. For instance, animals are more susceptible to diseases when housed in unhygienic, dirty sheds.

Despite this reality, livestock care is somehow considered a "male occupation". The work of women is seldom recognised and they are kept out of all important decision making processes, although the responsibilities ultimately impinge on them. To begin to truly understand the problems of rearing livestock in rural India, it is critical to begin to work with women.

Why gender matters

In a society as diverse and complex as India, the subject of women in livestock rearing could form the basis of many sociological studies. Traditional Indian society, with its complicated web of class, castes and communities, diverse livestock rearing and agricultural patterns, dynamics of access to resources and ownership of assets, all make for very complex interrelationships. At the same time, the rapidly changing environment impacts on local production systems and hence directly on communities, including both women and men. For example, the shift in agriculture from subsistence production to commercial production has meant that the role of women in agriculture has changed and many of the traditional jobs that women were once involved in, such as the post harvest processing of grains, are today being done by machines. Urban industrialisation has meant that men migrate to cities in search of jobs, leaving women to manage homes and farms in the villages. This has resulted in increased work pressures and work responsibilities for women. The rapid emergence of a disease like AIDS has also left many households bereft of the main earning member and forced women into a labour work force for which they are often not adequately prepared.

Development practitioners and policy makers often have fixed ideas on the role of women in livestock production. Policy makers tend to create uniform policies for the entire country, which prove ineffective given the diversity of situations. Policies are made for the more developed and accessible areas of the country, while the poor and remote areas, where women tend to have greater responsibility, remain marginalised. This can result in inappropriate schemes being thrust on women. One example is the Government of India goat distribution scheme for women below the poverty line in Maharashtra. This scheme largely failed because the beneficiaries were neither consulted nor trained before the goats were distributed to them. Most of the women beneficiaries had never raised goats before and within six months most of the animals had died.

Any work that aims at addressing the true needs of all the members of the community, must therefore begin by understanding the role of women in the production system of the community.

Action research in livestock production

Anthra is an NGO working with rural communities in India, trying to strengthen livelihoods by improving livestock health and productivity. To understand gender concerns in livestock management and in particular within indigenous knowledge systems, Anthra undertook a detailed study of the role of men, women and children in different livestock production systems. In most of the communities we worked with, women were responsible for 60% to 90% of the work related to livestock production, however there were distinct differences depending on the geographical area, caste, community and type of livestock reared. In some areas, such as the semi-arid regions of Latur, Medak and Ratnagiri, men and women equally shared responsibilities like cleaning sheds and milking. In the tribal communities in the Eastern Ghats, the work burden on women was considerably higher. Grazing responsibilities also differed from region to region. The one activity in which women always played a prominent role was in backyard poultry rearing.

With respect to indigenous knowledge, we found that women from Dalit communities, traditionally employed by wealthy farmers to weed their fields, are extremely knowledgeable about grasses and weeds for fodder and about the management of small ruminants. Conversely, women from prosperous traditional landed agriculture castes, who have been involved in dairying, are very knowledgeable on practices related to pre-partum, post-partum care and calf management. Women from other castes, who have never had dairying as a traditional occupation, do not have this knowledge. We also found that though women were knowledgeable about simple household remedies, cures and medicines for treating small ruminants, they have almost always been kept out of professional healing. Traditional healers were predominantly male, as knowledge was normally passed from fathers to sons and not to daughters.

Village women expressed a keen desire to have access to this specialised form of knowledge, which had been denied to them over the years. They also wanted to learn to recognise conditions that can not be treated with local remedies but need other kinds of treatment and care.

Women as Animal Health Workers

At Anthra, we took a conscious decision to ensure that at least 75% of all new animal health workers should be women, and that the women Animal Health Workers (AHWs) participate in all the healers meetings. The training did not merely focus on animal health issues, but also looked at women's health issues and gender questions in the larger context of sustainable development and natural resource use. The women AHWs were encouraged to work closely with other women in the village and share their knowledge in the village women's groups. These women have gained considerable recognition and respect from the rest of the community. They are now recognised as persons who possess specific skills and, very importantly, they are accessible to the villagers. Other women in the women's groups, who were previously entirely dependent on their husbands when the animals fell sick, have expressed that now they are able to get assistance and advice immediately from the women AHWs, who are always available in the village.

The women AHWs personally feel that they have become tremendously confident and can talk to others. Apart from their role as 'healers', they have also begun to take on leadership roles within the village women's groups and the community. They have become key persons who help resolve conflicts within families and mobilise others in the village to address gender issues that affect women: cases of violence against women, illicit brewing of liquor, and education of children, as well as other issues within the larger arena of natural resource management. They feel that by acquiring specific skills through this training, they have gained status in the family as well as in society. Interestingly, while we had anticipated resistance from the healers once the women AHWs began working, on the contrary they have been very supportive as they see this as an opportunity to sustain their knowledge. In many villages the women AHWs and the local healer work closely together.

Training programmes have also meant visiting other places, something most women say they had never even dreamed of. The training programme has meant forging new friendships with women from other regions -exchanging ideas, problems, and solutions and having fun together as well as singing, dancing and in other ways expressing their creativity. It has meant the breaking of traditional barriers of caste, class and gender, which are otherwise so predominant in rural India. Many have also acquired new skills such as literacy.

At the same time, the men must now recognise that women can successfully take on roles traditionally perceived as "male".

The way forward

It is not sufficient merely to work with or for women; it is also extremely important that gender concerns cut across all the activities of an organisation. To enable this process, we at Anthra have conducted several Gender Training workshops. Training is carried out by a team of resource persons, both men and women, drawn from Anthra and other collaborating organisations. Gender training is carried out in local languages and in English. So far, workshops have been conducted for the staff of Anthra and other NGO's, as well as for Animal Health Workers collaborating with Anthra and Veterinary Doctors and Livestock Assistants of the Animal Husbandry Department, Orissa.

Change on a larger scale, however, requires changes within the traditional agricultural institutions. One issue in this context is that the curriculum in agricultural universities does not consider gender issues important, and this omission is then reflected in the policies developed and implemented for agriculture. Engendering the curriculum is a necessary and important step forward for more gender sensitive policies and programmes in the livestock and agriculture sector. Anthra is participating in the effort to mainstream gender concerns into the agriculture curriculum of Indian Universities, initiated by the Gender Department of MS Swaminathan Research Foundation.

Concerns of rural women are not sufficiently addressed merely by resolving economic and livelihood issues. They also need to be addressed by enabling women to gain important social and political space, as well as being able to define and create new spaces within both the private and public domains. A considerable amount of work still needs to be done to achieve this, but our experience has shown us that little efforts do contribute significantly in raising gender questions, which had not been fully recognised or acknowledged earlier.

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Bitter cassava and women:
an intriguing response to food security

Linley Chiwona-Karltun, Chrissie Katundu, James Ngoma, Felistus Chipungu, Jonathan Mkumbira, Sidney Simukoko and Janice Jiggins

Studies in Africa and South America show that cassava is regarded as two different crops, the bitter and the sweet. Bitter cassava provides the staple food, whereas sweet cassava is the vegetable, the snack or the thirst quencher. All cassava contains a certain level of toxic cyanogenic glucosides. Bitter cassava contains higher levels of these toxins, and is toxic if not processed.

A devoted couple processes their cassava for drying into makaka, for storing. Photo: Linley Chiwona-Karltun

The detoxification process involves a sequence of steps that have to be followed in order to create a safe food product. The methods are as variable as the desired end products, ranging from the most effective process of soaking, fermentation and drying of the roots, to grating, fermenting and frying, or simply drying the roots. The final results are flour, granular grits or pieces of dried roots that can either be stored as they are, milled/pounded into flour or boiled separately or together with legumes or vegetables. Sweet cassava can be eaten as it is, boiled, roasted or fried as the palate and resources dictate.

It has been observed and documented that farmers not only prefer, but also grow a higher proportion of bitter cassava cultivars than sweet cultivars. This fact continues to intrigue scientists, and we have been interested in understanding why farmers grow bitter and toxic cassava in Malawi. Our research uses a problem-based approach, and integrated methodologies that range from participatory research to natural sciences and emerging advances in biotechnology, in order to further understand the interactions between social and biological factors in farmer decision-making.

Bitterness – a reason for cultivation

The results of our research show that bitter cassava cultivars are highly preferred, particularly by women, because they provide food security - locally termed as kuvikilia. Bitter cassava cultivars provide food security in three ways:

1) the toxin deters foraging rodents and pests from feasting on the crop;
2) the need to process the tubers directly after they are harvested deters thieving from the field (processing is largely a women's domain); and
3) as the processing adds value in terms of time invested, the social obligation of sharing cassava with your neighbours is reduced.

These three factors are of major importance to women farmers, especially to women farmers that are, *de jure* or *de facto*, single.

The preference for bitter cassava is not a local phenomena restricted to resource-poor farmers in Malawi. Studies in other parts of the world confirm that bitter cassava cultivars are preferred because they have superior end-product qualities and because the toxin protects the crop from intruders of all kinds, man and beast alike. "*We grow bitter, toxic cassava because it gives a certain level of food security, kuvikilia. If we are to grow sweet cassava, look at our neighbours! Their whole field was harvested by thieves while they slept and now they have no food. Nobody wants to die from hunger*".

Processing - a drudgery for the poor?

Breeding for reduction or removal of the toxin has featured very high on the research agenda for cassava. Interestingly enough, the women that are the custodians of this crop do not perceive the processing or the toxin to be a problem. Their major problems are the lack of mills to reduce the drudgery of pounding, and the lack of simple technologies that can be locally produced and maintained, such as low cost equipment for peeling or grating the roots. There is also a lack of infrastructure and markets, be it local, national or regional, for their products. The toxin could simply remain in cassava.

"Cassava is a wholesome crop, a complete crop. On top it is the relish (the sauce), in the middle it is the planting material and at the bottom it is the staple dish (kondowole). We do not need fertiliser to grow it, nor do we need money to grind it at the mill, chigawo chilera balanda" (cassava nurtures the poor).

For research to be of any use to resource poor farmers we need to listen to the voices of the farmers themselves:

- Cassava is a hardy crop, tolerant to dry spells.
- Cassava yields something even in nutrient poor soils, a characteristic hard to come by with any other staple crop, especially maize
- Cassava is tolerant to vermin
- Although cassava is somewhat tolerant to certain pests and diseases, we need varieties that are even more drought tolerant, more adaptive to poor nutrient soils
- We need more varieties that are even better than the ones we have now, high yielding, bitter, early maturing, high dry matter content and good storage qualities.

Give us our daily maize

One wonders if the thievery is due to the current food crisis in Malawi. In part yes, it has been exacerbated by the food shortage. However, the main problem stated by farmers is that they have fooled themselves by believing that maize is their only staple crop. When subsidies for fertiliser and seed were easily available they neglected cassava. Now poor farmers in Malawi simply cannot afford the inputs required to grow maize. Even more distressing is the fact that farmers that are able to grow maize produce barely enough to last throughout the year. To feed themselves, many Malawians resort to casual employment or *ganyu*. Ganyu literary means food for work, and workers are paid either in money, or simply in food. However, this opportunity is very limited for women.

Today it is very difficult to find cassava-planting material in areas like Domasi, a modest trading and service centre along the Lilongwe – Zomba road in Malawi. People are hungry; last year's maize harvest rotted by excessive rain and this year's harvest is not enough. Even their stores of dried cassava are not enough. They are resorting to stealing fresh cassava roots (literally roots because they are not quite mature) from the fields. In normal times, the villagers would be out at night protecting their crops. This year, the villages are silent. The chiefs say that there's no point counting the number of hungry households any more. So many people are dead or dying from HIV/AIDS that every one who remains is hungry. There are households where only children remain, cared for by an elderly grandmother or a young girl.

Farmer to farmer cassava selection and multiplication

What Domasi and the hungry villagers all lack is access to stem cuttings and above all, stem cuttings with desirable characteristics, so that the acreage planted to desirable cassava varieties can be increased. Interaction with the farmers, mostly women, made us realise the need to include and involve farmers in the selection of new cassava cultivars. Exchange visits between farmers in different areas were arranged. In a relaxed, friendly environment, farmers could discuss their cassava cultivars with each other. The guidelines given for selection of the participants were that women and men should be equally represented; that literacy was not required but enthusiasm for and knowledge of cassava was decisive; and that a fair representation of the Cassava Clubs should be considered. Cassava Clubs have been established as a result of continued collaboration between the scientists and the farmers. Club members are usually not among the ultra poor or chronically food short, but form a somewhat homogenous class of poor smallholder farmers (0.2 – 0.5 hectares) who, in normal years, are potentially short of food (see UNDP 2001 for the classification of Malawi's poor and ultra-poor). The project has made a conscientious decision also to include the Village-to-Village movement in Domasi that is supporting HIV-AIDS affected households which fall into the ultra poor or chronically food short category.

Selection criteria for new cultivars

The farmers, together with scientists, have established local community multiplication fields in Domasi. Experience has shown that not just any cultivar is selected. Our preliminary results show:

- That whether woman or man, married or unmarried, the first question that farmers ask each other is: is it bitter or sweet? Although farmers in Domasi have almost exclusively grown sweet cassava, this preference is loosing importance. What these farmers wanted was mostly bitter cassava. Why? *"Look, look at our friends, they have so much cassava still standing in the field and all because it is bitter. If we had planted bitter cassava as we did in the past, we would also have food to eat"*. Simply put, food security.
- Secondly, the women were very interested in the starch quality of the tubers, as this was important in the preparation of the staple dish *nsima*, which is synonymous with food.
- Of equal importance was the yield, time to maturity and cooking time. These factors were equally important for both men and women.
- The men were more interested in the sweet cultivars, because the sweet cultivars have a well-established rural and urban market. Nevertheless, the very same men were just as interested in the bitter cultivars for ensuring overall food security.
- In the case of the Village-to-Village community-based NGO, all cultivars were of interest to meet the challenge of providing planting material, as well as food to the victims of HIV/AIDS and People Living With HIV/AIDS (PLWHA).

Most noteworthy

There was one aspect of the farmer-to-farmer selection that deserves extra mention. Women farmers that were single, *de jure* or *de facto*, were much more keen on selecting as many varieties as possible in order to minimise the risk for failure - what mattered was that they were bitter and that they were resilient cultivars with a reasonable yield. To put it in the words of one farmer during the exchange visit:

"We simply cannot boil away the fuel that brought us here, who knows when we will ever have the opportunity to travel, to see the unseen and to be hosted by other cassava farmers that have more cultivars than I have ever seen in my entire life. Madam, I want everything that we are allowed to take".

The community multiplication sites are carefully tended and guarded by the communities themselves with the aim of being self-sufficient.The multiplication sites established by women, especially single women, are undoubtedly in a head start position in terms of care.

The women were less concerned about knowing the names of the cultivars collected because they figured that with time they would learn to select those that best suited their environments. The men were very keen from the start to identify the new cultivars correctly, as it is important for the fresh sweet cassava market.

It is important to point out that although Domasi was traditionally a sweet cassava growing area before the dominance of maize, the knowledge of cassava processing still remains. Within this project we have made available simple processing peelers that are also used in the district where the farmers had the exchange visit. It is our hope that the local artisans will locally produce these peelers.

None of these community-based, women-to-women, women-to-men and men-to-men efforts will bring back those who have succumbed to the wrath of HIV/AIDS, but when and if they succeed, perhaps food security will take on a smiling human face in Domasi.

From Domasi, Malawi - the warm heart of Africa.

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An Indian women's self help group - planning a future. Photo: AME

Women can move the earth

Experiences in working with Indian women farmers

Edith van Walsum

The Deccan Plateau is a drought prone region in South India covering substantial parts of Andhra Pradesh, Karnataka, Maharashtra and Tamil Nadu. 81% of this region is under rain fed farming. The Green Revolution has largely bypassed this area and there is a serious over-exploitation of the natural resource base. With the opening up of markets due to globalisation policies, the price of agricultural produce has crashed, poverty is increasing and male migration is on the rise. The number of *de facto* female-headed households is increasing, leaving women with the responsibility for managing their farms and ensuring food security - although they do not have the authority to make decisions.

Responding to a need

Realising the important role women play in the development process, NGOs started organising women's Self-Help Groups (SHGs) in the mid eighties. It quickly became clear that women's SHGs often functioned better than the men's groups. The focus of these groups has been on credit and savings, and today women's SHGs are receiving increasing recognition from governmental development agencies and the formal banking system. These developments have lead to a tremendous growth in women's individual and collective self-respect and their visibility in the community. This has had a positive impact on development in general, but the role of women as agricultural producers still remains largely unrecognised and has not been addressed.

Engendering organisations

Over the past eight years AME has engaged in comprehensive capacity building processes with NGO networks and farmers in South India. The focus has been on training NGOs and farmers to implement Participatory Technology Development (PTD) processes and Integrated Pest Management (IPM) Farmer Field Schools (FFS). Both approaches aim at experiential learning, through agro-ecosystem analysis followed by field level experiments and evaluation of the experiments. The aim of this capacity building process is that farmers are enabled to experiment with LEISA technologies so that they can develop and continuously adjust their own "package of practices".

AME has encouraged its partner organisations to look seriously at gender in agriculture. We have promoted a *household approach*, whereby a conscious effort is made to involve both women and men in the PTD/FFS processes. This is what we refer to as *gender mainstreaming.* The immediate objective of gender mainstreaming is that the PTD/FFS process itself will be more effective and its results more sustainable. The long-term objective is that gender mainstreaming should contribute to women's empowerment, by providing access to knowledge and institutions and giving an added impetus to ongoing processes of social organisation and empowerment.

Through this process, we have learnt that when there is involvement of both women and men, the quality of learning is greatly enhanced and so is the overall outcome of the PTD/FFS process. And once women are involved, they have a great energy to take the process further.

Why involve both women and men?

Women participated in a season-long training on Integrated Pest Management in cotton. In the course of the training process, they became confident that they could manage growing cotton without having to use pesticides. But at a critical stage their husbands, who had not participated in the training because they had gone to a nearby town for work, decided to intervene. They instructed their wives to apply pesticides, which - because it was done at the wrong time - lead to a reduction rather than an increase in the yield.

Methods used

There are no "unique" methods to ensure that gender is taken care of in a PTD process. In principle, all participatory methods can be used to address gender issues but they have to be used purposefully and systematically, with a clear gender focus in

mind. The gender analysis framework forms the basic reference for asking questions. This framework addresses three basic issues:
1) the gender division of labour;
2) the gender- differentiated access to and control over resources, and
3) benefits derived by men and women from the intervention/technology developed.

Training field staff in gender mainstreaming

WHAT:
Understanding gender division of labour, intra-household allocation of resources and benefits, communication and decision making.

HOW:
The use of gender analysis tools, PRA, interview techniques and focus group discussion techniques.

DESIGN STRATEGY FOR GENDER MAINSTREAMING:
Who should be involved in the PTD process; why, when and how?
How to identify gender specific constraints with respect to various technologies;
Women's constraints with regard to venues and time of meetings;
Strategies to enable women to benefit from PTD process and outcomes.

We use a combination of individual in-depth interviews, group discussions and observation to articulate the gender perspective in the PTD process. Discussions are held not only with the members of the groups, but also with their spouses and household members. Repeated interaction with both women and men in different contexts (individually, together, as single gender groups and as mixed groups) helps to strengthen the perspective. Most group discussions take place with women and men separately. On some occasions a few men take part in a women's discussion or vice versa. We use group discussions for problem analysis, to discuss learning points from the experiments, group organisational matters and group dynamics, and for the evaluation of the PTD process. Whenever relevant we use visualisation tools.

Women as well as men sometimes hesitate to talk about intra-household affairs in front of one another, especially regarding *decision-making and loans*. Therefore discussions on these issues are always held separately with men and women.

The use of PRA tools in a PTD process

- In the problem analysis stage, we use flow diagrams and seasonal labour calendars. The first reveals the resource flows as well as access to and control over the resources, and the second shows the gender division of labour and seasonal labour peaks.
- When identifying technological options (e.g. seeds or soil fertility improvement methods) we use pair wise and matrix ranking as tools to learn about women's and men's preferences and priorities, and the underlying rationale. Interesting differences can occur, which then can be taken up for further discussion.
- In the course of the experiments and during evaluation we ask men and women to draw maps of their farms. These show physical features of the farms and men's and women's perceptions of the same, which again can show interesting differences.

Stumbling blocks …

In our efforts to mainstream gender we have come across a number of stumbling blocks in the form of biased perceptions about women and men:

1) "Women do not have a say in agricultural decision making":
In spite of changing realities in agriculture many people, NGO workers, researchers and others, find it difficult to acknowledge the reality and to plan the PTD process accordingly.

2) "Participatory approaches are 'naturally' gender sensitive":
PTD, like any other participatory approach, provides no guarantee that women are also participants in the process initiated. Women's participation will not happen automatically, it needs to be facilitated.

3) "Trickle across: from men to women, from women to men":
Many extension programmes have been based on the incorrect assumption that information that reaches men automatically trickles across to women. We also see cases of "reversed" trickle across assumptions. Organisations have started to interact directly with women, but here the same problem on non-trickling or partial trickling across of information can be seen. There is also an additional problem: men are still the final decision-makers. This has lead to frustrating experiences for many women.

4) "Gender specialists take care of "the gender aspect":
It is often taken for granted that within development organisations, women will take care of 'the gender aspect' (whatever it is). The only way to overcome this obstacle is real teamwork and intensive gender sensitisation within organisations.

… and stepping stones

We have also experienced that PTD/FFS processes offer good opportunities for gender mainstreaming:

1) Understanding intra-household dynamics:
When interacting with farmers (men or women) we keep in mind that they are members of *households* and that 'our' farm experiment with them is only one of the many activities they are involved in. Other family members are likely to influence and be influenced by the PTD process. Once we succeed in developing an understanding of intra-household dynamics, it becomes easy to build up rapport with various members of the household and seek their active involvement.

We have seen that communication gaps within households can hamper the process of experimentation as well as the process of learning from it. We have also observed a clear tendency for women to get more deeply involved in the PTD process than men. Clarity about men's and women's stakes in the PTD process will help to guide the process in a meaningful direction, and to find an effective balance between women's and men's participation.

2) Learning with groups:
Groups provide the forum for learning, sharing, and disagreeing or agreeing on the merits and demerits of technologies and on the constraints and opportunities faced. Especially for women, the fact that they are members of a group has encouraged them to venture into trying out new things in agriculture.

Most women who got involved in the PTD process had already been functioning as a group for some time. This contributed to a rapid take-off. Adding PTD as a new function to an existing group gave it a new impetus. The fact that these groups had been involved in thrift and credit was very helpful, as they could take up the responsibilities of procurement and distribution of inputs among their members and manage a revolving fund to support these activities.

3) Learning from different NGO strategies:
There are so many NGOs, so many ideologies and so many approaches towards women and gender issues. Working together on PTD with a 'mixed' group of NGOs therefore poses its own challenges, **and** tremendous opportunities for learning. At different stages in the farming season, meetings are organised, wherein NGO staff and men and women farmers from different areas participate. These occasions provide opportunities to learn about how PTD processes work in different organisational contexts, and about conditions for successful gender mainstreaming.

4) Mobilising women's knowledge = empowerment:
Especially for women, more knowledge leads to greater self-respect and respect from others. Their mobility has increased; they decided to attend farmer's meetings and PTD review workshops that were 3 to 4 hours by bus away from their villages. It was primarily the group that gave them the confidence to do these things. Nowadays they visit agricultural knowledge and training centres and regional farmer meetings. In several cases, women have resisted pressure from their husbands to go back to chemical farming.

This process of mobilising knowledge also enables both women and men to improve the *quality of decision making*: 'best bets' regarding choices of technologies, how to allocate labour and money etc. become more focused and based on systematic comparisons. Last but not least, mobilising knowledge and putting it to new use is a joint learning process, which reinforces existing groups and helps to build new ones. This is what we believe *empowerment* is about, and this is perhaps the most important thing we saw happening in two years of 'PTD with a gender perspective'.

Women learning about insects for IPM. Photo: AME

Kadiri Women's Federation fuels PTD in groundnut

Kadiri is situated in drought-prone Anantapur District (Andhra Pradesh), the largest groundnut-producing district in India. Since the late 1960s, groundnut has gradually monopolised the farming system. Now, 85% of the drylands (about 850,000 ha) are under groundnut. Myrada, a large NGO, started working in Kadiri in 1982 with a focus on wasteland development, resettlement of the landless poor and participatory watershed development. Women's SHGs were established.

In 1997 the women's SHGs formed a Federation (Pragati Mahila Samakya) with the support of UNDP (United Nations Development Programme) and Myrada. Total membership was 2250 women. In the same year, erratic rainfall led to a shortage of seed. Mahila Samakya contacted the District Collector, who promised to help them but asked: "What will you contribute?" Within five days, the women remitted 7 lakh rupees into their collective account as assurance for seed repayment. This showed the emerging power of the Federation. District Authorities arranged for release of 3600 bags of groundnuts from the Andhra Pradesh State Seed Development Corporation (APSSDC). UNDP supported the effort by providing 8,5 lakh rupees worth of seed capital for Mahila Samakya. At the end of the season, the Federation repaid the groundnut seed to the APSSDC.

In the same year (1997) AME initiated PTD with one women's SHG, Venkateshwara Raita Sangha. The members tried out technologies for improving groundnut production. They identified three effective technologies: gypsum application, rhizobium and application of farmyard manure (FYM). Being convinced about the usefulness of these technologies, they decided to share them with other members of the Federation. Thus, Mahila Samakya became a platform for sharing information and knowledge on LEISA. On request, AME conducted training on LEISA technologies for groundnut for the functionaries of the Federation. They had formed their own training team that trained, in turn, the members of 45 SHGs and their families in PTD and LEISA technologies.

In 2001 and in 2002 two more women's federations were formed in Anantapur District. For the 2002 cropping season these three federations together placed an order for 1000 tonnes of gypsum. The first women's group started applying gypsum on an experimental basis in 1997 - with two tonnes of gypsum. Thus, the three federations ensured a scaling up of this technology by 500% in five years!

Women can move the earth, if given the space!

Lessons learned

LEISA technologies and Women's workload: Some technologies are labour intensive especially for women, e.g. bio-fertiliser and *mussoorie* phosphate application. Other technologies are big labour savers, e.g. in cotton IPM women are spared the work of fetching water for pesticide application, which can amount to 800 km walking with water per acre per cropping season.
We therefore cannot draw any generalised conclusion about whether LEISA technologies are "good" or "bad" for women. Women themselves are in the best position to decide. They take labour increase positively, as long as it is offset by benefits in terms of improved status and/or more say in decisions about the farm and money. Moreover, if they have a problem with a certain technology but also see its advantages, they will be inclined to find ways of making the technology more convenient. This is what happened when women experimented with the use of mussoorie phosphate. They found it dusty and slippery and therefore difficult to apply. They then started mixing it with farmyard manure and the problem was solved.

Health and nutrition have improved: The reduction in pesticide use leads to less health problems (notably reproductive health problems of women) and less medical expenses. Food tastes better and can be kept overnight because the storage capacity has improved. Skin rashes, loss of appetite, respiratory tract problems and reproductive health problems are frequently mentioned in connection with pesticides. These are other reasons why women are interested to learn more about LEISA technologies.

From cash crops to food security: Women have a direct interest in shifting from cash crops to food crops. Women farmers in Hosur shifted from groundnut to ragi (finger millet). They applied the experience gained in the groundnut PTD process on ragi. This interesting process was documented in a video film "Two fistfuls of small grains"(available from AME). Likewise, the farmers in Kadiri shifted from groundnut to bajra (pearl millet).

Increased involvement of women is part of a larger change process: In 1997, 30% out of 270 farmers involved in PTD/FFS processes were women, whereas in 2001, 65% out of more than 12000 PTD/FFS farmers were women. How do we look at these figures? They show that women are quite interested in learning new things about farming. They may also indicate an increased awareness on the side of institutions (NGOs and Departments of Agriculture) about gender issues. But, perhaps the most important reason for this increasing involvement of women is the fact that women are becoming the farm managers, as male migration increases. This is a tough situation for the women. In spite of increased responsibilities and an added work burden, they still have little control over resources and face several institutional gender biases. But there is also a silver lining. Women have found new and powerful ways of organising themselves into Self-Help Groups. And again these SHGs have organised themselves into Federations.

When implementing a PTD process, these factors have to be clearly kept in mind. Forgetting to do so may lead to ineffectiveness of the PTD efforts, and worse, it may lead to more problems for the women.

Gender in our own organisation

To be able to mainstream gender in our programs and projects, we needed to have a *gender sensitive organisation*. Although gender issues were given ample attention, inside the organisation we faced a number of dilemmas and problems.

Women in the organisation: Concerted efforts were made to identify suitable women for positions in AME. However, in reality there are comparatively few well-qualified women in AME's main professional areas who are willing to travel extensively and prepared to relocate to district towns. Also, retaining female staff proved more difficult than retaining male staff. Reasons for the higher turnover of female staff were primarily related to the personal situation (*gender specific*) of those concerned. Secondly, working in a male-dominated professional environment can sometimes be seen as a positive challenge, but it also leads to stressful and difficult situations.

Building a gendered organisational value base: Importance was given to gender sensitisation of the team. Though most team members responded positively, some found it hard to drop some strong and deeply rooted personal values, which were not well aligned with the principle of gender equity. This inconsistency between *strong personal values and organisational values regarding gender* sometimes manifested itself openly in conflicts between staff, but also in omission (intentional or unintentional), and a tendency to separate gender activities from other work (both by technical and social/gender persons).

Team-based structures and gender: AME's organisation structure has been designed in such a way that integration between technical and gender aspects is supposed to be taken care of by interdisciplinary teams in all programmes and activities. Even though these structural conditions for gender integration (and more broadly, for socio-technical integration) were created, in practice integration did not happen smoothly all the time. Time and again, there was the tendency to separate gender activities from other activities in AME.

Working together. Photo: AME

There is a long way to go, but...

Even though women play an increasingly important role in agriculture, this fact is yet to be reflected in more gender sensitive approaches in the majority of agricultural institutions - including our own. Many organisations *work with women*, but they are *not gender sensitive* and hence they contribute, knowingly or unknowingly, to increased physical and mental burdens for women. Still we are optimistic about the future - mainly because we have seen the tremendous energies of women. Once they have organised themselves, they cannot be stopped. They will demand that agricultural institutions become more gender sensitive.
It is up to all of us to respond!

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Maize cobs. Photo: A.Conti (FAO)

The feminisation of agriculture and the implications for maize development in China

Yiching Song and Janice Jiggins

Research carried out in the mid-1990s highlighted the rapid socio-economic changes taking place in Chinese agriculture. International and national maize breeders, as well as to local authorities in Southwest China, began to consider the implications of these changes for the conservation, development and use of maize genetic materials.

The most profound changes were found to be in the structure of rural households and farming systems, and related changes in the role of women on the farm. These changes could be characterised as the 'feminisation of agriculture', which in China has multiple causes and effects. As the pressure increases on poor rural households to participate in the cash economy, men are migrating in ever-larger numbers to seek wage employment in cities, local industries, or irrigated agriculture in the lowlands. The bias toward male migration is formed in part by the patriarchal expectations of the family. The husband is supposed to provide for his family economically, guide the household's decisions, and mediate its relations with the outside world. Male migration is also favoured by gender discrimination in the wage labour market, which favours men over women in terms of job opportunities, and pays them higher wages even for the same work.

Women are thus assuming a larger and larger responsibility for meeting the household and food needs of the rural family, while the men seek to make their way in the modern economy, creating a system known as 'two households, one family'. Rural women are also assuming the costs of bringing up children, at a time when China's 'one child' policy has reduced the amount of household and farm labour available to support women's efforts. In the absence of their male relatives, women also are taking on unfamiliar roles in community leadership at a time when the certainties of government provision are giving way to the uncertainties and challenges of the market. The traditional division of labour between farm men and women, captured in the folk slogan 'the men till and the women weave', is surrendering to the new reality of 'women till and the men work in industry'. A survey of farmers has shown that, in selected areas of the three Southwest provinces of Guangxi, Yunan, and Guizhou, women comprise more than 85 per cent of the agricultural labour force. At the same time, the traditional expectation that 'men control the outside world, and women the inner world of the home', is giving way to the reality that women must stretch their 'inner world' to include farming and community responsibilities.

Two of the most difficult challenges that women face in their new roles at the head of farms were shown to be:
1) Accessing viable improved seed from the public sector agencies responsible for seed management, and
2) Maintaining a range of varieties that have the particular characteristics suited to women's preferences and farming conditions.

It was noted that two parallel seed systems were in place: one that is supported by the formal plant breeding and extension sector, and one that is maintained by poor farm women themselves. The formal sector is focussed on the breeding and dissemination of hybrid, high-yielding varieties, and is driven by the government's push to raise yields per hectare. In favourable conditions, these hybrids provide stable and high yields. However, many of the formal sector's hybrid products were the result of single crosses and lacked the buffering capacity to withstand environmental shocks or to sustain yields in the face of production constraints. In most smallholder subsistence farming areas in Southwest China, the conditions are not at all favourable, and women farmers also experience great difficulties in getting access to hybrid seed. Therefore, they rely upon exchanging the seed from their own harvests amongst themselves and on their indigenous maize breeding practices.

The formal maize breeding and seed supply system before the new seed law

From women farmers' point of view, the almost exclusively male networks of influence and communication in the formal system, which persisted up to the end of 2000, were impossible to penetrate. Women's specific needs, skills, and knowledge were largely ignored. The primary stakeholder in the formal plant breeding process was the Ministry of Agriculture. The Ministry in turn was linked to public service extension agents, so-called 'leading' farmers, government plant breeders and government-controlled seed companies. At the same time, the government's policy of increasing yields through the development and release of hybrids, failed to deliver products that were adapted to the real farming conditions in the smallholder sector.

There were also institutional problems. The breeders tended to blame the extension workers for not communicating the advantages of the modern varieties (MVs) strongly enough and hence not getting them into the hands of sufficient numbers of farmers. The extension workers blamed the farmers for the poor adoption of MVs in more marginal farming areas. Further, since extensionists working in these areas communicated almost exclusively with the minority population of male farmers, they provided distorted feedback to higher authorities regarding the changes taking place in the structure of farming and regarding farmers' needs. In addition, local governments, Ministry officials and seed companies were rewarded on the basis of the number of new hybrid seed varieties released and planted, which biased the formal system toward agricultural areas that were more favourable for the production of released varieties. Also around this time, some official voices began to express concern about the loss of biodiversity in the more favoured areas where the more genetically uniform MVs were displacing farmers' own varieties.

The tensions created by divergent interests, communication blocks and deteriorating institutional relations between the central and local authorities, began to threaten the continued functioning of the formal seed system. At the same time, the political authorities were concerned that millions of poor farmers remained beyond the reach of the formal system and at risk of hunger, while the scientific capacities of the formal system did not seem to be able to reconcile production and conservation goals.

The new Seed Law: opening to innovation

Toward the end of the 1990s, the government began moving to ease the situation by liberalising and privatising certain roles and functions. The People's Congress approved a new Seed Law that became effective December 1, 2000. It allowed the establishment of pilot schemes in order to test local options for a more effective seed system that might reconcile production and conservation goals, and to test ways to bring the formal seed system and poor farmers' seed systems into a mutually supportive relationship.

The opportunities that the new law opened up for local initiative, and the entry of new participants into seed production and exchange, can be illustrated by reference to developments in the state of Guangxi. Guangxi Maize Research Institute (GRMI) had formerly exercised a monopoly on maize seed production in the state. Under the new Seed Law, it was able, without reference to any other authority, to sign contracts with a 'seed production base' such as a village or farmers' organisation, for the production of new planting seed. The conditions of such contracts are that the seed production base must be ready and able to multiply the seed that GMRI develops, and to sell the seed harvest back to the GMRI for distribution to other areas. The villagers or farmers benefit by receiving twice the normal price for the new seed, in comparison with sales of unimproved maize seed to the government.

However, since the incentive price for maize seed remains lower than the market price, new tensions have developed between the GMRI and its suppliers. Meanwhile, since all of the early contracts were issued to 'seed production bases' controlled by men, and to units in the somewhat more favoured areas, at first poor women farmers continued to be excluded.

Women farmers as expert maize breeders

In the case study village of Wenteng, women farmers definitely preferred open pollinated varieties (OPVs) to hybrid varieties, for a number of reasons:

- The seeds can be saved and used again the following year, whereas hybrids lose their vigour after one cropping cycle;
- Farmers can manipulate the genetic material themselves to produce varieties that have desired characteristics related, for example, to yield, stress resistance, taste, storage, and cooking qualities, and to the intensity of crop management;
- OPVs offer the potential for continuing evolution at local level. The 1998 CIMMYT Impact Study was one of the first to document in detail the practices by which women acquired, maintained, and refreshed their preferred varieties through OPV hybridisation.
- OPVs can be crossed with materials brought into the farming system from elsewhere, including those obtained through the formal seed system. The word 'creolisation' is used in this context to refer to the processes by which farmers maintain and improve introduced cultivars.

Women who are known in the village to be expert maize breeders skilfully control the breeding process, from field design to seed selection through to pollination. The women claim that they have maintained their landraces (traditional varieties) through generations by separating the planting of landraces in space and time. The seed that is destined for the following year's planting is harvested, cultivar by cultivar, in a three-step process. The first step is to select the best plants from the middle of the field, that is, healthy, vigorous plants with big maize ears. Step two is to select the best ears based on cob size, length, and the number of seed rows. Step three is to select the best grains from the middle portion of each ear, based on kernel size, shape, quality, and colour.

The process of collaboration

Since the beginning of 2000, a Participatory Plant Breeding (PPB) project has been implemented in Guangxi province by the Center of China Agricultural Policy. The general goal of the project is to enhance the linkages and collaboration between the formal and farmers' systems. PPB and PVS (Participatory variety selection) field trials have been used as a platform for interaction and collaboration between the main stakeholders, i.e. women and men farmers, extensionists and breeders. Six Farmer Plant Breeding Villages were selected in the trial area to represent farmers' seed systems. They were selected on the basis of the previous research and through an analyses of local stakeholders, in order to represent a range of agro-ecosystems and socio-economic conditions, as well as a range of potential opportunities for institutional collaboration with women farmer groups.

Women farmers taking notes in a maize field. Photo: Yiching Song

In the beginning, it was something of a surprise to the scientists and extension workers to discover that men and women, the poorer and better off farmers, or farmers in different farming areas, can make different choices when selecting the varieties, and varietal characteristics that they prefer. Today, these actors are together learning, among other things:

- how to characterise the goals and needs of different types of farmers and of professional plant breeders, as well as the socio-economic environments in which maize is grown;
- male and female farmers' preferences, their indigenous practices and knowledge of plant breeding, seed selection and landrace maintenance; and
- to identify the genetic importance of existing landraces and other creolised local varieties.

The scientists are also trying to understand how farmers have used the genetic material introduced by the formal seed system to create creolised local varieties.

In the process, the male extension workers and scientists are beginning to recognise how women's preferences are linked to their roles in the household. For example, women consistently give a higher rating to 'cooking quality', and to their need to ensure food security even if planting seed cannot be purchased from the market. In contrast, men tend to give higher preference to characteristics that match the demands of the market, such as ability to yield well when grown together with other high value crops such as sweet potato. They are also realising that there are marked differences in the number and type of selection criteria that professional plant breeders consider important, compared to farmers. For example, six men and ten women farmers, three men and four women extension workers, and six men and two women formal plant breeders together examined maize trials during a field day held in June, 2001. The farmers mostly preferred improved varieties of established landraces and creolised populations over the 'superior' hybrid preferred by the formal breeders. The formal breeders assessed a variety almost exclusively in terms of yield and its value in the breeding programme, whereas farmers were also interested in a variety's performance during drought, or its ability to perform well even if fertiliser was not used, whether or not seed could be saved for the next year's planting, or the plant's shape, grain colour, and cooking quality.

In addition to the differences in the selections made by men and women farmers, the farmers from different villages also made different selections, reflecting the distinct climatic and other conditions of each village.

Conclusion

In all, the partners who work in the formal organisations are recognising just how heterogeneous farmers' needs and opportunities are, and that a 'one size fits all' approach will not assist China to develop its agriculture as efficiently and as productively as the authorities would like. Since the numbers of farmers and the areas to be covered are huge, this in turn is forcing an acceptance of a greater role for local organisations controlled by farmers and villagers themselves, as effective counterparts to the formal plant breeding and seed dissemination system.

The collaboration is leading to changes in the ways that plant breeders and extension workers think about their work and behave towards women and men farmers. Over time, the knowledge, skills, and attitudes of the breeders and extensionists, on the one hand, and the farmers, on the other, are drawing closer together, which strengthens all participants. ■

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The feminisation of agriculture

Editorial

The majority of the world's agricultural producers are women. They produce over 50% of the food that is grown worldwide – more in most developing countries. In Sub-Saharan Africa, for example, women produce around 80 percent of food, both for household consumption and for sale. Women are usually responsible for food processing and also make a major contribution to food storage, transportation and marketing – although they seldom control the revenue generated. In almost all societies, rural women tend to work longer hours than men. Although the gender distribution of work and responsibilities varies with country, culture and situation, women are usually responsible for at least a large share of food production, preparation and processing, as well as the more fundamental roles of nurturing and caring for children and the elderly.

Despite these recognised facts and a considerable amount of development rhetoric about gender issues, women are still restricted in their role as farmers by unequal rights and unequal access to and control over resources, especially land. In India, Nepal and Thailand, for example, fewer than 10 percent of women farmers own land. In Kenya, although 98% of women work full-time in the agrarian sector, only 5% have land ownership titles (Schüssler p.28). Equal rights are internationally agreed upon in a number of instruments (see box), however this is slow to translate into practice.

In addition, women still carry out their work without much help from agricultural support mechanisms such as extension agencies, input suppliers and credit institutions. Women farmers receive less than 5% of extension services worldwide. The priorities of the woman farmer are rarely reflected in agricultural research or national policies, and when they are, this is often not translated into practice in agricultural development planning. Women, as producers, still remain largely invisible and unsupported. Mainstream investments and development interventions tend to focus elsewhere – and as a result, they are often ineffective.

So far, rural women have shouldered their burdens and often manage to cope. Modern times, however, have added to their load. In many parts of the world today there is an increasing trend towards what has been termed the 'feminisation of agriculture'. Men are becoming increasingly absent from farms and rural areas. In the face of economic change, men are migrating from rural areas to towns and cities, in their own countries or abroad, in search of paid employment. In addition, war, sickness and death from HIV/AIDS take a high toll on rural male populations. Women are therefore taking more and more responsibility for agricultural production, and there has been a great increase in the proportion of households headed by women.

Single: de facto or de jure?

A woman (or man) can be "single" in two different ways: de jure or de facto. If she is not married, or a widow, she is in fact and in the legal sense single – she is single de jure.

If she is married and her husband is alive, but for one reason or another is not living with her, she is considered single de facto. That is, she is not single in a legal sense but in practice.

It is an important distinction, as a woman's status and rights are often strongly dependent on her marital status. In particular, a woman's access and rights to productive resources, as well as the income from what she produces, is often strongly dependent on her civil status.

Ethiopian farmer and her ensete crop. Photo: Flemming Nielsen

One-third of all rural sub-Saharan African households are now women-headed. Women heads of household are often younger and less educated than their male counterparts, and have less land, less capital and less labour available to them. The land and other resources that they do use and have access to are usually controlled by the owner (often their husband) who also has the decision making power and retains it even if absent from the farm.

What can be done to support women farmers? The contributions of authors to this issue of LEISA cover a wide range of issues addressing the many facets of women's role in agriculture.

Different priorities, strengths, and needs

Women farmers often have different priorities to their male counterparts, and this can, in many cases, be related to their more direct role in feeding the family. Pionetti (p. 22) describes the stark contrast in the depiction of agricultural practices by women and men farmers in India. Men eagerly speak of their cash crops and commercialised agriculture, whereas women farmers speak about the food crops they grow, and value crop diversity. Chiwona-Karltun *et al* (p.14) describe how men are more interested in sweet cultivars of cassava, because they have a well-established market, whereas women prefer bitter cultivars for food security reasons, even though it takes more work to process.

In China, as in many other cultures, there is a traditional expectation that 'men control the outside world, and women the inner world of the home'(Song and Jiggins p.6). Such traditional perspectives can contribute to the lop-sidedness of "gender blind" information, collected by outsiders with the intention of helping a community. It is usually the men who provide information to outsiders, as such communication belongs in the "outside world". This means that women's priorities are often overlooked, unless they are specifically taken into account.

With the "feminisation" process, women must expand their world to include "outer world" aspects of agriculture and community responsibilities. Not taking women into account can mean ignoring not only the particular needs of women as opposed to men, but whole households headed by women who now have to take on double the responsibility.

The social effects of a changing economy

Economic change, driven by external forces, can unbalance gender relations and leave women with limited options. Lapoutre (p. 24) describes a process of community upheaval where rapid appraisal methods, which mainly focus on tangible information, were simply not sufficient to understand the processes of social change. By digging deeper and understanding the social dynamics of the situation, members of the community were able to relate the negative spiral of changing economic and social circumstances to changing cultural habits and preferences. Based on this understanding, it may be possible to rebuild a healthy community with space for women to develop, economically and socially.

Understanding the social aspects of economic change can also help to assess the merits of other options. Eisses and Chaikam (p. 26) describe the social benefits obtained by members of the Don Jieng Organic Farmers Group, who, after changing to organic agriculture, did not have time to work in the city, due to the increased labour requirements of organic production. Moreover, they no longer needed to work in the city to pay for agricultural inputs. The economic benefits of farming organically were not very different to the economic benefits of farming with inputs, but the social benefits of having the men in the village meant that membership of the organic farmer's group doubled within a year.

Access to and control of resources

Access to and control of resources is a power issue. In most developing countries, women's access to land and other resources is constrained as a result of cultural, traditional and sociological factors. This can also extend to agrarian reform. Schüssler (p.28) highlights the need to pay special attention to gender perspectives in all forms of land redistribution, entitlement programs and accompanying measures. This means not only making sure that women do not face active discrimination such as (in points-based land distribution schemes) awarding men higher points, but also compensating for indirect discrimination - such as awarding points for a higher education, in areas where women are discriminated against in the education system. Without a title to land, women have less control over their production and are often also denied membership of co-operatives and other rural organisations, and the accompanying benefits. Women have more and more responsibilities in the agricultural sector - they must also be allowed the power to effectively meet these responsibilities!

Mainstreaming gender considerations

Development organisations need to take gender considerations into account. Women have different needs and priorities, which are at least as important for food security as those of the men. "Gender mainstreaming" means that all activities conducted by a particular organisation must take into account different gender needs, and target them explicitly. De las Mercedes Rocha *et al* (p.18) and van Walsum (p.10) describe the importance of including both women and men in gender sensitisation - and how to bring it back into your own organisation.

Gender is the term for the socially and culturally defined roles for each of the sexes. Although women are women everywhere on earth and men are men, what is considered a "normal activity" for each of the sexes varies from place to place and from culture to culture. In one place it is normal for women to do most of the land preparation, whereas in another, it may be done exclusively by men. In one place it can be normal for women to do the fishing, whereas in another, fishing is reserved for men. The variation in these roles suggests that the different activities of women and men in practice have less to do with their biological sex, than with the social and cultural context in which they live. We talk about gender rather than sex because while a person's sex does not change, gender roles are socially determined and can evolve together with society.

Women's rights in international treaties – some examples

- Universal Declaration of Human Rights
- International Covenant on Economic, Social and Cultural Rights
- International Covenant on Civil and Political Rights http
- World Conference on Agrarian Reform and Rural Development 1979
- Convention on the Elimination of All Forms of Discrimination against Women
- Agenda 21 adopted at the Rio Summit 1992
- Vienna Declaration and Program of Action 1993
- Beijing Declaration and Platform for Action 1995
- Copenhagen Declaration on Social Development and the Program of Action of the World Summit for Social Development 1995
- Habitat Agenda adopted in June 1996 by the World Conference on Human Settlements (Habitat II)
- Commission on Human Rights resolution 2000/13 concerning "Women's equal ownership of, access to and control over land and the equal rights to own property and to adequate housing".

See www.ileia.org for links to many of these agreements on internet.

Simple technology to lighten the work

Women tend to work longer hours than men, and yet their needs and priorities are rarely considered in the research and development of agricultural technology. Simple labour-saving technologies can help women considerably in daily tasks such as food processing and storage, as well as food production and work related to water, sanitation, fuel and food preparation. Ross and Ross (p. 9) provide examples of several simple tools that can help relieve women's drudgery, such as wheeled hoes and broadforks. By taking women's needs into account in technology development, such simple implements can greatly increase women's quality of life - and the time available to do other work.

Never underestimate what women can do!

Where women are given space and opportunities, they can become tremendously valuable leaders in restoring community cohesion. Women Animal Health workers in India, for example (Ghotge and Ramdas, p. 16) apart from their role as 'healers', have also begun to take on leadership roles within the village women's groups and the community. They have been helping to resolve conflicts within families and to mobilise others in the village to address gender issues. These women feel that by acquiring specific skills through training, they have gained status in the family as well as in society. They work closely and in harmony with the village healers, who are usually men.

Women's groups involved in participatory technology development (Van Walsum, p.10 and Lemunyete p.20) have developed many successful technologies and these groups have even, in some cases, formed their own teams to train other groups and their families in the technologies developed.

The solution to the problems posed by the feminisation of agriculture is not simply a matter of recognising the value of women in a static sense. Rural communities are changing, and the role of women must be seen in the context of their role in community development. One fact becomes very clear, on reading the contributions of authors to this issue of LEISA: Women are the primary supports of the community. Food security, as well as the social health of the community, depends on including them in the development process. ■

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CONTENTS

Many farmers not only prefer, but also grow a higher proportion of bitter cassava cultivars than sweet cultivars - despite higher levels of toxins and more work required to process the bitter cassava. Women in particular prefer the bitter cassava cultivars, despite the additional processing work, because they have superior end-product qualities and because the toxin protects the crop from intruders of all kinds, man and beast alike. This article looks at the difficulties faced by farmers in Malawi, where the dominant maize crop does not provide food security. The farmers were having problems in obtaining cassava stem cuttings with desirable characteristics, and gender-balanced exchange visits between farmers in different areas were successful in helping to address this problem. The needs of women farmers that were single, *de jure* or *de facto*, became clear in these visits - they were keen to select as many bitter cassava varieties as possible, in order to minimise the risk of crop failure.

"Small change" crops are suited to dryland conditions, grow without any extravagant need of inputs, and meet the food and fodder requirements of the household. As a woman farmer from Pipri said "If we only grow cotton, where is the fodder for our cattle going to come from?". Yet, a majority of agricultural extension officers, agricultural scientists, breeders, rural bank managers and even policy-makers pay no attention to the queries and concerns of women, especially when they are 'merely' poor farmers. In domains that are typically under women's responsibility, like seed saving, weeding, and cooking, it is quite vital that women's concerns be allowed to emerge and to inform policies. This article looks at the difference in women's and men's perceptions, and the need for a sustained effort on the part of agricultural extension workers, scientists and policy-makers to understand women's practices and perceptions in agriculture, including cultural, social and symbolic dimensions.

ILEIA is the Centre for Information on Low External Input and Sustainable Agriculture (LEISA) in the tropics. ILEIA seeks to promote the adoption of LEISA through the LEISA Magazine and other publications. It also maintains a specialised information database and an informative and interactive website on LEISA (**http://www.ileia.org**). The web site provides access to many other sources of information on the development of sustainable agriculture.

LEISA is about Low-External-Input and Sustainable Agriculture. It is about the technical and social options open to farmers who seek to improve productivity and income in an ecologically sound way. LEISA is about the optimal use of local resources and natural processes and, if necessary, the safe and efficient use of external inputs. It is about the empowerment of male and female farmers and the communities who seek to build their future on the basis of their own knowledge, skills, values, culture and institutions. LEISA is also about participatory methodologies to strengthen the capacity of farmers and other actors to improve agriculture and adapt it to changing needs and conditions. LEISA seeks to combine indigenous and scientific knowledge, and to influence policy formulation in creating an environment conducive for its further development. LEISA is a concept, an approach and a political message.

28 Land in the hands of women?

Renate Schüssler

Land issues are issues of power. This is apparent not only in the unequal distribution of land between large commercial plantations and small farmers, but also in the inequities between men and women in terms of access to land. In this article, Schüssler looks at gender balance in the context of agrarian reform, including examples from around the world. To achieve greater gender democracy, it is important to pay special attention to gender perspectives in all forms of land redistribution, entitlement programs and accompanying measures. Under conditions of structural injustice, justice cannot be introduced by mere equal treatment – compensatory measures are necessary.

20 Developing camel products: pastoralist women and PTD

Laura Lemunyete

Members of Salato Women's Groups have been successful in developing several important food security items that group members are now producing for household level use. While the PTD methods have already resulted in several good products, the Salato Group members have learned that technology development is an ongoing process and they continue to seek new and better ways of preserving their meat and milk products. Positive outcomes of their work have included increased income and other benefits - from a camel drug fund to greater food security.

DEAR READERS

There seems to be general agreement on the fact that in many parts of the world, women are taking on an increasing responsibility for agricultural production, as men are becoming increasingly absent from farms and rural areas. The reasons behind this trend are many - including factors such as low prices for agricultural produce and the need to increase cash income, leading to male migration to urban centres in search of work; and the AIDS epidemic, which is increasing its toll on the most productive generation, leaving older women and children behind with the task of supporting themselves. So what are the responses to this trend? How does the formal agricultural system tackle the challenge of supporting women and children with appropriate technologies and supportive measures such as credit?

These were the issues we wanted to explore in this issue, and we tentatively called the theme the "Feminisation of Agriculture". Unfortunately, we quickly became frustrated. We simply could not find good examples of practical solutions. We found lots of studies about the problems and constraints women farmers face and about how important they are as food producers. But almost nothing on how to assist them. We started to wonder if we were looking in the wrong places. Surely, after thirty years of gender focus in development co-operation there had to be something positive happening for the women involved in agriculture?

After a lot of searching we compiled the material that you will read in this issue. It is less practical and offers fewer solutions than we had hoped - instead it provides an understanding of the challenges that women farmers face and of how important it is to understand the gender dimensions in agriculture if you are hoping to change things for the better.

However, we are not satisfied with this. We are still hoping that we have actually missed lots of interesting and useful approaches that benefit women farmers. Please get in touch with us if you have good experiences to share!

The Editors

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L E I S A

Magazine on Low External Input and Sustainable Agriculture

Women managing change

Experiments with spiders, ants and other indigenous practices

Some tribal communities are using social spiders (Stegodyphus sarisinorium) to control stem borers in paddy fields. Photo: K.J.N. Gowtham Shankar

K.J.N. Gowtham Shankar

IDEA is a NGO working with tribal people in the northern Ghats in India. IDEA is a partner organisation in the COMPAS Programme for Endogenous Development (see LEISA Magazine Vol. 17, No2, p15).

During documentation of tribal indigenous knowledge in 1992, we found that some tribal people use spiders to control stem borers in paddy fields. This was interesting but needed further analysis. We identified the spider as *Stegodyphus sarisinorium* - a social spider. The spider is called differently in the local languages - *Patmakidi* in Oriya, *Salepurugu in* Telugu, and we call it *Bulu*. We also found that using spiders for pest control is an age-old practice of a specific tribal community - *Nooka Dora* - of Andhra Pradesh and Orissa, border villages in the north eastern Ghats, India. However, the knowledge was almost dying out as only 5-6 families were practising it in a remote village and that too only in paddy fields. We stimulated some young tribal farmers and senior farmers to conduct several small and simple experiments in the research centre of IDEA, which proved to be very effective. Based on the results, we did further experiments together with farmers in different villages for validation by the community. These were also successful. Then, we designed a systematic process for participatory action research and started studying various aspects of this spider - its habitat, feeding habits, breeding biology etc.

Simultaneously, we experimented with Bulu on horticulture crops (guava and pomegranate), vegetable crops (brinjal, ladies finger, cabbage, cauliflower and chilli) and floriculture crops (roses). We found out that this spider can successfully control fruit borers and mites in these crops.

This study helped us to disseminate the knowledge gained among more tribal communities and farmers. We developed training material on the experimentation and propagation techniques of Bulu and provided training to more than 500 farmers for conducting further on-farm experiments on different crops in their villages together with other farmer families.

The knowledge vested with just 5-6 families of a single community has now spread to more than 2000 farmers of 6-7 communities. It is spreading further to other areas due to regular farmer network interactions and farmer-to-farmer knowledge exchange, which we are facilitating through ongoing projects.

Control of black ants with domestic red ants

We also found that some of the *Konda dora* tribal farmers control black ants with tiny domestic red ants in their *Jawor* fields. Mountain farmers face a severe threat from black ants, which eat away the tender *Jawor* grains and damage the crop. Some of the senior farmers collect these domestic red ants from their houses and drop them in the fields affected by black ants. These red ants eat the eggs of black ants laid around the *Jawor* plant roots and attack the black ants. The black ants leave the fields within hours. We found this particularly simple technique of using red ants to control black ants very effective.

IDEA's research staff further tested this with other farmers for validation in different villages. The results were successful. We have systematically documented this knowledge and trained farmers in promoting it widely in other areas. Now, many farmers in the mountain villages are using this technique to control black ants in their *Jawor* and maize fields.

Experiments with botanical pesticides

We also did several experiments with indigenous knowledge of tribals on botanical pesticides. Thus, we have revived the use of many of these botanical pesticides.

■

Our tribal farmers' networks would like to interact with farmers of other countries for mutual exchange of information on indigenous knowledge and endogenous development approaches. We will be happy if you send your comments and suggestions to the following address

K.J.N. Gowtham Shankar, IDEA, Flat No.6A, Maharaja Towers, R.K. Mission Road, Visakhapatnam 530 003, Andra Pradesh, India. Email: gowtham_shankar@hotmail.com

Issue 19.1, March 2003

Farmer Field Schools - emerging issues and challenges

The Farmer Field School (FFS) approach was first developed in the late 1980s for training rice farmers in Integrated Pest Management (IPM). The success of this discovery-learning approach based on the principles of adult education has contributed to its popularity. The FFS approach is now being applied and adapted in many regions of the world - Asia, Africa and Latin America. It is not limited to rice, but used in a variety of other crops and livestock. Farmer Field Schools are seen as entry points towards community strengthening and empowerment. As the FFS approach gains more ground, new issues and challenges emerge, i.e. maintaining quality in implementation, reflection of the core principles etc.
These issues and challenges will be the focus of the International Learning Workshop on "Farmer Field Schools - Emerging Issues and Challenges" to be held in Indonesia in October 2002. This issue of LEISA will include the findings of this workshop and highlight some of the interesting cases. We invite articles on experiences in applying/adapting FFS to various agro-ecological, socio-cultural and economic situations, monitoring and evaluation of FFS, upscaling FFS approaches etc. that would be interesting to field practitioners and add to the knowledge generated at this workshop.

You are invited to contribute to these issues with articles (about 800, 1600 or 2400 words + 2-3 illustrations and references), suggest possible authors, and send us information about publications, training courses, meetings and web sites. Editorial support is provided by ILEIA. Authors of published articles are entitled to a standard fee of USD 75,–.

Agroforestry species and technologies : a compilation of the highlights and factsheets published by NFTA and FACT Net 1985-1999
by Roshetko JM (ed.). 2001. 231 p. ISBN 1 57360 032 6. Winrock International, 38 Winrock Drive, Morrilton, AR 72110-9370, USA / forestry@winrock.org
Taiwan Forestry Research Institute. (TFRI Extension Series no.138).
This booklet assembles under one cover 97 factsheets and highlights published by the Forest, Farm, and Community Tree network (FACT Net) and its predecessor NFTA. These bulletins are concise summaries of important information on tree species and agroforestry technologies suitable for many environmental and socioeconomic conditions. A large number of nitrogen fixing trees and actinorhizal trees is discussed in alphabetical order. The publication provides a species index but this is disappointingly incomplete. Still the booklet is a practical reference tool for everyone involved in agroforestry.(WR)

Bridging human and ecological landscapes : participatory research and sustainable development in an Andean frontier by Rhoades RE (ed.). 2001. 368 p. ISBN 0 7872 8473 4 USD 40.97. Sustainable Agriculture and Natural Resource Management (SANREM) / www.sanrem.uga.edu ; anthro@arches.uga.edu. Kendall/Hunt Publishing Company, 4050 Westmark Drive, Dubuque, Iowa 52002, USA.
This book is a synthesis of the rich results of an interdisciplinary research programme on sustainable agriculture and natural resource management conducted in the mountainous landscape of Nanegal Parish, Ecuador. The major themes of the book, and its individual chapters, aim to show how people and the environment have engaged each other over time to create the human and natural landscape of Nanegal. The authors demonstrate that the landscapes are as much a medium of ideas and imagination of the people who live there as they are physical realities. The landscape pervades almost every aspect of daily life, and its pervasive quality derives not only from the natural lay of the land, but from the multiple ways farmers have encountered, constructed and represented it over time. By integrating these visions of the landscape, distinct but complementary, this volume provides a guide map to a sustainable future for people living in the mountains and hillsides of the world. Also available in Spanish, editorial@abyayala.org.

Reorientation of extension : a case study of participatory action research with a Non-Government Organisation in Northern Nigeria by Ehret W. 1997. 275 p. ISBN 3 8236 1279 4. (Kommunikation und Beratung, Sozialwissenschaftliche Schriften zur Landnutzung und ländlichen Entwicklung 17). Margraf Verlag, Postfach 1205, 97985 Weikersheim, Germany / margraf@compuserve.com.
In this book, the author documents a reorientation process of five years which he accompanied as a participative action researcher in a NGO in Nigeria. First the methodology of extension was changed, followed by a reorientation of the entire organization. The introduction of increased participation effects all three levels of extension services, the community, extension workers and organisation. In the communities the number of self-help activities, initiated and accompanied by the extensionists, increased significantly during the research period. For the extension workers it was diffecult to apply participative methods successfully in the beginning. It took at least three years of intensive coaching to get them used to these methods and to get them feel at ease applying these methods. However, at organisational level it was observed that the transformation towards participative concepts was difficult and that participative measures could only be introduced to a certain limit. The reorientation process revealed that achieving participation at the extension/client interface is easier than establishing participative management within an organisation. Also the specific situation of NGOs has been analyzed with the conclusion that NGOs lose their comparative advantages as they become bigger and, thus, more government-like.(WR)

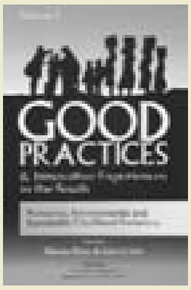
The living plateau : changing lives of herders in Qinghai : concluding seminar of the Qinghai livestock development project
by Wageningen N van, Wenjun S (eds). 2001. 96 p. ISBN 92 9115 376 1. International Centre for Integrated Mountain Development (ICIMOD), G.P.O. 3226, Kathmandu, Nepal / icimod@icimod.org.np / www.icimod.org.
The living plateau is about interventions by a development project for the improvement of the livelihood of sheep and yak herders on the Quinghai-Tibetan Plateau, China. The document takes stock of rangeland and livestock resources and describes the socioeconomic situation of herders. It summarises the outcome of field trials and technical interventions in the area of rangeland rehabilitation, the control of rodents, rangeland revegetation, seeded perennial forage and cereal fodders, the control of parasites in yak and sheep, and the control of young stock diseases. It further addresses the experiences of disseminating findings through extension services, and it reviews extension, including experiences with participatory rural appraisals. This small but concentrated document is a valuable information source because it contains the critically reviewed findings and lessons learnt from a large development project. (WR)

The real green revolution : organic and agroecological farming in the south by Parrott N, Marsden T. 2002. 147 p. ISBN 1 903907 02 0 EURO 12.- or downloadable. Greenpeace Environmental Trust, Canonbury Villas, London N1 2PN, UK / www.greenpeace.org.uk/realgreenrev.htm.
Greenpeace has launched an advocacy report for agroecological farming techniques, meant to contribute in the debate on the future of agriculture. The agricultural approach described emphasises the importance of using locally available resources and building agrobiodiversity to create productive and resilient agricultural systems. The report provides evidence from around the globe of the successes of the agroecological method: increased yields, enhanced food security and improved incomes. Recommended for policy makers and organisations involved in advocacy of sustainable agricultural development. This report is downloadable as html file from our website.(WR)

Ethnoagricultural development ; building on the strengths of indigenous beliefs and practices by Cooten DE van. 2001. 191 p. ISBN 1 876862 60 2 AUD 35.00. Kingdom Kookas Publishing, P.O.Box 133, Sanderson 0813, Northern Territory, Australia / winkent@optusnet.com.au.
Donald van Cooten has investigated the indigenous shifting, slash and burn agricultural systems in South Eastern Indonesia from a development point of view. In his book he concludes that ethnoagricultural development is the process of facilitating sustainable, agricultural development in the context of indigenous beliefs and practices. Agricultural development needs to proceed through the traditional religious leaders and bring about an indigenous enrichment movement. He sees the role of outside organisations in supporting and strengthening indigenous leaders and their communities.

This book provides necessary information on the indigenous people of the region and their sustainable, low external input agricultural systems. Agricultural development efforts should be aimed at ensuring sustainable production within the present systems. To make this possible studies like this one are needed, but a more participatory approach is also needed.(WR)

Securing tomorrow's food : promoting the sustainable use of farm animal genetic resources : information for action
by Geerlings E, Mathias E, Köhler Rollefson I. 2002. 89 p. League for Pastoral Peoples, Pragelatostrasse 20, 64372 Ober-Ramstadt, Germany / www.pastoralpeoples.org ; gorikr@t-online.de.
Farm animal diversity is vanishing at an alarming rate. As industrial livestock production expands, it is relying on fewer and fewer breeds. We are coming to depend on a livestock population with a dangerously narrow genetic base. Locally adapted animal breeds carry genetic material of immense value. These breeds must be conserved. The only realistic way to do so is by maintaining the production systems they are part of, by supporting the small farmers and pastoralists who manage these animals. The goal of this dossier is to stimulate policy makers, project staff and members of grassroots organisations to support, in their policies and actions, the sustainable use and community-based management of farm animal breeds. Important information, free available.(WR)



Good practices and innovative experiences in the south : vol 1 economic, environmental and sustainable livelihood initiatives by Khor M, Li Lin L (eds). 2001. 260 p. ISBN 1 84277 129 9 GBP 15.95.
Good practices and innovative experiences in the south : vol 2 Social policies, indigenous knowledge and appropriate technology by Khor M, Li Lin L (eds). 2001. 215 p. ISBN 1 84277 131 0 GBP 15.95.
Good practices and innovative experiences in the south : vol 3 Citizen initiatives in social services, popular education and human rights by Khor M, Li Lin L (eds). 2001. 260 p. ISBN 1 84277 133 7 GBP 15.95.
Third World Network, UNDP. Zed Books, 7 Cynthia Street, London N1 9JF UK / hosie@zedbooks.demon.co.uk.
United Nations Development Programme has collected a valuable number of case studies from developing countries all over the world. These case studies are gathered in three volumes of "Best Practices" for sustainable rural development. The aim of these books is to contribute to the exchange of these appropriate experiences between the different countries.
The described practices and experiences have been successful in solving environment, social and development problems. They cover the governmental sector as well as private and social institutions, NGO's and local communities. Each case study is extensively described, with detailed information on contact persons and background, mentioning the results and problems faced, and possibilities for upscaling.
The topics cover a variety of issues in policy, agriculture, economic, livelihood and gender. These books are recommended for everyone who is involved in sustainable development.(WR)

Ber (Ziziphus mauretania) by Pareek OP. 2001. 291 p. ISBN 854327525 GBP 15.- free of charge for developing countries. International Centre for Underutilized Crops, University of Southampton, Southampton SO17 1BJ, UK / A.Hughes@soton.ac.uk.
This monograph on the tropical fruit trees Ber and Chinese jujube, both Ziziphus species, provides thorough information on production, processing, marketing and utilisation of these species. Tropical fruit trees are important crops which can supplement and improve the quality of diets. Ber is a multiple purpose tree that produces non-food products like fuel, timber and leaf fodder together with a valuable fruit crop. Ber is cultivated all over the drier parts of the Indian subcontinent for its fresh fruits, which are rich in vitamins and minerals. It can be successfully cultivated even in the most marginal ecosystems of the subtropics and tropics. The tree propagates freely and greatly resists recurrent drought. It is thus an important tree suitable for integration into agroforestry systems of warm desert ecoregions. The tree can help in economic sustenance and insure against ecological degradation. Chinese jujube is cultivated in the drier parts of China; it can tolerate very low temperatures and is thus suitable for growing in colder regions.
This book is intended for researchers, students and NGO's. It is written in a rather scientific manner and completed with a list of "ber" experts and a seed suppliers directory. An extension manual for dissemination to farmers, field workers and policy makers is in preparation.(WR)

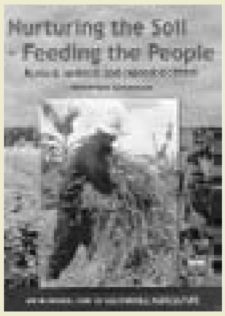
Participatory communication and adult learning for rural development by Coldevin G. 2001. 36 p. Food and Agriculture Organization (FAO), Sustainable Development Department, Extension, Education and Communication Service, Viale delle Terme di Caracalla, 00100 Rome, Italy / loyvan.crowder@fao.org.
Gary Coldvin has written this review paper on participatory communication and adult learning for rural development. The purpose of the publication is to provide an overview of the FAO Communication for Development Group's work as practitioner of applied communication for agricultural development over the past thirty years. During this period the role of communication has shifted from a one-way, top-down transfer of messages to a social process with a two-way sharing of information among communication equals, participatory communication. By seeking the views of the rural people themselves and involving them from the start of a project, participatory communication has become an important tool for successful implementing development initiatives. This paper provides a number of examples and cases drawn from FAO's field programmes and a lessons learned section.(WR)

Farmers and plant breeders in partnership
by Hanacziwskyj P (ed.). 2001. 28 p. Department for International Development (DFID), Plant Sciences Research Programme, University of Wales, Thoday Building, Bangor, Gwynedd LL57 2UW, UK / dfid.psp@bangor.ac.uk ; www.dfid-psp.org.
Participation allows plant breeders and farmers to learn from each other. In this paper of the Plant Sciences Research programme of DFID, advantages of the participatory approach are illustrated by examples of successful projects on participatory varietal selection and participatory plant breeding in Ghana, India and Nepal. In this research programme, farmers in developing countries are involved in the breeding, selecting and testing of new plant varieties. Such participatory crop improvement identifies or creates varieties to suit local needs, as well to marginal as to high-potential production systems.(WR)

Waste composting for urban and peri-urban agriculture : closing the rural-urban nutrient cycle in Sub Saharan Africa by Drechsel P, Kunze D. 2001. 229 p. ISBN 0 85199 548 9 GBP 45.- IWMI, FAO. CABI Publishing, Wallingford, Oxon OX10 8DE, UK / cabi-nao@cabi.org ; www.cabi.org.
Urbanisation has created a major challenge with regard to waste management and environmental protection. However, the problem can be ameliorated by turning organic waste into compost for use as an agricultural fertiliser in urban and peri-urban areas. This is especially significant in developing countries, where food security is also a key issue. This book addresses these subjects and is mainly based on papers presented at a workshop held in Ghana by the International Board for Soil Research and Management (part of IWMI) and FAO. Special reference is given to sub-Saharan Africa, with acknowledgement to experiences from other parts of the world. Contributing authors are from several European and African countries. This book provides a number of case studies, technical information and an analysis of constraints for the use and production of composted waste.(WR)

Vrkshayurveda : ayurveda for plants by Sridhar S, [et al]. 2001. 47 p. Centre for Indian Knowledge Systems (CIKS), No 30, Gandhi Mandapam Road, Kotturpuram, Chennai 600 085, India / ciks@vsnl.com ; www.ciks.org. (User's Manual-1).
This user manual on Vrkshayurveda is focused on certain aspects of plant nutrition and pest and disease management. Vrkshayurveda is an ancient Indian science dealing with all aspects of plant life. This booklet begins with an introduction to the subject. It lists certain important farmers' practices and provides a rationale for these practices based on the theory of vrkshayurveda. One section is devoted to specific recipes for disease treatment, for increasing general resistance to diseases and pests and seed treatments for increasing crop growth and yield. Use of specific growth regulators based on vrkshayurveda is also recommended. The recipes that have been recommended are based on field trials carried out by the Centre for Indian Knowledge Systems.(WR)

Participatory diagnosis of soil nutrient depletion in semi-arid areas of Kenya by Gachimbi LN, Jager A de, [et al]. 2002. 15 p. NUTNET programme International Institute for Environment and Development (IIED), Drylands Programme. (IIED Managing Africa's Soils, ISSN 1560 3520 ; 26). Drylands Programme, IIED, 3 Endsleigh street, London WC1H ODD, UK / drylands@iied.org / www.iied.org/drylands.
This paper describes the participatory diagnostic process undertaken as part of a 5-year research programme aimed at developing improved land and water management techniques in semi-arid areas of Kenya. The study indicates that farmers in the drylands of Machakos are well aware of the precarious condition of their soil resources. Soil sampling and nutrient monitoring activities jointly conducted by farmers, extension agents and researchers have increased their understanding of the causes of soil nutrient depletion, and farmers now recognise that soil quality is gradually declining because current farming systems do not use enough inputs to replenish nutrient stores in their soils. The results of the described diagnostic phase have been incorporated into a second programme in which the same group of participants test and evaluate new techniques. We look forward to the results of that project. (WR)



Nurturing the soil - feeding the people: an introduction to sustainable organic agriculture: revised, updated, and expanded edition by Scheewe W. 2000. 277 p. ISBN 971 23 2895 3. Rex Book Store, 856 Nicanor Reyes, Sr.St., Manilla, Philipines.
This is an expanded edition of the book "Nurturing the soil", which we reviewed in 1993 in the ILEIA Newsletter. It is nice that there is a renewed version of this book for all who are interested in an overview of concepts and ideas on sustainable agriculture. The book is written for extension workers and provides background information on soil management. The book helps to understand the important biological processes required in managing the soil sustainably. The author supposes that principles observed in nature can instruct farmers in the quest to improve farming practices. The book also provides basic information on agricultural practices that can improve the land, like mulching, composting, cover cropping, integrated pest management etc. The appendices contain important addresses and references for more detailed information. (WR)

An evaluation of strategies to use indigenous and imported sources of phosphorus to improve soil fertility and land productivity in Mali by Henao J, Baanante CA. 1999. 75 p.ISBN 0 88090 120 9. International Fertilizer Development Center (IFDC), PO Box 2040, Muscle Shoals, Alabama 35662, USA / general@IFDC.org ; www.ifdc.org.
This report is the result of a fertilizer research project conducted over several years in Mali as a collaboration between the government of Mali, through the Institute D'Economie Rurale, and the IFCD. Findings indicate that phosphate fertilisers are indeed needed for the production of food and cash crops and that Tilemsi phosphate rock is a suitable indigenous source of phosphorus for the sustainable production of important cropping systems in Mali.The report provides clear figures and a lot of data concerning soil fertility throughout the country, including economic evaluations. (WR)

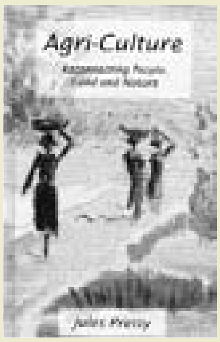
Soil conservation in organic farming : handbook 1 : green manure, green leaf manure, biofertilisers by Jayashankar M, [et al]. 2002. 30 p. Centre for Indian Knowledge Systems (CIKS), No 30, Gandhi Mandapam Road, Kotturpuram, Chennai 600 085, India / ciks@vsnl.com ; www.ciks.org.
During all stages, from seeds to harvest, agricultural crops take up a number of nutrients from the soil. The nutrients taken up by the plants during one season of cultivation should be replenished before the next sowing season. Only then can the nutrient level of the soil be maintained without depletion. Several practices are being followed to replenish these lost nutrients. This small manual gives an account of green manure, green leaf manure and the ways in which they could be used for increasing soil fertility. It also describes the different types of biofertilisers and their uses. The book ends with a list of Indian organisations supplying biofertilizers.(WR)

Dynamics and diversity : soil fertility and farming livelihoods in Africa : case studies from Ethiopia, Mali and Zimbabwe by Scoones I, (ed.). 2001. 256 p. ISBN 1 85383 820 9 GBP 16.95. Earthscan Publications Ltd, 120 Pentonville Road, London NI 9JN / earthinfo@earthscan.co.uk / www.earthscan.co.uk.
Ian Scoones is a well known expert in the field of soil fertility and small

scale farming in Africa. With this new book on the subject he adds another important work to his list of publications. This book is based on research carried out by teams of researchers from Africa and Europe over three years in a range of contrasting locations. The research results add up to a new approach for looking at soil management issues in Africa, with significant implications for development policy and practice. They suggest a more positive view of the prospects for sustainable agriculture in small-scale farming systems in Africa than the overridingly negative views of crisis and collapse which have dominated the policy debate. The research also points to the need for developing new technologies and management practices which are suited to the diversity of farmer needs and settings, when addressing the challenges of natural resource management. (WR)

Resource conserving technologies : transforming the rice-wheat systems of the indo-Gangetic plains : rice - wheat consortium, a success story by Gupta RK, et al. (eds). 2002. 42 p. Asia-Pacific Association of Agricultural Research Institutions (APAARI), FAO Office in India, 55 Max Mueller Marg, New Delhi 110 003 India, Rice-Wheat Consortium for the Indo-Gangetic Plains, (RWC) Campus, Pusa, New Delhi 110 012, India : rwc@cgiar.org, www.rwc.cgiar.org. (APAARI Publications 2002/1).
Rice and wheat are two major crops in the Indo-Gangetic plains of South Asia comprising of Bangladesh, India, Nepal and Pakistan. Following an eco-regional approach, the Rice-Wheat Consortium (RWC), convened by CIMMYT, has been operating farmer participatory research programmes from a perspective of system's ecology. These research and development efforts with a focus on resource conserving technologies are being practiced by a larger number of farmers, and a tillage revolution is emerging in South Asia. This booklet provides an account of useful and successful research and extension initiatives. Farmers are practicing zero- and reduced tillage in more than 250 thousand hectares at the moment. The ILEIA Newsletter 16.4 carries an article on the Rice Wheat Consortium. (WR)

Manual on integrated soil management and conservation practices 2000. 220 p. ISBN 92 5 104417 1 downloadable. FAO, Land and Water Development Division and Research, Extension and Training Division, Viale delle Terme di Caracalla, Rome 00100, Italy / www.fao.org. (FAO Land and Water bulletin, ISSN 1024 6703 ; 8).
This manual serves as a guide for technicians and farmers to jointly discover ways to solve the problems and the limitations posed by land degradation in Latin America and Africa. It has been put together with the aim of assisting diverse groups of people who are intervening in the conservation of the natural resources, particularly soil and water resources and in the context of each continent, country or zone. The publication brings together a collection of concepts, experiences and practical suggestions that can be of use for identifying problems and for formulating, executing and evaluating actions so as to benefit and to improve the productivity and conservation of soil and water resources. The manual is based on the training course for soil management and conservation, focused on efficient tillage methods for soil conservation, held in Nigeria in 1997. Available in English and in Spanish. (WR)



Agri-culture: reconnecting people, land and nature by Jules Pretty, 2002. Earthscan, London, earthinfo@earthscan.co.uk ; www.earthscan.co.uk .
'Agri-Culture' envisages the expansion of a new form of food production and consumption founded on more ecological principles and in harmony with the cultures, knowledge and collective capacities of the producers themselves. It draws on many stories of successful agricultural transformation in developing and industrialised countries, but with a warning that true prosperity will depend on the radical reform of the institutions and policies that control global food futures, and fundamental changes in the way we think. The time has come for the next agricultural revolution (author).

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Information on soil micro-organisms

FAO Soil Biodiversity Portal

http://www.fao.org/ag/agl/agll/soilbiod/default.htm

This web page provides general conceptions on the meaning and significance of soil biodiversity, stressing the need for **integrated biological soil management.** It also provides a framework, under which soil biodiversity can be assessed, managed and conserved, showing examples of successful and unsuccessful practices that have been used in various regions of the world in managing soil biodiversity. Finally, an assessment of needs for further work, research, capacity building and policy and programme development is presented.

Worldwide portal to information on Soil Health

http://mulch.mannlib.cornell.edu/TSHomepage.html

The Gateway to Tropical Soil Health Information currently offers an extensive database of annotated resources on the World Wide Web, an on-line resource reference service, and classified resource listings for products, services, organisations, databases, literature and electronic discussion groups that have direct or indirect links to tropical soil health issues.

Information on Conservation Agriculture

FAO Conservation Agriculture Portal

http://www.fao.org/ag/agl/agll/prtcons.stm

This web portal provides an entry to the main information page on CA: "Intensifying crop production with Conservation Agriculture". Besides the introduction, it contains extensive information on the concepts and principles, on experiences from Latin America, Africa and Central Asia and on the environmental and economic impacts of CA. There are also web linkages to the main networks (e.g. on ACT. and RELACO see below), databases (e.g. CATechnology database see below) and organisations on CA as well as a report on the First World Congress on CA held in Madrid, October 2001. The information is available in English and Spanish.

Conservation Agriculture Technology database

http://www.fao.org/ag/catd/index.jsp

The CAT database lists commercially available equipment, which is specifically designed or is essential for the successful introduction of Conservation Agriculture. Special importance is given to small-scale equipment. The database addresses the needs of farmers, extension staff, technicians and others involved in Conservation Agriculture projects and anybody else interested in equipment for Conservation Agriculture, and where to obtain it.

ACT - African Conservation Tillage Network

http://www.fao.org/act-network/contact.htm

ACT Secretariat, c/o IES University of Zimbabwe, PO Box MP 167, Harare, Zimbabwe. Phone: +263-4-334395, Fax: +263-4-332853, Email: actsecre@africaonline.co.zw

The purpose of the network is to enhance the dissemination of conservation tillage in smallholder agriculture. Its main activities are: support to national networks; maintenence of an informative website and the ACT literature database; publication of an electronic newsletter "Act now" and a very good information series; organisation of topical working groups e.g. on green manure /cover crops, impact on soil quality, implements, dissemination approaches, curricula and training materials for farmers; workshops and pilot activities.

RELACO – Latin American Conservation Agriculture Network

http://www.relaco.cjb.net

Secretariat, c/o EPAGRI, Santa Catarina, Brasil. Email: relaco@epagri.rct-sc.br

The network links up persons interested in CA. It stimulates research and studies on CA and diffuses results. It organises seminars and training courses, stimulates activities of national networks and has published a wide range of documents and manuals on CA in Latin America. Its web site contains information (in Portuguese and Spanish) on important CA events and publications, and also its electronic circular. Information on RELACO in English can be found on the FAO Conservation Agriculture Portal (see above).

CD-ROM# 18 - Conservation Agriculture

This CD-ROM contains detailed information and literature on Conservation Agriculture that can help improve the knowledge base of those interested in this concept of sustainable agriculture. The CD-ROM provides technical staff as well as policy- and decision -makers with information and arguments for supporting, promoting and introducing Conservation Agriculture. For more information please contact: FAO, Land and Water (AGLL): **jose.benites@fao.org** or click **http://www.fao.org/landandwater/lwdms.stm#cd18**

Information on cover crops

TropSCORE The consortium for tropical soil cover and organic resources exchange

http://ppathw3.cals.cornell.edu/mba_project/moist/TropSCORE.html

The current members of TropSCORE are:

CIDICCO The International Cover Crops Clearinghouse, an NGO located in Tegucigalpa, Honduras. Operates in Spanish and English. **http://rds.org.hn/miembros/cidicco**

CIEPCA The Cover Crops Information and Seed Exchange Centre for Africa, a group hosted by IITA in Cotonou, Benin. Operates in French and English.
http://ppathw3.cals.cornell.edu.mba_project/CIEPCA/home.html

CIIFAD / MOIST The Cornell International Institute for Food, Agriculture and Development's working group on Management of Organic Inputs in Soils of the Tropics.
http://ppathw3.cals.cornell.edu.mba_project/MOIST/home.html

ECHO, a non-profit interdenominational Christian organisation that provides international agricultural development resources including publications and free seed of underexploited food, agroforestry, and soil-improving crop varieties.
http://www.echonet.org

IDRC website on cover crops

http://www.idrc.ca/cover_crops/

IFDC-Africa has developed a decision support system for the use of legumes in West Africa: **Legumes, when and where an option?** Copies (in English and French) can be requested from the Programme for Integrated Intensification, IFDC-Africa, BP 4483, Fax: (228)2217817; Email: **ifdcafrique@ifdc.org**

Nitrogen fixation in tropical cropping systems

by KE Giller, 2nd edition, 2001. CABI Publishing, Wallingford Oxon OX10 8DE, UK, Email: cabi@cabi.org ; 425 pp. ISBN 0 85199 417 2 GBP 60, Euro 97.10

A fully updated and up-to-date standard work on nitrogen fixation by leguminous plants.

LEXSYS Cover Crop Database on herbaceous legumes
http://www.iita.org/research/lexsys.htm

Information Support Project for Soil Fertility and Improved Fallow Management
Institute of Biological Sciences, UP Los Baños, 4031 College, Laguna, Philippines.

ISP aims at providing an avenue for exchange of information on soil fertility, fallow management and shifting cultivation in the upland areas of Southeast Asia and the tropics.

Major activities include:
- publication of **Soil Fertility Matters**, a newsletters on soil fertility and fallow management
- development of databases, e.g. on contacts, fallow species, related references
- establishment and moderation of an electronic discussion list forum (**Fallow Net**)
- networking

The newsletter is available in printed and electronic forms. A free printed copy can be requested from macandog@pacific.net.ph .The on-line version and the other information can be found on **www.icraf.cgiar.org/sea/ifm**

Information on Integrated Soil Fertility Management

International Fertiliser Development Center
http://www.ifdc.org

IFDC's goal is to increase agricultural productivity in a sustainable manner through the development and transfer of effective, environmentally-sound plant nutrient technology and agricultural marketing expertise. Its web site provides information regarding IFDC's programmes and projects, services available, publications, events, news releases, newsletters, training courses, events etc. For information on ISFM you have to go the section on IFDC-Africa

FADINAP
the United Nations Fertiliser Advisory, Development and Information Network for Asia and the Pacific. **http://www.fadinap.org**

FADINAP provides assistance to developing countries in their efforts to increase food production by supporting the development of an efficient and effectively functioning fertiliser sector in Asia and the Pacific region. Its web site provides information on a wide range of fertiliser-related subjects: services, electronic newsletter, country gateways, market information and publications, among others on Integrated Plant Nutrient Systems.

Guidelines and reference material on Integrated Soil and Nutrient Management and Conservation for Farmer Field Schools
by Nabhan H, Bot A. and Roy RN. Publication Series: AGL/Misc/27/2000. Downloaded from

http://www.fao.org/landandwater/agll/oldocsp.jsp

These guidelines provide a basic conceptual framework and supporting reference material for assisting in the development and implementation of effective FFS focused on Integrated Soil and Nutrient Management and Conservation. They are intended for use by FFS facilitators with a background in agricultural extension, agronomy, soil science, plant nutrition, soil conservation or land husbandry and for the production of country or local specific manuals and curricula. These should be adapted to the agro-ecological environment, the cropping/farming systems, and the socio-economic conditions and educational level of the farmers in the areas where the FFS are to be implemented.

On-farm composting methods
by Misra RV and Roy RN, 2002, 26 pp. Can be downloaded from

http://www.fao.org/landandwater/ agll/compost/default.stm

This paper gives an overview of main composting methods used as a starter for the electronic conference on Organic Recycling conducted from May - August 2002.

DEVECOL a web-based information system for sustainable development
Development Ecology Information Service, 619 Upland Place, Alexandria VA 2301, USA / hansfree@comcast.net

http://www.devecol.org

Devecol is an information system and resource designed for field workers in sustainable development who want to take advantage of relevant experiences in comparable environments elsewhere in the world. The information resources consist of geo-referenced documents, base maps and thematic maps. The documents are site specific case studies, evaluations, surveys and research reports, which are full text available as pdf files. The maps show the climatic zones and soil conditions of the area where the studies are located.

At the moment a useful information tool for sub-Saharan Africa is under preparation. This will be ready in early 2003 with information on projects and case studies, which can be accessed from their map locations. FAO maps of soil associations and climate can be displayed under these locations.

The II World Congress on Conservation Agriculture: "Producing in harmony with nature"
Iguaçu Falls, Parana, Brazil - August 11-15, 2003.

This second Congress will call upon politicians, international institutions, environmentalists, farmers, and private industry to further support and develop the concept of conservation agriculture. Only with conservation agriculture techniques will we ensure the continuity of sufficient food production for an expanding population while maintaining environmental quality. This congress will build on the issues and lessons of the first World Congress which took place in Madrid in 2001. In line with the conference theme, keynotes and delegates will address the development of on-farm, practicable, farmer-originated and led, and scientist supported farming systems that develop towards more natural systems for the optimal use of the natural resources. Further information on the congress can be found on the FAO Conservation Agriculture web portal later this year.

Visit our website: www.ileia.org

Farmers develop new hand weeders in Sri Lanka to make SRI less labour intensive. Photo: Norman Uphoff

System of Rice Intensification gains momentum

Norman Uphoff and Erick Fernandes

Since 1999, the System of Rice Intensification (SRI), developed in Madagascar by Fr. Henri de Laulanié in association with the NGO Association Tefy Saina (ATS) and many small farmers in the 1980s, is spreading to many countries. Various articles and presentations on SRI at national and international fora, especially those by Dr. Norman Uphoff, Director of the Cornell International Institute for Food, Agriculture and Development (CIIFAD) at Cornell University in USA, have motivated many people to experiment with the approach and evaluate it for themselves.

SRI is a ‘system’ rather than a ‘technology’. It is based on the insights that rice has the potential to produce more tillers and grains than now observed, and that early transplanting and optimal growth conditions (spacing, humidity, biologically active and healthy soil, and aerobic soil conditions during the vegetative phase) can fulfil this potential. These principles are translated into a set of ‘baseline’ practices: transplanting of young seedlings, carefully one per hill, with wide spacing; no standing water during the vegetative growth phase; application of compost; and early and frequent weeding (see e.g. LEISA Magazine Vol.15, No.3/4, pp.48-49; Vol.16, No.4, p.12; Vol.17, No.4, pp.14-16). Practitioners of SRI are encouraged to vary and improve these practices, to see which can best give effect to the SRI principles in their specific situation.

The SRI approach has been tried in at least 17 countries under a range of climatic and other conditions. Farmers have worked with many different varieties (traditional, high yielding and hybrids) and soil fertility practices (organic, chemical, and a combination of both) and have developed several variants and improvements of the ‘baseline’ practices.

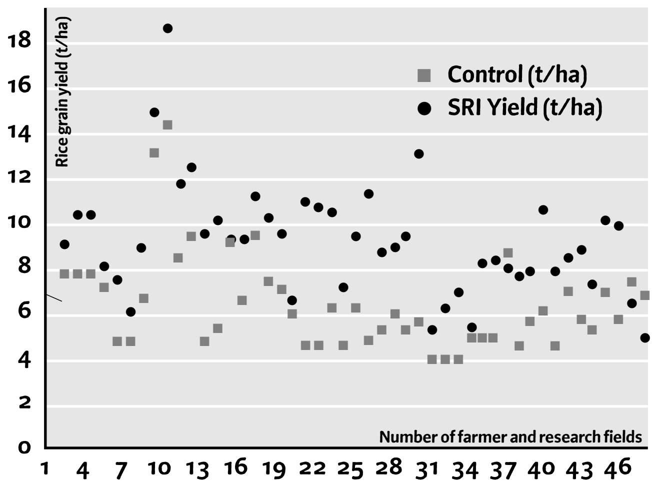

Figure 1: Comparative rice yields reported from cases where data were available on both actual SRI yield and comparison/control yield

First International Conference

As scientific validations of farmer and researcher experimentation have become available, it was timely to hold an international conference on the System of Rice Intensification. This was organised by CIIFAD and the China National Hybrid Rice Research and Development Centre, with co-sponsorship by ATS and the China National Rice Research Institute. It took place in Sanya, China, April 1-4, 2002. The objective was to better understand the variations in practices and the results that have emerged, and to establish means for communication that would facilitate evaluation of innovations from various sources and share them widely, so that farmers in many countries would have a longer “menu” of SRI practices to choose from.

Reports from China, Indonesia, Philippines, Cambodia, Laos, Thailand, Myanmar, Bangladesh, Sri Lanka, India, Nepal, The Gambia, Madagascar, Sierra Leone, Cuba, Peru, and the U.S.A. were presented at the conference. This article is a compilation of the main findings and comments.

Advantages

Numerous benefits associated with SRI practices were reported in the conference papers, the most important being an increase in

total factor productivity. Specific advantages included:

- **Higher yields:** increases of 50-200 %, with yields of 4-8 tons/ha common, but also yields above 10 tons/ha frequently reported (see Figure 1).
- **Increased returns to labour** with more production per day invested.
- **Water saving**: up to 50%, with higher productivity per unit of water applied.
- **Improvement of soil quality** and **increased efficiency of fertilisers**, both organic and chemical.
- **Reduced requirement of seed**: 5-10 kg/ha of seed is used, 5-10 times less than the quantity with the regular practice; this makes the use of improved and hybrid seeds much cheaper for farmers.
- **Less requirement of purchased inputs - water, fertiliser, seed and pesticides**, and lower costs of production contribute to **higher income** for farmers.
- **Higher seed quality:** SRI methods make it possible to increase considerably the yields for traditional rice varieties grown organically for which higher prices can be obtained; also, multiplication of 'breeder seed' can be faster as many more grains can be produced from a single seed.
- **Diversification of production**: less land is needed to produce the same amount of rice, freeing up land for producing green manure or crops with higher value.
- **Environmental benefits**, resulting from reduced demands for water and less or no use of agrochemicals.

The disadvantages reported included:

- **Requirement of good water control**, to be able to apply small amounts of water as and when needed to maintain soil moisture without saturation, rather than flooding fields continuously. Farmers who do not have such control or reliable access to water will get less or little benefit from SRI practices.
- **Requirement of more labour**, at least in the first year or two, as skills are learned for using the SRI practices quickly and confidently (see Box 1). This can be a barrier to adoption, even for poor households which are relatively more endowed with labour, if they need immediate returns from their labour to meet subsistence needs. At the present stage of development, SRI is mainly of interest to small farmers who have sufficient household labour. The challenge is to develop practices that make SRI suitable for situations where labour is more expensive and for larger-scale mechanised farming.
- **Drastic change of farmer practices** which is often not accepted by farmers, their communities, researchers and/or governments.
- **Requirement of greater skill** on the part of farmers, expecting them to adapt SRI practices to their own conditions based on their own trials and evaluations. This can, of course, contribute to human resource development, which is a benefit and not just a cost.

Box 1. Gender division of labour in SRI

We do not know how much SRI affects the gender division of labour within households, so this should be evaluated as a matter of some priority. Since SRI requires more labour per ha., at least initially, there is concern that this could increase the labour burden on women, who usually do the transplanting operation. Labour savings in terms of time spent on nursery construction and management with SRI would accrue usually to men.

However, conversations with women doing SRI transplanting in Sri Lanka indicated that they found SRI methods easier and quicker after the first year, once they became comfortable with handling tiny seedlings. Because lighter and fewer seedlings are transplanted, they reported that SRI transplanting had become quicker for them, and they found the technique more comfortable ("less backache").

In Madagascar, there are still complaints about the method taking extra time and effort, but the spacing for transplanting is still marked with ropes stretched across fields, rather than with a simple wooden rake that scores the surface of the fields with lines. With increased yield, women's burden at harvest time is probably increased, though a larger harvest helps maintain household food security, which is a major responsibility and burden for women.

Field experiences and observations

Using young seedlings. This is probably the single most important practice in SRI according to the factorial trial results in Madagascar, adding about 2.5 t/ha in this situation, other conditions being equal (Table 1). Some farmers have tried seedlings as young as 5 days; others have preferred older seedlings (3-4 weeks), e.g., because of slower growth in colder climate. Two evaluations in Madagascar have shown definite benefits from using younger seedlings. The advice to start by using 8 to 12 day-old seedlings remains sound, but decisions about seedling age need to match varietal and climatic differences.

Effective tillering. There is wide variation in tillering and the effectiveness of tillers. Sometimes there are up to 50% **unproductive tillers**, which cannot be explained very well. More often effective tillering is in the range of 60-80%, with some plots attaining 80-90%. How to optimise effective tillering is an important research question.

Quick and careful transplanting. Farmers have not found it difficult to transplant seedlings within 30 minutes, or preferably

Table 1. Factorial trial results, comparing yield responses on clay and loamy soils, Anjomakely, Madagascar, 2001

	CONTINUOUS FLOODING				SRI WATER MANAGEMENT			
	20-day plants		8-day plants		20-day plants		8-day plants	
	3 per hill	1 per hill	3 per hill	1 per hill	3 per hill	1 per hill	3 per hill	1 per hill
CLAY SOIL								
No Fertilizer	2.26	2.78	3.09	3.75	4.82	5.42	5.65	6.25
NPK	<u>3.00</u>	5.04	5.08	6.07	7.16	8.13	8.15	8.77
Compost	3.71	4.50	6.72	7.45	6.86	7.70	9.32	**10.35**
LOAM SOIL								
NPK	<u>2.04</u>	2.78	2.60	3.15	3.89	4.36	4.44	5.00
Compost	2.03	2.44	3.41	4.10	3.61	4.07	5.17	**6.39**

The yield figures reported (tons/ha) are each averages from 6 replicated trial plots. The average yield with conventional practices is <u>underlined</u>; that with all-SRI practices is **bold faced.** A traditional variety (riz rouge) was used for all trials, with soil type as one of the variables evaluated. These trials (N=240) were conducted in a village 18 km south of Antananarivo on the high plateau. More complete data from factorial trials conducted by Rajaonarison in 2000 and Andriankaja in 2001 are reported in the conference proceedings.

15 minutes or less, if they establish their nursery near the field. Farmers have found that using a trowel or other implement helps minimise trauma to the tender seedlings when they are uprooted from the nursery. Seedlings are sometimes planted in wooden or bamboo frames that can be kept in or near the house for protection and then carried to the field, so that seedlings are uprooted only at the time of transplanting.

Trauma during transplanting can be reduced by paying attention to the soil mixes used in the nursery and by appropriate water management practices. In Sri Lanka, for example, a nursery mixture of one-third soil, one-third sand, and one-third (chicken) manure has given very good results.

Traditional, improved or hybrid varieties. All varieties used so far have given higher yields with SRI practices, though not surprisingly, some varieties respond better than others, e.g., producing more tillers or giving better grain filling. It was observed that 120-140 day varieties responded most productively, but more evaluation is needed on this. The best SRI yields (up to 16 tons/hectare and higher) have been obtained with high-yielding or hybrid varieties, although traditional varieties, considered low-yielding, have also shown great yield increases. Since the latter are commonly preferred for taste and other qualities, and command a higher market price, they may regain popularity with SRI methods that increase yields up to 6-10 t/ha.

Seedlings per hill. 1 or 2 seedlings per hill can give good results depending on local conditions. Where soils are poor it may be better to use 2 seedlings per hill until soil quality is improved. There is enough evidence that 3 or more seedlings per hill retards growth due to plant competition below and above ground, and therefore does not need further experimentation. On good soil, single seedlings have been giving the best results.

Wide spacing. Some of the highest yields observed with SRI have come with very wide spacing, 50 x 50 cm, when soil quality is excellent. But spacing between plants is something to be optimised, not maximised, since one wants the largest number of grain-bearing tillers per sq. metre. This number is influenced by various factors (soil quality, variety) as well as by SRI practices, of which spacing is one. Most farmers are advised to start with 25 x 25 cm. Often 35 x 35 cm spacing has given the best results but on very poor soils 20 x 20 cm may be better.

Techniques of spacing. Instead of using strings to achieve desired and exact spacing, some farmers in Madagascar and Sri Lanka are now using wooden rakes with teeth (pegs) spaced at 25 cm, or wider, intervals to mark square grid lines on the muddy surface of their paddies. Farmers find that this speeds up the transplanting considerably (see Box 2).

Water management. There is plenty of evidence that in many conditions keeping the soil moist but unsaturated during the vegetative growth period is best. The SRI recommendation has been to add small amounts of water to the field daily, preferably in the late afternoon or evening (unless there has been rain during the day), and draining any excess (standing) water in the morning. This opens the soil to aeration and warming during the day. However, a large number of farmers, seeking to reduce their labour requirements, follow an irrigation schedule of alternate flooding and drying of their field instead of careful watering but not flooding during the vegetative growth period. It is not clear if this gives a higher yield but it does economise on labour. Certainly different practices are needed for clay vs. other kinds of soil. Further research is also needed to understand the implications of such changes at large-scale for water distribution and the environment.

Weeding. When fields are not kept continuously flooded to combat weeds, farmers have to use other practices. With SRI, early and frequent weeding is also important to aerate the surface of

Box 2. Adaptation and innovation of SRI practices in Sri Lanka

One of the reasons for fast dissemination of SRI in Sri Lanka is the enthusiasm and creativity of farmers to adapt and innovate SRI practices to resolve their field problems. The following are highlights:

- Various soil-enrichment practices have become part of the system including green manure (e.g. sunhemp), rice straw, chicken dung, and mixtures of certain green leaf extracts with cow dung. In this way farmers are improving soils degraded by conventional rice production practices without needing to transport huge quantities of compost to their paddy fields.
- Practical problems encountered in using the rotary weeder have resulted in alternative weeder designs to suit the specific conditions of different fields. Weeders are manufactured and sold by several farmer companies and private sector entrepreneurs. A motorised weeder is at the design stage in three locations and will be tested soon.
- To make transplanting easier, a rake was produced to draw lines in a square grid pattern on the ground. Seedlings are planted at the intersections of lines.
- A transplanter that can do careful planting of one seedling per hill in 6 rows at a time with required spacing has been developed.
- A seeder, which can drop one or two germinated seeds at the desired spacing has also been developed and is now in use.
- A foot-pedal water pump with sprinklers is being experimented with to ensure required moisture during the growth period and after panicle initiation. This is especially useful in drought periods when surface water is scarce, and also to ensure production of high-value organic rice for the export market.
- Many farmers are using different combinations of plant extracts, with or without ‘effective micro-organisms’ (EM), to avoid the use of chemical pesticides. They experiment with different plants available in highlands around the paddy fields. Some plant extracts are used not only as insect repellents but also as a source of nutrients.
- Farmers have stopped plastering their bunds and leave the grass cover on the bunds to protect the habitat of rice-pest predators. In this way they support biological pest control and microbial activity in the soil to improve soil health and biodiversity in the paddy fields. This saves money for plastering and pesticides and thus reduces production costs.
- SRI farmers experiment with different spacing and direct seeding. They also do careful time planning to prevent flowering during the full moon phase. They find that this reduces damage by insect pests.

The benefits achieved by farmers from SRI and other improved practices are attractive. Farmers have been able to at least double the yield they got from conventional practices while also reducing their production costs, often by half. They have become producers of quality rice earning a slightly higher income from sale as seed paddy. Biocide-free SRI rice fetches a higher price in the market, and the demand is increasing. Production of organic and traditional rice for export is increasing with one farmers’ group already obtaining certification for production of organic rice. In this way SRI is becoming a viable alternative for farmers cultivating small plots obtaining average yields of 8.5 tons/ha, achieving higher returns from reduced inputs, while increasing the productivity of land, water, labour and capital. Besides, SRI farmers produce clean and healthy rice through eco-friendly practices.

More information on the experiences in Sri Lanka can be found in Box 4 and in the Proceedings of the International Conference on SRI

Gamini Batuwitage, Additional Secretary, Ministry of Agriculture and Livestock, Govi Jana Mandiraya, Battaramulla, Sri Lanka. Email: batuwita@sltnet.lk

Training material used in Madagascar showing the steps involved in planting SRI rice.

the soil. SRI farmers could use hoes or weed by hand, but ‘rotary hoes’ or ‘cono-weeders’ are recommended. Access to mechanical hoes can be a bottleneck. Labour required for hand weeding can be as much as 20 – 25 days for one ha in Madagascar. Recently, SRI practitioners in Sri Lanka have developed a new design for a push weeder (see Box 2 and photo on p.24) which makes it possible to weed 1 ha in 3 to 5 days.

Soil and nutrient management. With SRI, the highest yields have been obtained with organic soil amendments, particularly compost. Research in Madagascar has shown that compost gives a considerable increase in yield compared to NPK fertiliser, especially for traditional varieties (Table 1). But it was also reported that most farmers are using neither compost nor NPK on their crop, and still getting yields with SRI methods that are twice as high as with standard methods. Participants wondered how this is possible, and for how long farmers can continue with such nutrient-depleting practices. At some point there may be soil nutrient constraints, e.g., P, that have to be alleviated by adding sufficient soil amendments. Often there are not enough organic nutrients available and chemical fertilisers are too inefficient to be profitable.

Better understanding of soil life and biological soil processes are needed to develop effective, efficient and sustainable soil fertility management strategies for SRI. There seems to be much scope for Integrated Soil Fertility Management (ISFM) practices. Green manure, composted rice straw, micro-nutrients and sprays of soil micro-organisms and plant extracts seem to be organic practices with good potential. Incorporation of a green manure crop either before rice (e.g., *Sesbania rostrata*, mung bean or bush bean) or after rice (e.g., jackbean) could work well with SRI. Researchers at the Tamil Nadu Agriculture University in India have good experience with sowing of green manure (*S.*

Box 3. SRI adaptation and diversification in Cambodia

After farmers gain confidence in SRI, they become interested in refining the ways of increasing rice production and diversifying rice-based farming systems. The following trends have been observed:

- Farmers modify the way that they transplant depending on their specific conditions, especially the age of seedlings and spacing. They are keen to assess appropriate practices in plant management for themselves through experimentation.
- It is much easier to talk to SRI farmers about integrating green manure after and before the rice crop, and they are more ready to invest in growing green manure.
- Some farmers are developing simple tools for weeding, like small hoes and harrows. The concept of soil aeration through weeding, which contributes to improved root growth, is now well understood by SRI farmers.
- This year, two farmers started with zero-tillage, and there are more farmers becoming interested in the practice. Zero-tillage is possible since SRI makes the cultivation of traditional rice varieties that produce a lot of biomass for mulching attractive again. So far, we observe that rice growing under zero-tillage is doing well, even better than the normal practices.
- When farmers see that their rice yield is increasing, they are willing to use part of their rice fields for growing other crops and for raising fish. We call this a multi-purpose rice field, or the System of Intensification and Diversification (SID) of rice production. Earlier, they would not consider diversification, as growing less of the staple food, rice, was unaffordable.
- Some SRI farmers return to practices of mutual help in transplanting, because those they would normally hire do not have the skills to transplant as required by SRI. By pooling their labour they find they can get good and quick results.

Based on our experiences, the SRI approach contributes significantly to increasing farmers’ innovative capacity, community learning and cooperation. Now, we see that ecological intensification of rice production through the small farmer group approach is a very good entry point to sustainable agriculture and rural development in Cambodia.

More information on the experiences in Cambodia can be found in the conference proceedings.

Yang Saing Koma, CEDAC, Email: cedac@camnet.com.kh

rostrata) within rows of rice plants and incorporating it into the soil with a cono-weeder, 30 days later. They have developed a special drum-seeder for this purpose.

With wide spacing of plants in SRI, broadcasting of fertiliser is less efficient. Application of chemical fertiliser granules (as successfully used in Bangladesh) or compost near the plants can be more efficient. Flooding and adding chemicals can have a strong negative impact on soil life and may affect crop production, but a lot remains to be understood. More ecological learning is needed to find the best soil management practices. Research presented to the conference from Madagascar indicated that crop responses to compost are non-linear, i.e., there may not be greater benefits from applying 4 or 6 t/ha compared to 1 or 2 t/ha, as the smaller amounts appear sufficient to "incite" the biological life of the soil and give good crop results.

Prof. L.P. Yuan of the Chinese National Hybrid Rice Research and Development Centre explaining his experiments on SRI using super hybrid rice varieties and inorganic fertilisers. Yields of 12 to 16 tonnes are expected. Photo: Coen Reijntjes

Land preparation. Good land levelling is important for getting best results from applying small amounts of water. At the same time, a proper drainage system for the field should be established so that alternate wetting and drying of the soil can be done effectively. With SRI, land preparation (puddling) does not differ from standard practices. There could be considerable saving of labour and energy by combining zero-tillage with SRI practice (both follow similar agroecological principles), but experimentation and evaluation on this remains to be done.

Raised beds, zero-tillage and direct seeding. One of the most promising adaptations of SRI appears to be the use of raised beds as being experimented with under the Rice-Wheat Cropping Systems Consortium in India and Pakistan (see LEISA Magazine Vol.16, No.4, pp.8-10). These beds are elevated 10-15 cm above the bottom of furrows in which irrigation water is intermittently issued. This can give water savings of 25-30%, with positive effects on yield due to soil aeration.

Some SRI farmers who have compared direct seeding with early transplanting found no difference in yield, but some saving of labour. Zero-tillage with mulching and direct seeding is practised with very positive results by farmers in, for example, Japan (Fukuoka), Sri Lanka (Nava Kekulama, LEISA Magazine Vol.13, No.3, pp.20-21), Nepal (LEISA Magazine Vol.16, No.4, pp.11), and Cambodia (Box 2). SRI was developed for irrigated lowland production, but some of its principles and practices could be extrapolated to rainfed areas. Some experiments in Madagascar, of direct seeding instead of transplanting, and using leguminous shrub cuttings as a mulch instead of mechanised hand weeding, have given good results (4 t/ha) in upland rainfed cultivation. This is a new direction for SRI research.

Ratooning. Some farmers in Madagascar let their SRI rice regrow after harvest for a second crop. The yields are not as high as the first crop, 60-70%, but this is profitable since it saves labour otherwise required for land preparation, sowing and transplanting. In Thailand, some farmers do a second ratooning.

Pest management. With SRI, rice plants are well developed and healthy due to organic soil management, high soil quality and deep rooting, which makes them more resistant to pest and disease attack and drought. Other traditional, organic or Integrated Pest Management (IPM) practices could help to make SRI rice production even more pest and disease resistant.

Diversification, from monocropping to integrated rice-based farming. Some SRI farmers who have discovered that they can produce the same amount of rice on less land have started to diversify their rice farming systems by growing green manure or higher-value crops and trees on the land no longer needed for rice production. This provides a higher income and has some advantages for pest and weed control and for soil fertility management. Integration of fodder crops and improvement of animal production can be a next step. In fact, SRI can be an important entry point for developing integrated rice-based farming systems that combine high production and profitability with high resilience and ecological sustainability.

Adaptation and diffusion

SRI is a complex system, which implies many drastic changes of current farmer practices. To train farmers in SRI is not so difficult, but there could be various difficulties in practising it. It is not just a matter of diffusing a few standard practices but rather of spreading a more holistic understanding of how rice plants can be grown more effectively. As adaptation to local conditions is needed, **farmer experimentation** is an essential part of any strategy for the dissemination of SRI.

From a scientific perspective, precise and well-documented comparisons are needed, both to convince scientists and to gain a better understanding of the potentials and limitations of SRI. Standard systems of evaluation and statistical analyses are necessary for scientific credibility. As this does not always combine well with a process of group-based farmer experimentation, effective **methodologies for participatory technology development and assessment** can be very helpful (see for example LEISA Magazine Vol.15, No.1/2).

Adaptation and diffusion of SRI is a very strategic process. It is important to convince **top-level government people** of the efficacy of these new methods and where possible to get policy-level promotion. **Political backing** for SRI will probably be gained most quickly and strongly where there are enthusiastic farmers who support the methods based on their personal experience and who are able and willing to lobby on its behalf. Successful SRI farmers will certainly be more effective in talking to politicians than researchers.

There should be special strategies to convince **professionals** in agriculture, who often find it hard to accept this new methodology. The mention of super-yields attained with SRI (e.g., 21 tons/ha in Madagascar) is seldom believed by researchers even when yield component information is provided, so it may be best to *stress average yields*, not those that can be attained with best SRI practices.

As long as governments do not accept SRI, there is a need for **alternative strategies** of dissemination. Even where there is government acceptance, multiple avenues for evaluation and dissemination can be complementary. So far, **NGOs** have been most active in taking advantage of SRI potentials, particularly attracted to SRI for its pro-poor, environmentally-friendly features. **Farmer groups** often are very interested in experimenting with SRI and in providing farmer-to farmer training to their colleagues.

SRI could be combined well with **Community IPM** and **Farmer Field School** (FFS) programmes on rice as the philosophy of experimentation and human resource development is common. **Credit facilities** may be needed for purchasing tools, in particular weeders. These can be very cheap, but for poor farmers even small expenditures like this may be a barrier. This, in fact, is the only area in which SRI requires credit.

Conclusions still provisional, further information on internet

As most of the knowledge about SRI is quite recent, conclusions about it must remain provisional for now, pending more years of experience and wider utilisation of SRI in a greater variety of circumstances. Much research is still needed to understand the ecological processes involved and to develop a variety of best practices. More insight is also needed in the applicability and limitations of the approach and the possible risks involved. The initial results are, however, mostly very positive and give reason to suggest that more countries and more farmers should have an opportunity to evaluate SRI for themselves.

The proceedings of the First International Conference on SRI, including all papers, contact addresses, training materials and illustrations are accessible on an SRI internet homepage: **http://ciifad.cornell.edu/sri/** Printed and CD-ROM copies are also available on request. The internet will also be used for follow-up information and discussions. Please send experiences, both good and bad, and comments too!! SRI networks have been established already in Bangladesh, Indonesia and Philippines and are being set up in China, Sri Lanka and elsewhere.

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Box 4. Experiences with diffusion of SRI

Several participants reported on how the process of diffusion has proceeded so far in their countries. These experiences differed considerably from one country to the next:

- In **Madagascar**, SRI was introduced first by an NGO, Association Tefy Saina, through training and farmer-to-farmer extension, supplemented by booklets and radio. Subsequently there was also some involvement from the university and government. But most farmers have still been hesitant to try these radically new production methods, and the spread has been slow. No exact statistics are available on the number of farmers using SRI methods. This is at least 20,000, but the Ministry of Agriculture has estimated the number could be as high as 100,000 (10% of rice cultivators). Use is accelerating now that a larger and better-equipped NGO, Catholic Relief Services, is involved in SRI dissemination, with donor support.
- In **Indonesia**, dissemination is just starting after three years of evaluation by government researchers. SRI methods have been incorporated into a new official strategy for raising rice production (Integrated Crop Management) that is being supported on a national basis, expecting to make appropriate local adaptations. This country's IPM programme is also starting to work with SRI as this is very consistent with the agroecological approach and dissemination strategy used in its Farmer Field Schools.
- In **Sri Lanka**, SRI is reported to be spreading fast. Dissemination started with an article on SRI experiences in Madagascar printed in the Ministry of Agriculture's extension magazine in 2000 (30,000 copies were distributed). A researcher from Madagascar, Joeli Barison, had visited Sri Lanka to share his knowledge on SRI in January the same year. Agricultural officers and extension workers who tried SRI on their own accord got good results. TV and radio became interested, creating a process of dissemination that could not be stopped any more. Rotary weeders, since long forgotten, have been reintroduced, with fabrication instructions spread among local blacksmiths. One ecological rice farmer, Mr. H.M. Premaratna, became the leading SRI farmer, trainer and promoter, transforming his farm into a training ground (Nature Farming Centre) where more than 4,000 farmers have been trained. Unfortunately, some researchers in Sri Lanka have remained opposed to SRI, and official endorsement for dissemination has not been obtained yet from the Ministry of Agriculture. The previous Deputy Minister has been very supportive and has used SRI very successfully on his own farm (up to 17 t/ha yield). The present Minister has declared SRI to be an important cultivation practice especially suited for small farmers. A green light from the government is expected once there is more research results to confirm existing findings. Opportunities to export organically-grown rice that uses SRI methods have also helped to raise interest in SRI among farmers.
- In **Cambodia**, the NGO CEDAC has been working with farmers to disseminate and innovate the SRI approach since 1999. CEDAC helps farmers to understand the principles of SRI and to analyse the practices that keep rice from achieving its full potential. Now there are at least 2,000 farmers actively experimenting with SRI.
- In **Laos**, some small-scale NGO experimentation and evaluation with farmers has begun. The International Rice Research Institute (IRRI) programme in Laos has now taken the initiative to launch a national evaluation starting in June 2002. It expects to do three seasons of testing before making recommendations, but some farmers are likely to start using it more quickly if the initial results are good.
- In **Cuba**, some top-level officials became convinced about SRI at an early stage as it meets the country's needs to raise rice production without reliance on petrochemical inputs. Dissemination can go very fast here because of farmers' literacy and their need to find ways of raising rice production without expensive inputs. The first sugar cooperative to try SRI methods on one ha of land got a yield of 9.5 t/ha as opposed to the usual of 6.6 t. The next season, it got 11.2 t/ha from its SRI field, and is fully persuaded of SRI's merits, even though it was not yet using young seedlings or doing any weeding to aerate the soil. Just changing the regime of water management and using wider spacing with single seedlings made a big difference. In the current season, when 12-day-old seedlings were tried on a small plot, their superior growth after 40 days has persuaded farmers to start utilising the full system next season.
- In **China**, SRI evaluations have been done at various rice research stations. Chinese rice scientists are very interested in SRI methods as they can increase the already very high yields of super hybrid rice varieties. They have concluded that SRI is a good way to improve rice production in China, especially given the need to reduce water demands. But certain adaptations will be needed to suit Chinese conditions, where labour costs are high and organic fertiliser material is in short supply. A next step will be to encourage farmers to try SRI methods for themselves. In Sichuan province, researchers have taken SRI already to six different locations (agroecological zones). Many innovations being made in rice production, e.g. triangular planting system, seed inoculation, paper frames for transplanting, intercropping with glutinous varieties for pest control, could be useful outside China as well.

Wise lessons from Mother Nature

Ambarwati D. Rahayu and Rik Thijssen

Characteristics and processes of natural ecosystems can be used as the basis for designing sustainable farm systems. This is, however, conditional to proper observation and collection of information for learning about the beneficial features of nature, as well as in understanding the various natural processes. The international development organisation VECO collaborates in Indonesia with more than 40 local NGOs, spread over 7 provinces, on the development of sustainable agricultural systems that can help to alleviate food insecurity.

LEISA developments

In mountainous Indonesia, soil and water conservation is an obvious precondition for sustainable agriculture. Frequent losses by erosion not only oppose basic ecological principles of LEISA ("optimising nutrient availability and cycling") but also harm soil life and, therefore, affect the soil negatively, both quantitatively and qualitatively. When VECO partner organisations start a new agricultural programme with rural communities, soil and water conservation is, generally, a good starting point. After making an inventory of the local conditions during a PRA exercise, programme staff and farmers are 'fresh' and eager to get going, while the principles of building erosion structures are quite straightforward and, by now, understood by many. In this way some quick first results can be achieved which have an enormous impact on further LEISA developments.

Using the principles of agroforestry, shrubs and trees can be added to protect and stabilise man-made erosion control structures. However, in cases where soils are not deep and slopes rather steep, experiences from natural forests show that tall-growing trees can be a hazard, and are frequently the cause of landslides during the rainy season. Local farmers in the district of Mamasa, on Sulawesi, recognise this danger and, therefore, plant only shrubs on such slopes and frequently prune and lop the woody species, which tend to grow tall.

Cover crops are in most agricultural development programmes another means of curbing erosion. The soil-creepers, mostly leguminous plants, can also serve as soil fertility improvers. But what could be done in situations where soils are rather acidic and common cover crops do not grow well? Or in cases where cattle roam freely around and could destroy the cover crop by trampling or browsing?

Learning from local insights

Ethnobotanical surveys often provide important information and local insights with which such issues could be tackled. During an ethnobotanical study in the area of Balla Satanatean village in Mamasa District, an answer was discovered for the first question. Soils here are acid and farmers use lime to increase pH on their fields. The common, natural soil cover here is a creeping fern, *paken* (*Gleichenia linearis*), and large areas on slopes have been colonised by this "wire fern". Local *adat* (customary law) demands great respect for the functions of this plant and people will think twice before they do anything that might damage the protective 'blanket' formed by this fern. The soil-holding capacities of *paken* are so well understood that most farmers plant this species on dikes around their *sawah* (irrigated rice fields).

Farmers in Ngada District on Flores appreciate, already for a long time, the natural presence of the "weed" *putri malu* (*Mimosa diplotricha* or giant sensitive plant). This fast-growing species can provide a quick cover on fields between cropping periods or during a fallow. Covered with many small thorns, it is not a crop that invites animals, and people alike, to walk through. According to farmers it is not easy to clear *putri malu* afterwards, but they take that for granted since it is an excellent soil improver, cover crop and soil binder against erosion.

Another problem that many farmers on Flores face is very hard soils. Low in organic matter after continuous use, soil compaction makes it impossible to plough such soils. Women lament that they cannot grow vegetables or fruit trees near the homes because the soil has become as hard as a rock. Perhaps even worse, because in rocky places there are still some plants and trees that grow.

This last observation has been a challenge to the community. If plants can grow in the wild in places where there are only rocks, then why can plants not grow in their hard soil?

Pits of 30x30x30 cm have now been chiselled out and filled up with soil from other places mixed with organic material. Vegetables and fruit trees have been planted in this *olah lubang* (pit planting) system. The first results are promising and the hope is that by bringing back some life to this hard soil, the soil will eventually become healthy.

Maintaining soil fertility

To keep the soil in place is one thing. To keep soil fertility in pace with day-to-day agricultural requirements is another. Farmers in Indonesia are searching for alternatives to the chemical fertilisers they have been using since the Green Revolution started. Convinced that inorganic fertilisers have destroyed many of the qualities of their soil, and stressed because of the high prices of the chemicals since subsidies were abolished, farmers in the VECO programmes are, for instance, experimenting with liquid manure. This manure is made by fermenting large amounts of leaves of certain shrubs and trees in containers with water. After a few weeks, the concentrated liquid is diluted with water and used as a fertiliser on small rice fields, vegetable plots or young fruit trees. Reactions from farmers are all very positive. They observe good growth and more healthy plants. There is less damage by pests and products such as onions can be stored for a much longer period compared to produce from fields treated with chemical fertilisers.

During technical monitoring and evaluation meetings, the

Production of different crops using Urea (250 kg/ha) or compost (10 ton/ha)

Crop	Yield with Urea (kg/ha)	Yield with compost (kg/ha)
Rice	1,200	2,680
Maize	800	1,460
Groundnuts	975	1,125

Farmer innovation in compost-starters

During a study visit in 1998, to an extension institute in Bogor, the use of a commercial compost-starter EM4 ("effective microbes") was demonstrated to farmers from Bandungrejo village in Malang District, East Java. This technology, developed by a Japanese biotechnology professor, was, of course, tried by the farmers once they got home. The conclusion of the group was that the process of composting mixtures of rice straw and other organic waste was indeed accelerated by using EM4. Where it would take normally months for rice straw to degrade, the new technology took only few weeks!

However, the expenses of buying the litre bottles of EM4 were relatively high (about 25,000 Rupiah or US$ 2.80). One of the group members, Mr. Kusno, therefore decided to try to develop his own compost-starter. From their visit to Bogor, it had become clear what natural processes and components were important for a more rapid composting process. Mr. Kusno, who had ample experience with the fermentation of cassava roots to the local food product tape, reasoned that if the ragi ("yeast") used was able to make the hard cassava root soft, than maybe it would even be able to break down the fibres of the rice straw.

Using the ragi for making tape from cassava roots, they found it is possible to produce mature compost in only a matter of weeks. The compost was analysed by the Soil Laboratories of the Agricultural Department of Brawijaya University in Malang. A cost-benefit study was done and also proved very favourable - using compost could save almost 50% of expenses on chemical fertilisers. While it could even be lucrative to produce compost for selling, since production costs for 200 kg of compost was about 10,000 Rupiah, while compost was sold for 200 Rupiah per kg.

The results of the experimentation by Mr. Kusno and his farmer group has triggered off a complete new thinking about composting. After extension officers had shown them how to make the ragi themselves, farmers have also started experimenting with alternative ingredients to make effective compost-starters. While the ragi for cassava tape is based on micro-organisms from the roots of laos (Languas galanga), starters have now been developed using roots of other plants as well as over-ripe fruits.

Mr. Kusno died in 2000 at the age of 58 years. His work will always be remembered by the many farmers in Indonesia who implement 'his' technology under the name pupuk ragi Kusno (fertiliser from Kusno's ragi).

important soil processes concerning mineralisation and nutrient availability are explained and discussed. The accelerating effect that N and P fertilisers have on the decomposition of soil organic matter is always a hot item of discussion. Initially, a bonus effect is created by increasing the availability of macro and micro-nutrients to plant roots. On the longer term, this priming effect causes a larger fraction of the soil organic matter to be broken down annually. Arguably, this is the most important factor why the Green Revolution scored its early successes but finally caused serious problems for main soil qualities.

When confronted with this information, it is not so difficult for farmers to draw a parallel between the use of chemical fertilisers and the use of their liquid manure. Since the liquid fertiliser contains only water, nutrients and microbes, they can only agree that chances are high that similar priming effects could cause new problems, especially because of decreasing the content of soil organic matter.

Therefore, it becomes imperative that organic material of a certain quality is regularly added to the soil. The usual green manures are not applicable since research in alley cropping has shown that the easily decomposable leafy material from leguminous species contributes to a priming effect and does not add significantly to soil organic matter. Animal manure would be fine, but not all farmers keep animals while quantities of animal manure are often not sufficient. This leaves compost as the better option. Especially compost made out of fibrous material such as rice straw and alang-alang grass (*Imperata cylindrica*) could provide the necessary, long-lasting organic supplement for soils. Crop yields are significantly higher with the application of compost in comparison to inorganic fertilisers as seen in the table. Compost starters are popular amongst farmers and have become cheap and accessible due to farmer innovation (see box).

Conclusion

In order to imitate natural ecosystems in our pursuit of developing sustainable agricultural systems, we – development agents and the farming communities - should be prepared to observe well the many different components, and ingenious arrangements between components, that make up such a natural ecosystem.

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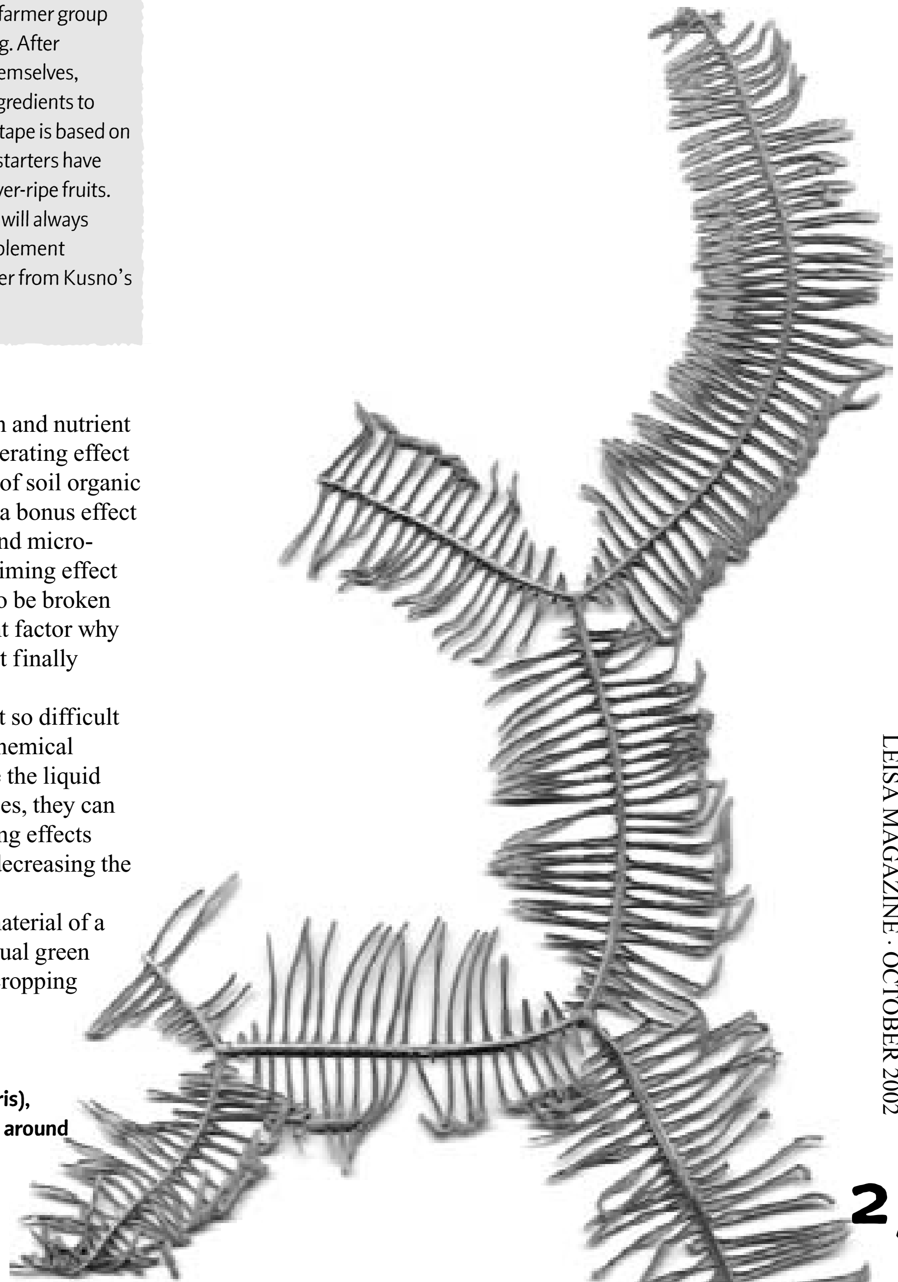

Farmers plant the creeping fern paken (Gleichenia linearis), a natural soil cover by traditional law protected, on dikes around their sawah (irrigated rice fields). Photo: the authors

Sustaining soil fertility: useful practices and methods in hill agriculture

FFS farmers' group discussing the quality of their soils. Photo: SSMP

Farmers in the hills of Nepal have, over the past centuries, developed complex farming systems based on a close integration of crop, livestock and forestry/grassland management. Manure derived from livestock is the main source of soil fertility management. About 32% of the fodder resources are derived from crop residues while the rest is derived from terrace risers, bunds and forests. Although fodder is in short supply and milk production is thereby reduced, farmers keep livestock partly for the purpose of manure production.

Farmers have constantly changed and adapted their farming systems over the past centuries as need and opportunities arose. New crops such as maize and potato entered the hills centuries ago and are now staple food crops contributing to food security. The expansion of fruit crops and vegetables is a more recent phenomenon improving food quality and farm income. At the same time, farmers have maintained traditional practices such as terracing, manure management, legume inter cropping, and mulching where appropriate.

Searching for innovation

The rapid intensification of land use, reduced access to biomass from public land, increasing access to input and output markets, new crops and cropping systems have exposed farmers to new challenges. Therefore, farmer-support organisations need to accelerate farmers' efforts to increase the productivity of the farming system with new practices and knowledge while maintaining its diversity and sustainability.

This article summarises experiences on the promotion of sustainable soil management of more than 50 governmental and non-governmental organisations under the common umbrella of the Sustainable Soil Management Programme (SSMP). More than 14000 households in 10 hill districts participated directly in project activities since 1999 through more than 1500 field trials or demonstrations per year. About 700 farmers participated in a recent evaluation of the programme. The major learning points so far are outlined below.

Technical opportunities for SSM

Various opportunities for improved soil management have been identified and confirmed with farmers over the past 3 years. For instance:

- ***Farm yard manure quality*** can be increased by better decomposition and the N-content can be increased by at least 2 to 3 times from about 0.5% N to 1.5% N through proper management of urine and manure. In particular, urine collection and the proper management of manure are new to most farmers, as many have initiated stall-feeding only over the past 1-2 decades. Previous recommendations for manure (use of starter, turning etc.) were derived from composting and proved to be too labour demanding and missed the importance of urine collection and N-preservation.
- ***Liquid manure*** can be prepared from urine and various plant extracts rich in minerals or secondary plant compounds. These "manure teas" were shown to be effective liquid fertilisers on crops such as vegetables and also for organic pest and disease management. Local marketing systems for such "manure teas" are emerging in some areas. The use of urea fertiliser declined in several areas due to liquid manure use.
- ***Increased fodder availability*** from fodder trees and grasses on private land has improved the fodder supply and quality for livestock. The quantity and quality of manure has increased (remember: about 80% of N in fodder is excreted through urine). Additionally the workload for fodder collection and transport, in particular for women, has been reduced.
- ***Legume cropping*** was not a successful intervention in many areas. However, it did expand considerably if the legume species was selected with farmers and well targetted to local ecological conditions and marketing opportunities. Groundnut has attracted, for example, the attention of farmers as a cash crop with local processing and marketing potential for women. Farmers have adopted Four-Season Bean, a climbing variety of *Phaseolus vulgaris*, as a vegetable and food crop.
- ***Multistorey Agroforestry*** systems have attracted farmers' attention in the case of inter cropping coffee (a new cash crop for most farmers), ginger, fruit trees, vegetable and fodder trees in the western and central region. Shade trees are essential for sustainable management of coffee plantations in minimising damage by stemborers, drought stress and low winter temperatures.
- ***High value crops with SSM*** such as fresh vegetables in areas with market access or ginger in more remote areas have stimulated farmers to care for their land and soil fertility. The initial doubt was whether short-cycle cash crops would contribute to an overexploitation of the soil and to a decline in soil fertility. However, field studies have confirmed that farmers increase their investment into soil fertility, if the information on the cash crop is delivered together with information on sustainable soil management. Fodder and manure production, for example, increased on these farms.
- ***Fertilisers*** may provide a response of at least 25-30 kg of additional maize yield per 1 kg of nitrogen applied if the fertiliser use is at low-moderate rates, correctly applied and well synchronised with crop demand. Farmers in accessible areas have started to complement manure with an inorganic fertiliser top-dressing. However, farmers' experiences on the correct type, amount, timing and placement of fertilisers in combination with indigenous organic manure management are still limited.

Technical challenges for SSM

Some major challenges remain to be addressed. We herewith invite readers to provide ideas and experiences on how to tackle the following challenges:

- ***Preventing the gradual acidification*** of soils is the most difficult challenge for sustaining soil fertility in the hills. At least one third of the soils have an inherent low soil pH and these soils will acidify further if inorganic fertiliser use expands and organic matter applications are reduced.
- ***Increasing phosphorous availability*** is another major challenge for SSM in the hills. Many soils have considerable P-reserves. A large part of the available P is linked to organic matter dynamics ("organic P") and the management of such P-pools, in particular in acidic soils, needs to be explored. Experiences with mycorrhiza application or P-mobilizing crops may be relevant.
- ***Organic pest and disease management,*** in particular of soil pests and soil-borne diseases, is required to manage soil fertility and soil health in an integrated approach. Experiences on the control of white grubs and red ant, in particular, and organic vegetable management in general are welcome.

Research over the past 5 years has confirmed the need for a combined use of different management practices to maintain or improve soil fertility under an "Integrated Plant Nutrient Management System" (IPNS). A joint effort between staff from the Nepal Agricultural Research Council, the Department of Agriculture, the Ministry of Agriculture and Cooperatives and various NGOs was initiated in 2001 to design and implement Farmer Field Schools on IPNS. Preliminary field trials indicate that the use of external inputs can be reduced to at least one half or can even be eliminated (using urine instead of urea) without yield reduction. More than 20 Farmer Field Schools on IPNS are under implementation in 2002.

Methodological opportunities

The promotion of SSM is not only based on technical interventions but is also a social process. Organisations working with SSMP use various approaches, methods and techniques in the promotion of SSM. Some have gone through a cycle of learning and improvements over the past years. This process continues, while the following conclusions can be drawn:

- ***Indigenous and new knowledge****:* Women and men farmers have confidence in their indigenous knowledge. New knowledge complements indigenous knowledge. Thus, methods of extension that build on discussion and interactive learning among farmers are most appropriate. Commonly known visual tools for soil characterisation (e.g. pH-paper, hydrogen peroxide, litter bags, erosion boxes) proved essential for stimulating discussion. The Farmer Field School approach for IPNS is centred around such a learning process.
- ***Soil fertility and land productivity:*** The farmers' concept of soil fertility is closely linked to land productivity as shown by various surveys. Farmers' interest in SSM-practices is much higher, if these are closely linked with complementary practices for increased soil productivity (e.g. vegetable plus better manure).
- ***Farmer-led experimentation:*** Farmers need to integrate new practices into their highly heterogenous hill farming systems. Methods of farmer-led experimentation were explored in 2000/2001 by some organisations. Simple experiments on inter cropping, crop arrangements, manure or urine use were most common. This proved to be effective in increasing farmers' role and commitment in the overall testing and diffusion process. Experiences were shared with others and over 30 organisations have started supporting farmer-led experimentation in 2002.
- ***SSM implications for women and men:*** Slightly more than 50% of all farmers participating in the field activities were women. However, this quantitative participation did not prove to be sufficient, particularly in more traditional communities. Thus, efforts were initiated to assess with farmers the implications of adopting specific SSM-practices for women and men farmers. This resulted in the identification of specific actions to address qualitative gender equity, which have become part of the strategy in a technically-oriented programme.

Methodological challenges

- ***Participatory planning, monitoring and evaluation (PPME):*** The introduction of new SSM-practices into traditional and complex farming systems is a gradual process of testing, adaptation and learning. Participatory surveys in project areas proved to be of a consultative character and were mostly dominated by staff of organisations. Additionally, surveys were quickly outdated by changes in opportunities and problems perceived by farmers. Thus, a regular process of PPME at the level of the farming community is considered essential to adjust projects to emerging needs and opportunities. SSMP supports this through annual work plans (Activity Proposals) and respective budget allocations to each project. However, the overall process of learning with farmers needs to be further strengthened. An exchange of experiences on PPME and on the integration of constant learning into project cycles would be appreciated.
- ***Farmer-to-farmer diffusion:*** As improvements of local SSM are a result of the integration of new and traditional knowledge and practices, experienced farmers turned out to be the best local promoters for SSM. Additionally, demand-led extension tends to be more effective and efficient than mandated extension. Thus, a new approach of farmer-to-farmer diffusion is under testing since 2001. The most experienced farmers received additional training so as to enable them to offer their services as local resource persons. A total of 400 farmers groups are expected to hire the service of these farmers with limited financial support by the projects. More needs to be learned about modalities to support demand-led farmer-to-farmer diffusion.

Governmental policies

Recent changes in governmental policies have in general been supportive of SSM. The termination of fertiliser subsidies, the recognition of organic amendments as fertilisers and the incorporation of IPNS into the Fertiliser Policy have set a new framework. The recognition and promotion of partnership between public and private organisations in agricultural development under various policy documents has set the stage for new institutional collaboration. Community forestry has strengthened the confidence in local management mechanisms. These changes were essential for creating a supportive environment. They coincided and were partly a response to a growing strength of civil society actors in the country. The gradual implementation and internalisation of such changes, however, does require continuous efforts and sometimes struggle.

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The paper summarises the work and experiences of many persons and organisations. For further information please contact: STSS, Department of Agriculture, Harihar Bhawan, Lalitpur, Nepal; or PSU, SSMP, GPO Box 688, Kathmandu, Nepal. Email: psussmp@wlink.com.np.

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A Farmer Field School group doing a situation analysis. Photo: Sally Bunning

Towards a holistic Farmer Field School approach for East Africa

James Robert Okoth, Godrick Khisa and Julianus Thomas

The Farmer Field School (FFS) experiential learning and self-help development approach has become very successful in Southeast Asia in improving irrigated rice production, even beyond Integrated Pest Management (IPM) for which it was initially designed (see LEISA Magazine Vol 17, No 3, pp 18-20). The approach is now also being used for IPM in many other crops (e.g. potato, see Sherwood et al, LEISA Magazine Vol 16, No 4, pp 24-25), for other focussed aspects of agricultural development e.g. Integrated Soil Fertility Management and even for more holistic community based rural development. It is spreading from Southeast Asia to South Asia and Latin America and, more recently, even to Africa. Adaptations of the approach are needed for each new purpose and each different situation. In 1999, the FAO Global IPM Facility launched an East African sub-regional pilot project for farmer field schools on Integrated Production and Pest Management (IPPM) in 3 Districts of Kenya, 3 Districts of Uganda and 2 Districts of Tanzania, to adapt the FFS approach to the East African context. In this article, the field coordinators of this programme report on the first experiences.

The specific context of East Africa

In East Africa agriculture is small scale and integrated, for both subsistence and market, combining multiple crops with several animal species and increasingly, with other economic activities. In the areas of Kenya, Uganda and Tanzania, where the programme is being implemented, rain comes in two seasons bringing between 600 – 2000 mm yearly. Maize, cassava, sweet potato, banana and beans are important food crops and maize, sugarcane, coffee, cotton and tea are the main cash earners. Most families keep some chicken, goats or sheep, and some have cattle. Population pressure is high, soils are increasingly depleted and eroded, and pests are very active. Economic opportunities outside agriculture are few and the HIV/AIDS pandemic is increasingly affecting agriculture. All this is putting a lot of pressure on farmers to find new sources of income and to adapt and intensify their farming practices.

A broad approach needed

A mono-crop (rice) and mono-focus (pest management) of the FFS, as practised originally in Southeast Asia, would not work in East Africa. Depending on the local situation, farmers have different priority issues on which they would like to work in improving their livelihoods. With integrated production and pest management as the entry point, the FFSs in East Africa have included other aspects that have a bearing on production and livelihoods in general. At the onset of the FFSs, farmers undertake a participatory prioritisation exercise during which problems are identified and available resources are mapped out holistically. This forms the basis for relevant inclusions such as: HIV/AIDS issues, basic principles of nutrition, reproductive health care, immunisation, malaria control, environmental management, financial management skills, farming as a business etc. As a result the FFSs in the region have evolved to a forum where community livelihood issues are discussed.

The IPPM curriculum includes growing a healthy crop in healthy soil, conservation of natural enemies, regular field observation and empowering farmers to become experts. During the season-long, hands-on training process farmers are exposed to different soil husbandry and production practices, ecological pest management, post-harvest handling, value addition commercialisation and more importantly rational decision making as regards crop management.

Programme implementation

In the first phase of the programme, core facilitator field schools were created. Local governmental extension workers and NGO staff were trained as first-line facilitators accountable to the District Extension Workers. These first-line facilitators initiated Farmer Field Schools in the regions where they were based. Now, after many Farmer Field Schools have been started, more and more farmers are volunteering as second-line farmer facilitators. Their motivation coupled with a better understanding of the community makes them more responsive to farmers' needs. As the farmers take on the facilitation of FFSs, the role of extension workers is shifting to technical backstopping and linking the groups to services.

The FFSs are established following a foci model (growing outwards from a nucleus). This has increased the level of interaction among farmers, enhanced the flow of innovations across the project area and led to better co-ordination. The model has also increased community interest because impact is visible. As a result, farmers groups have established FFS networks to take on the organisational lead and advocacy role at regional and national levels..

In the FFS groups farmers learn to make an agroecosystem analysis, a crop management decision process, a participatory problem and needs assessment and how to develop a vision on improving their livelihoods. They also learn how to write grant proposals for the activities they select to work on. On acceptance of the proposals by the programme small grants are transferred to the bank accounts of the groups. With this money farmers are able to "hire" extension workers and other resource persons who can provide the information and skill training they need. Farmers are motivated to create a culture of saving to refund the working capital of their FFS groups.

A questioning, sharing and learning attitude is stimulated to enhance participatory farmer experimentation and innovation. Exchange visits link FFS groups with other farmer innovators who provide farmer-to-farmer training on their innovations.

First results

In this way more than 1000 FFS groups of 20 to 25 persons each have been started. They are now very coherent, empowered to request services and to start up commercial activities that are partly self-financed. Farmers, resource persons and facilitators have shared their indigenous and scientific knowledge which has increased the farmers' understanding on, for example, the impact of pesticides on human health, how to apply pesticides in a safe way, integrated pest management or on integrated soil fertility management

Earlier, farmers tended to keep their knowledge to themselves and did not share it with extension workers. As the attitude of extension workers has changed, from top-down teachers to equal partners, farmers have started to trust and appreciate them for their contributions and willingness in solving problems. Thus many more farmers have been reached.

FFS groups are also being used by other government services as platforms for diffusing of information, e.g. on malaria and AIDS prevention. There also have been Field Schools on food security and health. So, the initial narrow focus on pest management has widened to a broad problem solving approach, and the network of FFS groups and innovative farmers is growing fast.

Practical applications and future plans

Some groups are working on the 'push and pull' system as developed by ICIPE in Kenya (see LEISA Magazine Vol 17, No 4, pp17-18) to increase their maize and bean production. Small farmers who did not have animals were not willing to replace beans by Desmodium or to include Napier grass in the system. Adaptations were therefore needed.

Other groups are looking at the locally available sources of nutrients, improved fallow, the use of Mucuna as green manure and compost making. The soil is observed routinely, and soil, plants and animals are analysed as an interactive and interdependent whole.

Groups working on mitigating the impact of HIV/AIDS increased their awareness of the problem, the need to take care of the sick and available coping strategies. They have developed ways of farming with less labour, e.g. shifting from banana production to other crops. Women's groups have started to work together and indigenous farming knowledge is being transferred to orphans who are expected to take care of the family plots.

In Uganda farmers are working on the extraction of oil from sunflower seed with the use of hand presses. In the next programme phase, the business aspects of farming and marketing of surplus production will be given attention. Marketing groups will be started, market information exchanged and the quality of the products improved, among others, by reducing pesticide use. In this way, groups will try to get higher prices for their products.

Constraints

The FFS approach is very new in East Africa and there are still some serious constraints. The necessary attitudinal change takes time and many facilitators still have limited participatory skills. Process documentation necessary to improve the Field School methodology is time consuming and often is not given enough attention. Practical information for farmers is lacking and the internal information flow of the programme often does not reach the facilitators and farmers. When the relations within the groups are not good, groups do not function well.

Prospects

Training of the professional FFS trainers is expensive. But overall, the approach is relatively cheap and cost-effective as the farmer facilitators are basically volunteers. Compared to the ineffective old extension system the results of the FFS approach are much better not only in terms of the numbers of farmers involved and increased production, but also in terms of education of the rural population. The good results are being acknowledged and appreciated by the governments but they cannot afford the costs of 300 – 700 USD/ Year (2 seasons) necessary for each FFS group. External funding therefore is needed. With financial support from the World Bank, GTZ, UNDP and IFAD, the programme will now be extended to seven other Districts in Uganda, five in Tanzania and seven in Kenya.

Even after this short pilot phase, the experiences in East Africa show that, where funding is available, broad-based Farmer Field Schools certainly are a very promising approach for farmers in Africa to increase and improve their agricultural production and livelihood conditions. ■

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Excellent groundnut growth around an eroding termite mound due to the much higher soil fertility. Photo: Joost Brouwer

Soil and crop growth variability can be an opportunity: examples from Niger

Joost Brouwer and Roelf Voortman

One of the most striking aspects of crop growth in the Sahel is its extreme variability. In one part of a field the millet or groundnuts may be lush and dark green. Only a few meters away hardly anything may grow at all (see photo). Is this good or is this bad? Or does it all depend on what you know as a farmer, and what you want, and what you are able to do?

We report here on a combined on-farm and on-station research programme at ICRISAT Sahelian Center near Niamey, Niger, that focussed on soil and crop growth variability. Many of the variability principles clarified in this research programme are also relevant to different parts of the world (see Brouwer and Bouma, 1997, a non-technical publication; Brouwer and Powell,1998; Voortman *et al.*, 2002).

Causes of soil and crop growth variability

Variability needs to be placed in the context of its environment. The overall slope of our terrain is only 1%. But the surface is covered with small rises and micro depressions, with short (2-20 m) slopes of up to 10%. Local soils, and thus crops, on these wind-blown sands in Niger are quite sensitive to periods without rainfall. Such intra-seasonal droughts are all too common during the rainy season, which lasts from June-September and averages 500 mm. The original vegetation was thorn scrub or very open woodland, which has now given way mostly to pearl millet fields and fallow. The millet is sown in pockets 1-1.5 m apart. Crop growth is also limited by the inherently poor soil fertility. Traditionally, the fertility of the millet fields closest to the villages was maintained through nutrient transfer: cattle, sheep and goats grazing in fallow and bush areas spent the nights on the millet fields, depositing their manure and urine. But there is no longer enough grazing land to satisfy the fertility requirements of the ever increasing number of fields.

In this setting, soil and crop growth variability plays a very important role. Physical causes of variability include micro topography, surface crusting and water availability, and the interactions of these aspects. Crusting affects seedling emergence, but also water availability: even on our very sandy soils, a slight slope with a slight crust can mean that as little as 30% of the rain infiltrates. A slight depression 5 or 10 m further on, and infiltration may be 300% of rainfall.

Needless to say, big differences in rainfall entering the soil cause equally big differences in leaching. In the depressions, soils are generally more acidic (pH-KCl of 4.0). On the small rises soil fertility is better, though still poor: the topsoil has about 0.3% organic matter, 120 ppm total nitrogen, 3 ppm available phosphorus and a CEC of about 1 meq per 100 g.

Both physical and chemical properties of the soil are influenced by biological factors: soil fauna and vegetation. Mound-building Macrotermes termites bring up less acidic and more clayey soil from lower layers to construct their mounds, and also incorporate plant and crop residues. Total nitrogen in the mound material can be as high as 3000 ppm, 25 times the content of the normal topsoil. Once the mounds have been abandoned, eroded and reworked by other termites, the crop growth on them can be spectacular (see photo). As much as 20% of a field had above average millet growth because of previous soil-enriching termite activity (Rotmans 1994). Trees and bushes also have their effects. Farmers in southwest Niger cut back *Guiera* bushes to reduce their water use and then sow millet more densely around the stumps, where the soil is more fertile. Under *Acacia albida* trees, which lose their leaves at the start of the rainy season, millet grows better because there is no competition for water, while shade from the bare branches lowers the soil temperature for sensitive seedlings. The trees can recycle nutrients from below the millet root zone, and manure left behind by livestock during the dry season also improves soil fertility. Indirectly, human activity can also contribute to crop growth variability: around wells and old dwelling sites soil fertility is relatively high.

What variability means to farmers and how they deal with it

Crop growth variability, much maligned in western agriculture, appears to have one great potential advantage to farmers in the Sahel: it can help stabilise yields (Brouwer *et al.* 1993). In years with good rainfall the best yields may be obtained on the higher, drier, but more fertile parts of a field. In years with poor rainfall, yields may be best on the lower, more leached but wetter parts of a field. Similarly, yields are usually higher on old termite mound sites and under *albida* trees. But as we have witnessed, the crop there may also develop too fast and wither during an intra-season drought, while the smaller millet plants in the open field survive and go on to produce normally.

Farmers react to spatial variability by differentiating their management. In better parts of a field the millet may be sown earlier and more densely, and certain parts of a field may be weeded first. The more demanding sorghum may be sown around termite mounds rather than millet. Sheep manure may be spread on eroded areas to help recover them. Branches may be placed on old termite mounds to speed up mound breakdown by attracting other termite species. Spatial variability may also be increased artificially, for instance by digging shallow holes to trap water. Small amounts of organic matter added as fertiliser also attract termites that improve soil structure ('zaï' technique).

Combining local and scientific knowledge

From what is stated above it might appear that farmers are already exploiting all locally available options for yield improvement. Indeed, there are those who say that the only way to improve agriculture in the Sahel is through external inputs. Such a statement ignores two facts:

- Firstly, for many farmers external inputs are unaffordable for the foreseeable future.
- Secondly, there are options that farmers do not know of yet, as they are based on processes they cannot observe, e.g. underground, or on ideas developed in other regions (Brouwer 1998). Here, scientists can assist farmers in making better use of their local resources. This may not result in enormous yield increases, but it can help buy time through small yield increases, thereby reducing pressure on the land. And that is an important aspect of sustainability: buying time so that one's options remain open for when circumstances change (Brouwer 2002). Besides, techniques that help make more efficient use of *local* resources can also help make more efficient use of *external* resources.

One of the things we found at Bellaré is that we are actually dealing with different wind-blown sand deposits (Voortman *et al.* 2002). The farmers already treat these deposits differently, for instance by sowing at lower density in part A. In part A soil surface sealing is a much bigger problem than in parts B and C. It may pay to look at ways of increasing infiltration there, e.g. chemically through addition of Ca or K, or with a grass mulch, making more water available for the millet.

On all three deposits there appears to be excessive manuring: more than 10 tons per hectare of manure plus urine are often found in the field, which leads to enormous annual leaching losses. Our findings suggest that it would be much more efficient to apply not more than 1.5 tons per hectare of manure, as evenly over the field as possible, every couple of years. This would allow regular fertilisation of a much larger area with the same amount of manure (Brouwer and Powell 1998, Voortman and Brouwer in press). In addition, in the relatively acidic depressions, cattle manure is quickly leached away and has almost no effect. It is better applied to the higher parts of the field. Sheep manure and urine, on the other hand, raise the pH of the soil in the depressions, and the slow breakdown of the manure pellets limits leaching losses. Our research suggests that spatial differences in effect and efficiency are also likely to apply to external inputs such as chemical fertiliser.

Ideas for the future

Our variability research has confirmed the rationale of certain current farmer practices in scientific terms, but it has also pointed to alternatives that deviate little from current practices and yet can improve efficiency of labour and input use. The challenge now is to take this further. If scientists know the locations in a field where nutrients are used most efficiently, can farmers devise ways to get them to the right place in the right amounts and at the right time? Knowing that young *albida* trees grow best near old termite mounds, can the survival rate of out-planted *albida* seedlings be improved? Knowing that mound-building termites can greatly improve soil fertility, can farmers and scientists together find ways of tilling the soil without discouraging the activity of these termites? And can they perhaps encourage these termites in areas where soil fertility is presently low? There are many ways in which indigenous farming systems may be fine-tuned, if farmers and scientists work together, really observe what is happening, and learn from each other. Only then can we truly understand how agro-ecosystems function, what role variability plays in them, and how productivity may be increased sustainably in the short term, even without external inputs.

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Integration of Soil Management in Farmer Field School Programmes in Uganda

The demand from smallholder farmers for help in overcoming declining soil productivity and low yields is increasing. The programme for Soil Productivity Improvement, Conservation Agriculture and Nutrient Monitoring using the Farmer Field School approach (FFS) is a response to this demand. Its objective is to provide farmers, their communities and service providers with better rain-fed land management skills and decision-making capacity to overcome soil productivity limitations, and to develop and adopt sustainable and economically-viable land management practices.

The pilot programme is being implemented in Eastern Uganda during 2002-2003, through a partnership of concerned governmental, non-governmental, research and academic organisations. The Africa 2000 Network, a recognised NGO in the agricultural sector, is conducting the pilot activities in four districts with over 20 existing FFS groups set up for the IPPM programme (see p.18).

The FFS approach is being adapted for soil management issues. Training materials are being developed and resource persons of various service providers are being trained. Soil Productivity Improvement (SPI) is interpreted in the broader and more holistic sense of "Integrated Land Management". It embraces the management of soils, including soil biota, nutrients, water, crops, pastures, vegetation, livestock and other living organisms, tailored to a particular cropping and farming system, with the aim of improving and sustaining soil fertility and land productivity. Conservation Agriculture (CA) principles and monitoring activities are also being introduced as an integral part of the farmer-driven research and development process.

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Integrated Soil Fertility Management

Opportunities for smallholders in West Africa

Henk Breman

Low soil fertility is the main reason as to why West African farmers deplete their soils. Integrated Soil Fertility Management (ISFM) provides a way to reverse this (LEISA Magazine Vol.16, No.1, pp24-25). ISFM aims at progressive improvement of soil quality and nutrient, water and labour efficiency through the combined use of soil amendments and inorganic fertilisers.

ISFM in practice

Experience shows that ISFM is effective in all climate zones having one or two rainy seasons, from the Sahel to Guinea savannah. In time, ISFM leads to improved agronomic efficiency of inorganic fertiliser, especially of N, but also of P. It usually takes 2 - 4 years or longer before this becomes visible to farmers in the form of increasing crop yields.

A three-fold increase of total millet biomass has been obtained in the Sahel, where five-fold fodder yield increases have been obtained. Similar fodder yield increases have been obtained in the Soudanian savannah. Maize yield increases due to ISFM are reported from the Soudanian, the Guinea and the Coastal savannah. While average farmer production is in the order of 1000 kg/ha, grain yields up to 6000 kg/ha have been registered with ISFM. Other crops that have reacted positively are sorghum and irrigated rice.

A whole series of soil amendments and related production systems in combination with inorganic fertilisers has been tested already. It concerns crop residues, manure, compost and household wastes, legumes and phosphate rock, agroforestry and perennial grass-crop rotations, leading to improved soil organic matter status. Part of the testing and validation is done in cooperation with rural development projects. An example is the use of a leguminous cover crop (Mucuna) in combination with local phosphate rock, to improve fertiliser use on a maize-cassava relay cropping system. An IFAD-funded project for village organisation and agricultural development in Southern Togo enabled IFDC to test and improve this ISFM option in 60 villages during 4 successive years. Such opportunities are exploited to develop and understand numerous options, to write and test technical advisory notes, and to develop a general guide on ISFM.

Strategic site selection

Three zones are distinguished in this context: 1 - zones where the use of inorganic fertilisers is already economically feasible; 2 - zones where the use of inorganic fertilisers can become feasible thanks to ISFM; 3 - zones where due to present fertiliser and crop prices, even ISFM cannot result in favourable cost benefit ratios for the use of inorganic fertiliser. Large parts of Africa comprise of marginal lands falling into zone 3.

For effective introduction of ISFM in zone 2, strategic site selection is a must. IFDC-Africa has developed two types of selection: Type I - for the choice of zones and villages, and Type II - for the choice of fields. Criteria for type I are the availability of inputs, relatively good production conditions, the accessibility of markets, and serious overpopulation with strong overexploitation of natural resources. The last criterion selects farmers with growing difficulties to make a living out of their land. Further resource depletion may be just enough for bare survival, but insufficient for courageous farmers seeking to improve their income and conditions. Such farmers are therefore very motivated to try new ways.

In West Africa, combinations of favourable conditions are found around cities with their market for cereals, fresh vegetables and fruits, in regions with intensive production of cash crops like cotton, and in regions with irrigated rice. Another example is regions with crop-livestock integration where intensification of animal husbandry through intensive fodder production is economically feasible. The Soudanian savannah, in particular, has strong comparative advantages for ISFM based crop-livestock intensification.

The IFDC-Africa approach exploits the opportunities created by favourable conditions within strategic regions, and aims for progressive inclusion of more marginal adjacent zones.

The second type of strategic site selection concerns the choice of fields at village and farm level. Practice shows that increasing cash income is the best stimulus for farmers to turn soil mining into sustainable production. Therefore, fertilisers and other external inputs have to be used on the best soils, not on the poorest or most depleted ones. Compound fields often offer the best chance of making fertilisers profitable. Farmers in Northern Togo succeeded in increasing maize production by almost 1000 kg/ha using 50 kg/ha of urea, while the same dose resulted in an increase of only 370 kg/ha on bush fields.

Participatory and holistic ISFM introduction

IFDC-*Africa* is introducing ISFM in a participatory and holistic way, working with farmers through NGOs, extension services and national research institutes. The process approach is indispensable: ISFM development can only take place through a careful integration of outside scientific knowledge and indigenous knowledge and experience, in particular where conditions are heterogeneous and the technology options are diverse and flexible. It is only by working together, evaluating progress and failures, and assuring that cooperation adds capacity to farmers and other stakeholders that progress can be made.

Investments are required to increase the capacities of farmers and other stakeholders, and to enable networking. Even for the relatively favourable strategic sites, ISFM can not be introduced without external financial support for credit, training and networking.

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A full version of the article is available on www.ileia.nl

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The effect of green manure is clear, but farmers have to find a way to fit it into their farming system. Photo: Henk Breman

Opportunities and constraints for Conservation Agriculture in Africa

John Ashburner, Theodor Friedrich and José Benites

Farmers in Uganda evaluating an animal drawn direct seeder. Photo: Alexandra Bot

It is only recently that government services and development organisations in Africa have become interested in Conservation Agriculture (CA), having learnt of its successful application in Latin America. International organisations including the World Bank, FAO, GTZ, RELMA and Sasakawa 2000, started supporting initiatives to introduce CA in Africa in the late 1990s. Early experiences have been positive although CA has yet to be applied in a manner that encompasses all its aspects. But it is very clear that for CA to eventually be adopted in regions of Africa, it needs to provide sustainable solutions to the many urgent problems that African farmers are currently facing. These include soil degradation, loss of soil fertility, frequent droughts, labour shortages, declining yields and the general drudgery associated with human-powered agricultural production systems. This article discusses some of the opportunities and constraints involved with CA.

Africa's tentative experiences with CA

Many traditional farming systems in Africa have characteristics closely resembling CA systems. Tillage is often limited to planting in holes, mulching is practised (using weeds, crop residues, grasses or green manure), as is direct planting with a hand hoe and a wide diversity of crops and trees are grown. In many commercial agricultural exploitations, conservation (or reduced) tillage and direct planting, combined with the application of herbicides has been widely practised in Eastern and Southern Africa for some time (*Biamah et al 2000*). In Zimbabwe for example, about 75% of the commercial farmers practice some form of conservation tillage (but this may now be in the process of changing). One of the first "No Till Clubs" was formed by a group of commercial farmers in KwaZulu-Natal in South Africa back in the 1970s (*Fowler, 2002*). Cover crops have been the subject of research for many years, as have more suitable crop rotations and ways to better integrate crop and livestock production. However, the impact and the practice of these techniques by smallholder farmers in Africa are still very limited.

Labour saving practices needed

Increasingly, labour shortages are seriously affecting the availability of farm labour in Africa. In many countries, the rural population is steadily being reduced through migration to urban centres. This particularly concerns the younger male population, meaning that those with the best potential for heavy physical work are no longer working on the land. The situation is being further aggravated by the HIV/AIDS pandemic that is so tragically striking many parts of the African continent. As a result, many African households are now headed by women who are experiencing tremendous pressure as they have to not only care for the household and family, but run all the farm operations at the same time.

For these and other reasons, it is now becoming even more essential that farming methods that conserve resources, reduce human labour requirements and significantly improve food security be adopted. CA scores high on all these points, as is described in the previous pages.

Issues influencing adoption

Although there is much potential for the adoption of CA systems in Africa, there are also many issues that affect the feasibility of its introduction and how its principles can be translated into location-specific, agricultural production systems. Some of these are summarised below.

Awareness of the problem by a critical mass of stakeholders is a major precondition for change, particularly if the solution requires dramatic changes in behaviour or practices. The perceived problem must be serious enough to provide the pressure and incentive for change. This is not always the case and many extension services that are accustomed to promoting good ploughing practices are not yet ready to reverse their philosophy and deliver a message favouring direct planting.

A general lack of knowledge is a major constraint, particularly concerning how best to introduce CA techniques and the need for appropriate equipment and inputs such as cover crop seeds and herbicides. Fortunately, there is already a wealth of knowledge available in some parts of Africa, notably in Zimbabwe, Tanzania and Zambia as well as in various parts of Latin America. In addition, there is much that can be learnt from traditional African agricultural production systems, including water harvesting technologies, direct planting, indigenous crops etc. When one considers the present situation in Africa and the rapid advances of CA in Latin America, one cannot but note the excellent opportunity for the development of South-South exchanges.

Lack of a local infrastructure to support the manufacture and repair of CA equipment. A limited range of CA equipment is being produced in Zambia, Zimbabwe and recently in South Africa, with limited distribution. Hardly any CA equipment is available in other African countries and importation from Latin

Knife roller drawn by oxen is a popular tool on small to medium farms in southern Brazil. Photo: Alexandra Bot

America is not an option, due to the low purchasing power of smallholder farmers. Preparing the way for more widespread adoption of CA in Africa will consequently involve strengthening the private sector and provision of appropriate credit facilities.

Land tenure is a critical issue influencing the adoption of CA, as stakeholder commitment to land management is likely to be serious only if there is clarity concerning land titles and property rights. The need for a permanent soil cover can compete with traditional arrangements such as communal grazing of farmer's fields after harvest. Where communal grazing is practised, few crop residues remain and farmers are generally unwilling to invest in growing green manure or cover crops. Solutions to this typical African problem have to be found, preferably by analysing the issues with all the stakeholders concerned.

A permanent soil cover is an essential aspect of a sustainable CA system but the availability of sufficient biomass, both in quantity and throughout the year, can create a serious problem in Africa. The reasons are many. In humid conditions, the decomposition rate of the biomass is very fast. In contrast, a lack of rainfall may constitute a constraint for biomass production. And the available crop residues are needed for animal feed, fencing, fuel and a myriad of other uses. For CA to be successfully adopted in such a context, crop rotations and cover crops must allow production of enough residues to meet all these needs. To help achieve this objective, shrubs or trees can be included in the production system, inter-cropped or planted as living fences.

The integration of livestock into CA systems is very important in Africa, particularly when livestock constitutes a major component of the local economy. Uncontrolled grazing should in any case be avoided if animal nutrition is to be improved. The annual seasonal feed demands of the livestock must be integrated into the design and planning of CA rotations so as to ensure adequate supplies. Specific measures that can be adopted include controlled grazing, zero grazing, improved pastures, forage conservation, improvement of the cut-and-carry system, etc. (*Mueller et al., 2001*).

Organisation of stakeholders so as to improve public commitment is another important factor for the introduction of CA in Africa. Use should be made of existing groups such as Farmer Field Schools (FFS) and exchanges between farmers can usefully be promoted through publicity campaigns, inter-community exchanges and study tours.

Awareness creation

In recent years, a number of international workshops have been convened and pilot projects to create awareness of CA techniques are now being implemented in several countries. The most recent workshop was held at Jinja, Uganda, in May 2002, where amongst others, a range of CA equipment suitable for manual use, with draft animals and with tractors was exhibited (photo p.13).

Work is also commencing in Swaziland and 24 indigenous legume species have been identified already in the Lubombo mountain region and are being studied for their potential for use as cover crops. The first animal drawn knife roller to be constructed in the country was demonstrated in July 2002 and it is planned to demonstrate CA production systems on pilot plots over the coming months. Other CA equipment has also been fabricated in Ghana and Uganda. Awareness creation in CA is also being undertaken in Eritrea and Uganda, whilst additional projects are likely to commence within a few months in Kenya, South Africa, Mozambique and Tanzania. Requests for assistance have also been received from Lesotho, Ghana and Guinea Conakry.

The African Conservation Tillage Network (ACT) was founded in 1998 with the objective of promoting CA and exchanging experiences amongst African practitioners. For this purpose, a web site has been established through FAO (www.fao.org/act-network, see p.30). The Animal Traction Network for Eastern and Southern Africa (ATNESA) is also playing an important role in the development of animal drawn equipment for CA in Africa (www.atnesa.org).

CA - opportunities in Africa

There seems to be an interesting potential for the site-specific application of CA principles in different locations of Africa, both in the humid tropics and also in the more arid areas. A major opportunity arises from the time saving and reduced drudgery of field activities, given the "feminisation of agriculture" and the HIV/AIDS problem. Another opportunity arises from what is considered to be its better mitigation of drought and adverse climatic situations. CA can provide an entry point for arresting the loss of soil fertility through its characteristic of integrated soil fertility management. In this way, it can also contribute to improved yields and enhanced food security.

But the wide-scale adoption of CA in Africa is still in its infancy and its long-term adoption will depend heavily on the human factor and a general willingness for major stakeholders to change. It should not be considered as the only solution, but the authors are of the opinion that, over time, it can make a significant contribution towards improved food security in the continent. ■

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The views expressed in these papers on CA are the personal opinions of the authors and do not necessarily reflect the official policy of FAO.

A farmer in the steep lands of southern Honduras using a planting stick to sow his maize in a mulch layer of fallow vegetation. Photo: Alexandra Bot

farmers produced more or less the same quantity as the year before.

Farmers are reporting increases in maize yield of a minimum of 60%. Even more important is that yields remain stable at a higher level for longer periods. The longest period fields have been under continuous maize production is seven years. These fields, with a slope of 35% and poor soil have an average production of 2.9 t/ha. Before, on the same fields, the best yield was 1.6 t/ha while the land had to be left fallow for several years after a two-crop cycle. Besides maize and sorghum the plot is providing the farmer with firewood and poles, which give an extra value to the production. Additionally, from the first year onwards, the farmer can rent his/her terrain for livestock grazing, because of increased stover production on the field. Usually this is done for two months. Efforts are still needed to integrate livestock production better into the system.

Rural development enhanced

The Quesungual system not only meets the household subsistence needs for fruit, timber, firewood and grains, but generates a surplus, which when sold on the market generates cash income. This change is just the beginning of a process of intensifying land use and increasing land and labour returns. Once the farmer feels comfortable with the enhanced food security (maize and beans), (s)he starts to diversify into crops for the local market or home consumption, soya, sugarcane, indigo, pumpkin etc., as well as small animals for the market such as pigs and chickens. Increased grain availability is accompanied by the improvement of the household post-harvest storage system. When basic grain security is assured, families begin to invest time in improving their living conditions and education, and devote time also to community organisation. Women's production cooperatives are now making dairy products. Farmer and trade organisations have also been established. The people themselves are now taking full responsibility for planning improvements in their communities.

Obstacles to adoption

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Experiences in El Salvador

Conservation Agriculture and rural development

Marcos Vieira and Jan Van Wambeke

Besides knowledge, technologies and supplies, adoption of Conservation Agriculture (CA) needs a favourable (policy) environment, motivation and participation of farmers and their communities. The presence of leaders and/or farmers' organisations is important for knowledge sharing and capacity building. The combination of all these parameters with CA at catchment level results in sustainable rural development based on the integrated management of natural resources.

Productivity and conservation

In Guaymango (El Salvador), about 85% of the land area is used for agriculture, and consists of small hills and slopes between 40 and 90%. Half of the agricultural land is used for pastures, the other half for crop production (mainly maize and sorghum). Monoculture, overgrazing, burning of crop residues and intensive tillage rapidly led to severe land degradation, low yields, poor nutrition and increased poverty in the early 1970s. Following the spread of the Green Revolution in wheat and rice, the thinking on research and extension in El Salvador was conditioned by traditional extension methods, combined with a "package" approach. The package disseminated by the Ministry of Agriculture, primarily during the late 1960s and throughout the 1970s, consisted of the following technology, according to Sain and Barreto (1996):

- use of hybrid maize seed,
- use of nitrogen and phosphate fertilisers,
- increased plant densities, through reduced row distances,
- application of herbicides and insecticides.

During a diagnostic appraisal that was held in the area of Guaymango in 1973, three major problems were identified: high poverty levels, food insecurity and recurrent health problems in the community. Based on this appraisal, it was concluded that low productivity of the agricultural system was one of the main causes of the high poverty levels found in the area (Calderon, 1973). Furthermore, it was concluded that the low quality of the soils caused by serious degradation in the area was the main reason for the low productivity of the agricultural systems. Based on these conclusions, an intensive programme was launched by the Ministry of Agriculture and several private and public institutions to increase maize and sorghum productivity and to improve soil conservation practices. A number of soil conservation measures were added on to the package mentioned above, based on zero tillage and improved crop residue management, and included the following components:

- no burning of crop residues,
- uniform distribution of crop residues over the field,
- use of living and dead barriers, and
- contour sowing.

The promotion of these measures was the starting point of a new phase in land management in the area, based on conservation tillage. Through this programme and later through land reform, farmers improved agricultural production, increased their net income more than 2.5 times and adopted "conservation" practices at the same time. Close collaboration between institutions and organisations participating in this programme was also an important factor, which has contributed to the successful adoption of Conservation Agriculture practices by farmers.

Integration of crop and livestock

The interaction of crop production and livestock within the agricultural production system is vitally important in understanding the adoption of conservation tillage practices by farmers. Livestock in the farming system is probably the most difficult challenge, particularly when there are other uses for crop residues than cattle feed, like mulching and soil improvement.

At the end of every crop cycle, the improved maize-sorghum system in Guaymango produces almost 10 tons of crop residue per hectare. At the end of the dry season, nearly 6-7 tons of crop residue per hectare remains for use as mulch. Compared to similar regions (2.3 tons per hectare) this is a substantially greater quantity and can be explained by three main factors:

- farmers here value the use of crop residue as soil cover more than elsewhere;
- the high economic importance of cattle in the farming system (number of cattle and duration of grazing period);
- the high degree to which a fodder market has been developed (trade of grazing rights).

The experience of Guaymango is one of the few that reports successful integration of the crop and livestock components of the farming system, without creating competition in the allocation of crop residues. The amount of residues produced by the system is enough to serve both the conservation purpose and as fodder for livestock (Choto and Saín, 1993). This is precisely why farmers do not sow hybrid varieties of sorghum in Guaymango, but local varieties that have a high straw/grain ratio (Choto et al., 1995) instead.

Farmers' perceptions

According to local farmers, the adoption of conservation tillage practices and the improved crop production technologies have induced a considerable change in their livelihoods. The most apparent differences are the increased yields - it has doubled and in good years even tripled; and the labour required for sowing has been reduced by 75%, which according to the farmers is because the soil has become softer and easier to work with. When residue burning was used to clear the fields, the soil was very hard and it took almost a day and 10 people to sow a hectare, compared to 5-6 people needed now in half a day.

The mulch effect of crop residues has additional advantages. According to the same farmers, it conserves more soil moisture, which allows them to harvest in dry years. It also prevents seeds from being washed away by rain showers, just after sowing, and facilitates rainwater infiltration. The decomposing mulch layer gives the soil a darker colour, which is usually an indicator of better soil fertility. The presence of more earthworms was mentioned as a positive change because 'their excrements are like fertilisers'. "Tilling the soil at this stage would mean destroying the existing fertility (residues and roots) and soil life", said one of the farmers.

After 25 years of managing crop residues optimally, some farmers are even applying less fertilisers to their maize fields than when burning residues was a common practice.

Pest and disease incidence has been reduced. One of the insect species, white grub ('*gallina ciega*') (*Phyllophaga* sp.), which was formerly reported as a pest in maize, is still present in the fields, but is no longer a problem. Farmers think that the larvae now feed on the roots and residues of the previous crop, instead of attacking the roots of the crops growing in the field. The mulch layer also prevents birds from feeding on recently sown seeds. The birds, which still visit the fields, are now a form of biological pest control, because they feed on caterpillars and larvae found in the crop residues or on the plants.

Full adoption after only ten years

The expectation of increased yields and the increased awareness of the value of appropriate crop residues management as a soil conservation measure are the main reasons given by farmers for not burning crop residues when preparing their fields. Although many farmers were initially sceptical about changing from burning crop residues to more conservation-oriented soil management, full adoption of the technological package was achieved in just 10 years. Both the successful agricultural extension programme and the link between practical recommendations, incentives and restrictions were key elements that induced this change in soil management. ■

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Table 4. Increase of yield and farm income with CA (in monetary units)

Covered distances (km) by man (m/f) for the cultivation of one hectare of maize, using animal traction under conservation agriculture and conventional tillage (Melo, 2000).

Operation	Conservation Agriculture	Conventional Tillage
Ploughing	–	40
Harrowing	–	15
Furrowing	–	10
Planting	5	5
Fertilisation	10	10
Knife roller	7.5	–
Weeding	–	30
Nitrogen application	10	10
Bending over of the cobs	10	10
Harvest	15	15
Total distance (km)	**57.5**	**145**

The Quesungual system in Honduras

An alternative to slash-and-burn

Luis Alvarez Welches and Ian Cherrett

Slash-and-burn agriculture is an efficient system as long as population pressure is low enough to limit impact on the tropical forest. As the rural population grows the cycle of land clearing becomes shorter, leaving little chance for the vegetation and soil to recover. The lack of fertile land pushes subsistence farmers onto steeper hillsides and into the more humid forests. This leads to accelerated deforestation and environmental degradation and land use becomes increasingly unsustainable.

In Central America, and especially in Honduras, slash-and-burn agriculture has been 'technified'. In an attempt to modernise basic grain production by small farmers, projects and NGOs have promoted credit, fertilisers and other inputs without changing the production system. The result has been even worse for the small farmer and the environment: the rural population has become debt-dependent and the process of deforestation and degradation of land and water resources has accelerated further. This has increased the vulnerability of the countryside to natural phenomena such as hurricane Mitch in 1998 when many died and rural incomes dropped dramatically (see LEISA Magazine Vol.17, No.1, p.18-20).

The Quesungual system

In the department of Lempira, one of the poorest and most isolated regions of Honduras close to the border with El Salvador, small farmers cultivate their land (1-5 ha) on hilly terrain, 200 to 900 meters above sea level. Supported by the Lempira Sur collaborative project initiated by FAO, a massive shift to a new production system has taken place over the past ten years. This system is called "*Quesungual*", after the village in which it was first developed. It is a Conservation Agriculture system with a tree component which allows small farmers to cultivate their land on steep slopes continuously while regenerating it.

The Quesungual system is an adaptation of an indigenous agroforestry system, which can be found in the dry tropical forest ecosystem (140-800 masl). This system is characterised by three layers of vegetation: mulch, crops, and dispersed shrubs and trees. It usually combines grain crops with naturally regenerated trees and shrubs with high-value/ multipurpose timber and fruit trees. A typical plot has numerous pollarded trees and shrubs and about 15-20 large trees: timber and fruit species. The diversity of species in the system is high (see table 3).

Burning has been abandoned, vegetation and plant density are controlled by hand and in addition some farmers use herbicides prior to sowing. Maize is intercropped with sorghum and beans, using zero-tillage, mulching and direct sowing technologies. The natural vegetation is used as a cover crop, in between the grain crops.

In the dry season, the trees and shrubs are pollarded at a height of 1.5-2 m, in order to eliminate the branches and regrowth, and to provide light for the future crop. The pollarded material is used as mulch to cover the soil. The branches and trunks, which can be used as firewood and poles, are removed from the plot. In general, high-value timber trees and fruit trees are not pruned. Farmers achieve an ideal density through the management of the natural regeneration. Before sowing the second crop (often beans) the field is cleared a second time but trees and shrubs are not necessarily pollarded. Mineral fertilisers are expensive and thus used only when maize and sorghum are both grown as first crop. Only once during the cropping season, weeds are cleared either manually or by using a herbicide. The crops are harvested in the traditional way (FAO, 2001).

Impacts on resilience, natural resource base and production

For the farmers it is the moisture retention qualities of the system that makes it so attractive. The agroforestry system retains 15% more water in the soil in the driest month (April) than the slash-and-burn system (8% humidity in a traditional field and 23% in a Quesungual field). This difference is equivalent to 20mm of rainfall, which means that crops can be sustained 20 more days without rainfall. And it is this difference that counts for the success or failure of a crop in a climatic regime with irregular dry spells during the rainy season.

Besides better infiltration of rainwater into the soil profile through the soil cover, the increase in soil moisture can be explained by the increase in organic matter content of the soil. The organic matter content was monitored during four years, in three different places, and increased from 2.4% to 4.5%. At the same time soil erosion has been nearly stopped. The loss of nutrients through erosion has been estimated to be more than 10 times lower in the Quesungual system than in the slash-and-burn. Taking into account only the nutrients, these losses represent US$34/ha under the Quesungual system, instead of US$396/ha, in the slash-and-burn system.

The improved soil conditions make the system more resistant to climatic phenomena. Compared to farmers who remained with the old system of slash-and-burn, the Quesungual farmers didn't experience a total loss in maize production during the dry period of el Niño in 1997. Even in the following year, when hurricane Mitch passed over Central America resulting in excessive rainfall and many farmers losing their crop for a second time, the Quesungual

Table 3: List of tree and shrub species found in Quesungual plots

Timber species		Fruit species	
Common name	**Scientific name**	**Common name**	**Scientific name**
Salmwood	Cordia alliodora	Guava	Psidium guajava
Guacima	Guazuma ulmifolia	Nance	Gyrsonima crassifolia
Honduras Cedar	Cedrela odorata	Plantain	Musa sp.
Guachipilin	Diphisa robinioiles	Cashew	Anacardium oxidentalis
Mahogany	Swietenia sp.	Avocado	Persea americana
Paradise tree	Simaruba glauca	Papaya	Carica papaya
Stinking toe	Cassia grandis	Mandarin	Citrus sp.
Orchid tree	Bauhinea sp.		
Almond	Andira inermis		
Mother of cocoa	Gliricidia sepium		
	Luhea seeamoinii		
Trumpet tree	Cecropia peltata		
	Lonchocarpus oficinalis		

(after Hellin, 1998)


A farmer in the steep lands of southern Honduras using a planting stick to sow his maize in a mulch layer of fallow vegetation. Photo: Alexandra Bot

farmers produced more or less the same quantity as the year before.

Farmers are reporting increases in maize yield of a minimum of 60%. Even more important is that yields remain stable at a higher level for longer periods. The longest period fields have been under continuous maize production is seven years. These fields, with a slope of 35% and poor soil have an average production of 2.9 t/ha. Before, on the same fields, the best yield was 1.6 t/ha while the land had to be left fallow for several years after a two-crop cycle. Besides maize and sorghum the plot is providing the farmer with firewood and poles, which give an extra value to the production. Additionally, from the first year onwards, the farmer can rent his/her terrain for livestock grazing, because of increased stover production on the field. Usually this is done for two months. Efforts are still needed to integrate livestock production better into the system.

Rural development enhanced

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Productivity and conservation

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Direct sowing through a cover of crop residues, avoiding ploughing and minimising soil disturbance: soybean grown under CA in Brazil. Photo: Sally Bunning

Planting concepts and harvesting good results

José Benites, Sandrine Vaneph and Alexandra Bot

In large parts of Latin America, Asia, Eurasia and Africa soil tillage by plough or hoe is the main cause of land degradation leading to stagnating or even declining production levels and increasing production costs. It causes the soil to become more dense and compacted, the organic matter content to be reduced and water runoff and soil erosion to increase. It also leads to droughts becoming more severe and the soil becoming less fertile and less responsive to fertiliser.

In the early seventies, farmers in Paraná, Southern Brazil, recognised that continuing soil erosion and declining crop yields were forcing them to abandon their land and move into a marginal existence. Their first attempt at changing this trend was to rigorously adopt conventional terracing systems. The mixed and often disappointing results led them to tackle the problem of erosion at its source, considering the direct impact of rainfall on the bare soil. They abandoned the plough, broke their compacted soils, introduced cover crops, stopped the burning of crop residues and developed cutting rollers to turn crop residues and cover crops into mulch. This mulch layer eliminated rainfall impact on the soil, reduced the speed and quantity of runoff and virtually eliminated soil erosion. It also significantly increased soil fertility and yields, and reduced the labour and cost of land preparation (Hercilio de Freitas 2000, see also ILEIA Newsletter Vol.11, No.3, pp.16-17).

This was in the early nineties, at the beginning of the Zero-Tillage (ZT) movement in Latin America. At that time '*conservation*'-, '*reduced*'-, '*no*'- or '*zero*'-tillage or '*direct planting'* in combination with herbicides was already being practised by commercial farmers, mainly in the USA. But it was only after ZT was combined with cover crops and crop rotation, adapted to tropical conditions, and improved herbicides and special equipment were developed, also for small farmers, that the tremendous benefits of this approach were widely appreciated and it spread faster.

At present, ZT is being practised on about 60 million ha, mostly in Latin and North America. In Latin America, particularly in Brazil, Argentina and Paraguay, some 25 million hectares have been converted to ZT in the past ten years. As the approach has become far more comprehensive than simply ZT, it is now being referred to as Conservation Agriculture (CA) by FAO and other organisations (see also LEISA Magazine Vol.17, No.3, p.22).

In Latin America, farmers, their organisations and networks took the lead in the development of CA. Government support was initially limited as ZT was not an officially recognised technology and researchers, extension agents, trainers and policy makers were reluctant to accept new ideas. Now, all this has changed and CA is developing fast due to effective collaboration between farmers, private enterprise, research and extension. CA has long passed the stage that it was only suitable for grain crops, like maize, beans and soy. Now, crops like sugarcane, cassava, tobacco, onion, tomato, cabbage and lettuce are all successfully grown under CA.

CA also fits into an increasing number of cropping conditions of large and small farmers in the humid and dry tropical, semi-tropical and temperate climate zones in Latin America, Africa, Eurasia and Asia. The FAO is playing an important facilitating role in promoting and further developing CA, among others, by its field projects, by actively supporting regional CA networks and by providing information on CA through its publications and web site. This article provides an overview of principles, practices, potentials, constraints and methodologies. The articles on p. 10 and 11 present two FAO-supported cases of CA in Honduras and El Salvador. The article on p. 13 discusses the perspectives of CA in Africa. Previous issues of LEISA Magazine have presented approaches similar to CA: New Kekulam zero tillage rice farming in Sri Lanka (Vol.13,No.3,pp.20-21); traditional mulch farming in Burkina Faso (Vol.15, No.2&3, p 37), traditional shifting cultivation and analog agroforestry (Vol.16, No.3); the Rice Wheat Consortium approach to CA in India and Pakistan(Vol.16, No.4, pp.8-10). Other cases can be found in (García-Torres, Benites and Martínez-Vilela 2001).

General principles of CA

Three technical principles are crucial in CA:

- ***No mechanical soil disturbance*** *– direct seeding or planting*
- ***Permanent soil cover*** *– particularly with the use of crop residues and cover crops*
- ***Judicious choice of crop rotations*** *– multiple cropping, agroforestry and animal integration*

The permanent soil cover provided by growing crops, crop residues or mulch not only protects the soil from the physical impact of rain and wind, but also stabilises the soil moisture and temperature in the surface layers. This zone thus becomes a favourable habitat for a number of organisms, including plant roots, worms, insects and microorganisms such as fungi and bacteria. This soil life uses the organic matter from the soil cover, recycling it into humus and nutrients, and contributes to the physical stabilisation of the soil structure, allowing air and water infiltration and storage. This process, which can be called "biological tillage", strongly enhances soil and water conservation and soil fertility. Mechanical tillage is avoided in order to maintain soil life and soil structure, and to reduce mineralisation of soil organic matter. A varied crop rotation is important to avoid pest and disease problems, improve soil conditions and make full use of the entire soil profile and the synergetic and complementary interactions between different plant species. Green manure/ cover crop species (leguminous and non-leguminous) that are part of the crop rotation are essential in building up the soil organic matter content. The soil cover also provides new habitats for natural enemies of pest and disease organisms. It provides a physical barrier to weeds and releases allelopathic substances that reduce weed germination. Thus a healthy soil which offers optimal physical, chemical and biological conditions for the growth and reproduction of plants is created.

Box 1. Key features of CA systems

- No ploughing, disking or seed bed preparation
- Green manure / cover crops are integrated into the cropping system
- Crop, weed and cover crop residues applied as mulch protect the soil permanently
- Direct seeding or planting
- No burning of crop residues or fallow vegetation
- No uncontrolled grazing
- Nutrient cycling through the biomass in and above the soil
- Surface application of lime and fertilisers
- Specialised equipment for seeding and mulch management
- Continuous use of cropland
- Crop rotations and cover crops are used to maximise biological controls

Specific practices

Many traditional shifting cultivation systems follow the above principles of slash and mulch. Uncontrolled burning (slash and burn) and grazing, however, works against these principles. There are no blueprints for the development of new CA systems and the general principles and key features (see box 1) have to be adapted to each specific agro-ecological, socio-economic and cultural context. The success of such a new system depends entirely on the creativity and flexibility of its practitioners in developing management practices suited to their particular situation and needs. Traditional practices and species, which are adapted to the local context, but abandoned due to reasons of low productivity, are often re-introduced with good results. Agrochemicals are not excluded, but low or decreasing quantities are used efficiently. CA often includes Integrated Soil Fertility Management (ISFM), Integrated Pest Management (IPM), Integrated Weed Management (IWM), agroforestry and crop/livestock integration, for which the three principles provide an excellent basis. The integration of trees and livestock into the system is especially important. CA can come close to or be completely organic.

Benefits are many

Permanent vegetative soil cover ***strongly prevents soil erosion*** and reduces the need for other soil and water conservation measures, bunding, terracing, etc. The increased soil organic matter content allows more water and nutrients to be stored in the soil profile, so ***more soil moisture and nutrients are available for plant growth***. The excess water filtrates to deeper soil layers, ***recharging groundwater supplies*** and reducing floods and sedimentation of waterways downstream. The water conserving effect of the soil cover and the increased organic matter result in an ***economisation of irrigation water***, as is shown in table 1.

With time, the accumulation of soil organic matter and the increased activity of soil micro-organisms lead to ***higher efficiency of organic and inorganic fertilisers*** and thus allow lower application rates. This saves costs and increases the profitability of in-organic fertilisers, thereby making them affordable to more farmers.

Increased soil moisture and soil fertility favours root penetration and development, which in turn ***boosts biomass production and crop yields***. CA is a successful strategy for ***ecological intensification,*** among others ***of shifting cultivation and slash and burn systems,*** which can evolve into permanent agroforestry systems, while burning is abandoned.

CA allows ***early and timely planting*** due to the absence of tiresome land preparation activities. The effects of the soil cover result in an agricultural system that is ***less vulnerable to drought, heavy rainfalls or other natural disasters.***

Also ***the risk, scale and frequency of weed, pest and disease infestation are reduced considerably***. Where chemical pesticides or herbicides are applied in CA, the amount needed often decreases with time as farmers gain skills and new ecological balances are established. Compared to conventional tillage, ***the use of chemical pesticides and herbicides is less*** in CA.

The improved workability of the soil and less agronomic activities during the production cycle ***reduce the labour requirement substantially*** (see table 4, p.12). This is especially important for those who rely only on family labour and in areas where labour is becoming a constraint because of deaths and diseases. The reduction in the on-farm labour requirement allows ***farmers*** to ***diversify their activities***, including processing of agricultural products, and thus improve their incomes. Besides the reduction in

Table 1. Economy of irrigation water through soil cover (Pereira, 2001).

Percentage of soil cover	0	50	75	100
Water requirement (m^3 ha^{-1})	2660	2470	2090	1900
Reduction in water requirement (%)	0	7	21	29
Number of times irrigated during season	14	13	11	10
Number of days in between irrigation	6	6	8	9

Table 2. Increase in yield and farm income (in monetary units; CA=Conservation Agriculture)

	Conventional Agriculture	CA Year 1	CA Years 2-4	CA Years 4-6	Year 6 and onwards
Gross output	2000	1800	2200	2300	2400
Total variable costs	1400	1300	1200	1100	1000
Gross Margin	600	500	1000	1200	1400
Total fixed costs	200	200	200	200	200
Net farm income	**400**	**300**	**800**	**1000**	**1200**

(FAO, in print. Conservation Agriculture. What you should know about... economic aspects of Conservation Agriculture. Training module. AGLL. FAO Rome.)

labour, the ***cost for land operations and maintenance of tools and equipment are also reduced***. Even where mechanical traction is used, CA leads to ***considerable savings in the use of fossil energy***. As CA also strongly contributes to carbon sequestration due to the increase of biomass in and on the soil, it could when applied at large scale, provide ***a major contribution in controlling global warming.***

All this contributes to ***increased and more stable yields and revenues*** (***up to double or even triple)*** which build up during a period of 2-6 years. Diversification of agricultural production also plays a role in ***improving the farmer's livelihood: less risks, increased income, improved diet, etc.***

CA provides a truly sustainable production system, not only conserving but also enhancing the natural resource base and ***increasing biodiversity*** without sacrificing yields at high production levels. Therefore CA is a major opportunity that can be exploited for achieving many objectives of the international conventions on combatting desertification, on biodiversity and on climate change.

Constraints and challenges

Conversion from conventional tillage to CA is not simple and poses many constraints that need to be resolved, demanding time, effort and money. It may include costs for purchasing specialised equipment and agrochemicals, possible temporary income decreases until the new dynamics are established, and a learning process by the farmer to acquire higher management skills. For many (small) farmers, a general lack of financial resources and lack of access to equipment, chemical inputs or green manure seeds can be serious limiting factors.

Tenure may also be a constraint in situations where most of the land is collectively managed and where land is accessible to multiple users often having contradictory interests in terms of land use, for example pastoralists and farmers. Farmers who have insecure tenure may be reluctant to adopt CA even though they see the benefits, because improving the soil productivity increases the risk of losing the land to more powerful persons in the society. This is a major problem for landless persons and female heads of households.

Pest, disease, weed or soil fertility problems could occur in the transition stage when the system has not yet stabilised ecologically. This may require the use of chemical pesticides, herbicides or fertilisers for which money could be a constraint. In moist areas for example, a major issue raised by the permanent soil cover could be pest and disease management. The crop cover may harbour small animals such as rats or snakes. In drier areas, the lack of biomass due to water or nutrient shortages and other uses of the biomass (livestock feeding, cooking) is often a major issue. Where population density is low and agriculture is marginal, availability and the cost of equipment and agrochemicals is a constraint. Social and cultural acceptability may also be a problem where CA differs substantially from the indigenous or conventional system.

Before starting with CA, it may be necessary to eliminate some major effects of degradation, such as compacted soil layers, plant nutrient deficiencies or heavy weed infestation. Subsoiling of compacted and degraded soils can, due to higher water infiltration, result in immediate yield increases of up to 30%, but may be too costly for small farmers.

Conversion from conventional tillage to CA calls for a drastic change of thinking. CA is based on agro-ecological processes and systems which require farmers to think in terms of ecological concepts such as soil as a living system, plant communities, nutrient flows, pest – predator and animal – crop – soil relations, etc. If farmers are unable to radically change their thinking and vision on farming, they will not succeed in making CA work effectively. This is not only true for farmers but also for technicians, extensionists and scientists.

Farmers who depend on their local resources may have a lot of traditional / indigenous knowledge that fits with CA. Often, extensionists and researchers find it difficult to accept indigenous knowledge and learn from and with farmers. For them, shifting to the concept of CA and a participatory way of working means a tremendous change. The resistance to change of researchers, academics and advisors can be much greater than that of farmers.

Box 2. "Friends of the Land" clubs in Brazil

In Brazil, the main obstacles for farmers in the adoption of Zero Tillage were the lack of knowledge, information and technical support. These obstacles were overcome through the activities of "Clubes Amigos da Terra" (CATs), non-profit, non-commercial and non-political farmer organisations. The operational basis of the CATs is farmer-to-farmer exchanges of experiences on a monthly basis and organisation of promotional events, such as field days and debates. CATs also organise on-farm research and pilot projects with the support of other organisations. An important factor for success has been the assistance which medium and large farmers, through individual CATs and the Brazilian Federation for Direct Planting, have provided to small farmers wishing to adopt ZT. Private sector support was fundamental to the expansion of ZT as well. In South Brazil, where ZT by small farmers is well developed, there are more than ten manufacturers specialising in ZT machinery for small farmers. Both in South Brazil and Paraguay, ZT systems that eliminate the need for herbicides have been developed, especially for small farmers.

Recently, the Landcare movement in South Africa adopted an approach similar to CAT in Brazil, advocating the establishment of local Landcare Groups which would conduct situation analysis, broaden their strategic understanding with a visioning process of CA, and then undertake participatory land use planning.

Farmer groups crucial for CA

Access to information, cover crop seeds, equipment, training and technical support is a prerequisite for successful conversion to CA. In addition, financial support, especially for small farmers, is often a major requirement to catalyse the conversion process. But, one of the lessons learned from Brazil is that new technologies spread fast only when farmers feel the need to change their practices and when they take the lead in technology adaptation and innovation. Simple extension of the message, even coupled with demonstration, usually will not suffice. Also, successful improvement of land husbandry depends not just on the motivations, skills and knowledge of individual farmers. The formation of farmer groups and associations or, even better, building on existing and active groups for testing and adaptation to local contexts and learning from shared experiences is crucial for CA to take off. In Brazil such groups have become action groups, transmitting the new ideas and technologies from farmer to farmer, stimulating and supporting members to make the change (see Box 2). In addition they have also become important local pressure groups, managing to obtain improvements at institutional and political level.

Strategies for conversion to CA

Specific conversion strategies are needed to make conversion to CA attractive and affordable to farmers. In Latin America, building up soil organic matter content in the soil with intercropped green manure / cover crops (associated with the normal cash or subsistence crops) over a period

Box 3. Principal mechanisms for mass conversion to CA

- farmer-to-farmer exchange
- extension activities
- commercial and NGO-sponsored events
- small farmer pilot projects
- technical assistance/promotion activities of private sector
- private and co-operative technical assistance
- NGO/government/private-sector publications
- press and television reports
- small financial inducements

of one to three years before moving to ZT is the strategy followed by most farmers. In this way the conversion takes place without loss in productivity, while costs (for tillage and equipment) already drop considerably (Rolando Bunch, Fallow Net email discussion on CA).

Farmers may have their own specific reasons for wanting to change their farming practices. These reasons can vary from community to community and from one social group to another within a community. This calls organisations working with farmers to offer specific entry points. Saving labour, increasing yield, reducing costs, drought proofing, improving health or the livelihood system in general can be appropriate entry points to start CA. It must be the farmers themselves who decide on trying out or transferring to CA and which entry point is most important for them. They should also decide on the use of external inputs: choosing between herbicides and mechanical weeding, and using fertilisers and lime to correct initial soil imbalances. Good information on potential benefits, opportunities and constraints is a prerequisite for farmers in making their choice.

Finding the right approach of facilitating a farmer-driven participatory conversion and technology development process while ensuring the communication of a very straight-forward technical message is challenging. It requires the support of convinced and capable extension workers and researchers. Often, low-cost or ecological options can be found for adaptation to the local context and resolving conversion problems, for example weed control with hand tools, cover crops and crop rotations; use of manure and biological nitrogen fixation; home-made "soups" for disease control; compost starters etc. (Barber 1999). Sometimes new innovations are needed.

CA started in many countries as a farmer-driven adaptation of a production system. But researchers and extension workers from both public and private sectors have played an important facilitating role in reaching a critical mass of farmers and generating knowledge and adaptations to the system as a whole or to equipment in particular. In addition the process has drawn sectors together and allowed the development of coherent integrated strategies and approaches (see Box 3) addressing crops, livestock, land and water resources, as well as infrastructure, marketing, education etc.

Involving the private sector

The large-scale shift to CA in Brazil and Argentina was possible among others due to close collaboration between innovative farmers and the private sector to develop and disseminate appropriate equipment. CA is challenging the existing private sector companies and local craftsmen/artisans to support the transition to CA systems. In particular, the testing, manufacturing and provision through local markets of required tools and implements. The same applies for cover crop seeds and associated herbicides plus spraying equipment, in case chemical weed management is chosen (see Box 4).

Exchange and networking

Access to information is very important in reaching a critical mass of CA practitioners, both within a country and between countries and organisations. Part of the information can be made available in the form of selected case study material describing CA experiences under different conditions. Researchers can gather in-country information on, for instance, validation of different cover crop species and testing and adapting of hand and animal drawn equipment.

The transfer of the concepts, principles and technologies of CA needs network interchange within and between countries, so as to facilitate sharing of known solutions to problems identified during the continual learning process. Such networks can accelerate the advancement of knowledge and techniques being steadily accumulated by both national institutions and community groups in their efforts to reverse land degradation on a global scale. For this purpose several regional networks -RELACO, ACT, SACAN and ECAN- have been founded in Latin America, Africa, South Asia and Central Asia (see Websites p.30) respectively.

Policy support

CA will only spread rapidly and widely when and where government policies, services and infrastructure facilitate the conversion to these systems. Policy support is needed to adjust legislation and to provide an enabling environment to meet the requirements and facilitate the initiatives of local groups and land users. This means an appropriate policy and institutional framework and the provision of incentives (pricing, markets, land reform, security, etc.). Existing incentives and subsidies should not jeopardise the implementation of the system. New incentive measures may be needed to encourage CA uptake, including the identification and multiplication of seeds and supply of equipment through public and private sector involvement. Financial support alone cannot boost a CA programme. It is essential to make the general public, decision and opinion makers aware of the social benefits of the adoption of these practices in order to gain the government's support for natural resource management initiatives of farmers.

Finally, international organisations such as World Bank and FAO, and OECD countries in their own right, should encourage a vigorous international and regional media campaign emphasising the importance and relevance of CA as an entry point to the process of rural poverty alleviation, food security, and environmental protection. Development of CA can only be achieved by integrated action at farm, community, national and international levels.

■

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- **Sandrine Vaneph** and **Alexandra Bot,** FAO.

Box 4. Development of equipment for CA in small farms

Even in 1990, there were few small farmers working with CA in Brazil. Although the general principles were broadly applicable, the planting technology for manual and animal traction had not been developed. It was pioneer research and small manufacturing firms, which resolved the problems of adapting the planting technology in direct collaboration with farmers. Equipment for direct seeding in mulch (e.g. jab planter or animal driven direct seeders), management of vegetative cover (e.g. knife rollers and slashers), spraying of herbicides (e.g. adapted knapsack sprayer) and mini-tractors were thus developed for small farmers (see illustrations on cover, p.3,13,14). Collective purchase and use of such equipment was stimulated, as CA allows for greater flexibility in the time of sowing.

Living soil -basis for Conservation Agriculture

Editorial

Conservation Agriculture spreading fast

Thirty years ago it all started with herbicide-based Zero Tillage (ZT) for grain crops like maize and soybean. Gradually a much broader and ecologically sound approach evolved, which is now being called Conservation Agriculture (CA). CA is based on reduced or no tillage, direct seeding and crop rotation. The soil is covered with a mulch layer of crop residue, green manure or cover crop, and herbicides or mechanical or natural methods for weed control are used when required.

Presently, many crops, e.g. sugarcane, banana, cassava, tobacco, rice, onion, tomato, cabbage and lettuce, can be grown in CA systems in humid, dry and temperate climates. CA is practised widely: from commercial, large-scale, relatively simple mechanised systems using herbicides, pesticides and inorganic fertilisers to semi-subsistence, complex systems with integration of trees and animals replacing slash and burn (p.10). CA is challenging farmers to produce in a more integrated and ecological way by following Integrated Pest Management (IPM), Integrated Weed Management (IWM), Integrated Soil Fertility Management (ISFM) or Agroforestry, or even to go organic.

The potential benefits of CA - reduction of soil erosion, more efficient use of inputs, important savings in labour, fossil energy and total costs, and increase in production - are impressive. CA has become one of the fastest spreading approaches in agriculture, not only in the USA and Australia but also in Latin America, where millions of farmers are practising it (p.6). The CA movement in Latin America is an important breakthrough in the acceptance and development of agroecology / LEISA. However, in Africa and Asia, despite some initial successes, practitioners are still few and far apart.

Different actors working together

The past decade has witnessed important advances in herbicide technology and in the designing of special equipment for mulching, direct seeding and spraying. Also green manure/ cover crop (gm/cc) technology is developing fast. Larger and smaller farmers in Latin America now have a wide choice of herbicides, equipment and gm/cc species, both leguminous and non-leguminous.

In Latin America, development of CA is strongly site and crop specific and driven by farmers' organisations with participatory support from research and extension. Private enterprise is playing an important role as well, especially in development, production and sale of herbicides, equipment and gm/cc seeds. FAO and many other international development organisations are strongly supporting CA.

Also multinational companies like Monsanto are investing in the introduction of ZT approaches to increase their sales of seeds and agrochemicals. They propagate high-external-input ZT based on direct seeding, monocropping and hardly any mulching of crop residue. They seem to offer an attractive opportunity to farmers but not without hidden risks. NGOs and a small farmers' organisation in the Philippines point at the risk of upland farmers getting too dependent on these companies and their costly and health affecting agrochemicals. It may also mean that farmers loose their own local seeds and end up with the genetically engineered seeds propagated by these multinationals. It is not at all necessary to take these risks when organic- and traditional seed-based alternatives are available at low cost as in the Philippines (Biotechnology and Development Monitor No.46, June 2001, p.13). It is therefore important to establish a clear distinction between low-external-input based Conservation Agriculture and high-external-input based Zero Tillage.

Africa faces many constraints to CA

For many years, CA (or Conservation Tillage as it is called in Africa) is being practised by commercial farmers, e.g. in Zimbabwe and South Africa, but only by a few small farmers. Adoption of CA and gm/cc is hampered by many constraints including those related to soil, climate, free grazing of animals and lack of biomass for soil cover at the end of the dry season, availability and affordability of equipment and herbicides, availability of gm/cc seeds, labour migration, community land tenure and lack of information (p.13). Still, FAO staff is of the opinion that, over time, CA can make a significant contribution towards improved food security, also in the dryer parts of Africa.

Traditional Conservation Tillage - entry point for CA

The practices applied in CA (zero tillage, mulching, direct seeding, crop rotation) are not new; many traditional systems have similar characteristics. Some examples have been published in LEISA Magazine Vol.16, No.3. Traditional Conservation Tillage is practised by many small farmers in the humid as well as the dryer parts of Africa, but is now under pressure. *The immediate future challenge is to build productivity enhancing improvements into these systems without destroying their unique advantages* (Kayombo, Elis-Jones and Martin, see p.33). These traditional practices can be good starting points for the development of small farmer CA systems (p.10).

In the ILEIA Newsletter's special issue 'LEISA in perspective' Vol. 15, No. 2/3, pp37-39, Hien reported on an interesting Conservation Tillage/mulch farming case now spreading on the Mossi plateau in Burkina Faso. Here, traditional mulching is used in combination with other traditional water and nutrient management strategies (planting holes, stone and grass contour bunds) and increasingly with composting, tree planting, production of fodder and intensification of animal husbandry. Recent studies (IFAD/GTZ-PATECORE) found that this ecological intensification trajectory is leading to resource conservation, increased yield and income, and improved social conditions in the villages (Haramata No.41, June 2002, p.9-10). Such cases may provide important learning points for development of CA for small farmers in Africa.

Integrated Soil Fertility Management a new chance

Breman (p.15) stresses the importance of increasing soil fertility, as a first among other measures, in combatting poverty in Africa. And, according to him, inorganic fertilisers have a key role to play in this. The International Fertiliser Development Centre (IFDC) has concluded that the conventional way of using inorganic fertilisers is not profitable in most places in Africa. IFDC suggests that Integrated Soil Fertility Management (ISFM), also called Integrated Plant Nutrient Systems (IPNS) or Integrated Nutrient Management (INM)), combining locally available natural nutrient resources and inorganic fertiliser, can change this. ISFM can double fertiliser use efficiency and increase water use efficiency and fodder and cereal production 3-5 times. IFDC-Africa now follows a Farmer Field School approach for participatory development of ISFM in strategic sites where benefits from inorganic fertilisers are highest. This is mainly on compound fields, around cities with markets for cereals, fresh vegetables and fruits and in regions with intensive production of cash crops like cotton or irrigated rice, or where intensification of animal husbandry through intensive fodder production is profitable. ISFM and CA can support each other very well.

However, in large parts of Africa, even as part of an ISFM approach, inorganic fertilisers still may not be profitable. Only more efficient and creative use of the local natural resources and ecological processes can provide improvements in such regions, for which there are still many opportunities. Hien's case from Burkina Faso mentioned above shows that mulching alone increased sorghum yield by 50 –75%. Researchers and small farmers in these regions can work together to improve traditional biological soil management e.g. through enhancing the activities of termites (Brouwer and Voortman p.16).

Farmer Field Schools for more holistic development

FAO concludes that small farmers in Africa have complex systems and a wide diversity of needs and opportunities. And for this reason FAO has started a pilot programme in East Africa for developing a holistic Farmer Field School-based approach for agricultural development (p.18). In this approach farmers analyse their situation and decide which entry point - soil fertility, drought proofing, pest management, marketing or even health - they want to work on. A special sub-programme is working with farmers on development of the FFS approach for CA, including IPNS (p.17).

Soil micro-organisms increasingly popular in Asia

Also in Nepal, farmers, researchers and development workers are working closely together in a Farmer Field School approach to develop IPNS (p.20). Farmers have identified several possibilities for improving soil management such as improvement of manure quality, increasing fodder availability, legume cropping, agroforestry, growing high value crops and using inorganic fertilisers. Liquid manure teas are becoming very popular and in some places are replacing urea on the local market.

In Indonesia, farmers are discovering that Mother Nature still has many wise lessons for them, among others, the effectiveness of creeping ferns and leguminous weeds to maintain soil fertility. Also here, liquid manure, biological extracts, Effective Microorganisms and compost starters are becoming popular. These are effective innoculants and boosters of micro-organisms which can considerably increase the efficiency and effect of organic fertilisers. However, Rahayu and Thijssen (p.22) also warn that these technologies, on the long term, can break down soil organic matter if not enough organic fertiliser is returned to the soil. Compost starters based on micro-organisms (yeast) from the roots of *laos* (*Languas galanga*) and other plants or from over-ripe fruits have revolutionised compost technology in Indonesia. A next step and challenge for agricultural development in Indonesia could be to develop Conservation Agriculture.

Feeding the soil instead of the crop

The importance of soil micro-organisms (mycorrhiza, bacteria, yeast, fungi, termites, earthworms, etc) and the potential benefits of technologies that make use of these micro-organisms is being better understood. One of the main learning points of CA is that for efficient, productive and sustainable agriculture, farmers should create favourable soil conditions and feed the biological community in the soil instead of only the crop (FAO Soils Bulletin 78). FAO has an interesting web page on how soil micro-organisms can and are being used by farmers (see p.30).

Farmers and researchers should learn to think in terms of 'ecological soil management' instead of conventional nutrient management, which has proven to be unsustainable.

Rice farmers eager to reduce inorganic fertilisers

The experiences with the System of Rice Intensification (SRI) (p.24) are confirming this conclusion. Experiments in many countries have proven that rice has the potential to produce more tillers and grains than now observed, and that early transplanting and optimal growth conditions (spacing, humidity, biologically active and healthy soil, and aerobic soil conditions during the vegetative phase) can fulfil this potential. Researchers cannot explain how such high yields can be obtained and sustained with modest amounts of (organic) nutrients. Further research on 'ecological soil management' is therefore still needed. Farmers in many countries are actively trying to adapt the basic SRI practices to their conditions and are developing innovations to make application easier and more effective. In some countries, farmers are even experimenting with no tillage-based SRI.

Time for governments to change their policies

The adaptation, innovation and diffusion process of SRI could become very similar to the participatory development process of CA in Brazil. Also in SRI, participatory development of appropriate tools is very important. The active role of farmers in

Soil life in good hands with SRI farmers. Photo: H.M. Premarathna

the development of SRI and CA shows their eagerness to return to more natural and less costly ways of farming. Now, organisations like the FAO and World Bank are strongly supporting CA and are confirming the need for 'ecological soil management'. It may be time for governments to change their policies as well. Countries like Brazil and Costa Rica (CA), but also Indonesia and Sri Lanka (SRI) are already leading the way.

The experiences with CA seem to confirm what the famous Japanese conservation agriculturist / natural farmer Masanobu Fukuoka stated in 1975: ***"whether or not farmers spread straw over their fields may well decide the fate of the agricultural land"***.

■

Coen Reijntjes

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Coverphoto
The matraca, or hand jab planter, being used to sow rice in the residues of the natural vegetation in Hojancha, Cost Rica. Photo: Alexandra Bot

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The editors encourage readers to photocopy and circulate articles. Please acknowledge LEISA Magazine and send us a copy of your publication.

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C O N T E N T S

ILEIA is the Centre for Information on Low External Input and Sustainable Agriculture (LEISA) in the tropics. ILEIA seeks to promote the adoption of LEISA through the LEISA Magazine and other publications. It also maintains a specialised information database and an informative and interactive website on LEISA (**http://www.ileia.org**). The web site provides access to many other sources of information on the development of sustainable agriculture.

LEISA is about Low-External-Input and Sustainable Agriculture. It is about the technical and social options open to farmers who seek to improve productivity and income in an ecologically sound way. LEISA is about the optimal use of local resources and natural processes and, if necessary, the safe and efficient use of external inputs. It is about the empowerment of male and female farmers and the communities who seek to build their future on the basis of their own knowledge, skills, values, culture and institutions. LEISA is also about participatory methodologies to strengthen the capacity of farmers and other actors to improve agriculture and adapt it to changing needs and conditions. LEISA seeks to combine indigenous and scientific knowledge, and to influence policy formulation in creating an environment conducive for its further development. LEISA is a concept, an approach and a political message.

6 Conservation Agriculture: planting concepts and harvesting good results

José Benites, Sandrine Vaneph and Alexandra Bot

Tillage is one of the main causes of soil degradation and low yields. Conservation Agriculture (CA): zero tillage, direct seeding, mulching, green manure/ cover crop production and crop rotation, with or without the use of herbicides, has become an enormous success in the USA, Australia and Latin America in the past decade. It is now being introduced in Africa and Central, South and Southeast Asia with promising results. The articles on Conservation Agriculture (p.6-15) discuss the concepts of and experiences with this approach in Latin America and Africa.

36 Experiments with spiders, ants and other indigenous practices

K.J.N. Gowtham Shankar

IDEA is working with tribal people in the northern Ghats in India. During documentation of tribal indigenous knowledge they found that social spiders were used to control stem borers in paddy. This practice, which was still known only to a few families, has now been disseminated to many farmers in the region who are now using Bulu also for pest control in other crops. This is just one of the many indigenous pest management practices documented and shared by IDEA. The tribal farmers in the region invite the readers of LEISA Magazine to exchange experiences with them.

DEAR READERS

This issue of LEISA Magazine is focused on three important approaches in agricultural development: Conservation Agriculture (CA), Integrated Soil Fertility Management (ISFM) and System of Rice Intensification (SRI). All three approaches are deeply rooted in 'ecological soil management' and move towards LEISA, agriculture that makes optimal use of the ingenuity of nature. The articles prove that farmers, who work with nature instead of against it, can produce high and sustainable yields. The articles also demonstrate the creative and innovative force of farmer experimentation and participatory development processes. Especially the development of Conservation Agriculture in Latin America by millions of larger and smaller farmers is a break-through in the development of agroecology / LEISA.

Part of this issue has been produced in close collaboration with the Conservation Agriculture Working Group of FAO. Their support is very much appreciated by ILEIA.

The editors

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Magazine on Low External Input and Sustainable Agriculture

Recreating living soil

Despite advances in telecommunication, printed magazines remain the only source of information for many people (Lalomama, Ethiopia). Photo: Flemming Nielsen

Story of a tattered newsletter

Ann Waters-Bayer

The young man, a recent university graduate, has enthusiastically started his first job as agricultural advisor with a local NGO. He works "in the bush" (although there are precious few bushes there), in a dry and dusty area with no paved roads, no telephone, no short-wave radio. In the NGO office in the regional capital, there is a computer, but no modem.

He is based 350 km from the capital. After dark, he has electricity for five hours. It is hard to read the small letters of the newsletter in the dim light. Nevertheless, he continues reading, because the article is about farmer-developed methods of harvesting water, methods that would interest farmers in his area.

In one village is a youth group that is particularly keen on experimenting with new ideas. He lends the newsletter to the group leader. By the time the newsletter is returned, it has passed through several hands. Comments by the young people reveal that they have read not only the water harvesting article but also several others. The village has no library, no bookshop, no newspaper. They have nothing new to read, except this. The NGO advisor explains that the newsletter is available free of charge. The group would have to arrange that it be brought somehow from the post office in the capital, because there is no postal service to the village, but the NGO vehicle often comes from the capital, so that's a possibility.

In the Networking section of the newsletter, a website is mentioned. One of the young women had seen a website when visiting her sister, a secretary with an international aid agency in the regional capital. It took a long time until the colourful pictures appeared on the computer screen. But then they disappeared again. Her sister explained that it was difficult to "stay connected". The young woman couldn't bring the pictures back to show in the village. Something had been written with the pictures; she couldn't recall what. But she has read the newsletter twice, happy also to practise her English, and has discussed it with friends.

The youth leader shows the article to the village development committee. The committee head asks the NGO advisor if the work described in the article can be visited. The advisor says it is too far away, but a friend who also read this article knows of farmers in this very region who are doing something similar. Maybe the NGO vehicle could be used to take some members of the development committee and the youth group to visit these farmers.

Low-external-input technologies and farmer experimentation to adapt new ideas to local conditions are most needed in the more marginal and risk-prone areas of rain-fed farming. Information about such technologies and experiences can stimulate local innovation. When we in the North spend much of the day communicating with our computers, we can get carried away with the wonders of the new information and communication technology, like children with new toys. In large parts of Africa, when you leave the cities, when you reach the more remote areas, when you see a well-worn and well-read copy of an old ILEIA newsletter as I did recently in Ethiopia, you are brought down to earth.

This is a plea to all information and networking services and donors: in your enthusiasm to explore new paths in electronic communication, don't forget that a large number of people who are hungry for information still depend on the printed and spoken word. Please don't starve them.

■

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Issue 18.4, December 2002

Feminisation of agriculture needs appropriate responses

The feminisation of small and marginal agriculture is increasing rapidly in many parts of the world due to processes such as labour migration, part-time farming, urban life focused education and HIV/AIDS. This has an enormous impact on women, their households, rural communities and farming. Supporting women in their role as farmers requires many changes and adaptations. These relate to property rights, access to productive resources as well as to adaptations, i.e. decision making, labour division, crop management, animal husbandry and production of tools. Also research, extension, information management, input supply, financing and marketing etc. have to become more women-focused and have to develop methodologies and procedures adapted to the specific conditions and needs of women. Often, women as the main managers of change have to cope with ecological degradation. What specific needs do women in such conditions have and what adaptations have been developed by women to cope with these processes? What are the experiences of participatory programmes that have been supporting women to cope with change? What are good examples of technologies and methodologies suited for use by and with women? We invite you to share your experiences on these and other relevant questions with other readers of the LEISA Magazine. First deadline for contributions 1st of September 2002.

You are invited to contribute to these issues with articles (about 800, 1600 or 2400 words + 2-3 illustrations and references), suggest possible authors, and send us information about publications, training courses, meetings and websites. Editorial support is provided by ILEIA. Authors of published articles are entitled to a standard fee.

Actor-led change for efficient agrifood systems : handbook of the participatory actor-based CADIAC approach by Bourgeois R, Herrera D. 2000. 136 p. ISBN 979 9317 10 X EU 22.87. Regional Coordination Center for Research and Development of Coarse Grains, Pulses, Roots and Tuber Crops in the Humid Tropics of Asia and the Pacific (CGPRT)
CIRAD, Avenue Agropolis, 34398 Montpellier Cedex 5, France / librairie@cirad.fr ; www.cirad.fr. (CGPRT Centre Monographs no. 39).
This book is intended as a practical handbook for scientists, analysts, and students working on the definition and implementation of policy changes that contribute to real economic and social agriculture-based development. The objective is to promote competitive and sustainable agrifood systems that broadly benefit society.

The commodity-chain analysis and action-oriented dialogue approach (CADIAC) is meant to be a tool to achieve policies, measures and actions that contribute to improving the competitiveness of agriculture. This handbook presents and describes the CADIAC method and ends with the formulation of concrete proposals. The book is also available in French and Spanish. (WR)

Land rights under pressure : access to resources in Southern Benin by Edja H. 2001. 23 p. ISBN 1 899825 82 7. International Institute for Environment and Development (IIED), London. GRET. (Land Tenure and Resource Access in West Africa). SMI (Distribution Services) Ltd, P.O.Box 119, Stevenage, Herfordshire SG1 4TP, UK / orders@earthprint.co.uk
This paper forms one of the four 2001 outputs of the series 'Land Tenure and Resource Access in West Africa'. The objective of this IIED series, jointly financed by DFID and GRET, is to enhance the research capacity of West African researchers and their institutes and to further the level of knowledge on land tenure and resource access issues in West Africa and their implications for policy and practice contributing to sustainable development. The French version of this series can be obtained GRET.

Rising population density and degradation of soils increase the pressure on land, which in itself often causes degradation, and is one of the main constraints in the West African region.

This report about Benin examines the diverse set of arrangements by which people gain access to land and trees, through a widespread system of rental, loans, sharecropping, mortgage and guardianship contracts.

The other three papers are about access to land in the cotton zone in Burkina faso, land management in Ghana, and share contracts in Ghana.(WR)

The Prosopis juliflora - Prosopis pallida complex : a monograph by Pasiecznik NM [et al]. 2001. 162 p. ISBN 0 905343 30 1. HDRA, the organic organisation, Ryton Organic Gardens, Coventry CV8 3LG, UK / kcadoret@hdra.org.uk
This is a manual with information and research on the Prosopis genus, and specifically on the two most widespread species in tropical regions, *Prosopis juliflora* and *Prosopis pallida*. The two species are covered together due to continuing taxonomic confusion, and similar biology, ecology and resource characters. Native to South America they are now widespread in many arid and semi-arid areas in Africa, the Middle East, Australia and Asia. Prosopis trees are a valuable source of fuelwood, timber, animal fodder, bee forage, medicines and other raw materials to local people.

The monograph is divided into five chapters. Chapter 1 - People and Prosopis, contains sections on Prosopis as a resource, the history of exploitation and world Prosopis distribution in the year 2000. Chapter - 2 The species, includes systematics and nomenclature, a description, biology, ecology of, and environmental requirements of the Prosopis juliflora - Prosopis pallida complex. Chapter 3 - The complex as a resource, provides information on Prosopis as a source of fuel and wood, fruit, foliage, plant extracts (honey) and other benefits. Chapter 4 - Husbandry and management, includes nursery propagation, field establishment, stand management, and exploitation of the resource. Chapter 5 - Recommendations, covers use of improved genetic material, improved management, development of processing technologies, commercialisation of Prosopis tree products. An extensive reference list is included.

The genus Prosopis : a reference database 2001. HDRA, the organic organisation, Ryton Organic Gardens, Coventry CV8 3LG, UK / kcadoret@hdra.org.uk ; www.hdra.org.uk.
The reference database is distributed with the monograph and contains 6443 non-abstracted references. It is the largest single collection of references covering the genus Prosopis. Each reference has been keyworded from a selection of 41 subject areas for ease of searching.

The above publications together are a useful resource to anyone working specifically with Prosopis, especially to research and development workers, students and land-users in the worlds arid and semi-arid zones.

Bamboo in the high forest of Eastern Bhutan : a study of species vulnerability by Messerchmidt D, [et al]. 2001. 32 p. ISBN 92 9115 314 1. International Centre for Integrated Mountain Development(ICIMOD), GPO Box 3226, Kathmandu, Nepal / www.icimod.org ; distri@icimod.org.np
This booklet is a clear case study from eastern Bhutan on how policies that ignore traditional forest and species management systems that have evolved, and worked well from generation to generation, do so at the risk of the disappearence of not only sustainable locally acceptable management and harvesting systems, but also at the risk of species disappearing. Bamboo is an important alternative forest resource harvested from the high forests of Bhutan. This study was conducted to determine the significance of bamboo in the local subsistance and commercial economies, with particular attention to factors affecting the risk of extinction of the species. (WR)

Ten million trees later : land use changes in the West Usambara mountains : the soil erosion control and agroforestry project in Lushoto district 1981-2000 by Johansson L. 2001. 163 p. USD 15: GTZ, Dag Hammarskjöld Weg 1-5, 65760 Eschborn, Germany / www.gtz.de
Can be ordered from www.maneno.net ; lars@maneno.net ; secap@tanga.net.
The first chapter can be downloaded from www.maneno.net
'Ten million trees later' tells the story of the SECAP project towards the background of dramatic land use change in Tanzania. It combines an account of project activities over a twenty-year period with a discussion of underlying theories and a critical analysis of the achievements. The book was written for two different kinds of readers: people who live, work or visit in Lushoto District, and as a case study for people who study or work with rural development. Most of the chapters can be read independently, which is why main ideas and conclusions re-occur in different forms. It starts with the description of the case study. The following chapters provide the historical context and describe

how the project changed over the years. Chapters five to eight discuss the different sectors and technical aspects for readers working with development or extension, like soil conservation, livestock and forestry. In the end, the author summarises the lessons learnt. This very interesting long-term case study is well illustrated with colour photographs, maps and charts, and written in an appealing style. However, it lacks an index and a list of references.

Water rights and empowerment by Boelens R, Hoogendam P (eds). 2002. 256 p. ISBN 90 232 37641 : EURO 25.00. Van Gorcum, PO Box 43, 9400 AA Assen, The Netherlands / assen@vangorcum.nl.

In the Andean region, most irrigation systems have been built by local users, organised into peasant or indigenous communities, who also manage their own systems under collective control and norms of their own.

This book emphasises the issues of internal water rights within irrigation systems, but since collective rights between irrigation systems or between these systems and other types of water users are becoming increasingly important, a chapter on collective rights within the context of water management in watershed or catchment areas is added. Further chapters reach beyond the system level: discussing the issue of local collective rights regarding other normative frameworks, regarding other groups of local, regional or national interest, within the perspective of national legislation. With this book the authors seek to contribute to the development of methodological proposals that strengthen local water control and empower peasant and indigenous communities. Recommended. (WR)

Review of the agricultural knowledge system in Fiji : opportunities and limitations of participatory methods and platforms to promote innovation development by Bachmann L. 2001. 275 p. ISBN 3 8236 1350 2. (Kommunikation und Beratung, Sozialwissenschaftliche Schriften zur Landnutzung und ländlichen Entwicklung 44). Margraf Verlag, Postfach 1205, 97985 Weikersheim, Germany margraf@compuserve.com.

The author describes the articulated agricultural knowledge system of the small island country Fiji. The focus of this study is the agricultural research and extension department of the Ministry of Agriculture. A participatory action research methodology was used to investigate the potential of participatory methods to improve information flows between farmers and the ministry, in order to achieve systematic user integration in the knowledge system. Furthermore, several project cases were analysed to investigate the potential of platforms, to bring together different actors, and to improve innovation development and diffusion. The book provides methodological tools for tackling the complex issue of agricultural development. By promoting multiple perspectives, better integrating farmers and their knowledge through participatory methods, and the use of platforms as joint learning opportunities for all relevant actors, the book highlights new ways for innovation development, and improves the chances for wider adoption.

Managing manure to sustain smallholder livelihoods in the East African highlands by Lekasi JK [et al.]. 2001. 32 p. ISBN 0 905343 336. Henry Doubleday Research Association (HDRA), Ryton Organic Gardens, Coventry, CV8 3LG, UK / kcadoret@hdra.org.uk
ILRI, KARI.

The scope of this research report on manure management in the central Kenyan Highlands was to evaluate manure management options that could best conserve nutrients and improve manure quality. Livestock make an important contribution to the sustainability of intensive smallholder farming through their contribution to soil fertility. This research shows that increases in crop yields on smallholder farms gained from simple techniques for better care of manure during collection and storage, can be substantial and enduring.(WR)

Negotiating poverty : new directions, renewed debate by Middleton N, O'Keefe P, Visser R (eds.). 2001. 239 p. ISBN 0 7453 1822 3. ETC International. Pluto Press, 345 Archway Road, London N6 5AA, UK / www.plutobooks.com

This policy document on global poverty provides a critical account of Western aid policies. With contributions from leading academics and activists who debated with the politicians, it offers a radical analysis of the real issues. The authors argue that before any effective strategy can be put into action, the poor themselves must be included in the debate. For those in the developed world, resposibility must be taken for contributing to the creation of poverty before it can effectively be eradicated. Chapters cover the aims and framework of poverty reduction; the role of the global market; the problems of employment; human security; environmental security; legal aspects; and the practical problems of implementation.

Paysans du sertão : mutations des agricultures familiales dans le nordeste du Brésil by Caron P, Sabourin E (eds.) 2001. 243 p. ISBN 2 87614 449 2 EU 39.03. CIRAD, Avenue Agropolis, 34398 Montpellier Cedex 5, France / librairie@cirad.fr ; www.cirad.fr

This book presents the results of a number of studies of the family-based agriculture in the northeast of Brazil. Though the agriculture in this region is generally considered unproductive, unadapted to liberalisation, and unable to innovate, these studies show that family-based agriculture in reality is undergoing drastic technical, economic and social changes. The authors analyse the role and the functions of development oriented research by looking at the results and the methods developed. Several examples of research and action operations are used to illustrate this: the implementation of a local credit system and support of municipal planning of rural development.(WR)

Handpump : operation, repair and maintenance by Kamble V, Pate G. 2001. 16 p. Rs 20.-. BAIF Development Research Foundation, BAIF Bhavan, Dr. Manibhai Desai Nagar, Warje, Pune, Maharashtra 411 029, India / baif@vsnl.com. (BIAF Barefoot Technician 1).

This small manual is an useful guide to handpumps, and provides proper instructions on handling. In many places, damaged handpumps have been abandoned due to lack of repair skills and the unavailablity of suitable tools. This manual explains the design and operation of the handpump. It provides guidelines to repair defects; causes and remedies for defects have been presented in the form of pictures and tables. The last part shows how to do repairs with the help of fishing tools. The drawings are meant to explain the method of handling tools. A clear and cheap publication.(WR)

WEBSITES

The World Bank ICT Department
http://info.worldbank.org/ict/
If you want an overview of donor funded ICT projects and ICT companies that are active in your country, this is a good starting point. For projects and companies basic information like objectives, size and contact persons is provided. In some cases the website also provides access to more comprehensive project documents.

National Community Radio Forum
http://www.ncrf.org.za/
This site is focused on South Africa but will be of interest for people from elsewhere who are interested in rural radio. It is an example of how the Internet can be used to support networks using other media – in this case radio that support the poorest of the poor. You can read their manifesto, see how they organise collaboration and the experience they have gained since their inception in 1993.

Developing Countries Farm Radio Network
http://www.farmradio.org/
Please read the article in this issue of the magazine for more information about the Farm Radio Network. On their website you can find scripts that are distributed to radio stations. If you are involved in rural radio broadcasting this is a site to check. They do not charge for their scripts and library services.

PEOPLink
http://www.peoplink.org/
This is another example of new opportunities provided by ICT. PEOPLink is a nonprofit marketplace benefiting grassroots artisans and their communities around the world. They manage to bring buyers in contact with producers in developing countries and involve many NGOs in promotion.

Digital Dividend
http://www.digitaldividend.org/
A website dedicated to exploring creative business approaches, public- private partnerships, and other sustainable ways to bridge the global digital divide.

Women in the Information Age
http://www.ksg.harvard.edu/witia/
This site, developed by the Women in the Information Age Project at Harvard University's John F. Kennedy School of Government, aims to address the gender issues in ICT.

Honeybee
http://csf.colorado.edu/sristi/honeybee.html
The Honeybee network of India is one of the pioneers in using ICT for capturing and sharing indigenous knowledge. On their website you can find research papers and a database with farmers' innovations.

The Association for Progressive Communications
http://www.apc.org/
The Association for Progressive Communications (APC) is an international network of civil society organisations dedicated to empowering and supporting groups and individuals working for peace, human rights, development and protection of the environment, through the strategic use of information and communication technologies (ICTs), including the Internet. The website has many resources for small internet service providers working with civil society. APC also develops free software.

Itrain Online
http://www.itrainonline.org/
ItrainOnline is a joint initiative of six organizations with expertise in computer and Internet training in the South. The website aims at being a single source on the web containing a selection of the best and most relevant computer and Internet training resources for development and social change. You can find practical information about anything ranging from "how to use Email" to how to do advanced programming for your own website.

OneWorld
http://www.oneworld.net/
OneWorld is a network of more than 1200 organisations focused on human rights and sustainable development. The website is a good entrance to information on these topics. Most of the resources consist of reviews of resources elsewhere on the Internet and is organised in "channels". There is for instance a channel named the "Digital Opportunity" channel that is good if you want to keep up-to date with ICT and development.

The African Virtual University (AVU)
http://www.avu.org/
AVU is an example of how ICT can enhance education. Since the launch of its pilot phase in 1997, AVU has provided students and professional in 17 African countries over 3,000 hours of interactive instruction in English and French. More than 24,000 students have completed semester-long courses in technology, engineering, business and the sciences and over 3,500 professionals have attended executive and professional management seminars on topics such as strategy and innovation, entrepreneurship and e-commerce. AVU provides students access to an on-line digital library with over 1,000 full text journals. Over 45,000 free AVU e-mail accounts have been created and the AVU website currently receives more than 1 million hits per month.

Bellanet
http://www.bellanet.org/
Bellanet is an international non-profit initiative focused on helping the international community to work together using ICT. Their website is an entry point to the activities of Bellanet that ranges from defining technical standards to compiling experience in knowledge management and web-to-email service as described in the centre spread of this magazine.

The International Institute for Communication and Development
http://www.iicd.org/
The International Institute for Communication and Development (IICD) assists developing countries to realise locally-owned sustainable development by harnessing the potential of ICT. On their website you can find many documents about the latest developments and experiences in ICT for development.

Visit our website: www.ileia.org

Free Software

Basic software applications for an office computer include: operating system (the main choices are Windows, Linux, or MacOS), word processor, spreadsheet, email client (to send and receive email), web browser, and *utilities* for file transfer (FTP), file expansion and compression (Zip) and viewing of PDF files.

Operating Systems: Linux or Windows?

The operating system (OS) is the software platform on top of which other applications run. The choice of OS determines to a great extent the applications that will run on a personal computer. Most of the products listed below are compatible with both Linux and Windows operating systems.

Linux (**http://www.linux.com** and **http://www.linuxiso.org**) is a free, reliable, and secure operating system that can be a good alternative to Windows, especially for those using older computer hardware. However, it is considered more difficult to set up than its main rival, Windows. Popular Windows applications such as Word and Excel will not run on Linux. For more information visit: **http://www.seul.org/docs/whylinux.html**

Windows (**www.microsoft.com**) is the most widespread operating system for personal computers worldwide. Microsoft's commercial dominance means that much of the world's software is designed for computers running Windows OS. Windows is not free, but free software *is* available for Windows users.

Office applications

OpenOffice (**http://www.openoffice.org**) is a free office suite that includes word processing, spreadsheet, graphics, and presentation applications. OpenOffice has every feature you could ever dream of. For basic word processing consider AbiWord (http://www.abisource.com/). It is free, fast on old computers and easy to learn.

Ftp

If you have direct access to the Internet and want to download computer programs and documents FTP (File Transfer Protocol) is often the fastest method. Most browsers have limited support for FTP transfers so it is better to use a dedicated FTP program If you make your own web pages you can also use FTP to upload them to an Internet server.

WS-FTP LE **http://www.ipswitch.com** is the classical FTP program. It is fast, small and efficient and includes a list of good ftp sites. You can buy a version with more features but don't worry; the LE version is more than enough for even advanced users. The download page is on: **http://www.ftpplanet.com/download.htm**.

Compression

Many files on the Internet are compressed so they can be transferred faster. To use them they have to be uncompressed. The most common method for compression is Zip. These files have a ".zip" extension and can be uncompressed with Winzip (**http://www.winzip.com/**) or "StuffIt Expander" **http://www.alladinsys.com**. Both programs also handle a number of less known compression methods.

PDF

Pdf (portable document format) is a popular format for distributing electronic documents. The advantage is that the layout is preserved, e.g. if you download an article from the LEISA Magazine as a pdf file and print it, it will look exactly as the printed magazine. The disadvantage is that pdf files are big and you need special software to view and print them. You can download the free pdf reader at: **http://www.adobe.com/support/downloads/main.html.**

Email

If you have Internet access you may chose to use the Email program in your browser. However, if you only use Email or if you want more features that the simple features in the browsers, then a dedicated Email program is worth considering.

Pegasus Mail (**http://www.pmail.com**) is a free electronic mail client that enables several people to maintain private accounts on the same computer. Pegasus Mail donates manual sets to non-profit organisations. Euroda light (**http://www.eudora.com**) is another free and feature-rich Email program.

Delete unwanted Email without downloading

Spam is the word for the unwanted advertising Emails that become still more widespread. If you don't want to waste time to download them to your computer you can check the subject and sender of the Emails and delete the unwanted ones on the server. With web based Email like Yahoo and Hotmail this is straightforward. However, if your Email uses the common POP3 protocol then you will need a program like "Harvester" (**http://spazioinwind.iol.it/neutronstar/mysoft.html**).

Check web-sites for updates

Some websites offer to notify you by Email when they change the content. However, if the site you are interested in does not offer that facility consider using a free utility like WebMon (**http://www.markwell.btinternet.co.uk/webmon/**). It can quickly check the sites you are interested in and tell you if they have changed. It is much faster than checking the sites manually.

Download websites and browse off-line

If there are many people accessing the same websites from the same computer it may be worth downloading the whole site and browsing off-line. In particular libraries and documentation centres can benefit from this. "Ttrack Website Copier" (**http://www.httrack.com**) can download whole websites. It rebuilds the web pages on your hard disk so all links will still work when you are off-line.

UNESCO Free Software Portal

http://www.unesco.org/webworld/portal_freesoft
UNESCO has collected a large number of links to free software for communication, library management, office applications, and science and education. The site also contains information for users who wish to understand and follow the Free Software movement, and for software developers themselves.

Nonags software

http://www.nonags.com/ is a software site with thousands of free programs well organised and described.

For French speakers...

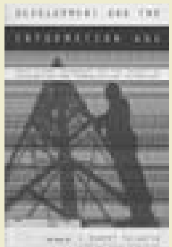
Boîte à outils du CIDIF is a CD-ROM containing over 150 free software programs for French-speaking computer users in the Caribbean, Eastern Europe, Africa, the Middle East, and the South Pacific region. For information contact: Centre international pour le développement de l'inforoute en français (CIDIF), 165, boulevard Hébert, Edmunston NB, Canada E3V 2S6.
http://www.naviguer.org/boite | **http://www.cidif.org**

Information Revolutions - How information and communication management is challenging the lives of rural people by Mundy P and Sultan J. 2001 234 p. ISBN 92 9081 2289CTA, Technical Centre for Agricultural and Rural Cooperation, Postbus 380, 6700 AJ Wageningen, The Netherlands. cta@cta.nl
This book could be called a tribute to several enterprising individuals and organisations in Africa, the Carribbean and the Pacific who have taken steps - some modest, some bold - to help revolutionise the management of information for agricultural development. CTA's intention in publishing these experiences is to raise awareness and thereby motivate others to follow these examples in the context of their own lives. The authors have done a wonderful job in selecting the best examples -those that are real local or national initiatives, having a proven track record and are sustainable. Approximately 40 of them are described in the book. The book has nine sections on radio and television, newspapers and newsletters, literacy and local languages, computers and telecommunications, farmers' groups and markets, farmers' knowledge, research and extension links, research networks and libraries. Written in a simple and straightforward style, the stories will certainly capture the attention of many and stimulate them to take on new initiatives - and thereby get them to communicate, without which development efforts are doomed to fail. (CW)

The appropriateness and effectiveness of drama as an agricultural extension tool by Munro J. 1998 30p. Occassional Publications Series No. 26, Network on Bean Research in Africa, CIAT, Kampala, Uganda
The Network on Bean Research in Africa serves to stimulate, focus and coordinate research efforts on the common bean. The network is organised by CIAT, International Center for Tropical Agriculture, which is one of the international agricultural research centers (IARCs). CIAT tries to find different ways of disseminating information on new technologies together with its partners. This paper is the result of a study of a project in Uganda that used drama as a method of technology transfer. The findings revealed that drama had been effective in communicating the message. Among those who had been at a performance and then interviewed, 68% had learnt something new from the drama, and 65% had made a change in their agricultural practice (i.e. planting beans, planting trees etc.) as a result of the drama. Apart from the success, the paper also covers the limitations of drama as a tool for extension and provides recommendations for overcoming these limitations. (CW)

Picture supported communication in Africa - Fundamentals, examples and recommendations for appropriate communication processes in rural development programmes in Sub-Saharan Africa by Hoffmann V. 2000 352p. ISBN 3 8236 1342 1 Margraf Verlag, PO Box 1205, D-97985 Weikersheim, Germany. CTA, Postbus 380, 6700 AJ Wageningen, The Netherlands.
This book is an English translation based on the second, updated and completely revised edition of the original version published as a habilitation thesis in 1990 by the author in German. What the author tries to examine quite thoroughly in this book is the perception that pictorial communication, which is omnipresent in industrialised countries, is a universal, language-independent and supracultural means of communication, particularly for development programmes in the Third World and for reaching people who are not literate. The book does have a lot of theoretical content, which is balanced with two extensive case studies from GRAAP in Burkina Faso and CFSME, Rwanda, both of which have used pictures as an aid to the African oral tradition through low-cost techniques such as flannelgraphs. In conclusion, the author gives some recommendations for the production of pictorial material, training of facilitators, use of media in different settings etc. This is a book that is suited to those who are willing to spend time in going deeper into communication practise. Also available in French. (CW)

ICTs in Developing Countries Crede A. and Mansell R. (eds) 1998 ISBN 90 804322 1 0 International Institute for Communication and Development (IICD), PO Box 11586, 2502 AN The Hague, The Netherlands.
A series of four booklets published by the IICD focuses on the significance of information and communication technologies (ICTs) for sustainable development. The first booklet titled "The importance for sustainable development" explains what ICTs are and why they should be considered very important for the sustainable development of developing countries. Two important issues in this context - building of human capacity and setting in place a policy framework - are discussed. Booklet II is called "Gaps in provision" and examines the major imbalances in the provision of ICT in developing countries, i.e. inadequate infrastructure, the urban-rural divide etc. Suggestions to overcome the ICT gap are presented. "The basis for a national policy framework", the third booklet, focuses on issues related to setting up a national policy framework for ICT, including policies for learning, funding etc. The fourth booklet contains case studies and is titled, "Examples of ICTs in practise" and covers six areas: education, health, commerce, public information, environment, agriculture and rural development. An informative series presented in a simple-to-read style. Get copies through information@iicd.org



Development and the Information Age - four global scenarios for the future of information and communication technology
Howkins J. and Valantin R.(eds) 1997 59 p. ISBN 0 88936 835 X International Development Research Centre (IDRC), P.O.Box 8500, Ottawa, ON, Canada, K1G 3H9.
The Information Revolution is producing astonishing transformation in virtually all spheres of human activity. But how can these technologies help to balance the scales of development between the countries of the "industrialised" world and those of the "developing" world? Will they narrow the existing gap, or will they widen it? These were the questions debated by many experts from around the world at a workshop co-sponsored by UNCSTAD (United Nations Commission on Science and Technology for Development) and IDRC in June 1996. The four scenarios envisioned are described in the book and offer a glimpse into the future of the information age, particularly on its impact on reaching the goal of global sustainable and equitable development.

Correction LEISA Magazine Vol.18 No.1 - Livestock: which way?
The e-mail address of the publisher of the book "Utilizing different aquatic resources for livelihoods in Asia: a resource book" mentioned under "Sources" on page 31 should read bookstore@iirr.org

Information villages:
Connecting rural communities in India

Katherine Morrow

The Information Villages project was started in 1998 in Pondicherry, South India, by the M. S. Swaminathan Research Foundation. The project links 10 villages near Pondicherry into an information network connected to the Internet. The goal is to develop community ownership and collective action around the use of new technologies, in keeping with a “pro-poor, pro-nature, pro-women” approach to development. M.S.Swaminathan, the chairman of the Foundation, is guided by an insight regarding technology dissemination that he puts in a nutshell, “From my long experience in agriculture, I find that whenever poor people derive some benefit from a technology, the rich also benefit. The opposite does not happen,” he says.

Pondicherry is a former French colonial area in southern India, on the Bay of Bengal. The main language of the rural people is Tamil. Almost a quarter of the families in this region earns less than a dollar a day. It is predominantly a paddy or sugarcane producing area.

Women have not been excluded from ICTs.
Photo: M.S. Swaminathan Foundation

Hub and Spokes model

The Information Villages project has established a rural information network along a hub and spokes model. Ten villages constitute the network. In each village is a small, community-owned and operated Village Knowledge Centre, staffed by trained volunteers and equipped with several computers, printers, telephones, and Internet access. The centres provide supervised free access to those who wish to find information, learn about computers, search the Internet, communicate by phone or email, or use other services such as word processing, printing, and fax.

At the centre of the wheel is the project headquarters in the town of Villianur, where staff scour local sources and the Internet for information that is relevant and useful to the rural people of the region: information on agriculture, health, government policies, educational opportunities, the weather, and more. This information is put into a format that makes it more accessible to rural communities with a low level of literacy, translated into Tamil, and transmitted to the info shops electronically, via the network.

Technical infrastructure

With the help of committed volunteers, the villages around Pondicherry, beginning with Veerampattinam, were brought online starting in 1998. The near absence of a modern electrical and telephone infrastructure in the region led to some creative solutions: solar panels for electricity and wireless transmission systems where communication lines didn’t reach. Costs were minimised. The emphasis on low budget technologies undoubtedly enabled more villages to be connected, and freed up funds for a greater emphasis on training and evaluation aspects, which are often neglected in technology projects.

Building the network

Site selection was accomplished after a process of participatory rural appraisal in 13 villages. Villianur, a market centre and administrative node, well connected by roads, was chosen as the headquarters of the project and the hub of the information network. The Villianur hub is equipped with a computer, modem, telephone, a small telephone exchange, and wireless equipment. It is here that the project staff produce, translate, and update information that is fed into the network.

The “spokes” or sub-centres in nearby villages were chosen with care. In each village, participatory rural appraisal was carried out in order to identify an accessible rent-free building, electricity and volunteers. At each centre, the Foundation entered into a written agreement delineating the responsibilities of the Foundation to provide equipment, expertise and training, and the community to maintain and staff the site with volunteers, pay the telephone bills, and ensure prejudice-free access to all members of the community.

Each village is unique, and the project has experienced the closing of some centres and the opening of new ones. Some knowledge centres established in private homes were closed when they did not allow socially underpriviledged people to visit, and when the managers exhibited reluctance to share knowledge freely. These experiences made the project team realise how critical community ownership is to the success of each knowledge centre. The community as a whole must endorse the project so that it does not become associated with one group or caste.

Staffing and training

Staffing is by village volunteers identified by the community members. At least half of the volunteers must be women, under the terms of the agreement with the Swaminathan Foundation. The Foundation provides training in Windows 95/98, MS Office, web site construction, voice recording, file compression and wireless data transmission. The volunteers also learn to send and receive email and fax messages, and some receive training in desktop publishing, computer programming and design, which enables them to produce letterheads, posters, visiting cards and wedding invitation cards. The provision of such services is seen as one way in which the centres can generate an income.

Working with newspaper reporters, the Foundation is also providing journalism skills training to the volunteer knowledge centre employees in writing and presenting information clearly and crisply.

Mapping the rural information landscape

When the project began in 1998 there was almost no modern telephone infrastructure and a three-to five-year wait for standard telephone lines. A survey of 11 villages targetted by the project revealed two reading rooms, six post offices, 12 public telephones and 27 private telephones for 22,000 people. There were also 1,129 television sets, of which 424 were connected to cable TV broadcasting in Tamil.

Television and radio were generally regarded as sources of entertainment, not practical information. For useful information farmers turned to other farming families, local shopkeepers, and suppliers of farm inputs. They expressed a low opinion of local government functionaries.

There is high demand for agricultural information: the costs and availability of agricultural inputs, including seeds, fertiliser and pesticides, and grain prices in different markets throughout the Pondicherry area. 121 farmers interviewed in 2000 reported that grain prices are the most important piece of information they receive. *"Now that [villagers] have access to market rates, middlemen are not able to exploit the farmers or fishermen,"* says Raja Mohan, the head of the information technology hub in Pondicherry.

The knowledge centres provide detailed weather forecasts downloaded from the Internet in audio format and broadcast over a speaker system outside the knowledge centres. The knowledge centre in Veerampattinam downloads wave height predictions from the US Navy web site, which provides 12-hour predictions for wave heights in the Bay of Bengal. The centre prints out detailed maps from the site that are posted outside the centre, and broadcasts the information over a speaker system for the benefit of fishers who cannot read. The fisher families of Veerampattinam, most of whom use non-motorised catamarans, consider this information life saving.

Value Addition: local content is the key

Along with access, a key component of the project is "value addition" – collecting, creating and disseminating locally relevant information in Tamil. This activity mainly takes place in Villianur, the network hub. Recognition of the need for "intelligent intermediaries" based in the communities to interpret and package information for local use is seen to be one of the major success factors of the project.

Information compiled by community volunteers and provided in the village knowledge centres is locale specific. It relates to prices of agricultural inputs (such as seeds, fertilisers, pesticides) and outputs (rice, vegetables), market (potential for export), entitlement (the multitude of schemes of the central and state governments and banks) health care (availability of doctors and paramedics in nearby hospitals, women's diseases), cattle diseases, transport (road conditions, bus and train schedules, cancellations), weather (appropriate time for sowing, areas of abundant fish catch, wave heights).

There is growing evidence that farmers are using the information. For example, 14 farmers who had had their sugar cane crops devastated by "red rot" disease in two consecutive years were able to contact an entomologist through the knowledge centre. The preventive measures prescribed by him helped them save the sugarcane crop in 2001.

Farmers' Diary

Staff at Villianur have recently initiated a daily news item sent to the knowledge centres called "Farmers' Diary." The bulletin provides information on technologies and techniques relevant to agriculture and animal husbandry, with an emphasis on sustainable approaches such as Integrated Pest Management, Integrated Crop Management, and Integrated Nutrient Management Practices relevant to the main crops grown in the region: paddy, sugarcane, cotton, pulses, cereals and horticulture crops. The information comes from the agricultural university, magazines, individuals, research stations, and indigenous farming practices shared by the farmers in magazines. The diary for animal husbandry aims to give information on animal health practices suggested by Tamil Nadu Veterinary University, research stations and farmers' indigenous animal health practices. Project staff have so far developed 135 items related to agriculture and 59 animal husbandry health practices.

Linking with Extension

Greater cooperation with the Department of Agriculture is being discussed, and a partnership is taking shape. The Department wants to link their farm clinics to the Villianur hub so that extension staff can communicate more quickly with Departmental headquarters. Farm clinics in three villages will begin sharing agricultural information via the knowledge centre located in their assigned village. The Foundation is also developing a web site which will bring together all the relevant agricultural information in the region, including

- the schedules of Agricultural Officers and the training programmes they plan to conduct
- IPM methods developed in consultation with agricultural extension officers, university professors and people with indigenous knowledge

Village knowledge centres are run by community volunteers. Photo: M.S. Swaminathan Foundation

- Information on vermiculture, biopesticides, biofertilisers and bioremediation agents
- Crop and livestock integrated farming systems
- Conservation, sustainable use, and equitable sharing of water and the establishment of community water banks
- Government entitlements related to farmers.

Once the website is in place, it will provide a rich source of information to extension workers, other Department staff, members of the communities in which knowledge centres operate, and many others who have an interest or need for such information, in the Pondicherry region and elsewhere in the world.

Power and gender impacts

The Swaminathan Foundation and the project's funder, the International Development Research Centre, took great pains to ensure that the technology was not appropriated by the powerful to further exclude women, the Dalit caste, and the poor.

Unlocking information that was previously inaccessible to the rural poor can be threatening to those for whom knowledge is the key to exercise their power. Local bureaucrats are often reluctant to give up their monopoly on information, which can be a source of power.

Before setting up the knowledge centres, the Foundation required participating villages to agree to certain criteria. Each centre had to guarantee access to members of the Dalit population (formerly known as 'untouchables'), and ensure that at least half of the trained volunteer operators are women.

The key to success has been the integration of gender analysis and awareness at the earliest stages of project design, and making it a part of ongoing training, evaluation and monitoring. The knowledge centres track the number of men and women visitors to the centres on an ongoing basis, providing a changing picture of how rural women are using ICTs. Statistics kept by each shop indicate that between 34% and 50% of users are women, depending on the village.

The terms of the agreement with the Foundation that at least half of the volunteers must be women, helps ensure that women feel at home in the centres and continue to visit. The experience of handling and maintaining computer equipment and answering men's questions gives women new confidence and status in the community and helps ensure that technology is not thought of as "man's domain."

Photo: M.S. Swaminathan Foundation

Women primarily visit the knowledge centres to obtain information about family income supplements and public welfare schemes, low-cost insurance, and health issues, especially child bearing and rearing. Some women have also explored ways to start up new family enterprises. Grain price information is of interest to women agricultural workers who receive part of their wages in grain.

Lessons learned

Several constraints have been noted by project staff: lack of local language content on the World Wide Web, the weakness of both telecommunications and electrical infrastructure in the region and especially in rural zones, and the reluctance of local bureaucrats to give up their monopoly on information on government services and programmes.

In an earlier phase, project leaders Balaji and Arunachalam summed up the lessons thus: *"ICTs can make a positive contribution to improving the quality of life in ultra poor families in rural areas. It is essential that community ownership of ICT devices and training is established in the initial phase to prevent influential sections from appropriating all the benefits. Special efforts are needed to identify knowledge and information needs both of men and women. Local level "intelligent intermediaries" are an essential component in any such project. There is a need to maintain a continuous dialogue with the actual users to assess changing needs vis-à-vis the network derived information. A wide variety of access technologies are available now, and the emphasis should be on what is operable locally without cumbersome licenses or power requirements."*

Balaji and Arunachalam note, however, that direct economic benefits from this type of enterprise are difficult to quantify, although they certainly exist. They see potential for ICT to support micro credit and community banking. Empowerment of local communities can be seen in the increased level of awareness that rural families have about their rights and entitlements under publicly funded schemes, and the improvement in their bargaining power in the marketplace.

Sustainability through partnership

Sustainability of the network in a context where most users are below the poverty line is one of the most difficult hurdles to overcome. Most of the knowledge centres are partially self-sustaining, thanks to the efforts of volunteers. A key to sustainability is the fact that the centres are valued community assets. When repairs are needed, they are made, not always with external financial assistance.

The tangible social benefits of the project are compelling to the Indian government. The Department of Science and Technology wants to see the experiment replicated in most of the villages in Pondicherry, and is covering the cost of connecting five more villages through wireless technology. Other avenues to sustainability that are being explored are the sale of services such as desktop publishing and online banking, and partnerships with the departments of Education, Agriculture, Statistics, and the District Rural Development Agency.

The positive media attention the project has received since 1999 has helped to bolster the Information Villages Research Project. Internationally, the project received coverage in the Human Development Report 1999, the New York Times (May 2000) and in 2001 won the Stockholm Challenge, an award for pioneering ICT projects that benefit people and society.

Going Global?

The emphasis that the Information Villages Research Project places on community ownership and local content is reflected in an ambitious international initiative being undertaken under the auspices of the G8. The Open Knowledge Network seeks to build on the Pondicherry approach in order to create a global network of locally-based knowledge centres together with sectoral hubs, engaged in production and exchange of practical information for development. Oneworld International, a UK-based media organisation, is leading this experiment, which is currently at the stage of technical pilot. If successful, the Pondicherry approach will be the basis for expanding the reach of ICTs to rural communities in many parts of the world.

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Katherine Morrow, see p.10 for contact details

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Sowing seeds of peace. Artwork: Eric Drooker

Using the Internet for advocacy: the ETC perspective

Katherine Morrow

For more than thirty years, Pat Mooney has worked with civil society organisations (CSOs) on international trade and development issues related to agriculture and biodiversity. The author of several books, he is co-founder and Executive Director of ETC Group (formerly Rural Advancement Foundation International - RAFI), a small international CSO addressing the impact of new technologies, especially biotechnologies, on rural communities. "Any major new technology introduced into a society that is not, by its nature, a 'just' society, will exacerbate the gap between rich and poor" is its position as stated in *The ETC Century.*

ETC Group is known for its hard-hitting critique of frameworks for technological innovation that put profit ahead of people. For this reason ETC Group is sometimes seen to be 'anti-technology', but the Group has appropriated information technology and has used it very effectively. The success of the Group's advocacy work depends on credible research, combined with effective and fast dissemination to the media, policymakers, and citizens at large. In addition to offering "cheap mail" for an organisation that consists of seven people located in three countries, information technology plays a key role in every aspect of the Group's strategy. The Internet helps researchers gather evidence and collaborate on papers. It also provides the dominant platform for research dissemination, and for the critical business of supporting the efforts of individuals wishing to voice their concerns in their own countries or at the international level.

In a recent interview Pat Mooney shared his views on information technology and the ways that ETC Group uses the Internet to disseminate research and conduct global advocacy on biotechnology issues. What emerges is a picture of an organisation that has wholeheartedly included the Internet in its communications toolkit, while remaining alert to the limitations of the technology and the problems encountered along the way.

Supporting citizen engagement

The interactive nature of the Internet, the way it enables people to instantly connect with each other, is perhaps its most significant characteristic. CSOs such as Amnesty International have pioneered the use of email and the web to promote citizen engagement through direct action. The Internet is an inexpensive and highly effective tool to support letter-writing campaigns, the gathering of signatures for petitions, donations, and online discussion forums. ETC Group uses basic web technology to help visitors to its website write letters (or emails) of concern to legislators and policymakers.

> MOONEY: *We started to use computers back in the early eighties, around 1982, when the first IBM-DOS computers came out. At the time, other groups were horrified that we were actually using computers. We got a lot of criticism for using this "obscene, dangerous" technology. But I think it's fair to say that advocacy organisations have been more effective in using the Internet and computers, than, for example, the corporate world. That may well change in the years ahead, but for the moment, at least, we've gained by it all.*
>
> *In our advocacy work, the Internet enables us to do things we couldn't do before, ways of creating interest, discussion and participation. In the 'Take Action' section of our website, we suggest ways that people can put their concern into further action, including model letters. It's been great to be able to say not only "here's some news", but also "here's what you can do about it."*

While dynamic websites undoubtedly enhance advocacy efforts, simple email offers a cheap, effective way to communicate directly with decision-makers. In the South, where web access is not widespread, email is more widely available and can be just as effective - when the right message reaches the right person.

> MOONEY: *I think many of our southern partners underestimate their capacity to use email to reach policymakers. Most policymakers and their staff have email addresses. They are seeking support and information. Email is a way to*

get critical information to them quickly, for example by sending information to the Agricultural Committee of the local congress or parliament. When a negotiator in an international meeting gets an email message from a CSO back home it counts for something. That message has more impact than if it came from us.

Using the web for publishing and research

Pat Mooney describes the central role of the ETC Group's website as a low-cost publishing tool for the group's research. Publishing on the web allows organisations to disseminate content in less time, and at a lower cost, than is possible with print publication.

Mooney notes, however, that as a tool for researchers, the web presents some drawbacks. One is the tendency of websites to keep only the latest information, discarding their archives. Another problem is that while the web presents a wealth of sources, it is often difficult to assess the quality and reliability of online information. These difficulties point to the need for organisations to put more time into quality control of their websites as well as the need for Internet users to develop specialized online research skills.

MOONEY: *The Internet has been a critical tool for getting information out about breaking issues and circulating it as fast as possible among our partners in the South. Virtually everything we publish is up on our website before it's available in paper.*

The web is critical for our research function, but whereas we felt pretty relaxed a few years ago, thinking "everything's on the web," we now realise that's not true. One of the shortcomings of the web is the lack of historical information. We've gone back to books and magazines to get a perspective on how things compare over time.

Measuring impact

Computers originated as number crunchers, and Internet-based tools offer a distinct advantage when it comes to tracking usage data. These data, when analysed, can provide organisations with very detailed quantitative measures related to their online audience.

MOONEY: *Web statistics allow us to know who is using our information, which is extremely important. We count on average 15,000 people actually downloading data from our website each month, with an even balance between corporations, academia, governments, and civil society groups. We also measure how many other websites link to ours, which I think is a pretty good indicator of impact. The Alta Vista search engine lists 1655 external links, which is high for a civil society organisation of our size.*

Reaching audiences in the south

Adopting the Internet as a primary dissemination tool cannot be done without taking into consideration extremely low rates of access in most of the developing world. Given ETC Group's mandate to address issues that affect farmers in the South, this is a major challenge. The Group frequently relies on telephone for communication with staff in the field, and makes use of Internet-connected partners in the South to relay information to and from the grassroots level. Many international efforts to "bridge the digital divide" give specific priority to improving Internet access and providing technology training to nongovernmental actors working in developing countries, in part due to the critical role these organisations play in ensuring that the concerns of local people are heard internationally.

MOONEY: *We don't use the Internet as effectively as we could, but that's at least in part because it's much harder to work online if you're in Chiapas, or rural Zimbabwe, or even in the middle of a UN meeting in Rome! In the South it's still hard to get online and download information. We depend on our partners in the South to download, print, and disseminate our material. We also encourage them to adapt the material, to make it locally relevant. We don't copyright any of our information. People can take it and use it as they want, translate it and pass it around.*

Information overload

MOONEY: One of our frustrations is that the speed of communications cuts into our ability to do research. What's dragging us down, of course, is the amount of email we get. We get hundreds of requests a week. Responding to everyone means less and less time to do research. All of us are cutting back on the number of listservers we're on, preferring to communicate one-on-one and by phone. We've had to develop form responses to email queries; otherwise we'd spend our entire lives answering emails. We have a form letter that says, "Go to our web site and look for these keywords."

Working with the media

No matter what the issue, in order to reach a wide audience it is essential to reach the media. This means developing a relationship of mutual respect and trust with journalists reporting on agricultural and development issues. ETC Group's experience points to the limitations of email in communicating with journalists. Email, an exchange of text between people, lacks the subtlety and richness of face-to-face and telephone interaction. Some situations simply demand more interpersonal contact than email can provide; communicating with journalists seems to be one of them. However, email and the web play an important role in making these relationships more productive by supporting the exchange of background material and the dissemination of press releases.

MOONEY: *The press rely on one-on-one contact by phone with key parties. We talk to three to five journalists a day, sometimes more. Journalists have to know that they can rely on us for accurate information and good quotes. It's a combination of accurate information, good quotes, and being known in general, not just on the Internet. The more you have that combination, the more they contact you, so success in working with the media is cumulative over time.*

Technology concentration

The ETC Group's broad premise is that it is not technology itself that poses a risk, but the concentration of power over its development and application in society. We asked Pat Mooney to reflect on this premise as it applies to information and communication technology, now and in the future.

MOONEY: *As time goes on, we see the issues surrounding technology as issues of governance more than anything else. And governance means who controls the media and communications technologies. We are seeing what we describe as the merger of conduit and content. The hardware conduit services of informatics are merging with the content side, so that you have concentration of providers of both the substance and the technologies for communication, for example the AOL-Time-Warner merger. We think that monitoring this is extraordinarily important for the future of good governance and democracy, and for the preservation of dissent.*

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Radio browsing the Internet: an option for rural communities

Modern information and communication technologies (ICTs), more specifically the Internet, has the potential to offer a new generation of tools for rural development. However, it requires special efforts to create appropriate access models for those who can neither afford internet access nor have the language capacity to understand the content. The purpose of the Kothmale community radio internet project was to test and demonstrate an access model that could overcome these barriers and make information accessible to otherwise marginalised communities in rural areas. UNESCO implemented the project in collaboration with the Sri Lankan Ministry of Posts, Telecommunications and Media, Sri Lanka Broadcasting Corporation, Sri Lanka Telecommunication Regulatory Commission and the University of Colombo.

Kothmale community radio

The Kothmale community radio station is located in the central hill region of Sri Lanka and serves a population of 200,000. The area of coverage includes around 60 villages with an average of 400 residents and three rural towns with around 175,000 residents. The station began broadcasting in 1989 and in ten years has become an integral part of the community and the most popular FM radio in the area. Currently, it has morning and evening broadcasts; the morning broadcast is commercialised and the revenue generated covers 75% of the station's operational costs.

Combining Internet with radio

The community radio internet project introduced three features, which combine new information technologies with conventional radio.

a. ***"Radio browsing the Internet" programme*** The radio station broadcasts a daily two-hour programme during which broadcasters supported by resource personnel browse the internet on-air together with their listeners and discuss and contextualise the information in the local language. Listeners direct queries to the station (in person, by mail or by telephone), and the broadcasters surf the Internet on their behalf and transmit the information. Resource persons (agricultural extensionists, doctors) who are invited as studio guests help to put the information in context.

b. ***Provision of internet access*** Besides its own internet café, the station's server provides free internet access at two nearby public libraries. This is quite attractive to people who cannot afford the facilities of a computer and are unable to pay for long-distance telephone calls. Trained volunteers take turns to assist the visitors in using the computer facilities.

c. ***Development of a community database*** The community radio develops its own information database based on the requests of listeners. This database attempts to package information that meets the needs of the rural population in the local languages on the Internet. In addition, the station provides skills to help the community to develop their own web sites and encourages them to produce content for the Internet.

Successful initiative

The project has succeeded in accomplishing its goals - it has brought the benefits of ICTs to a rural population. Many people are benefiting from the increased access to information and the examples are as diverse as the users. A local farmer has obtained information on organic farming of tomatoes and improved storage methods. Another farmer was delighted with the housing diagrams and feeding information for geese he gathered from the Internet. A group of local producers of "*jaggery*" (sweet made of palm treacle) found markets for their product. A group of youth used internet sources to network with other organisations in setting up an environmental NGO. Having mobilised resources, they have launched a reforestation programme in their community. A local health worker was able to find information on mosquito-borne diseases directly relevant to her work.

The project has led to an increased awareness on the benefits of ICTs within the community. Many within the community have opened e-mail accounts to keep in touch with their relatives working abroad. Younger members of the community are enthusiastic users of the computers and the internet facilities at the radio station. Many of them have gained computer literacy and are a bridge for the rest of the community in the learning process.

Apart from expanding the knowledge base of the people, it is also contributing to increased participation of the community in economic and social development.

Keeping it going

The Kothmale project was implemented with an initial grant of US$ 35,000, which covered project management, costs for internet connectivity, equipment and installation, training, research and workshops for project partners. The existence of a well-equipped radio station in Kothmale reduced the setting up costs significantly.

With the UNESCO funding coming to an end, the future of Kothmale internet community radio depends on whether it can finance itself. The station would have to generate an additional US$ 1000 per month to maintain the present activities. Many income generating options are being tried out. Already work has begun on hosting a number of commercial web sites on the station's internet server. The local youth have been trained to design and develop web sites for the private sector. The server can provide seven additional access points, which the station intends to rent to government or non-governmental organisations. The "radio internet browsing" programme is expected to increase the volume of radio advertising. Listeners, who have formed an Internet listeners club, are raising funds to support the facility.

Meanwhile, UNESCO is developing a global programme drawing on the experiences of Kothmale. This programme on community multimedia centres offers a global strategy to address the digital divide in the poorest communities of the developing world.

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This article has been compiled from UNESCO information sources with permission from Wijayananda Jayaweera, Regional Communication Adviser, UNESCO, P.O.Box 12544, Kuala Lumpur, Malaysia. More details can be found on www.unesco.org

Communicating innovation: the 'In the Field' project

Monica Janowski and Kaz Janowski

Under an apple tree in our garden in 1998, we talked about innovation and communication. Monica is a social anthropologist at the Natural Resources Institute (NRI) of the University of Greenwich, whose staff need and want to communicate the results of ground-breaking projects to a wider audience who are not scientists or specialists. Kaz is a radio producer at the BBC, which needs depth and really good content in programmes. We decided that there was potential complementarity there; and that we would try to make something happen.

Two years later, after discussions within NRI and between the NRI, the BBC and the UK Department for International Development (DFID), we succeeded in getting a series of 12 programmes commissioned by the BBC World Service, and in getting funding from DFID to support NRI's part in the collaboration. We called the series `In the Field', with the subtitle 'Exploring Innovative Improvements to Livelihoods around the World'.

Making 'In the Field'

Building on earlier discussions, Monica put out the word at NRI asking for researchers to volunteer their projects as topics for programmes. The idea was that the researchers themselves, where possible, would act as 'barefoot reporters' and would carry out the interviews themselves, with villagers and local researchers in their project sites. At the core of each programme we wanted to have local people telling their own stories and talking about their feelings about the particular problem they had faced and how this had been tackled.

To act as reporters, NRI researchers needed practical training in using the equipment and in face-to-face interviewing skills.

Programmes in the "In the Field" Series

- The Buabeng-Fiema monkey sanctuary, Ghana
- Tree pods - a new way of feeding goats, India
- The need for agricultural land in the city, Ghana
- Stepping off the pesticides treadmill, India
- Vegetable gardens in the city, Zimbabwe
- Farmers who just don't farm, Poland
- Introducing ethical trade, UK and Ghana
- Different ways of understanding ethical trade, Ghana and UK
- Fighting the rat problem using new traps, Mozambique
- Alternatives to "slash and burn" agriculture, Bolivia
- Trading cocoa fairly, Ecuador
- Training "barefoot vets" to treat village animals, Indonesia

We arranged this at the BBC. The training was enjoyed by all; BBC staff found the topics of the research projects very interesting and the researchers were excited at the prospect of communicating their results to a wider and more general audience through their input to the programmes.

Once the researchers returned from the field, we used excerpts from the interviews, local music and sound effects to make the programmes, held together by a script read by a presenter. Where voice-overs in English were necessary, we used people from the countries concerned, so as not to distance them from the interviewees themselves. We also interviewed the researchers and included excerpts from these interviews in the programme, so that the researchers became `characters' in the story too. Topics covered in the programmes were wide-ranging, both geographically and in terms of subject matter, from tackling the rat problem in Mozambique to trading cocoa fairly in Ecuador (see box on this page).

We worked closely with the NRI researchers, and through them their local research partners, to ensure that they, and local informants, were happy with what went into the programmes. We decided that this was very important since researchers told us that that in the past when they had been in touch with the media, whether print or broadcast, their work had often been misrepresented.

The 'In the Field' booklet and websites

To partner the radio series, we produced a booklet with the aim of consolidating what was in the programmes and to raise other related issues. The booklet was funded by DFID, and was sent out by the BBC free of charge to listeners, who were prompted to write in.

We tried to make the booklet as attractive and engaging as possible, with photographs of many of the villagers who talk to us in the programmes and of the villages they live in and maps showing the location of villages. The double page spread for each programme is separated into sections for ease of reading, entitled 'Setting the Scene', 'Defining the Problem', 'Taking Action', 'Global Relevance', 'Cast and Key Quote' and 'Thinking Points' (see example on p.24). There are also two double page spreads looking at cross-cutting issues related to tackling livelihood problems. To ensure that the text for the booklet was accessible, we brought in a popular science journalist to work with Monica on it.

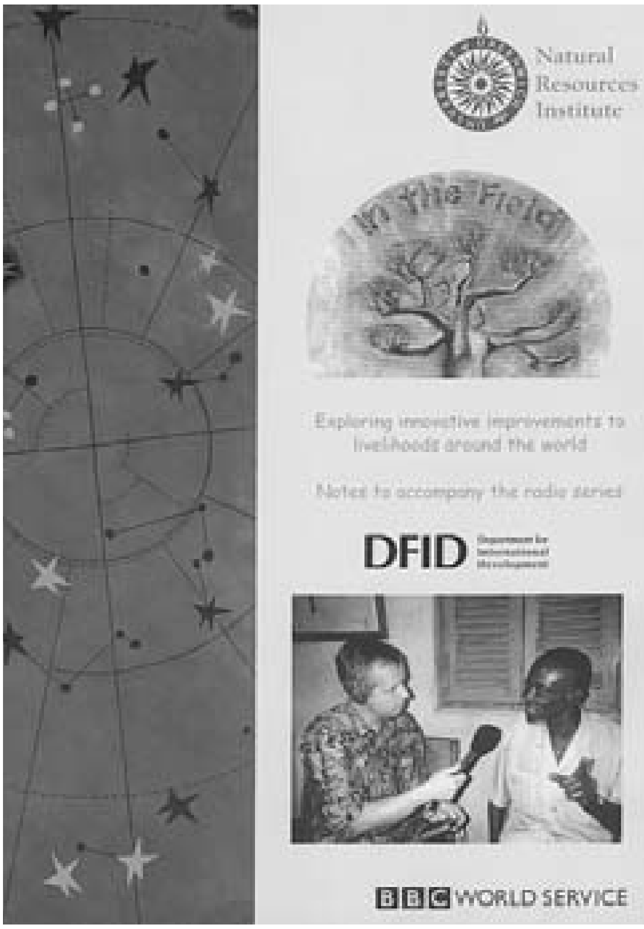
In addition to producing the booklet, we presented the text, photographs and maps in downloadable form on a series website at the NRI (*http://www.nri.org/InTheField/)*. The audio of the programmes is on a series website at the BBC (*http://www.bbc.co.uk/worldservice/sci_tech/features/field/index.shtml)*.

The series was first broadcast on the World Service between January and March 2001. It went out for the second time between January and March 2002.

Who was listening and what did they think?

Our hope with the series was to increase appreciation of the common issues and problems affecting people in different parts of the world, and how these can be tackled effectively. We also hoped that this would stimulate and encourage local initiative to tackle problems of this kind.

Our potential audience for these programmes was very wide, since they were going out through the BBC World Service, which has a diverse audience all over the world, ranging from



opinion leaders to people at village level in countries where English is spoken as a second language. To find out whether we had been successful in our aims, we wanted first of all to try to find out who was listening to the programmes, who was writing in for booklets and what they thought about the series, website and/or booklet. We were particularly interested to know whether people at village level were listening to the programmes and writing in for the booklet.

Since we didn't have funds to do research locally on response to the programmes, we relied on response to the booklet, with which we enclosed a feedback form. In this we asked listeners/readers to let us know something about who they were, how they might use the material and what they thought of it. We had a healthy response, from all over the world, to the offer of the notes, both on the feedback form and by email. The initial print run for the booklet was quickly exhausted and a reprint was arranged in early 2002, in time for the second transmission of the series in January that year.

We have had a number of requests from people at institutions who see the material as a valuable resource for teaching and for teacher training, both in the South and in the North. This includes teaching in schools, at university level and teaching extension workers at village-level.

We have also had many responses from people who were interested on a personal level in the programmes. These demonstrate the chords which the programmes seem to have touched in relation to individual work and also in relation to interest in how people live in other parts of the world, and how these parallel respondents' own experiences. For example, a comment from Chun-Quan Meng in X'an in China: *'I enjoyed 'In the Field' very much. It is an interesting and practical agricultural programme. On January 30th's programme you review vegetable farming in Harare. It is a wonderful topic. It reminds me of my farming activities in the 1970s when I was a farmer at a small mountain village about 140 km SW of X'an. At that time I grew vegetables for making money. Nowadays I usually grow vegetables on the balcony of my house for enjoyment. Anyway, I love looking at and caring for vegetables.'*

Another from Huthyfa H. Mohammed in Baghdad, who has 'an interest in global issues and self-improvement': *'I am enormously grateful and thankful for the significant help you afford me throughout your fundamental informative programmes broadcasted by your unique World Learning. In the Field, one of these lively and provoking programmes to which I keep listening intensively, since it enhances my knowledge and invigorates my experience as long as I live in the modern world'.*

From Anish Damodaran a livestock inspector from Kerala in India, who was attracted by the programme on paravets in Indonesia: *'I have been working in villages as a livestock inspector for about 5 years. I will try to become a barefoot vet. This article has been a great source of inspiration. This has been an idea I have been keeping for a long time. At some point in my life I will go back to teaching. Then these notes can be a study material. I will share these notes with anybody who is interested to do first aid for animals, to love them or as a hobby'.*

An educational role for 'In the Field'

Because we received so many responses from educational institutions saying how much they liked the programmes and notes and that they were already using the booklet in teaching, we decided that it would be worthwhile to formally pilot the use of the notes and radio programmes in teaching.

We have therefore set this going in a number of institutions around the world, both in the North and in the South. We identified schools, colleges and universities to pilot the material both through the responses which the BBC received from listeners and through contacts which the NRI has with institutions around the world.

As well as making class sets of the booklet available to teachers piloting the material, we wanted to make it possible for them to use the radio programmes themselves in teaching. Although the radio programmes are posted on the BBC series website, it is not always easy for institutions, particularly in the South, to play these in a classroom. We have therefore produced cassettes containing the radio programmes, which we are sending out free of charge to educational institutions involved in piloting.

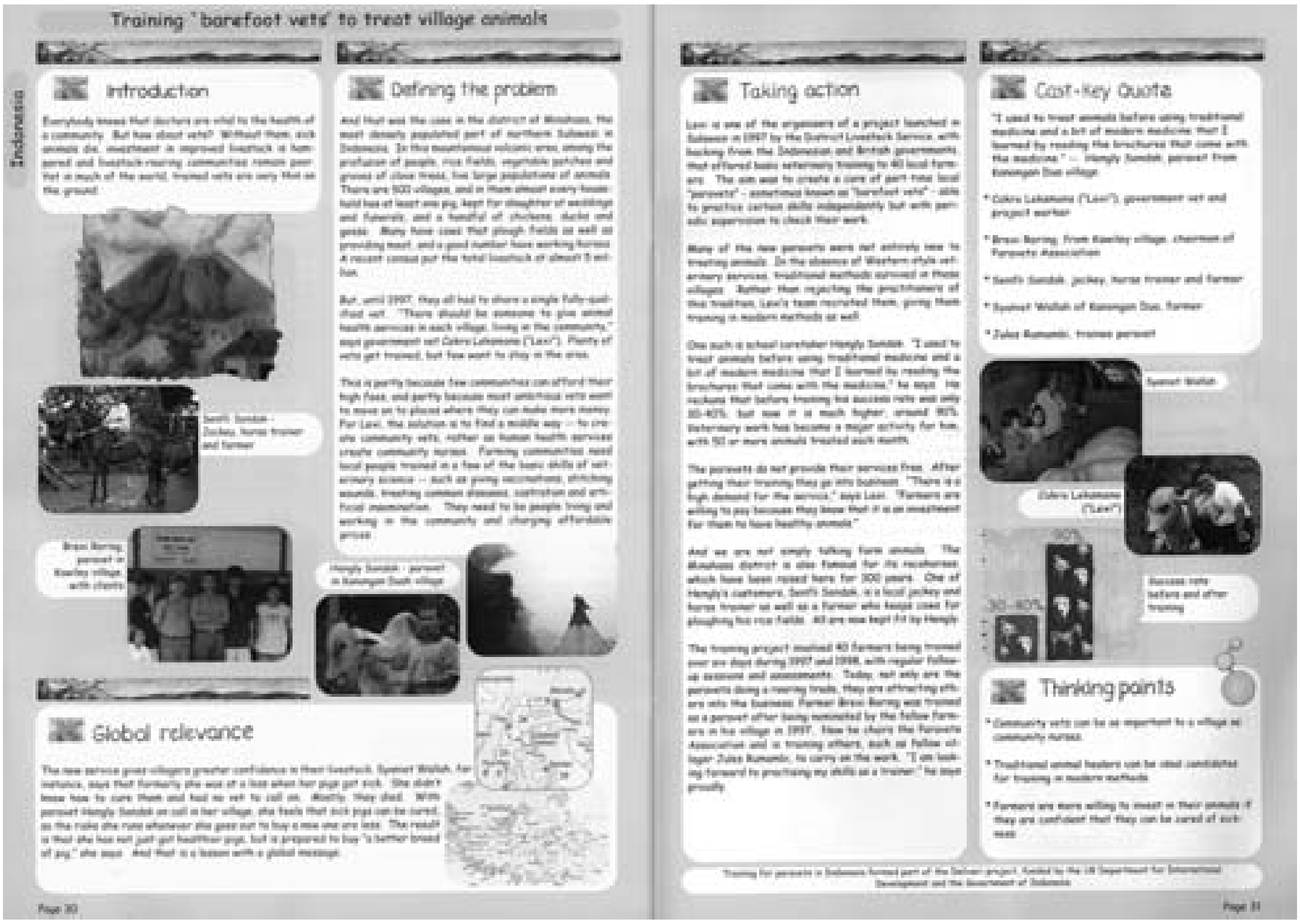
Reaching down to village level

We haven't heard as much as we would like from listeners right down at village level, although most of our correspondents seem to have close contact with villages either personally or professionally. In order to ensure that we are succeeding in reaching into villages, we are hoping to go more local through rebroadcasting. We have received several requests to allow rebroadcasting of the series on local radio stations, which the BBC allows free of charge.

We are particularly interested in an initiative in Zambia, where rebroadcasting is being combined with setting up Listener Groups to discuss the programmes at village level, whose members use wind-up/solar-powered radios.

Conclusion: the benefits of partnership and the future

We feel that the 'In the Field' collaboration between the BBC and the Natural Resources Institute has been a great success. The two sides brought very different backgrounds, skills, and networks to the table, and we found that these were complementary in many ways. From the BBC's point of view, the collaboration with the NRI has meant access to a network of knowledge and village-level research; from the NRI's point of view, the BBC has access to a wide audience of people in all walks of life, also at village level, far beyond the NRI's project areas.



Crucially, as far as the NRI is concerned, the BBC has the ability to make interesting and lively programmes that have a wide popular appeal, translating the findings of research projects into something that is human and accessible. This is something which NRI scientists do not have experience in, and consequently it is difficult for them to communicate the findings of their projects directly to the people they most want to reach – potential beneficiaries of their new knowledge at village level around the world.

The fact that the programmes have been transmitted on the BBC World Service all-English stream is both a help and a hindrance to communication. A major plus is that programmes can be made which are listened to around the world, and that the drawing of parallels between problems and solutions in different places is encouraged in a way that would not be possible through a purely locally-focused series. However, most people in most countries do not understand English and they can have access to the programmes only through an intermediary. We hope that in many countries where English is a second language there will be at least a few people in each village who will listen to the programmes and tell others about them. However, we do have concerns about the exclusion of many people because the means of communication is English. Rebroadcasting in languages other than English, maintaining the original interview village-level extracts and translating the script and voice overs, is a way of overcoming this problem.

The feedback forms and emails we have received are only partial commentaries on response to the material. We do not have very much information on the kinds of people who are responding in this way, and on the responses of groups of people, in particular within communities at village level. It would be very useful to be able to carry out research at village level in conjunction with local broadcasting of 'In the Field' through a local radio station. This would enable us to make an assessment of the responses of different categories of people – for example young/old, women/men, poorer/better off – within communities.

This in turn would allow us to begin to see how this kind of approach, combining broadcast information with printed information, can be used at village level to disseminate information on useful technologies and to stimulate debate on important topics. A particularly exciting idea would be to set up links between discussion groups and/or interest groups (with, for example, the same technical problems) in different parts of the world through an initiative where the same material is used in different places. This could potentially be linked to the connection of villages to the internet which is developing in different parts of the world.

■

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Copies of the booklet can be obtained free of charge from : World Learning, BBC World Service at the address above or e-mailing *world.learning@bbc.co.uk*
They can also be found on *www.nri.org/InTheField*

For class sets of the booklet and the cassettes contact Monica Janowski at the above address.

"In the field" will be transmitted for the third time on the BBC World Service in mid-October 2002

Radio brings information to many rural communities worldwide. Photo: Danielle Baron, JHU/CCP

Connecting farmers worldwide through radio

Nancy Bennett

Radio has long been used as a tool for learning and community adhesion. Particularly in remote regions without telephones, people use radio to announce arrival dates, funerals and weddings. People learn about their government's policies and plans on radio, and hear about events and issues in their communities. They also use their local or community radio stations to voice their own views.

Radio network for Canadian farmers

In Canada, with thousands of communities isolated by the vast distances between them, radio has been an important tool for rural development. National public radio, the Canadian Broadcasting Corporation (CBC), was formed in the first half of the 20th century to strengthen the nation. Canadians needed a way to get Canadian perspectives about Canadian and international issues, especially because of their proximity to the powerful and far-reaching media networks of the United States.

In the 1950s, the CBC launched a new programme that was intended to specifically address the needs of farmers who were spread across the country. The National Farm Radio Forum was an interactive programme that brought farmers together on Monday evenings to listen to the weekly broadcast. In groups, in the kitchens or living rooms of their neighbours, farmers discussed the programme and answered questions in a workbook that was distributed to these organised groups. Their answers, and their questions, were then sent to the CBC office to be used in the following week's programme.

By the 1970s, the CBC's farm radio programmes no longer included the Forum – but the daily farm reports were still immensely popular and important to rural listeners, and CBC's farm programming had gained international renown.

Taking the experience beyond Canada

In 1974, CBC farm commentator George Atkins was invited as a resource person to a conference in Zambia for African farm broadcasters. There, the idea for Developing Countries Farm Radio Network was born. Speaking with his African colleagues, Atkins was struck by their need for practical, relevant information for their radio programmes. Without a variety of reliable information sources, African broadcasters were dependent on the brochures of commercial agricultural suppliers – often biased to promote sales of products that their listeners could neither use nor afford. Without accurate and appropriate information sources, how could the broadcasters provide popular, important programmes?

On his return to Canada, Atkins devoted his efforts and time to his idea of a network of farm radio broadcasters – a new kind of forum that would enable them to exchange information that was useful to their listeners, and that would support the development of viable and environmentally sustainable agriculture. With start-up funding from Massey Ferguson, Atkins enlisted 36 participating broadcasters in 24 countries. Soon, agriculture researchers and extensionists joined the effort by providing information that was relevant to small-scale farmers in Africa, Asia and Latin America. By the 1980s, Atkins had left the CBC and was working full-time to achieve his vision of farm radio broadcasters working in concert for rural development and food security. The radio programmes and scripts developed and distributed by the Toronto office, based on contributions from the field, was limited only in number, due to limited finances – never by information, ideas or energy.

Worldwide radio network

Today, five hundred radio broadcasters, stations, and training organizations in almost 100 countries participate in Developing Countries Farm Radio Network. Almost one-half of participating stations is in Latin America and the Caribbean; one-third is in sub-Saharan Africa. Their programmes are heard from the Andean mountains to the African savannah in 300 languages, and are changing farm practices all over the world. A community garden in South Africa experimented with a bamboo irrigation system developed by a farmer in Thailand after hearing about it on a local farm radio programme – and has improved its management of a scarce resource. This kind of success is repeated over and over – a testament to the value of information, communication, and networks.

Keys to success

The success of any network is based on the participation and skills of its members, and Developing Countries Farm Radio Network is no exception. Indeed, we refer to our members as our partners in recognition of the contribution they make. Network partners must regularly assess the needs of their listeners and develop radio programmes that respond to those needs. They are responsible for finding and filtering appropriate information for their programmes, often translating it into the local language of broadcast, and producing entertaining and informative programmes that attract listeners. They take a globally-relevant topic (such as pest management, or soil conservation) and add local information and perspective to make it understandable and practical for the farmer tending her small plot. In a world that is increasingly complex and interconnected – even small-scale farmers are affected by international agreements and protocols – the demands on farm radio broadcasters are daunting.

Changing with the times

In response to the increasing and evolving role of radio broadcasters working for rural development, Developing Countries Farm Radio Network is changing. We continue to provide reliable and relevant information – in the form of scripts, stories and programme ideas - to broadcasters who have limited resources for local research and production. Many of our partners are community or small local radio stations operating with volunteer labour, basic equipment and shoestring budgets. They do not yet have regular access to the Internet.

We also provide custom research services to our partners who are preparing programmes about specific issues or are responding to listener enquiries. In the 25 years we have been gathering information, we have built up a library that we believe is unique in the world. With contributions from the 1000 extensionists, educational and research institutions, NGOs and others – mostly in developing countries - with whom we have established regular contact, we have a collection focused on small-scale (usually tropical) agriculture, practical approaches, experimentation and innovation. We hope, one day, to make our catalogue available on-line and our library services available to others working for food security and rural development.

Building the skills and capacity of partners

Increasingly, our programme aims to develop the skills and capacity of our partners to understand and respond to local needs. This means that the scope of the information we deal with is broader than it was a quarter-century ago. Once focused on crop production, animal husbandry and nutrition, we now take a more integrated approach that includes, for example, how small-scale farmers can cope with HIV/AIDS, how to get and use information about markets, or how cooperative community models can improve rural incomes and quality of life.

Skills and capacity development also includes training. With each package of scripts and stories we share amongst our partners, we include training and professional development materials. Background articles sensitize broadcasters to issues affecting their listeners, and increase their comfort in covering these topics. Few journalists have in-depth subject knowledge and must be alerted to opportunities for new programming. We regularly make organisations and other resources on specific subjects known to our partners, both in our newsletter and on our web site. A current project in partnership with ISNAR (International Service for National Agricultural Research) aims to promote increased cooperation and collaboration between radio broadcasters and their national and local agriculture research services.

A women's listener group in India. Photo: JHU/CCP

Other training materials promote effective communication approaches, with an emphasis on involving the listeners as information providers as well. While many people think of radio as a one-way medium, we encourage broadcasters to begin with listening, and to provide forums - through panel discussions, taped community meetings, call-in shows, and even the on-air reading of listeners' letters – for public discussion and debate of issues of interest and importance in their communities.

Radio - unrivalled in its outreach to rural communities

Because of its unrivalled access and its low production costs, radio is the technology that best meets the information and communication needs of farmers, world-wide. At Developing Countries Farm Radio Network, we will continue to support radio broadcasters so that they can meet those needs, strengthening small-scale farming and rural communities as they work toward food security.

■

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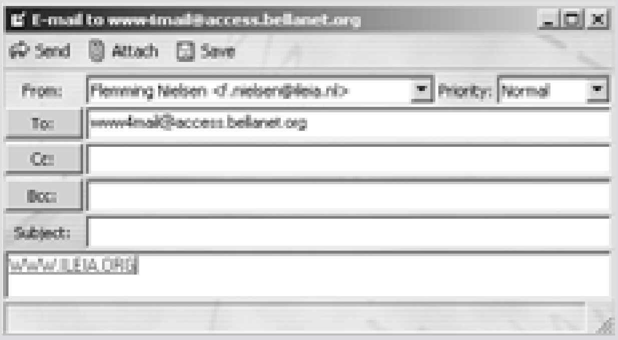
Accessing the Internet in the Sou

Web Access by Email

In most developing countries, access to the Internet is expensive, slow, or both. Very often, many people share a single Internet-connected computer. To surf the web in the conventional way requires a stable power supply and continuous Internet connection while the user visits one page after another. If this is not possible or practical, web access by email is a solution that allows you to access web pages using only email. You can prepare the emails before you go online to minimize the time you are connected.

What you need: Access to email, and a web browser such as Netscape or Internet Explorer.

1. Compose an email message addressed to **www4mail@access.bellanet.org**
   In the body of the message, type the address (URL) of the web page you wish to receive. Send the message.



Requesting a web page by Email

2. You will receive in reply an email message containing an attachment. Open the attachment in a web browser. The web page contains only the text, no pictures, because images on the web contain a lot of data and take longer for you to download.

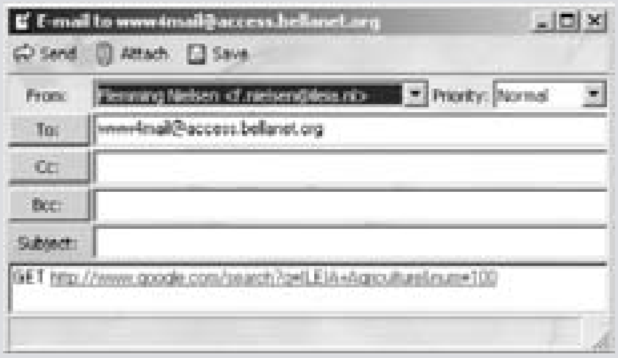
3 To follow the links, or request to see the pictures, just click in the boxes and press "send." Later on, check your mail and you will have received the requested pages.

Search the Web by Email

Send a message like the following:

To: **www4mail@access.bellanet.org**
Subject: [leave blank]
Body:
GET http://www.google.com/search?q=ILEIA+Agri culture&num=100

Try it, or replace 'ILEIA' and 'Agriculture' with your own keywords, as many as you like, separated by +



Searching the Internet with Email.

You can use a similar technique to search ILEIADOC, ILEIA's online bibliographic database:
As an example, send a message to:
www4mail@access.bellanet.org
with
http://ileia.cust.iaf.nl:8080/Ileiadoc.html?pg=q&q= sheep+goats
(replace 'sheep' and 'goats' with your own keywords) in the body of the message.

More on Web Access by Email

- Accessing the Internet by E-Mail: Guide to Offline Internet Access
- Full instructions on surfing the web by email, ftp by email, and much more. Available in many languages. By Bob Rankin and Gerald Boyd. To receive a copy, send a blank email to: **accmail-faq@expita.com**
- See also: How to Do Just About Anything by E-Mail, by Gerald Boyd **http://www.expita.com**

uth: some tools and techniques

Translation of Email by Email

Send an email as usual to a colleague in your own language. In the “Cc:” line, send a copy of the message to the Universal T-mail Translator. The way you format the address will determine how the message is translated.

The format of the cc address is: (Original language)-(Final translation)@t-mail.com, where the language codes can be: English (en or an), French (fr), German (ge or de), Italian (it), Spanish (sp or es), Portuguese (pt or po).

To get from an English to a French translation you would use cc: **en-fr@t-mail.com**

The person you mail to will receive both your original email and the translation.

Automatic translation of your Email using the free t-mail.com service

Reading and Converting PDF Files

Many scientific and other documents on the web are saved in Adobe PDF format. To read these documents you need the free software Acrobat Reader (See p.33 on how to get it) However, you don’t need to the PDF reader if you use the “PDF Conversion by Email”. This service allows you to convert PDF files to a plain text format that is easier to read and send by email using older computer technology.

You can receive pdf files from the Internet as text files. Here an article from LEISA magazine vol. 17, no. 4, page 6-8 is requested.

If the PDF is on the Internet (tip: the web address or URL ends with .pdf), mail the URL in the body of an email message to **pdf2text@adobe.com**. The converter will mail back the plain text of the file. If the PDF file is on a diskette or on your computer, send it as an email attachment to **pdf2text@sun.trace.wisc.edu**

Web-browsers

Most new operating systems (e.g. Windows) include a web browser. However, you may want to try one of the alternative free ones. Lynx (**http://lynx.browser.org/**) is a text-only browser that run fast on even the oldest computer. Since it ignores graphics you can surf very fast. It allows you download graphic files to you hard disk if you want but Lynx itself will not show them.

Opera (**http://www.opera.com/**) is a highly-rated free web browser Opera that is much smaller than other major browsers and includes an FTP client and Email program. A good choice for those using older hardware. The only problem is that the free version download adverts and thus keeps you online for a longer time.

Netscape Communicator (**http://browsers.netscape.com/browsers/main.tmpl**) Netscape’s web browser comes with a set of free tools: Netscape Mail (an email client), Netscape Instant Messenger, and Netscape Composer (for creating web pages).

Microsoft Internet Explorer (**http://www.microsoft.com/windows/ie/default.asp**) Microsoft’s IE web browser comes with a similar set of complimentary tools: free email client (Outlook Express), instant messaging, and web page editing. Outlook Express is frequently targeted by viruses and is not recommended as an email client.

Viruses

Viruses (and also Worms and Trojan Horses) are programs designed to harm your computer and spread from one computer to another. They will not destroy your computer physically but can change or delete software and your files so the computer becomes useless until the software has been installed again. It is wise always to keep backup on floppy disks or CDs.

Typically, you contract a virus by opening an email attachment from an unknown person, or by sharing computer diskettes with another person. The best way to protect against viruses is to install Virus protection software on your computer and to update it regularly. If you receive a file you did not ask for, especially with the extension .exe, it may contain a harmful virus. Infection occurs once you click on the file to open it. The best solution is to delete the file without opening it.

Free virus protection software include: “AVG AntiVirus” (**http://www.grisoft.com/html/us_downl.htm**) and VCatch (**http://www.vcatch.com/download.html**)

More on p.33

Compiled by: Katherine Morrow (Bellanet)

“Farmer to Farmer”: Participatory radio for Dekhon farmers in Tadjikistan

Armorer Wason

Farmers in Tajikistan have only recently begun to farm with a measure of independence from the state and collective farms of the Soviet era. They face enormous challenges: breakdown of the rural Soviet infrastructure, lack of effective structures to support private farming, lack of finance, endemic corruption, poor rule of law, and during 2000 and 2001 very severe drought. Moreover, there has been almost no discussion in the media of the real problems they face. Farmers do not have reliable sources of information, even on the most basic, uncontroversial, technical aspects of farming.

Farming in Tajikistan

Tajikistan is in a stage of transition from the Soviet economic model, with much of the economy still controlled by the state and most farmland under a high degree of state influence. Between 1995 and 1999, 120 (out of 600) state controlled farms were privatised, mainly into lease farms, joint stock companies and some private peasant ‘dekhon’ farms.

A ‘dekhon farm’ is generally either a small to medium-size family farm (2-50 ha.), or a large ‘collective dekhon farm’ or ‘dekhon association’ (50 to 500 ha.). Dekhon farms are created with a lifelong inheritable dekhon lease. From June 1999 land privatisation was accelerated, with a further 160 collective farms to be converted into private dekhon farms through the issue of land share certificates to collective farm employees. By November 1999 there were 13,000 dekhon farms.

The main priority for the Tajik Ministry of Agriculture is the revenue from the cotton crop, and it is almost entirely taken up with administering the production and delivery of cotton from large state farms through a modified form of central planning. Some of these farms have been nominally privatised, but in reality they are not free to make their own decisions: they must sell to the state at prices determined by the state. Cotton comprises 30% of exports and 30% of total state tax revenues, but the actual returns paid to producers, and the wages of much of the rural population working on the cotton-producing state farms, are close to zero. In lieu of unpaid wages, farms commonly “rent out” land to their workers.

Most of the rural population relies for its basic livelihood on self-production on household plots of land. These provide 45% of the total consumption of rural households. Households implement a complex form of integrated agriculture and land productivity is high. Vegetables are grown for market and for the household’s own consumption, and crop residues from the plots partially sustain small and large livestock.

Mass Media in Tajikistan

Upon independence from the former Soviet Union, Tajikistan descended into a civil war that claimed some 60,000 lives out of a population of 6.7 million. A power-sharing agreement concluded between the warring parties in 1997 established an uneasy peace. The short period of relative openness subsequent to independence from the Soviet Union is popularly believed to have been a major contributing factor in the outbreak of the civil war. The Minister of Agriculture expressed the opinion that giving information to farmers was a very dangerous thing to do, and that freedom of information was one of the causes of the war.

At present, there are no independent national television or radio stations in Tajikistan. There have been several attempts to gain licences for independent broadcasting projects, but no licences have been granted to transmit nationally. Tajik Radio is essentially an arm of the state, with no public service responsibility. There is no commitment to programmes that honestly reflect the preoccupations or concerns of audiences. The role of programme managers is to control programme content, while programme quality, especially in terms of relevance to audience concerns, is not considered important.

Journalists exercise significant self-censorship, as indeed they did in the Soviet era. Self-censorship is so effective that the people of Tajikistan survive with almost no detailed information beyond what government wants them to know. The impact of this is very deep: this is a society that does not have a dialogue with itself. As in Soviet times, the very act of asking questions becomes uncomfortable, even on the most uncontroversial themes.

“Farmer to farmer” radio series

The radio series *Farmer to Farmer* aims, despite the very considerable constraints, to respond to the concerns and questions of private dekhon farmers through interviews with farmers and a range of agricultural experts. It is broadcast once a week as part of Tajik Radio’s lunchtime programme for rural listeners, and then repeated in the evening. Initially, programmes were 15 minutes in length, but now run for 20-25 minutes.

Radio producer interviewing farmers in the Kulyab province of southern Tadjikistan. Photo: FAO

With support from the Swiss Agency for Development and Co-operation (SDC), the local office of the Food and Agriculture Organization of the United Nations (FAO) manages the production of the radio series. This is part of a larger project, based in the capital Dushanbe, which trains veterinarians, supports veterinary services, and distributes seeds. The Project Co-ordinator and national staff have close links with the Ministry of Agriculture, which supports the project.

The series is transmitted throughout the country by Tajik Radio. It is a significant departure for Tajik Radio, which has never broadcast an independently produced radio series before.

Implementation strategy

The FAO radio project required attention to four areas in order to be effective: a workable degree of control over production, participatory audience research, journalism training for the radio producers, and, at a later stage, a campaign to promote the series.

It was essential both to recognise the very real limits on the editorial independence of the radio programmes and to attempt to ensure that the project had as much influence as possible over the production of programmes. The agreement was that the radio producers recruited to the project would plan, record and script materials under the supervision of the FAO Project Co-ordinator, and then edit and mix the final programme at Tajik Radio. Inevitably, Tajik Radio managers would have an ultimate veto over programme content.

To meet the information needs of the target audience, to ensure the credibility and reputation of the programmes among farmers, and to stimulate and encourage farmers to work together to find solutions to their problems, it was essential to build the project on a solid basis of effective, participatory, audience research. In Tajikistan, however, it was clear from the outset that compromises would have to be made in order to protect both the programme producers and the project. It was decided that radio programmes should initially concentrate on non-controversial technical questions, and that gradually the programme producers would feel their way towards covering more difficult areas.

Focus groups were used to inform and mediate the agenda for the programmes and to fulfil two other invaluable functions. Firstly, they were to provide an objective process for evaluating the success of the programmes - an opportunity to test the extent to which farmers understood, liked and made use of the material. Secondly, the focus groups were intended as a powerful force to re-orientate the radio producers to a new view of their role. Programme producers in the former Soviet Union did not solicit the needs and concerns of their audiences and were not expected to take them into account. Their key function was not to ask questions but to give their audiences an officially sanctioned view.

It was clear that the radio project was a valuable opportunity to support the general development of good journalism practice in Tajikistan, in a relatively uncontroversial subject area. Apart from the two programme producers recruited to the project, training seminars on journalistic research were given to interested parties.

As the audience for Tajik Radio's programme for rural listeners is very small, it was evident that some effort would be needed to promote the radio series once it had achieved an acceptable standard.

Successful initiative

The arrangements for producing and transmitting programmes have been very successful. Programme scripts are finalised with the project coordinator before being edited at Tajik Radio. This has worked well, and there has been a steady improvement in both production values and journalism standards. Tajik Radio representatives welcomed the programmes and have appreciated the variety and new approaches they inject.

There has been valuable synergy in locating the series in an existing agricultural project. The agronomists and veterinarians have provided valuable background information, contacts and stories for the programme producers and have welcomed the radio producers on trips to rural areas. They have been extremely supportive in the research process and sensitive to professional and editorial boundaries.

The lack of journalism training and a decision to concentrate on 'safe' technical themes ensured that the early programmes did not pose a challenge for Tajik Radio. As the series has become established it has gradually become more adventurous thematically, and the questions put to interviewees are more focused.

The participatory audience research has been partially successful. The facilitation in some focus groups has been better than in others. The groups have been well attended, which could be an indication of the motivation of farmers. Participants generally felt that the programmes gave useful information, but that at times they lacked dynamism and did not always provide a rounded view of a subject. The groups stressed the need for appropriate technical information, i.e. plant and animal diseases, warnings of disease outbreaks, coping in drought conditions, assessing quality of livestock, sources of reliable seed material etc. There were also requests for information on the prices of produce, fuel, fertilisers, pesticides, and ideas for alternatives to increasingly costly pesticides, fertilisers and other inputs.

Broader subjects of concern included rights to land use and legal regulation, relationships with the collective farms, finance and credit etc.

It is clear from the programme scripts that the radio producers have endeavoured to adjust their work to respond to these constructive criticisms. There is no doubt that the radio producers were strongly affected by the experience of observing focus groups, and that they worked hard to meet the needs they heard expressed.

The agenda for the radio series clearly reflects most of the concerns of the focus group participants. Programmes have been made on all the technical subjects requested by the farmers, with close attention paid to ensuring that they are seasonally and regionally appropriate. Increasingly, the programmes are covering the frustration and problems faced by farmers, eg. taxation, corruption, credit, land registration. An excellent "Question and Answer" section in later programmes of the series has given clear and helpful answers to farmers on specific questions. It is very encouraging that the experience and voices of farmers themselves are at the heart of the programmes.

The radio producers have made significant progress in producing well-structured, clear, accessible materials and there has been considerable success in using new production ideas. The producers now have a far better grasp of the strengths and limitations of radio as a medium, and of how to ensure that listeners can take in the information that they seek to communicate.

Staff of the larger FAO project has actively promoted the radio series, distributing 1,500 promotional leaflets in rural areas in many parts of the country. Leaflets promoting the radio series were also sent to the international agencies operating in Tajikstan. However, there have been very few letters and telephone calls from farmers, and it is likely that audiences have remained fairly small in the absence of a structured mass media campaign to advertise the programmes.

The future

Tajik Radio is pleased with the project but like other governmental institutions in the country, they barely survive in economic terms. They have no resources to support the continuation of the project. Sustainability of the project inevitably derives from the availability of donor funding. If economic transition proceeds successfully it may be possible to achieve longer-term sustainability through private-enterprise sponsorship.

Through 'Farmer to Farmer' great strides have been made to improve the responsiveness and relevance of radio to farmers' needs and problems. This is a good beginning, given the constraints of the wider political context. But for farm radio in Tajikistan to be genuinely farmer led, the new programme approach will need to be matched by political change concerning the role of journalists.

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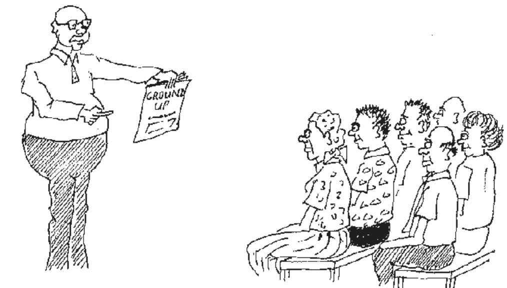
*Compiled from the report "**Az Dekhon ba Dekhon (Farmer to Farmer): A participatory radio series for private farmers in Tadjikistan**" by Armorer Wason (International Consultant in mass media, communications and public affairs) in collaboration with the Communication for Development Group, Extension, Education and Communication Service, FAO, Rome Italy. 2002.*

"Ground up": facilitating networking and sharing in sub-Saharan Africa

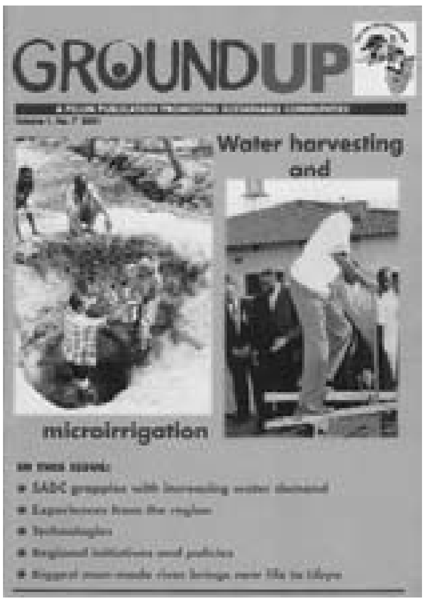
Parkie Mbozi



SOME MEMBER ORGANISATIONS USE GROUND UP IN COMMUNITY WORKSHOPS.

Participatory Ecological Land-Use Management (PELUM) Association is a regional network of 138 civil society organisations with over 15 development partners working in nine countries in eastern and southern Africa. They are Botswana, Kenya, Lesotho, Malawi, Uganda, South Africa, Tanzania, Zambia and Zimbabwe.

The members are involved in a wide range of activities in sustainable agriculture, food security, and natural resource management The activities include training, information dissemination (including gender, HIV/AIDS), drought relief, seed multiplication and delivery, financial support, advocacy and lobbying.



PELUM members have joined hands in forming strategic alliances to fight poverty and remedy other social injustices in the region, and to enhance capacity building. The PELUM mission statement reads in part: "We aim to build the capacity of members to respond appropriately to changes and challenges towards the empowerment of communities."

Launching "Ground Up"

PELUM Association launched its regional magazine, *Ground Up,* in March 2000, five years after the Association was formed. *Ground Up* was a response to the information needs of its members. They wanted a magazine, which would enhance their capacity to deliver extension messages through the sharing of experiences and information across the region. The magazine was to be a vehicle for networking in participatory ecological land-use management (pelum) across eastern and southern Africa and with like-minded partners and organisations beyond the region.

The magazine was also meant to fill a gap in development literature which focuses specifically on agriculture and environment at a Sub-Saharan regional level, and which is rooted in the region and looks at development from a southern perspective.

The specific objectives of the magazine are to:

- popularise the participatory ecological land-use use management (pelum) approach among communities in eastern and southern Africa;
- influence policy-makers to think pelum and to lobby and advocate for sustainable communities;
- provide a forum for critical analysis and evaluation of pelum approaches;
- share pelum approaches in the region and beyond and to promote networking;
- encourage research in the area of pelum; and,
- to provide a voice for the South, giving a southern perspective to development.

After a series of consultations, a feasibility study and a week long planning workshop, and armed with a dummy edition, we finally published the maiden issue in April 2000.

Ensuring sustainability

The planning workshop produced a five-year business plan, which projected that the magazine would attain financial sustainability by the third or fourth year of publication. While many development publications are given out free, we decided to take a different route: combining information service delivery with business. We wanted to look ahead to the time when donor support would fall away, particularly after the period of our current strategic plan (2000-2004).

In the firm belief that there was a niche for a regional development magazine, we planned for a commercial publication from the outset. We printed the magazine in colour, signed up designers, originators and printers, and went in search of subscribers, advertising agents, distributors and editorial contributors throughout the region.

The magazine sells at US$1.50 on the newsstands and at US$5 to subscribers, against a production and distribution cost of around US$2.7. This means that the difference of US$1.2 on the newsstand price is a subsidy to popularise the magazine.

The editing and printing of the magazine is done in Harare, Zimbabwe, the base of the regional office of PELUM Association. The magazine is then sent to country-level commercial distributors and bookshops and to country PELUM offices to be distributed through the PELUM network at a commission of 10% for members and 20% for country PELUM offices.

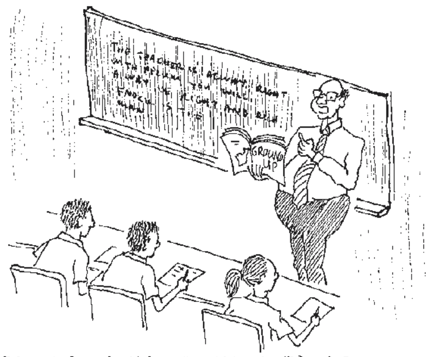
While we commission experienced journalists to write on given themes, we also encourage PELUM members to contribute their experiences, in line with our aim to "sing our own song" in the magazine. Ideally, the content should be dominated by contributions from the members. This is in line with PELUM principles and values and intends to give the members greater control of the magazine.

Realising that not many members have had journalism training, we have been running training courses in basic writing skills every year since 1999.

Content of the magazine

In deciding the themes for *Ground Up* editions we have been mindful of the core business of the members and partners, and problems specific to the eastern and southern African region. To make the magazines more relevant we ask the members to suggest themes, which reflect the information demands of the farming communities they work with. The previous issues of the magazine have, therefore, focused on:

- farmer innovations
- participatory methodologies and concepts
- seed security
- issues and experiences in advocacy and lobbying
- farmer-to-farmer extension
- organic farming and marketing
- micro-irrigation and water harvesting
- measuring impact of development programmes.



GROUND UP HAS BEEN USED AS LECTURE MATERIAL IN UNIVERSITIES.

For the rest of 2002 we will focus on mainstreaming gender in agricultural programmes, the World Summit on Sustainable Development, in particular the Farmers' Convergence which PELUM is organising, and biotechnology and food security. These themes are intended to fill information gaps and enhance the capacity of the members in those specific areas.

Achievements

Two years of publishing *Ground Up* has been a mix of opportunities and challenges. We have just over 100 subscribers at present and a little under 30% of the copies produced are sold through newsstands across the region.

We have some structural achievements in producing a regional magazine and in facilitating networking across the region and beyond. Firstly, the Association has gained invaluable experience in producing such a magazine, which can be shared with others in the region and beyond. This experience also adds to the learning and growing process of the Association.

Secondly, the magazine has managed to bring together experts with different backgrounds and has facilitated networking. To an appreciable extent, through the magazine, we have also managed to provide an avenue for linking experts with the communities on the ground and between policy makers and those affected or afflicted by those policies.

Through the magazine we have also created a pool of journalists and media who are friendly and sympathetic to the cause of PELUM and are now working closely with us on a number issues in sustainable agriculture. The journalists are paid US$60 for an article and US$10 for a photograph or cartoon used.

Testimonies of Impact

From the beginning, comments like the following have been received regularly: "*I realise the importance of the publication your organisation is producing. The magazine is very relevant and essential to my field of agricultural extension and rural development in my country. I am a civil servant in the Ministry of Agriculture in Ethiopia ...*" We realised that this type of feedback was not enough; we wanted some deeper insights. We decided to have a comprehensive external review of the magazine, which was carried out in Tanzania, Zambia and Zimbabwe in March and April this year.

From the preliminary results of the review we have deduced that the magazine has been instrumental in selling the PELUM values, principles and methodologies in sustainable agriculture. The Tanzania *Ground Up* review report reads, "*Ground Up successfully documents the achievements and constraints of various experiences, e.g. in micro-irrigation, thereby allowing farmers and development workers to share across the region.*" James Mwami, an extension worker in Uganda, says, *"I find Ground Up useful because it tackles grassroots mobilisation and participation. The magazine is proving to be very useful to our organisation."*

There is also a reported trickle-down and multiplier effect from *Ground Up*. Mark Maseko, the Zambian reviewer, reports that, "*Some member organisations use it (Ground Up) in community workshops while others use the information from the magazine to develop course materials for their community education projects. Worldwide Fund for Nature (WWF) and the Catholic Diocese of Lusaka reported this kind of utilisation of information from Ground Up." Ground Up* has also been used for compiling teaching material in universities. The School of Agriculture at the University of Zambia, for instance, has asked for back copies to distribute among its students. The magazine's use of research findings seems to be one of its major attractions among academic and research institutions.

Some members describe *Ground Up* as the flag-bearer for the Association and in campaigning, advocacy and lobbying. Through *Ground Up*, PELUM Association has raised awareness about the issues that need to be brought to the attention of politicians and policy-makers.

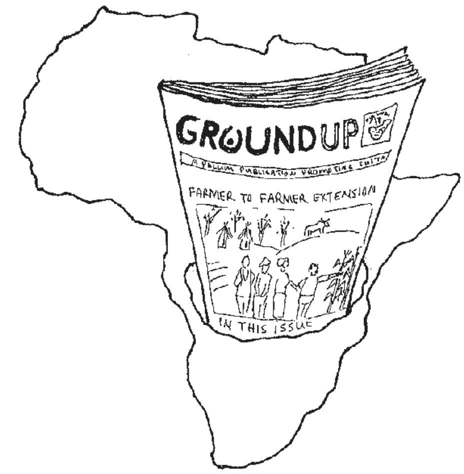
The magazine has also enhanced networking and the sharing of information and experiences throughout the region. A number of respondents state that they read the magazine specifically to learn about the experiences of other members or about organisations involved in similar work or facing a similar problem. Through *Ground Up* we have been able to link organizations and individuals wishing to learn from each other. For instance, a number of farmers wrote to us or directly to the International Development Enterprise inquiring about an innovative treadle pump, which we featured in Volume 1, Number 1.

The magazine has facilitated networking by providing sources of information and contact details of authors, individuals and organisations involved in particular areas of interest. One farmer reader based in Hurungwe, Zimbabwe, wrote, *"I was interested in the article about micro-irrigation technology for small-scale farmers (Ground Up, Vol. 1, No. 1). Please send more information about how I can get a quotation or terms of payment and the address of the agent of treadle pumps. I have been looking for this type of pump to boost my farming business."* The theme of organic farming in Vol.1, No. 6 was eagerly taken up among organic farmers, marketers and consumers in the region and beyond.

---- INCREASE THE MAGAZINE MARKET BASE AND MAKE IT MORE RELEVANT ON THE GROUND.

Challenges

Although it is evident that the magazine ranks highly among its readers, we still face a number of challenges. We are yet to expand the reach and penetration of the magazine in the region. Postal charges are prohibitive, and customs regulations differ from country to country. In some countries educational materials attract duty and value-added tax which cost as much as the price of a copy. These



THE MAGAZINE HAS FILLED A GAPING HOLE IN AFRICAN MEDIA

problems have restricted the number of copies sent out.

Being a relatively young publication, copy sales, subscriptions and advertising are still limited. We are also recognizing that development information and products do not sell as much, particularly in this part of the world where purchasing power is limited among households and development information is known to be free.

The less than expected number of contributions from members has also been a source of concern. We aimed to have at least 75% of the content from members of the Association. The best we have done is 50% with the rest of the articles coming from academics, researchers, journalists and partner organisations. We believe this reduces the extent to which experiences are shared among members of PELUM, though not necessarily between PELUM and similar organisations.

Our biggest challenge remains to be in assessing the impact of the magazine in the area of advocacy and lobbying and, more fundamentally, its impact on the livelihoods of farmers and farming communities.

The future

The Tanzanian reviewer of *Ground Up* writes, *"Despite some structural weaknesses, the magazine has filled a gaping hole in African media, and serves as a vital means of realizing the vision of PELUM and raising the Association's prestige and visibility. If Ground Up remains sensitive to the needs of its target group, and flexible enough to adapt its editorial policies, there will always be a need for such a publication. In terms of meeting market needs, Ground Up has good prospects."*

This is an encouraging observation. We intend to use the review to strengthen the magazine, particularly in marketing, distribution, advertising and member participation. We want the country desks to become more involved in the magazine and assume its ownership. Two country offices are already producing their own newsletters, largely inspired by, and learning a lot from, *Ground Up*. We would like to see such developments scaled up and replicated in the other countries.

One of our strategic priorities is enhancing the capacity of members, extension workers and farmers in the region to document their experiences for the magazine. This would facilitate not only the sharing of information and experiences but also increase the magazine's market base and make the magazine more relevant on the ground.

One major lesson we have learnt in the last two years is that it is not easy to attain financial viability of a development-oriented magazine. However, *Ground Up* being the only agriculture and environment magazine produced and circulated in the region currently is the magazine's greatest strength. We intend to capitalise on this strength to keep the PELUM flag flying.

■

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Market rates flow out of the cradle of a telephone

Given the glamour of information technology, we are led into believing that costly hi-tech tools are essential for harnessing the power of IT. But VIIT (Vidya Pratishthan's Institute of Information Technology), a young engineering college in the small town of Baramati, India, has been working out a way of offering agricultural information via the much-overlooked phone.

Telephone - effective medium

VIIT recently has been putting together its interactive voice response (IVR) system, meant to benefit the rural population. This IVR system is meant for use in Indian conditions - where connectivity is often not available, computers are few, telephone lines could be noisy, and there is a lack of literacy among the rural population.

Phones have spread out to large areas of India particularly over the past decade-and-half. VIIT points out that telephone links today cover 70% of India's geographical area, and could, thus, play a vital role in ensuring that IT has a wider penetration across the many small villages that dot India.

The telephone is, in fact, the most penetrating medium of communication in rural India. "It can be used in conjunction with computers to provide updated information to the people who are not acquainted with the use of computers and IT," argues the VIIT. That's the solution they've tried to put forward.

Market rates by phone

"So far a voice engine in the regional language was not available," says the VIIT. Now, the system is being set up around the area of Baramati. It offers market rates of various commodities via the phone. The service is called 'aaj ka bazaar bhaav' (today's market rates), and is being used by the Baramati Marketing Society. Rates can be dynamically updated, and the user can choose the preferred language. This means that the information can be accessed via a normal phone line.

What are the advantages? Users can have instant access to the changing market rates at an affordable price, and in their own language. There is 'time management' on both sides. Resource-management is also stepped up. Besides, there is a report generation facility.

It works quite simply. For starts, the user dials into the telephone number of the Marketing System. The system - without human intervention - picks up the call and plays the welcome message; it then waits for the user's response. This done, the user has to dial the code for the category of information needed. The system then plays the rates of the required category. Then, the user has the option of dialling '0' to stop the conversation, or dial another code to listen in to more details. Following this, the system disconnects and gets ready for the next call.

IVR systems could be the way to revolutionise the access to digital information (across a context like India). It ensures availability of information, by investing limited resources. Once the framework is ready, it is easy to implement this system according to the need of the user in no time," argues Prof. Amol C.Goje, the Director of VIIT.

Frederick Noronha, Saligao, Goa, India. Email fred@bytesforall.org

Training of Extension Link Farmers on sweet potato by UNFFE and government extension workers. Photo: Stephanie v.d.Kool

UNFFE: exploring new alliances in agricultural extension

Uganda National Farmers' Federation

In the ten years since its inception, the Uganda National Farmers Federation (UNFFE) has grown to become the main representative of farmers' interests in Uganda. Currently it has more than 100,000 members throughout the country. UNFFE works both at the farm level where it provides training, advice and inputs, but also at the policy level in realisation of the important role that agricultural policy has in improving farmers' livelihoods.

UNFFE – or UNFA as it was called until February of this year – has been at the forefront of the new trends in agricultural extension. Being the main farmers' organisation in Uganda, UNFFE plays an important role in the new government's plan for modernisation of agriculture (PMA).

The fast growth of UNFFE was facilitated by donor support, but self-sufficiency has always been high on the agenda. UNFFE is trying to bring both farmers' organisations and agricultural companies under one umbrella. This is an unusual alliance that many donors and governments hope will provide part of the answer to the funding crisis for public extension. The experience of Uganda's PMA - and UNFFE – is being watched carefully by other countries that are interested in seeing whether it can work before they decide to embark on a similar strategy.

Structure, goals and services of UNFFE

The Federation was founded in 1992 by farmers throughout Uganda in response to a need for better services for and exchanges between the farming community that comprises over 80% of Uganda's population. At the same time, it was to serve as an organised channel through which government or any other interested agency could extend services to farmers. The overriding objective was to mobilise the farming community into one independent umbrella organisation. Currently, 68 farmers' organisations are members of UNFFE, 56 of them are active.

Organisationally, UNFFE consists of three main organs, i.e. the Farmers' Council, National Executive Committee and the Secretariat. The major goals are:

- To improve farmers' incomes and welfare through increasing the quality and quantity of their production by providing services to members on demand and at cost. Sustainability and farmer empowerment is of major importance.
- To bring all farmers' organisations and agro-based industries under one umbrella organisation as a common front for the promotion, co-ordination and safeguarding of their activities and interests.
- To improve the environment in which farming activities take place through lobbying and advocacy.

Services to member organisations include the following:

- Providing agricultural advisory services.
- Providing agricultural and related information through the *Farmers' Voice* magazine, topical cassettes, brochures and other publicity material.
- Organising and conducting training programmes for farmers.
- Organising agricultural fairs.
- Mainstreaming gender in all aspects of the activities of the Federation
- Lobbying and advocating for farmer-friendly agricultural policies

History of agricultural extension in Uganda

UNFFE is one of the recent developments in the history of extension in Uganda that goes back to the days of British colonialism. Over the years, several disparate agricultural extension service systems have been introduced and practised.

In the colonial period, the extension service was a regulatory and enforcement body. It was organised like an army with the farmers being the soldiers on the ground who had to implement the orders from above. A series of regulations where designed to foster quicker adoption of new practices and crops.

Later extension work shifted from enforcement to education of farmers. During this period, the extension services were commodity-based with an emphasis on export crops like cotton and coffee.

Next came the community development – cum-extension approach, whereby the general agricultural officer was simultaneously charged with administrative duties, technical promotion, distribution of inputs, credit schemes and other ad-hoc assignments such as political mobilisation and census-taking. This wide-ranging set of duties usually resulted in low performance, discontinuity and demobilisation, with little organised technical work being effectively carried out.

The Project approach followed, whereby donors funded projects of their interest and staff were as such attached to various projects within the same office. This then gave way to the "Training and Visit System" that was implemented under the Unified Agricultural Extension programme. This management system provided for regular training of extension staff by subject matter specialists (SMS), and a regimented schedule of visits to farmers. Although this system of extension improved on the preceding one, it also had its limitations.

In spite of good intentions all of the above-mentioned approaches did not address directly the needs of the farmers. Over time, farmers' needs varied, marketing was liberalised, and so the need arose for setting up farmers' associations to address the problems that are unique to farmers.

UNFFE's demand-driven, cost-recovery agricultural advisory services

In 1995, UNFFE (at that time UNFA) started implementing a demand-driven and cost recovery agricultural advisory service in five pilot districts. In each of the five districts, one county was taken as a pilot area to implement the agricultural advisory service on the principle of demand driven cost recovery. This was a new concept, which was entirely different from the government approach.

The service was established with cost recovery as a high priority to ensure sustainability, and continues to run on voluntary farmers' participation as Extension Link Farmers (ELFs) and Contact Farmers (CFs). Farmers are organised into Special Interest Groups (SIGs) depending on the farming enterprise of their interest. Each SIG has a CF who should be a model/progressive farmer whose responsibility, among others, is to demonstrate new technologies and to encourage members to adopt them through the example of his/her practical experience. An ELF is basically a teacher and should at least have good communication skills and be innovative. The ELFs are regularly trained on the job by UNFFE's professional advisors at the district level and, in turn, provide training and advice to their respective SIG members through their demonstrations.

The procedure is that ELFs carry out a training programme by adopting an appropriate technology that addresses a major constraint in the local agricultural systems of their members.

The roles of the ELFs include: providing training and basic technical support to members of the SIG on farming techniques; encouraging other farmers to form SIGs; monitoring members' farms; collecting marketing information and assisting in the formation of marketing centres. ELFs also organise exchange visits among themselves.

The National Agricultural Advisory Services

In 2000, the Ugandan government launched the "Plan for Modernisation of Agriculture" (PMA). The PMA is meant to be a holistic strategic framework for eradicating poverty through multi-sectoral interventions enabling people to improve their livelihoods in a sustainable manner. The PMA has got seven priority areas for action, one of which is the National Agricultural Advisory Services (NAADS).

The NAADS aims to be an agricultural advisory service owned by all stakeholders, and to be an effective, efficient and sustainable organ, responsive to the needs of farmers. The programme aims at engaging farmers into critical thinking and discussions regarding their agricultural endeavours and the management of their farms as a business enterprise rather than simply delivering messages and inputs for their own sake. The underlying principle is to be responsive to the needs and demands as identified by farmers themselves, who then determine the work programmes and activities of advisors. In other words, the government has now moved away from service-driven extension to demand-driven extension services, just like UNFFE.

The role of UNFFE vis-à-vis government

The role of UNFFE is complementary rather than competitive. UNFFE has purposely recruited only a skeleton staff for co-ordination purposes, in order to also utilise the available government staff. Hence, in the implementation of UNFFE's advisory services, government extension staff has participated as subject matter specialists, resource persons, facilitators, and consultants. UNFFE, in turn, has also been used by government staff to mobilise farmers to benefit from government extension services.

UNFFE participated in the Task Force and was very actively involved in the formulation of the NAADS policy. Many of UNFFE's ideas were incorporated into the NAADS document. The NAADS is also working on the principles of being demand-driven and aiming for cost recovery. The only difference is that with UNFFE, individual farmers do the cost recovering while with the NAADS, farmers will cost recover as a group, sub-county and district.

UNFFE is a member of all NAADS institutions starting from the NAADS Board, the farmers' fora at district and sub-county levels, and in farmers' groups. UNFFE members and staff are members of the various committees and task forces of the NAADS. The federation participates in NAADS workshops and other extension service-related seminars.

The future as UNFFE sees it

Since its founding in January 1992, UNFFE has made steady progress. In its early years, UNFFE funded its activities using membership fees. From 1994, the federation started getting financial, technical and moral support from DANIDA (the Danish government's international development agency). This enabled it to acquire office premises, transport, office furniture and equipment. It also helped UNFFE to serve a growing farming community.

However, these days donor support is declining though demand for UNFFE's services is growing. The federation therefore needs to find ways to continue offering services to its members while keeping an eye on its cost-recovery plans.

■

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Cost recovery is not easy in practice

Stephanie de Kool worked for some years as field level advisor for UNFFE. We asked her how cost-recovery for extension services works at the field level. Here is her reply.

UNFFE's structure and cost-recovery plan for its services appear to be the solution to guaranteeing a **demand-driven** (bottom-up) and **sustainable** agricultural advisory service. However, the cost-recovery of advisory services at the grassroots level of UNFFE district organisations has not been realised to the extent envisioned. Only a small percentage of the costs of extension services are actually covered by the farmers.

Lack of cost-recovery makes the district organisations dependent on donor funds. Besides this threat, the organisations are presently weakened because staff do not get the expected percentage of their salary out of cost recovery and are therefore underpaid.

There are several factors that seem to hinder cost recovery at the grassroots level in Uganda:

- In the first place, the economic situation of average Ugandan farmers is very weak. They use the small income that they earn from marketing their produce for basic household needs and school fees for the children, rather than for agricultural training and advisory services.
- Secondly, the level of education amongst the farmer community is low. As a result, it is likely that many farmers do not value knowledge as something that can improve their livelihood. Therefore, they might be less willing to pay for knowledge than they would for something tangible.
- Thirdly, the UNFFE district organisations are limited by funds and available manpower whilst attempting to serve and organise their members, who are spread over extensive rural areas. The organisational structure is, therefore, not well established everywhere. Yet, the organisational structure of Extension Link Farmers (ELFs) leading Special Interest Groups (SIGs) at the grassroots level, is a pre-requisite for realising cost recovery of the services.

Hopefully, the NAADS will result in a solution to the problem, since it provides funds that can be used by farmer communities to pay for the agricultural services they demand. The NAADS will, however, have to prove itself in the coming years. Its performance will depend to a great deal on the success of organising farmers at the grassroots level to function independently and on making the right decisions on the way funds are spent.

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Will ICTs change the rural information landscape? Photo: ITU/Jean-Marie Micaud

The ICT agenda: global action plans and local solutions

Katherine Morrow

Information and Communications Technologies (ICTs) have brought issues of communication and rural access to information to the forefront of the development agenda. In this energetic atmosphere, experiments and pilot projects abound. People are forming new social networks, learning together and sharing knowledge across geographic and cultural boundaries. The context for this issue of LEISA is a global phenomenon: the growth of information and communications technology, a process that is both a product of, and a stimulus to, the parallel phenomenon of globalisation. Many see these changes as a historic societal transformation on a par with industrialisation, with the Internet as the harbinger of "perhaps the greatest revolution that humanity has ever experienced."

Whether or not this proves to be the case only time will tell. At the moment, computers and the Internet are becoming part of the daily life of millions in the North, giving them instant and largely free access to over 50 million pages of information on every conceivable topic (collectively known as the World Wide Web), and enabling them to use email and other computer applications to speak to each other and exchange written messages and pictures in a flash. The information networks that make this possible are formed by linking computers together into a global network of fibre optic cable, satellites and telephone lines, known simply as the Internet.

The digital divide

In the South, the situation is radically different. There are relatively few telephones, let alone computers needed to connect to the Internet. In terms of delivering information or communicating electronically, rural areas in the South are considered "the first mile of connectivity." For many LEISA readers and others, this mile, by and large, must be travelled using more traditional technologies: a magazine, a printed email message, a book, a cassette tape, a story or a song.

A fundamental issue is the poor state of rural electrical and telecommunications infrastructure in the South, causing a North-South disparity, termed "the digital divide". The lack of adequate infrastructure is only one aspect of the digital divide, however. Nor is it simply a North-South gap. When expressed in numbers, one in 15 people in the world counts as an Internet user. The figure for North America and Europe is one in two; for Africa it is one in 200 (Jensen, 2000). But these statistics do not take into account the even greater disparity between Internet access in urban vs. rural areas. Mike Jensen, an expert on ICTs in Africa, states, "No studies have been made in Africa of the number of rural vs. urban users, but it is safe to say that users in the cities and towns vastly outnumber rural users."

Global responses

Infrastructure and related policy issues are high on the agenda of various international bodies that have been convening global conferences, issuing statements, and drafting action plans regarding ICTs, the Information Society, and the digital divide.

The United Nations ICT Task Force was established in 2001, a forum for discussions on policy and particularly on how ICT can help to achieve the Millennium Development Goals. A similar initiative is the Digital Opportunity Task Force, created by the G-8 in July 2000. The DOT Force brings together governments, non-governmental organisations, experts and the private sector around initiatives focusing on different aspects of the digital divide, such as access, training, and support for locally relevant Internet content.

In his opening statement to the General Assembly plenary meeting on ICTs for development in June this year, the Secretary General of the United Nations, Kofi Annan, identified three areas of shortfall in the policy process at the international level:

- ***Top down, donor-driven:*** *"Our efforts must be based on the real needs of those we are seeking to help. They must be fully and genuinely involved. […] In particular, we must find* *better ways to ensure the participation of developing countries at all stages."*

- ***Lack of long-term commitment:*** *"Our efforts must be sustained over the long term. In recent years, we have witnessed a number of very promising initiatives that, regrettably, did not live up to expectations. The reasons were diverse, but one of the principal causes was insufficient long-term commitment on the part of initiators and sponsors."*

- ***Duplication of efforts:*** *"There is a real need for the many initiatives to come together, united by a common purpose and common determination."*

The latest milestone in the international dialogue around ICTs and development is the World Summit on the Information Society (WSIS), set to take place in Geneva in 2003 and Tunis in 2005. The Africa Regional Conference on WSIS concluded in Bamako, Mali, in May 2002, with a declaration calling for greater infrastructure investment and the removal of regulatory, political, and financial obstacles to the development of communication facilities.

The WSIS process is an opportunity to achieve greater coherence among international initiatives. A greater challenge will be in ensuring that the information society of the future is one in which cultural diversity and indigenous knowledge systems are genuinely valued and supported.

Back to the drawing board

The development impact of ICTs is notoriously difficult to capture. Development projects that set out to achieve specific goals through the introduction of ICTs, for example to enable farmers to access agricultural information, often find that the technology is being used in altogether different ways, for instance that local youth use the Internet to look for jobs outside the community.

Lessons learned from such experiments point to a need to apply the hard-won lessons of the past to the new technologies. Community-driven, participatory approaches tend to succeed; hasty, top down experiments tend to fail. A new focus on the communication role of ICT, local content, training and the use of simple ICT applications in combination with existing media such as radio is needed to support societies with low levels of functional literacy.

ICTs are proving their value in helping to deliver information to and from intermediary information providers such as universities, government offices, telecentres, NGOs and libraries. Some of the most successful ICT for development projects are focused on supporting the work of intermediaries who are relaying information to and from farmers and others at the grassroots level who do not themselves have access to the technology.

Many early efforts to introduce ICTs in village settings failed due to unrealistic expectations regarding people's ability to pay for the services offered. While many cities in the South have a thriving market for private cybercafes, in rural areas the "business case" for ICTs is much weaker. In the aftermath of these frustrating attempts, alternative, indigenous models of community access such as the Information Villages Research Project (p.28) are springing up, challenging the consumer-demand framework for technology adoption. It appears that, viewed as a community investment and a community asset, information technology will have to demonstrate its value in each local context, and if it is valued, it can be sustained.

The role of mediating organisations

In this respect the role of local "mediating organisations" is critical. Even with the community-owned model, ICT investments can fail to pay off because of a lack of training and technical support and the difficulty in finding relevant information in the local language.

Research by the Telecommons Development Group describes how "mediating organisations" – community development organisations that know how to use ICTs effectively – are linking local information and communication needs with technology, funding mechanisms, and policy arenas. Farmers' organisations, for example, are enabled to participate as stakeholders in international policymaking on issues that affect their lives. It is important that they do so, and as Pat Mooney of the ETC Group notes in p.26, such messages do carry weight.

Linking communities of practice

A major thrust of Bellanet's work with ICTs is in helping development workers use the technologies to engage in dialogues with each other (see also p.3). Participation in online communities doesn't require high-end technology; simple email is a powerful tool that enables users to connect with each other. For example, in partnership with the Technical Centre for Agricultural and Rural Cooperation (CTA) Bellanet hosts an online dialogue called AFAGRICT, an electronic discussion among people interested in the use of ICTs in agriculture in Africa. AFAGRICT is a community of practice linking researchers and practitioners in the North with those working in isolated rural settings. Such communities can be a valuable resource and source of moral support for extension workers and others working at the community level.

An important lesson that Bellanet has learned in its work with communities of practice is that networking is not about technology; it's about people connected through their common interest, sharing knowledge and working together toward common goals. The principles that underlie LEISA approaches also hold true for networks: their strength lies in diversity, and the best networks are organic, arising from the commitment and hard work of individuals. They are formed from the ground-up around practical issues, and they use technology in an appropriate and sustainable way.

Future opportunities

Widespread access to ICTs in rural areas is still several years in the future, but wireless technologies may eventually end the reliance of ICTs on costly telephone infrastructure. In Central America and many other regions, mobile telephones are increasingly affordable, helping to overcome rural isolation and enabling dispersed families stay in touch.

The challenge for those working at the grassroots level is to understand the choices offered to them by investment in ICTs and to make informed decisions. At this level, where information is scarce and communication difficult and expensive, ICTs have a lot to offer, but the high initial costs – not only in hardware, but in the cost of training and applying the technologies in day-to-day work – can be an insurmountable obstacle. We hope that this special issue of LEISA Magazine will help clarify some of the issues, offer some solutions, and perhaps inspire others to tackle the challenges and find their own way of travelling "the first mile." ■

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Recent and future challenges in agricultural extension

John Farrington

Historically, many of the changes in agricultural technology have been viewed as "public goods". It was in the interest of the nation to ensure food production and develop agriculture, and therefore, government funding was often provided to work with farmers - often farmers' associations - in explaining and testing the new technologies. The private sector became important in Europe and the USA with the introduction of, first, mechanical and subsequently chemical technologies. Even so, the impact of public funded extension was undoubtedly significant.

Over the last 50 years, there have been a lot of changes in fashion in agricultural extension. Keeping in mind the basic distinction between the ways extension is *organised*, and what it does (i.e. its dominant *functions*), this article asks:

- What have been the main patterns of organisation and function?
- What has underpinned the transition from one pattern to the next
- What extension issues are currently most prominent on the international agenda, and why?

Dominant patterns during colonial times

Two patterns of extension provision were dominant in these times. One was for extension to be linked specifically to export crops extracted from the "colonies". Typical examples included such major commodities as tea, coffee and cotton. Cocoa and rubber, being regarded initially as "forest" crops, came under this system later. Extension services were generally organised by the private companies or parastatal marketing boards involved directly in the production (but more often in the processing or marketing) of the commodity. The services were paid for by a levy on the sales of the product, which was easy enough to collect where the product had to pass through a monopoly purchaser.

A second was for colonial governments to impose their concepts of "good husbandry" in relation to soil and water conservation. However, much of the activity here consisted of issuing orders, checking whether farmers followed these, and imposing fines or imprisonment where they did not.

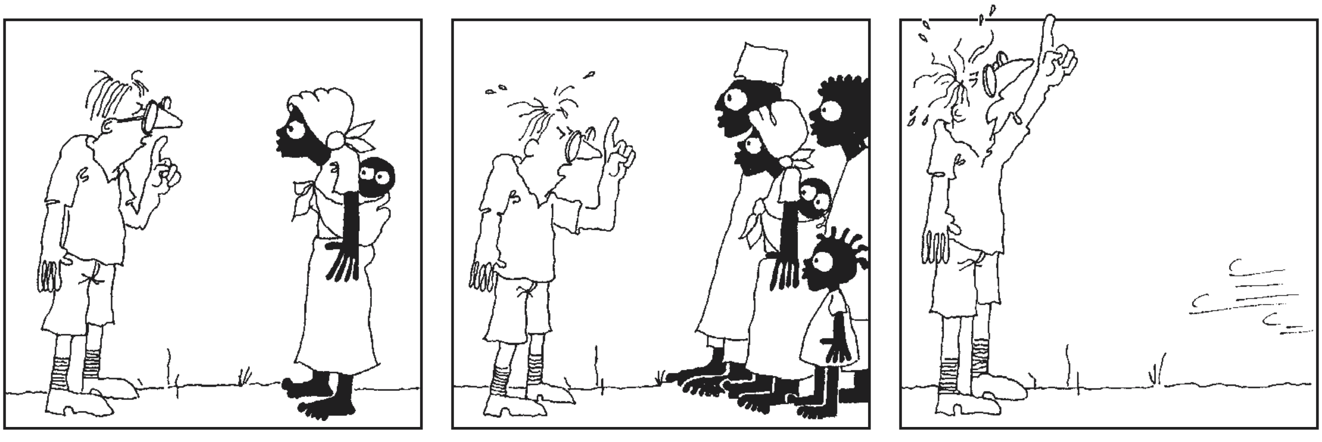
In both of these cases, the underlying concept is that technology has to be transferred, that recommendations have to be followed rigidly and that farmers who do not adopt are "laggards" in some way. Whilst technical specifications remain important for internationally marketed produce, outside of this context there has over the last 2 decades been a growing recognition of the validity of farmers' own knowledge and practice in such matters as varietal selection and soil and water conservation itself.

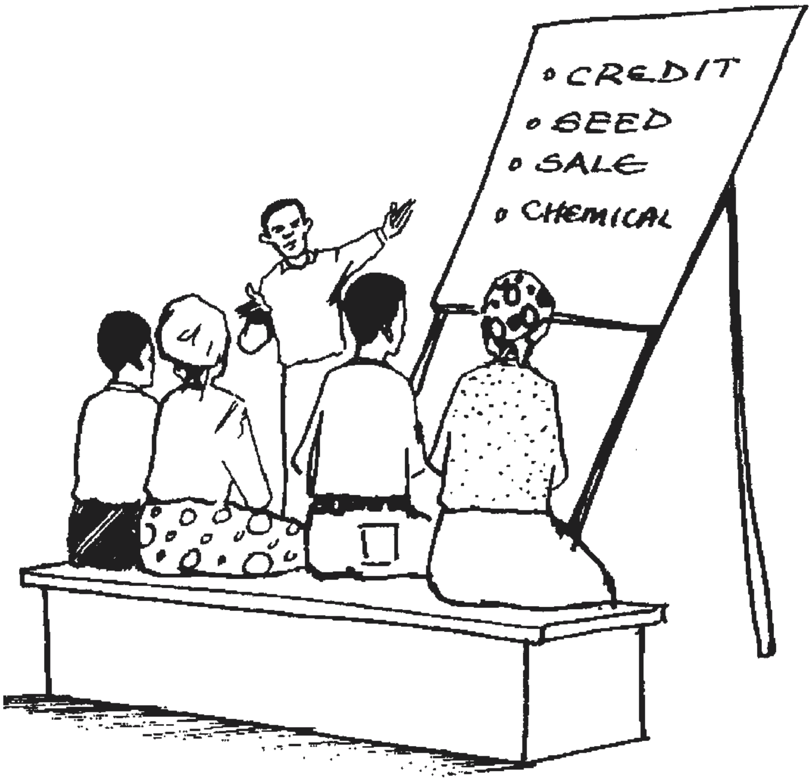
Post-Independence changes

One of the most pressing tasks facing newly-independent governments was to ensure adequate food supplies (which, incidentally, highlights the fact that food security is as much a matter of political self-determination as of economics – by contrast with the near-exclusive emphasis that neo liberals place on the trade economics of food security). Accordingly, they began to build up existing national agricultural research and extension services, or create new ones where these did not already exist. Research and extension were often run by separate departments. The interrelations between the departments were generally weak and dominated by researchers' perceptions that extension existed simply to disseminate the results of research. In other words, extension "existed to transfer new technologies to the masses". Others saw the potential for extension agents to carry out all manner of other activities, such as those relating to census and statistics, or even tax collection, so that in many cases they became distracted from their main purpose, and in some cases were even viewed by farmers with antagonism.

Two broad sets of efforts - both promoted by donors, but sadly, with little compatibility between them - were undertaken to strengthen national extension services in the 1970s and 1980s. One was the promotion of "systems" approaches. Approaches such as farming systems research focused on the understanding and improvement of existing systems instead of their wholesale replacement. These ideas were based on recognition that farmers had developed complex systems of managing crops and livestock in ways adapted to locally varying agro-ecological and socio-economic conditions. If options for technical change were to be developed which would be relevant to these farmers, it was essential to base them on good understanding of how farmers perceived and managed their farming systems. In this context, extension would not be restricted to dissemination functions, but would have a key role in feeding information on what innovations farmers adopted or rejected (and how and why) back into research systems. Whilst much of the philosophy of this approach remains relevant, in practice, it has been dogged by high cost, inability to shift "recommendation domains" onto a large scale, and resistance by many scientists to be drawn out of conventional modes of operation.

A second, starting in the 1980s, was the promotion, especially by the World Bank, of the Training and Visit (T&V) system. It is important not to lose sight of the immense scale of





this initiative: by 1992 World Bank and IDA had funded 602 projects with an extension component, almost all based on T&V, to a total value exceeding US$5bn. By the late 1990s, the pendulum had swung the other way - the World Bank lost interest in T&V, leaving numerous countries with T&V-based systems which were both costly and largely dysfunctional. T&V was intended as a system for managing public extension resources, but also had profound effects on extension methods and farmer-extension worker interaction (Garforth and Harford, 1995). It was developed and promoted in the belief that existing public sector services were overburdened with distracting tasks, poorly organised and inadequately trained. The main features of T&V are well known: it stripped away from extensionists such "extraneous" functions as promoting input subsidy schemes, or selling inputs themselves; it had a strongly hierarchical structure, with village workers backstopped by subject-matter specialists; it relied on strong technical "messages" reminiscent of "technology transfer" thinking; and it relied on local level dissemination through "contact farmers" – initially individuals and subsequently group approaches. There has long been widespread agreement on its shortcomings, which include its lack of flexibility of response in unstable, rainfed environments, its reinforcement of structural inequalities through the contact farmer approach, and its unsustainably high cost.

In retrospect, what also makes T&V look old-fashioned is its insistence that extension should be uniquely a publicly-funded, publicly-delivered service with no room for public/private partnerships of any kind, and, secondly, the insistence that extensionists should not take on any related activities such as the sale of inputs.

Privatisation and institutional complexity post-T & V

With the demise of T&V, the organisational landscape has become much more complex – in some ways, necessarily so. Some of these changes have resulted from the growth and replication of locally-based initiatives, such as the creation of local groups to test and exchange technologies, some groups being formed by farmers themselves, others spinning off from local institutions such as churches. Some of this complexity is the result of pressure from eg the World Bank and IMF towards economic liberalisation. Extension has not been spared from this "rolling back" of the state - "cost recovery" has been introduced for some aspects of what extension services did (eg. soil testing or livestock vaccination), or extension has been handed over entirely to the private sector for some categories of farmers (eg the more commercial) or categories of activity (such as veterinary).

This pressure has also accelerated trends that were established long before disillusion with T&V became widespread. These include:

- Efforts to build multi-agency partnerships in ways that (for the state) reduce costs, but also spread the reach of extension to areas where a purely public sector service is unlikely to be viable, and make it more responsive to local needs and opportunities. Such partnerships include service-providing non-governmental organisations, though much mutual suspicion needs to be overcome and these to some extent remain reluctant partners (Farrington and Bebbington, 1993)
- Efforts to build community-based organisations, such as farmers' associations, and to expand their capacity to make demands on technology systems and share new ideas, skills and approaches among their members. This approach has been pursued especially strongly, and with some success, in francophone countries
- Efforts to place funds in the hands of farmers so that they can "contract in" extension from whatever source they prefer. These include the voucher scheme operational in Chile for some time, and the channelling of extension funds to farmer groups via the Sub-Counties in Uganda following the NAADS Act (p.12).

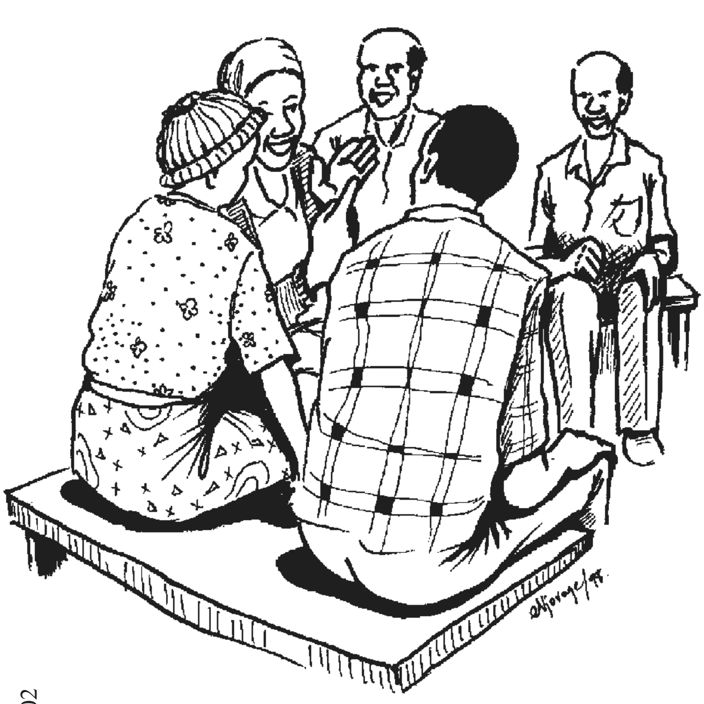
Emerging priorities

Two new sets of conditions have to be faced by developing countries and have important implications for extension. One is globalisation, especially in respect of trade in agricultural commodities. Many, especially in the North, overestimate the potential benefits for developing countries (especially landlocked countries in eg Africa) of globalisation, and underestimate the threats it poses. Where it does offer potentially new markets, the implication for extension is clear – all aspects of production, processing and marketing need to be driven by the requirements of the market, and extension guidance has to be tailored accordingly. This would not be much different from the approach pursued largely for export commodities and largely by extension agents employed within

large private companies in francophone countries. Where it poses threats, appropriate trade, agricultural and rural development policies need to be in place to meet such threats. In terms of agriculture, these will have to identify how internal markets and production systems can be supported and stimulated, and extension strategies designed accordingly.
The other change on the international landscape that affects extension is growing concern among donors that their support should be geared towards poverty reduction. This poses the interesting question of *whether* (not *how*) extension can contribute towards poverty reduction. A recent study (Farrington et al 2002) argues that it can, but only so long as poor people are seen to be not just farmers (or producers in general), but also labourers and consumers. Consumers can benefit through lower-cost food – and the extension implications of this are clear. The implications for extension of supporting the "poor as labourers" more than in the past are not so self-evident. Basically, little can be done unless agricultural policy in general (and technology policy in particular) bases itself on a fuller understanding of the labour economy – are wage rates stagnant, falling or rising, at what times of year and for what kinds of work (and worker)? when are particular kinds of workers relatively underemployed? What kinds of activity (within or outside agriculture) can be promoted to offer employment during these periods? It is only on the basis of questions such as these that extension can then be designed to offer what would be appropriate, check on its uptake, and make necessary course-corrections.

Changes in techniques and approaches

Our discussion up to now has focused largely on the question of how extension can best be organised. We now consider techniques and approaches – though these are not entirely unrelated to organisation: for instance, an organisational structure such as that of T&V which lends itself to linear, "transfer of technology" types of approaches is unlikely to be appropriate for more participatory types of approaches based for example on experiential learning.



Broadly, during colonial and early post-colonial periods, farmers were treated as passive recipients of technologies designed and delivered from scientific centres. Farming systems research, and growing interest in indigenous knowledge, prompted approaches which recognised the validity of traditional ways of managing farming, and appreciated that new technologies would have to be consistent with these if they were to have any chance of adoption. "Participation" by farmers in setting the agenda for research and extension therefore began to be advocated (Chambers et al, 1989). It was soon recognised that participation could take many forms, ranging from consultative approaches to make sure that extension recommendations were adequately targeted, to empowering approaches supporting the rights and entitlements of farmers as citizens, and therefore an end in their own right.

Many approaches to extension have been driven by the ethos of participation, and not all can be reviewed here. They include:

- Farmer-to-farmer approaches, in which farmers themselves are trained to promote learning among their colleagues, and to make demands on "external" systems (Scarborough et al (eds) 1997)
- Experiential learning approaches, such as farmer field schools. These emphasise the importance of learning in practical field settings instead of through didactic modes in classroom settings. They have been widely used with, for instance, integrated pest management.
- "Soft systems" approaches such as the Agricultural Knowledge and Information System (AKIS – Roling 1988) to think about the institutional framework supporting extension, and to identify the roles played by different kinds of actors in different settings.

The future?

The purpose of this article has been to set out a personal view of how and why patterns of extension have changed in the recent past, and fuller speculation on what the future holds is best left to others. However, it seems to me that extension will have a major role (but also many challenges) in the future in identifying how to bring together (on the one hand) the best that farmers can input into technology design, adaptation and dissemination, and (on the other) the best that technology systems themselves can offer. Nowhere will this be more difficult than in areas weakly-integrated into markets, where the majority of the rural poor still live (Farrington and Gill, 2002). These areas will be characterised by growing impossibility of recruiting and retaining conventional village-level public sector agents. This problem may be addressed by encouraging them to form small businesses involving for instance input supply, or generating the skills necessary to provide small business advice to local people. It might also be addressed by locating a strong cadre of extensionists and higher-level specialists in local towns, and increasing the capacity of people to draw on these – this will involve not only the logistic problems of getting them into towns, but also major psychological shifts on the part of public sector workers so that they welcome such "demand pull", visit the villages as necessary, and link closely with the private sector to generate advice appropriate to shifting market contexts. This is a complex agenda, but one which extension will have to take in its stride if it is to continue having an influential role in the future. ■

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Changing information flows

Editorial

Access to information is one of the most valuable resources in agricultural development. Today, the demand for agricultural information is stronger than ever. The increased market integration that is experienced by even the most remote farming communities greatly increases the pace of change. Events and developments far away from home have profound effects on the livelihoods of farmers. Information is needed:

- to exploit opportunities in time – like the many emerging niche markets for organic products;
- to raise awareness about the potential negative impacts of current choices, e.g. embarking on the use of genetically modified crops when more and more markets don't want them
- to get to know about the experiences of other farmers in order to search for better opportunities and sustainable solutions, like the System of Rice Intensification that is improving the livelihood for many rice farmers

Today, the demand for agricultural information is stronger than ever. Photo: Bert Lof

The last decade has seen tremendous changes in information provision to farmers, resulting from policy changes, financial crises and revolutions in information and communication technology (ICT). In this issue we attempt to explore these changes and what they mean to small-scale farmers in rural communities in the South.

Public funded extension in crisis

Agricultural development has long been seen as a pre-requisite for economic development in the society at large and thus it made sense for governments to invest significantly in agricultural extension systems. Public funded agricultural extension was a corner stone in development policies all over the world.

In developing countries the 1970s saw the fastest growth in national extension systems – often they grew close to ten percent per year. However, in the 1980s the annual growth rate slowed down to a few percent and over the last decade stagnation or even dismantling of extension systems has been on the agenda. Farrington (p.6) provides more insight into the history of public extension.

The decreasing public support for agricultural extension is the result of many factors, among them:

- severe and repeated financial crises in most developing countries;
- a shift in preference for private enterprises over government intervention that is reflected in structural adjustment programmes imposed by international donors but also by national governments – it is believed that private companies are more efficient than the public sector in providing services;
- dissatisfaction with the perceived lack of impact by agricultural extension.

Today national extension systems are in dire straits with resources being cut to a minimum. Many extension workers have been laid off or have left for opportunities elsewhere and the ones who remain often lack the basics for their work like transport and access to information. Staff morale is often low due to the inability to perform their task well combined with continuous criticism from outsiders who often do not understand the impossible working conditions of the extension staff.

Exploring new ways to deliver information

For a long time nobody questioned the existence of public funded extension systems, so the focus was on efficiency within the extension system instead of alternatives. But the crisis in public extension services has led to a search for solutions and alternatives. No universal prescription to the "problem" of extension has emerged. Instead a pluralistic system is envisioned with many players selling extension services, including NGOs, private companies and extension departments. (Farrington, p.6) The thinking is that it will force every extension provider to maximise efficiency and to provide relevant extension.

The Uganda National Farmers Federation (p.11) is an example of such a partnership for agricultural extension. It is a young successful farmer organisation trying to provide extension services on a cost-recovery basis by building alliances with private companies and other actors.

There is much talk about the shared interests among the different actors in agricultural development, but very little about the conflicts. Will these new partnerships promote only high-input farming because the participating private companies can earn money on selling the inputs? Or will they promote self-sufficiency and low-input alternatives that may be in the interest of many farmers but undermine the private companies? Only time will tell, but it is important to be aware that these old conflicts do not disappear just because the different actors take on a shared identity.

Another trend is the attempt to shift the workload from public paid extension to farmers who have to do their own research and farmer-to-farmer extension. This can be empowering and can stimulate endogenous development, but too often the costs are not considered. It is important to remember that many farmers suffer under labour constraints that will limit their possibilities of running their own research and extension system and it does not solve the problem of getting required information from outside.

The current trends point towards the development of a dual system in which the farmers who can pay are served well whilst the poor farmers are left "empowered" to do whatever they want but with resources to do nothing. The many new unconventional partnerships between private, public and civil society will make it much more difficult to see what is really going on.

What can modern ICTs offer?

And it is in this context that information and communication technologies are seen as being able to change the landscape of rural information exchange. Most of the experience as of now relates to information delivery in the developed countries, which has been revolutionised over the last two decades through the widespread adoption of computers and Internet connection. Here, it is now common to have a computer at work and at least one at home.

The Internet spreads faster than almost any previous technology. It took radio almost forty years to reach an audience of 50 million and for the Internet just four. The amount of information available on the Internet is tremendous and growing fast. Many international and national organisations make almost all their publications available on the Internet. Publishing to the Internet is easy, quick and almost free. Advocacy organisations like ETC have been able to gain the benefits of ICTs as is seen in the interview with Pat Mooney on p.26.

Most information on the Internet is available at no cost so the user “just” has to find a way to get connected. This is easy and cheap in developed countries due to the well-developed infrastructure; not so in many developing countries. Computer equipment is expensive and reliable power supply and telephone connections are not readily available. When the computers break down, spare parts and qualified technicians are difficult to come by. There is also the problem of “computer literacy”. Computers are much more difficult to use than other technologies like radio, telephone, and fax, for which special training is required.

Thus it would be over-optimistic to think that everybody will soon have access to the Internet. There are plenty of limitations and obstacles to be overcome as pointed out by Morrow on p.9. However, there are some encouraging success stories like that of the village information centres in Pondicherry, India (p.28) and the Internet Radio project in Kothmale, Sri Lanka (p.25) Both these experiences have been used to develop larger, global initiatives for improving Internet access in rural communities.

Using all available means

Yet, for many farming communities in the South, modern ICTs are still a technology of the future. Therefore, it is important not to forget the “old” technologies and to use all available means in reaching people with the information they require.

Radio is one such technology, which has penetrated deep into otherwise inaccessible rural areas. Rural radio has a long and fine track record but is often overlooked because of all the attention paid to the Internet. Developing Countries Farm Radio, for example, broadcasts to nearly 100 countries in Latin America, the Caribbean and sub-Saharan Africa. (p.20). Its success has been in building a network of broadcasters, radio stations and training organisations, which has been able to keep pace with the changing times and provide their audiences with globally-relevant information in a locally-adapted form. The case of Tadjik Radio (p.16) is quite different. This article shows that it is not only technical obstacles that need to be overcome to facilitate the access of information; an attitude of participation and openness is also required.

Getting information to where it is most needed often requires creative partnerships. The “In the field” project on p.22 is a partnership between researchers of NRI, funders, people in the communities and broadcasters from BBC World Service. The series, broadcast twice in 2001 and 2002, has been immensely popular and has led to new partnerships: with schools in developing educational material and with local radio stations for re-broadcasting in local languages. The radio series was accompanied with a booklet, web site and a set of audiocassettes, thus combining media to get the best impact.

For some rural communities, like the one mentioned on the back page, a printed magazine is still the only shred of information they have access to. In places with no power supply, no computers and telephones, magazines or newspapers can still be read and passed around to others - information used and shared. And even in not so remote places, magazines have an important role to play as demonstrated by the “Ground Up” magazine of PELUM in Zimbabwe (p.13). It is popularising ecological land management approaches, influencing policy makers to take note of them, providing a forum for critical analysis of the approaches, encouraging research and giving a southern perspective to development.

The message is clear - use all the means available, both the new and the old, to change information flows and thus enable rural communities to access, share and exchange experiences in sustainable agriculture.

■

Photo: Henk Kieft

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22 Communicating innovation: the "in the field" project

Monica Janowski and Kaz Janowski

The "In the field" series broadcast on the BBC World Service in 2001 and 2002 is an example of a fruitful partnership between researchers, broadcasters and funders in communicating innovations to a wider audience. It is also an excellent example of using different media to get the best impact - a radio series complemented by a website, printed booklet and audio cassettes. The 12 programmes in the series feature interesting initiatives in bringing about innovative improvements to livelihoods around the world. The response to the series and the requests for educational material is a good indicator of how useful the information is to the listeners. The follow up to the series in terms of rebroadcasting in local languages and development of appropriate educational material will not only ensure that the information reaches more people at village level, but also that it will be translated into action. Many more of such partnerships are needed to get valuable information to the people who need it most.

GROUND UP HAS BEEN USED AS LECTURE MATERIAL IN UNIVERSITIES.

13 "Ground Up": facilitating networking and sharing in sub Saharan Africa

Parkie Mbozi

Participatory Ecological Land-Use Management (PELUM) Association is a network of 138 civil society organisations working in nine countries in eastern and southern Africa. "Ground Up" is the magazine launched in 2000 by PELUM in response to the information needs of its members. The magazine is being used to share field experiences and to network with like-minded organisations in the region. It is also a tool for advocacy and a means of popularising participatory ecological land-use management. Just two years and 8 issues later, the impact of Ground Up as a source of information and inspiration is commendable. A recent evaluation of the publication is explicit in pointing out that the magazine has filled a gaping hole in African media.

ILEIA is the Centre for Information on Low External Input and Sustainable Agriculture (LEISA) in the tropics. ILEIA seeks to promote the adoption of LEISA through the LEISA Magazine and other publications. It also maintains a specialised information database and an informative and interactive website on LEISA (**http://www.ileia.org**). The web site provides access to many other sources of information on the development of sustainable agriculture.

LEISA is about Low-External-Input and Sustainable Agriculture. It is about the technical and social options open to farmers who seek to improve productivity and income in an ecologically sound way. LEISA is about the optimal use of local resources and natural processes and, if necessary, the safe and efficient use of external inputs. It is about the empowerment of male and female farmers and the communities who seek to build their future on the basis of their own knowledge, skills, values, culture and institutions. LEISA is also about participatory methodologies to strengthen the capacity of farmers and other actors to improve agriculture and adapt it to changing needs and conditions. LEISA seeks to combine indigenous and scientific knowledge, and to influence policy formulation in creating an environment conducive for its further development. LEISA is a concept, an approach and a political message.

28 Information villages - connecting rural communities in India

Katherine Morrow

The Information Villages project connects 10 villages in Pondicherry, India, through the use of modern ICTs. The project was started in 1998 by the Swaminathan Research Foundation and has gained international fame for its success in bringing the benefits of modern ICTs to the rural poor. Using a hub and spokes model, a central information centre (hub) is connected to the knowledge centres in the surrounding villages (spokes). In each village, volunteers selected by the community run the knowledge centres. The project's gender focus has ensured that 50% of these village volunteers are women, thus ensuring that women are not excluded. Prejudice-free access to the socially underpriviledged has also been ensured through the agreement between the project and the villagers. Training has been a major focus of the project enabling the volunteers to collect, create and disseminate locally relevant information in Tamil, and allowing the villagers to access useful information. The experiences of this project with its focus on community ownership and local content are reflected in recent initiatives to create similar networks elsewhere in the world.

DEAR READERS

BELLANET

Bellanet is an international not-for-profit organisation established to help the international development community to work together more effectively, especially using information and communication technologies (ICTs). Based in Canada, Bellanet is funded by the International Development Research Centre, the Canadian International Development Agency, the Swedish International Development Cooperation Agency, and the Royal Danish Ministry of Foreign Affairs - Danida.
www.bellanet.org

As an organisation involved in the collection and dissemination of information through the LEISA Magazine, ILEIA knows the value of information in improving the livelihoods of rural people. Every time you, our readers, give us feedback on how you use the information from the magazine - to try out new agricultural practices, to set up new enterprises, to build new linkages, to lobby for policy changes etc. - we are not only encouraged, but also convinced that our efforts bear fruit.

Of course, the printed medium, like the LEISA magazine, is just one amongst the many ways in which information can be communicated and exchanged. Eight years ago, the ILEIA Newsletter on "New ways of information" dealt with some of these methods. (March 1994, vol.10.1)

Much has happened since then. Public extension systems are being dismantled, giving way to other more creative alternatives, especially partnerships between different stakeholders. At the same time, modern information and communication technologies have progressed rapidly and are expected to drastically change rural information access. As such, we thought it appropriate to examine this theme again, particularly the changes that are taking place with the rise of modern communication technologies, and to call the issue "Changing information flows".

In doing so, we have been priviledged to collaborate with Bellanet in Canada, an organisation with a great deal of experience in harnessing modern ICTs for development. Special thanks are due to Katherine Morrow of Bellanet, who despite her hectic schedule, wrote up several interesting experiences, worked with us on the contents, put together some interesting tips for ICT users in the South, joined the hunt for an appropriate cover photograph and kept answering our endless questions.

We hope that you will enjoy this issue and be inspired to take up creative ways of sharing your knowledge and experiences with others.

The editors

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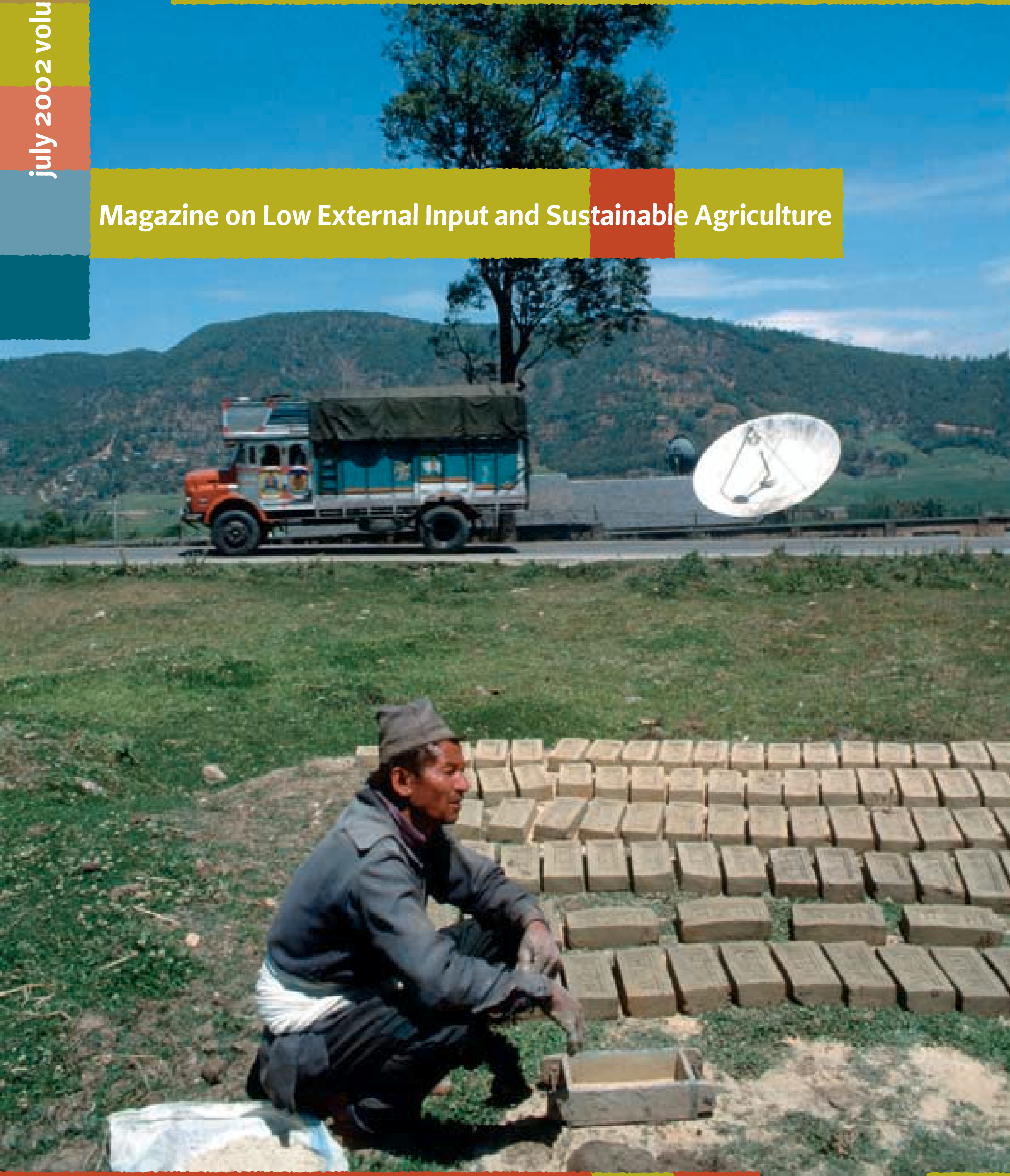


Changing information flows

Networking for family poultry development

E. Fallou Guèye and K. van 't Hooft

Mr. Subramanium actively promotes indigenous chicken breeds. Photo: Bertus Haverkort

Around 80% of the world's poultry is managed in traditional poultry systems, consisting of chickens, guinea fowls, turkeys, ducks, pigeons etc. These animals, of a wide variety of indigenous breeds, play an important role in the family: as a small asset, as a source of food or for social and spiritual obligations. The importance of poultry as a tool for poverty alleviation has been long identified. Many projects have attempted to replace the local poultry breeds with exotic or cross breeds specialised in egg or meat production, whilst introducing the standardised conditions of more intensive systems. Success, however, has been limited. In the past few decades, family poultry projects based on local knowledge and the improvement of indigenous breeds of different fowl species under local circumstances have been developed. In this process, high mortality due to infectious diseases (especially Newcastle disease) as well as predators, theft, and seasonal lack of feed, had to be dealt with - a tough task under local conditions and policies.

Several networks have been established to exchange experiences and research results between people engaged in family poultry keeping in developing countries. Examples are the FAO programme to support family poultry production that works through the International Network for Family Poultry Development (INFPD) (www.fao.org/ag/aga/agap/lpa/fampo1/fampo.htm); the Network for Smallholder Poultry Development of the Royal Veterinary and Agricultural University in Frederiksberg, Denmark (www.poultry.kvl.dk); Fowls for Africa of the Agricultural Research Council of South Africa (www.arc.agric.za); and the Improvement in Rural Poultry in Developing Countries of the University of Queensland, Australia (www.vsap.uq.edu.au/ruralpoultry).

One issue that these networks have focused on is the development and testing of thermo-stable vaccines for the control of Newcastle disease under rural family conditions. Newcastle disease is capable of causing a 50 - 100% mortality in unprotected chicken flocks, and the impact and unpredictability of the outbreaks in rural communities have discouraged many families from investing in new animals. Vaccination is the only way of controlling this disease, both in industrialised and extensive systems. The commercial vaccines commonly available (La Sota, Hitchner B1 and Clone 30) are adapted to large-scale chicken farms; these require constant refrigeration and once opened need to be used on a large number of individual animals within a short time. These multi-dose vials of vaccine (minimum 1000 doses) are not suitable for village poultry systems.

The INFPD and the Australian Centre for International Agricultural Research (ACIAR) have supported projects in the development of vaccines suitable for use in village poultry systems. These do not require continuous refrigeration and give optimal effect when administered as eye drops, but can also be given as a food additive to animals that cannot be caught. The first of these vaccines (NDV4-HR), was successfully tested in Asia and Africa, and is now produced commercially. Another thermostable vaccine (I-2) developed later is free of commercial ownership. (for more information contact: Dr. John W. Copland copland@aciar.gov.au) It is available at no cost to countries that wish to produce their own vaccine; the simple techniques required for producing and testing the vaccine can be learnt in short workshops. It is now being produced in Vietnam, while it is currently being tested in several African countries. The outcome of this effort shows the potential and the importance of networking and research in optimising low-input livestock systems. ■

Theme for issue 18.4, December 2002

Feminisation of agriculture needs appropriate responses

The feminisation of small and marginal agriculture is increasing rapidly in many parts of the world due to processes such as labour migration, part-time farming, urban life focused education and HIV/AIDS. This has an enormous impact on women, their households, rural communities and farming. Supporting women in their role as farmers requires many changes and adaptations. These relate to property rights, access to productive resources as well as to adaptations, i.e. decision making, labour division, crop management, animal husbandry and production of tools. Also research, extension, information management, input supply, financing and marketing etc. have to become more women-focused and have to develop methodologies and procedures adapted to the specific conditions and needs of women. Often, women as the main managers of change have to cope with ecological degradation. What specific needs do women in such conditions have and what adaptations have been developed by women to cope with these processes? What are the experiences of participatory programmes that have been supporting women to cope with change? What are good examples of technologies and methodologies suited for use by and with women? We invite you to share your experiences on these and other relevant questions with other readers of the LEISA Magazine. First deadline for contributions 1st of September 2002.

You are invited to contribute to these issues with articles (about 800, 1600 or 2400 words + 2-3 illustrations and references), suggest possible authors, and send us information about publications, training courses, meetings and websites. Editorial support is provided by ILEIA. Authors of published articles are entitled to a standard fee.

The role of smallholder farmers in seed production systems report and recommendations of a study visit organised by the technical centre for agricultural and rural cooperation, Zimbabwe, 1999. 2000. 94 p. ISBN 92 9081 2176. Technical Centre for Agricultural and Rural Co-operation (CTA), PO Box 380, 6700 AJ Wageningen, The Netherlands / cta@cta.nl CTA number 965. 10 credit points.

This book reports about the CTA study visit to 19 seed supply projects in Zimbabwe by 16 seed supply experts from sub Saharan Africa. The visits focused on work with smallholder farmers and on small grain and other indigenous crops. The report details the visits, outlines the seed supply situation in participants' home countries, and explains the follow-up work upon returning home. The report provides a lot of technical information but also encompasses socioeconomic aspects in management decision making.

The availability of improved seeds holds a key to enhanced farm productivity and increased income generation. The formal seed sector has had an impact on the productivity of high-value crops. But high quality seed supply for smallholder farmers has often been neglected, though indigenous crops grown by small farmers largely contribute to household and national food security in most countries. It is the informal seed sector that supplies 90% of the seeds of these indigenous crops. This report provides recommendations to improve the informal seed sector. The participants in the study agreed that when the informal seed sector is given the resources it needs to generate high-quality seeds for the nearly 90% of farmers in Zimbabwe and neighbouring countries who presently rely on this source, it will have a huge impact on national food stocks and food security. (WR)

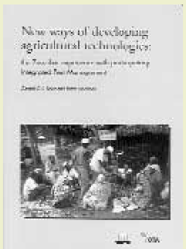
Global development : an experiment in rural development in Bolivia 2001. 83 p. Centre of Studies on Social and Economic Reality (CERES), Cochabamba, Bolivia. Simon I. Patino Foundation, 8, rue Giovanni-Gambini, 1206 Geneva, Switzerland.

From 1990 to 1995, the Simon I. Patino Foundation undertook an integrated development project in a peasant community near Cochabamba (Bolivia) with the objective of improving the quality of life of the population and halting the process of emigration, severely affecting the region at that time. The book describes the experiment from its inception, the handing over of responsibility to the community and the relative continuance of activities. In the first part of the book the agricultural site with its drought problems is discussed and the start-up of the project together with the organisation and the activities undertaken. The last part deals with relations within the community, the handing over of the project to the community and the causes and consequences of the interruption of most of the project activities. The text concludes with a more general reflection on the subject of development, for which the experiment under consideration serves as a starting point. (WR)

From indigenous knowledge to participatory technology development : soil and water conservation by Michael YG, Herweg K. 2000. 52 p. Centre for Development and Environment, University of Berne, Institute of Geography, Hallerstrasse 12, 3012 Berne, Switzerland / cde@giub.unibe.ch. Dr. Yohannes Gebre Michael, P.O.Box 33569, Addis Abeba, Ethiopia / Fax: +2511 518977.

This booklet on extension in soil and water conservation contains extracts from the detailed case studies Yohannes Gebre Michael carried out on different sites in Ethiopia, as part of his PhD. It is targetted at Development Agents of the agricultural extension service. The booklet helps the user to understand and respond to the diverse rural communities and landscapes, to see the needs and understand how indigenous soil and water practices work, to consider these indigenous practices as options for participatory technology development, and to integrate both indigenous and introduced know-how and practices for a more sustainable land management.

This booklet illustrates a procedure on how to learn about the prevailing natural and human settings in a rural area. It shows how to make best use of existing know-how through discussions with farmers, women, elders and leaders. Land users have most knowledge of their area, and development agents and experts should not attempt to do the farmers' job on behalf of them. Recommended. (WR)



New ways of developing agricultural technologies : the Zanzibar experience with participatory integrated pest management by Bruin GCA, Zeeman F. 2001. 167 p. ISBN 90 6754 624 0. Wageningen University and Research Centre, Technical Centre for Agricultural and Rural Cooperation (CTA), PO Box 380, 6700 AJ Wageningen, The Netherlands / cta@cta.nl.

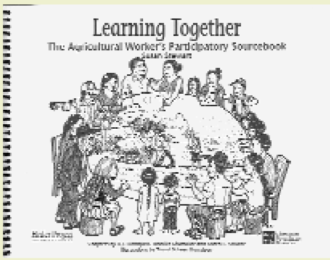
This book tells the story of an international collaboration in crop protection that evolved over sixteen years in Zanzibar. The project developed from a top-down activity focussing on the strengthening of a governemental plant protection organisation, to a successful process of bottom-up development in subsistence agriculture.

Experiences are decribed with the Farmer Field School (FFS) development on the islands of Zanzibar. The results in five different cropping systems are described, and general lessons are drawn from the successes and failures. Lessons include necessary adaptations of the FFS model, originally developed in rice agriculture in Southeast Asia, to the typical agro-ecological and socio-economic conditions of small-scale farmers in East Africa. By doing so the book addresses biological, ecological, social, economic, bureaucratic, and political dimensions of agricultural development.

The conclusions of this work show that FFS can work in an East African context if certain conditions are met. These conditions include raising awareness, creating mutual trust, developing new partnerships in research and extension, promoting conducive policies for FFS development, and mobilizing funds to make this happen. The good news is that the FFS way of working is capable of effectively mobilising people to collaborate in new and productive ways. However, this will not happen overnight and requires commitment of many stakeholders.

The international seminar on non-timber forest product : China Yunnan, Laos, Vietnam 2001. 187 p. ISBN 7 81068 271 7 RMB 40.-. Sino-Dutch Cooperation Forest Conservation and Community Development Project Office / hepikun@public.km.Yn.cn Yunnan University Press, 8 Jiaolin Road, Kunming, Yunnan 650031, P.R. of China.

This seminar aimed at increasing understanding about the role of Non Timber Forest Products (NTFP) in conservation and development in three countries - China, Vietnam and Laos. The report contains all the papers presented and summaries of the plenary discussions. Besides the plenary discussions, three parallel working group discussions tackled specific practical problems, in order to share and discuss experiences and lessons learnt. The three working groups were: NTFPs and forest conservation, NTFPs and community development, and NTFPs and marketing and processing. Papers addressing these topics with a lot of case studies and recommendations for sustainable use and management, participatory methods to determine the role of NTFPs in community's life, and marketing information are compiled in the proceedings. Useful information on forest conservation and sustainable development.(WR)



Learning together: the agricultural worker's participatory sourcebook
by Stewart S. 1998. 350 p.
ISBN 1 886532 10 9. Heifer project International, PO Box 808, 1015 Louisiana Street, Little Rock, AR 72202-2815 USA / www.heifer.org
Triops, Hindenburgstrasse 33, D-64295 Darmstadt, Germany / triops@net-library.de ; www.net-library.de.
Christian Veterinary Mission, 19303 Freemont Ave.N., Seatle, WA 98133 USA / www.vetmission.org. CTA no. 1045, 80 creditpoints

Learning together is a very rich resource book of excellent quality, meant for trainers in the field of agricultural and livestock development. It focuses mainly on trainers (both professionals or farmers) who are or will be training farmers in a participatory way. It is written by a variety of people working in agricultural development connected to a range of organisations. Drawing on the training experiences of practitioners from over 25 countries on 5 continents makes the book extremely practical. It offers a wealth of useful participatory methods, tools, techniques, games, energizers, etc. that can be used to improve on the quality of agricultural training.

It is designed primarily as a reference book. Users can pick out ideas from the sections related to the activity they want to undertake. The book is very comprehensive and includes all relevant topics, which are covered in a very practical way. The source book contains four sections: (1) How adults learn and effective learning techniques, (2) The steps in a training cycle, (3) Issues in agricultural and livestock training (gender, communication and IK) and (4) Reference section.

The book is rich in illustrations and the text is easy to understand. The approach to learning is very refreshing. Instead of the traditional form of theory followed by exercises, this book gives a lot of exercises through which reflection on the theory is stimulated. In short, this is certainly a book that will be frequently used and highly appreciated by every agricultural trainer who seeks to improve his or her training/facilitation skills. (WvW)

Urban Agriculture 2001. 45 min VHS PAL. ETC Netherlands/Resource Centre on Urban Agriculture and Forestry (RUAF), PO Box 64, 3830 AB Leusden, The Netherlands / www.ruaf.org ; ruaf@etcnl.nl.

This video on urban agriculture has been produced to facilitate a greater understanding of urban agriculture among policy-makers, urban planners, NGOs, sectoral organisations and other people who can make a contribution to the integration of urban agriculture into urban policies, plans and development programmes. It can be used in meetings, seminars, workshops, staff-training sessions, and initial phases of projects. The first part of the video shows the potential contribution of urban agriculture to enhancing urban food security, to poverty alleviation and to sustainable urban management. The second part of the video presents two examples of local processes of situation analysis, planning and action regarding urban agriculture - one example in Dar es Salaam, Tanzania, and the other in Cuenda, Ecuador. The video is also available in French and Spanish.

Ethical consumers and ethical trade : a review of current literature
by Tallontire A, [et al]. 2001. 34 p. ISBN 0 85954 527 X GBP 5.-. Natural Resources Institute (NRI), University of greenwich, Chatham, UK
DFID. (Policy series ; EP 12). NRI Catalogue Services, CAB International, Wallingford, Oxon OX10 8DE, UK.

This review examines both the nature of ethical consumerism and the characteristics of consumers themselves. The motivations of ethical consumers are varied, as is their willingness to pay an ethical premium on consumer goods. Ethical consumerism is a complex phenomenon and the experiences obtained within the fair-trade and organic movements are reviewed in an attempt to clarify issues determining its future potential. These conclusions are important both to the commercial sector and to development agencies concerned with trade with developing countries.

On-farm seed priming - a key technology to improve the livelihoods of resource-poor farmers in marginal environments by Harris D., 2001. 15 p. DFID plant Sciences Research Programme, Centre fro Arid Zone Studies, University of Wales, Bangor, Gwynedd ll57 2UW, United Kingdom.

Soaking seeds before sowing, or priming, is a technique that has been used by farmers for generations. However, it has been done mainly in times of drought to "catch up " on time lost, and the duration of soaking has been highly variable. This booklet documents the findings of participatory research undertaken by researchers of the Centre for Arid Zone Studies of the University of Wales and farmers in several countries in Asia, Africa and Latin America on seed priming as a regular practice. The findings prove that seed priming is a low-cost, low-risk technology ideally suited to the needs of resource-poor farmers in marginal areas of the semi-arid tropics. The booklet contains a lot of practical information on a range of crops that can be tried out and adapted by farmers. More information can be found on the web site www.seedpriming.org (CW)

The meat business : devouring a hungry planet by Tansey G, D'Silva_J (eds.). 1999. 249 p.
ISBN 1 85383 603 6 GBP 12.99. Earthscan, 120 pentonville Road, London, N1 9JN UK / orders@lbsltd.co.uk ; www.earthscan.co.uk.

This book tackles a fundamental global concern: how can we feed ourselves in the coming centuries, in a way that provides healthy and plentiful food for all people and yet is gentle on animals and on the environment? The papers of Compassion in World Farming's conference on Agriculture for the new millennium- Animal welfare, poverty and globalisation have been transformed into this book. The book is very informative and provides ethical consumers and campaining citizens with practical advice on how to achieve urgently needed reforms in agricultural practices. The exploitation of animals in factory farming is criticized. It says that cheap meat takes food from the mouths of the poor and creates degradation and pollution of the environment. The book contributes to the discussions on the need for a more sustainable agricultural system both in developed and in developing countries.(WR)

Visit our website: www.ileia.org

Milk south-north (Lait sud-nord) by World Herders Council (Conseil Mondial des Eleveurs), 2000. B.P.2453, 6002 Lucerne, Switzerland
http://www.condial.org/francais/fspublications.htm
The World Herders Council is an initiative of traditional herders of the Sahel. It is an international network of herders who are determined to stay and who have a concept of cattle breeding which includes a respectful attitude towards nature, towards animals and towards people. Their dossier Milk south-north, is a reflection on ethics for herding dedicated to milk, in which the discussion between herders from "the South" and European stockbreeders is paramount. The printed version of the dossier is in French and English and can be ordered via this web site.

Impact of changing agropastoral systems on agrobiodiversity: A case study of the Qinghai-Tibetan Plateau
an article by Wu Ning, 1998.
http://www.icimod.org.sg/focus/agriculture/agribio_bk/agrobio4.htm
This study describes the daily lifestyle of the pastoralists and discusses the economic progress and resultant pressure on the environment, particularly on the rangeland ecosystem and its biodiversity.

International Centre for Integrated Mountain Development (ICIMOD)
4/80 Jawalakhel, G. P.O. Box 3226, Kathmandu, Nepal.
icimod@icimod.org.np
http://www.icimod.org.sg/
ICIMOD's mission is to help promote the development of an economically and environmentally-sound mountain ecosystem and to improve the living standards of mountain populations in the Hindu Kush-Himalayan Region.

Farming Systems by International Institute of Tropical Agriculture (IITA), c/o Lambourn (UK) Limited, Carolyn House 26 Dingwall Rd., Croydon, CR9 3EE, UK. IITA@cgiar.org
http://www.iita.org/crop/farmsys.htm
IITA's mission is to enhance the food security, income and wellbeing of resource-poor people, primarily in the humid and sub humid zones of sub-Saharan Africa. It conducts research and related activities to increase agricultural production, improve food systems, and sustainably manage natural resources, in partnership with national and international stakeholders. Information on sustainable crop-livestock systems is available on this page. IITA also provides publications free of charge.

Integrated Crop-Livestock production for the slopelands of Asia, 1998, informative article to introduce a workshop on this topic.
http://www.agnet.org/library/article/ac1998d.html
Combining livestock with crops is a sustainable and profitable system of production for low-income slopeland farmers in Asia.

Low-cost livestock technology development by farmers, 1998.
http://www.agnet.org/library/article/ac1997f.html
This survey undertaken by the FFTC (food and fertiliser technology center) aimed at collecting and disseminating low-cost indigenous farming technologies related to livestock production. These technologies are described in the paper.

A knowledge link on livestock and rangeland systems, Work in progress 2002-1st edition. International Fund for Agricultural Development (IFAD), Via del Serafico, 107, 00142 Rome, Italy / livestockadvisory@ifad.org
This CD-Rom contains all the html available on the livestock and rangeland knowledge subsite of the IFAD website: **http://www.ifad.org/lrkm/index.htm**. It is based on case studies of a range of IFAD projects that support livestock production among pastoralists, agro-pastoralists and smallholders.

The Real Green Revolution
www.farmingsolutions.org
Farmingsolutions is a website jointly created by Greenpeace, Oxfam and ILEIA. The aim of the website is to bring forward successful experiences of ecologically-sound, socially responsible and economically-viable farming practices, and to demonstrate that this kind of agriculture can be successful in fighting hunger and malnutrition.

The website argues for a fundamental shift in agricultural production; from the present resource degrading, chemical-dependent, industrial agriculture controlled by corporations, to an agriculture suitable for small farmers and adapted to local conditions.

The web site is easy to navigate and has a lot of information on world hunger, agricultural production and successful agro-ecological approaches.

You are invited to contribute your own experiences and opinions to the site, please do!

www.farmingsolutions.org

Ethnovetweb, Evelyn Mathias, Weizenfeld 4, 51467 Bergisch Gladbach, Germany. evelynmathias@netcologne.de
http://www.ethnovetweb.com/
This website is about ethnoveterinary medicine, or how people around the world keep their animals healthy and productive, and how development can build on this information. The site provides information resources and publications, some in full text. A strong part of the website is the page with links and descriptions of other web sites on ethnoveterinary medicine and livestock development.

Livestock, Environment and Development Initiative (LEAD) is an inter-institutional project with the secretariat in FAO, Rome.
http://www.virtualcentre.org/selector.htm
The work of the LEAD Initiative targets at the protection and enhancement of natural resources as affected by livestock production while alleviating poverty. The website provides information in English, Spanish and French, about electronic conferences, online discussion forums, research and development and electronic newsletters on livestock production.

Centre for research on sustainable agricultural production systems - CIPAV, Cali, Colombia / lrrd@cipav.org.co
http://www.cipav.org.co/index.html
The CIPAV Foundation is a Colombian NGO founded in1986. The projects and programmes on which it focuses are alternative agricultural production systems. These systems promote the efficient and sustainable utilisation of the available human and natural resources, in harmony with the environment. Their experience in a wide array of ecosystems and social conditions can be summarised in a strategy for sustainable farming systems in tropical humid America. The site provides information on livestock research, the electronic journal Livestock Research and Development, conferences, publication lists etc., in Spanish and in English.

Animal production and health page of FAO, Rome Italy
http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGA/index_en.htm
Global livestock production is growing more dynamically than any other agricultural sector. Livestock are already the world's largest land user, and the livestock sector is predicted to become the most important agricultural sector in terms of added value by 2020. On this page FAO provides recent information on livestock production. A lot of publications are mentioned. Of particular interest is a series of practical publications especially meant for farmers.

International Livestock Research Institute (ILRI). ILRI-Kenya P.O. Box 30709, Nairobi, KENYA / ILRI-Kenya@cgiar.org
http://www.cgiar.org/ilri/research/prod-con.cfm
The International Livestock Research Institute works to improve the wellbeing of people in developing countries by enhancing the diverse and essential contributions that livestock make to smallholder farming. On this research page of ILRI, information on the production-to-consumption systems approach is to be found. Research to improve livestock productivity and sustainability in market-oriented smallholder systems will help ensure affordable balanced diets for the urban poor while reducing poverty and building assets for the rural poor. More information can be obtained from the newsletter of the Crop-animal Systems Research Network (CASREN) which is available in pdf format on the ILRI site.

Food and Fertilizer Technology Center: An international information center for farmers in the Asia Pacific Region fftc@agnet.org
http://www.agnet.org/
Asian countries are densely populated, and farms are small. The articles available on the site cover a wide range of policies, programmes and problems in Asian agriculture. Also information on FFTC seminars, workshops, training courses and special projects to collect and disseminate information about agricultural technology for small farms in Asia is provided. Free publications and other technical information, including low-cost technology for resource poor farmers is given.

http://www.icimod.org.sg/publications/imd/imd98-5.htm
The paper "Livestock Development in Mixed Crop Farming Systems 98/5" is found on this page. This paper reviews and analyses: 1) the temporal changes that took place over the past years in terms of livestock population and composition and 2) the institutional programmes for developing the livestock sector. Finally, it draws implications of these experiences for livestock planners and policy-makers and raises several research issues related to livestock sector development.

Primary Animal Health Care in the 21st Century: Shaping the Rules, Policies and Institutions

Mombasa, Kenya, 15-18th October 2002

From the 15th to 18th October 2002, the Community-based Animal Health and Participatory Epidemiology (CAPE) Unit of PACE/OAU-IBAR is organising an international conference in Mombasa, Kenya. The objectives of the conference are to:

- review progress with the formulation of supporting policies and legislation for primary-level animal health workers
- identify key lessons learned and make recommendations regarding future policy and legislative needs

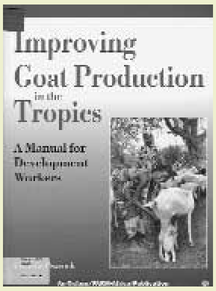
The conference, funded by DFID and CTA, will take the form of keynote presentations, submitted papers and posters and facilitated group discussions to arrive at recommendations regarding future policy and legislative needs.

Papers and posters are invited on the five themes listed below:

1. General policy, legislation and institutional issues
2. Financial sustainability and privatisation
3. Policies and Animal Health Research
4. Policy on training and learning issues
5. Policy on community-based surveillance

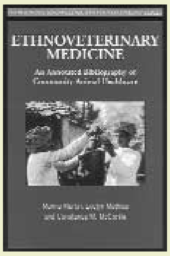
The venue for the conference is the Whitesands Hotel, Mombasa, Kenya. Accommodation will be available at the special conference rate of US$60 per single room on a full board basis. Sponsorship will be available for limited numbers of selected participants to cover the costs of travel and accommodation.

For more information and to register please contact: Dr Keith Sones, c/o CAPE Unit, PACE Programme, OAU/IBAR, P.O. Box 30786, 00100 Nairobi, Kenya. Fax: 254 2 212289 e-mail: ksones@net2000ke.com



Improving goat production in the tropics a manual for development workers by Peacock C. 1996. 386 p.. ISBN 0 85598 269 1 (pbk) : £ 14.95. FARM-Africa, 9-10 Southampton Place, London WC1A 2DA, UK. Oxfam, 274 Banbury Road, Oxford OX2 7DZ, UK.
This book is written both for livestock specialists and for development workers who do not have formal training in animal production. It explains the theory of goat-keeping, and how it can be used to design simple and cheap improvements in the nutrition, health, and breeding management of small or large flocks.

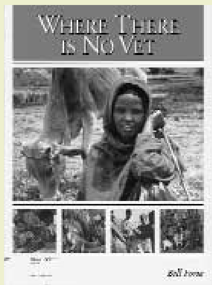
The role of forages in reducing poverty and degradation of natural resources in tropical production systems
by Peters M [et al] 2001 11 p. (Agren Network Paper no. 117) The Overseas Development Institute (ODI), 111 Westminster Bridge Road, London SE1 7JD, UK / agren@odi.org.uk
The paper reviews the role of forage crops in improving the productivity of smallholder farming systems and breaking the cycle of poverty and resource degradation. It reviews the contributions of forage crops to increasing farm incomes, intensifying farm production, and contributing to better human nutrition. Several case studies are presented including mucuna in Central America and West Africa, the forage peanut in Colombia, a forage legume in China, forage crops in Costa Rica and the production of forage crop seed in Bolivia. The paper also describes a strategy for farmer participatory research in identifying suitable forage crops in Southeast Asia.



Ethnoveterinary medicine : an annotated bibliography of community animal healthcare by Martin M, Mathias E, McCorkle CM. 2001. 611 p. ISBN 1 85339 522 6 : USD 45.00. (Indigenous Knowledge and Development Series). ITDG, Publishing, 103-105 Southampton Row, London WC1B 4HL UK, orders@itpubs.org.uk / www.itpubs.org.uk.
This bibliography with 1240 abstracts of documents on ethnoveterinary medicine covers 118 countries over the whole world and 25 livestock species including numerous breeds of cattle and sheep.

Forage husbandry by Bayer W, Waters-Bayer A. 1998. 198 p.. ISBN 0 333 66856 1. (The tropical agriculturalist / Coste R (ed.)). Technical Centre for Agriculture and Rural Cooperation (CTA), PO Box 380, 6700 AJ Wageningen, The Netherlands.
This book gives an overview of different aspects related to forage and livestock keeping, with an emphasis on pastoralists and smallholder farmers. Included are basic aspects of the farming systems, basic biology of livestock and forage resources, management of natural forage, forage as an auxiliary product from cultivated land, cultivated forages, and forage conservation and supplementation. The information explains the way pastoralists and smallholder farmers organise their lives, using livestock as part of their risk reducing and diversification strategies, combining livestock with crops and other - often non-farming - activities. In this sense not only technical and socio-economical aspects are taken into account, but also gender and other characteristics of the cultural dimension of livestock keeping. The last chapter gives an overview of the research and development approaches related to livestock keeping and forage production. This methodological guide includes a combination of traditional practices with outside ideas and technologies, according to the specific characteristics and needs of the farmers. Also available in french (KH)

The long dry season: crop-livestock linkages in Southern Mali by Ramisch J. 1999. 24 p. (IIED Issue paper no 88) International Institute for Environment and Development, Dryland Programme, 3 Endsleigh Street London WC1H 0DD, UK / drylands@iied.org
This paper investigates the interactions brought about by the co-existence of animal herds and agriculture in a village setting. It draws on PhD research that used soil nutrient balances to evaluate exchanges of animal manure and traction between owners and non-owners of livestock in Mali. The examples describe an agricultural sector undergoing an increasing level of intensification together with a growing number of animals. The challenge is to find ways of building on practices to intensify agricultural production further, while keeping at bay the risks of soil mining or widening inequality between different groups.



Where there is no vet by Forse B. 1999. 368 p.. ISBN 0 85598 409 0 : GBP 14.95. Oxfam, 274 Banbury Road, Oxford OX2 7DZ, UK.
Oxfam and CTA supported the preparation of this guide to first aid for animals. The author is a veterinary practitioner and farmer, and does a commendable job of explaining an impressive number of livestock diseases and their causes, symptoms and treatment. The numerous drawings make the text easy to understand. Although some information on care, feeding and handling of animals is given, the recommendations focus on curative measures. Important mechanisms of specific (often local) livestock species or breeds, such as tolerance or resistance to a particular disease, are mentioned only briefly. Although it is clear that a general book on simple veterinary medicine for the tropics cannot cover ethnoveterinary treatment in any detail, it would have been desirable if more emphasis was placed on local medicines which people can prepare themselves and which need not be kept cool. The book will be useful for field-based development workers, to guide them in making routine treatment and in handling emergencies. It frequently points to the limits of what can be done where there is no vet, requiring assistance from more experienced people. (AWB)

Managing mobility in African rangelands : the legitimization of transhumance by Niamir-Fuller M (ed.). 1999. 314 p.. ISBN 1 85339 473 4 GBP 17.95. Food and Agriculture Organization of the United Nations (FAO). IT Publications, 103-105 Southampton Row, London WC1B 4HH, UK / orders@itpubs.org.uk.
This book addresses one of the most important questions in range management in dryland areas of Africa: that of livestock mobility, which is still the most important economic strategy to deal with seasonal and inter-annual variation in forage and water availability in the rangelands. The book is divided into 11 chapters, of which 8 are case studies from countries in northern (Morocco), western (Mauritania, Mali, Niger), eastern (Sudan, Uganda) and southern Africa (Zimbabwe, Namibia). These cases cover the most important ecological zones for range management: arid, semi-arid, seasonally dry subhumid, in both lowlands and highlands. They deal in

some detail with current practices, their ecological foundations and problems, and issues of resource access and tenure. In the final chapter, key concepts related to livestock mobility are discussed: transience and flexibility, priority of use, managing uncertainty and risk, strengthening management regimes, managing key sites, law enforcement and mechanisms for conflict resolution. This book is a must for both policymakers and practitioners in range management and pastoral development. Moreover, in comparison with other technical texts, it is also reasonably priced. (AWB)

Agricultural services and the poor : case of livestock health and breeding services in India - summary by Ahuja V, [et al]. 2000. 148 p + 17 p. Indian Institute of Management, Vastrapur, Ahmedabad 380 015, India / www.iimahd.ernet.in The World Bank, Swiss Agency for Development and Cooperation.

This study on the delivery of livestock health and breeding services in three states of India attempts to develop policy recommendations for a more efficient and balanced system of delivering these services. The report with a seperate summary describes two field surveys. The first covered service provider units operated by various agencies like government, cooperative unions, private entrepreneurs and non-governemental agencies. The second study focused on the demand side of livestock service delivery. Its objective was to evaluate the potential impact of privatization and cost recovery on different categories of farmers. In the light of the findings of these two surveys, the study recommends a redefinition of the role of government in this sector by moving the curative veterinary and AI service into the realm of the private sector. (WR)

Capitalising on experience in Indo-Swiss cooperation in livestock development in India 2000. 50 p. free. Capitalisation of Experiences in Livestock Production an Dairying (LPD) in India project(CAPEX), Intercooperation, PO Box 6724, CH-3001 Berne, Switzerland / intercooperation@intercoop.ch; Swiss Agency for Development and Cooperation (SDC)/IC NRM Programme, Chandragupta Marg, Chanakyapuri, New Delhi 110021, India.

The main findings of the project Capitalisation of Experiences in Livestock Production and Dairying (LPD) in India -CAPEX- are presented in this booklet. This project reviewed the experiences of the Indo-Swiss Programme LPD in India, from its inception in 1963 to date, and formulated future priorities. LPD involved 8 projects spread throughout India. It also included support to developing a national livestock policy. Considering the wealth of experiences available after such a lengthy and large programme, the CAPEX-team choose 2 topics to focus on: 1. the evolution of a comprehensive LPD programme out of single projects and 2. selected technical issues in livestock breeding. The project is a nice example of the value of reflection on experiences! This booklet is a summary of a full version, also available at Intercooperation, as technical report no. 15. (IHG)

Politics, property and production in the west African Sahel : understanding natural resources management by Benjaminsen TA, Lund C (eds.). 2001. 335 p. ISBN 91 7106 476 1 GBP 18.95. Nordiska Afrikainstitutet, Uppsala, Sweden.

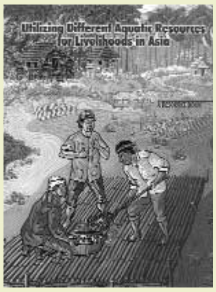
This collection of studies about Burkina Faso, Mali, Niger, Nigeria and Senegal presents natural resource management (NRM) for cropping, livestock husbandry and fishing in the context of political, economic and sociocultural processes. It shows that NRM is, above all, about relationships between people. It gives a glimpse into what is happening at local level while development agencies herald new programmes of decentralisation, democratisation, combatting desertification and participatory multi-stakeholder decision-making. Keen attention is paid to details of how local people decide about production and access to natural resources with a view to more than official policies, and often despite these. The studies reveal the need to look not only at the rules of the game but also at what people actually do. The book should not discourage interventionists trying to strengthen the rights of the marginalised, but does encourage them to become better aware of the tactics of the powerful.Nevertheless, the evidence of production by smallholders in the midst of environmental uncertainty, official and actual changes in property regimes, and political manoeuvring contradicts the alarmist cries of crisis in the Sahel. The book creates a modest optimism that people have a capacity for change and development with the right political environment, yet makes clear that there is no policy blueprint.

It is striking that only one of the 14 authors is African. Are African academics such a marginalised group? (AWB)

Corrections: LEISA Magazine Vol. 17 No. 4 - GM not the only option

The caption to the photo on page 27 should read, "P.V.Satheesh from the AP coalition in defence of diversity gives evidence to the jury. Photo: Agroindia"

The letter published on the back cover, "Using the poverty of the south to justify GM food to the north" was an initiative of Tewolde Berhan Gebre Egziabher of Ethiopia. He was awarded the "Alternative Nobel Prize" (Right Livelihood Award) for his international negotiations on behalf of the South.



Utilizing different aquatic resources for livelihoods in Asia : a resource book

2001. 416 p. ISBN 1 930261 02 0. International Institute for Rural Reconstruction, Y.C.James Yen Center, Silang Cavite, Philippines / jelmontoya@hotmail.com IDRC, FAO, NACA and ICLARM.

Natural resources, especially water resources, continue to be available to poor families in many parts of the world and poor families have demonstrated that they can utilise these resources in a sustainable manner.This resource book is a compilation of proven experiences from Asia that are totally field-derived, and is the result of a participatory workshop conducted in 2000 at the IIRR. With clear descriptions and nice illustrations, this book provides extremely useful information on aquatic resource management. Participatory approaches and extension strategies, community managed aquatic resources, freshwater systems, lake and reservoir-based systems and brackishwater and marine systems are the chapters dealt with.

The materials of the book can be used freely in advocacy, training and planning. The authors realise the value and need for upscaling their efforts in small-scale aquaculture. Especially recommended for development practitioners, local government officials and academic institutions.(WR)

Observations and farmer experimentation with predatory ants

Paul Van Mele and Vo The Truyen

Mr. Nguyen Van Cung cultivates one hectare of organic citrus in Giong Trom district of Ben Tre province in the Mekong Delta of Vietnam. He has nearly 40 years of experience with biological pest control. Mr. Cung fears that a lot of his experience will be lost because the new generation of farmers spends less time observing and 'experiencing' their crop. Whilst on a visit to his orchard, Mr. Cung shared with us some of his knowledge and experiences in keeping the weaver ant *kien vang (Oecophylla smaragdina)*.

Orchard diversity

Mr. Cung grows mainly lemon trees in his 1 ha. orchard as lemon tolerates the widely-occurring greening disease better than other citrus varieties. But we also came across trees of papaya, mandarin, king orange, pomelo, soursop (*Annona muricata*) and rose apple (*Syzigium* sp.) in his orchard. This he does to spread labour and get an income throughout the year. On an average he makes about 1000 US$ per month.

Moreover, Mr. Cung finds the latter three fruit species particularly useful for the weaver ant, because these trees have big and flexible leaves that are ideal for building nests. The density of the trees is such that the canopies touch one another, enabling the spread of the weaver ant throughout the orchard.

Farmer Nguyen Van Cong (left) and son Phong (second left) in the family orchard. Photo: Vo The Truyen

Benefits from the weaver ant

Protects fruit crops from pests
It is known that the weaver ant is a good predator on citrus and other trees such as mango, longan, lychee, cashew and coconut palm. A fruit crop not mentioned before in publications is soursop, which does not suffer from the fruit borer due to the weaver ant.

Protects annual crops from pests
Before Mr. Cung started cultivating citrus, he helped his father on the farm. With a rope the ants were guided from the trees towards the rice nursery beds and to the fields where pulses were grown. If left undisturbed ants even made nests by stitching the leaves of the leguminous crop together. Through experimentation they had found out that pests in these major annual crops could also be sufficiently controlled by the weaver ant that normally resides in the trees.

Deters rats
Besides insect pests, the weaver ant also attacks or deters a small type of rat that feeds on fruit in and around the orchard.

Increases mango fruit set
A major problem for mango production in the Mekong Delta is low fruit set, which is greatly improved when ants are present. Mr. Cung describes this as an indirect consequence of the ant preying on the mango flower hopper.

Improves citrus fruit quality
Mr. Cung says that mandarins grown without ants would be less sweet and juicy, and more granulous (*suong*). He also has a good citrus yield with the ants.

Provides a means of weather forecasting
The ants' behaviour helps him to predict the weather of the coming days. For instance, weaver ants sense oncoming storms. They become very active and move from the weaker to the stronger branches of the trees. This is a sign for the family to prepare for a storm.

Some observations on ant behaviour

The best time for making new nests is the beginning of the rainy season, as the trees produce new growth flushes. It is also a good time for introducing nests to new orchards as the ants are highly active. In the dry season there are more and smaller nests with a lesser number of ants per nest compared to the beginning of the rainy season when ants seem to join in larger nests.

During the cooler period of the year, from December to February, the nests are high up in the trees. At the hottest time of the year and during the rainy season from May to November, ants move to nests inside the canopy, to protect themselves from the heat and strong rains.

The Vietnamese word Mr. Cung uses to describe a colony or several nests that can live happily together without fighting is literally translated as ants 'from the same place' or settlement (*ô*). This can vary from nests in one tree at the beginning of colony establishment, to nests in one planting bed, one orchard or in neighbouring orchards. Mr. Cung's interventions to support the ants throughout the years have resulted in his colony covering more than 1 ha at present.

Weaver ant technology

Mr. Cung is often asked by colleague farmers to give advice on matters concerning the weaver ant. He was one of the first farmers who started converting paddy fields into orchards. Now, all citrus farmers of the village practice some level of ant technology. At social gatherings farmers discuss and exchange ideas about many things of their farm, including the ants.

Weaver ant colony establishment
Citrus farmers generally consider the black ant *kien hoi* a pest. Mr. Cung tells us that the black ant causes a lot of the citrus fruit to drop. He attributes this to the presence of sucking insects that are abundant when the black ant is present. As black ants and weaver ants fight each other, one of the first things before establishing a weaver ant colony is to get rid of this black ant.

(a)

(b)

(c)

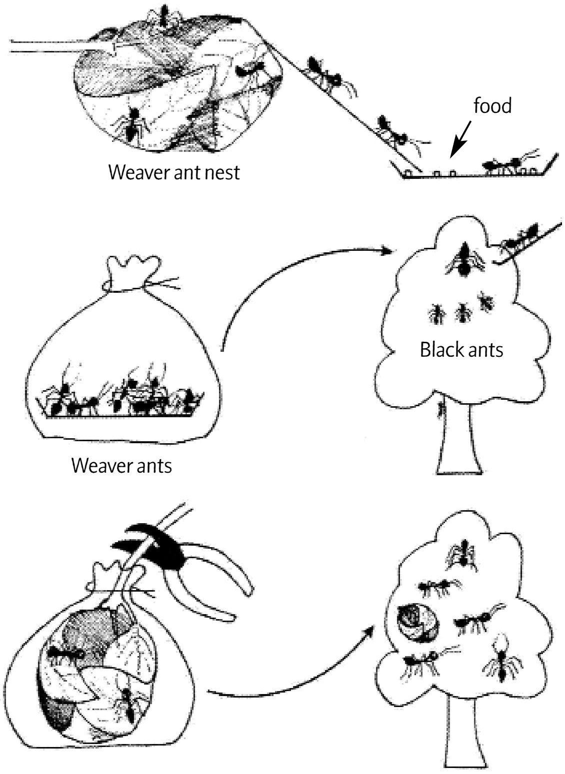


Figure 1: A good way to introduce a new weaver ant colony in case black ants are present as proposed by Mr. Cung. Drawing by Marcella Vrolijks.

Mr. Cung has developed a very successful strategy for this purpose as illustrated in figure 1.

The first step is to lure the strong soldier weaver ants by putting a rope from one of the trees with nests to a container with food such as shrimps (figure 1a). After the container is full of strong soldier ants you put a bag over it and transport it to the place where you want to establish a new colony. Once on the spot, you climb the tree all the way to the top where you then release the soldier ants (figure 1b). This approach guarantees better success than when you just release it at any other place in the tree. Once the black ants are defeated you then introduce a complete nest (figure 1c). The best time to do this is at the beginning of the rainy season (April/May) as ants are then very active.

Helping weaver ants to win from invading black ants

'To fight the black ant, you study its military strategy, and then you know how you can help the weaver ant to win the battle', Mr. Cung continues. One weaver ant can easily win from 5-6 black ants by cutting their bodies in half. However, when black ants become too numerous, the weaver ant gets tied down by the legs and finally killed. But it is not only numbers that matter.

Mr. Cung has observed that black ants sometimes attack established weaver ant colonies from several directions, simultaneously. When the weaver ants start running away, it is time to intervene so that they do not loose the battle. You have to trace down the soldier base of the black ants and cut their support line, for instance by pruning the branches along which they enter the tree. Black ants also have a kind of journalist ants or 'liaison officers' (*giao lien*) that report back to the 'base camp' (*can cu*) for more support. By cutting the line, this flow of information is also cut off.

But if the branches are bearing fruit, they cannot be pruned. Then a different intervention is required. Mr. Cung collects an 'aid force' (*luc luong ho tro*), a nest from the same weaver ant colony, and puts it directly in the base camp of the black ants. The fighting black ants in the tree are soon informed and return to their base camp. The weaver ants, which were disoriented, return and fight side by side with the ants of the aid force.

In the case of black ants attacking a newly introduced weaver ant colony, it is even possible to bring in an aid force from a different colony. This is the only time that weaver ants from different colonies do not fight each other, but join forces against a common enemy.

Mr. Cung has developed two different strategies to keep the black ant population under control. When the black ant becomes too numerous in the dry season, a rotten fish is crushed and spread over a small area of half a square metre in the orchard. This attracts many black ants, which are killed by burning the spot. In the rainy season, the black ants look for a dry place to build their nest. By hanging a bunch of dried leaves or grass in the tree, black ants are lured in and then removed and burnt.

Supplementary feeding

Mr. Cung has observed that weaver ants do not need supplementary feeding in the rainy season due to an abundance of food. He now feeds them moderately in the dry season with mainly fish and small shrimps. Although the ants can transport large pieces of food to their nest, he prefers to provide small pieces that can be carried by a single ant. The amount of food given determines for a great part the number of nests.

Reducing harm to both the weaver ant and farmer during harvest

To avoid the irritation of ant bites during harvest, Mr. Cung has developed a simple ant-friendly technique. When harvesting fruit he takes a bag of wood ash and spreads some ash on the branches he wants to climb. The ants retreat back to their nests. Once the wind or rain removes the ash from the branches, the ants return.

Conclusion

The knowledge and experience of farmers like Mr. Cung will be lost unless more efforts are undertaken to document and spread them to others.

■

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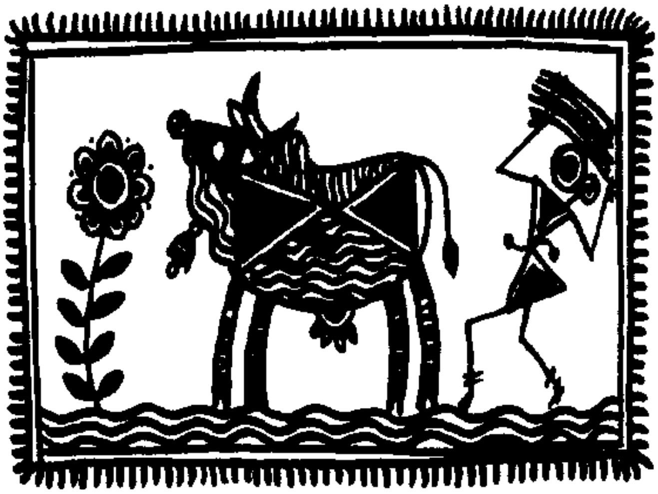
We invite everybody having experience with farmers making use of predatory ants to share information on this topic. Of special interest is also how other farmers have been convinced and trained in using such predators. Please contact Paul Van Mele.

Weaver ant nest in pomelo. Photo: Paul Van Mele



Local livestock for empowerment of rural people

W.M.K. Warsi

Domestic animal diversity represents one of the most neglected as well as threatened aspects of biodiversity. According to FAO, one third of the world's estimated 4000 livestock and poultry breeds are in danger of extinction. In the South, these breeds are vested with traditional farming and pastoral communities, who manage them according to their indigenous knowledge and in tune with local ecological constraints. Causal factors for their extinction include political backing for cross breeding, loss of grazing land, globalisation of the economy, catastrophes, conflicts, legal restrictions on the marketing of their products etc. Many countries provide direct subsidies on feed and other inputs, which tend to favour exotic breeds and industrial animal farming.

Nevertheless, many local livestock breeds continue to represent the lifeline of rural populations. While they may not be able to compete with "improved breeds" in milk and meat yields, they fulfil a much wider range of functions and provide a larger range of products. Being able to thrive even with low fodder inputs, their maintenance is ecologically more sustainable, especially in marginal environments. Requiring lower levels of health care and management, they commonly entail a lower workload for women in comparison with exotic breeds. As is becoming increasingly clear, they often have scope for speciality products and can be essential to preserve habitats and cultures.

At the local level, the loss of a breed means the loss of a livelihood strategy and loss of indigenous knowledge. At the global level, it means decreased manoeuvring room for adapting to environmental and economic changes. The Convention of Biological Diversity (CBD) mandates maintenance of the remaining livestock genetic diversity. It also emphasises the need for the active involvement of indigenous communities and the role of local knowledge and institutions in conservation.

The LIFE Network

The League for Pastoral Peoples (LPP) and the Indian NGO Lokhit Pashu Palak Sansthan (LPPS) jointly organised an international workshop on "Local Livestock Breeds for Sustainable Rural Livelihoods" at Udaipur and Sadri, Rajasthan, India, in November, 2000. This workshop initiated the process of implementation of the Convention of Biological Diversity in regards to domestic animal diversity. It received an overwhelming response and a large number of participants from scientific institutions, universities, NGOs, governments and international donor agencies from Asia, Africa and Europe attended it. At the end of the workshop a joint declaration, known as the "Sadri Declaration", was signed by all the participants. Inspired by the response from the participants of the workshop and the Sadri Declaration, LPP and LPPS took the initiative to establish a network: LIFE (Local Livestock for Empowerment of Rural People).

LIFE aims at supporting and fostering the following activities:

- Study and document indigenous knowledge relating to livestock breeding and breeds.
- Make case studies of livestock breeds that are threatened and the social, economic and political factors involved.
- Exchange information between NGOs, pastoralists and farmers' associations, scientific institutions, policy makers and others through workshops and a mailing list.
- Build capacity of NGOs in the conservation and development of indigenous livestock breeds.
- Analyse the macro-economic and political factors driving the process of livestock genetic resource erosion.
- Lobby for more participatory orientation of research concepts in formal-sector organisations.
- Establish a network of organisations and individuals for community-based conservation of livestock breeds.

Membership of LIFE is not restricted to a particular geographic location. Any organisation or individual concerned for sustainable livestock development is welcome to join this network.

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For more details, the workshop abstract and copies of the Sadri Declaration please contact:

W.M.K.Warsi, LIFE Coordinator, C/o Lokhit Pashupalak Sansthan,
Ambedkar Nagar, Desuri Road, Sadri, District Pali – 306702, Rajasthan, India.
Email: lpps@sify.com

World watch list for domestic animal diversity

The increasingly grim outlook for indigenous livestock breeds – and for the farmers who depend on them – is detailed in the third edition of the 726-page volume of the FAO/UNEP World watch list for domestic animal diversity (WWL-DAD:3), released in December 2000. While local communities generally possess extensive knowledge of the observable characteristics of their breeds, there is negligible documented research data for about 85% of all breeds and even less sound breed comparison information for decision making on breed use. The real value of genetic diversity is not properly reflected in current choices of breeds and associated technologies. Breeds that utilise low-value feeds, or survive in harsh environments, or have tolerance to or resistance against specific diseases could be very beneficial in the future.

Indigenous breeds can be improved to provide better outputs
Opportunities for improvement of indigenous breeds have never been explored systematically. To help countries in improving the performance of indigenous breeds, the FAO's initiative for Domestic Animal Diversity (iDAD) is currently producing guidelines for identifying and achieving particular breeding objectives (more meat, milk, eggs, wool, etc.). In addition, iDAD supports the conservation of pure breeds, which is vital for maintaining genetic diversity and preserving the genetic material on which future agriculture may depend.

For more information visit the web pages of FAO's Domestic Animal Diversity Informati on System. www.dad.fao.org

Towards local resources-based integrated crop- livestock systems

T.R. Preston

The present livestock production systems in most industrialised countries are in direct competition with human needs. Livestock presently consume almost 50% of world cereal grain supplies. In the "intensive" large-scale production systems (Sansoucy 1998), increasingly promoted by corporate agriculture, livestock wastes contaminate soil and water resources, create less than favourable working conditions for the personnel involved in feeding and cleaning, and decrease employment opportunities. To meet food needs in 2050, it is necessary to develop livestock production systems, which do not depend on cereal grain.

In developing countries in the tropics, instead of grain-based livestock systems, alternative production systems must be developed which make optimal use of locally available resources, solar energy, soils, water and people for multiple end purposes. The challenge is to capture the sun's energy in systems of production and utilisation which at the same time will contribute to alleviation of poverty, creation of jobs, a more equitable life-style, protection of the environment and increased biodiversity. Close integration of livestock in the farming system, with recycling of all excreta, will be the basis of an agriculture which can be highly productive and also sustainable (Figure 1).

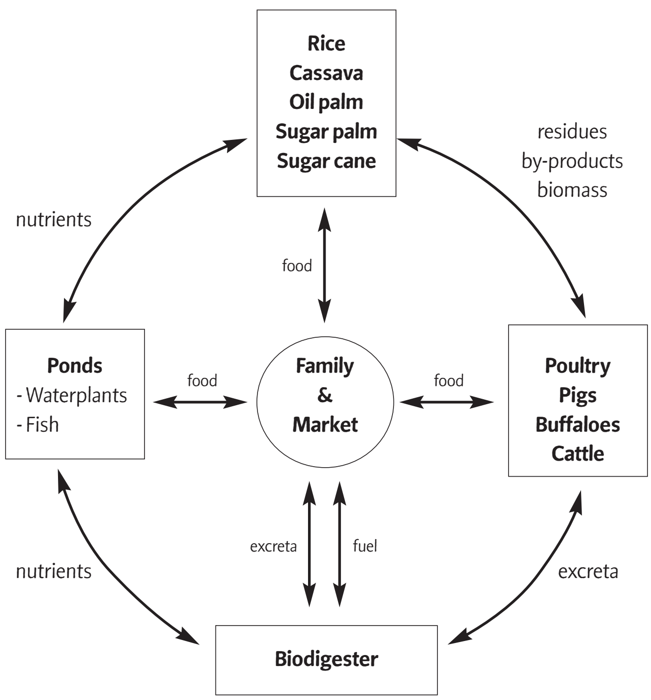

Figure 1: The integrated farming system

Energy crops
In tropical countries, especially in the humid zone, there are many crops and farming systems that considerably exceed the productive capacity of grain cereals. Key plants in this scenario are sugar cane, cassava, and the palm family, especially the oil and sugar palms.

The yield potential of the sugar palm (*Borassus flabellifer*) is extremely impressive. An annual average yield equivalent to 18 tonnes of soluble sugars per hectare has been documented in a study with 12 family farm households in Cambodia (Khieu Borin and Preston 1995). Despite this demonstrated potential almost no research is currently conducted to improve the technology of growing and using this tree, which is found throughout the SE Asian region.

Protein crops
There is an equally great potential to produce high yields of protein in the tropics. But this will be with trees, shrubs and water plants, rather than with soya beans. The *Lemnacaea*, of which "duckweed" is the most widely distributed, have a particularly important role to play in efficient resource utilisation because of their capacity to extract nutrients from water fertilised with wastes (excreta) from livestock and people. A specific feature of this plant is that its protein content can be manipulated according to the nutrient supply in the water. Values in the range of 35-40% protein in the dry matter can be attained when the nitrogen content of the water is in the range of 20 to 30 mg/litre (Leng 1999). Duckweed is easy to harvest and needs no processing prior to being fed to livestock. The protein is highly digestible and the excellent balance of essential amino acids makes it an ideal supplement for chickens, ducks and pigs. Average yields are in the order of 100g fresh biomass/m^2/day equivalent to 8 tonnes of protein/ha/year (Nguyen Kim Khang 2000).

The cassava plant (*Manihot esculenta*) can be managed as a perennial forage crop with repeated harvests of the foliage at 50-70 day intervals. The foliage yield increases over successive harvests (Preston, 2001) as the repeated cutting stimulates new growing points. Yields of 3-4 tonnes of protein/ha/year are possible with this regime. The fresh foliage is an excellent protein source for ruminants, while after ensiling (which converts the toxic cyanide into non-toxic cyanates) it can safely be fed to pigs (Ly and Rodríguez 2001). Cassava is an exploitive crop when grown in monoculture and on sloping land. Managing it as a perennial shrub / tree and associating it with N-fixing legumes, such as *Flemingia macrophylla* or *Desmanthus virgatum*, or fertilising it with heavy dressings of livestock manure or biodigester effluent, are ways in which it can be grown sustainably with enhancement of soil fertility (Preston et al 2000). The presence of cyanide components in the leaves may even serve as an "organic" pesticide, providing protection against a wide range of pests.

Changing the livestock system
The feeds derived from these "alternative" crops (juice from sugar cane and sugar palm, roots of cassava, fruit from oil palm, duckweed biomass and cassava foliage) do not lend themselves to "factory" farming systems which traditionally use dry feeds, easy to store, transport and mix into "least-cost" rations. The "alternative" feeds require "alternative" farming systems such as developed by CIPAV in Colombia (see page 14) which are now widely being adopted and adapted in, among others, Vietnam and Cambodia.

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Please contact the author for more information on the references.

Dutch dairy farmers find own solutions to their environmental problems

Willem van Weperen en Henk Kieft

Farmer experimentation and innovation and farmer-researcher platforms for the development of low external input and sustainable agriculture are very successful not only in tropical countries. Also in the Netherlands, there are remarkable initiatives of farmers to develop alternatives to the unsustainable conventional dairy production model. Ten years ago, two environmental associations of dairy farmers, VEL and VANLA in the province Friesland, in the north of the Netherlands, started to experiment with nature and landscape management and integrated agriculture. Now, after several years of successful experimentation with environmentally-sound farming practices, this initiative is being taken up by several hundreds of dairy farmers in different parts of the country.

Fifty years of dairy development

In the '60s, the average Dutch dairy cow produced 4000 kg milk per year. In 2001, this was about 8500 kg. The average yearly increase of about 100 kg milk per cow was possible due to very successful technology development, enhanced by effective research-extension-farmer interaction, access to credit, and a conducive policy environment. Artificial Insemination and effective breeding policies increased the potential milk yield of dairy animals to levels that our grandfathers did not even dream of. Other important innovations were: the shift from rope-tied to free-roaming stables with sleeping cubicles and a much better ventilation system; disease control through effective vaccination; very high fertiliser application levels which boosted grass yields; mechanisation of fodder production; improved fodder conservation techniques and the introduction of fodder maize. The availability of ample high quality roughage, supplemented with high levels of protein-rich concentrates, made it possible to fully exploit the improved genetic potential of the dairy cows. But also, the low prices of these high quality fertilisers and concentrates were essential in achieving high milk production.

Increasing environmental problems

The recommended fertiliser application for pastures has gone up to 400 kg nitrogen (N) /ha. Presently, annual grass production on pasture land is 10-12,000 kg dry matter/ha. in 5-6 cuts. The low price and high status of mineral fertilisers made cow manure lose its importance and was used only as an extra, over and above the recommended fertiliser application. Until recently, the nitrogen present in manure was not even considered in calculations.

These high fertiliser applications increasingly led to serious environmental problems: leaching of nitrates from the topsoil to the groundwater negatively affecting the quality of the drinking water and high levels of ammonia emission from the cows negatively affecting the quality of nature in the surroundings of the farm. In the '80s, the Ministry of Agriculture had to introduce a series of 'restrictive' measures for dairy farmers to meet the environmental targets set by the European Union. Broadcasting manure on pasture land was banned and instead it was made compulsory to inject the manure as slurry into the soil during the growing season.

In the early '90s, a mineral bookkeeping system for dairy farmers was introduced and was tested as a voluntary management tool. Through simple accounting of mineral input and output at farm gate level, nutrient losses within the farming system were made evident. Ideally, inputs (concentrates and fertilisers) balance with the outputs (milk and meat) in terms of nutrients. However, losses of nitrogen occur in the cow and in the soil. This bookkeeping revealed that losses of N/ha in the conventional dairy system had become very high and hence N efficiency very low (<18% at cow level and <30% at soil level). See figure 1.

Animal health problems and consumer concern

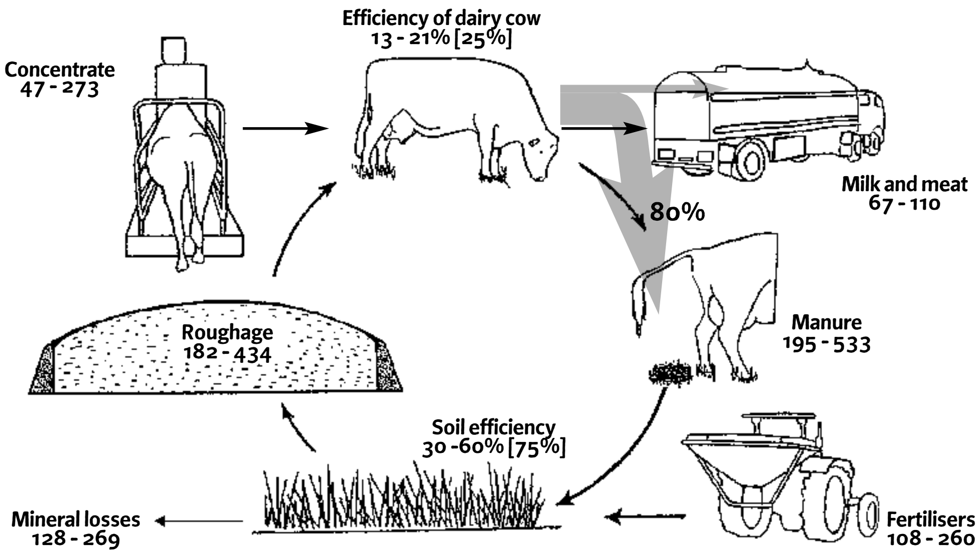
The high-input farming system led not only to environmental pollution but also to animal diseases:

- very high protein levels in the rations causing digestion problems and malfunctioning of the liver;
- high incidence of mastitis;
- animals becoming susceptible to hoof diseases;
- prolonged calving intervals due to fertility problems.

These health problems are increasing veterinary costs and decreasing milk production.

Consumers are showing increased concern with the (perceived) lack of animal welfare related to intensive production, and with human health in relation to cow-diseases like Mad Cow Disease (BSE). They have begun challenging the so-called "license to produce" of farmers. The Foot and Mouth Disease crisis of last year aggravated this feeling and exposed the vulnerability of the modern livestock production systems.

Figure 1: Nitrogen efficiency of Drenthe project farmers expressed in kg N/ha/year [ideal]



Two environmental associations start the process

Ten years ago, the two environmental farmer associations in Friesland were founded by farmers to regain control over their own future. They argued that by development of integrated agriculture, pollution control by conscious use of agrochemicals and plastics, and the management of nature and the many small-scale natural landscape elements (hedges, bunds, pools, etc.) on and between their farms, they could greatly improve the quality of their environment. These measures, they said, should not necessarily decrease their production and income, while certified quality products, landscape management and income from agro-tourism could provide new opportunities.

The philosophy of these dairy farmers, based on their 'gut feeling' and experience with the production system of their fathers, is that many relationships exist between the various components of the farming system, and that these relationships should be considered in all management decisions. For example, the way they feed their cows affects the quality of the manure. The quality of the manure affects the quality of the soil. The quality and fertility of the soil affects the quality of the pasture and fodder crops and hence the feed, which in turn affects the health of the animals and the quality and quantity of the products. All parts of the system as well as the whole are important! The quality and quantity of the dairy products (milk and meat) are improved by optimising the (biological) quality of all the different aspects (manure, soil, pasture, feed, animals, products) and the quality of the whole system. In conventional dairy production, the concept of system quality was lost because of the focus on the development of a high input - high output system. Through refocusing on quality, the system develops in the direction of a low input - high output system.

The farmers found that by reducing the amount of protein and increasing the amount of crude fibre (roughage) in the feed of their animals, the quality of the manure is much better than the slurry produced by conventional dairy farmers. They argue that this type of manure (with higher C/N ratio and relatively rich in organic N) is more beneficial to soil life and therefore more efficient in production of biomass. Consequently, N emission to the environment will be reduced. Broadcasting manure with these qualities is also less detrimental to the environment.

The approach builds, as much as possible, on farmers' knowledge and ecological regulating mechanisms found in nature. The farmers consider their experiences as added value to the conventional scientific knowledge as they also use practices and methodologies not accepted by conventional agricultural science.

Apart from system quality, the farmers also work on adapted animal breeding, new opportunities to diversify the local rural economy such as agro-tourism, and farmer cooperation to enhance processes of change.

The PMOV platform – taking it further

In the last 3 years, this initiative has been taken up other farmers and together with some researchers they have founded the PMOV platform to promote 'eco-technological' farming. Presently, the platform constitutes about 120 experimenting dairy farmers, two formal experimental research farms comparing integrated and organic agriculture and the two environmental associations of Frisian dairy farmers.

The network felt strongly that a link should be built with university research for two major reasons. The farmers, who rely on their own observations and incidental measurements, wished to get more insight into what ecological processes actually take place in their farming systems. Secondly, they wanted policy makers to understand their exploratory efforts and promising results, and adapt legislation towards objective-oriented regulations instead of instrumental ones. "Politicians should tell us what they want, but we will decide ourselves how to do it!" Initially, the Ministry of Agriculture was very reluctant to cooperate. The farmers were perceived as those trying to escape environmental legislation. Only with great difficulty could the farmers negotiate some legal space for their experiments which did not conform to Dutch law for manure application. After several years of good results some recognition for the value of these experiments is emerging, and money from the government has been allocated to facilitate further experimentation by a larger number of farmers also in other parts of the country.
Also in 2002, a grant is expected from formal Dairy Research to formulate a joint monitoring project to assess PMOV farm results and compare these with conventional farms. 'Joint' here means that farmers and scientists together design the project. Interest also exists to better understand the dynamics and decision-making logic of experimenting farmers, to make the sharing of their experiences to other interested farmers cost efficient. These farmers do not only perceive themselves as entrepreneurs, but also and often even more so, as 'stewards of complex agroecosystems'. They often feel the need to regain their 'license to produce' within society at large.

Management guidelines for dairy production

Based on the long years of experience of the farmers and the experiments carried out on the experimental research farms, the platform formulated some new management 'guidelines' for keeping dairy cattle in a more sustainable way:

1. Reduce the percentage of crude protein in the diet (from 18% to around 16 or 15%) and increase the crude fibre content;
2. Try to keep the OEB (Rumen Protein Balance) at zero;
3. Try to increase the C/N ratio of manure from 7 to around 10;
4. Feed concentrates to a maximum of 25 kg per 100 kg of milk;
5. Reduce the fertiliser applications on pasture stepwise with about 30 kg N/ha/year. Try to get it down until it is in balance with the permitted yearly losses (180 kg N/ha/year);
6. Distribute larger portions of the manure applications to the 1st and 2nd cut. Stop manure and fertiliser applications entirely after mid July.

Preliminary results

The results of the practical experiences indicate that it is possible to maintain the milk yield with lower costs due to substantial reduction in mineral fertiliser supply and concentrate feeding. The values of nitrate losses into the ground water and ammonia losses into the air were clearly below the set EU-targets. The health status of cattle on many PMOV farms has improved, adding significantly to cost reduction. The biological quality of milk, manure and soils is presently being assessed.

Beside these technical results, the farmers strongly value the benefits from improved social relations and collaboration within the working groups and their communities. As farming now is more in line with their intuition, farmers feel less stressed as well.

The techniques, ideas and experiences of the farmers and the two experimental research farms are shared through farmer-to-farmer meetings, newsletters, seminars and info-markets, lectures and excursions, farmer study-clubs and educational material.

The experiences show that these farmers are well able to resolve their own problems and make their farming systems sustainable to a large extent. Within the norms set by society, farmers should have professional freedom to find their own solutions adapted to local conditions.

■

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Camelids are best suited to the conditions of the Andean highlands. Photo: AIGACAA

Improving llama production in Bolivia

Osman Rocha Ravollo

For over 6000 years the South American camelids have been a distinctive feature of the Andes region, both physically and culturally. Of the four existing camelid species, two have been domesticated: the llama and the alpaca. With the arrival of the Spaniards, these native animals and their breeders were forced to retreat to the highlands of the Altiplano.

Bolivia is the country with the largest number of llamas in the world. Almost all of the two million animals are bred in small family herds, grazing exclusively on wild pastures. The llamas are part of the life strategy of these poor peasant families; they are a means of transport, they provide meat, their manure is used as fertiliser and fuel, and their wool for garments and similar articles.

Llamas are intimately connected to the culture and cosmovision of the Andean indigenous people and play a central role in many of their rites and celebrations. For example, when a couple gets married, they receive several llamas from their parents, depending on the number owned by the parents. This inheritance is then carefully administered by the newlyweds. The common ritual known as *Rhuthucha* - 'first haircut' - takes place around the age of two; on this occasion, too, the child receives a couple of llamas from his or her godfather, as well as parents and other relatives. Although the parents take care of the animals, from that moment onwards the child has his or her initial asset called the *lacama*.

A llama breeding family

Señor Pánfilo Gerónimo is 55 years old and lives with his wife Damascena in the community la Rivera of the Oruro department. The couple has 6 children, some of them are still in school, and the others have migrated temporarily to work in Chile. The mountainous region where the family lives is situated at 3,800 m above sea level; its climate is harsh with frequent frosts. A small part of their land is used for crops, such as potatoes, *quínua* (local grain), barley and oats, while the rest is used for grazing.

Don Pánfilo explains, *"We have 180 llamas and 30 sheep. The whole family takes care of them, taking turns with herding. The sheep graze elsewhere and my wife takes care of them; we also have 5 donkeys. All decisions about the llamas or the sheep are taken together with my wife. We breed llamas to have meat ourselves, and also to sell at the Pisiga fair, some 40 km from here. The male llamas are also used as packers. The sheep are for our own consumption. We use the manure of the llamas and the sheep as fertiliser in the fields and sometimes as fuel for cooking."*

The family has learnt the art of breeding llamas from their parents and grandparents. They keep many traditions, such as the Wilancha ritual, alive. Don Pánfilo explains, *"This ceremony is performed to plead for the well being of the families, when a new task is undertaken, or in the hope of a good year for the animals. During the ritual a llama or a sheep is slaughtered at dawn. Blood is shed for the Pachamama* (Mother Earth) *and for the work that is about to be started. The meat of the animal is then cooked and all present are invited to the meal."*

Limitations

Over the past decades, the tendency has been to reduce the size of the family-owned llama herds in Bolivia. In the areas where camelids were predominant, people started to combine them with, or give priority to other species, particularly sheep. Economically, the main function of the llamas - transportation - was being taken over by engine-driven vehicles, while at the same time the prices of llama meat and wool were particularly low, due to the low quality of these products.

Llama wool is inferior to that of the alpaca as it contains a great deal of low-quality bristles. Therefore, in many areas, only 20% of the animals are sheared each year. Llama meat is consumed either fresh or as *charque* (sun dryed). The sale of fresh meat is limited and the prices are very low due to the presence of grain-like cysts of the parasite *Sarcocystis aucheniae* and *S. lamacanis*. Though this parasite does not pose a danger to human consumers, meat with a high degree of infestation is often confiscated. Therefore, it is usually sold through informal channels. The incidence of the parasite, which is transmitted by dogs, is approximately 90% in animals older than 2 years.

Other factors that limit llama husbandry are the degradation of the pastures, the lack of labour, external parasites, lack of shelter, and the degeneration of the animals due to inbreeding. Mortality rates are high, both in adults and offspring. Another problem is the lingering influence of the traditional authorities, which used to regulate the use of the communal pasture areas. All this, plus the fact that breeding takes place almost exclusively in areas of extreme poverty, has increased the cultural prejudices and lowered the status of breeding llamas.

Economic and ecological potential

Despite these limitations the llama is the species of highest potential in the Bolivian highlands, which explains why families have continued breeding it. On the one hand, the highlands comprise huge areas of natural pastures, especially suited to camelids. They are best adapted to this environment, being highly resistant to the effects of the altitude and climate, and – unlike sheep, goats and cattle – do not disturb the fragile ecosystem of the Andean mountains when they walk and graze. As such, the camelids play a fundamental role in recovering the large areas of degraded pastures.

Furthermore, as long as Sarcocystiosis is kept under control, camelid meat is excellent for consumption, with lower levels of cholesterol and fat than beef, pork or lamb. It is possible to reduce the mortality rate of the animals by controlling external parasites, improving shelter and nutrition; better quality wool – comparable to the alpaca – can be achieved by selective breeding programmes. Other potentials include the families' experience in llama breeding and their knowledge of wool processing – both of the fabric (the women) and of the loom (the men) – and other artisan products.

ASAR

ASAR (Asociación de Servicios Artesanales y Rurales) is an NGO, which has since 1995 been developing programmes for improving llama husbandry in 6 provinces of the Oruro and Cochabamba departments. After analysing the potential and limitations of llama breeding, they have worked towards organising the llama farmers, training them and letting them have a voice in the strategies of the project. In the training of livestock para-technicians, two participants were elected by each community. The methodology was directed at illiterate adults with a great deal of practical knowledge.

After several courses in organisation, llama breeding, transformation and commercialisation of products, the association ARPROCA (Regional Association of Camelid Producers) was established, drawing together the communities from the Litoral, Atahuallpa and Mejillones provinces. It managed to generate funds from UNEPCA (Executive Unit of Camelid Projects) in 1995. These funds were used as credit for the members of the association to buy selected llamas and to establish a special llama-slaughterhouse in Huachacalla to commercialise the venture.

Quality improvement and marketing of meat

In September 1997, this abattoir for camelids was ritually opened by the communities. Subsequently, courses on slaughtering and the preparation of dried meat were given. Several small solar drying units were built in the communities, to produce high quality *charque*. Once the abattoir was opened, it was also possible to collect data on the slaughtered animals, and monitor the effect of the actions taken to reduce the incidence of sarcocistiosis, by controlling the incidence of infestation in the dogs (periodic deworming) and by strategic grazing strategies. Between 1997 and 2000, sarcocystiosis in animals older than 2 years has been reduced from 90% to 54%. Thanks to these efforts, good quality fresh and dried meat is now sold in the established meat stores, and the producers fetch a better price. In the year 2000, ARPROCA was able to sell 35,687 kg of fresh meat and 480 kg of charque in local and regional markets. Likewise, a network of 12 veterinary community animal health workers has been trained to provide basic veterinary help to the families in the ARPROCA area. This has made it possible for families to increase the weight of their animals. The family income for each llama sold has increased by US$ 9.65 per adult animal and US$ 8.76 per young animal, between 1997 and 2000.

Llama wool and its market

Some llamas have high quality wool similar to alpacas. In the area of Calientes, a breeding programme for the genetic improvement of llamas was started in coordination with the Universities of San Simón, Bolivia, and Hohenheim in Germany. Groups of llamas were selected according to their wool or meat producing qualities, and three breeding centres of the ARPROCA now stimulate controlled breeding in the family herds , for either meat or wool production.

In December 1997, 23 people from 14 different communities belonging to ARPOCA were trained in classification, selection and spinning of the wool, and the weaving of carpets and fabrics. Currently, the crafts centre in Huachacalla employs 8 women and one man. The annual production of this centre is eight carpets of 3 x 2 m., 48 rugs, 200 m of woven cloth, 24 sweaters and 12 ponchos. Private companies, such as SARTAWI, COPROCA and LLAMACTIVA, pay the llama breeding families a good price for the wool as they have found international markets for these products.

Not marginal anymore

Thanks to these new possibilities in management and markets, the breeding of llamas in these areas has ceased to be a marginal activity. The families are now trying to increase the size of their llama herds, not only for cultural and ecological reasons, but also for the socio-economic advantages. Don Pánfilo explains: *"Earlier, it was difficult. Each year I could sell some 20 llamas of different ages at the fair. Each llama gave us about 30 kg of meat, 5 bolivianos per kg. Sometimes they didn't want to take it because of the arrocillo* (Sarcocistiosis)*. With the money I would buy groceries and bread to take home. I didn't sell the wool or the leather, because there weren't any buyers. Now, fortunately, the situation has changed. There is less arrocillo, the llamas are heavier and we can sell the meat at a better price. Also LLAMACTIVA buys our wool at a good price to export it to Peru. They also buy our leather as they have also found a market for this product. With all this we are certainly better off now than before!"*

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Women working with llama wool at the crafts centre in Huachacalla. Photo: ARPROCA

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More information in "*Gracias a los animales: la crianza pecuaria familiar en América latina con estudios de caso de los valles y el Altiplano de Bolivia*". Edited by Agruco, Cochabamba, Bolivia. Forthcoming. Katrien van't Hooft, editor.

The Cuban experience in integrated crop-livestock-tree farming

Fernando Funes-Monzote and Marta Monzote

For nearly 25 years agriculture in Cuba strongly depended on trade with socialist countries in Europe and the Far East. A few export products (sugar cane, citrus, coffee and tobacco) were exchanged for, among others, modern inputs to sustain the farming and ranching activities.

In 1990, this advantageous trading system collapsed. As trade was blocked also with the USA and other Western countries, import of inputs was not possible anymore. The ensuing economic crisis demonstrated the vulnerability of agriculture strongly dependent on imported external inputs. But agriculture in Cuba proved to be unsustainable, also due to the ecological and environmental problems it had created: soil degradation, deforestation, water pollution and loss of biological diversity.

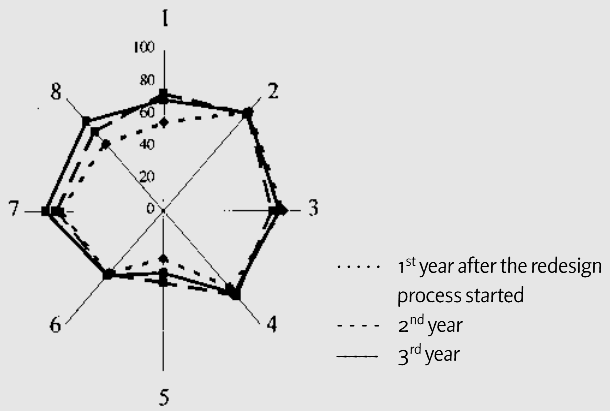

Figure 1. Evaluation of a farm through weighted indicators (% satisfaction) represented in a spider web

The challenge to transform agriculture

This crisis challenged Cuban farmers and the government to transform their export-oriented, large-scale, specialised production systems into diversified, integrated, self-sufficient, small-scale systems. Agricultural research started to experiment, among others, with local cattle and the development of integrated systems and management practices, and more sustainable feeding methods. Conversion of ranching systems into integrated crop-livestock-tree systems to reverse the economic and environmental crisis and to provide income and food security for producers was the focus, with efficiency as a key factor for success.

In 1994, the Cuban Grass and Forage Research Institute started a project to study, develop and promote integrated small and medium-scale crop-livestock-tree systems. The work included research on 14 experimental farms and a large outreach programme in the provinces of Havana, Sancti Spiritus, Camaguey and Las Tunas based on participatory extension for spreading the lessons (Monzote and Funes-Monzote, 2000).

Six years later, the project has shown that integrated crop-livestock-tree systems can be sustainable, efficient and productive alternatives to specialised, external-input dependent dairy farming. Researchers and farmers show that combining the components into a consistent whole brings better results in terms of total production, energy efficiency, recycling of organic matter and the use of available natural resources.

The experimental farms

The project converted 14 ranches into integrated farms. These farms cover a wide range of soils (alfisoles, mollisoles and inseptisoles) and climates (1000 to 1400 mm rainfall, nearly 80% during the rainy season). These rainfed farms, ranging from 1 to 20 ha. in size, had not used agrochemicals or imported animal feed in the four years before the project began. Eight of them were specialised ranching systems dedicated to pasture and milk production.

Each experimental integrated farm has its own unique combination of crops, livestock and trees (with 25 to 50% of crops integrated in the livestock system) which suits the local conditions: soils, topography, climate, natural vegetation, wildlife and farmer preference. Each farm has a crop production sub-system (areas of arable crops, perennial crops and vegetable garden) and an animal production sub-system (forest ranch land, pastures with a mixture of gramineous and leguminous species, fodder banks with e.g. Pennisetum, sugar cane, protein banks with leguminous fodder crops and trees such as glycine, kudzu, leucaena, and areas for small animals). Medicinal plants and fruit trees are distributed throughout the farms.

Each farm manager defined the process of redesigning the farm. Self-sufficiency in food, fodder and organic fertilisers, high production of biomass, diversification and integration were the leading principles. Strategies like the use of crop residues for animal feeding, functional biodiversity, reforestation of grazing areas, recycling of manure, composting of organic waste, soil regeneration and conservation were followed.

Table 1. Scores of the sustainability indicators in the experimental farms

Indicator	Range*
1 Milk production (tons/hectare)	1-3
2 Food production (tons/hectare)	1.9-6.1
3 Reforestation level (number of trees/hectare)	53-277
4 Diversity of wildlife (total number of species)	46-78
5 Food products (Number of edible products)	11-20
6 Production of organic fertilisers (tons/hectare)	1-2.8
7 Intensity of work (hours/day/hectare)	0.8-4.5
8 Energy efficiency (calories produced / calories invested)	4.5-10.6

* as a mean result of the 14 farms during six years

Evaluation of performance

Spider web diagrams (figure 1) were used to show the results of a large number of tests used to interpret the performance of the farms. Eight agroecological indicators were selected to evaluate the performance and sustainability of the integrated crop-livestock-tree systems. In milk specialised systems in Cuba the average yield is about 1 to 1.5 tons of milk per ha. Some of the integrated farms achieved 3 tons of milk and 6.1 tons in terms of total food production from crop and livestock (Tabel 1).

Diversification of production

The biodiversity in the redesigned farms had increased considerably in the three years. The number of trees per hectare had increased by 26 – 50% a year and the average number of food crops had increased from 14 to 17 to 20. The total biodiversity of wildlife had increased from 46 to 78 species per hectare, in addition to the increase in the diversity of soil life.

Reforestation is an essential activity in the transformation to integrated systems. But securing the survival of planted tress is a complex task on farms with livestock. Therefore, for each sub-system several strategies (see Table 2) were defined:

Table 2. Reforestation strategies

Reforestation	
Crop production sub-system	**Animal production sub-system**
• Around the fields • Within the cropping land (in strips)	• Within the pastureland (with protection) • Forest patches (segregation) • Fences (hedges) • Use of species that are not palatable for cattle

Organic fertilisers

A crucial question is where to obtain the organic matter and nutrients. One option is to import them from another farm, which is usually the case in market-oriented organic production.
The other option is to produce them on-farm. In this respect, Jeavons (1991) dismisses the former and stresses that organic fertilisers must be produced on the farm itself, recycling nutrients and maintaining the fertility of the soil by proper management. In balancing nutrient flows, long-term, nutrient losses by soil erosion, leaching, etc. have to be minimised and export of nutrients to the market has to be compensated by import of nutrients, e.g. as fertiliser or feed. The advantage of having cattle is that they produce considerable quantities of manure, which makes recycling of nutrients and organic matter easier.

The evaluation showed that it is possible to produce enough good quality organic fertiliser from the by-products available in the farms to fertilise both the ranch and crop areas at a rate of 2 - 6 tons per ha., depending on the design of the farm.
In addition, worm humus is produced in smaller quantities and green manure crops at a large scale. In this way the degraded soils are being regenerated into biologically active and nutrient-rich soils. Nevertheless, there may be a nett outflow of nutrients, which has to be compensated for on the long-term.

Multiple cropping

Designs for multiple cropping systems were made that are well adapted to the local conditions and with crops commonly used in Cuba: cassava, beans, groundnuts, soy beans, sesame, maize, sorghum, squash, melon, tomatoes, cucumbers and *vigna, mucuna* and *canavalia* etc. (as green manure) (see Figure 2). These systems resulted in high land use rates (LUR), proving the vast potential of multiple cropping for intensive land use.

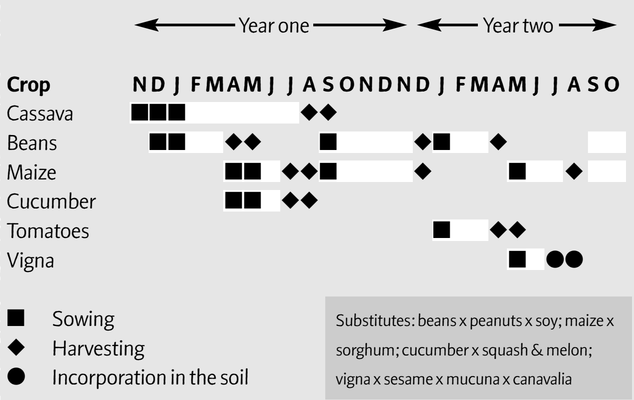

Figure 2. Sequence of rain-fed crops for 2 years

Biomass production and energy efficiency

The evaluation revealed the high productivity of these farms. The total biomass production was 3-9 tons of dry matter/hectare/year, of which 1-3 tons/hectare/year relates to the livestock system and the rest to crops, which corresponds with 3,000 - 10,000 Mcal/hectare of protein. The number of persons that can live from each farm varied from 4 - 10 persons and the sources of protein and energy are diverse (see Table 3). This shows the potential of integrated farms to produce a complete diet, food security for the family and a market surplus.

The energy balance of 4 - 10 calories produced for each calorie invested, shows the biological benefit and efficiency of these systems. In conventional livestock systems applied in Cuba during the '70s and '80s, this is normally in the order of 5 calories invested for 1 calorie produced (Funes-Monzote, 1998).

Table 3. Number of persons sustained on the monitored farms

Indicators	Range*
• People fed per hectare	4-10
• Sources of energy	4-9
• Sources of vegetal protein	3-10
• Sources of animal protein	5-12

* as a mean result of the 14 farms during six years

Final comments

This study showed the high potential in terms of production, sustainability and environmental care of integrated crop-livestock-tree farming built on agroecological principles.
The practical evaluation methodology based on selected sustainability indicators is appropriate for further defining of strategies, planning and research. The redesigned farms attracted a lot of attention from farmers, technicians, researchers and teachers; they provided training opportunities and led to the adoption of the approach by other farmers.

The agroecological concepts stimulate the creativity and enthusiasm of farmers, which leads to better decision making and performance of the farm. By incorporating crops and trees in their farming system, ranchers can become self-sufficient in food products and increase the amount of by-products available for animal feed and income. Recycling of manure, green manure crops and trees help to take care of the environment, whilst adding value to the production unit.

Promotion of crop-livestock-tree integration is important to change the farming mentality and to develop more efficient production practices based on the optimal use of locally-available resources and a fair and sustainable balance between nature and human beings.

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Adaptation of the zero grazing concept by Luo farmers in Kenya

Nelson A.R. Mango

The National Dairy Development Project (NDDP) of Kenya was implemented by the Kenyan and Dutch governments with the main aim of increasing milk production for the market. In 1979, the NDDP introduced a dairy farm concept based on *zero grazing* (ZG) which involves confining of dairy cattle in a stall and the development of a cut and carry fodder system. When the project ended in 1999, it had covered a total of 25 districts throughout the country and over 10,000 farmers were involved in either ZG or semi -ZG dairy farming. Many of the Luo farmers of Siaya district embraced the project as they were attracted to the additional benefit of ZG, namely replenishment of soil fertility for crop production. However, they introduced a number of adaptations to the ZG concept to fit their needs and opportunities. The ZG concept and the adaptations made are discussed below.

Farmers saw many possibilities in the "zero grazing" approach. Photo: Willem van Weperen

The zero grazing concept

The research component of NDDP produced a technology package that aimed at addressing the constraints of smallholder dairy farming in Kenya: lack of grazing land, low productivity of dairy cows, low quality of fodder, prevalence of diseases and lack of financial means (Valk, 1990; Muma 1994). The package consists of several components:

Housing (the zero-grazing unit): Fig.1 shows the floor plan of a ZG unit building as proposed by the NDDP. In the ZG system, the cows are kept inside all year round to prevent tick-borne diseases and other health hazards.

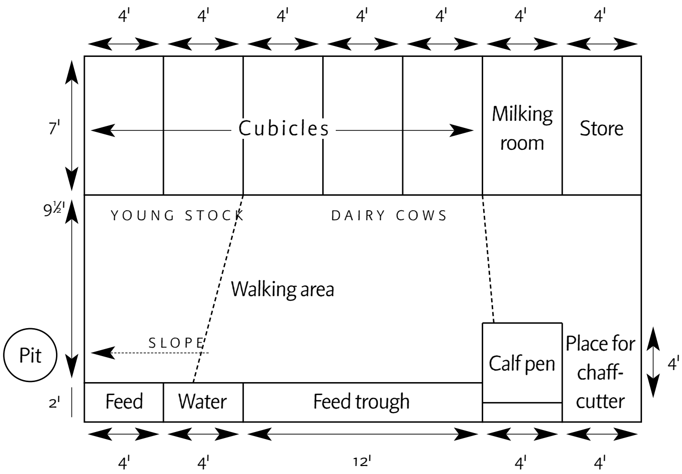

Fig.1 Floor plan of zero grazing unit

The introduction of improved dairy cattle breeds. The NDDP recommended that farmers stock their units with high milk yielding graded dairy cows. Graded cows, in this case, were not pure breeds, but animals with more than 50% 'exotic blood'. Exotics used for obtaining graded cattle were Jersey, Ayrshire, Guernsey, Friesian and Sahiwal.

Breeding and fertility: Farmers were advised to maintain the dairy breeds by upgrading their stock through artificial insemination using semen from a dairy bull.

The production of high-yielding fodder on-farm. In a ZG system all feed is brought to the animals, as they are not allowed to graze outside. Napier grass is the main fodder crop that the project recommended to the farmers. Its re-growth after cutting is rapid and establishment is relatively easy.

Utilisation of farmyard manure and artificial fertilisers to maintain soil fertility. To replenish soil fertility, NDDP recommended that farmers return all manure to the napier plot every 2 to 3 days. Farmers were also advised to apply 4 bags (@ 50 kg) of compound NPK fertiliser (20-10-10) per acre per year.

Feeding: The project advised the farmers to plant 0.75 - 1 acre of napier grass per mature cow and her offspring, and to cut it when approximately 60-90 cm long. Commercial dairy meal was to be given as the main protein concentrate supplement to the cows at milking time, the quantity depending on the production of the cow. Mineral salt lick was to be offered to the animals *ad lib* in the mineral box.

Introduction of the ZG concept to Luo farmers

Initially, dairy production with graded cows was developed in Kenya on large-scale European farms during the colonial period. Since the 1950s, it spread to African smallholdings as well. In Siaya, the first graded cows arrived in the early '50s. But, being settled pastoralists, the Luo people still highly valued its own breed of African Zebu cattle, which played an important cultural role, for example in wedding and funeral ceremonies. Free ranging animals were essential in providing manure for crop production. By bringing in nutrients and organic matter from a wider area to the cropped fields, soil fertility can be replenished. Being more expensive and needing more care, graded dairy cattle could not be used to perform these functions. As such, the Luo people did not accept these animals.

When the NDDP was launched in Siaya in 1987, farmers were actively seeking solutions for the problems they were facing: reduced land sizes, low incomes, loss of soil fertility leading to poor crop yields and market failures of cash crops like coffee, cotton and sugar. Some innovative farmers had already started with ZG, particularly after seeing its benefits in the neighbouring districts where it had been introduced much earlier. The Luo people were getting more integrated into the money economy and cash crop production. Their ceremonies were changing as well as their opinion about graded cows. Now, most farmers have adopted the ZG concept, because they were able to adapt it to their needs and opportunities.

Production of napier grass

Most ZG dairy farmers have an average of 2 to 3 cows, 1 or 2 heifers and 1 calf. Some have a young or full grown bull. The majority of farmers have only 0.4-0.6 acres of napier per cow and her offspring. Farmers do not find this a problem as they always supplement napier grass with crop residues such as maize stalks, sweet potato vines, banana leaves and stems, and molasses.

During times of scarcity, farmers are forced to feed the African Zebu cattle on the napier grass as well. This lowers the amount of napier grass that is available for the dairy cows. Then they harvest the napier grass even below 60cm in height. During times of plenty (wet seasons), the napier grass is allowed to overgrow as a lot of labour is required in the other areas of the farm. Farmers then cut napier grass only to feed the high-grade dairy cattle and not the African Zebu.

Replacing commercial concentrates

Most farmers use commercial dairy meal. They feed dairy meal to the cows at milking time at a rate of 2 kg per day or depending on productivity. Some farmers reduce this rate of dairy meal provision due to the availability of ample roughage. Several farmers in the district have come up with ‘home-mix’ dairy meal. Farmers who use this home-mix state that they get twice as much milk for the same amount of commercial dairy meal, which is sometimes adulterated with sawdust. A typical composition of a 100 kg of home-mix dairy meal is 40 kg sunflower cake, 40 kg maize grain, 10 kg sorghum, 5 kg soya beans and 5 kg dried cassava chips. The mixture is dried and milled.

Some farmers have embarked on using brewer’s waste (*machicha*) as a protein supplement. Farmers get their brewer’s waste from Kenya Brewers Limited some 40 km from Kisumu town. They find brewer’s waste cheap to buy even though its transportation is costly. Farmers mention that the use of brewer’s waste as a feeding supplement, *ad lib,* increases the milk production by 7 litres per day.

Other additional sources of protein are fodder legumes. Some farmers grow their napier grass mixed with *Desmodium spp.*. Apart from increasing the protein content of the feed, it also fixes nitrogen in the soil. Also, fodder trees like *Leucaena spp., Calliandra spp.,* and *Sesbania spp.*, are used to increase the protein content of the diet.

Use of manure and artificial fertilisers

Most farmers in Siaya do not apply fertiliser to their napier. Those who do, apply an average of 39 kg per acre per growing season instead of the recommended 100 kg. Figures on the amount of manure that is returned to the napier plot in Siaya are also much below the recommended amounts. A bag of fertiliser is quite an investment, which most farmers prefer to use on cash crops, food crops or vegetable crops instead of on the napier grass. Fertilisers are also not readily available everywhere in the district. There is an apparent competition for manure between the napier grass and cash crops, especially vegetables. Farmers with sufficient manure from their ZG units have expanded farming by growing high-value crops like vegetables (kale, cabbage and onions). Some farmers prefer applying the manure to their maize crops.

Farmer innovation in napier production

A group of farmers are now using a new method to grow napier known as *tumbukisa*. This method is a response to the high labour input required by the normal method of growing napier recommended by the NDDP at a spacing of 3 feet by 2 feet. With *tumbukisa*, farmers dig holes of 3 feet by 3 feet and 4 feet deep; they mix the topsoil with three wheelbarrows of compost manure from the dairy unit and use the mixture to fill the hole. About 10 cane sets are planted on top of the filled hole in a concentric manner. Top dressing with slurry is done every six months instead of 2 to 3 days. This method is labour intensive to establish, but requires far less labour to maintain as slurry application in only done twice a year. Since the holes are spaced 2 feet apart, some farmers plant sweet potatoes in between.

As applying slurry to the napier plots manually is labour intensive, some farmers have constructed furrow channels, that take the slurry by gravity from the unit into the napier plots, maize and vegetable fields. Some farmers just remove the dung manually from the unit and heap it somewhere to decompose and form farmyard manure.

Conclusion

Some farmers in Siaya adopted ZG with the aim of commercialising milk production. As a result of the project, they set up the Yala Dairy Co-operative Society for marketing their milk. The society also advances credit to its members to expand dairy farming. These farmers see ZG as an alternative to coffee, sugar and cotton that are now less successful in the area. ZG provides them another way to generate money for household requirements and to pay for their children’s education.

Farmers accepted the “zero grazing” approach but only after adapting it to their own situation. Photo: Willem van Weperen

Others adopted ZG in the first place to obtain manure for crop production. By buying nutrients as feed (napier grass, concentrates or other sources of protein) from outside the farm, the losses of nutrients due to soil erosion and export of products to the market, can be compensated. ZG makes it possible to still keep cattle where land is scarce. These farmers see ZG as a way of re-establishing the balance between livestock and crop production, which was largely lost due to reduction in the numbers of African Zebu cattle.

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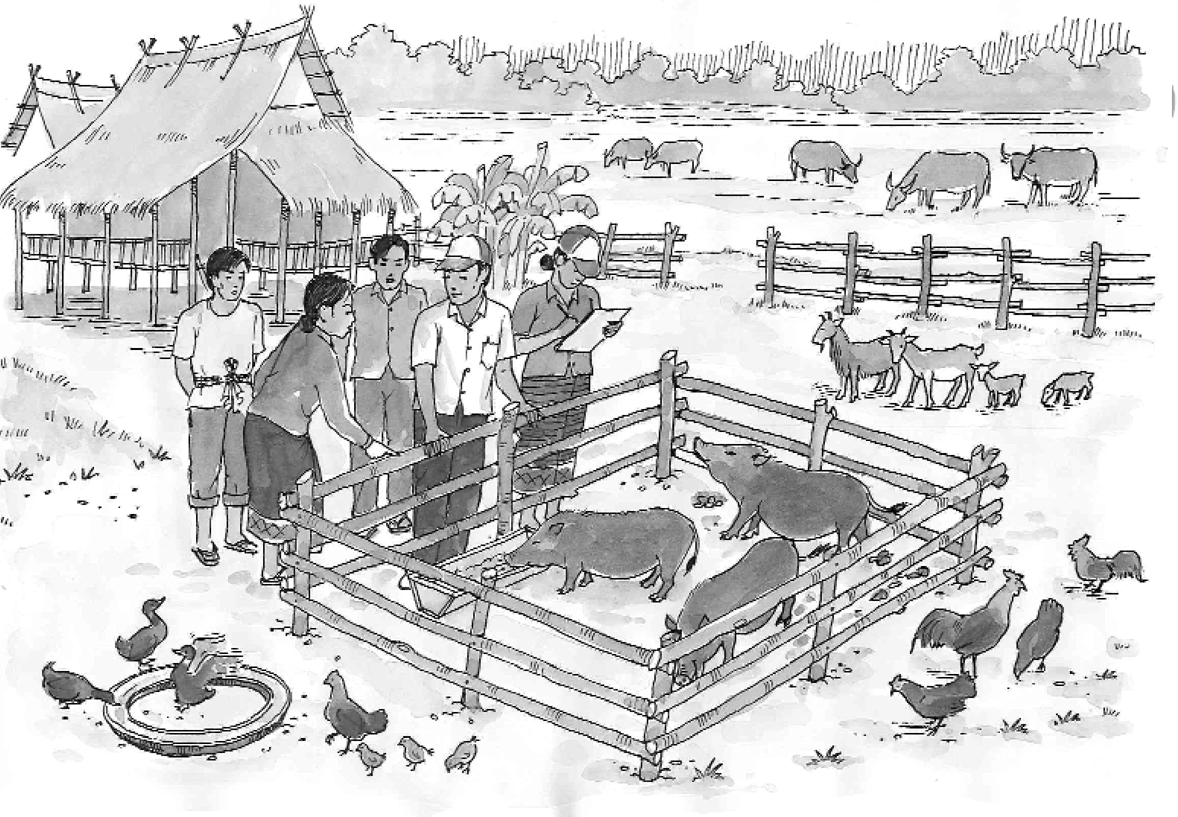

What happens when the river runs dry?

Viengsavanh Phimphachanhvongsod, Peter Horne and Werner Stür

Lao people say, "*When the river is in flood, the fish eat the ants. When the river runs dry, the ants eat the fish*". For many of the 80% of the Lao population who are rural, this saying encapsulates their deep connection with seasonal change and cycles of shortage and surplus. Shifting cultivation, the dominant farming system in the northern mountainous regions of Laos, is susceptible to the vagaries of climate, soils and steep slopes. In Xieng Khouang province, for example, where shifting cultivation is widespread, upland rice yields are among the lowest in the country (<1.2 t/ha), the average household size (6.5 – 8.1) is the highest in the country, female literacy rates are among the lowest in the country and 6 of the 7 districts have nett negative food balances (Sisouphanthong and Taillard, 2000).

The most pressing problem facing farmers in these areas is declining rice yields, due largely to declining soil fertility and increasing weed problems. Both of these are the result of shorter fallow periods (which averaged 12 years in 1981-2 but have fallen as low as 3-4 years in the more-intensively farmed areas). In the recent past, farmers were able to overcome occasional disasters in their rice crops by gathering forest products and hunting wild animals for home consumption and sale. These coping mechanisms have, however, rapidly diminished in the last 20 years, resulting in newly emerging poverty.

So, how do farmers cope with this increasingly vulnerable farming system? Many strategies are emerging depending on local and household opportunities. Some are robust strategies and are likely to persist, such as diversifying farm activities to reduce reliance on upland rice and concentrating labour and manure on the smaller areas of more fertile fields. Other strategies are short-term coping mechanisms that have developed in the absence of better alternatives, such as selling labour and growing cash crops in the hope that traders will come to buy them. But, the most widespread strategy, which is becoming increasingly important, is to raise animals. Livestock are the easiest way for most upland farmers to accumulate capital, (delivering a high return per unit of labour input) and they can be sold in a market environment where there is constant demand and stable prices (unlike most crops). Typically, the better-off farmers will have 5-10 cattle and buffalo whereas nearly all farmers raise small animals (chickens, pigs, ducks or goats).

The link between livestock and reducing poverty

A study by the State Planning Committee (SPC) in 2001 asked farmers across Laos to define poverty, identify its causes and prioritise the ways they would like to overcome poverty. Livestock emerged as the primary indicator of wealth, livestock disease ranked second as a cause of poverty, and livestock acquisition ranked second as a solution to poverty. This was particularly so among the ethnic groups which inhabit the remote mountain areas. Among the poor, women were, on average, worse off than men. The raising of small livestock is typically women's work. At certain times of the year (especially at the start of the wet season) they spend 30-50% of their working time collecting feed for pigs. These small animals are particularly susceptible to catastrophic disease epidemics and, when disease strikes, "the loss to the family is every bit as traumatic as the collapse of a bank in which all of one's savings were held".

The need for new options in smallholder livestock production

The strong emphasis placed by smallholder farmers on livestock as a "stepping-stone" out of poverty has encouraged government and non-government organisations throughout the country to work on improving smallholder livestock systems. In an earlier article in LEISA Magazine (Vol.16, No.3, pp.26-27) we described research that is being done with farmers in the northern mountainous regions of Laos to identify forages (both grasses and legumes) that can help minimise some of the livestock feeding problems. In this first year, working with 222 farmers in 18 villages, the most promising forage technologies that have emerged are those which:

- help farmers overcome seasonal feed shortages (such as the grass *Panicum maximum* "*Simuang*" for cut-and-carry feeding of cattle and buffalo when they are sick, working or penned)
- help reduce labour requirements in looking after animals (such as the legume *Stylosanthes guianensis* CIAT184 which can be grown near pens as a source of high quality feed for pigs) and,
- can provide feed at particular times of year when traditional feed resources are in short supply (such as *Brachiaria brizantha* "*Marandu*" for providing green feed to cattle and buffalo in the dry season)

The most promising varieties for Southeast Asia and their potential impacts on smallholder farmers (based on field experiences of over 5 years) have been described in two books that are available in English and five regional languages (Horne and Stür, 1999, Stür and Horne, in press).

Forages will, however, only ever be one component of livestock feed resources and, especially for small animals, new supplementary feed resources are needed. To provide an energy source for their pigs, for example, Hmong women in the remote district of Nonghet grow maize. They have two traditional varieties but neither satisfies their needs. We are now expanding our work in partnership with such farmers to evaluate and develop other feed resources (especially new legume, maize and sweet potato varieties) to help them diversify their livestock feed resource base.

In the study by SPC about 70% of the villages surveyed identified livestock disease as an urgent and high priority problem. Epidemic diseases (particularly fowl cholera and Newcastle disease in chicken, swine fever in pigs and the parasite *Toxocara vitulorum* in buffalo calves) can cause annual losses of 80% or more. *Haemorrhagic septicaemia* results in occasional major losses of cattle. Two complementary approaches are being developed to deal with these disease problems. The first is to build a national network of Village Veterinary Workers who are linked to district offices, which can supply them with veterinary medicines. This is a strategy that will have longer-term impacts but is dependent on the development of a supply chain that can deliver good-quality vaccines and veterinary chemicals to remote areas. In the shorter term, some organisations are working with farmers to develop livestock management and simple medication strategies that do not eradicate these diseases but limit the impact.

Where is this leading?

Working with upland farmers in Laos to improve livestock health, feeding and management strategies is likely to have major positive impacts on poverty in the short to medium term. Research and development like this is not, however, an "end-game" in which a solution is developed for a problem and that's the end of the story. For every solution there are new opportunities, problems and issues. In 25 years time, many farmers we are working with now may no longer keep livestock, but they have used livestock to build capital to allow them to take the risk of moving into new enterprises. The key to sustainable development in this context is the mentoring of groups of people at community, district and province-level who have the experience, skills, confidence and mandate to work together to resolve new problems (or take advantage of new opportunities) as they arise. In this sense, the **process** of research and development is as important as the technologies that are developed.

It is common for district officers to make trips to villages only when they are asked to collect data or when there is a technology package to be 'extended', often through the development of model farms. These unrelated village visits and the lack of adoption of 'tech-packs' by farmers develops an expectation among district officers that 'we cannot make a difference'. The general trend towards genuine participatory research that is happening throughout the world offers an alternative that empowers district officers to see that they **can** make a difference. We are assisting four districts in Laos to implement a new process in which the district officers, their institutions and farmers work through a series of steps in an annual process to find solutions to their livestock problems and capitalise on emerging opportunities (see Figure 1). Details of each step in the process are described in more detail in a book that will be published later this year (Horne and Stür, in prep). The key to the process is to encourage district officers to experiment and adapt the approaches to suit their needs. Working with farmers as active partners will be a learning experience for all concerned.

So what happens when "the river runs dry"? Poverty in Laos is not endemic and not generally synonymous with hunger, but farmers are susceptible to an increasingly risky environment. Livestock are an important insurance against calamity when "the river runs dry". Developing new technical options with farmers in a process that builds linkages and confidence between farmers and development workers is helping to build resilience into their farming systems.

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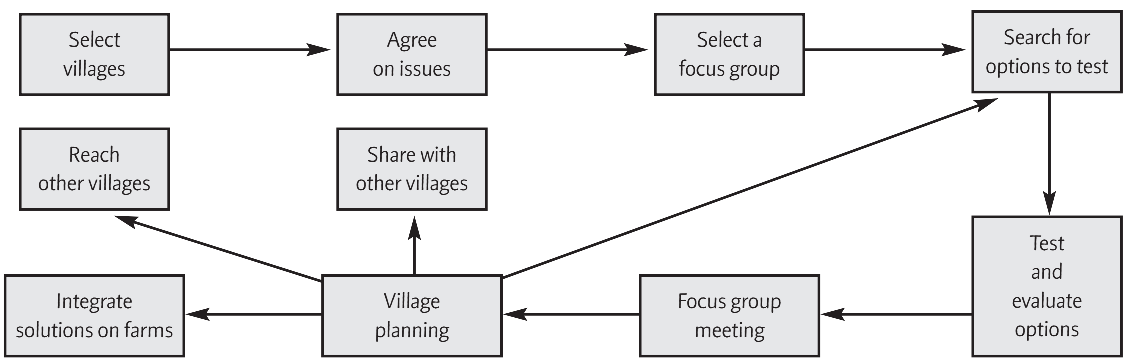
Figure 1: The process of finding solutions to livestock problems



The drawing provides an overview of the different components of an integrated system as developed by CIPAV.

Integrated systems: the experiences from CIPAV in Colombia

Enrique Murgueitio

In Colombia, inefficient extensive cattle ranching by 10% rich farmers occupies 40 million ha, 90% of agricultural lands. The 90% poor subsistence farmers have access only to about 10% of the land and must produce in an increasingly intensive way. Farming units smaller than 20 ha cover only 13% of the land but comprise 74% of farms. Permanent crops such as coffee, oil palm and sugar cane occupy 3 million ha and short-cycle crops, mainly cereals and tubers, around 2 million ha.

Since 1986, the Centre for Research on Sustainable Farming Systems (CIPAV) has worked in the south-west of Colombia, conducting participatory research studies with peasant farmers and entrepreneurial producers on different aspects of integrated systems. In recognition of the development and implementation of these systems in the humid rural areas of Colombia, CIPAV was awarded the ecological prize "Blue Planet Award" in 1995. Presently, much of the progress made in generating, validating and applying new know-how regarding these systems has been concentrated on issues such as agroforestry and silvopastoral systems, environmental adaptation of livestock, management of micro watersheds, water decontamination and production of healthy food products. In this article the author provides an outline of the basic models.

The basic components of the peasant systems

The small-scale integrated systems that have been developed with peasant farmers use highly productive annual crops, multipurpose trees and water plants as sources of biomass to provide feed for cattle and other animal species, food and fuel. The systems consist of several subsystems that can be introduced separately or as an integrated farm. These subsystems are: biomass production (crops), ruminants, monogastrics (poultry, fish, earthworms), water decontamination and biogas (see Figure p.26). This basic model is developed for small-scale farms but has been adapted to large-scale as well.

The system can be either based on a crop or on residues and by-products of processed tropical crops. Sugar cane planted at high density, oil palm, coconut palm, plantain, banana or cassava are a few examples of crops that can be used. In the case of sugar cane, the juice is fed as a complete replacement of cereals to pigs and ducks and supplemented with fresh water fern *Azolla filiculoides* and whole soybean grain. Local fodder tree species like *Gliricidia sepium, Trichanthera gigantea, Erythrina fusca, Erythrina peoppigiana, Erythrina edulis, Thitonia diversifolia, Morus alba, Leucaena leucocephala, Moringa oleifera, Cnidoscolus aconitifolius* or *Guazuma ulmifolia* are used depending on which adapts better to the local conditions. The tree foliage is harvested and the leaves are used as a source of protein to supplement sugar cane tops for feeding cattle. Trees are also used as sources of fruits, shade and nitrogen. Animals are partially stall-kept, allowing for easy recycling of their excreta by vermicomposting or through a biogas digester to provide fuel. Biodigesters are part of the treatment for decontamination of waste water from washing animal enclosures and coffee beans. The productivity of these intensive integrated farming systems is 3 - 10 times higher than of traditional farming systems. The system can be implemented gradually at a pace convenient for each farmer. Few farmers set up the whole system at once. Resources required are mainly manpower, manure and plants.

The "Productive Decontamination" subsystem

This subsystem consists of a plastic-bag biodigester of *continuous flow* (water and organic residues enter and escape continually at a constant rate), aquatic plant channels, fishponds and associated crops. Waste water goes into the biodigester to produce biogas from organic waste. The effluent is directed through zigzag channels with aquatic plants where suspended solids, phosphorus, nitrogen and heavy metals are removed by bacteria and the plant root systems. The channels have different species of plants that vary in their degree of efficiency to decontaminate (*Azolla filiculoides, Azolla sp., Lemna minor, Eichornia crassipes, Salvinia natans*). Aquatic plants and sediments from the channels are used to fertilise forage and fruit crops. Finally, the water can also be sent into a fishpond where plankton utilises the remaining minerals in the water to produce biomass to feed fish. Fish are produced in a system of multiple association of species (*Prochidolus reticulatus, Cyprinus carpio* and *Colossoma macropomum*). Pressed stalk and stems are also used as fuel. In this integrated system waste products are minimised and the local resources are efficiently used. Fuel production is an added benefit for the family and the environment. In small farming units biogas is used for cooking while entrepreneurial farms use it for warming piglets or generating electrical power in internal combustion engines.

Components of the commercial systems

In the larger-scale commercial systems, the biomass subsystem is divided into four components (sugar cane, silvopasture, grassland and aquatic plants). The cattle are of a dual-purpose type for both milk and meat production. The silvopastoral subsystem consists of grass (*Cynodon nlemfuensis, Panicum maximum* or any other Gramineae), associated with a legume tree like *Leucaena leucocephala* or *Erythrina fusca* (10,000 or more plants/ha). Grazing on these pastures allows the animals to freely browse on the fodder trees, which regenerate naturally. Grazing is rotational and pastures are fertilised with manure and effluent from the biodigester. Calves are kept under a restricted suckling regime supplemented with sugar cane tops, grass, urea-molasses blocks and a mixture of tree foliage and palm oil. Commercial feed has been completely replaced with excellent biological results. These systems eliminate the costs of nitrogen fertilisation, allow an increase in the number of animals per unit area up to 5 animals/ha (national average: 0.5/ha) and increase milk production above 12,000 l/yr. Given the fact that the system is environmentally friendly and highly productive, some areas of land can be freed for conservation.

Diversification in the use of sugar cane has resulted in the production of certified organic *panela* (dark sugar loafs) for export using animal manure as fertiliser and substituting herbicides with hair sheep and manual weed control. Sugar cane has also been used in steer fattening (stalks and tops) combined with tree forages such as *Gliricidia sepium* planted in densities between 10,000 and 20,000 trees/ha.

In commercial swine production, water is decontaminated using biodigesters that allow 20-25% reduction in the cost of electric power by using a mixture of biogas and fossil fuel (diesel or gasoline) in internal combustion engines.

The use of tractors for low-weight cartage is restricted through the use of animal draught, mainly buffaloes and mules, with a 50% reduction in the cost of these activities and environmental (emission reduction) and social (employment generation) benefits, while maintaining efficiency.

The approach is spreading in the humid tropics

The CIPAV system is ideal for the humid tropics in Central and South America and Southeast Asia, where biomass production is not a limiting factor but conservation of natural resources and the environment is a priority. For the last 10 years these systems have been tested, adapted and adopted (either all or some of the components) by small farmers in different climatic conditions in Colombia. Currently this technology is being transferred and adapted to the Philippines, Cambodia, Vietnam, El Salvador, Barbados, Trinidad and Tobago under FAO assisted projects. ■

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CIPAV has produced many how to do publications, available in Spanish only.

Native tree species for silvopastoral systems

Currently, CIPAV is working with local communities in the central and western Andes of Colombia on the integration of native tree species in silvopastoral systems. Two examples of research on such trees are:

1. Nacedero *Trichanthera gigantea*

This species, native to the northern Andes, is traditionally used by rural indigenous and small farmer communities in Colombia and Venezuela. Its main uses are related to its medicinal properties and to increasing spring water. The water-attracting capacity has been mentioned by different authors but has not yet been proved through formal scientific methods. Researchers from CIPAV learned from the farmers how to use this species as a fodder plant. Since then participatory research has allowed for considerable gain of knowledge related to this species. Some important products and results of this research are:

- Intensive cultivation in protein banks in more than 20 departments in Colombia and 12 countries in Central America, the Caribbean, Venezuela and Southeast Asia
- Fast asexual propagation techniques
- Germoplasm collection in Colombia and Venezuela
- Inclusion in most Andean micro-watershed reforestation projects in Colombia
- Commercial products for natural medicine

2. Arboloco *Montanoa quadrangularis*

This is a tree species from the Andes of Colombia and Venezuela that grows fast in unforested habitats. For more than a century this species has been used for construction of houses and buildings, animal enclosures, coffee-drying sheds, corrals, furniture, fences etc. Its white pith is used in handcrafts.

Work done by CIPAV with this tree relates mostly to phenology, regeneration, growth, rehabilitation of degraded pastures, plantations and agroforestry systems. Young farmers trained to conduct rigorous periodic observations participate as co-researchers. In less than 5 years and with a limited budget these studies have benefited small farmers and institutions in the form of:

- Guidelines for the restoration of deforested micro-watersheds
- Plantations for the rehabilitation of degraded pastures
- Low-cost technology for establishing habitat corridors, live fences and tree-lines for erosion control.

The results of these research programmes have been presented in the electronic conference on 'Agroforestry for animal production in Latin America' organised and run by FAO and CIPAV (see http://www.cipav.org.co).

Animals need shade trees to feel comfortable. Photo: Ana Primavesi

Optimising climate-soil-pasture-cattle interactions in Brazil

Ana Primavesi and Odo Primavesi

In nature, nothing functions in isolation; everything depends on the other factors present. In animal production, to optimise the performance of cattle, it is very important that management practices try to enhance the ecological functioning of the web of living organisms within the production system - climate, soil and soil life, vegetation and cattle - by influencing their interactions. In this article we look at some of these interactions and how, in Brazil, they can be optimised in an ecologically sound way.

Adapting pasture to the soil and cattle to the pasture

Cattle breeding is a very expensive activity when the breed is selected first, then the pasture suited to that breed and finally the soil is corrected with lime and fertiliser to make the pasture grow. This order has to be reversed. The pasture has to be adapted to the soil and the cattle to the pasture, and all of it has to fit the climate. In the tropical climatic zone, European breeds should be used only for crossbreeding with zebu cattle. It is not the most productive breed that will give the best performance, but the breed that adapts best to the existing ecological conditions, climate, soil and pasture.

Increasing water availability for plant growth

Forage yields depend strongly on the availability of water. Especially in the dry areas of Brazil, improving permeability and the storage capacity of the soil can increase water availability. Covering soils with vegetation and its residues allows for better infiltration of rain water, improves the soil structure, and thereby increases its air and water circulation and storage capacity necessary for plant metabolism and efficient plant nutrition. In a well-structured soil, roots are able to explore a larger soil volume for more water and nutrients. Plants can, therefore, develop better and faster and will be less affected by drought. Integrating deep-rooting crops and trees into the pasture system will further increase the production of biomass and the overall performance of the system.

Plants absorb water from the soil and transpire it. When the air is saturated with water vapour, plants cannot transpire any more. But when the wind carries it away, they absorb more water from the soil and transpire more water into the air, thus drying up the soil. In Brazil, in one year, wind can carry away an equivalent of 750 mm of the total rainwater. Planting of shrubs and trees as windbreaks can strongly reduce the transpiration of pastures and hence increase the available water for plant growth.

Enhancing micro-climate for comfort

When the surface temperature of tropical soils is higher than 33° C, plants cannot absorb water and nutrients any more. Deep rooting trees can act as air humidity and temperature regulators, pumping water from the subsoil, and releasing it through transpiration. Therefore the shade of trees is cooler than for example, the shade of a dry leaf roof.

An animal is not a machine into which forage is put in and milk and meat comes out. It is a living being that needs to be comfortable to produce well. Shade trees provide comfort to cattle. In the colder season it is 3 to 4° C warmer under the trees and in the hot season it is 3 to 4° C cooler. Pastures with at least 50 shade trees/ha allow a yield increase of 15 to 30% milk and around 20% meat. It is not only the quantity of fodder quantity or the energy consumed or the digestibility of the forage that matters; it is also the comfort that makes cattle produce well.

In Brazil, there is an increasing tendency to establish wind shelters and small shade forests to avoid water losses by wind and to improve animal comfort. In extensive systems with *cerrado* (savannah) vegetation, the bushes and trees provide additional advantages, like the supply of forage and increase of biodiversity of forage species. This allows for better animal weight maintenance and even an increase, compared to monoculture grassland, also in the dry season. When new pastures are opened, with maintenance of bush and tree strips of the original "cerrado" vegetation, the grass grows faster and the productivity is higher, due to wind protection. *Embrapa Agrobiology*, the Brazilian research centre on agrobiology, near Rio de Janeiro, has developed an easy way to establish legume trees even on very degraded pastures, by inoculating the seedlings with *Rhizobia* and *Micorhizae* and adding a little phosphorus to the substrate. Organic matter production and accumulation in these soils is surprisingly fast. This works well as a pre-treatment for establishing forage plants

Grazing rotation instead of fire

The division of pastures into smaller sub-units for grazing rotation is fundamental to prevent grassland being destroyed by cattle. In native grassland, cattle always first eat the plants it likes most. The plants that are not eaten get old, hard and are not tasty. The eaten plants sprout again and are grazed on another time. This goes on until these palatable plants disappear. But the less appreciated plants continue to grow and multiply and with time the entire pasture gets hard, rough and has little nutritive value. Then the ranchers set fire to the pasture. Many plants die, and only those that can protect their growing points against fire survive. Thus the pasture becomes worse and the forage volume smaller. Eight consecutive years of burning, with one fire per year, is enough to decrease plant production to 25% of the initial. As only the hard, less palatable plants that cattle eat only when very tender are left, farmers burn the pastures up to five times per year. Thus all organic matter that nourishes soil micro-organisms is burned out, resulting in their death. The soil compacts, water runs off and the vegetation gets scantier.

All perennial plants need a rest period to recover the reserves in their roots, which are needed for re-sprouting. Forage plants and weeds recover their root reserves only when they bloom. Grasses need to bloom and form seeds once a year. This makes pastures more resistant to droughts and low temperatures and warrants vigorous re-sprouting. Ranchers say: "*rest for a pasture is as good as irrigation*". Forages cannot always be grazed when it is best for the cattle. Sometimes they have to rest to recover their forces. In Brazil, rotative grazing is getting more common under better-controlled conditions, using electrified fences, sometimes powered by solar energy.

Integrating leguminous forage plants

In Brazil, 70% of the pastures are of *Brachiaria (decumbens, brizantha* or *ruziziensis),* and 80% of the cattle are improved *Bos indicus,* this is zebu, mainly of the Nelore breed. *Brachiaria* is an African grass with very active *Micorrhizae* fungi on it roots which give it a high degree of adaptation, productivity and efficiency of phosphorus absorption and use. The main problem is that it is planted in monocultures. In more fertile soils, *Cynodon dactylon* cv. Coastcross and Tifton , and different cultivars of *Panicum maximum* (Tanzania, Tobiatan) and *Pennisetum purpureum* (Elephant grass) are used.

Grass-legume mixtures are rare because the tropical grasses are very aggressive when supplied with nitrogen. Pasture with soybean rotation is more common. After 3 to 4 years of *Brachiaria brizantha,* soybean is direct seeded into the desiccated pasture. The nitrogen input by soybean improves the growth of *Brachiaria* grass, allowing an increase of the stocking rate from the national mean of 0.5 Animal Units (AU)/ha up to 3 AU/ha. Nitrogen-fixing legume shrubs and trees like *Cajanus cajan* or *Leucaena leucocephala* and other fast growing species are introduced in semi-intensively managed pastures for protein rich forage.

Eliminate nutrient deficiencies

Tropical grasses have a very high biomass production potential, but need a good water and mineral supply. But cerrado soils, for example are acidic and poor, especially in calcium, magnesium, phosphorus and potassium. The major nitrogen sources are nitrogen-fixing leguminous plants, cattle manure and synthetic nitrogen fertilisers. Small doses of phosphorus (35 to 42 kg/ha P_2O_5) are needed to guarantee the development of forages. Phosphorous-deficient, decumbent grasses like *Brachiaria*, don't form stolons, have a shortened vegetative cycle, bloom early and produce little biomass.

Cattle also need phosphorus. Insufficient phosphorus in the pasture lowers milk and meat production and makes cows sick. It happens specially when pastures have old, dry forage, or when the soil is compacted by overgrazing and forage roots cannot penetrate the surface layer of the soil. It can be completely avoided by applying phosphate fertiliser or giving cattle mineral salts.

There also can be other nutrient deficiencies, which affect animal health, like that of calcium causing a kind of "grassland tetany". This can occur especially in *Brachiaria humidicula* pastures, but also in young, vigorously sprouting grasses or in very compacted soils.

Magnesium-deficient zebu cattle are very nervous and aggressive and the heifers do not develop well. Cobalt, extremely deficient in the Amazon region, is the mineral which is most lacking in Brazilian grassland. Young animals are meagre, gloomy, without appetite but gnawing at tree barks; they loose the hair from their tails and have a scrubby hide. In all cases mineral salts are very important to compensate for the mineral deficiencies and to keep the animals healthy.

Parasites and diseases

One of the biggest problems in tropical cattle breeding is parasites, mainly worms, ticks and bots. The horn fly becomes an increasing problem in flogs treated against parasites with injectable *Ivemectin*. This is because the beetle that eats the larvae of the fly in the cattle excrements is also killed. With rotational grazing and a pasture with 20-25 % legumes, the worm problem can be practically controlled. Tick attacks are mostly seen in European cattle that have a thinner hide. Zebu cattle are rarely affected. The problem of bots can be resolved by selecting the bot-resistant animals and selling the affected ones. Normally, "sweepers" (animals with no respect for fences, grazing anywhere) never have bots.

Towards "green meat" and "green milk"

To prevent 'global climate change' by 'greenhouse gases', it is important to reduce methane emission by cattle. This obliges farmers to speed up animal production per unit area and to reduce the slaughter age to get a lower ratio of kg methane/kg animal protein (meat). The use of grains for animal feed has to be reduced as well, giving priority to human consumption. This then increases the dependence on forage. But, as grass cellulose is the main source of methane emission, management practices that contribute to an increase of forage yield per unit area and maintain stocking rate without weight losses, all year long, are needed. Profitability, competitiveness and sustainability of the production system will be thus increased whilst reducing the negative impact on the environment.

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Optimising livestock strategies in Bolivian mixed farming systems

Also for pigeons, there is a place on diversified Andean farms.
Photo: Katrien van 't Hooft

Katrien van 't Hooft

Most smallholders in rural Bolivian communities have developed mixed systems, in which the production of crops and the rearing of animals are combined with income-generating off-farm activities. The strategies vary a great deal from one family to another, and also within a family, depending on the time of the year, the age of the family members, or external circumstances. It has been calculated that 90% of rural families in central and south Bolivia earn more than 50% of their income through non-agrarian activities. (Jimenez Sardon, 1984)

Principle of diversification

The strategy used by rural families to counteract risks and optimise opportunities under changing and adverse circumstances is to diversify their activities. (Valdivia and Jetté, 1996). This principle of diversification also forms the basis of family-level livestock keeping in Bolivia, as in most parts of Latin America.

Each family has control over a couple of small plots of land, which are often on different ecological floors and from which they produce a variety of crops, thus minimising the considerable weather-related risks, and guaranteeing self-sufficiency for the family. The animals reared are poultry, guinea pigs, sheep, goats, pigs, cows, donkeys, llamas, alpacas and rabbits, and sometimes, depending on ecological circumstances, carp and bees. Women bear most of the responsibilities in animal care. Animals are an important part of the agricultural system and the culture of peasant families. Animal raising is embedded in Andean cultural values, such as solidarity and reciprocity, community organisation, and respect for *Pachamama* – or Mother Earth. Rural families perform, therefore, numerous rituals and festivals related to livestock throughout the agricultural cycle. The subject of livestock rearing by families is also closely connected to those of biodiversity, environment, gender, poverty and migration.

Livestock research and education

Despite massive investment in livestock research, the benefits to marginalised communities, where livestock is especially important to livelihoods has been very poor. In Latin America, as elsewhere, technologies were developed mainly for intensive and industrialised livestock production systems, assuming that the same technologies could be used to improve all livestock systems. This assumption turned out to be invalid. In fact, most modern technologies do not fit the reality of the low-input livestock system, while they have also enabled commercial producers to displace the smaller and less specialised producers.

Animal science as taught in Latin American universities and farming schools does not take into account the complexity of the context in which rural families rear livestock. Rather, attention is focused on reaching the maximum productivity per animal, limited to animal species used in industrialised livestock keeping, especially cattle, pigs and chicken. The absence of essential elements of family-level livestock keeping in the curriculum is reflected in the frequent failures of livestock projects.

Failure of livestock projects

Stimulating livestock keeping at family level is an objective of many livestock projects. It is at this level, though, that failures are most frequent and have harsh consequences. An analysis (Blackburn et al, 1992) of different livestock projects revealed that many were inadequately adapted to the social, economical and cultural reality of the families belonging to the target population. The projects intend to change the people's system of production, usually from a diversified low-input system to a specialised one, directed to a monetary market, without consideration of the social implications and risks that these actions pose to rural families. Many of these projects have not been preceded by a thorough analysis of the reality of the families, like their ways of seeing the world (or cosmovision), their survival strategies, the rationale behind their different productive systems, the role of animals within this reality and the way the families perceive projects. Moreover, a lot of information on the outcome of projects is shelved as work reviews, poorly accessible to students and other interested people. Thus, the same mistakes are repeated.

Two basic strategies

A wide array of livestock keeping strategies can be observed among rural families. Basic elements of these strategies are the use of various animal species, the flexibility to change from one species to the other, and the low-external-input nature of the management system. Most families base their livestock keeping on *diversified* husbandry practices: poultry and pigs scavenge around and do not require major labour or capital input, and *cuy* (guinea pig) are kept in the kitchen, fed on leftovers. Though there is high mortality amongst these animals, their output is produced against very low cost. In addition, one species, like for example milk cattle, may be managed under a more *specialised* system, requiring relatively high levels of capital and labour input, and depending on market sales. The logic behind this more 'specialised' livestock system is quite different to that of the 'diversified' livestock system.

Though all divisions are artificial and never reflect reality in all its complexity, we can use this division in the main strategies of family-level livestock keeping: diversified and more specialised management of animals (Table, next page). They have to be considered as the two extremes of a continuum, with many variations in between. It is helpful, however, to understand the basic idea and logic behind each of these livestock keeping systems, in order to find ways to optimise each of them.

Different ways for optimising

In general terms, under the conditions of diversified livestock keeping, it is not possible to increase profits by reducing the costs of production, because these costs are minimal. It is also not possible to aim for a major increase of productivity per animal, as that would require a large investment of cash and labour, which goes against the basic principle of this strategy. The

Table 1: Characteristics of the two basic livestock keeping strategies

CHARACTERISTICS	DIVERSIFIED LIVESTOCK KEEPING	SPECIALISED LIVESTOCK KEEPING
LABOUR	Mainly women and children - combined with migration	Usually the whole family, including men
RISK FOR FAMILY	Low, because of the different species used	High, dependence on (external) conditions related to one species
FUNCTION OF THE ANIMALS	Multiple: to be consumed by the family, to be sold, as a way of saving and reducing risks, to produce organic fertiliser and medicines, for cultural and spiritual reasons	Mainly for income generation
PRINCIPLES	The number of animals most important. Reduced investment and low output of traditional products (meat, milk, eggs, wool, fur), combined with the use of other products, like manure, bones, horns, blood, bladder.	Main focus on production level per animal. Large investment of money and labour to sell traditional products. Specialised keeping of one species is often combined with diversified keeping of other species.
MANAGEMENT	The animals are kept in many different ways. Temporary food shortages and disease risks are part of the system.	The animals are kept in a relatively uniform way, directed at optimal conditions throughout the year.
TYPE OF HEALTH CARE	Based on local practices and medicine (ethnoveterinary medicine), sometimes complemented with selected 'modern' practices. Veterinary care includes rituals and local practitioners.	Based on 'modern western' practices by field workers and veterinarians, complemented with selected ethnoveterinary practices of the owners. Limited consultation of local practitioners
FLEXIBILITY	High, it is easy so shift from one species to another	Low, due to high individual value of the animal and the specialised knowledge and network required

best way of optimising diversified livestock keeping, without veering away from its principles, is to *reduce the mortality rate* of the animals. Under normal circumstances, the mortality rate in diversified livestock keeping can vary from 40% to 80%. This is due to a variety of reasons, such as infectious diseases; theft, accidents and predators; food and water shortages; lack of shelter; internal and external parasites; lack of care during special moments such as parturition and disease; and inbreeding. The relative importance of each of these variables differs according to the animal species and the circumstances.

In more specialised livestock keeping the mortality rates are generally much lower than in diversified keeping, because of the extra attention given to feeding and care of the animals. The way to optimise specialised livestock keeping is by *reducing the costs of production* and *increasing the profit margin per animal*. This may imply, for example, improving feeding strategies throughout the year, or cross-breeding with exotic breeds. As this is also the basis of industrialised livestock keeping, plenty of documentation about these technologies is available. Stimulating the cooperation and organisation amongst families that produce a specific species can be a major starting point, to improve marketing and infrastructure, for example.

Niche for poverty alleviation

The measures taken to reduce the mortality rate in diversified livestock keeping should be based on the strategies, the practices and the knowledge of rural families, especially of women. These measures should be cheap and require little additional labour; the income earned in the short term as a result of these measures should be greater than the costs necessary to implement the change. Under these conditions, the measures can combine traditional practices with strategies of modern veterinary medicine, and include the training of community-based animal health workers.

Various projects have shown that it is indeed possible to reduce mortality rates under these circumstances, i.e. low-cost vaccinations against specific diseases such as Newcastle disease in chicken or hog cholera in pigs; protection of chicks from predators by confining them during the first 2-3 weeks of their lives; strategic parasite control in llamas and alpacas; selection and exchange of stock of indigenous breeds; and specific actions to counteract the worst effects of food shortages, such as supplying mineral salts and supporting traditional forms of feed supplements during the critical periods. Special attention and simple infrastructure during and after parturition, can drastically reduce the number of piglets crushed to death by the sow.

There is, however, a lack of knowledge generation, extension materials, research and education in this field, as most livestock development initiatives have aimed at changing the diversified systems into more specialised ones. Optimising the diversified system of family level livestock keeping within it's own context, and without changing the logic it is based on, is an under-utilised niche for poverty reduction. It implies a major challenge for projects, as well as for research and education in the livestock field.

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Diversifying their livestock activities, a strategy used by rural families to counteract risks and optimise opportunities under changing and adverse circumstances. Photo: Katrien van 't Hooft

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More information in "*Gracias a los animales: la crianza pecuaria familiar en América latina con estudios de caso de los valles y el Altiplano de Bolivia*". Edited by Agruco, Cochabamba, Bolivia. Forthcoming. Katrien van't Hooft, editor.

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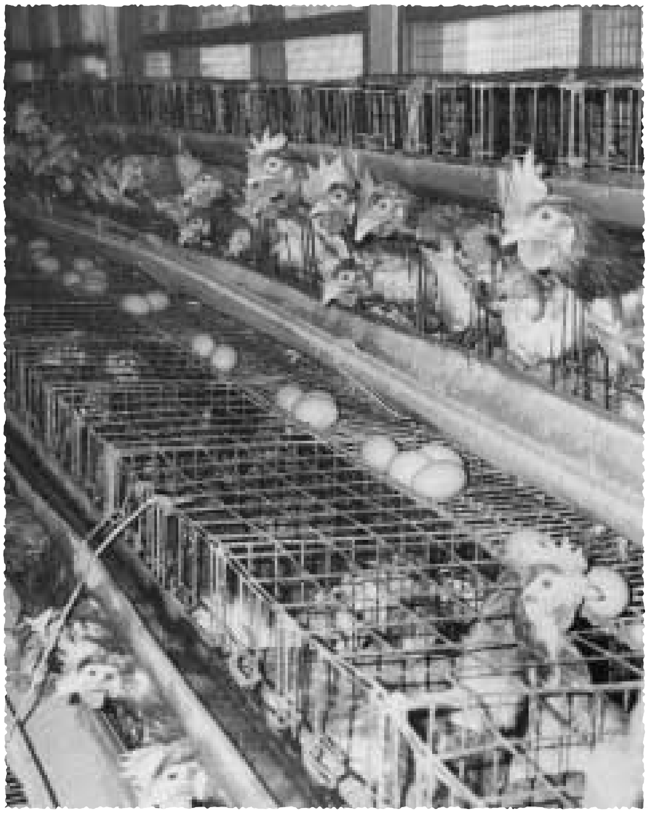

The rise of factory farming in Southern countries, as seen here of laying hens kept in battery cages in Thailand, is proving detrimental to food security, the environment and animal welfare. Photo: CIWF

The 'Livestock Revolution' and its impact on smallholders

Leah Garcés

Two-thirds of the world's livestock are found in 'developing' countries. Most farmers in these countries practise multiple-purpose, non-intensive methods of animal production. Animals are critical for their livelihoods, cultures and social status. Many of these animals graze areas not suitable for crops or scavenge freely, often consuming garbage and harmful insects. Small farms that combine livestock and crops use the land relatively sustainably: crop residues are fed to animals; manure provides good fertiliser and fuel; and animal draught power reduces the need for fossil fuels. Smallholder livestock production makes a substantial contribution to the economy.

In India, for example, livestock contributes about 30% of the total farm output, and 80% of livestock products come from small farmers with 3-5 animals and less than 2 ha of land (Rangnekar 2001). It is estimated that one-quarter of the world's total land area is being used for grazing livestock, including extensive grazing systems. A further one-fifth of the world's arable land is used for growing cereals to feed livestock. This makes livestock production the largest user of land in the world.

The 'Livestock Revolution'

But livestock production systems in these countries are changing fast, due to the so-called 'Livestock Revolution'. The global demand for meat is expected to more than double over the next twenty years, creating an increased demand for cereal feed. Southern countries are expected to become the main producers of meat and animal products for the rest of the world, with increasing dependency on imported grain. It is expected that there will be a shift from livestock being kept for multiple purposes and local food supply to animals being raised under factory farming conditions for export. Many small-scale farms will be out-competed and replaced by large-scale industrial farms (Delgado et al 1999).

This Livestock Revolution will provide new opportunities for agriculture in the South. But, who will benefit from it, what will be the cost to small farmers, food security, the environment, farm animal genetic diversity and farm animal welfare? Compassion in World Farming Trust (CWFT), a research-based farm animal welfare organisation that investigates the development of factory farming at an international level, recently studied the effects of the rise in factory farming on Southern countries, their farmers and farm animals (Gracés 2001; Cox and Varpama 2000). An overview of the results is given below.

Small farmers are loosing

The leading agencies working on hunger alleviation admit that rural small farmers are being pushed out of business by factory farming. Farmers in the UK, US and Europe have already experienced the painful consequences of the so-called 'vertical integration' of livestock production, in which specialised enterprises such as feedlot farms, animal feed traders, and meat packers, all merge under one giant company. This leaves very limited market opportunities for small, independent farmers, many of whom have been forced to leave the business altogether. According to the US Department of Agriculture, there were 5.7 million farms in the USA, in 1950. Today, the number has decreased to about 2 million farms.

This same pattern is quickly taking hold in Southern countries. Brazil's poultry industry is a good example. Between 1970 and 1991, Brazil's poultry industry grew from small backyard farmers to a multi-national mechanised industry, becoming almost entirely vertically integrated. Originally, small family farmers were given day-old chicks by major companies and were paid to raise them. Sadia is an example of a family-owned company, which employed 14,000 smallholder farmers to raise chickens on their mixed farms with a clear benefit to these farming families. The chickens were brought back to Sadia, who processed and distributed them to consumers.

Unfortunately, this system began to change four or five years ago, due to financial troubles of family owned companies, such as Sadia, which were taken over by financial interest groups and foreign companies. Now, Sadia is raising, providing feed for, and processing its own chickens in large production units. Certainly, most of the 14,000 mixed farmers, who once raised chickens for the Sadia industry, do not benefit from this new 'development' initiative.

Harm to import-dependent developing countries

There are many examples that support the view that the introduction of industrial livestock rearing not only harms the individual small-scale farmer but also the developing countries as a whole. As a consequence of industrial livestock rearing, these countries have become more import-dependent. Grains, tractors, fuel, fertilisers and special animal units and processors are required for intensive livestock rearing, none of which a developing country starts out by making itself.

Over the last decade, Asia has begun to import large amounts of grain to feed its industrially-produced farm animals. Likewise, machinery, oil and production units are being imported and subsidised by the government. The Asian economic crisis of 1999, that raised prices of imported feeds and depressed urban demand, proofed that being an import-laden economy can be disastrous and unsustainable.

Threat to food security

A *World Poultry* study (Gueye 2001) done in sub-Saharan Africa indicates the importance of family-level poultry rearing for food security, poverty alleviation, environmental health and genetic diversity. While the one or two breeds of broiler chicken used for chicken meat in factory farms are generally imported, 85% of rural families keep several species and breeds of poultry of indigenous types. The products of these local breeds are often preferred to those from exotic breeds by local consumers. Furthermore, the local breeds are better adapted to local diseases, pests and climate. Poultry are usually raised in extensive systems, while some families specialise in semi-extensive and small-scale intensive poultry systems.

In extensive production (backyard) systems, birds are reared with little land, labour or capital, can be accessed by even the poorest social communities in rural areas, and are of great importance for women, especially in female-headed households. The study indicated that an average flock of 5 chickens enabled a woman in Central Tanzania to earn an additional US$38 per year or a 9.5% increase in income. Poultry raising has contributed to the 'greater empowerment of women by improving their financial status, if socio-cultural and religious environments allow it'. As such, the loss of family farming to industrial farming could seriously affect women and children.

Effects on the environment

Factory farming was developed in Europe with the aim of ending food shortages after the 2nd World War. Science and technology were promoted, farmers were given subsidies to encourage production increases, and consumers were given cheaper food. But, these policies of production at all costs can no longer be supported. As far back as 1997, the chief of the FAO's Asian Pacific Regional Office declared that it was time to move away from the 'Green Revolution' livestock model, as the environmental problems of this approach were already obvious.

Industrial animal farming has proved to have detrimental effects on the environment both in the short and the long term (Haan et al. 1998). For example, the production of cereals for the livestock industry often takes place far away from where the animals are raised. This is leading to depletion of soil fertility where cereals are produced, and pollution at the other end of the trading spectrum where cereals are used for animal feed. Soya and maize are major products of the US supplied to industrial animal farms around the world. Such monoculture systems, though strongly promoted by governments, have unintended consequences for soil and water quality. Thirty percent of the total cropland in the United States is now eroding at excessive rates, according to the Soil and Water Conservation Society (http://www.swcs.org/).

Globally, farm animals produce 13 billion tonnes of waste per annum (Turner 1999). Animals on industrial farms consume high-protein feeds and produce waste that is extremely environmentally damaging. Industrial animal farming contributes 5-10% of the total of greenhouse gases in the world, accelerating climate change. Moreover, large amounts of water and fossil energy are required to grow, process and transport industrial farm animal feed and treat the animal waste (Pimentel et al.1997).

Loss of genetic diversity

The FAO (2001) reports that the greatest threat to the world's domestic animal diversity is the export of specialised breeds of farm animals from developed to developing countries. Crossbreeding with and eventual replacement of local breeds has resulted in a situation that around 1,350 domestic animal breeds (30% of all domestic breeds) are at risk of extinction. Every week, two breeds of farm animals disappear.

One of the greatest misjudgements of the 'Livestock Revolution' is to deny the importance of genetic diversity for food security. For example, in 1996, some 942,000 inseminations have been carried out in the Netherlands alone, with semen from a single Holstein Friesian bull, named Sunny Boy. In that period the Dutch dairy sector averaged 1.7 million milking cows! (Compas Magazine, Oct.1999, p.26.) Semen of this bull was also used in many other countries.

Nearly 12,000 years of domestication and breeding under different environments have resulted in some 4000 breeds of farm animals. The genetic diversity of these breeds has made it possible for humans to thrive in all corners of the globe, facing a range of environmental challenges including varied climates, diseases, parasites and pests. Unlike imported industrial breeds, local farm animals in given environments have developed resistance or adaptations to these challenges.

For example, in Rajasthan, India, non-industrial breeds of farm animals have benefited human food security even in a harsh desert climate, where temperatures can rise to 50ºC. This region counts 7 local breeds of cattle, 8 breeds of sheep, 4 breeds of goats, as well as camel and horse breeds. Through these local breeds Rajasthan significantly contributes to the national milk and wool output. Marginal lands can contribute to food security only by working with farm animals adapted to the local climatic conditions (Rathore et al. 2001).

Government interventions in Rajasthan have focused on 'improving' local breeds by crossbreeding them with exotic breeds from other climates. Not surprisingly, the crossbreeding of local sheep with exotic sheep has failed to achieve any improved yield, mainly due to high mortality and problems with feed supply. In the case of cattle, the government has realised the detrimental effects of crossbreeding, and in 1998 revised its policy to protect and improve local breeds.

Negative impact on farm animal welfare

Another negative impact of industrial farming is its impact on farm animal welfare. As recognised by the Treaty of Amsterdam,

Measures to benefit the poor to better compete with the livestock industry (LID 1999)

- Access to credit (to allow for the purchase of animals);
- Access to appropriate (community based) animal health services and simple preventive measures such as vaccinations and improved hygiene;
- Secure grazing rights and access to water;
- Access to markets;
- Trade policies and frameworks that allow smallholders and pastoralists to compete with industrial animal production. For example: support to cooperatives, levying taxes from animal producers based on their ecological and social impacts;
- Improve feeding to increase the performance of local breeds (Haan et al 1998);
- Support livestock production based on local resources (feeds, breeds, indigenous knowledge and institutions) and integrated farming systems;
- Stop subsidising intensive animal production in the North and the South;
- Stop export of subsidised products of the livestock industry to developing countries.

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Local breeds of farm animals, such as these cattle in the Gambia, are better adapted to their environment than breeds imported for factory farming. Photo: CIWF

farm animals are living creatures capable of feeling pain and suffering. Industrial animal farming often closely confines the animals indoors, without light and with little or no exercise. This inhibits the natural behaviour of animals, and is known to create aggression, stress and injuries in animals. Industrial animal farming also carries out standard practices of mutilation: the hen is debeaked, so that she can no longer peck her cage mate, and the pig is tail-docked, so that his bored pen mates can no longer bite its tail.

The surroundings of industrial animal farms can be dirty and poorly ventilated, leading to poor animal health. Moreover, selected breeding for large muscles and fast growth, especially in pigs and chickens raised for meat, leads to leg problems, cardiovascular inadequacy, increased risk of mortality and poor welfare.

Learning from the mistakes of the North

In superficial economic calculations, industrial animal farming is considered the cheapest and most productive form of animal production. But, these calculations do not include the 'total costs' of this production system. Industrial animal production looks viable only when selected aspects of the production – consumption system is viewed. In reality, the hidden costs of industrial animal production for future generations are enormous. It is therefore very important that policy decision makers examine questions such as: Is it acceptable to cause job losses by putting small-scale farmers in poverty stricken populations out of business? Is it acceptable to cause ecological degradation, environmental pollution, climate change and increased ozone layer depletion? Is it acceptable to cause unnecessary pain and suffering to farm animals?

The UK, for example, has been struck by diseases such as foot and mouth disease and mad cow disease (BSE) that has brought the industrial animal farming system under serious questioning by the public. Food poisoning connected with eating animal products is also higher than it has ever been in the UK, leaving consumers to doubt the safety of industrial animal products. More and more consumers are turning away from the products of industrial animal farming towards the products of more sustainable systems such as organic and free-range. The governments in Europe are now beginning to recognise this situation and the value of more quality-driven livestock production. The Netherlands government, for example, has recently begun to subsidise organic pig production by 30%. An editorial comment in World Animal Review in 1998 raised an all-important question: "Should this type of livestock production continue to be encouraged globally, or should alternatives be sought?"

Policy makers must now support more sustainable and humane forms of animal farming and realise that industrial animal farming holds no future for Southern and Northern countries alike.

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For a complete version of the report and the references therein, please contact Compassion in World Farming Trust.

Livestock: industrial or integrated?

Editorial

Livestock production is important for the majority of farmers in developing countries, especially for small farmers in more marginal conditions where land cannot be used for other purposes. Smallholders keep livestock for food, fibre, fertiliser, fuel, draught power, as a buffer in case of crop failure, and also for social and cultural functions. Increasingly, livestock is also produced for cash, which is the main objective of specialised livestock production systems. This type of livestock production strongly depends on the dynamics of the global markets.

A team of researchers of the International Food Policy Research Institute (IFPRI) and the Food and Agricultural Organisation (FAO) produced an extensive report called: 'Livestock to 2020: The next Food Revolution' (see Garcés p.7). 'Livestock Revolution' was the term they used to describe the expected massive increase in livestock production in developing countries due to doubling of the demand for livestock products, especially in the North, over the next 20 years. Like the 'Green Revolution', this 'Livestock Revolution' involves the large-scale transformation and growth of production along the same lines as it has already taken place in many 'developed' countries. What will be the consequences of this development?

Painful experiences in the North teach us that this development towards 'factory farming' will put enormous pressure on natural resources, food safety, animal diversity and welfare, as well as threaten the income generating possibilities of small farmers. In reality these systems are very inefficient and the hidden environmental and social costs of the livestock industry are enormous (Garcés p.7). Also, to meet food needs in 2050 it is necessary to increase human food production considerably. But, the 'Livestock Revolution' will compete strongly with human food production. Presently, livestock already consumes almost 50% of world cereal grain supplies. It is therefore very important to develop livestock production systems, which do not depend on cereal grain (Preston p.26). The Animal Welfare Review in 1998, therefore, raised the all-important question: *"should this type of intensive livestock production continue to be encouraged globally, or should alternatives be sought?"*

Even without the 'Livestock Revolution', livestock keepers already have enough ecological problems, for example, due to overgrazing and burning. Research has developed technologies mainly for intensive and industrialised livestock production systems. But, many modern technologies do not fit the reality of low-input livestock systems (van 't Hooft p.10).

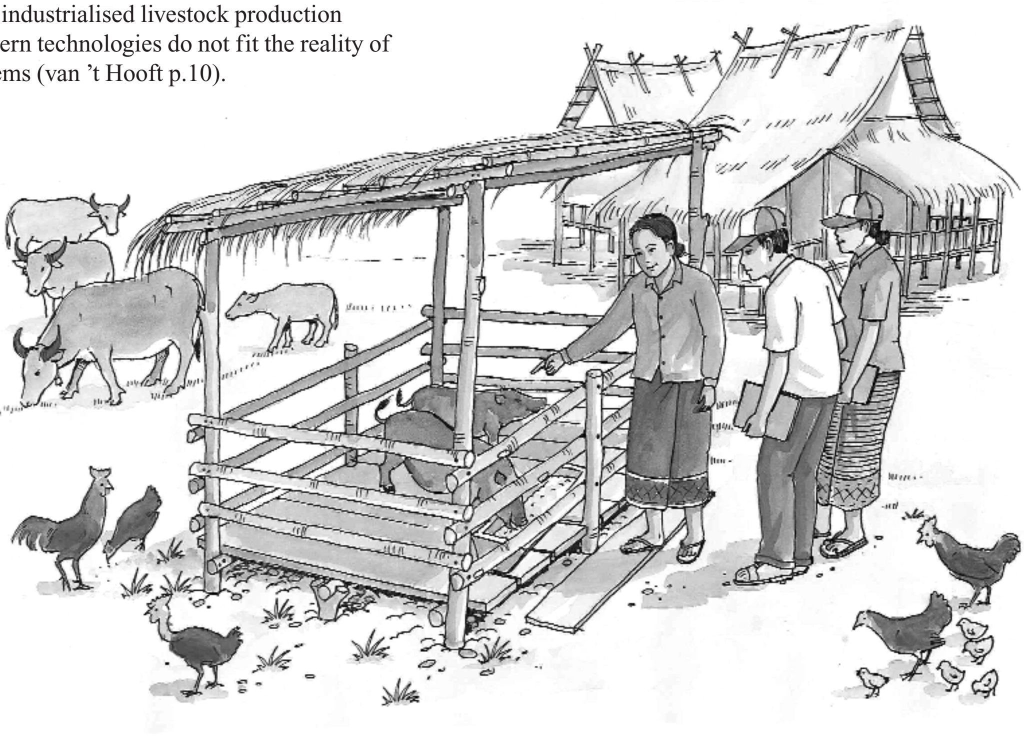
But what alternatives are available to farmers? The articles in this issue present some useful insights, practical suggestions and ways to achieve them.

Enhancing the quality of the whole system

To optimise the performance of farming, it is important that management practices enhance the ecological functioning of the 'web' of all living organisms within the production system by influencing the interactions between climate, soil, vegetation, animals and farmers (Primavesi and Primavesi p.12).

Traditional farmers often have mixed systems in which the production of crops, animals and natural resources are integrated, products are of multiple-use, and waste products of one sub-system are used as inputs in other sub-systems. Within this integrated system, depending on needs, opportunities and risks, farmers may follow different strategies: keep many different animal species under low-input management system, or combine this with the intensive production of one specific species (van 't Hooft p.10). Traditional systems can be relatively productive, while making optimal use of the available natural and human resources. Presently, influenced by modernisation and globalisation, most of these traditional systems are loosing their economic and social coherence.

The awareness that agro-ecological systems are complex and integrated, and that the quality of all parts of the system, including its social and cultural dimensions, is important to optimise the performance of the whole system, has been lost in more modern agriculture. Intensive livestock production in The Netherlands, for example, strongly focused on high input / high output relations and profit making and forgot about the environment. Two environmental associations of dairy farmers, rediscovered the importance of the quality of the whole system. They found that the quality of the cow manure influences the quality of the soil, which, determines the quality and quantity of the pasture and fodder crops, the feed for the animals, which is important for animal health and the quality and quantity of their products (see Figure 1 on p.24). They have developed a new way of feeding their milk cattle with lower protein and higher fibre contents by using less concentrates and fertilisers, which reduces nutrient losses while maintaining milk production at the same level. (van Weperen and Kieft p.24).



Presently, livestock research appears to show heightened interest in mixed or integrated farming systems going by the number of conferences that has dealt with this subject in Latin America, Africa and Southeast Asia (Sources p.30). Agroecological research in Colombia and Cambodia is working successfully on the development of integrated farming systems, with close integration of animals, recycling of all excreta, and the use of highly productive energy and protein crops, to improve productivity and sustainability of smallholder and commercial agriculture in the humid tropics (Preston p.26; Murgueitio p.14).

Integration of crops, grasses, trees and animals

Many of the authors stress the importance of diversification of agriculture. Van 't Hooft (pg.10) explains the importance of animal biodiversity in smallholder agriculture in the Andes. Primavesi and Primavesi (pg.12) report on the benefits of integration of leguminous crops and trees in pastures in Brazil. Funes-Monzote and Monzote (p.20) analyse the effects of integrating crops and trees in dairy farms in Cuba. Viengsavanh et al (p.16) explain how, in Laos, integration of specific grasses, trees and legumes help farmers overcome seasonal feed shortages for their animals, reduce labour requirements, improve animal health and performance in extensive systems. Murgueitio (p.14) points at the complementarity between ruminants, monogastrics like chicken, fish and earthworms, micro-organisms in biogas digesters, crops, grasses and trees to optimise the benefits of intensive integrated systems.

In tropical countries, especially in the humid zone, there are many crops and farming systems that considerably exceed the productive capacity of grain cereals. Key energy plants for intensive integrated systems are: sugar cane, cassava, the palm family (especially the oil and sugar palms). Key protein crops are: N-fixing legumes (trees and shrubs rather than soy beans) and water plants like "duckweed".The feeds derived from these "alternative" crops do not lend themselves to "factory" farming systems which traditionally use dry feeds, easy to store, transport and mix into "least-cost" rations. The "alternative" feeds require relatively small scale, diversified and integrated farming systems. The role of animals in these systems will be synergistic rather than as primary producers (Preston, pg.26).

In more marginal environments it is very important to integrate farm animals adapted to the local climate and forage (Primavesi and Primavesi, Pg.12). Indigenous animal species are often much better adapted to these conditions. Thriving even at low levels of fodder inputs, their maintenance is ecologically more sustainable. While they may not be able to compete with "improved breeds" in regards to milk and meat yields, indigenous animal species fulfil a much wider range of functions and provide a larger range of products. As is becoming increasingly clear, they often have scope for specialty products and can be essential to preserve habitats. Improved feeding can double the performance of local breeds (see box on p.9). But, according to FAO, one third of the world's estimated 4000 livestock and poultry breeds are in danger of extinction! The 'Livestock Revolution' will speed up the loss of indigenous animal biodiversity. Action is therefore urgently needed – an example of this is the LIFE project (Warsi p.27).

In addition, small animals and insects could have considerable potential to improve the integrated farming system. Poultry is an example of a small animal which plays a very important role in smallholder production and poverty alleviation. Earthworms (Murgueitio) and weaver ants (Van Mele and Vo p.28) are examples of very useful insects which could strongly enhance the overall productivity of integrated systems. And, of course, we should not forget the wide diversity of micro-organisms in the soil and the animals without which agriculture would not be possible.

Chain management and weak links

An increasing number of organisations are working on improvement of the whole livestock production chain, including aspects such as input supply, processing, marketing, transport and farmer organisation. Rocha (p.22) presents such an example. In the Andean highlands of Bolivia there is an enormous ecological and economic potential for llama production. However, llama production is strongly marginalised due to, among other factors, a parasite in the meat (Sarcocistiosis), which makes it less attractive for human consumption. Farmers, supported by a local NGO, have succeeded in reducing the prevalence of this parasite, improving market structures for commercialisation of this product, and undertaking other activities to revitalise family-level llama production, with positive economic, ecological and cultural effects.

Often there is a weak link in the production chain, which could strongly inhibit the overall performance of the system. Strengthening of weak links may have unexpected results. Unlike in the intensive systems in The Netherlands, mentioned earlier, in extensive systems, for example, animals often get too little proteins or lack specific minerals (e.g. phosphate, calcium, magnesium or cobalt). Integration of leguminous or other protein-rich crops and trees into the system and feeding of protein-rich concentrates with added minerals could contribute a lot to improve animal health and production (Primavesi and Primavesi; Preston; Viengsavanh et al).

In Kenya, Luo farmers had a lack of manure to fertilise their crops. By adopting 'zero grazing' they succeeded in strengthening the livestock component of their integrated crop-livestock system, which then brought the whole system to a higher level of production. However, intensification of indigenous farming systems, e.g. by introduction of zero grazing, has to fit local perceptions, needs and opportunities (Mango p.18).

Another example of a weak link is Newcastle disease in poultry production. Poultry networks are now testing new vaccines for control of Newcastle disease which can be produced locally and can be easily administered (van 't Hooft p.36).

Integrating researchers, policy makers and educators

By following a more holistic, ecological approach many farmers seem to come closer to their own 'gut feeling' of how they should manage their farm, which is also more in line with how their parents thought about it (van Weperen and Kieft, p.24). The problem is, however, to get other players such as researchers, policy makers and educators involved in this approach to form (inter)national networks and local platforms for change. Although, increasingly, these players are aware that there is something wrong with the conventional approach to livestock production, they have to make quite a change in attitude and thinking to take a different stand. For example, animal science as taught in Latin American universities and farming schools is focused on reaching the maximum productivity per animal, limited to the animal species used in industrialised livestock keeping, especially cattle, pigs and chicken. The absence of the essential elements of family-level livestock keeping and the basic principles of integrated, ecological livestock production in the curriculum is reflected in the frequent failures of livestock projects and the negative impact of livestock production on the environment.

Although integrated livestock systems have considerable potential to improve livestock production, the chances of small farmers competing with industrial livestock production will remain weak as long as research, policies and education systems do not change.

■

LETTERS

Dear Editor,

I agree entirely with your overall theme of issue 17.4 that GE is not the only option, but do also believe that your argument has been weakened in some of the articles which you included in that issue.

My fundamental concern is that in an edition dedicated to GM crops and smallholders there is no mention of China. The country claims that by 2010 up to 80% of the national area of cotton, corn, rice, soyabean and wheat will be planted to transgenic material (Chen Z.L. Transgenic Food: Need and Safety. OECD Edinburgh Conference on the Scientific and Health Aspects of GM Food 28th Feb. to 1st. March,2000).

On page 21 you state that "GM cotton is unlikely to have much appeal to small-scale cotton farmers" without providing evidence for the statement which appears to be contrary to the actual facts. Despite problems with seed supply small-scale cotton growers in China have gone to enormous lengths to obtain GM seed travelling hundreds of km. to buy it. The big attraction has been the reduction in the need for pesticide use with a reduction in average expenditure from RMB 1927 per ha. for pesticides on non Bt. Cotton to just over RMB 300 for the GM crop with no significant reduction in yield.

A striking result of this was that in 1999 only 4% of farmers using GM cotton had experienced any symptoms of pesticide poisoning as compared to 33% using conventional cotton. At the same time survey data revealed 23 beneficial insect species on Bt. cotton as compared to 5 on conventional.

The material on pages 6 and 7 also rings a false note. The great majority of the world's small-scale farmers live in Asia with a minority living in Sub-Saharan Africa. It is difficult to see evidence of "colonial land grabs pushing rural food producing societies off the best lands" in China, India, Bangladesh or Vietnam. It is equally difficult to accept that "healthy domestic markets will never emerge" in these countries. Even more surprising is the statement regarding lagging productivity in third world countries when average grain yields in the third world have risen overall from 1.2 to 2.52 tonnes per ha. over the past 25 years and average per capita food consumption has risen by 28% (FAO 2000).

Yours faithfully, **Stephen Carr**, Private Bag 5, Zomba, Malawi.

We agree that the GE experiences in China should have been covered. Unfortunately we were not successful in our search for a suitable contribution. If any one of you have first-hand information, please send it to us.

There is little doubt that there are farmers who have immediate benefits of switching to GE. However, like in all agricultural technologies and approaches it is important to look beyond the single farm and beyond the next harvest when assessing the value of GE. Our goal was to view GE in this broader perspective. It is also important to realise that GE is different from any previous agricultural innovation in that there is no way back when GE crops have been released: most of them have some biological advantages that will ensure the survival of their genes in nature. If problems show up we cannot get rid of the genes just by stopping the release of GE crops. This is particularly worrying in poor countries who do not have sufficient resources to remedy the situation.

We will take note of your comments on general statements (pag 6.7) in future articles.

Dear Editor,

I have something to say about GM crops, "Will GM crops feed the hungry and reduce poverty"? As these crops are created by private companies they are not introduced for reducing poverty or feeding the hungry. The question therefore must be, "Will GM crops bring profit for the companies"?

The problem of hunger is not productivity only, because in our time there are more than enough productive crops, which can feed the world. A fact is that not everybody can buy enough food. This is because some people are unemployed or do not have enough income to buy what is needed properly. GM crops will not help poor people.

Even in Ethiopia which is known as one of the poorest and the most drought affected countries there are always regions, which produce enough crops to feed the whole country. But there are always people who cannot afford to buy these food crops. For example, in 2001 the price of maize in Ethiopia dropped by 2.5 times and in some places by 5 times from the previous years due to mass increase in production. Until recently the government subsidised the price of fertilisers. But thanks to the World Bank and the IMF, the government eliminated subsidies to farmers. So farmers were obliged to sell their animals to pay their debt resulting from the price increase for inputs, even though they had harvested more than in the previous years. This resulted in even more hungry people who could not afford to pay the price of maize.

The introduction of new GM crops of which we do not know the future consequences is very dangerous. The example of Mad Cow Disease (MCD) may illustrate this. It is said that MDC may result from feeding cows meat and fish products. Cows are herbivores but we are trying to make them carnivores, without thoroughly studying the consequences. We change nature and have to pay for our carelessness.

In my opinion the GM crops and abundant use of fertilisers and pesticides are not necessary to feed the world. What is needed is sincerity in our work and ideas. So we have to think twice before we create new organisms on this small planet.

Yours, **Fekade Fullas**, P.O.Box 36, Bodity, Wolaita, Ethiopia

Dear Editor,

Congratulations on your recent special issue on biotechnology and GM crops. It had many very interesting and worthwhile articles that deserved to be widely read and discussed. However, we would like to correct an important misrepresentation. In the article by Mr. Peter Rossett (p.7) there is a photo with the caption: "Will the "super" rice presently being developed by the International Rice Research Institute (IRRI) meet the needs of small farmers?"

For the record, the "super" rice the article refers to is in no way genetically modified or engineered and so should not be included with the article. Known also as the "New Plant Type", this rice germplasm was developed over a 12-year period via traditional breeding methods. It is also incorrect to say it is "presently being developed" as last year it has been completed officially. Those readers who are interested to get the full story behind "super" rice can go to the following Internet address: http://www.irri.org/vis/prl1001.htm or contact my office directly. It should also be noted that the "New Plant Type" is not really a new rice variety as such. Instead, it is an advanced rice germplasm with better disease resistance and higher yield potential among its many improved features. As of last year, IRRI began sharing this germplasm with anyone (farmers, national systems, NGOs) who would like to use it in their traditional breeding programmes. Already, countries like China and India have started to include some of the NPT's improved qualities in its own new rice varieties for farmers.

Yours Sincerely, **Duncan Macintosh**, Spokesman, IRRI, Philippines.
Email: d.macintosh@cgiar.org

The photo and caption referred to in this letter was inserted by ILEIA and not by the author, Mr. Peter Rossett. As such ILEIA takes full responsibility for this error.

Please note that all letters have been edited by ILEIA to accommodate them in the space available.

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Coverphoto
A proud milk buffalo owner in Himachal Pradesh, India. Photo: Wolfgang Bayer

The editors have taken every care to ensure that the contents of this magazine are as accurate as possible. The authors have ultimate responsibility, however, for the content of individual articles.

The editors encourage readers to photocopy and circulate articles. Please acknowledge LEISA Magazine and send us a copy of your publication.

ISSN: 1569-8424

CONTENTS

The authors of this article show how cattle farming in Brazil can be optimised in an ecologically sound way. They argue for management practices that influence the interactions between the different aspects of the production system - climate, soil and soil life, vegetation and cattle. Increasing the water availability for better plant growth, introduction of shade trees for enhancing the micro-climate, grazing rotation instead of burning pastures, integration of leguminous forage plants and elimination of nutrient deficiencies are some of the topics discussed. Towards "green meat" and "green milk" is what, according to the authors, animal production should strive for.

In 1979, the National Dairy Development Project of Kenya introduced a dairy farm concept based on zero grazing, with animals kept in stalls and a cut and carry fodder system. The article describes the main components of this ZG concept and how the Luo people of Siaya district have adapted it to suit their specific conditions. For instance, the Luo farmers do not grow napier grass as recommended by the NDDP as it is labour intensive; they have found a less labour intensive form which is called *tumbukisa*. Luo farmers have also found ways of adapting the feeding regime suggested by NDDP; instead of commercial feed, they have come up with a "home-mix" dairy meal and use brewer's waste as a supplement. For some farmers who aimed at milk production, ZG has become a viable alternative to coffee, sugar and cotton growing. For others, ZG is a way of re-establishing the balance between crop and livestock production.

ILEIA is the Centre for Information on Low External Input and Sustainable Agriculture (LEISA) in the tropics. ILEIA seeks to promote the adoption of LEISA through the LEISA Magazine and other publications. It also maintains a specialised information database and an informative and interactive website on LEISA (**http://www.ileia.org**). The website provides access to many other sources of information on the development of sustainable agriculture.

LEISA is about Low-External-Input and Sustainable Agriculture. It is about the technical and social options open to farmers who seek to improve productivity and income in an ecologically sound way. LEISA is about the optimal use of local resources and natural processes and, if necessary, the safe and efficient use of external inputs. It is about the empowerment of male and female farmers and the communities who seek to build their future on the basis of their own knowledge, skills, values, culture and institutions. LEISA is also about participatory methodologies to strengthen the capacity of farmers and other actors to improve agriculture and adapt it to changing needs and conditions. LEISA seeks to combine indigenous and scientific knowledge, and to influence policy formulation in creating an environment conducive for its further development. LEISA is a concept, an approach and a political message.

24 Dutch dairy farmers find own solutions to their environmental problems

Willem van Weperen en Henk Kieft

Dutch dairy farming in the last fifty years focused on increasing milk production through a variety of interventions that included technology development, effective research-extension-farmer interaction, access to credit, conducive policies etc. However, this development resulted in increased environmental as well as animal health problems. Many animal-related crises in the recent past has raised consumer concern considerably. Ten years ago, two environmental farmer associations in the Friesian province of the Netherlands began experimenting with environmentally-sound farming practices and integrated agriculture. Although these experiments raised suspicion within the authorities, initially, the results are gradually gaining recognition. Now, more than 120 farmers have taken on the initiative and together with researchers they have formed a platform called PMOV to take the initiative further. This experience shows that farmers are able to resolve their own problems and make their farming systems sustainable.

DEAR READERS

The 'Livestock Revolution', intensive industrial livestock production, is spreading fast to the South. In the North, it stands for loss of employment of many small farmers, environmental pollution, epidemic animal diseases (such as BSE and swine-plague), unsafe food and ill-treatment of animals. What alternatives do small farmers have that are competitive enough to keep them in business? In this issue of LEISA Magazine we have brought together a selection of articles which deal with improvement of livestock production by more holistic and ecological management and integration of crops, legumes, grasses, trees and other animal species. These integrated livestock systems seem to be more productive and better for the environment and the animals. But can smallholders and pastoralists really compete within the Livestock Revolution if politics does not make a conscious choice in favour of small farmers, the environment and animal welfare?

This issue has been conceptualised by the ETC livestock working group. Katrien van 't Hooft, a veterinarian with many years of experience with livestock farmers in the Andes (see page 10), who works as editor for the ETC Compas Magazine on endogenous development, was the guest editor for this issue. We are very appreciative of all the work she has put in.

Included with the LEISA Magazine is a special supplement on 'Ecosystem Disruption and Human Health', the result of a collaborative effort between IDRC, UNEP and ILEIA. IDRC holds the main responsibility for the content of this supplement, which is based on a consultation hosted by IDRC and UNEP in November 1999. Human health is an important issue that should become an integrated part of development efforts towards sustainable land use.

For those of you who have access to internet, we would like to mention that ILEIA together with Oxfam and Greenpeace are launching a campaign called *Farmingsolutions* on 8th April. The aim of this campaign is to show how food security can be achieved by innovative, ecologically and socially sound agricultural systems. The campaign is undertaken in preparation for the World Food Summit that is to take place in Rome, Italy, in June this year. The website **www.Farmingsolutions.org** gives easy access to information on world hunger, food production and innovative agro-ecological approaches. More information can be found on page 32.

On the request of many readers we have re-introduced a "letters" section in this issue. So please keep your letters rolling in and we will publish them.

The Editors

april 2002 volume 18 no.1

LEISA

Magazine on Low External Input and Sustainable Agriculture

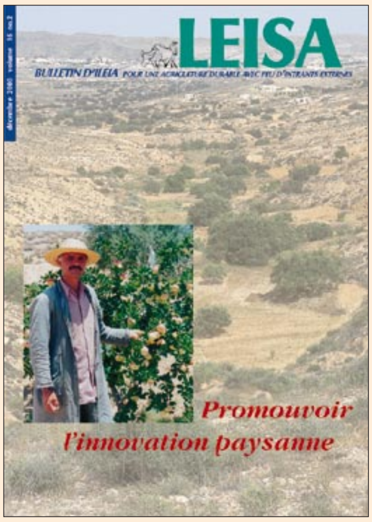
Livestock: which way?

The new ILEIA team

From left to right:
Lila Felipie (Secretary) - The Netherlands, **Ingrid Huibers Govaert** (Librarian) - The Netherlands, **Coen Reijntjes** (Content Editor) - The Netherlands, **Teresa Segura** (Subscriptions Officer) - Spain, **Flemming Nielsen** (Senior Researcher) - Denmark, **Anita Ingevall** (Director) - Sweden, **Chesha Wettasinha** (Intern in Editing) - Sri Lanka, **Wilma Roem** (Documentalist) - The Netherlands, **Bert Lof** (Deputy Director) - The Netherlands, **Marlies Marbus** (Office Manager) - The Netherlands, The inserted photographer is **Wilko Willemsen** (Information officer) - The Netherlands

After quite a while, the ILEIA team is once again at full strength. As you see, we have added some foreign flavour and made it a truly international team. With an abundance of new ideas and skills, we are energised and inspired to reach greater heights in championing the cause of LEISA in the coming years.

We wish you all a very challenging and rewarding year 2001!!



Promouvoir l'innovation paysanne

With financial support from the Technical Centre for Agricultural and Rural Co-operation (CTA) and the Indigenous Soil and Water Conservation Programme (ISWCP) the ILEIA Newsletter Vol.16, No.2 on "Grassroots innovation" has been translated into French. This special publication has been distributed, among others, to the subscribers of the ILEIA Newsletter in the French speaking countries of Africa. ILEIA hopes that this issue will lead to the initiation of a West African regional edition on LEISA at the end of 2001. Like the Latin American and the Indian regional editions, this edition will contain articles and information on LEISA and participatory development from the region itself, as well as a selection from the international ILEIA Newsletter translated into French. A regional editorial committee will be responsible for editing, publication and distribution. Readers interested in receiving the French West African edition, could request ILEIA to be put on the mailing list and receive a free copy of 'Promouvoir l'innovation paysanne'.

Themes for next issues

July 2001 Vol. 17-2
Globalisation challenged

Many farmers in the tropics are negatively affected by globalisation of the world economy and expansion of the consumer culture. To them, this is one step further on the road to economic and cultural marginalisation. In reaction, some farmers, communities and organisations have started to reconstruct traditional 'agri-culture', save indigenous seeds and breeds, or organise water harvesting. Others focus on development of the local agriculture based economy, local products, empowerment of local institutions or alternative education. Still others lobby for access to land, protest against genetically modified organisms or international agreements on intellectual property rights.
For this issue we invite articles on such reactions to globalisation, and on how local communities and farmer organisations can be strengthened to retain the right to their own futures. ***Deadline for contribution 1 March 2001***.

September 2001 Vol. 17-3
Going to scale

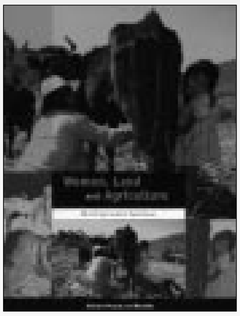
How do the benefits of innovations in agriculture and natural resource management spread to more people? What type of innovations do people prefer - when, where and why? How and when does spontaneous diffusion take place? What conditions can be created and what methodologies can be used to enhance or plan going to scale? What are the obstacles of going to scale, can they be overcome and how? What can we learn from case studies that analyse more or less successful experiences with going to scale? Going to scale has multiple dimensions, methodologies, players and contexts – spatial, temporal, technological, economic, ecological, social, gender, cultural, institutional, empowerment, capacity building, partnerships, communication, negotiation, financial incentives, etc. What role do these dimensions play in going to scale?
This issue will include and build on the results of earlier workshops on this theme. With some extra pages to spare and considering the complexity of the theme, some longer articles (up to 3600 words) may be accepted as well. ***Deadline for summaries of contributions 15 March 2000.***

You are invited to contribute to these issues with articles (about 1800 words + 2 illustrations), suggest possible authors, and send us information about interesting issues, publications, training courses, meetings, websites.

NEW IN PRINT

Small holding up *by Zarb J. 2000. In: The Ecologist, ISSN 0261 3131; v.30 no.9, p.40-44.*
In this article Dr. John Zarb, consultant researcher in sustainable farming, states that modern agriculture is in a crisis and that the alternative is: to move towards sustainable farming, not only in the "South" but also in the "Developed " world. He describes several examples in which the agroecological approach succeeded in developing a sustainable, self-supporting agricultural system using renewable resources. If sustainable technologies have brought significant improvements in agriculture under crippling economic, environmental and political conditions, then application in Europe or US, where structures like transport systems and markets already exist, should be successful. (WR)

Women, land and agriculture *by Sweetman C (ed.). 1999. 72 p. ISBN 0 85598 400 7 : USD 12.95. (Oxfam Focus on Gender). OXFAM Publications, 274 Banbury Road, OX2 7DZ Oxford, UK / bebc@bebc.co.uk.*
This book appears in the series Oxfam Focus on gender. It is composed of nine articles on agriculture, land rights and gender relations in countries in Africa, Asia and South America.

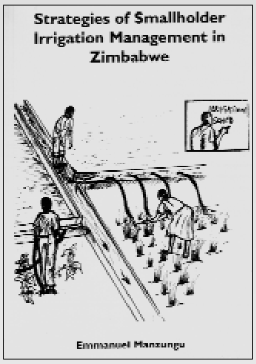


The articles assert that women's contribution to global agricultural production for food and for profit continues to be largely unacknowledged and undervalued, and that their ability to farm is constrained, because the resources they need are often controlled by others. Independent land rights, which enable women to decide on the use of land and keep the proceeds from such use, are still a dream for women in many countries, despite their increasingly central role in agriculture. Two articles shed light on methodological issues for development policy-makers and practitioners. Some tools have been developed to assist the process of integrating gender issues into planning and implementation. (WR)

Social responsibility in the global market : fair trade of cultural products *by Littrell MA and Dickson MA. 1999. 366 p. ISBN 0 7619 1464 1 (pbk) : GBP 18.99. Sage Publications, 6 Bonhill Street, London EC2A 4PU, UK / orders@sagepub.co.uk / www.sagepub.co.uk.*
This book is about fair trade from the angle of all the stakeholders: the producers or artisans, the alternative trade organisations and the consumers. Their needs, interests and preferences and business practices within the trade system are studied. There is a special focus on fair trade organisations that market cultural products from developing countries into the United States, but the themes covered (e.g. artisan empowerment and organisational sustainability) are of general interest. (IHG)

Policies for soil fertility management in Africa *by Scoones I and Toulmin C. 1999. 128 p. ISBN 1 899825 41 X. International Institute for Environment and Development (IIED), Drylands Programme, 3 Endsleigh Street, London WC1H 0DD, UK; Institute of Development Studies (IDS), University of Sussex, Falmer, Brighton BN1 9RE, UK.*
Fifteen case studies from 12 African countries (south of the Sahara) have been carefully analysed to: a) identify the key factors to explain patterns in soil management, b) give criteria for the need for public intervention and c) assess the options available for the determination of the intervention strategy. The conclusion presented is a very complex and diverse picture, which is in contrast to the generalisations often made in the international debate regarding the crisis in African agriculture. Recommendations are made to test ways to work with farmers more effectively, to promote a greater stakeholder involvement in discussions of policy options and the design of interventions aimed at generating a more sustainable agricultural sector. A thorough study that will take an important place in the African soil fertility management debate. (IHG)

Strategies of smallholder irrigation management in Zimbabwe *by Manzungu E. 1999. 200 p. ISBN 90 5808 145 1. Emmanuel Manzungu, 1606 Marapa Road, New Houghton Park, Harare, Zimbabwe.*
Emmanuel Manzungu presents a detailed study on operational irrigation management in Zimbabwe in accordance with his thesis in Wageningen University. This study seeks to understand the implied management problem in both government and farmer-managed smallholder irrigation schemes. Empirical evidence was gathered with respect to Mutambara,



Chibuwe and Fuve Panganai irrigation schemes, between 1994 and 1996 and included at least two wet and dry seasons. His major conclusions are that the state tended to administer rather than manage irrigation schemes. In contrast farmers easily engaged with operational aspects of irrigation management. Farmers, however, had their shortcomings in relation to extra-local factors. Emmanuel states: the beginning of management wisdom is the awareness that there is no one optimum management system. (WR)

Moving methodologies : learning about integrated soil fertility management in sub-saharan Africa *by Defoer T. 2000. 189 p. ISBN 90 58082 319 5. Royal Tropical Institute (KIT), PO Box 95001, 1090 HA Amsterdam, The Netherlands / kitpress@kit.nl, www.kit.nl/books.*
Toon Defoer, the first editor of "Managing soil fertility: a resource guide for participatory learning and action research, has written this book in accordance with his thesis in Wageningen University. The resource guide, volume 1 of the thesis has been reviewed already in ILEIA Newsletter 16(1) p.25. It provides user-friendly ways to gather, manage and analyse information, using participatory learning and action research. Moving methodologies is volume 2 of the thesis and describes the development of the participatory learning approach through the analysis of 3 case studies. Factors are analysed that have given direction to the adaptations and site specific configuration of the approach and applicable field tools. Two complementary interfaces are taken into account: the field teams interacting with farmers and the field teams as part of wider institutional settings. The book also deals with the impact of participatory action research in terms of changes in farmer learning, knowledge and innovation. The thesis concludes with discussing the major learning points in facilitating farmer learning and analysis of the major implications and issues in extending the approach. (WR)

How to convert sea water into drinking water : an easy-to-use manual *by Ryan F. 1998. 43 p. ISBN 81 87380 07 1 : USD 5.00. Books for Change, 28 Castle Street, Bangalore 560 025, India.*
This booklet is a handy guide for grassroot workers, trainers and the urban or rural poor to make healthy drinking water available in every home with little effort and almost no investment. Fourteen simple methods are explained with drawings and a clear description. Most methods described require only household utensils like pots, vessels and plastic sheets, and can be used for sea and brackish water, but also for tap water below the quality standard for human consumption. (WR)

Comics with and attitude... : a guide to the use of comics in development *by Packalén L and Odoi F. 1999. 96 p. ISBN 951 724 271 9. Ministry for Foreign Affairs of Finland, Department for International Development Cooperation, Kanavakatu 4-A, FIN-00160 Helsinki, Finland / kyoinfo@formin.fi.*
This book is meant as a source of inspiration for people searching for new cost-effective ideas to get the (development-related) message across. Comics draw the reader's attention, as they are a quick and easy way to tell a story in a

humorous or dramatic way. The author emphasises that comics should be simple, have a good story behind it and that the target group should be clear. Often, when local artists are involved the stories become more meaningful, and this book is full of such examples, ranging from campaign material on health, agriculture and environment to human rights, democracy and civil society. One chapter shows the complete procedure of making a comic with an attitude, of course in the form of a comic! At the end of the book references are given to more books and internet sites on comics. This book itself has an internet version on the internet site of the Department of International Development Cooperation of the Ministry of Foreign Affairs of Finland. (IHG)

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Green beginning : joint forest management in Jhabua. *2000. 185 p. ISBN 81 85419 67 1. Tata Energy Research Institute (TERI), Darbari Seth Block, Habitat Place, Lodhi road, New Delhi - 110 003, India / mailbox@teri.res.in , www.teriin.org; SIDA.*
This book tells the rather successful story of the Jhabua forestry department in restoring land use possibilities in the Jhabua district in the state of Madhya Pradesh, India, with the use of a participatory approach: joint forest management and watershed programmes. The Jhabua district was suffering under frequent droughts and poor productivity of natural resources. The joint forest management program attempted to stop forest destruction, but also aimed at poverty eradication and generating employment to reduce pressure on natural resources. The history of the district and the whole process of implementing the programme is described in the book. Attention is paid to the role of women's self-help groups. What is achieved in Jhabua, so far, is that the district is green again and that the peoples income is raised. (WR)

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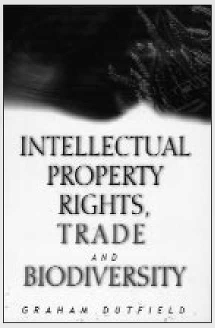
Intellectual property rights, trade and biodiversity : seeds and plant varieties *by Dutfield G. 2000. 238 p. ISBN 1 85383 692 3 : GBP 35.00. The IUCN Project on the Convention on Biological Diversity and the International Trade Regime, International Union for Conservation of Nature and Natural Resources (IUCN). Earthscan Publication, 120 Pentonville Road, London N1 9JN, UK / orders@lbsltd.co.uk.*
Patents and intellectual property rights in relation to the biological diversity of seeds and plant varieties are critical issues in the controversy between interests of trade and environment. The book deals with this controversy, looking at all its different aspects and from all angles. International agreements such as the Convention on Biological Diversity, the TRIPS agreement of the World Trade Organisation, and the Convention of the International Union for the Protection of New Varieties of Plants (UPOV) are examined and ways of narrowing the gap between their interpretations are considered. Examples of genetic resource access and benefit sharing (ABS) laws, which



are being used by some countries to place conditions on the exercise of intellectual property rights are given, as well as examples of NGO initiatives to influence the international agreements. A very important book, balanced in its opinion and providing a complete update on the complex subject matter, including a very well annotated bibliography. (IHG)

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Participatory forest management : implications for policy and human resources' development in the Hindu Kush-Himalayas. Volume I: workshop proceedings *by Bhatia A and Karki S (eds). 1999. 83 p. Volume II: China by Bhatia A and Ya T (eds). 1999. 65 p. Volume V: Nepal by Bhatia A (ed.). 1999. 41 p. ISBN 92 9115 970 0. International Centre for Integrated Mountain Development (ICIMOD), 4/80 Jawalakhel, GPO Box 3226, Kathmandu, Nepal / distri@icimod.org.np.*
These publications together are the proceedings of the regional workshop on Participatory Forest Management: Implications for Policy and Human Resources Development, held in May 1998, Kunming, China. The workshop brought together forest management personnel from various parts of the Hindu Kush-Himalayas. The basis of their discussions was the people-centered forest policies that have emerged in many countries of the region and their objectives of supporting and strengthening participatory forest management to ensure that the needs of mountain people receive the priority they deserve. Volume 1 is the workshop document, which gives an overview of the workshop and the participants. Volume 2 deals with China and concerns forest policies in China in general, and participatory forest management especially in Yunnan Province and in Tibet. Volume 5 deals with Nepal and describes the role of forests in the livelihood strategies of mountain people and the status of community forestry in Nepal. Volume 3 Eastern Himalayas, Volume 4 India and Volume 6 Pakistan complete the series. (WR)

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Manual on contour hedgerow inter-cropping technology *by Ya T ; Pandey A (ed.). 1999. 29 p. International Centre for Integrated Mountain Development (ICIMOD), G.P.O. 3226, Kathmandu, Nepal / distri@icimod.org.np / www.icimod.org.sg.*
This easy to use manual on hedgerow intercropping explains the benefits of the system for the land and the farmer in an illustrative way. The technology for hedgerow planting and management is explained clearly and illustratively. Recommended for trainers, extension workers and farmers in mountain areas. The contour hedgerow intercropping technology is a soil-conserving technique. It involves planting double hedgerows of nitrogen-fixing plants along the contour lines of a slope at a distance of four to six meters. Space between the contour hedgerows is used for crops. The plants for the hedgerows are selected according to the needs for fuel or fodder, and also for their soil-conserving attributes. (WR)

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The participatory learning and action CD-ROM *is a new product from the Resource Centre for Participatory Learning and Action at IIED, the International Institute for Environment and Development, 3 Endsleigh Street, London WC1H 0DD, UK e.mail claudia.sambo@iied.org*
This new CD-ROM contains a database of 2000 bibliographic references on participatory methodologies and approaches, including a whole index of PLA Notes with abstracts.

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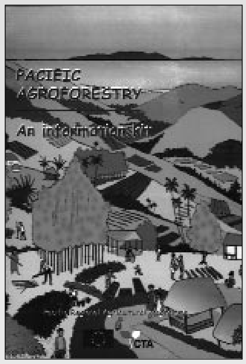
Pacific agroforestry : an information kit *by Rogers S and Thorpe P (eds). 1999. 200 p. ISBN 982 343 038 1 : 40 credit points / CTA no.975. Pacific Regional Agricultural Programme (PRAP), Suva, Fiji Islands. Technical Centre for Agricultural and Rural Co-operation (CTA), PO Box 380, 6700 AJ Wageningen, The Netherlands.*
This information kit is the result of a workshop with agriculturalists from the different South Pacific Islands, for compiling their knowledge on agroforestry. As a farming system, the use of trees in farming has not been emphasised in this region until recently, although there is a great need for sustainable forms of agriculture in these fragile island ecosystems. The kit



proves that both indigenous and technical knowledge is (still) available, and that it is very timely for these agroforestry practices to be spread among a larger circle of extensionists. This glossy manual has a beautiful lay-out with a lot of instructive drawings and pictures. Technical information is interspersed with case studies, and the last chapter deals with ways to successfully promote agroforestry within the communities. (IHG)

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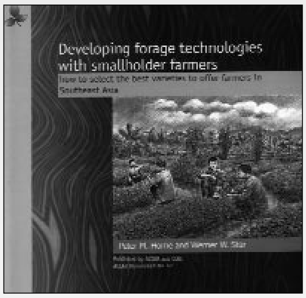
Capitalising on experience in Indo-Swiss cooperation in livestock development in India. *Capitalisation of Experiences in Livestock Production and Dairying (LPD) in India project (CAPEX), Intercooperation, PO Box 6724, CH-3001 Berne, Switzerland / intercooperation@intercoop.ch; Swiss Agency for Development and Cooperation (SDC)/IC NRM Programme, Chandragupta Marg, Chanakyapuri, New Delhi 110021, India. 2000. 50 p. free.*
This booklet presents the main findings of the project CAPEX, Capitalisation of Experiences in Livestock Production and Dairying (LPD) in India. The task of this project was to review the experiences of the Indo-Swiss Programme LPD in India, since its inception in 1963 to date, and to formulate future priorities based on its findings. LPD involved 8 projects spread throughout India and included support to developing a national livestock policy. From this wealth of experiences gained after such a lengthy and large programme, the CAPEX-team chose 2 topics to focus

on: 1) the evolution of a comprehensive LPD programme out of single projects and 2) selected technical issues in livestock breeding. The project is a nice example of the value of reflecting on experiences! This booklet is a summary of a full version, also available at Intercooperation, as technical report no. 15. (IHG)

Developing forage technologies with smallholder farmers : how to select the best varieties to offer farmers in southeast Asia *by Horne P and Stuer W. 1999. 80 p. ISBN 1 86320 271 4. Australian Centre for International Agricultural Research (ACIAR), GPO Box 1571, Canberra, ACT 2601, Australia / aciar@aciar.gov.au; Australian Agency for International Development (AusAID); CIAT Forages for Smallholders Project. (ACIAR Monograph ; 62).*
This booklet is based on the experiences of researchers and farmers working with the Forages for Smallholders Project in Southeast Asia.



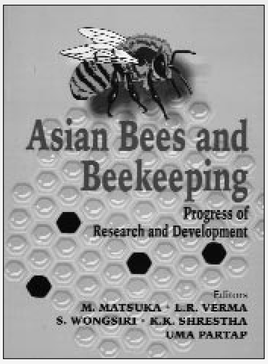
The manual can be useful for development workers in selecting appropriate forage options for farmers. It contains a list of forage species and varieties that grow in a wide range of conditions, and are either being used successfully by smallholder farmers or have significant potential in Southeast Asia. On many farms, feed resources for livestock are no longer plentiful, so farmers have to spend more time finding food for their animals. Planting forages can help to overcome this problem. (WR)

Natural crop protection in the tropics : letting information come to life *by Stoll G (ed.). 2000. 376 p. ISBN 3 8236 1317 0 : EUR 55.-. Tropical Agroecology Series. Margraf Verlag, PO Box 105, 97985 Weikersheim, Germany.*
This completely revised, enlarged and updated new edition of one of our most consulted books has been recently published. The first edition of Natural Crop Protection was published in 1986; though there were several updates, this revised edition is very welcome. The book presents practical information on natural crop protection techniques, already presented in former editions, combined with a number of case studies. By presenting both technical information and case studies on farmer participatory research, the book links information on natural crop protection with approaches and methodologies. Valuable suggestions are made for research to further improve engagement in developing natural crop protection practices for resource-poor and organic farmers. (WR)

The emerging alternative rice marketing system: selling high volume excellent quality rice : a preliminary study of an emerging alternative rice marketing system in Manila and Luzon provinces *by Miclat-Teves AG (ed). 1999. 100 p. Project development Institute, 3-B Mayumi St., U.P. Village, Diliman, Quezon City, Philippines; Center for Research and Information on Low External Input and Sustainable Agriculture (ILEIA).*
This study on alternative rice marketing has been prepared for the ILEIA Collaborative research program in the Philippines. Although it focuses on Luzon, its conclusions and recommendations are important for the development of alternative rice production and marketing in the whole country. Marketing of rice produced by small farmers' organizations, based on the principle of "fair trading" is studied. The low volume of the commodity is compensated by its high quality, and the marketing activity seeks to promote sustainable agriculture as well as to provide higher incomes for farmers. This alternative rice marketing system in which NGO's play an important role is compared to the mainstream rice marketing system. The book ends with a summary of problems, potentials and recommendations. (WR)

Agricultural Information Resource Centers - A World Directory 2000 *Edited by Johnson J.S., Fisher R.C. and Robertson C.B., 2000.752p. ISBN 0 9624052 2 1:US$105.00. IAALD World Directory, The Samuel Roberts Noble Foundation, 2510 Sam Noble Parkway, Ardmore, Oklahoma 73401, USA. pbrennen@noble.org*
Updated over the past five years, this third edition of the directory provides the most complete, up-to-date, single source of access to the world's agricultural information centres. Contains 3,940 entries from 189 countries, including contact details. The information is organised alphabetically first by country, then by city and parent institution. The key to acronyms and abbreviations that appear in the directory for databases, database vendors, institutions, institutions, and networks is an extremely valuable tool.

Asian bees and beekeeping : progress of research and development : proceedings of Fourth Asian Apicultural Association International Conference, Kathmandu, March 23-28, 1998 *by Matsuka M ... [et al.]. 2000. 274 p. ISBN 1 57808 084 3. International Centre for Integrated Mountain Development (ICIMOD), G.P.O. 3226, Kathmandu, Nepal / distri@icimod.org.np / www.icimod.org.sg . Science Publishers, PO Box 699, Enfield, N.H. 03748, USA / sales@scipub.net, www.scipub.net.*
This publication is an outcome of the knowledge and information shared during the conference and related workshops in Kathmandu, organised by the Asian Apicultural Association (AAA). The book presents an overview



of indigenous bees and beekeeping research and development in Asia, and highlights the issues related to conservation and management of the Asian hive bee, *Apis cerana*. In part one the authors advocate the need to conserve *Apis cerana* and suggest strategies for conservation of this indigenous bee species in the hindu Kush-Himalayan region. Part two explains new frontiers of bee biology research, especially of *Apis cerana* compared to the introduced species *Apis mellifera* (honey bee). There is a part on recent findings in bee diseases and pest control and on innovations in apiary management. A section on production, processing, properties, and marketing of different bee products- is also provided. In addition, new advances in crop pollination research through beekeeping and experiences in extension covering topics ranging from beekeeping needs and extension methodology in hills and mountain areas to the role of various institutions in promoting sustainable beekeeping are given in detail. The last part of the book provides information on traditional beekeeping methods and indigenous knowledge of beekeeping, and potential of beekeeping as a self-employment opportunity for women in hilly and mountain areas. (WR)

Roots and tubers for the 21st century : trends, projections, and policy options *by Scott GJ, Rosegrant MW and Ringler C. 2000. 64 p. ISBN 0 89629 635 0. The 2020 Vision, International Food Policy Research Institute (IFPRI), 2033 K Street, N.W., Washington, DC 20006-1002, USA / ifpri-info@cgiar.org; Centro Internacional de la Papa (CIP), Apartado 1558, Lima 12, Peru. (Food, Agriculture and the Environment Discussion paper ; 31). To order via internet or to download the complete paper, go to: http://www.cgiar.org/ifpri/pubs/catalog.htm#dp.*
This paper gives an overview of the most recent data and information on potato, sweet potato, yam and cassava and gives trends and projections towards the future per region. Research activities and organizations are also provided, with the objective of providing a vision for research on roots and tubers in the CGIAR. This publication provides a clear insight of the importance of roots and tubers in the food systems of developing countries nowadays, the role of which will remain important, and diversify increasingly in the future. (IHG)

Profit for the poor: cases in microfinance *by Harper M. 1998. 188 p. ISBN 1 85339 438 6 : GBP 12.95. Intermediate Technology Publications, 103-105 Southampton Row, London WC1B 4HH, UK.*
This book shows that there are many different ways of banking possible, which are rooted in the traditional methods of money-lending, local saving and credit groups. Fifteen case studies are presented, varying from well-known cases to more obscure ones, but they are all successful. Although sympathetic and accessible, the tone in the book is unmistakably that of a banking viewpoint. This does not have to be a disadvantage, as is said in the introduction: "micro-finance can offer a unique opportunity to combine genuine humanitarian aid for the poorest with good opportunities for trade and investment". (IHG)

The Center for Agroecology and Sustainable Food Systems of the University of California in Santa Cruz, USA. Its website www.agroecology.org is an information resource for developing sustainable ecosystems, emphasising international training, research and application of agroecological science to solving real world problems. The site provides information on related short courses and international events. An interesting series of practical case studies and a glossary of agroecological terms help understand the principles of agroecology as also explained in the textbook Agroecology: Ecological processes in sustainable agriculture by SR Gliessman (see next page). Very handy is the page on Agroecology Links www.agroecology.org/links.htm which makes it possible to make direct links to the main university, farmers and general sites on agroecology in USA.

Agroecology in action is the website www.cnr.berkeley.edu/~agroeco3/ of University of California in Berkeley, USA. This site gives access to the latest articles by Professor Miguel A.Alteiri and colleagues, among others, on agroecology and modern agriculture; agroecology and small farmers in the developing world; agroecology and biotechnology; agroecology and pest management (see next page). There is also a video on agroecology and biotechnology.

The International Maize and Wheat Improvement Center's website www.cimmyt.mx is quite elaborate and provides information on its worldwide programmes, contacts and publications. Information on the various resource conserving technologies that CIMMYT is developing together with wheat and maize farmers can be found on the site. CIMMYT's Natural Resources Group collaborates with national researchers, farmers and non-governmental staff in increasing and sustaining the productivity of maize and wheat systems while protecting resources. Some of this work is well described on the website.

Global Programme on Direct sowing, Mulch-based systems and Conservation tillage (GP-DMC) has been launched during the Global Forum on Agricultural Research, May 2000. In many countries DMC practices have fostered higher productivity, improved resource conservation, lowered food costs for consumers, and improved incomes for producers. The global-partnerships programme features a bottom-up process of learning and synthesis by analysing and comparing experiences with DMC in different regions. A facilitation unit is to be created. Stakeholders with relevant practical experiences are requested to join the open action group.

Further information: Larry Harrington, chair of the Interim Steering Committee, CIMMYT, Apdo. Postal 6-641, 06600 Mexico, D.F., Mexico. Fax: +52 5804 7558; l.harrington@cgiar.org

African Conservation Tillage Network launched

The purpose of the network (ACT) is to identify, disseminate and promote the adaptation and adoption of soil and water preserving tillage in Africa. The Network intends to create national networks for the exchange of information and experiences among researchers, extensionists and practitioners and to encourage farmers to experiment with the approach. A monthly, down loadable newsletter, Act Now, and training materials will be produced and pilot projects will be initiated to test and compare technologies. There will be an E-conference as well.

For more information: Edward Chuma, ACT Secretariat, IES/University of Zimbabwe, P.O. Box MP 167, Harare, Zimbabwe, Tel: +263-4-302603, Fax: +263-4-263433, Email: chuma@africaonline.co.zw and actnownews@africa.com

International Course on Integrated Pest Management will be conducted by The International Agricultural Centre from March to June 2001. The course deals with the effective implementation of IPM programmes, looking at technical as well as socio-economic aspects. It consists of 6 main modules: introduction; plant protection disciplines; development of IPM; pesticide management; IPM research, extension and implementation and IPM project proposal development.

More information and applications can be obtained from the IPM Course coordinator, International Agricultural Centre, P.O.Box 88, 6700 AB Wageningen, The Netherlands
Phone: (31)(0)317-495495
Fax: (31)(0)317-418552
e-mail: training@iac.agro.nl
website: www.iac-agro-nl

21st training in interdisciplinary team research for agricultural development will be organised by ICRA, International Centre for development oriented Research in Agriculture in 2002. It is a professional experiential learning programme in which participating researchers enhance their capacity to develop research proposals that meet the needs of clients and beneficiaries and contribute to sustainable development. Through workshops in the Netherlands and professional field work for a client agricultural research institute in the South, participants enhance their capacity to work in interdisciplinary teams, to use systems approaches for the analysis of agricultural change and to involve stakeholders in the planning and implementation of research. Course dates: January 17 – July 25, 2002 (English) and January 21- August 1, 2002 (French). Applications close 1 October 2001. Fellowships available.

Details and application forms: ICRA, P.O.Box 88, 6700 AB Wageningen, The Netherlands.
Phone: (31)(0)317-422938
Fax: (31)(0)317-427046
e-mail: icra@iac.agro.nl
internet: http://icra.agropolis.fr

AREOL 13 - action research and evaluation on line is a free on-line course offered as a public service by the Southern Cross University, Australia. Beginning late February 2001, the course will run over 4 months on the theme, "Integration of effective change with rigorous research". The course will allow participants to understand some processes that combine action research, and can be used in practice. The course, however, does not attempt to cover all types of action research, nor does it analyse its philosophy.

More details and course materials can be found on www.scu.edu.au/schools/gcm/ar/areol

Centre for Alternative Agricultural Media, CAAM has been launched on 3 December 2000 in Dharwad, Karnataka, India. The first of its kind in the country, the centre's focus is on farmer friendly communication systems. Promoting alternative efforts in agricultural communication, encouraging self-help journalism among farmers, bridging the communication gap between farmers and scientists/ government, focusing on farmer innovations and pro-farmer issues feature among the centre's many objectives. Its website www.farmedia.org will focus on several aspects of alternative agricultural media. Regular e-bulletins will be released for networking with like minded individuals/ organizations engaged in innovative alternative efforts in the farm journalism sector.

For more information contact: Dr. Shivaram Pailoor, Director CAAM, Krishnalaya, 1st main, 4th cross, Narayanapur, Dharwad 580008, Karnataka, India. E-mail: caam@vsnl.net

International Society for Nature Farming (ISNF)

This society has as objective to promote teaching, research and extension activities of nature / organic farming. It creates awareness about the role of nature farming in sustainable and eco-friendly agriculture and encourages the adoption of the concepts. It also provides a forum for exchange of experiences and information and publishes two Newsletters: Prakritik Kheti (in Hindi) and Nature Farming (in English). The Society will shortly launch the 'Journal of Agriculture and Environment' and is organising, in collaboration with the Haryana Agricultural University, the International Conference on Nature Farming and Ecological Balance (ICN-FEB-2000), March 7-10, 2001 at Hisar, Haryana, India. At the same time there will be an electronic conference on the same themes:
Food production, quality and marketing; Land use planning and resource management; Organic farming systems and ecology; Indigenous knowledge and nature farming; Biodiversity and rural development; Government policies and extension programmes.

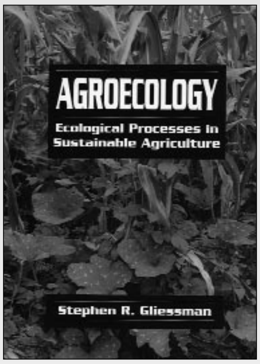
More information: ISNF, c/o Dr. IS Hooda, Dep. of Agronomy, CCS Haryana Agricultural University, Hisar – 125004, Haryana, India, icnfeb@hau.hry.nic.in
or www.geocities.com/icnfeb2001

Integrating Sustainability in Higher Agricultural Education. AFANet has developed a key activity to conceptualise sustainability in agriculture and to integrate it in the curricula of higher education in agriculture, forestry, aquaculture and the environment. AFANet, an EU SOCRATES Thematic Network, aims to stimulate co-operation in universities and colleges in Europe. The recently published book **Integrating concepts of sustainability into education for agriculture and rural development** edited by Bor, Holen, Wals and Filho, 2000, Frankfurt/M, Peter Lang Publishers (see ILEIA Newsletter Vol.16, No.3, p. 34), was the first main outcome of this AFANet activity. Part one of the book attempts to conceptualise the issues surrounding sustainability in higher agricultural education whilst part two provides case study examples from around the globe of the integration of the concept of sustainability into curricula. As a follow-up to the book, two dissemination activities were developed: an on-line discussion about the main outcomes of the book and an international seminar which focused on both the book and the results of the on-line discussion. The international seminar took place recently in Krakow, Poland, as part of the Euro-Eco 2000 conferences and was attended by university faculty members from 12 countries.
It was reconfirmed during the on-line debate and the Krakow seminar that the concept of sustainability is ill-defined. It should be realised, however, that this vagueness has an enormous strength if it is systematically used as an operational device to exchange views and ideas, and to make sustainability meaningful within a specific context.
Colleges and universities in the tropics could join this debate or start their own.

For more information: http://www.clues.abdn.ac.uk:8080/demeter/
The on-line debate can be visited on: http://www.lei.wag-ur.nl/sustainability/

IF YOU WANT TO KNOW MORE

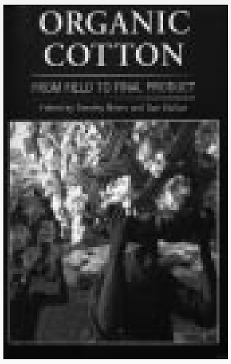
Agroecology : ecological processes in sustainable agriculture
by Gliessman SR. 1997. 357 p. ISBN 1 57504 043 3 : USD 49.95. Ann Arbor Press, 121 South Main Street, Chelsea, MI 48118, USA.
This basic textbook on agroecology is on the interaction of agriculture and ecology, purposes to promote a sustainable way of agriculture. It is divided into four sections. First it describes the concept of agroecosystems and why it is an answer to the failures of convential agriculture. Then subject-wise that



agriculture should be broadened to include the whole food system. This book is written in the first place for students, but offers everybody interested in agroecology a very complete picture in an attractive manner. Every chapter concludes with a list of recommended reading. By the many case studies it appears to be creative in a farmer's search for solutions. (IHG)

Agroecology : researching the ecological basis for sustainable agriculture *by Gliessman SR (ed.). 1990. 380 p. ISBN 0 387 97028 2. Sustainable Agriculture Information Project, Agroecology Program, University of California, Santa Cruz, Cal 95064, USA. (Ecological studies ; 78).*
This is an important overview of recent agroecological research in both the North and the South. Part 1 deals with basic ecological concepts in agroecosystems: Part 2 with agroecosystem design and management. The contributors (34 in all) are agronomists and ecologists who have begun to bring their respective strengths and approaches together to address the serious problems that test the world's ability to sustain its food production systems. Topics include research methodology, theoretical aspects of crop diversification and biological control, low-input ideotypes, analysis of traditional farming systems, and theoretical explorations of variability, stability and risks. Practical cases are reported from Mexico, India, Netherlands, USA, China and Thailand.
The book is presented just as a beginning. Agroecology is a field in its formative stages: it is more than ecology applied to agriculture, since it takes on a cultural perspective as it expands to include humans and their impact on farming environments. The book concludes by stating that it is one thing to express the need for sustainability and yet another actually to quantify issues such as nutrient cycling, energy flow, and population dynamics. There is a long way to go, and this book gives a challenging contribution along the way.

Organic cotton : from field to final product *by Myers D, Stolton S (eds). 1999. 267 p. ISBN 1 85339 464 5 : GBP 16.50. The Pesticides Trust, Eurolink Centre, 49 Effra Road, London SW2 1BZ, UK. Intermediate Technology Publications (ITP), 103-105 Southampton Row, London WC1B 4HH, UK.*
As cotton is one of the world's major cash crops, many farmers are confronted with the negative environmental impacts of its production such as reduced soil fertility, loss of biodiversity and especially the problems related to pests and pesticide use. Also further in



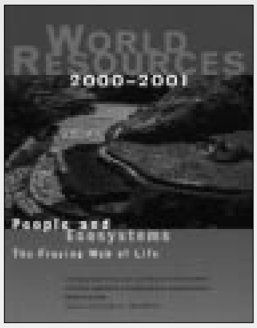
the processing chain pollution takes place, especially by bleaching and dyeing the cotton fabrics. This book describes organic cotton production and processing and is the first complete overview of its kind, since the first organic cotton was marketed some 10 years ago.
Still in a rather preliminary stage, there are signs that it is moving into a mass market. The book provides a very good and complete picture of the insights gained till now, and case studies from all over the world are compiled. Besides cultivation (including the growing of genetically engineered cotton) and processing, attention is paid to economic and marketing aspects, the conversion process, certification and support requirements for projects. Judging from the questions about environmentally friendly grown and -processed cotton that reached ILEIA in recent years, we predict this book will become a bestseller. (IHG)

Alternatives to conventional modern agriculture for meeting world needs in the next century. Report of a conference on Sustainable agriculture: evaluation of new paradigms and old practices, April 26-30, 1999, Bellagio, Italy. *Copies can be obtained from Cornell International Institute for Food, Agriculture and Development, Ithaca, NY 14853, fax: +1 607 255-1005, ciifad@cornell.edu. The full report can be down loaded from http://ciifad.cornell.edu/ciifad .*

The potential of agroecology to combat hunger in the developing world *by Miguel A. Altieri, Peter Rosset and Lori Ann Trupp. Available on: www.cnr.berkeley.edu/~agroeco3/*
The authors state that evidence suggests that the Green Revolution approach is unlikely to be the appropriate strategy to end hunger and that the agroecological approach offers several advantages. The principles of agroecology are explained and several examples from different parts of the tropics are given. Thousands of farmers are following the agroecological approach, thus showing its potential. The authors point at the necessity to increase investment and research into this strategy and to scale-up successful practices. (CR)

IRRI 1998-1999. *2000. International Rice Research Institute, MCPOBox 3127, 1271 Makati City, Philippines, irri@cgiar.org*

World Resources 2000-2001 People and Ecosystems: the Fraying Web of Life
World Resources Institute in collaboration with the United Nations Development Programme, The United Nations Environment Programme and the World Bank,2000. Paperback version 400p.ISBN 1 56973 443 7: US$27.00. World Resources Institute, 10G Street NE, Washington DC 20002, USA.
This millennial edition of the World Resources takes stock of the condition of the Earth's ecosystem and draws lessons from global experience in managing and protecting them. It focuses on five critical ecosystems that have been shaped by the interaction of physical environment, biological conditions and human intervention: croplands, forests, coastal zones, freshwater systems, and grasslands. Three steps to good management of ecosystems are proposed in the report. The first is to acknowledge the value of goods and services provided by these ecosystems and the tradeoffs that are often made among them. The second is to base decisions on current information about the capacity of ecosystems to continue



to provide goods and services. The final step is an "ecosystem approach" that explicitly recognises the interaction and tradeoffs among these goods and services, as well as the political and social context in which environmental decisions are made. Like the previous eight editions, this edition also presents an overview of current global environmental trends in population, human well being, food and water security, consumption and waste, energy use, and climate change.

Modern agriculture: ecological impacts and the possibilities for truly sustainable farming *by Miguel A. Altieri, Division of Insect Biology, University of California, Berkeley, USA. Available on: www.cnr.berkeley.edu/~agroeco3/*
The article discusses the development and impact of monocultures and the ecological problems they are creating. The author identifies an array of alternatives to conventional agriculture and discusses barriers for the implementation of alternatives. (CR)

Evaluating the sustainability of integrated peasantry systems
The MESMIS Framework

Santiago López-Ridaura, Omar Masera and Marta Astier

How can the sustainability of an agroecosystem be evaluated? How does a given strategy impact on the overall sustainability of the natural resource management system (NRMS)? What is the appropriate approach to explore its economic, environmental and social dimensions? These are unavoidable questions faced by any project dealing with complex agroecosystems. In Mexico, a number of development institutions, working on alternative agroecological strategies in a wide range of eco-zones, have joined forces to develop a Framework for Sustainability Assessment, the MESMIS framework.

The MESMIS project is an interdisciplinary and multi-institutional effort led by GIRA, the Interdisciplinary Group for Appropriate Rural Technology, a local NGO based in Western Mexico. The project originated in 1994 with the objectives of: a) developing an evaluation framework to assess the sustainability of alternative natural resource management systems; b) applying the framework to different case studies; c) training of individuals and institutions interested in the topic; and d) generating and disseminating materials to facilitate the application of the framework. Box 1 gives an example of how the Sustainability Assessment was put into practice by GIRA in the State of Michoacan, Mexico.

Sustainability evaluation

Most conventional evaluation approaches (e.g. cost-benefit analysis) are not always appropriate for addressing the challenges of analysing complex agroecosystems. A qualitatively distinct conceptual and practical approach is required. The MESMIS evaluation framework is such an attempt. It is a methodological tool to evaluate the sustainability of natural resource management systems, with an emphasis on small farmers and their local context (Masera *et al* 1999).

The framework is applicable within the following parameters:

1. Sustainability of NRM systems is defined by seven general attributes: productivity, stability, reliability, resilience, adaptability, equity and self-reliance.
2. The assessment is only valid for a management system in a given geographical location, spatial scale (eg. parcel, production unit, community etc.) and determined time period.
3. It is a participatory process requiring an interdisciplinary evaluation team. The evaluation team usually includes outsiders and local participants.
4. Sustainability is not measured *per se*, but is done through the comparison of two or more systems. The comparison is made either cross-sectionally (eg. comparing an alternative and a reference system at the same time), or longitudinally (e.g. by analysing the evolution of a system over time).

Figure 1. General Structure of the MESMIS. From Attributes to Indicators

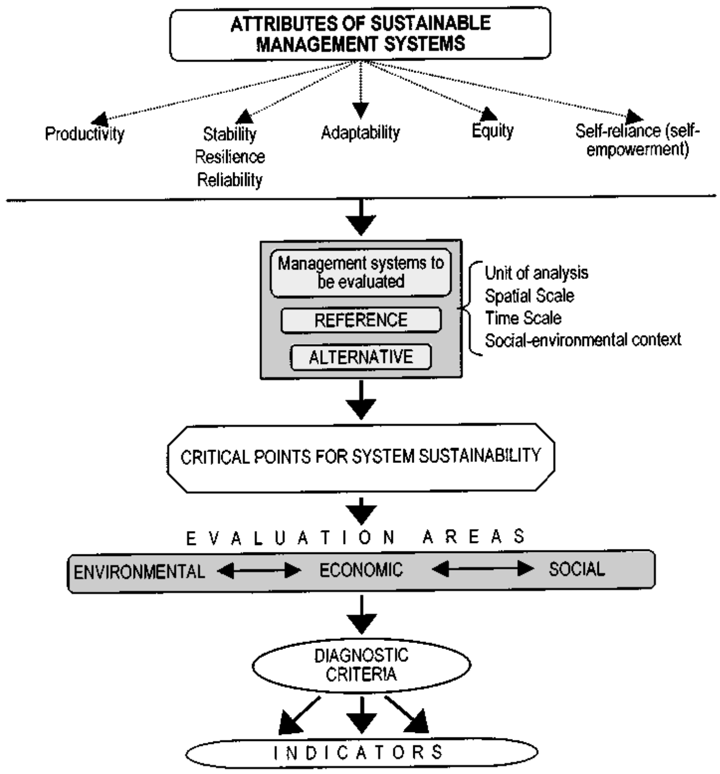


Figure 1 indicates the general structure of the framework. On the basis of the 7 attributes, a number of *critical points* for the sustainability of the system are identified, which are then related to three *areas of evaluation* (environmental, social and economic). In addition, for each evaluation area, diagnostic criteria and indicators are defined. This procedure guarantees a consistent relationship between the sustainability indicators and general attributes.

By providing an integrated strategy for sustainability assessment and evaluation, the MESMIS project has generated increased interest within academic and extension organisations. Several farmer organisations, research institutions and NGOs are currently using the MESMIS framework as a tool to evaluate sustainability. Since 1996 it has been applied in more than 20 case studies in Mexico and Latin America. It has also been used in more than 30 courses, workshops and seminars, and included in 14 university programmes in Latin America and Spain. The project has resulted in 15 publications, including one book on the MESMIS framework (Masera et al 1999), and another describing five case studies of sustainability evaluation within Mexico (Masera and López-Ridaura 2000).

Implementing the Framework

The operational structure of the MESMIS framework consists of an *evaluation cycle* of six steps.

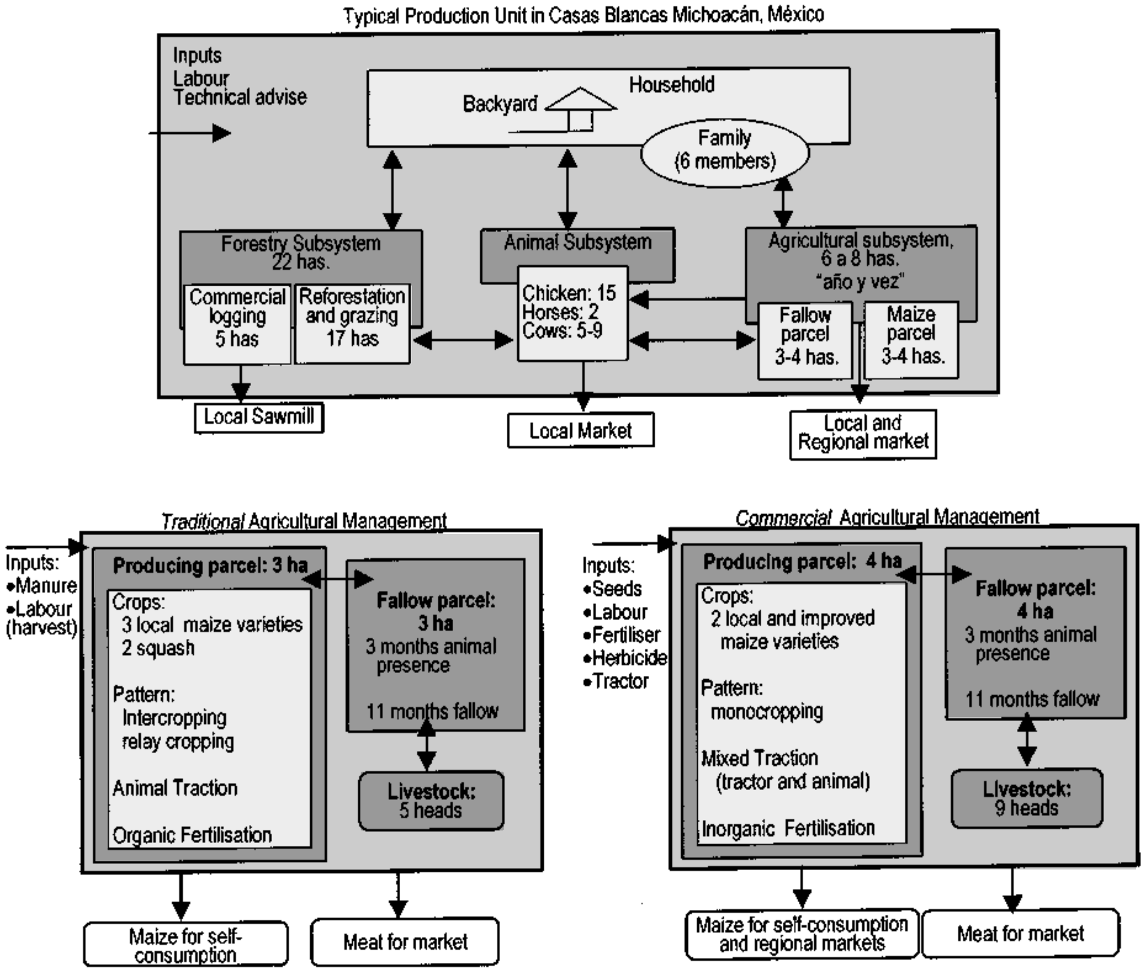
Step 1 Definition of the evaluation object

In this first step, the evaluation team characterises the system under study (both reference and alternative), as well as the socio-environmental context and scope (spatial or temporal) of the evaluation. An accurate description should include: the components of the system (subsystems), the system's inputs and outputs, the main management and productive activities in each subsystem and the main social and economic characteristics of the stakeholders and the form of organisation they have.

Step 2 Determination of the critical points

The critical points of a system are the main features or processes threatening or

Figure 2. Characterization of Casas Blancas production unit.
***Traditional* and *commercial* agricultural management**



Source: Modified from Astier *et al.*, 2000.

strengthening the system's sustainability. Identification of the critical points will focus the evaluation process to the most important aspects of the system under analysis. Some key questions in identifying critical points are: What makes the system vulnerable? What particular problems are presented? What constitutes the strongest, most prominent feature? Examples of critical points are low yield and product quality (productivity attribute), soil loss, deforestation and pest damage (stability, resilience and reliability), or peasant indebtedness (self-reliance).

Step 3 Selection of diagnostic criteria and indicators
The diagnostic criteria elaborate on the seven attributes of sustainability. They represent a level of analysis more detailed than attributes, but less than indicators. Diagnostic criteria serve as a necessary intermediary link between attributes, critical points and indicators, enabling a more effective and coherent evaluation of sustainability. The set of indicators used in an evaluation process is specific for the system under analysis. They should be easy to measure, possible to monitor, derived from

Box 1 THE MESMIS FRAMEWORK IN PRACTICE
In the Casas Blancas *ejido,* an indigenous community in the Purhepecha Region of Michoacán State, GIRA has facilitated the development of alternatives for an agrosilvopastoral system. This was done by diversifying the cultivated plots (*milpa)* in order to obtain better stubble quality, avoid extensive grassing and control erosion. (Masera and López-Ridaura 2000).

The Casas Blancas *ejido* is representative of how many communities in the region manage their natural resources. Each farmer manages approximately 30 hectares - about 70% being forested (logging and reforestation) and 30% used for maize production and cattle raising. The agricultural management system, known as *año y vez,* consists of mainly maize production on one parcel for a year and a fallow for 1 to 3 years. In Casas Blancas, a *commercial* and a *traditional* strategy can be identified. They differ mainly in the type of fertilisation (inorganic or organic) and use of seeds (local or improved varieties), the type of traction (animal or tractor), the source of labour (wage or family), and the main objective of agricultural production (market or self consumption) (Figure 2).

A number of critical points were identified jointly by farmers and an external team through surveys, interviews and workshops. For each critical point, the evaluation team selected the diagnostic criteria and the indicators to be measured. Table 1 shows the critical points, diagnostic criteria and indicators used in this case study (Astier 2000). Figure 3 presents an AMOEBA diagram with the results from some of the indicators used.

The first evaluation cycle of the Casas Blancas case study helped in designing an alternative system, considering the strengths and weaknesses of the two different management strategies. The alternative system, now adopted by farmers is the focus of a second evaluation cycle, which proposes: a) the diversification of agricultural production by re-introducing amaranth and two edible leguminous species as intercrops, b) the use of organic and inorganic sources of fertilisation with special emphasis on phosphorus, c) the use of mixed traction for ploughing, and d) the introduction of leguminous cover crops and controlled grazing in the fallow parcel.

Table 1. Critical points, diagnostic criteria and indicators for sustainability evaluation in Casas Blancas Michoacán.

Attribute	Diagnostic criteria	Critical points	Indicators	AE[1]	MM[2]
Productivity	Efficiency	Low agricultural productivity	1 Grain yield	A	i,a
			2 Harvesting index	A	i,a
		Low animal productivity	3 Fodder availability	A	a,f
			4 Animal pressure capability	A	j
		Low profitability	5 Production costs	E	a,b,c
			6 Income	E	a,b
			7 Utility	E	k
			8 Cost/benefit ratio	E	k
Equity	Costs and benefits distribution	High costs for commercial systems adoption	9 Grade of adoption	S	g
		Limited basic grain supply	10 Grade of grain self-reliance	S	a,b,l
Stability	Resource conservation	High risk of erosion	11 Soil erosion control	A	m, d
		Soil degradation	12 Stability in nutrient balance	A	a,f,m
	Space and time diversity	Monocropping domination	13 Species diversity in parcel	A	a,f,b
Adaptability	Innovation capability	Failure of technological packages	14 Grade of technological innovation	S	a,b,e
			15 Permanence in technological packages	S	b,e
			16 Capability to adapt to environmental and political changes	S/A	a,b,m
Self-relianc e	Participation, control and organisation	Lack of co-operation among farmers	17 Participation in "ejido" assemblies	S	g
			18 Number of farmers in workshops	S	h
			19 Grade of External input dependence	S	a,b

(1) Areas of evaluation	(2) Measuring Methods		
E Economic	a Survey	e meetings with farmers	i Random grain sampling (C.P., 1986)
S Social	b Interviews	f Direct field measurements	j Calculation as Trillas (1982)
A Environm	c Workshops	g Assemblies archives	k Calculation as Masera *et al.*, (1999)
	d Field visits	h Registry of participation farmers in workshops	l Calculation as Alarcón (1997)
			m Literature review

Source: Astier *et al.*, 2000.

available and reliable information, and clear and simple to understand. E.g. A common diagnostic criterion for the stability attribute is *Diversity.* Indicators reflecting this criterion are the *Number of species* in the environmental area, or *Number of markets* in the economic area.

Step 4 Measurement and monitoring of indicators

This step includes the design of analytical tools and the methods of data collection. Indicators can be measured in a variety of ways. Methods that have been used in the MESMIS case studies include direct field measurements, setting-up of experimental plots, literature review, surveys, formal and informal interviews and participatory group techniques. Selection of the type of measurement depends on the availability of human and financial resources. A combination of direct and indirect measurement techniques is advised in applying the MESMIS framework. Here, farmer participation is important as has been proven by the great accuracy of the indicators selected and measured by them.

Step 5 Presentation of results

At this stage, the results obtained are summarised and integrated. Generally speaking, there are three techniques for presenting the results: quantitative, qualitative and graphical techniques. When properly designed, graphical techniques may provide the most effective way for identifying problems. In the MESMIS framework, an AMOEBA-type diagram is recommended. This diagram shows, in qualitative terms, how far the objective has been reached for each indicator by giving the percentage of the actual value with respect to the ideal value (reference value). This enables a simple, yet comprehensive comparison of the advantages and limitations of the system under evaluation.

Step 6 Conclusions and recommendations.

Step six recapitulates the results of the analysis. Firstly, the evaluation team appraises how the reference and alternative systems compare in terms of sustainability. Secondly, they discuss the main elements that enhance or inhibit the alternative system compared to the reference system. Based on these conclusions and considering the needs and priorities of all stakeholders, the evaluation team proposes recommendations to improve the system's sustainability.
Step six is also the phase for reflection upon the evaluation process itself, its logistical and technical aspects.

Making sustainability evaluation a permanent and cyclic process

An evaluation process is considered successful when it helps to improve the social and environmental profile of a NRMS. In other words an evaluation should aim not only at *qualifying* management options, but also at effectively helping to formulate an action plan geared towards improving the management system. Evaluating sustainability must be, ultimately, a *tool for planning and design.* Its success lies in its ability to be applied in the day-to-day activities of agroecological projects. Consequently, in the MESMIS framework, evaluation is not conceived as a linear process but as an iterative spiral. The conclusions and recommendations obtained form the starting point of a new cycle. ■

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Website: www.oikos.unam.mx/gira/english.htm

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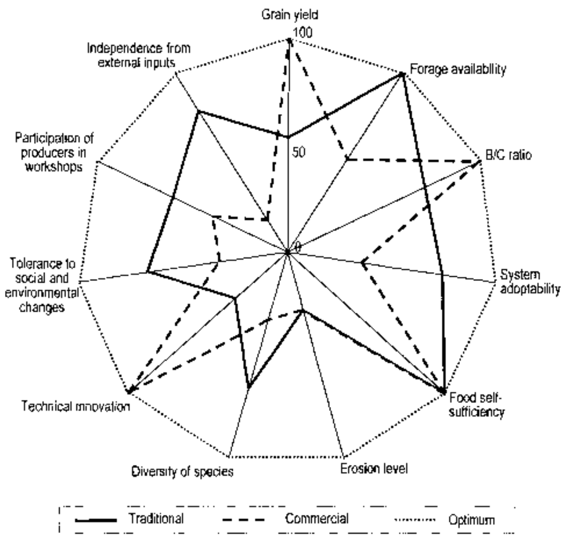
Figure 3. AMOEBA-type diagram for the evaluation of agrosilvopastoral systems in Casas Blancas Michoacan



Mahaweli settlers in Sri Lanka diversify their farms using Farm Planning

Alice de Jonge

The Promoting Multifunctional Household Environments (PMHE) project, implemented by ETC-Lanka, was operational in Mahaweli System C in Sri Lanka, from 1991 to 2000. This article deals with Farm Planning for Sustainable Farming, an approach towards sustainable development of farms, initiated by the author and developed further in the project, which resulted in farmers moving away from a monoculture of paddy, to more integrated farming.

Photo: Alice de Jonge

Farm planning, a family affair

Paddy – main cash crop

Mahaweli System C is part of a large agricultural settlement scheme in the "dry" zone of Sri Lanka. Between 1980 and 1990 nearly 22,000 settler families arrived from various parts of the island to become paddy farmers. Each settler family was entitled to 1 ha of irrigated paddy land and 0.2 ha of highland for a homestead. The settler farmers were in turn supposed to transform Mahaweli System C into one of the key rice producing areas of the country. Agricultural extensionists of the Mahaweli Authority of Sri Lanka (MASL), were equipped to support farmers in cultivating rice.

Low profitability of paddy farming

After the first 2-3 years (5-6 seasons) of paddy cultivation, the majority of farmers began to see drastic yield decreases due to loss of soil fertility. Maintaining yields of around 4 to 5 tonnes per ha, much lower than the initial yields of 6 tonnes per ha, required application of increased quantities of inorganic fertiliser. With the price of fertilisers escalating steadily, the returns from paddy farming were marginal. Added to this was the lack of experience amongst farmers on how to maintain soil fertility under conditions that differed considerably from their areas of origin. The extension package offered by the MASL was hardly conducive in developing location specific farm systems suited to the different soil and water conditions in Mahaweli System C.

Finding alternatives to paddy

The deteriorating economic situation of the farmers, sub-optimal use of resources and degradation of the resource base prompted PMHE to consider principles of ecological farming and low external input and sustainable agriculture for developing alternatives to the existing farm system. Farm Planning for Sustainable Farming evolved through intensive interactions between farm families, MASL and PMHE extension staff and developed into a participatory extension methodology and a farmers' tool for resources management and farm development. (see box)

Farm planning helps farm families to search for alternatives and combinations of crops that would bring them more returns than paddy. It also helps them to find ways of utilising resources more efficiently. The families realise that bio-mass has to be created to make up for the nutrients that leave the field in the form of paddy grain.

Farm Planning and ecologisation

Farm Planning for Sustainable Farming is based on ecological principles (see box) and as such it contributes to develop a farm system in a more ecological way. In Mahaweli System C, it contributes, in combination and synergy with all of PMHE project activities, to the ecologisation of the paddy mono-crop in the irrigated tract. This is however inspired in the first place by an economic motive: how to get more returns from farming and how to reduce costs. Aspects of environmental conservation and health are of secondary importance. Based on ecological principles, Farm Planning enhances the awareness among farm families on the optimum, instead of maximum use of the environment.

A recent study shows a remarkable difference in ecological practices between farms of families practising Farm Planning and their neighbours without a Farm Plan. Almost 100% of the farm families involved in Farm Planning practise recycling of organic matter to improve the soil fertility of their paddy field - against hardly 50% of those not acquainted with it. Incorporation of paddy straw has become an established practice among farm planning families in place of the former habit of burning it. Banana, peanut and vegetables are being grown in the irrigated fields alongside paddy. Some families have successfully incorporated livestock in the farm system. Glyricidia is planted along the bunds of the paddy field to serve many purposes: fodder, green leaf manure, trails for climbing annual crops, firewood, etc. In this way certain needs of the farm are fulfilled by material produced on the farm itself, which reduces the cost of and the need for external inputs. A majority of the farm planning families considers soil fertility as the most important criterion for sustainability of the farm. Despite the home garden and paddy field being located apart, farm families bring surplus organic matter from paddy field to home garden and vice versa to improve soil fertility.

An important effect of Farm Planning is that the paddy land is observed and analysed: which parts are suitable for paddy cultivation and on which parts other crops or even perennials would do better? While diversifying the paddy mono-crop, the ecological principle of a site-specific choice of plant species is increasingly practised.

A young farmer's story

Mr. Jayasinghe, a young farmer from Mahaweli System C, changed his entire approach to paddy farming, remarkably, since he started with Farm Planning in 1996. After analysing the situation he improved the paddy field step by step. By levelling his land in a planned way over different seasons, he is now able to control weeds by flooding. He has planted a plot of about $\frac{1}{2}$ acre, less suitable for paddy cultivation, with banana, inter-cropping the young banana plants with vegetables at first. Gliricidia is being established on the bunds of his field. Jayasinghe uses the gliricidia leaves, together with the rice straw, to improve the soil fertility in poor plots. In the banana – vegetable plot he uses cow dung. He has also started to plant arecanut and coconut in his paddy land, thus diversifying his income and spreading the risk.

His external inputs have decreased considerably. " I use straight chemical fertiliser, which gives a good result in combination with the straw and leaves. Insecticides and herbicides are used only when necessary. I follow an IPM course with the extension officer", says Jayasinghe.

In the early years of settlement Jayasinghe sold his paddy crop directly from the field, like all his neighbours did at that time, and received the lowest price. In his Farm Plan he planned for storage of his paddy, to get better returns by selling it at the right time. Now he is a seed paddy farmer, delivering high quality seed to the South of Sri Lanka.

Jayasinghe is very clear about the benefits of Farm Planning for his farm and life: "After Farm Planning I have better results and I am more focused in my work. In the beginning, however, I had the feeling that I had lost my freedom, that I was trapped in a 'cage'. But now I have realised that it is my own plan, and that I can change it whenever I want."

Asked in which way his farm has become more sustainable, he answers: "When you plan your farm, you should use all your own resources first, before buying any inputs. I am now using all the crop and farm wastes, which I did not do earlier. I have been able to reduce my costs so much that I am no longer taking crop loans."

At the end of every season, the young farmer evaluates his well-kept records, to plan for the next season. "If you don't plan, you can't do all your activities in time, you miss things. It is also important to put your plans on paper, so that you can look at your objectives from time to time and build up your motivation". That maybe the reason why Jayasinghe has put his marriage into the plan for the near future: he has understood that Farm Planning is more motivating when it is a family affair.

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Key elements of "Farm Planning (FP) for Sustainable Farming"

1. Learning from the forest for the farm.

Before starting a farm planning process in a farm, farm families and extension staff learn from the example of a natural forest as a sustainable environment. The most important ecological processes through which the natural forest sustains itself and creates a **balanced environment** are in brief:

- Bio mass production
- Diversity and Complexity (a web of relations in unity)
- Living soil as a major component of soil fertility
- Recycling of all organic matter
- Efficient use of all the resources
- Site specificity of plant and animal species chosen.

By discovering and analysing these processes and their linkages in a natural environment, families and extension staff draw learning points for sustainable farming. **Efficient resource use** serves as the starting point for FP. The **unity** in a natural forest environment as **a system with a web of interactions between its elements** is also important. Likewise, in FP the farm is considered in a holistic way, as a system with flows of material and energy between all the different farm enterprises.

2. Observation and analysis of the existing situation of the farm.

The planning process starts from the existing situation on the farm, which is carefully observed and analysed. How does the present farm **system** work and what are the available resources? The farm family members are the most important resource persons in the exercise of observation and analysis of **resources, processes, practices, opportunities and problems** in their own farm**.** Extension staff act as facilitators. Together they document the analysis of the farm system in maps, flow charts and written or "symbolised" text: this is the first part of the **farm document.**

3. Exposure visits to farm families who successfully developed their farms.

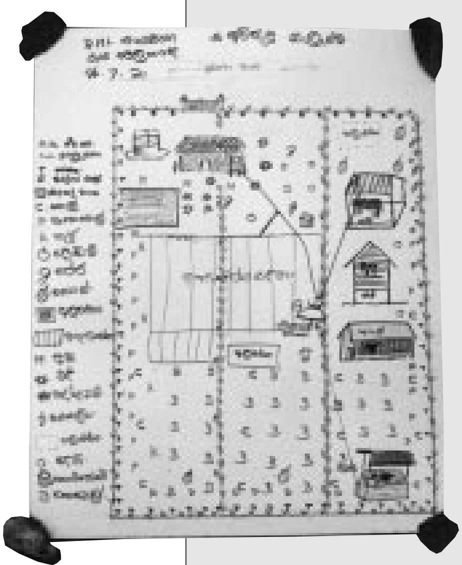
Groups of farm families who have mapped the existing situation of their farms visit others who are in the process of successfully developing their farms, and collect ideas for their own farm plans.

4. Planning for further development of the farm.

Before making the Farm Plan, farm families and facilitators discuss about planning in relation to needs, goals, dreams, and **vision on the future**. Planning starts with the 'here and now', the existing situation, and reaches a final goal. It describes changes and **improvements in different feasible steps**, keeping in mind the lessons learned from the natural forest environment and utilising **available resources** optimally.

In a Farm Plan this final goal, the more sustainable situation of the farm, is put on paper. Then, with the help of simple formats, often designed by the farm families themselves, the different steps of systematic development of the farm over several years, towards the desired situation, are chalked out: the **long-term plan.** The long-term plan is divided in **seasonal work-plans,** in which the activities for the season, the necessary resources and the expected returns are documented. This is the second part of the **farm document** made by the farm family.

This farm document, the Farm Plan, is not a blue-print but a **flexible framework for farm development**, which can be adapted to changing situations (e.g. weather conditions, availability of resources, changing views and priorities, new ideas, etc.). This makes Farm Planning an **ongoing process.**



Farm plan of a diversified home garden

5. Implementation of the Farm Plan.

Implementation of Farm Plans is the responsibility of the respective farm families. Their Farm Plan is a documented **commitment** to the systematic development of their farm. It increases the confidence of the farm families: "We can reach this goal on our farm with our own resources". At the end of each season the outcome of the **seasonal** work-plans is **review**ed and **new work-plans** are made, based on the results, and with reference to the long-term plan.

Farm Planning for Sustainable Farming is a **family affair**, involving women, men and children and their experience, knowledge and views of the farm. The planning process, the plans and their implementation are 'owned' by the family and facilitated by extension staff.


photo: Stephen Sherwood

Farmer Field Schools for ecological potato production in the Andes

Stephen Sherwood, Rebecca Nelson, Graham Thiele, Oscar Ortiz

Various partners are working with farmers to strengthen local innovative capacity as a means of enhancing production and integrated management of potato in the Andes. Groups in Ecuador, Peru and Bolivia have used the Farmer Field School approach as a jumping-off point to tackle a range of challenges, most notably knowledge gaps and the devastating late blight disease.

Challenges to Andean potato farming

Although potato has been a staple crop in the Andes for millennia, modern population pressure has led to agricultural intensification and in turn to ecological disturbance and land degradation. Chemically intensive technologies have allowed for increased potato production in many areas, but at great costs to ecosystem health and also to farmers exposed to toxic substances. Modern market forces have contributed to the sharp reduction in potato varieties, and the trend is toward shortened fallow periods and monocropping. Mechanised tillage in many areas has contributed to physical soil erosion and compaction. High input requirements and market price fluctuations have led to significant loss of profitability.

The effects of ecological disturbance are acutely evident with late blight, a particularly destructive disease caused by a fungus-like microbe. Late blight contributed to the Irish potato famine of the 1840s when the pathogen arrived to Ireland from its centre of origin in Mexico. Since the 1980s, pathogen migrations have brought fungicide-resistant strains to South America. Management of late blight poses special challenges for several reasons: the high risk of crop loss, the invisible nature of the pathogen, the lack of natural enemies, and the small number of effective management tactics. As a result, it is difficult, in many parts of the Andes today, to grow the crop without regular fungicide applications.

Meanwhile, "modernisation" policies and structural adjustments have dismembered classical agricultural extension and research services in the Andes. The financial support to relevant public institutions has been severely decreased by full privatisation, as in the case of the national research institution in Bolivia, or semi-privatisation, as in Ecuador. This has transformed the roles of researchers and extensionists and placed greater responsibility on rural communities. While tremendously challenging for institutions, improving present-day agriculture will demand approaches that are more responsive and better suited to local agroecological and socioeconomic conditions.

Responding to collapse

The International Potato Center (CIP), the FAO's Global IPM Facility, and a diverse group of governmental and non-governmental organisations are working with Andean communities in Ecuador, Peru and Bolivia in responding to pressing potato-farming demands. Project partners are striving to enhance farmer understanding of agro-ecosystems and to strengthen local decision-making and technology development capacities for more productive and sustainable agriculture. Faced with tremendous pest problems and pesticide abuse, they are emphasising management-intensive approaches that require a good understanding of biology and ecology.

Beginning in the early 1990s, CIP began to work more closely with communities and other partners to strengthen potato IPM. Such collaborative arrangements have yielded diverse benefits. Communities gained new access to information and institutional resources, rural development agencies received increased technical support, and research organisations found brokers to mediate between their relatively narrow interests and the broader needs of communities.

The partners are building on this experience through a range of participatory extension and research models, in particular the Farmer Field School (FFS) methodology developed by the FAO in Asia, Local Agricultural Research Committees (CIALs) developed by CIAT, and Farmer-to-Farmer extension developed by World Neighbors and others in Central America.

Farmer Field Schools

From 1993-1996, CIP and CARE collaborated on IPM in the Peruvian Andes, working in community-based "pilot units" to validate and implement a series of management tactics for insect pests. Seeking sustainable mechanisms for participatory training and research, CIP and CARE began to test the Farmer Field School model in 1997.

CIP staff based in Peru, Bolivia, and Ecuador who were experienced with participatory methods, began to work with national counterparts to adapt the FFS approach to the diverse conditions of Andean potato farmers. The initial agronomic emphasis was on disease management, but now includes general pest and soil fertility management.

The Global IPM Facility led an intensive three-month training of trainers (TOT) in FFS for a group of 35 extensionists from the three countries, who have served as resource people for further developing national initiatives.

CIP's decentralised mode of operation has permitted semi-independent evolution of its national efforts. While each country promotes similar technical themes, such as agroecology, IPM and, in particular, late blight management, modalities and processes change depending on local needs and interests.

Ecuador: Community-based extension and pesticide reduction

CIP and the Ecuadorian National Institute for Agricultural Research (INIAP) collaborate with a large number of NGOs, in particular the Centro Julian Quito, the International Institute for Rural Reconstruction (IIRR) and World Neighbors, and with local municipalities to establish community-based extension systems in response to government restructuring. The FFS methodology strengthens extension approaches that previously centred on technology transfer modes of change. Early work centred on improving facilitation skills and independent farmer learning through self-discovery techniques. The partners now place emphasis on the training of farmer promoters and on linkages with farmer-to-farmer extension.

By the end of 2000, fifteen farmer field school courses would have been completed with the objective of helping farmers to fill knowledge gaps for better understanding of general agroecology and achieving more integrated (i.e., with less external input) management of production. Field school facilitators have shared endogenous know-how, such as a promising limited tillage system known as *wachu rozado*, and have introduced new technologies, such as late blight resistant varieties and insect traps.

As with the Asian experience in which FFS were organised for IPM in rice, the Ecuadorian field schools have used site visits between FFS groups and field days for exchange of ideas and raising public awareness. FFS graduates have expressed interest in follow-up activities, creating links with existing CIALs and establishing their own participatory technology development groups.

Bolivia: Decision support systems and resistance management

The Bolivian Foundation for Research and Promotion of Andean Products (PROINPA) had worked with farmers to develop and test improved simple decision support systems (DSS) for managing fungicides with resistant and susceptible varieties. Use of the DSS was seen to be highly profitable. The FFS approach was adapted as a way of teaching farmers about diagnosis, disease processes, and implementation of the DSS. Learning parcels in most FFSs contrasted the use of DSS with normal farmer practice, with three resistant varieties and one susceptible. ASAR, a collaborating NGO involved, added a change from inorganic fertiliser to manure and wider spacing, to look at the effects of cultural practices on disease development.

Farmer participants have also conducted trials of advanced clones with late blight resistance, where they evaluate varieties at flowering, harvest and after cooking. FFSs were conducted in seed producing communities located at altitude extremes, with the intention of generating seed flows from higher altitudes, where pests tend to be less problematic, to lower zones. As follow-up, a group is planting basic seed of three resistant varieties for seed consumers in the lower zone.

Peru: Capacity building and varietal selection

Since 1997, CARE and CIP have worked with farmer groups in Cajamarca, using the FFS approach to strengthen farmers' knowledge of crop management and to provide access to potato varieties and breeding lines with resistance to late blight. Initial work centred on disease management is evolving toward broader pest and crop management.

The first campaign involved a season-long training programme with four communities and included participatory experiments to test varieties and breeding lines under different fungicide regimes. The curriculum concentrated on disease processes, diagnosis, and management. In the field experiments, the yields of the moderately resistant varieties varied according to fungicide treatment, while the resistant varieties performed well even at low fungicide levels. Eight additional communities participated in the second season. Participants continued testing clones in their own fields, and CARE provided credit to allow larger-scale production of the most promising variety identified in the first years' FFS. Three breeding lines were released by other institutions based in part on the results obtained by the FFS groups. Qualitative evaluations show that farmers have enhanced their general IPM knowledge, particularly regarding late blight management.

The partners are currently facilitating 13 FFS in Cajamarca, with six more groups being led by new partner organisations. The basic curriculum now includes insect ecology and management, and each FFS group is conducting multiple experiments. One general problem is a tendency to design overly complex experiments. In future seasons, experiments will be tailored to the particular interests of the community.

Lessons and challenges

Introducing FFS to the Andes required more than just a re-writing of extension manuals. Local extensionists who agreed on the benefits of 'discovery-based learning', took to heart the re-design of their activities to create a new extension guide (see Pumisacho and Sherwood, 2000). Regarding the technical approach to IPM, extensionists generally favoured the less academic approach of the Asian FFS, which centred on the following principles: grow a healthy crop, conserve natural enemies, observe the crop regularly, and help farmers become experts.

Late blight in the Andes poses a special challenge to FFS and integrated disease management, and in particular to pesticide reduction. The disease's aggressive epidemiology has left farmers with few alternatives to fungicides. Consequently, FFS have had to emphasise not just capacity building, but also technology development in order to assist farmers in improving management of the disease and overall farming productivity.

Farmers and partner organisations have requested training in other components of Andean cropping systems, animal-pasture management, and greenhouse crops, requiring new institutional arrangements, curriculum development, IPM expertise and continued technology development. Further, communities in each country have solicited FFS in IPM for youth, so TOTs for teachers in technical aspects of IPM and FFS methodology are needed.

The FFS approach has been recognised as a highly flexible platform for bringing farmers, extension workers, and researchers together to improve potato production. Expanding and sustaining this work in an age of decreasing government support for agricultural development will require increased community leadership. The partners will be looking at "farmer-to-farmer" approaches that have proven so successful in Central America and elsewhere. National-level projects have recently been approved to expand FFS in Ecuador and Peru. They hope that these and similar initiatives in Bolivia will enhance community capacity to catalyse agricultural improvement in the region.

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From sugarcane monoculture to agro-ecological village

Lindsey Mulkins and colleagues

The island of Negros is known as the sugar basket of the Philippines. More than half of the available agricultural land in the lowlands is devoted to sugarcane cultivation. The social and ecological problems associated with monoculture sugarcane production pervade the island. Negros became infamous in the 1980s when the collapse of the sugar industry led to the starvation of thousands of sugar workers and their families. Today, much of the landscape of Negros remains in monoculture sugarcane production under the control of wealthy plantation owners known as *hacienderos*. Many landless labourers continue to toil in the cane fields for 1.50-2 US$/day and are locked into a cycle of poverty, indebtedness and physically gruelling work.

For some of the sugar land communities of Negros, however, there is a positive transformation underway. One such community is the Flora community near Kabankalan in southern Negros Occidental. In 1997, through the Philippine government's Comprehensive Agrarian Land Reform Program (CARP), 76 hacienda workers and their families (approximately 375 people) were awarded an 87 hectare former sugarcane plantation, which they divided into individual farms of 0.82 hectares, and a collective farm of 17.7 hectares.

Photo: REAP-Canada

Conventional sugarcane production in the Flora community is now being transformed into sugar-cane trash farming

The Flora community has since diversified the former hacienda and is following an ecological approach to increase its food self-reliance and make more efficient use of its production capacity. To create a more organised and collective decision making structure, the community has formed a farmers association called PAGLA-UM. The community has also benefited from the presence of a number of organisations specialising in sustainable farming systems research and development. These include PDG, MAPISAN, MASIPAG, REAP-Canada and University of the Philippines in Los Baños, Department of Agronomy.

The Agro-Ecological Village

The Flora community's efforts to create internal food and energy systems are gradually resulting in a more ecological way of living. This approach, which emphasises community self-reliance, is called an 'agro-ecological village'. The general characteristics of agro-ecological villages are outlined and compared to conventional approaches in table 1. The community is using the approach to achieve empowerment, increase financial security, and minimise vulnerability to vagaries in the weather or fluctuations in the market. Sugarcane production has been reduced in scale and ecologised through the implementation of alternative production systems. It still remains a vital crop for the community, providing (outside) income, feed for 145 draught animals and organic matter to maintain soil fertility. In fact, sugarcane's capacity to produce large amounts of biomass for decomposition drives nutrient and organic matter cycles that are critical to the sustainable production of other crops like maize, grain legumes and vegetables.

Modified sugar production

The traditional form of cane production in Negros has led to serious environmental degradation. Sugarcane fields are frequently burned before or after harvest, resulting in reduced soil fertility. Between the early 1970s and 1988, soil organic matter declined by 26% in one of the main cane growing regions of Negros. Reduced soil fertility has led to lower cane yields, and consequently, higher application rates of fertilisers. Current estimates of sugarcane fertilisation levels in the Philippines are 209 kg N / ha, 55 kg P_20_5 /ha, and 74 kg K_20 / ha per year. Additionally, cane production in upland areas causes erosion, resulting in the siltation of water bodies. Ground water has also been contaminated by the high application rates of nitrogen fertiliser and persistent herbicides such as *simazine*. Trash burning has reduced biodiversity and is leading to respiratory ailments, eye disease and increased incidence of cancer among the people.

The alternative practice of pre and post harvest trash (crop residue) cane farming is beginning to be implemented in the Flora community. Three months before harvest, dead leaves are manually removed from the cane stalk (detrashed) and left to decompose on the soil. After harvest, the residual sugarcane biomass is maintained on the field. Through the decomposition process, the trash fixes nitrogen and increases soil organic matter content, reducing application rates of nitrogen fertiliser. Trash farming also enhances weed control, preserves soil moisture, minimises erosion, protects canes from lodging during typhoons, and significantly reduces harvesting time.

Trash farming is known to increase sugarcane yields, particularly those of ratoon crops (regrowth of cane after harvest). In Southeast Asia, yields increase on average by 5.8% in the planted crop and 21.1% in the first ratoon crop. Trash farming reduces the yield decline traditionally associated with ratooning, enabling sugarcane to be cropped an additional one to two ratoon cycles before yields become economically non-viable. If practised over a long time scale, sugarcane trash farming in communities such as Flora has the potential to create a positive feedback system where continuous improvements in soil fertility will lead to increased productivity, reduced input requirements and longer ratooning cycles. The Flora farmers are currently using less than half the amount of urea used by conventional sugarcane growers. However, with changing cultural practices, the optimal fertilisation level is yet to be determined.

The main disadvantages of trash farming are an increased risk of fire and higher labour costs. Cane trash is usually piled in alternate rows to minimise fire risks and enable cultivation between every other row. Labour costs of trash farming are offset by reduced input costs and increased cane productivity. Currently, average yields in the community are about 70 tonnes / ha.

Flora's production of rice and maize

The introduction of rice farming is central to the Flora community's move toward food self-reliance, enabling members to satisfy about 75% of their current rice needs with 3.8 ha of rice. The farmers have successfully implemented an organic rice farming system developed by MASIPAG (see ILEIA Newsletter Vol.14 3&4, p.47), the national ecological farmers' association in the Philippines. The MASIPAG programme emphasises the use of locally adapted varieties of rice selected under organic production systems, facilitating the management of rice without the use of synthetic fertilisers, herbicides or pesticides. Similar to sugarcane trash farming, Flora farmers maintain soil fertility in the rice paddies by mulching the rice straw back into the paddies after harvest. Whereas 90% of rice straw in the Philippines is burned, the mulching system has enabled the community to completely eliminate burning and inorganic fertiliser inputs, as the rice straw fixes nitrogen during decomposition. More nitrogen is provided by azolla, a nitrogen-fixing aquatic plant that grows during and after the rice harvest. Recycled rice hull ash from household cooking and mud press from sugarcane processing are also added to the paddies to maintain fertility.

In the MASIPAG system, the rice is transplanted in rows 30 cm apart. Farmers plough the ground deeply to help the rice crop form deep roots to improve nutrient uptake. Disease pressure is minimised by maintaining low plant density, wide row spacing, and planting disease and pest resistant rice varieties. Fields are planted in an east-west orientation to facilitate air movement through the paddies and minimise crop shading. A MASIPAG trial farm of up to 50 rice cultivars is maintained by the community each cropping season.

In Negros, the most serious pest problems of rice are black bug and golden snail. Black bug is managed by manipulating water levels at critical periods of rice development. Golden snail populations are controlled by maintaining low water levels after transplanting. They are also lured away from the rice seedlings by supplying taro leaves, a preferred food of the golden snail, for a period of 25 days after transplanting.

The Flora farmers intercrop glutinous and sweet maize with the sugarcane crop for home consumption and fresh market sale. To minimise competition effects, maize is harvested after 60 days and is only planted in alternate rows of cane. The community is currently testing alternative cropping systems for more ecological maize production, including intercropping white grain maize, pigeon peas and squash or sweet potato.

Vegetable Production

The Flora community grows a wide variety of vegetable crops for home consumption and fresh market sale, including eggplant (12 ha), squash (5 ha), daikon radish (2 ha), bitter gourd and peppers. The large production of vegetables not only serves the farmers by improving their diets and income levels but also increases the supply and affordability of vegetables in local markets.

Of all the crops grown in the community, vegetables are sprayed with the most pesticides. The farmers' lack of experience with larger scale vegetable production and the absence of locally adapted seeds have prevented the fully organic production of vegetables. Farmers are intensively experimenting with new vegetable varieties and alternative pest controls.

Social and Ecological Implications

Through modified sugarcane cultivation and crop diversification, the Flora Community is enhancing the quality of life of its residents, while reducing the environmental impact. The health of the community has improved as the people have secured a reliable and diverse source of food. The new approach has resulted in a system of labour that better matches the working capacity of the community. Since cane detrashing usually occurs during the rainy season when labour demand is low, it enables farmers to divide work throughout the year. Unlike sugarcane monocultures, the community's diversified agricultural production offers many more opportunities for the involvement of women in all aspects of food cultivation, including cane detrashing, seed collection, planting, marketing and value-added processing.


Photo: REAP-Canada

Sugarcane trash farming

In Negros, men and women who were once marginalised are becoming full participants in the region's economy. Rising income levels amongst the rural poor increase demand for basic consumer goods, and higher education for children. The combination of agrarian land reform and the ecologisation of monoculture production systems in Negros thus appear to have the potential to create socio-economic benefits beyond those at the farm production level. Although the Flora agro-ecological village is still evolving, it already seems to provide a promising model as a development strategy for communities dependent on monoculture agriculture systems.

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Table 1. An agroecological approach to rural development in the Philippines

Activity	Agroecological system	Conventional approach
Approach	• Emphasises self-reliance and empowerment through optimal use of on-farm resources • Orientates market development towards import displacement • Minimises human impact on local environment and biosphere	• Emphasises development of export markets to pay for imported goods • Communities are vulnerable to external forces and loan-dependent • Degrades local natural resources and biosphere
Food Supply	• Internal and plant-based, on-farm production of seasonal vegetables, rice, corn, fruit, fish and eggs	• Much food imported, including rice, canned and dried fish, processed foods, livestock feeds
Soil tillage and on-farm hauling	• Carabaos (water buffalo)	• Tractors
Seeds	• Community seed banking of open pollinated seeds, new seeds assessed in trial farms, farmer driven participatory plant improvement	• No local adaptation trials, plant improvement or seed saving. Imported hybrid seeds dominate plantings
Soil Fertility	• Maintained through trash farming, nitrogen fixing legumes, azolla, mudpress, carabao dung, rice hull ash. Soil erosion minimised.	• Urea, phosphorus and potassium fertiliser
Insect and disease control	• Biological control strategies, resistant cultivars, balanced fertility	• Insecticides and fungicides
Weed control	• Mechanical weeding devices, crop rotation, good soil fertility management, trash farming	• Herbicides and tillage
Household cooking	• Use of rice hull cookers, efficient wood stoves, biogas, with all fuels farm-derived	• LPG fuel stove, open fire cooking, kerosene as fire starter
Marketing	• Emphasis of internal self-reliance and import displacement with value-added processing	• Monoculture production, products sold to distant markets

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Conversion to Organic Farming

A project approach from China

Johanna Pennarz

The Organic Farming Development Project co-operates with advisory staff and experts from agricultural universities and local government to support farmers in converting to organic farming.

Initial situation

Following the high demand for organic products on the international markets, traders are the dominant actors in the organic farming movement in China. They try to identify farm products, which are on a low external input regime already and thus respond to the minimum requirements of international certification bodies. They are not interested in lengthy conversion processes and leave the solving of technical problems to farmers. There are no experts or technical staff specialised in organic farming yet. Staff who lack expertise in dealing with the highly diverse problems in organic farming, advice farmers to simply replace conventional inputs with biological ones. Farmers request blueprint solutions from experts and advisory staff and are not well prepared to start indigenous innovation processes themselves.

The project: conversion as a process

The project has introduced conversion to organic farming as a process in Yuexi, Anhui Province, with the following objectives:

- to develop an extension methodology on conversion, based on a participatory approach,
- to stimulate technical innovations in local farming systems,
- to organise smallholders for internal quality control, technical support and marketing, and
- to attract political support to organic farming.

Extension methodology on conversion

After the pilot villages in Yuexi county were selected, a first assessment of the potentials and problems for development of organic farming was conducted in 1998. This did not provide farmers with a ready-made solution, but proposed a number of options for conversion. The framework elaborated by the advisors made clear that the conversion would be a farmer-led process of gradually modelling the organic farming system by testing various options and possibilities.

At the time, the advisors could only refer to a few experiences in organic farming available in China. The first workshop, held in Yuexi in 1998, provided farmers with a basic understanding of the organic farming concept. It encouraged them to work on specific technical issues like inter-cropping, biological pest control, and green manure. A second training was held in 1999. Meanwhile, farmers fully understood the principles of organic farming and undertook organic practices. They selected the technical innovations they were going to try out during the coming season. A third workshop, held in early 2000, evaluated the experiences gained during conversion. Workshops served as focal points to summarise and exchange experiences and document the joint decisions made in the communities. Apart from these formal training workshops, the advisors have undertaken regular visits to the pilot areas to discuss the ongoing experiments and propose additional options. Through the process, they have developed methods to systematise information on local farming systems and feasible options for conversion.

Stimulating technical innovations

During the process of conversion, farmers have gained experiences with a number of organic farming techniques. They have become more self-confident and are willing to solve problems locally. Their production systems have improved significantly, and some innovations have already spread to their neighbours following conventional practices. In order to cope with the higher demand for organic fertiliser, farmers have increased their livestock production and integrated green manure into their annual cropping cycle. Green manure was common in traditional agriculture, but has been replaced by chemical fertiliser during the “green revolution”. As a result, traditional manuring techniques have fallen into oblivion and seeds of green manure plants have disappeared. Initially, some varieties were made available by the project, but then farmers started searching for seeds of traditional varieties from their region. Experiments with green manure have been very successful and others who wish to purchase seeds of green manure varieties are approaching the organic farmers now.

Even though the conversion process started just three years ago, farmers are already experiencing a visible improvement of the agro-ecological environment. They find that the biodiversity is enriched by beneficial organisms, which have returned to their gardens after a long absence: bees now replace the artificial pollination of the kiwi flower and snakes control the population of rodents. Farmers have become more aware of soil fertility issues. The project has introduced the spade analysis as a simple tool for monitoring processes within the soil, and farmers have learned that the texture and consistency of the soils under green manure has greatly improved within this short period.

Organising smallholders

In the beginning, conversion was confined to a demarcated area of land on which a single crop is converted to organic production. But, the project has encouraged a voluntary approach with only those farmers who are interested in organic farming participating. As a result, some farmers within the designated area have been sticking to conventional production, while others outside this area have converted to organic farming. Altogether, a higher number of farmers and a higher acreage have been converted to organic farming than originally planned. The voluntary approach with dispersed plots has placed higher demands on the organisation of the internal control and certification system.

Farmers in Yufan Village have established the first association of organic kiwi growers in China with the objective of providing technical support and information, and organising marketing of organic products. The kiwi farmers now plan to establish a direct marketing outlet in the provincial capital. The Organic Kiwi Association has put much effort in the development of their own requirements and in the internal documentation system. Each member keeps his own records on inputs and outputs. Recently, those farmers who have been participating in the conversion from the beginning received organic certification.

Attracting political support

The objectives and framework of conversion planning have been carefully communicated with the State Environmental Protection Administration (SEPA) in Beijing, which showed great support for the development of organic farming. The conversion plan resulted from a months-long communication process between project staff and the farmers. Finally, the conversion plan has been integrated into the master plan for ecological reconstruction of Yuexi. The political support has raised the significance of the conversion process for environmental policies and further motivated the administrative staff engaged in this process. At the same time, Yuexi has gained importance as a national pilot area for organic farming. ■

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The project publishes a quarterly newsletter (English/Chinese), subscription free of charge.

The Cuban response to scarcity of inputs
Crop associations

Maria de los Angeles Pino and Humberto Ríos Labrada

Until 1989, Cuba's agricultural system was characterised by its dependency on foreign external inputs. This system covered over 70% of the country's arable land. In some parts of the country, such as in the eastern region and in the western province Pinar del Rio, traditional agriculture still played a dominant role. It was official policy to reduce the land share of small farmers: producers had to either pass on their land to state farms or form co-operatives (Trinks and Miedema, 1999).

After the collapse of the socialist countries in 1989, the share of monoculture-based agriculture diminished drastically. The use of fuel, the main agricultural input, fell from 13.0 to 6.1 million tonnes in two years. In the same period, the amount of fertiliser used fell from 1.3 to 0.3 million tonnes and expenditure on pesticides from 80.00 to 30.00 million USD (Rosset and Benjamin, 1993).

At the same time, farmers and scientists in Cuba began to look for alternatives that would protect plants from biotic and abiotic stresses. They attempted to use the land efficiently and experimented with low input levels. In these experiments, farmers' knowledge, underestimated for so long, played an essential role once again.

Traditional crop associations, such as maize-beans and maize-pumpkin that had been used before by small farmers, became a common practice in large areas. At the same time, unusual crop combinations, such as carrot-cabbage, lettuce-cabbage, carrot-garlic, tomato-beans, sweet potato-pumpkin, maize-tomato, banana-beans, banana-taro-beans-maize, sugar cane-beans, began to appear in areas that had long been dominated by monoculture practices. Even though most of the work by formal research institutions was still directed towards monocultures, many areas started to produce food in a manner that remained invisible to formal statistics by the early 1990s.

In this new situation of virtually no external inputs, most of the new crop associations were found to be more productive than monocultures. Many farmers practising crop associations were able to obtain two or more crops on the same piece of land, previously monocropped. The different crop production schemes made it possible for farmers to operate in different ways: first, to produce and sell the entire harvest of the principal or "duty" crop to the state market at very low prices, as is obligatory; second, to produce and sell on the free market, with strong price incentives. For instance, in huge sugar cane tracts, one or two rows of beans or cowpea were planted between two rows of sugar cane. In this way, farmers who sowed beans at the start of the growing period of sugar cane could either be self-sufficient in beans or sell them on the free market. Thus, polycropping allowed farmers to produce one official crop, and at the same time secure an income through selling secondary crops.

Polycropping also led to better control of pests and diseases in the absence of chemical pesticides, to more efficient use of very scarce inputs and to higher economic profitability. The polycropping approach quickly spread all over Cuba as a way of alleviating the consequences of the external input crisis. Scientists joined the movement and started research on this method.

Tomato and maize: an unusual association

Tomato (*Lycopersicon esculentum* Mill) was a typical monoculture in Cuba before 1989. This crop requires a combination of temperature, radiation and relative humidity that is optimal between October 21 and December 20 in Cuba. Producing tomatoes out of season, though extremely lucrative, is very expensive, as the production should, ideally, be in greenhouses with high-energy consumption.

The solution to this problem was found in using maize as natural shade for tomato, and thus modifying the microenvironment favouring tomato production off-season. Different spatial arrangements of tomato-maize were tested under small farm conditions. Fertilisation was done with a combination of biofertiliser and 90 kg/ha of Nitrogen (120 kg/ha of Nitrogen being the normal recommendation).

The most productive spatial arrangement was three rows of tomato planted between two rows of maize (see Figure 1). Maize was sown 30 days before tomato was transplanted. Every row was oriented from north to south.

This spatial arrangement led to a reduction of the radiation intensity by about 25% and a temperature decrease of approximately 3°C. Yields of tomatoes produced under maize shade increased by 5-6 tonnes/ha in comparison with tomatoes grown as a monoculture. The tomato-maize association decreased adult white fly presence by some 24% and reduced virus infections by 6%. Fruit quality was found to be better.

The main advantage for farmers is in being able to plant before and after the optimum sowing period, allowing them to market fresh tomatoes off-season and thereby increase income. In the transition from tomato grown as a monoculture to the tomato-maize crop association, the benefit-cost ratio increased from 1.9 to 3 when sown after the optimum moment or from 2.4 to 3.5 when sown before the optimum sowing time. At the same time, some maize was produced for home consumption or sale on the free market. (Pino, 2000, in preparation).

The once unusual combination tomato-maize is becoming more and more common in small, private farms (with, on average, one hectare of land) of the San José de Las Lajas municipality. One of the principal obstacles to further spreading of this crop association has been the difficulty of mechanisation. It is interesting to note how quickly farmers have adopted this and other low input systems, in a setting where few Cuban functionaries realised the advantages of crop associations as a principal component of the new Cuban agriculture. In spite of the fact that such alternative practices in agriculture have contributed to a slight recovery of the Cuban economy and to higher food security, policy makers still advocate a backward move towards use of high external inputs. In order to avoid a renewed dependency on external inputs, the challenge now, for researchers and farmers alike, is to gather more evidence on successful crop associations.

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The experience of family farmers from Tauá, Brazil

Organic cotton

Pedro Jorge B. F. Lima, Teógenes Senna Oliveira


Photo: Bert Lof

For more than two decades now, the so-called 'cotton crisis' strikes in the semi-arid Northeastern region of Brazil. This crisis has touched many sectors of the region's economy, but the burden lies mostly with the family farmers who usually plant cotton as their most important market crop. Since 1986, when the boll weevil (*Anthonomus grandis* Boheman) spread throughout the region, the crisis became even worse. The boll weevil was neither the only nor the main cause of the crisis, but it made the cultivation of traditional cotton crops (mocó, perennial cotton (*Gossypium hirsutum* L. r. *marie galante* Hutch) almost impossible.

In 1990, a local NGO, ESPLAR, began researching and developing agroecological alternatives for cotton cultivation in the semi-arid region. This was before the first demands for organic cotton in Brazil emerged. The initiative was a response to the demand of family farmers from two municipalities of the Ceara interior, in the Northeast of Brazil.

First steps

Between 1990 and 1996, ESPLAR carried out a Research & Development project titled "Ecological management of perennial cotton". Family farmers from different municipalities of Ceara took part in the discussions on what strategies for agro-ecological management to adopt and how to carry out the experiments. The management alternatives consisted of intercropping the perennial cotton, planting of an early maturing variety, removal of affected flower buds, and soil conservation measures.

The chosen alternatives found many barriers during experimentation. Farmers did not adopt all the recommended technologies, especially the removal of flower buds, which is crucial to the control of boll weevils. A long tradition of relatively extensive cultivation of perennial cotton made it difficult to cater to the additional labour needed.

However, in 1994, on the basis of the first results, diffusion of the proposed technologies took place. It was supported by a loan of US$150/ ha. 130 farmers cultivated almost 250 ha of crops. Although they did not reach the expected cotton production levels, the alternative management system resulted, in many cases, in the restoration of soil fertility, and in the continued maize and beans intercropping. Besides, substantial increases in the intercropping of Leucaena (*Leucaena leucocephala)* and the making of contour lines were observed (Sousa, 1999). It was the start of a gradual change of mind and an inversion of the predominant logic of many farmer-researchers.

Despite the limitations in production, the merit of this initiative was the exposure of ESPLAR and the farmers' organization of Tauá (ADEC) to the emerging market for organic cotton. Thus, in 1993 and 1994, ADEC sold 10.5 tons of cotton fibre, produced without any chemical input, for the production of organic cotton T-shirts for Greenpeace Brazil.

A new R & D project

In 1997, ESPLAR started a new project to develop cropping systems of both perennial (mocó) and herbaceous cotton on an agroecological basis. At that time there was deep discouragement amongst the farmers to continue growing cotton, due to consecutive crop losses.

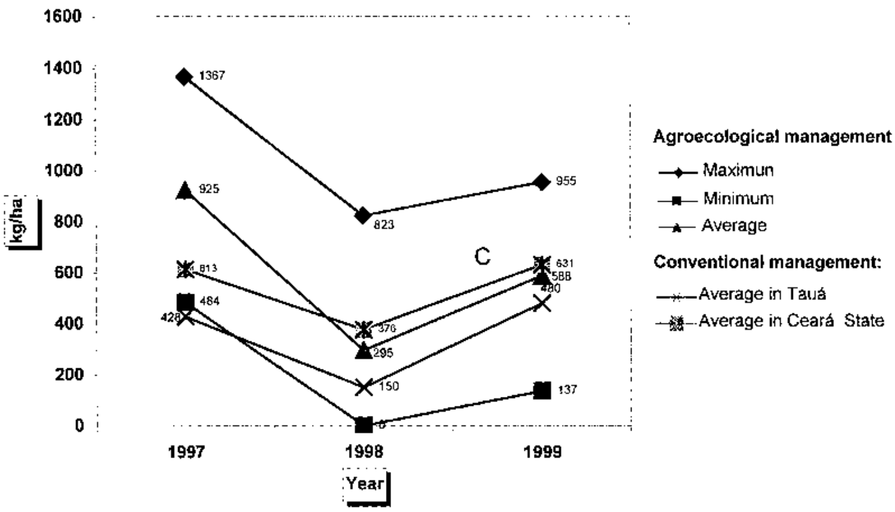
The new practices to be tested included planting of annual, herbaceous cotton at the beginning of the wet season, always in association with maize, beans and/or sesame, besides legumes such as *Leucaena* and/or *Cajanus cajan.* Cotton is planted in strips of 5 or 6 lines, alternated by strips of the other crops. Contour lines and other soil conservation practices are adopted where necessary. Fertilization is done with farmyard manure, depending on the quantity available to each grower, as well as with biofertilization of the leaves with fermented fresh manure mixed with other mineral, vegetal and animal components that are found locally. Pest management is based on the removal of flower buds affected by the boll weevil and on monitoring of the boll weevil population by means of pheromone traps. Moreover, farmers make use of *Trichogramma* spp. to biologically control *Alabama argilacea* and other harmful insects. Sprayings with Neem (*Azadirachta indica*) leaf extract are also used to control worms and as a repellent for the white fly. After harvesting, cattle graze on the crop residues in the fields. During the wet season the pruning of *Leucaena* is recommended for use as mulch.

In order to stimulate the farmer-researchers to apply most of the practices, ESPLAR has established a "risk contract", which gives each of them R$150 on a loan basis. After harvesting, the cotton goes to ADEC to be ginned and accounts are settled. The surplus is paid to the grower, but when the production value is lower than the debt, ESPLAR bears the loss.

Participatory research and extension: its results

Despite 3 consecutive years of drought, from 1997 to 1999, the number of growers using soil conservation practices, associated crops and ecological pest management in cotton production has increased considerably, from 4 to 154 in the year 2000. Some of them have been certified as organic cotton growers. All of them received technical support from ESPLAR. In the same period, the cultivated area increased

Figure 1 – Yield of herbaceous cotton with agroecological management in the experiments in Tauá and with conventional management in both Tauá and Ceará state, 1997-99.



from 2 ha to almost 180 ha, as is shown in Table 1. This indicates that the research strategy of associating participatory experimentation with the extension of the agroecological practices was successful.

The results obtained with the 4 original farmer-researchers in 1997, positively influenced dozens of other farmers. These farmers decided, often after years of abandonment, to start growing cotton again. In addition, the price for certified organic cotton, which reached a premium of 30% above the price of conventional cotton, was an extra incentive. Around 70% of the farmers indicated that they had been directly influenced by the 4 original farmer-researchers.

The average yields of the ecologically grown cotton in the experimental areas, during the 1997-1999 period, were always higher than the average yields obtained in Tauá for conventional cotton in monoculture (Figure 1). When compared with the yields of Ceará state, the experimental fields in Tauá were yielding higher in 1997, whereas the Ceará average surpassed the experiments in the two following years. It should be noted that due to intercropping, it was possible to harvest additional crops such as maize, beans, sesame and *Cajanus cajan.* They are, despite their small quantities, important contributions to the food needs of the farmer families.

In this organic cotton production system, boll weevil control is still a bottleneck, as there are no specific techniques on how to grow cotton together with the pest. Thus, in the dry years, 1997 to 1999, the recommended practices showed a relatively easy control of the insect. In a wet year with a much higher incidence, as in 2000, the control becomes more difficult.

Until now, the volume of organic cotton harvested has been relatively small, but has good market prospects with organic textile factories, both national and international. Several textile companies, from Brazil and abroad, have contacted ESPLAR for buying organic cotton. However, the current supply in Tauá is not enough to meet all the demands. Even if the potential to increase production in Tauá is considered, it will hardly exceed some tons of fibres per year. Nevertheless, Tauá is gradually becoming a reference point for organic cotton production in the semi-arid region of Ceará and the Northeast of Brazil. In 1999 ADEC made one more step ahead in aggregating value to the organic cotton, when it contracted the spinning of 3 tons of organic fibre.

Another relevant result of the research is related to the ecological control of the white fly (*Bemisia* spp.). The farmer–researchers are encouraged to carefully observe the interaction between insects, spontaneous and cultivated plants. In 1998 it was observed that the white fly strongly prefers sesame (*Sesamum indicum*). The infestation levels in sesame in 7 systematically monitored intercrops were 6 to 20 times higher than in cotton. It was also verified that two spontaneous plants with fuzzy branches and leaves, known as “gervão” or “rabo de raposa” (*Stachytarphetta cayenensis*) and “pega-pega” or “amor de velho” (*Mentzelia fragili*), attract and kill adult white flies. This opens up possibilities to effectively control this cotton pest by incorporating these plants in crop associations.

Progress, limitations and prospects

Research to design, test and diffuse agroecological alternatives for organic cotton growing, with the direct participation of family farmers in the semi-arid region of Ceará has faced serious difficulties. They are inherent to the environmental conditions of the region, to the poverty situation that excludes most of the population from formal credit, and to the unsustainable practice of traditional cotton production.

10 years later, it is observed that an increasing number of farmers are gradually adopting the agroecological practices. They are driven by the need to preserve the scarce natural resources and stimulated by the possibilities of an emerging organic market, offering higher prices.

Presentation of the results through the media and at several technical and scientific events, in and outside Ceará, roused the interest of many technicians, cotton growers, municipalities, NGOs and even the regional bank, in the organic cotton experience. This opened up the prospect of expansion to other states in the Northeast of Brazil. Furthermore, partnerships with official education and research and development institutions were established.

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Table 1: Evolution of the number of family farmers adopting agroecological management with cotton consortia, according to certification results, Tauá - CE, 1997-2000.

Year	No of Farmers			Area (ha)		
	Total	Organic	In conversion	Total	Organic	In conversion
1997	4	4	0	2	2	0
1998	69	18	51	103	27	76
1999	104	42	62	144	57	87
2000	154	*	*	182	*	*

**Numbers not available yet, until the certification by the IBD - Instituto Biodinâmico, from Botucatu, São Paulo.*

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Photo: Billy Howard, Esq./courtesy CARE, c.2000

Rice - fish integration increases production and income

Ecologising rice-based systems in Bangladesh

Marco Barzman & Luther Das

The Green Revolution in Bangladesh altered highly diversified agroecosystems that were strongly dependent on natural processes. A wide variety of vegetables such as lentil (*Lens esculenta*), eggplant (*Solanum melongena*), amaranth (*Amaranthus tricolor*), chilli (*Capsicum annuum*) and okra (*Abelmoschus esculentus*) were grown as field crops in the middle elevation areas between the homestead and the rice fields. Climbing vines such as bottle gourd (*Lagenaria siceraria*), bitter gourd (*Momordica charantia*) and country bean (*Dolichos lablab*) were grown in the highest elevations, using trees and houses as support. A wide variety of trees usually surrounded the homestead areas. Oxen, goats, and chickens were abundant. Irrigation networks covered only 15% of the country's cultivated land. A single annual crop of rain-fed rice was grown during the monsoon and rice fields were mainly confined to low-lying areas. Native wild fish and other aquatic organisms entered rice fields freely. The fish actively migrated and settled in the fields to breed. Rice farmers exploited this source of protein and made sure to open their dikes at the beginning of the monsoon. They also placed branches in their flooded fields to create a habitat more attractive to gravid brood fish. The use of composted cowdung and legumes such as *Sesbania rostrata* along with regular silt-laden floods maintained soil fertility. The absence of pesticides favored a balance between pests and natural enemies. These traditional systems provided a sustainable supply of fruit, vegetable, grain, meat, eggs, fish, fodder, fuelwood, construction material and animal power.

Green Revolution changes

Today, irrigation networks extend over 40% of Bangladesh's cultivable land. Rice areas have been gradually extended, two crops of rice per year is now the norm. Increased production is nearly meeting the needs of 130 million people. There have been, however, serious unforeseen agro-ecological consequences. Vegetable production for household consumption, now confined to the homestead, no longer meets the requirements of the rural population. The number and diversity of trees has reached catastrophically low levels generating a fuel crisis and a scarcity of fruit. With a scarcity of fodder, oxen are difficult to maintain and are increasingly replaced by mechanical tillers. The small quantity of dung still available is used almost entirely as cooking fuel, leaving little for organic fertilizer. Elevated roads, flood control, pesticide residues and eutrophication from fertilizers stopped the migration of fish from rivers to rice fields. Populations of native fish species (*Channa* spp., *Heteropneustes clarias*, *Anabas testudineus*) are now endangered and the traditional rice-fish systems have disappeared.

The system is already showing signs of unsustainability. Most rice farmers are dependent on insecticides for pest control. A 1995 CARE survey of rice farmers in Comilla district—a high-input use area—showed that 96% used insecticides during the dry season. But despite—or due to—the prevalence of insecticide use, old farmers report that insect pests are now more difficult to control than in their youth. They also report increasing fertilizer dosages for the same yields and are nearly unanimous in saying that their soils "are tired".

The decrease in the ability of rural households to produce vegetable, fruit, and high-protein food has contributed to an unbalanced diet, over-reliant on rice. The increased rice yields, on the other hand, have not translated into either improved nutrition or income.

CARE's Agriculture and Natural Resource sector realized that some of the elements of diversity and natural pest control from traditional systems could be restored to the intensive rice monoculture systems. The "ecologised" rice-based systems would help to increase the availability of diversified food while making the systems more sustainable. Using the Farmer Field School approach, the New Options for Pest Management (NOPEST) project introduced farmers to the ideas of integrating vegetables, fish and trees in their rice systems using a natural pest control approach. The "new-old" techniques have been widely adopted by more than 40,000 farmers without negatively affecting rice yields.

Reverting to natural pest control

Starting in 1995, the project promoted non-chemical means of pest control in rice. As a result, 85% of participating rice farmers completely left out the use of synthetic insecticides within a single season, and continued to practice natural pest control 5 years later. They rely on natural enemies

Table 1. Rice yield differences between users and non-users of insecticides.

	Dry season 1998 Mean rice yield (t/ha)	Monsoon 1998 Mean rice yield (t/ha)	Dry season 1999 Mean rice yield(t/ha)
Project participants using no insecticides	4.66 (n=134)	3.28 (n=172)	5.11 (n=114)
Non-participants using insecticides	4.18 (n=155)	2.73 (n=172)	4.71 (n=152)

Table 2. Rice yield differences between rice-vegetable and rice-only systems.

	Monsoon 1998 Mean rice yield (t/ha)	Dry season 1999 Mean rice yield (t/ha)
Participants' rice-vegetable	3.61 (n=13)	5.82 (n=10)
Participants' rice-only	3.66 (n=17)	5.16 (n=14)

Table 3. Rice yield differences between rice-fish and rice-only systems.

	Monsoon 1998 Mean rice yield (t/ha)	Dry season 1999 Mean rice yield (t/ha)
Participants' rice-fish	3.04 (n=35)	5.25 (n=35)
Participants' rice-only	3.66 (n=17)	5.16 (n=14)

Table 4. Rice yield differences between rice-fish-vegetable and rice-only systems.

	Monsoon 1998 Mean rice yield (t/ha)	Dry season 1999 Mean rice yield (t/ha)
Participants' rice-fish-vegetable	3.30 (n=3)	5.59 (n=10)
Participants' rice-only	3.66 (n=17)	5.16 (n=14)

and on the ability of the rice plant to compensate for insect damage, with no negative effects on their yields. The yields of project participants using no insecticide are consistently higher than those of non-participant insecticide users (see Table 1). Since the project participants also modify other practices, besides foregoing insecticides, it cannot be said that the yield increase is due entirely to the absence of insecticides. It does show, however, that insecticides are not needed to obtain yield increases. Project participants have higher net returns than insecticide users. In 1998, the average net return from the rice crop of participants, if they sold the entire crop, was Tk.5,373 (=US$107) per farmer per season, as opposed to Tk.3,443 (=US$69) per farmer per season of insecticide users.

Integrating vegetables

In 1991, a group of agronomists from CARE visited Sitakondo (Chittagong District), in the southeast of Bangladesh. They found what appears to be an indigenous dike crop system. Covering several kilometers, dikes between and surrounding rice fields are occupied by rows of country bean grown on simple supports. Local growers did not know the origin of the method and believed it to be ancient, attested to by the large number of country bean varieties in the area.

This system, along with experimental dike cropping systems from Indonesia prompted CARE staff to initiate a pilot project involving this technique. In 1995, the project began exposing men and women farmers to such cropping systems using the Farmer Field School approach. Since then, at least 40% of participating farmers are growing vegetables on the dikes of their rice fields, by elevating and widening their dikes. The most successful crops have been country bean, yard-long bean, bottle gourd and okra, all of which, except for yard-long bean, are traditional crops.

Data of 1998 and 1999 show either no difference or a slight increase in the rice-vegetable systems, in spite of the area lost to dike crops, i.e., the entire rice-vegetable field—the check plus the wider dikes—is producing at least the same total quantity of rice (see Table 2). The net returns from the vegetable crop that farmers would obtain if they were to sell the entire crop—they usually sell $\frac{1}{4}$ of the crop—is Tk.733 (= US$15) per farmer per season, an added value of 14% to the rice crop. Rice-vegetable growers eat vegetables more frequently and share the surplus with neighbours, friends and relatives.

Trees-on-dikes

The project also introduced the idea of growing trees on the dikes without affecting the rice crop, using cultural practices, such as periodical pruning of roots and branches. This type of pruning is perfectly appropriate to trees producing timber, cooking fuel and fodder. Now, 35% of project farmers are growing bokain (*Melia azidirach*), shishoo (*Dalbergia sissoco*), mahogany (*Swietenia macrophylla*) and acacia (*Acacia auriculiformis*), and continue to tend them long-term. Although it is too early to formally evaluate the benefits of this technique, the number of farmers planting trees on their dikes is growing and many have initiated small-scale tree nurseries to supply their community with planting material.

Integrating fish in rice-based systems

ICLARM and the Bangladeshi Government's Fisheries Research Institute were among the first to experiment with integrating fish in flooded rice systems in Bangladesh, but their ideas were not extended to farmers. In the 1992 dry season, CARE conducted pilot activities in which 180 farmers experimented with rice-fish using non-native fish species as common carp (*Cyprinus carpio*), tilapia (*Tilapia* spp.) and sharputi (*Puntius gonionotus*). These early trials showed that rice yields were increased by 16% with rice-fish relative to the previous dry season with rice-only, 6% of which was attributed to presence of fish in the rice field.

In 1998 and 1999, yield data of project participants practicing rice-fish compared to those practicing rice-only shows that rice-fish causes no significant decline in rice yields, and in some cases even an increase. The rice yields presented here are underestimated by about 5% because the ditch area in the rice-fish field was not taken into account when calculating rice yields (see Table 3).

The net returns from selling all the fish average Tk.7,354 (= US$147) per farmer per season. This is more than the returns from rice and it is perfectly compatible with rice production. Although not all rice fields are feasible for rice-fish systems, 30% of project farmers are practicing it and their numbers are constantly increasing. As with vegetables, rice-fish farmers eat fish more frequently and donate much of it to their social networks.

Integrating both vegetables and fish

Of course, both vegetables and fish can be integrated into the rice monoculture and we estimate that 18% of project farmers have done so. As expected, their rice yields are not inferior to those of farmers practicing rice-only (see Table 4).

In conclusion

Cereal crops are frequently considered to be obligate monocrops. Our experience, however, shows that there are many ways in which rice can become part of a more

Photo: Billy Howard, Esq./courtesy CARE, c2000

Planting vegetables on rice bunds to improve nutrition and income

diversified agroecosystem. The "ecologised" monocrop becomes more productive, it offers more services to the farmer household, and the multiple ecological interactions within the system increase its sustainability. The successes we obtained in diversifying rice monocultural systems still represent the initial stages in making small-scale agriculture more sustainable. Areas that require future attention include use of native fish species, integration of livestock, interactions between the home garden and the rice field, and scarcity of organic inputs for soil fertility management in rice. In other words, there are probably still many possible beneficial options that could further diversify and "ecologise" these systems.

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Photo: Jan Valkoun

A dense stand of wild wheats (T. dicoccoides and T. urartu) in southern Syria

In defence of monocultures

David Wood

Crop monocultures are almost universally decried as unnatural, ecologically dysfunctional, and a threat to sustainable agriculture. At least part of this belief is based on the idea that all would be well if agriculture could mimic the structure of natural vegetation, which time has shown to be productive, stable and biodiverse. However, relatively complex natural vegetation - for example, tropical forest– is always suggested as a model for fields rather than simpler vegetation. Consequently, all prescriptions for ecological agriculture recommend between-crop diversity (polyculture), even to the extent of combining trees with crops (agroforestry). This diversity is thought to bring higher levels of productivity, stability, sustainability and equitability. This 'defence of monocultures' will question the *sole* reliance on complex models for *all* agriculture. In contrast, it will suggest that more appropriate models for a key section of farming - annual cereal cropping, now producing most of our food - can be found in vegetation dominated by single species, that is, 'natural monocultures'. Is there something that can be learned from natural monocultures that could be of value to sustainable cereal cropping?

Monocultures in nature

It has now been recognised by ecologists that monocultures exist throughout nature in a wide variety of circumstances, of which two could be of importance for sustainable agriculture.

***Marginal conditions**:* Firstly, natural monocultures are found in geographically marginal conditions, very commonly, between water and land. There are many familiar examples like the reed beds of *Phragmites australis* growing on the margins of fresh-water lakes in Europe. Such stands can have an age in excess of 1000 years. Salt marshes on the margin between land and sea in Europe and North America are often dominated by species of the grass genus *Spartina*. Net annual primary productivity of *Spartina alterniflora* marshes has been reported as up to 60 tonnes/ha, a figure close to the highest dry matter yields of intensively managed arable crops.

***Disturbed conditions**:* Secondly, natural monocultures are found in disturbed conditions as in the case of *Impatiens glandulifera,* a summer annual that colonises the margins of water courses in Europe. It has been argued that the objective of many forms of arable farming, especially cereal cultivation, is to achieve weed control by creating conditions in which the crop plant attains the dominant status. As in the example, dominance of a cereal crop depends primarily upon the synchronous germination of a high density of large seeds followed by the rapid development of a dense vegetation cover composed of a large number of plants of comparable age and maturity. More generally, the importance of cereals - that is, grasses - in food production may relate to the ability of grasses to resist disturbance, indeed to thrive under seasonally disturbed conditions.

Natural monocultures as models

***Rice**:* If there is a natural model for monocrop wet-rice production it should be found in a region of domestication of rice, in southeastern Asia, among wild relatives of domesticated Asian rice. The seasonally flooded rivers and deltas of the great silt-laden rivers draining the Himalayas seem to provide the ecological conditions for wild rice monocultures. The wild rice relative *Oryza coarctata* was the most common and plentiful grass species in the Sundarabans mangrove swamps of Bengal and: 'the first species to establish itself on newly-formed alluvial river banks, which are both marginal and seasonally disturbed by flooding.'

If early farmers chose swamps, first to gather, then to farm rice, they would be working in habitats where 'natural monocultures' are common. Single dominants are able to monopolise a swampy site to the virtual exclusion of any rival and any understorey. In addition, swamp vegetation has relatively high productivity, generally around 15-20 tonnes/ha/year. This is attributed to a plentiful supply of nutrients, due to flushing with nutrient-rich water, and low water stress for most of the year.

***Sorghum**:* Savannah grasslands worldwide are often dominated by limited numbers of species, often from the grass tribe *Andropogoneae,* a tribe which includes *Imperata*, but also *Sorghum* and *Saccharum* from which the crops sorghum and sugar cane were domesticated.The *verticilliflorum* race of *Sorghum bicolor* was identified as the progenitor of cultivated sorghums. It was found as the chief dominant, in enormous quantities, of the extensive tall-grass savannah of Sudan and Chad. Sorghum was domesticated somewhere along a belt south of the Sahara from Chad to western Ethiopia. The races *aethiopicum* and *verticilliflorum* of *Sorghum bicolor* are often dominant grasses in the northern savannah of Africa. These 'massive stands' of wild sorghum provide both an evolutionary and ecological pedigree for monoculture sorghum cropping.

***Wheat**:* Perhaps the strongest evidence of the importance of natural simple models for cereal agriculture comes from immediate wild relatives of wheat. These are found in the Near Eastern region of domestication, where there has been the most intensive research on crop relatives. Botanists and plant-collectors have repeatedly and emphatically noted the existence of dense stands of wild relatives of wheat. Wild einkorn (*Triticum monococcum* subsp. *boeoticum*) in particular tends to form dense stands, and when harvested its yields per square metre often match those of cultivated wheats under traditional management. Wild emmer (*Triticum turgidum* subsp. *dicoccoides*) grows in massive stands in the northeast of Israel, as an annual component of the steppe-like herbaceous vegetation and in the deciduous oak park forest belt of the Near East. The stand density of these wild cereals is comparable to cultivated fields, suggesting that these southwestern Asian cereals form the basis of modern monocrop agriculture.

Ecological determinants

Although the simple structure of natural monocultures may indicate a model for cereal cropping, a major question remains unanswered. What are the ecological determinants of natural monocultures, and can these be reproduced in sustainable cropping? Answering such questions would allow farmers not just to mimic the structure of natural monocultures, but also to mimic the ecological processes that maintain natural monocultures. Despite considerable recent research by ecologists on the role of species diversity, very little of the newer work takes up the question of why some ecosystems have more species than others. Yet some argue that low species diversity is characteristic of unpredictable and 'environmentally buffeted' environments, and that diversity is not correlated to environmental productivity, as in the case of salt marshes.

Natural flood and fire regimes are examples of environmental buffeting. At the time of transition between food gathering and cropping, early farmers would have been very aware of the impact of ecological determinants such as fire and flood on both productivity and the structure of natural cereal monocultures: human existence depended on this knowledge. A transition to farming that mimicked natural disturbance regimes in early fields would maintain the undoubted robustness of natural monocultures. For rice, the 'artificial swamp' of the field reduces competition from weeds and has allowed rice to persist in pure stands, as with many grasses in natural swamps. For the seasonally-dry grasslands which form a natural model for sorghum, and for wheat and barley fields, seasonal burning or grazing may be the 'fluctuating environment' that gives grasses the competitive advantage in annual seed production.

Diversity within monocultures

The level of within-species diversity in natural monocultures is also of direct importance for agriculture. Monoculture is defined by IBPGR (1991) as: '*the growing of a single plant species in one area, usually the same type of crop grown year after year*'. Nothing is said in this definition of variation within the crop species: complex varietal mixtures, as often found for example in common bean (*Phaseolus vulgaris*) under traditional farming, are monocultures by this definition. However, the term monoculture is now commonly used as a synonym for single-variety fields. Whatever the usage for fields, it will be important to know the genetic structure within natural monocultures and how it compares with the genetic structure of species found in more diverse vegetation. There are indications that some natural monocultures may be genetically uniform – for example, the many examples of aquatic plants, which spread vegetatively – with no intra-specific genetic diversity. It is commonly thought that such a low level of diversity is unsustainable in farmers' fields. How then does it persist in nature? In contrast, if natural monocultures of wild relatives of our cereals are found to be genetically diverse, then varietal mixtures could add sustainability to cereal cropping.

Crop-associated biodiversity

Concern over the ability of crop monocultures to maintain associated biodiversity may be misplaced. There is now substantial evidence that single crops such as rice have self-regulation through great crop-associated biodiversity. At higher trophic levels, including parasites and predators on the herbivores, there is yet more diversity. Management of the crop cycle to increase detritus from the rice crop could encourage detritus feeders and, in turn, natural enemies of rice pests, contributing to substantial biodiversity in a monoculture, and, under most circumstances, minimal pest damage. Indeed, the main problem with monocultures in Green Revolution agriculture could be the loss of associated biodiversity due to the use of agrochemicals, intensive tillage and the large-scale of production, rather than the monoculture itself. More information is needed from wild ecosystems to indicate how the biodiverse properties of natural monocultures can be maintained in agriculture.

Conclusions

Hitherto agroecologists have claimed that sustainability results only from complex polycultures, which mimic complex - and therefore stable - natural ecosystems. While this may be true for more equable tropical regions, it may not always apply to seasonally disturbed or marginal environments. Indeed, cereal cropping – producing most of our food - may be a close mimic of structurally simple but seasonally stressed and disturbed natural grassland ecosystems.

However, before simple natural models can contribute to sustainable farming, we need answers to many questions. There is an urgent need for research on natural monocultures – preferably on the close relatives of our most important cereals such as rice, wheat, and sorghum. We need to know:

- The genetic structure of natural monocultures: are they genetically uniform or diverse? What implications could this have for annual cereal production and could combinations of different varieties be more productive and sustainable than the present monocultures?
- How does the level of genetic diversity relate to persistence under pest and disease pressure and to short-term adaptation? Can this provide lessons for sustainable farming?
- What role does crop-associated biodiversity have in self-regulation of monocultures and what is its contribution to productivity and sustainability? What implications does this have for the technologies used in production of monocultures?
- What are the ecological determinants of natural monocultures? Does their ecology always include natural stress or disturbance such as burning or flooding that could provide models for field management? Are there lessons for zero-tillage systems?
- Finally, were natural monocultures an ecological pathway to domestication, skilfully managed by the first farmers and becoming our first fields? Or, have traditional monocultures always been mixed to some extent with other crops?

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A longer version including references is available from the author and on ILEIA'S web site www.oneworld.org/ileia.

Pasture Cropping

Darryl Cluff and Col Seis have grappled for many years with the development of workable and regenerative solutions to the severe land degradation problems in the Birriwa-Gulgong area in central west New South Wales, Australia. In the 19th century, the perennial grasslands on the flat to undulating country, with an average but highly variable rainfall of about 600 mm, were very productive and ideal for raising livestock. However, the winter-active perennial grasses and palatable native legumes disappeared due to set-stocking and failure to reduce stock numbers during droughts. Since 1882 cropping became a major enterprise for most farmers. Traditional techniques, which involved the complete removal of all vegetation, resulted in vast tracts of bare ground both before and after the crops. Soil erosion and nutrient decline on arable land became extensive.

In 1995, they started to experiment with direct drilling of oat and wheat into native pasture. They direct drilled the grain into the permanent groundcover at 25-30 cm row spacing, using 80-100 kg seed and 210-330 kg NPS fertiliser per ha. The pasture cropping technique utilises a niche in the growth cycle of what remains of grasslands that have lost cool season perennials almost completely. Yields were similar to those from conventional farmers crops. But as the cool season annual cereal crops face little competition from warm season perennials they require no cultivation and little or no herbicides, and they improve the vigour and biodiversity of the grazed pasture and the condition of the soil.

They are now trying alternative crops such as lupins and are experimenting with resowing of native grasses with the crop seed to improve the pastures. Livestock is an important component of pasture cropping. Seis improved the gross profit on his sheep enterprise by using sheep to heavily graze pastures prior to sowing. Adaptation of machinery to the needs of pasture cropping was important in the creative innovation process.

'Only lack of imagination prevents us from growing productive healthy crops in sustainable biodiverse landscapes'.

Adapted from: Pasture cropping by Christine Jones, published in: In Practice, July/August 1999, pp.12-14. Further information: Christine Jones, PO Box 199a, Armidale NSW 2350, Australia, cjones@dlwc.nsw.gov.au

How to grow winter wheat? The Fukuoka-Bonfils method

Winter wheat is normally sown in September-November and grows just a little before going dormant in winter. The winter cold triggers flowering. After the floral initiation in January, the plants develop a number of tillers and are finally harvested in August.

There are a number of drawbacks in growing winter wheat the conventional way. As the plants are still small at the onset of winter, soil erosion is high. Tillering takes place in February-March when temperatures are sub-optimal for this physiological stage of plant growth. The plants are vulnerable and require numerous treatments against weeds and fungi. The frequent tractor passes over the land lead to compaction and bad aeration of the topsoil.

Marc Bonfils' method

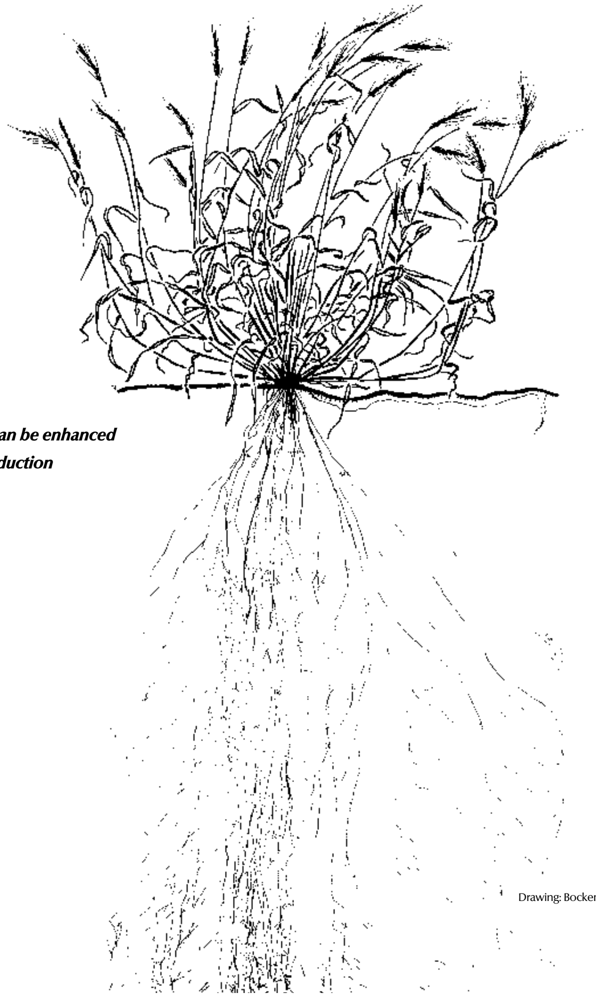
Is there an alternative? Can we regenerate our soils and still grow the food we need? Marc Bonfils has experimented with alternative cultural measures in the region of Beauce, France, for many years and has developed a system that embraces the general principles of permaculture. Although Bonfil's method is primarily for wheat, it is easily adaptable to other cereals. Bonfils found a way of growing food without ploughing in the European climate, as Masanobu Fukuoka did in Japan.

At the end of June – much earlier than in the traditional way - wheat is sown, or rather *pressed* into the soil at a spacing of 60cm, through the carpet of spreading perennial clover, previously sown in April. The clover cover assures Nitrogen fixation, better bacterial life, and development of algae that are also capable of fixing Nitrogen. During its long vegetative period the wheat plant makes deep roots before winter sets in, thanks to better availability of nutrients and greater bacterial activity. This gives the plants a head start for the next summer. Yields of over 15 tons per hectare (6 tons per acre) have been obtained in this manner. A comparison of some parameters:

	Conventional	Bonfils
Plants/m	350	1.5-4
Ears/plant	0-3	100-150
Earlets/plant	12-15	35
Grains/ear	20-30	40-60
Weight of grains	Low	High

Even before harvesting of the ears, the new wheat crop is already pressed in through the clover carpet amongst the maturing 'bushes' of wheat. Clover is a perennial: it is not sown each year but simply cut down at the beginning of the season, at a height that does not damage the wheat plants.

After harvesting in August, the straw and chaff are returned to the field. In this method, tillage is reduced to a bare minimum, avoiding practices like ploughing and compaction that retard the process of revitalising the soil.



Tillering in grain crops can be enhanced to increase production

Drawing: Bockemühl, 1980.

Advantages

The optimal temperature for tillering is 20-25°c. In Bonfils' method, unlike in the conventional, tillering starts already in August of the year of sowing, when temperatures are closer to the optimal. A better root system develops and a better plant stand is obtained, reducing leaching of nutrients in winter. These bigger plants appear to resist the cold better than young seedlings. With a wider stand, much more tillers are produced, each tiller leading to an ear. The tillering period starting in August is much longer than with the conventional winter wheat growing method.

Problems

The main danger lies in the wrong choice of variety: if a strictly winter variety is not used, then the plants will go to grain before winter, producing less than the standard methods. Most modern varieties, being hybrids between winter and spring or warm-climate types, have this tendency. Therefore, one should seek long-straw, traditional varieties, with strong vegetative vigour that gives plenty of side-shoots and dense foliage.

Mechanical harvesting constitutes a problem in the Bonfils method, as harvesting takes place amidst young, vulnerable seedlings. Cutting should be at least 5 cm above the soil.

A problem of the wheat-clover association is that the wheat grows too tall because of the richness in soil Nitrogen. Sowing wide, permitting maximum sunshine and thus reducing the risk of lodging of the wheat, can counteract this. ■

Adapted from
- Marc Bonfils. ***Le blé d'hiver et sa physiologie végétale selon la méthode Fukuoka-Bonfils***. Permaculture Pyrénées. Association las Encantadas. B.P. 217. F-11300 Limoux, France.
- Marc Bonfils. **The harmonious wheatsmith: can we regenerate our soils and still grow the food we need?** Permaculture Association, Old Cuming Farm, Buckfastleigh, Devon TQ11 0LP, UK.

Similar experiences are presented in:
- Sayre KD, Moreno Ramos OH. 1997. **Applications of raised-bed planting systems to wheat. Mexico**, DF (Mexico): CIMMYT. 36 p. Series: CIMMYT Wheat Special Report (WPSR) No. 31.

Update on the System of Rice Intensification

Photo: Association Tefy Saina

Well-developed SRI rice plant.

The ecological System of Rice Intensification (SRI) developed in Madagascar gives remarkably good results. Hundreds of farmers have increased their irrigated rice yields to 6–10 and even 15 tonnes. The main characteristics of the approach are: capturing full potential for tillering by early transplanting, planting one by one with wide spacing; providing full potential for root growth by creating aerobic conditions, alternative wetting and drying of the field, minimum irrigation and early and frequent weeding. A comparison of some parameters:

	Conventional	SRI
Seed requirement (kg/ha)	80 to 120	5 to 10
Transplanting after days	20 to 30	8 to 15
Spacing cm	10x10 to 20x20	25x25 to 50x50
Transplants per clump	3 to 4	1
Plants/m^2	75 to 150	4 to 25

A full description of the SRI approach has been published in the LEISA Newsletter Vol.15 3&4, pp.48-49, "Revolution in rice intensification in Madagascar", by Justin Rabenandrasana.

There is an increasing interest in the approach, as confirmed by Norman Uphoff of CIIFAD in a recent update on SRI trials, which states:

Madagascar: In January 2000, Robert Hirsch did a report for the French Development Agency, "*La Riziculture Malgache Revisitée: Diagnostique et Perspectives*, 1993-1999," He reported that over the period 1994-99, the average yields of farmers using SRI had ranged between 6.7 and 11.2 t/ha.

In contrast, the SRA system of rice improvement, recommended by the government and uses HYVs and fertiliser, produced average yields ranging from 3.12 to 4.92 t/ha in the same irrigation systems. Traditional practices averaged 2.78 t/ha.

China: The first willingness to test SRI outside of Madagascar was at Nanjing Agricultural University. Dr. Ding Yanfeng in the NAU Department of Agronomy set up SRI trials in June-October 1999. With plant spacing 25x25 cm and 20x30 cm, the yields were 9.5 t/ha and 9.2 t/ha, but with spacing of plants 30x30 cm, the yield was 10.5 t/ha. This is well above the current national average of 6 t/ha, but more important, it was obtained with about half as much water as usual. More trials are being undertaken during 2000.

Indonesia: During the wet season 1999-2000, Central Research Institute for Food Crops (CRIFC) conducted SRI trials at Sukamandi station, with a yield of 9.5 t/ha. Nearby farmers' yields with SRI methods were 5.9-6.9 t/ha. CRIFC now plans to conduct SRI trials at its stations throughout the country during 2000, if possible in all provinces, to assess any variations in ecosystem suitability.

Ivory Coast: The West African Rice Development Association (WARDA) conducted a series of tests during the 1999 season, which were characterised at first as "disastrous." Yields from two different varieties with SRI methods were only half as much as with WARDA varieties and methods.

However, WARDA conducted the trials without water control, so seedlings were inundated for much of their early growth period, nullifying the synergistic effects of SRI methods, which require well-drained soil.

WARDA has designed three sets of trials comparing SRI with conventional methods for testing in 2000.

Also in Nepal (CIIFAD), Cambodia (CEDAC), Sri Lanka (Ministry of Agriculture), Cuba (The Institute for Investigation of Rice), Sierra Leone (World Vision International), Bangladesh (CARE International), India (ActionAid), Colombia (CIAT), Honduras (Pan-American School of Agriculture at Zamorano), South Africa (Agricultural Research Council of the University of Pretoria) and Ghana (Ministry of Agriculture) trials have been or will be started.

Trials that we do not know about may be going on in other places, since papers on SRI have now circulated fairly widely. ■

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- Cornell International Institute for Agricultural Development (CIIFAD), Box 14, Kennedy Hall, Cornell University, Ithaca, NY 14853, USA.
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- Stoop WA, Uphoff N, and Kassam A. 2001. **Raising food production and achieving agro-ecological sustainability in farming systems for resource-poor farmers through integrated agricultural science**. A review based on the System of Rice Intensification (SRI) from Madagascar. Accepted for publication in "Agricultural Systems".

Genetic diversity and disease control in rice

Scientists from the Philippines-based International Rice Research Institute (IRRI) have found a new way to control a major disease in rice without using any chemicals. By planting different types of rice alongside each other, they could almost completely control the spread of rice blast, a disease that can cost the rice industry millions of dollars a year.

A small scale experiment in 1997 suggested that interplanting could achieve 92 to 99% control of rice blast, as well as an unexpected double success by boosting farmers' yields by half a ton to 1 ton per hectare.

In 1998, 812 hectares were planted with hybrid rice and glutinous rice, four rows of one and one row of the other. The crop was sprayed with fungicide only once. Yields reached 9 tons of hybrid rice and nearly 1 ton of glutinous rice per hectare. Even more impressive was the fact that, within the interplanted crop, the incidence of blast fell to 5 percent from a common level of 55 percent and the yield loss dropped from 28 percent to nothing at all. In 1999, the area grew to 3,342 hectares, and the farmers involved boasted that interplanting was providing them with about US$150 more income per hectare. By the end of 2000, the IRRI-Yunnan research team plans to extend the scheme to cover up to 60,000 hectares and continue to expand it into the Philippines, Thailand, and other rice-producing nations.

IRRI's Director General Ronald P. Cantrell says, "The days of unsustainable high-input rice production are a thing of the past!"

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- Youyong Zhu et al. **Genetic diversity and disease control in rice**. Nature 406, 718-122 (2000), Macmillan Publishers Ltd.

No-tillage rice/wheat cultivation
The one straw revolution

Chris Evans

The natural farming rice-wheat no-tillage system was developed over 3 decades by Japanese philosopher and natural farmer Masonobu Fukuoka. His philosophy evolved as he saw the reductionist nature of modern science and the distancing of society from nature as root causes of humanity's many problems. This led him to search for better ways of farming that work more with nature, not against it. He realised that many of our current agricultural needs are met by too much hard work and high inputs. Instead, he reasoned that nature should be allowed to do more work in the farming system, which it has been "designed" to do anyway.

JPP Background
The Jajarkot Permaculture Programme is a grassroots NGO working in 4 districts of Nepal. As its name suggests, it is based on Permaculture, a technique of sustainable systems' design using the direct application of the principles of ecology. Thus its philosophy also embodies observation of and working with nature as the prime model of sustainability.

The JPP gained its first experience of no-till farming during a visit in 1988 by the author and co-founder of the JPP to Japan. After this trip, a trial plot was set up on JPP's Farm #2 Resource Centre (RC) in Jajarkot. The farm is about 1 acre of land consisting of irrigated rice-wheat and dry-land crops. Later a second trial was started at Sita Paila RC in Kathmandu.

The Fukuoka System
The plot was ploughed one last time, sown with wheat and white clover, then mulched with the straw from the previous rice crop. Weeding was necessary until the clover was established.

The wheat sprouts vigorously while the clover forms an undercover, acting as a green manure. This conserves moisture, fixes nitrogen and suppresses weeds - all needs, which the farmer normally tries to fulfil through labour and external inputs. By letting the clover and the straw do this work, inputs are lowered and the soil is not disturbed, allowing it to create its own system of fertility management, as in a natural undisturbed soil.

There is no further work until the wheat harvest the following spring. At this time, the wheat is cut, and rice is sown into the stubble and clover, with the wheat straw mulched on top. There is a risk that the clover smothers the young rice plants. Fukuoka floods his fields which weakens the clover and allows the rice to get away. After 1-2 weeks he drains the field allowing the clover to recover while the rice gains height. At farm #2 there was not enough water to do this; instead we grazed cattle on the clover briefly, a few days after the rice had been planted. At Sita Paila RC in Kathmandu, the clover was cut for rabbit fodder. Either way, the clover is controlled while the rice is given a chance to establish. For both rice and wheat, it is advised to coat the seed in a mixture of powdered clay and water to protect it from birds. When the straw is applied, it is possible to apply small amounts of well rotted compost (Fukuoka uses chicken manure) to help with its decay.

In this way, transplanting is completely eliminated, while weeding is reduced almost to zero. And there is no need for extensive flooding of rice paddies as its purpose in the traditional system is weed control.

Ms Man Maya Gaha, JPP technician, with no-till showing wheat with clover under-storey

Photo: Chris Evans

Experience and lessons
The no-till system as adapted by the JPP has been extremely successful in that it really takes much less work to produce yields which are equal to and in some cases greater than the conventional/traditional methods. Because of the healthy soil, plants are robust and diseases are almost non-existent. It has worked consistently at Jajarkot's Farm #2 since 1989 and at Kathmandu RC since 1996. But the technique hasn't caught on by itself in the communities surrounding the RCs. This is partly due to the traditional use of straw as livestock fodder, and a lack of clover seed. Therefore, JPP has been reluctant to carry out extension of the method until sufficient alternative fodder can be obtained from agroforestry (AF) systems. Extension of AF thus takes priority over no-till, until the time is right for introducing the latter. The no-till method is so radically different that a major cultural shift is needed to enact it.

There are many ways of adapting the method, as JPP was able to do from the original system of Fukuoka. Timing of sowing is important, and it is possible to sow rice into wheat, and vice versa, when the previous crop is still standing. In Jajarkot we had a problem that the wheat ripened earlier than in surrounding fields, thus increasing its susceptibility to bird predation. The solution was found by either delaying sowing or using a longer rotation variety. Alternatives to clover need to be tried out – plants, which fulfil the same functions but are suitable to different environments, especially hot tropical/sub-tropical, which clover does not like. Perhaps vetches are a possibility. This method emphasises skill in observation of the crop and its environment, and ability to find plants and cropping systems, which mimic relationships and patterns found in nature ■

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Sustaining the Green Revolution by resource conserving technologies:

The Rice-Wheat Consortium's example

Peter R. Hobbs, Raj Gupta, J.K.Ladha and Larry Harrington

The Indo-Gangetic Plains of Pakistan, India, Nepal and Bangladesh are endowed with plentiful natural resources, deep productive soils, sufficient good quality water, climatic conditions that permit multiple-cropping, high population densities and relatively good infrastructure. The Green Revolution (GR) of the 1970s and 1980s radically changed the traditional agricultural system of this region. Now, about 13.5 million hectares of land are in continuous rotation of irrigated rice and wheat, providing food and livelihoods for many millions. Between 1960 and 1995 rice yields increased from 1.55 to 2.66 tonnes/ha and wheat yields from 0.84 to 2.34 tonnes/ha.

The majority of the farm households have less than 5 ha of land, whilst a minority have more than 20 ha. All farmers use improved varieties of wheat with fertiliser. In rice, some farmers still grow traditional, fine quality varieties like *Basmati* as they fetch higher market prices. Mechanisation levels are high, especially in the western regions, with resource-poor farmers renting tractors and threshers for tilling and harvesting. Animal power is still common in the eastern regions, but farmers complain of the increasing costs of maintaining draught bullocks. Many farmers are moving to contract ploughing with tractors; dairy cows are acquired in place of draught bullocks.

Rice-wheat a safe system

The main factors for the initial success of the GR and the emergence of the rice-wheat system were the introduction of high-yielding, semi-dwarf varieties and chemical fertilisers. Pesticides, investments in irrigation infrastructure, political commitment and policy support played a lesser role. Free irrigation water, cheap agro-chemicals, subsidised power supply and low-interest farm credit were some of the crucial supports provided by South Asian governments that made intensive rice-wheat production profitable and a safe system for farmers.

Stagnation of production growth

However, in the past several years the productivity growth of wheat and rice has declined and the expansion of rice and wheat area has halted due to many reasons (Hobbs and Morris, 1996). Ecological degradation of the natural resource base has occurred as farmers using conventional technologies harvest up to 10 tonnes of cereal per year. Long-term rice-wheat experiments have shown that yield growth declines at constant input levels. Unbalanced use of fertiliser and delayed planting of crops are cited as major factors. Profitability has dropped as more inputs are needed to get the same yield. Input subsidies that favoured the GR have lacked farm-level incentives for efficient input use. The price of rice and wheat has declined steadily over the last 30 years. Partial removal of subsidies and ecological problems have put stress on the economy of farmers.

Ecological degradation

Resource degradation in the rice-wheat system can take many forms: loss of organic matter; mining of soil nutrients; build-up of weeds, diseases and pests; waterlogging, salinity and sodicity. Additional problems that reduce system productivity are: low nutrient and water use efficiency associated with delayed crop establishment, driven in turn by inappropriate tillage practices (delays in sowing wheat after rice can reduce yields as much as 1.5% per day); flat sowing and flood irrigation causing nutrient leaching; puddling leading to formation of a ploughpan, reduced soil permeability and enhanced soil cracking; and restriction of plant root and shoot growth and chlorosis due to temporary water stagnation. To compound these problems, *Phalaris minor*, the major weed in wheat has developed strong resistance to the commonly used herbicides and farmers have had to shift to new, more expensive herbicides. Excessive pumping from wells is leading to declining water tables in fresh water aquifer zones, while inadequate drainage is causing waterlogging and salinity in others. Many of these problems are interrelated and tend to be concentrated in areas where farmers practice continuous rice-wheat rotations (Pingali and Shah, 1999).

Rice at harvest time grown on beds in the Indian Punjab (9t/ha crop, 50% water savings)

Photo: Rice-Wheat Consortium

The Rice-Wheat Consortium

The concern today is to continue the GR sustainably – to make agricultural practices ecologically sound and more efficient while increasing productivity and profitability, improving farmer livelihoods and reducing poverty. As population in the region swells, a yearly cereal yield growth of about 2.5% will be needed to meet food demands. The Rice-Wheat Consortium for the Indo-Gangetic Plains (RWC) is an institutional mechanism created to deal with these issues in SE Asia. It is a partnership of national programmes (Bangladesh, India, Nepal and Pakistan), international centres (CIMMYT, IRRI, ICRISAT, IWMI and CIP) and various advanced institutions (Cornell, CABI Bioscience, IACR, Rothamstead, and IAC Wageningen etc.). The RWC believes that the key to a sustainable Green Revolution lies in Resource Conserving Technologies (RCTs).

Participatory research

A stakeholder participatory approach based on strong partnerships is being used to develop and promote new technologies. Stakeholders include researchers, extensionists, local manufacturers, NGOs and farmers. Farmers experimenting with technical options are proving more successful than researcher demonstrations of "finished" technologies. With access to the necessary equipment, farmers are adapting practices to their own situations and providing valuable feedback to the other stakeholders. This approach required a change in paradigm that increased the mobility of stakeholders, decentralised decision making and allowed for strong partnership and trust building. The long-term implications of farmer tested technologies on the environment are being closely monitored by a team of scientists.

Promising technologies

Promising technologies to ensure timely sowing and good plant stands, crucial for rice-wheat system productivity and efficiency, are being tested. RWC scientists have developed new tillage and other resource conserving options, such as surface seeding, zero / reduced tillage, bed planting, mechanical transplanting, laser levelling, dry seeding rice, etc. These options have opened up "space" (time, labour, land and water) for farmers to experiment with more diverse cropping systems.

Sowing wheat before harvesting rice

Surface sowing of wheat on to unploughed, wet soil before or after rice harvesting is working well in heavy, poorly drained soils. This technique is particularly relevant to farmers with small land holdings and little or no power sources. In the 1997-98 wheat season, farmers in Nepal using surface weeding were able to get their crop planted on time, despite continued rain, and harvested an average of 4 tonnes/ha. Farmers who used traditional methods were unable to plant a crop at all.

Zero tillage and stubble sowing

Zero tillage and sowing of wheat in standing rice stubble using a seed drill, locally manufactured in India and Pakistan, is a key technology for farmers with access to tractors. This drill, a modified version of the local *rabi* drill, costs US$400. Resource-poor farmers are able to rent them. In a variant of zero tillage (reduced or minimum tillage) a rotovator stirs a thin layer of soil in a strip ahead of the seed drill. Although it delays planting by 4-5 days compared to zero tillage, reduced tillage may be the preferred system for areas with post-rice harvest weed problems. There is also a "strip-till" version that cultivates only the area where the seed is placed and not the entire area. Both 2-wheel and 4-wheel versions are available for these reduced tillage systems. Such technologies open the door to improvements in resource efficiency leading to timely sowing, water savings, higher fertiliser efficiency, reduced weed germination, less herbicide use, reduced residue burning, lower fossil fuel use, decreased air pollution – and higher yields!

Farmers are very enthusiastic about the technologies as they save money and increase production. For example, current land preparation practices for wheat after rice requires nearly 12 tractor passes, whereas zero-tillage only one. This saves up to 100 litres of fuel per hectare, approximately 1 million litres of irrigation water and wear and tear of tractor parts. This is roughly a US$50-60 or 30% saving in production costs per hectare while increasing production simultaneously. The acreage of zero-till has risen from a few hectares in 1996 to 10,000 hectares in 1999 and over 100,000 hectares in 2000 in NW India and Pakistan. The main constraint now is the availability of sufficient good quality seed drills.

RWC scientists and farmers are trying to cut down on the burning of crop residues, which amounts to nearly 10 tonnes/ha. Leaving the stubble on the field as straw mulch and seeding wheat into this residue, rather than burning it, could improve soil structure and fertility, reduce water use and create a habitat for beneficial insects. This technology, however, is still in the experimental phase.

Broadcasting rice seedlings

Raising of seedlings in beds and transplanting them into puddled soil is the predominant method of cultivating rice. Puddling destroys the soil's physical properties and gets more expensive as real rural wages increase. Direct sowing has system benefits and is an attractive option when the problem of weed growth is tackled. Research is underway to find integrated ways to control these weeds. Broadcasting of rice seedlings, a system common in China, reduces labour even further.

Modified bed planter

Traditionally, wheat is planted by broadcasting on flat land. Research has proven that this method is not ideal for enabling uptake of nutrients and controlling of weeds. Bed planting was introduced by scientists as an alternative, and is being used by farmers in Mexico on about 0.5 million hectares of irrigated lands. Here, a machine makes two beds of about 70 cm width. The technology has interesting advantages: it saves seed rate by about 40-50 %; saves water by about 30-40 %; gives higher yields; reduces lodging; enhances mechanical weeding; overcomes temporary water logging problems; promotes rain water conservation and allows subsurface fertiliser placement for reducing N losses in rice and wheat.

The technology is mainly used in wheat, but is being adapted to rice. Costs of making the beds after every rice harvest is to be reduced by permanent beds on which each successive crop will be planted on the previous residue. Bed planting would enable crop diversification in rice-wheat areas with the introduction of soybean, maize, cotton, mungbean, vegetables, and canola on beds. It also has great potential for expanding the acreage of hybrids with reduced seed rate. The latest – modified – version called the PAU bed planter is manufactured locally in Amritsar, Punjab, India at a cost of about US$ 425 *ex-factory*.
A similar model is available in Pakistan.
To help make seed drills, hand tractors, and tractor implements more widely available, RWC staff are linking with and advising farmer groups, local machine shops, and agricultural engineering specialists.

Integrated Pest Management

To minimise the use of chemicals, the RWC is developing integrated control measures for pests, weeds, and diseases in the rice-wheat system. Planting wheat in beds facilitates mechanical weeding and provides good weed control without the use of herbicides. In farmer-participatory trials, zero-tillage reduced *Phalaris minor* populations by two-thirds in the first year. Growing early planting varieties (late October) means that the wheat crop is well established and can suppress *P. minor* as it emerges in mid-November. Crop diversification with sunflower, sugarcane and other crops helps reduce losses to weeds. Stemborers survive in rice crop residue, but zero tillage practices actually help reduce this problem by leaving the rice stubble standing or as a mulch, providing a habitat for beneficial insects that control stemborers.

Photo: Rice-Wheat Consortium

Pau bed planter for no-tillage wheat production

Integrated Nutrient Management

Balanced and efficient use of organic and inorganic fertilisers is crucial in making the rice-wheat system sustainable and profitable. The reduced use of cattle manure over the years has resulted in a decrease of soil organic matter. The use of zero-tillage and the halt to burning of crop residues will improve this situation. Soil organic matter dynamics are being studied and monitored in fields with new tillage options, rotations and crop technical innovations. The RWC is also working on on-farm development of Site-Specific Nutrient Management. SSNM builds on: 1) crop nutrient requirements based on economically efficient yield targets; 2) estimation of potential soil supply of N, P and K; and 3) plant N-status during critical periods of growth. The technique permits an estimation of leaf nitrogen content at specific stages in plant growth by measuring leaf greenness. This gives farmers an idea of when to apply fertiliser and in what quantities. Simple colour charts that help better targeting of fertiliser applications are being introduced to farmers. (Ladha et al. 2000).

Biotechnology will be needed

Further increasing the yield potential of rice and wheat seems inevitable. This can be done by using hybrids, synthetics or improving the photosynthetic efficiency of crops. While traditional plant breeding has been effective in improving crop yields, biotechnology can make this more effective, e.g., through marker assisted selection. Biotechnology can play a role in providing needed resistance for various pests, diseases and other biotic stresses. Herbicide resistant crops may finally enable farmers to use direct seeded rice without weed problems. Insect resistant crops could help reduce the application of pesticide sprays. A combination of biotechnology and resource conserving technologies may give the best perspective on continuing and sustaining the GR. Although investments in biotechnology are increasing fast, major benefits for the rice-wheat system are still to come. Of course, any research and release of genetically modified crops should adhere to biosafety and bioethics standards, and must be acceptable to civil society.

Policies needed

Policies concerning pricing, incentives, research, agricultural education, funding etc. are essential if the efficient use of inputs and RCTs are to be enhanced. The case of the Indian Punjab demonstrates how the efficient use of water is hampered when farmers are given water free of charge. Such a subsidy should be more production oriented and linked to water saving practices. The same applies to pricing of fertilisers and other inputs. Fertiliser subsidies could be easily used to regulate fertiliser application, to encourage the switch from prilled urea to urea super granule (USG) or slow release forms, and to promote machines that help deep placement of fertiliser to reduce ammonia volatilisation and nitrogen leaching. Easier credit to purchase equipment would certainly be a better policy than subsidies on equipment.

Making the shift to resource conservation

A major bottleneck in large-scale adoption of RCTs is the mindset of farmers and other stakeholders on, for example, the age-old practice of excessive tillage. The shift to RCTs requires a reorientation and retraining of all stakeholders. Integration of RCTs into the respective curricula will enable extension workers, scientists and farmers to learn the benefits and needs of these technologies. Public awareness on the benefits of RCTs at the farm, village, country and global level is needed. Reaching out to more farmers requires innovative ways of scaling up RCTs based on participatory approaches involving all stakeholders.

Can we make it?

Farmers who have experimented with these technologies show tremendous enthusiasm in adopting it and sharing it with fellow farmers. The RWC believes that these technologies will become common place in South Asia in the coming years. Similar successes of farmer led technology adoption are seen in Brazil and Argentina where conservation tillage has been adopted on millions of hectares of land.
However, one note of caution needs to be made. Unless the population growth in South Asia is reduced in the next 2 decades, it will not be possible to produce sufficient food without degrading the environment. ■

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Further information: www.rwc.cgiar.org/new

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Effective Micro-organisms Technology

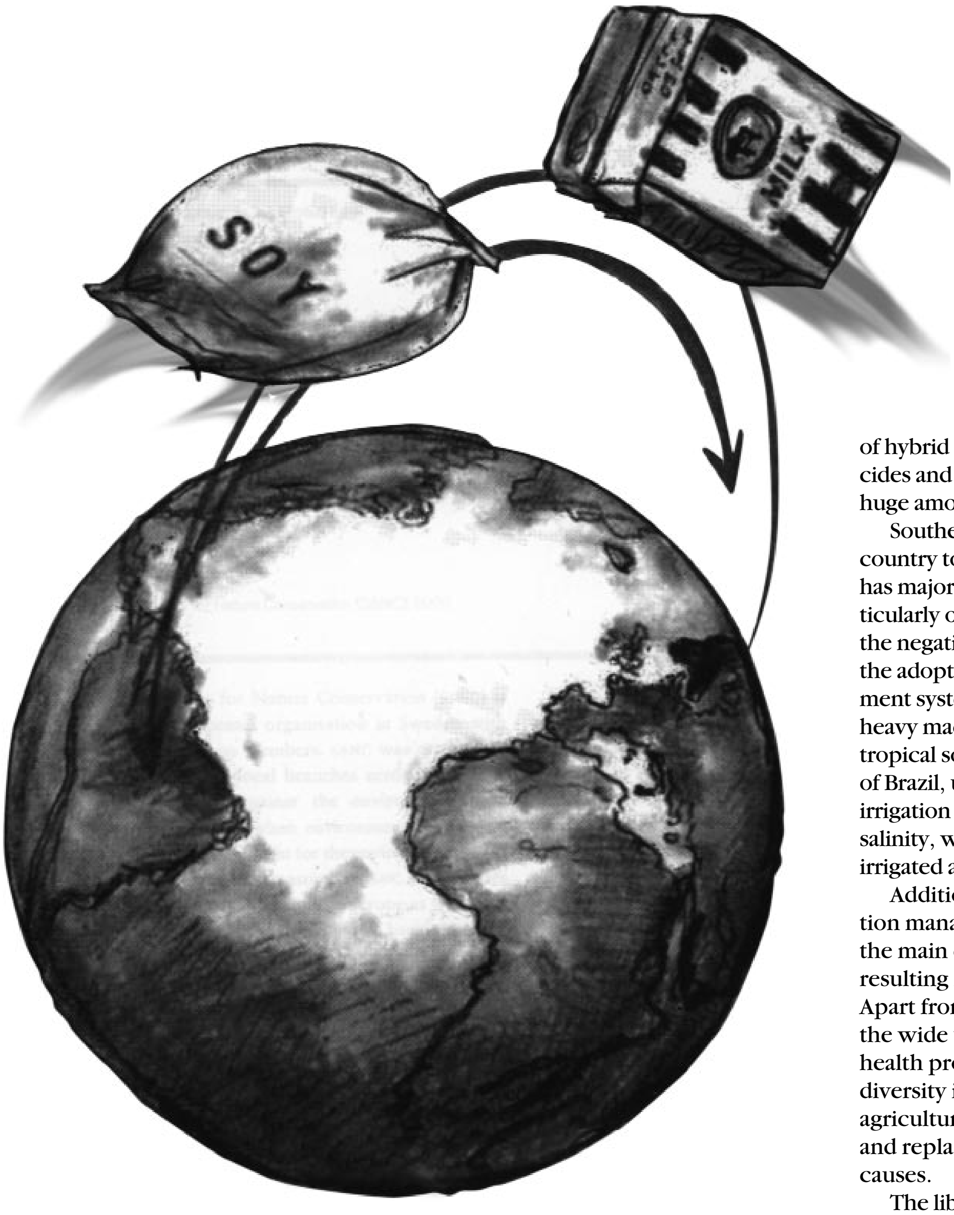
EM-Technology was developed by professor Dr. Teruo Higa in 1980 at the University of Rhyukyus, Japan. At the First International Conference on Nature Farming held in Tahialand in 1989, the Asia Pacific Natural Agriculture Network (APNAN) was formed. This network established an international programme for promoting research, education and extension of nature farming with EM-Technology.

EM contains photosynthetic bacteria (*Rhodopseudomonas spp*.), lactic acid bacteria (*Lactobacillus spp*.), and yeast (*Saccharomyces spp*.). It also supports the activities of other microbes. It is claimed that EM promotes germination, growth, flowering, fruiting, and ripening in crop plants. It enhances the photosynthetic capacity of plants and the efficiency of organic matter as fertilisers. EM develops the resistance of plants to pests and diseases and suppresses soil borne pathogens and pests. It can also be used in human and animal health care. A good introduction on EM-Technology can be down loaded from www.agriton.nl/higa.html

In Pakistan EM-Technology is being promoted by Nature Farming Research & Development Foundation (NFRDF) which set up the Nature Farming Research Centre and the EM-Technology Training Institute. In the last 8 years extensive experimentation has led to some important innovations in EM-Technology. Now a wide network of EM suppliers and technology transfer officers are available for the thousands of farmers who have begun using EM-Technology.

In January 2000, the **EM World Journal** (ISSN: 1562-255X) was launched by Nature Farming Research & Development Foundation, 41-X-101, Susan Road, Madina Town, Faisalabad, 38060 Pakistan. Fax: +92 41 613507; nature@fsd.paknet.com.pk

The Journal contains research articles on EM-Technology in agriculture and health. One of the articles: **Technology of Effective Micro-organisms as an alternative for rice and wheat production** in Pakistan by Tahir Hussain et al., reports on a long-term field experiment at Faisalabad, Pakistan, to determine the agronomic and economic merits of EM-Technology. Results were, among others: EM applied in combination with NPK fertilisers, Green Manure (GM) and Farm Yard Manure (FYM) caused significant increase in grain and straw yield and in nutrient uptake by the grain and straw of each crop following the order NPK+EM > GM+EM > FYM+EM. The GM+EM treatment produced grain and straw yields of each crop that approached those for NPK alone. A comparative economic analysis of the treatments showed a significantly higher net return due to EM. The average net profit from rice and wheat production using EM was US$44.90 / ha and US$62.35 / ha , respectively, compared to about nil for the conventional rice-wheat system with optimal fertilisation and management.



Soybeans for dairy products, a good deal?

The World Trade Organisation (WTO) makes claims for international liberalisation of trade in place of national protectionism. Countries are not autonomous any more; planning of the national economy is subject to international rules applied by the WTO. Even in remote rural areas the world market influences people's lives.

Brazil is the second largest soybean grower in the world, producing around 30 million tons per year. The European Union is the main importer of Brazilian soybean for its extensive dairy industry. In turn the EU exports large amounts of dairy products back to Brazil. In the past five years Brazil has had a negative balance of trade. Soybean is naturally seen as the crop, which can generate extra income for making up the trade deficit.

Specialisation in soybean and dairy is resulting in serious socio-economic and environmental problems in both regions, and is a good illustration of the "system error" that is inherent to the global system of agriculture. The challenge of implementing sustainable farming systems has become even greater in this context.

Angela Cordeiro, a Brazilian agronomist, was asked by the Swedish Society for Nature Conservation to undertake a study on how European agricultural policy affects Brazilian agriculture and vice versa. The report is being used in SSNC's campaign for sustainable agriculture. This article is based on the report.

Modernisation of agriculture

The modernisation of agriculture has been promoted by the Brazilian Government, since the 1970's, through the expansion of agricultural area, subsidised credit and educational, research and extension services oriented to promote "modern technologies". This process, aimed basically at the export market, relies on the intensive use of hybrid seeds, chemical fertilisers, pesticides and mechanisation, and consumes huge amounts of fossil energy.

Southern Brazil, the first part of the country to introduce the Green Revolution, has major problems of soil degradation, particularly on large farms. This is evidence of the negative effects of monocropping and the adoption of an European soil management system, use of chemical fertilisers and heavy machinery, which are not adapted to tropical soils (see Box 1). In the Northeast of Brazil, unsustainable management of irrigation has resulted in increased soil salinity, which at present effects 30% of irrigated areas.

Additionally, unbalanced plant nutrition management has been suggested as the main cause of pests and plant diseases, resulting in increased use of pesticides. Apart from water and soil contamination, the wide use of pesticides has become a health problem in rural areas. Loss of biodiversity is another negative impact of agricultural expansion, with deforestation and replacement of local varieties as main causes.

The liberalisation of the Brazilian economy in the 90's has resulted in further changes in land use.

Soybean - a foreign exchange earner

Current market theory states that comparative advantage provides better competitiveness on the international market. In the case of agriculture, it means that countries able to produce at the lowest cost are the most competitive. It is assumed that increasing scale is the best way to reduce costs. Geographic expansion of soybean from the South of Brazil to the Cerrado region followed this assumption. Therefore, soybean cultivation is now concentrated on farms larger than 500 ha. This is in contrast to 1985 figures, when medium and small farmers together produced almost 50% of Brazil's soybean production.

On the world market, demand for soybean is based on meat consumption patterns. According to market analysts, an increase in the global demand for meat is expected due to the market liberalisation. Consequently, there will be an increase in demand for soybean meal. Among other competitors, Brazil is in the best position to expand soybean production and potentially increase its market share. Therefore, soybean is seen as the "golden crop" of Brazilian agriculture, receiving special attention from Brazilian agricultural policies. The equation is simple: the country needs to achieve a favourable balance of trade, and agriculture is one of the main sources of income. Thus, soybean is seen as a foreign exchange earner that can boost the national economy and help the Government fulfil its commitments to the International Monetary Fund.

Dairy production – loosing out

Dairy production is another dramatic example of the impact of current agricultural policies. While Brazil is the second exporter of soybean and an important source of soybean meal, it is also one of the main importers of dairy products. As a result of opening up of the Brazilian market, liquid milk imports from the EU has risen from 19,435 tons in 1992 to 82,433 tons in 1997, causing serious damage to the domestic dairy sector. After the market deregulation in 1992, the Government did not control milk prices. Imports passed on to the hands of private industries that also took over the domestic dairy industry. With increasing costs of milk production and lowered revenue, many small farms are not able to continue with milk production.

However, milk production is a very important component of small farming. While EU, US and Argentina have 805, 105 and 22 thousand farms incorporating dairy production, Brazil has nearly 1.2 million of them. Around 40% are family farms below 50 ha. Over and above the continuous cash flow provided by milk production, cattle are an important element for the environmental sustainability of small farming. Crop rotation with forage legumes and the use of cattle manure in crops and vegetable production are ways in which animal and crop production coexist in diversified farming systems.

Hidden subsidies

These models are justified on the apparent competitiveness of soybean production in Brazil and dairy production in the EU. However, this competitiveness is not real as it depends on hidden subsidies, both in Europe and Brazil.

In the case of soybean, the cost does not include negative aspects such as the environmental impact of this crop on Brazilian ecosystems. For instance, the expansion of soybean to the Cerrado region led to deforestation and considerable loss of biodiversity. No mention is made of the cost of energy required for transportation of soybean to the main ports, thousand of kilometres away from the fields. The Government has given fuel subsidies to farmers and provided all types of facilities to make it feasible to grow soybean in the Cerrado. Actually, Brazilian society has paid a high cost to sustain this "false" competitiveness.

On the other side of the Atlantic, European society pays for the high competitiveness of its dairy sector. The low costs of dairy products are sustained by enormous government subsidies, creating a very artificial situation. Moreover, the intensive production system results in environmental problems, the costs of which are not considered. The high yields associated with artificial low costs disrupt the national production in countries where subsidies do not exist, creating a monopoly in European milk imports.

By analysing these cases it is easy to conclude that the production systems of Brazilian soybean and European dairy are interconnected and that the weaknesses of both systems sustain each other. Recognising this connection gives an idea on the complexity of building sustainable farming systems. However, from another perspective, it also shows the potential for building global alliances between farmers and consumers beyond national borders.

Fair trade essential

Fair trade is important for food security. Yet, how can fair trade be established, respecting social, environmental, economical and cultural diversity between nations? How can trade be built up so that benefits to developed countries do not imply exploitation of developing countries?

Interchange of experiences between local groups at global level could strengthen capacities for overcoming the technical, financial, cultural, political, and trade barriers to sustainable farming systems. The case of Genetic Modification (GM) is a good example of how local actions can have global influence. The European society reacted negatively to the introduction of this technology, because of possible negative impacts on health and environment. Thus, by refusing to buy GM products, European consumers created a pressure on retailers, which was transferred to food processors and food traders.

At the same time, civil society in Brazil campaigned against GM crops. As a result of European pressure and domestic campaigning, a court decision was taken against GM crops in Brazil until environmental impact studies were carried out. This delay in introducing GM crops to Brazil strengthened the European position.

Soybean for dairy products is portrayed as the type of exchange required in meeting the increasing food needs of a growing world population. But what should not be forgotten is that both soybean and dairy production depend on a natural resource base that is fast degrading due to modern agricultural practices. As such, sustainable farming systems are no more a luxury but a necessity.

■

Adapted from:
Angela Cordeiro. **Sustainable agriculture in the global age: lessons from Brazilian agriculture** Swedish Society of Nature Conservation, ISBN 91 558 661 31. Ordernr. 9132, SSNC, PO Box 4625, SE-11691 Stockholm, Sweden. Fax: +46 8 702 08 55, Email: info@snf.se. Also available on www.snf.se/pdf/rap-jordbruk-soja-eng.pdf

Box 1. Ecologisation of soybean production

Can we 'ecologise' soybean monoculture? It seems that soybean monoculture begins with a monoculture of the mind, that is specialisation. We cannot change global politics in a short time, that is if we can change it at all. What can we do, technically, to make soybean production ecologically sound?

The first problem is that the technology being used in Brazil is from a completely different ecosystem, the temperate climate of Europe and USA. As a result, soils degrade and plants perform badly. Instead of building up biological soil life to enhance productivity, more fertiliser, irrigation, herbicides and other chemicals are applied. Ecologically sound management of soils is the basis for sustainable agriculture.

Tropical soils need protection from overheating, rapid drying and rain. This can be provided by closer planting, mulch, zero-tillage, cover crops, intercropping or even shade trees. A large quantity of organic matter is needed annually to recuperate the soil aggregates and the porous system. Soybean furnishes too little straw, decomposes rapidly as it is rich in nitrogen and poor in cellulose, and as such does not contribute to soil aggregation. In order to maintain the structure of the soil, crop rotation with maize, millet, or a similar crop is necessary. After a few years of continuous soybean production, especially when planted under zero-tillage, deleterious rhizo-bacterias including *rhizobios*, appear, and may kill the soybean plants. When alternated with maize, soybean yield increases by 20% already in the first year, and the need for agrochemicals goes down by 50%. When soybean is grown within a full crop rotation, using *soybean - groundnut - maize* in summer and *wheat - fodder turnip - black oats* in winter, there are practically no diseases and yields increase every year. The absence of wind break belts may lower the yields. In rotation with other food and fodder crops soybean does not have to be an anti-ecological and anti-social crop. However, adaptation of soybean varieties to Brazilian soil types and microclimate is still needed.

Bolivian Indians say," *Agriculture is a spiritual – social – material activity, and only when all these three factors are in harmony does she maintain life"*.
Only oriented towards the material aspect, agriculture will not work, and people will be sick, degenerate and die.

Ana Primavesi, Fazenda Ecológica, 18730-000 Itaí, SP. Brazil.

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Monocultures towards sustainability

Editorial

The prevailing global trends - improvement of crop varieties, increase in the use of agrochemicals, mechanisation, liberalisation and globalisation of agricultural trade, national economic growth, increase in the use of fossil energy, agricultural policies and subsidies favouring production of main and export commodities, development of biotechnology, hybrids and genetically modified organisms, and privatisation of research and extension - support the growth of monocultures, which are often seen as unsustainable. The productivity and sustainability of annual food crops is of extreme importance for feeding an ever-growing world population. In this issue, we look at the negative impact of monocultures, especially of annual food crops, and the alternatives that are being developed.

Photo: PMHE project

Monocultures of the main annual food crops urgently need to be made more productive and sustainable.

Expanding monocultures

Whenever farmers focus on market production and adopt the agrochemical model, high-input monocultures become predominant. Not only the number of different crops and animals but also the genetic diversity tends to decrease. The increased use of agrochemicals seriously affects the natural biodiversity in and above the soil, on the farm and in the wider environment. Expanding scale and levelling of land leads to the loss of natural micro-environments and to a further decrease in diversity. In extreme cases this leads to large-scale farming with near endless high-input monocultures, year-to-year production of single crops on the same land, as in many Western and in some Southern countries like Brazil (soybeans, p.6), Philippines (sugarcane, p.22), Bangladesh (rice, p.16) and India (rice and wheat, p.8).

Political and economic forces are driving agriculture towards monocultures. Such systems are rewarded by economies of scale and contribute significantly to the ability of national agricultures to compete on international markets. The case study on soybean monoculture in Brazil (p.6) provides a good example of how international trade reduces biological and economic diversity, degrades natural resources and affects small farmers.

Serious consequences

Although this type of agricultural development made it possible to increase production in excess of global population growth, there is increasing evidence that if continued its negative impact on food security, rural poverty, and the conservation of natural resources will outweigh the benefits. For example (Torres et al, 2000; Altieri, 2000):

- Evidence from a number of experimental and field sites indicate declining growth of yields for the main 'Green Revolution' cereals under intensive cropping on some of the better lands, e.g. the Indo-Gangetic plains (p.8). In some places (e.g. p.6 and p.22), yields are actually in decline.
- Most large-scale agricultural systems exhibit a poorly structured assemblage of farm components, with almost no linkages or complementary relationships between crop enterprises and among soils, crops, and animals. Cycles of nutrients, energy, water and wastes have become more open which makes it increasingly difficult to recycle nutrients. Hence, these systems are very inefficient in the use of their resources.
- Higher primary production is obtained by increasing the use of external inputs and is leading to a decrease in their efficiency.
- Use of pesticides in the developing countries is increasing exponentially, just as is their negative impact on the health of people and the environment.
- As specific crops are expanded beyond their "natural" ranges to areas of high pest potential, or with limited water, or low-fertility soils, intensified chemical controls are required to overcome the limiting factors.
- High-input monocultures depend increasingly on fossil energy and lead to depletion of soil organic matter, which in turn contributes strongly to climate change.
- Lower prices of agricultural products were particularly beneficial to urban populations, but have not had the same effect in rural areas. On an average, around 50% of the rural population in many places remain to be poor. The most affected regions are Sub-Saharan Africa and South Asia.
- Dietary consequences of monocultures are substantial. Reduced crop and natural biological diversity has resulted in decreased dietary diversity. Eating more maize, rice or wheat has actually increased micronutrient malnutrition, especially in Green Revolution areas, termed as 'hidden hunger' (IRRI, 1999).

About two-thirds of the agricultural lands have been degraded to some degree in the past 50 years by erosion, salinisation, compaction, nutrient depletion, biological degradation, or pollution; about 40% of these lands are strongly or very strongly degraded. Unlike more complex agro-ecosystems, high-input monocultures are not capable of providing multiple functions of ecological and economic value. If we choose to continue the current patterns of resource use, we will be faced with the decline in the ability of agro–ecosystems to yield their broad spectrum of benefits – from clean water to stable climate, fuelwood to food crops, timber to wildlife habitat (World Resources Report, 2000).

Sustainable alternatives possible

In many places in the world it is already happening! Out of economic and ecological necessity, farmers and development supporters are trying to move away from high-input monocultures. Different approaches are being followed, e.g. Resource Conserving Agriculture, Evergreen Revolution, Agroecology, Permaculture, Regenerative or Organic Agriculture. There are important differences between these approaches but they all have a common denominator: resource conservation.

The transitions described in the articles lead to: reduced and more efficient use of agrochemicals, fossil energy, irrigation water and seeds; storage of carbon in soil organic matter and biomass (which reduces climate change); reduction of soil degradation. But at the same time they lead to higher production and lower costs and labour! This is true for zero tillage in rice-wheat production (p.8), ecological intensification of rice production (p.11 and 12), diversification of the production of rice (p.16), sugarcane (p.22), cotton (p.18) and maize (p.20), and is contrary to common belief!

Monoculture or polyculture?

But what type of biological diversity is needed for ecological sustainability? Wood (p.14) challenges polyculture as a means of sustainable production of annual cereals in the light of many natural grass monocultures. What can farmers learn from these natural monocultures to improve the productivity, stability and ecological sustainability of the present high-input monocultures? Wood states that single crops have self-regulation through high crop-associated biodiversity, in the soil as well as in the vegetation, in and outside the field. It is this associated biodiversity that is strongly influenced and reduced in high-input monocultures, due to agrochemicals, intensive tillage and the large-scale. The cases show that higher productivity and reduced losses and costs can be achieved by: combining different varieties of e.g. rice (p.12), intercropping, e.g. maize and tomatoes (p.20), rotation of soybean and wheat (p.7) or combining rice, fish, vegetables and trees (p.16).

It may also be possible to learn from the experiences of traditional and ecological farmers, e.g. how do they manage their annual cereals? Do they mimic natural monocropping or do they consciously combine annual cereals with other crops to enhance productivity, stability and sustainability? It may be interesting to look at these in terms of crop management, e.g. How do ecological farmers in Madagascar get higher rice yields than Green Revolution farmers? (p.12). Their System of Rice Intensification (SRI), is now being successfully tried out in many countries. Other cereals can be produced in a similar way, as in the example of the Bonfils/ Fukuoka approach for winter wheat (p.13). Clover or other leguminous cover crops used in wheat (p.13) and in rice-wheat production (p.11) may be an interesting additional element to zero-tillage, among others, in the Indo-Gangetic Plains (p.8).

Ecosystem approach needed

A shift to resource conservation requires, first and foremost, a reorientation on how we look at (agro-) ecosystems - we need to view their sustainability as essential to our own. Adopting an "ecosystem approach" means that we evaluate our decisions on land and resource use in terms of how they affect the capacity of ecosystems to sustain life - not only human well-being, but also the health and productive potential of plants, animals, and natural systems (World Resources Report, 2000). 'Agroecology' is based on a detailed understanding of ecosystems and the complex interactions of soil, water, plants, animals and farmers; it involves the whole farm and landscape system, and is far more holistic than the conventional crop ecology approach. This requires a scientific re-orientation as well.

In essence, the optimal behaviour of agroecosystems depends on the level of interactions between the various biotic and abiotic components. By assembling a functional diversity it is possible to initiate synergisms which support agroecosystem processes by providing ecological services such as the activation of soil biology, the recycling of nutrients, the enhancement of beneficial arthropods and antagonists, and so on. Today, there is a diverse selection of practices and technologies available, although they vary in effectiveness as well as in strategic value. (Altieri, 2000; Gliessman, 1999). Making monocultures sustainable is not just replacing chemical inputs by organic equivalents, but a systematic farmer-led conversion process. It requires gradual re-modelling of the agro-ecosystem by testing various options to improve ecological and economic performance as in conversion to organic agriculture (pg.21).

The design of farm implements adapted to ecological practices, such as zero-tillage (p.8) and polyculture is often very important, not only for conditions where mechanisation is needed, but also for those in which hand labour and animal traction prevail.

Old truths to be revised

The acceptance of the narrow scientific logic of conventional agriculture restricts the real possibility of implementing alternatives that challenge this logic. Some opposing practices are:

- Intensive seedbed preparation – zero-tillage (p.8).
- Use of herbicides – use of mulches and cover crops (p.11).
- Continuous irrigation – rice production in aerated soil conditions (p.12).
- Practices that inhibit tillering in cereals – practices that stimulate tillering e.g. in rice (p.12) and wheat (p.13).
- High density row planting in grains – low density planting e.g. in rice (p.12) and wheat (p.13).
- Use of agrochemicals to fertilise the soil and control pests and weeds – use of cover crops, mulches, and functional biodiversity (p.22).

The time is ripe to revise such old truths as the alternatives are resource conserving and have the potential to increase production in a competitive way. Yet, much remains to be learned about sustainable agriculture, thus further research is essential and urgent (Global Forum for Agricultural Research, 2000).

The experiences show that there is great potential in agriculture based on resource conservation and agroecology. Unleashing this potential may reduce the need to introduce genetically modified varieties, before taking the time to analyse and discuss possible risks.

Towards biodiversity based agriculture

Merely introducing alternative agricultural designs will do little to change the underlying forces that lead to high-input monoculture production, and will not improve the situation long-term. Ecological degradation is not only an ecological process, but also a political, economic and social process. Many national and international policy changes, e.g. regarding pricing and incentives, research and extension, agricultural trade and education are necessary to create favourable conditions for development of sustainable agriculture (Altieri, 2000).

Transforming monocultures needs large-scale and intensive involvement of all stakeholders. Participatory learning, research and extension programmes that can reach and mobilise large and diverse groups of farmers are needed. Supporting farmer learning and experimentation through, for example, Farmer Field Schools (p.24), Farm Planning (p.26), Sustainability Analysis (p.28), Participatory Research (p.8) and Farmer-to-Farmer approaches and the use of mass communication and information technology can be important elements of a large-scale, cost-effective strategy to make the shift.

A mass movement needed!

However, this cannot happen without a mass movement of farmers and consumers convinced of the dead-end road of high-input monocultures. Broad coalitions of development workers, researchers, policy makers and funders who support such a movement and create a critical mass against prevailing economic and conventional scientific forces are needed.

■

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Other references see p.31

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Rice and groundnut monocultures in Andhra Pradesh, India. Photo: Bert Lof

The editors have taken every care to ensure that the contents of this Newsletter are as accurate as possible. The authors have ultimate responsibility, however, for the content of individual articles.

The editors encourage readers to photocopy and circulate Newsletter articles. Please acknowledge the ILEIA newsletter and send us a copy of your publication

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Dear Readers

This issue of the ILEIA Newsletter pays attention to high-input monocultures, especially annual commodity crops. It emphasises the experiences being gained with development of LEISA for these typical Green Revolution systems. Normally, the ILEIA Newsletter has a strong focus on smallholder farmers with one leg in self-sufficiency and the other in market agriculture, or even a third leg in other sources of income. But we assume that farmers with larger holdings, strongly specialised in commodity crops, have at least as many ecological sustainability problems. And it was for this reason that we intended to include a few articles on larger-scale farming in this issue. Although we got several interesting cases on 'ecologisation' and diversification of monocultures, most of these cases were, again, on smallholder agriculture. Could it be that besides IPM and zero-tillage, not much is moving towards LEISA yet in larger-scale high-input agriculture in the tropics, or is it that we just do not have the right contacts to get the information. Maybe this had to be so, considering the large number of small farmers trapped in monocultures. Hopefully, the articles and additional information will inspire many new initiatives towards LEISA.

As promised in the last issue, we are pleased to present the new ILEIA team on the back page. How do you like the picture? The team wishes you an inspiring, creative and resourceful year 2001!

The editorial team

Sustaining the Green Revolution by resource conserving technologies

Peter R. Hobbs, Raj Gupta, J.K.Ladha and Larry Harrington

Photo: Rice-Wheat Consortium

The Rice Wheat Consortium in South East Asia has joined hands with farmers in developing resource conserving technologies to improve production and ecologise the rice-wheat system in the Indo Gangetic Plains. Farmers are experimenting with new technologies like zero tillage, direct seeding, bed planting, Integrated Pest Management and Situation Specific Nutrient Management. Although the use of some of these technologies is spreading fast, much still has to be done to make the Green Revolution sustainable.

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ILEIA is the Centre for Information on Low-External-Input and Sustainable Agriculture. It seeks to exchange information on LEISA by publishing a quarterly newsletter, bibliographies, and books. ILEIADOC, the data base of ILEIA's documentation centre, is available on diskette and on ILEIA's Homepage: http://www.oneworld.org/ileia. Back issues of the ILEIA Newsletter are also available on ILEIA's website.

LEISA is about Low-External-Input and Sustainable Agriculture. It is about the technical and social options open to farmers who seek to improve productivity and income in an ecologically sound way. LEISA is about the optimal use of local resources and natural processes and, if necessary, the safe and efficient use of external inputs. It is about the empowerment of male and female farmers and the communities who seek to build their future on the bases of their own knowledge, skills, values, culture and institutions. LEISA is also about participatory methodologies to strengthen the capacity of farmers and other actors, to improve agriculture and adapt it to changing needs and conditions. LEISA seeks to combine indigenous and scientific knowledge and to influence policy formulation to create a conducive environment for its further development. LEISA is a concept, an approach and a political message.

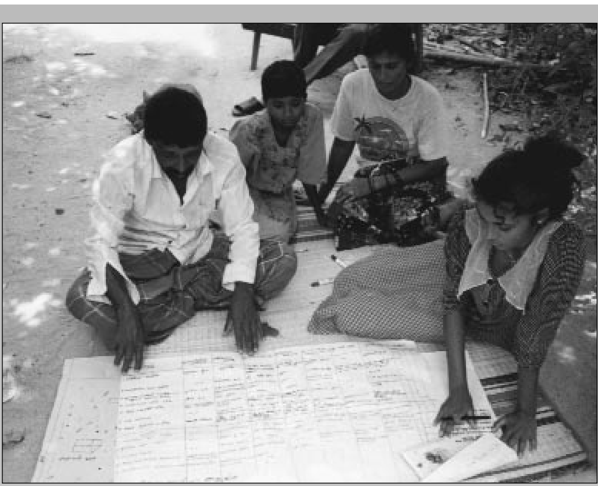

Photo: Alice de Jonge

Mahaweli settlers in Sri Lanka diversify their farms using Farm Planning

Alice de Jonge

In the huge irrigated agricultural settlements of the Mahaweli in Sri Lanka, farmers are up against the ever-decreasing profitability of rice monocropping. Farm Planning for Sustainable Farming, introduced as a tool for better management of resources and sustainable farm development, has helped farm families to diversify their farming system and thereby increase their family income.

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From sugarcane monoculture to agro-ecological village

Lindsey Mulkins and colleagues

Photo: REAP-Canada

The Flora community in Negros, the sugar basket of the Philippines, diversified the former sugarcane hacienda to become more food and energy self-reliant through its transition into an "agro-ecological village". Sugarcane production has been reduced considerably and supplemented with crops like maize, grains, legumes and vegetables. Trash cane farming, which recycles the residue by allowing it to decompose in the field, is replacing the traditional burning method that has led to serious ecological degradation. Farmers are experimenting extensively with new and old organic farming technologies.

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Ecologising rice-based systems in Bangladesh

Marco Barzman & Luther Das

Farming in Bangladesh is increasingly showing signs of unsustainability. The New Options for Pest Management (NOPEST) project implemented by CARE-Bangladesh is following a Farmer Field School approach to introduce farmers to the ideas of reintegrating vegetables, fish and trees. Comparative data show that diversification of rice monoculture is beneficial.

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Photo: Billy Howard, Esq./courtesy CARE, c.2000

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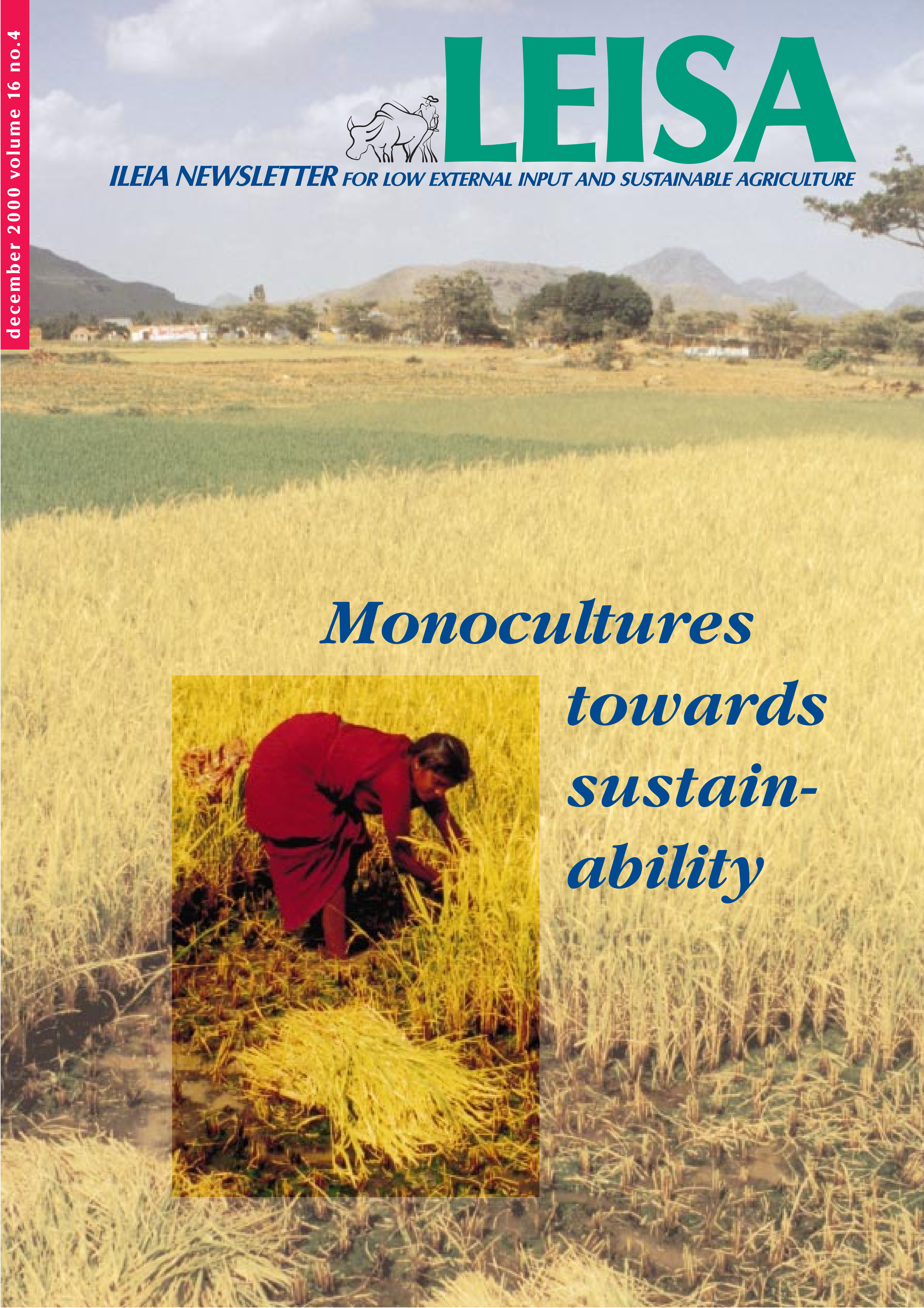

Monocultures towards sustain-ability

Araurocária forest with maté shrubs

Photo: Paulo Petersen

From maté extractivism to the regenerative management of Araucária forests

Paulo Petersen, José Maria Tardin and Francisco Marochi

Extraction of maté leaves has always been an important economic activity in Paraná, Brazil. Now, improving the production of maté groves has become the entry point of a Regenerative and Analog Agroforestry (SAFRA) programme initiated by the Central-Southern Paraná Farm Workers Forum. Farmer experimentation, farmer-to-farmer exchange, technical training and multi-media communication are important methodologies in this programme which is now extending to value adding and marketing of other forest species, especially medicinal plants.

Historic development

The maté (*Ilex paraguariensis*) is a tree species native to the *araucária* (*Araucária brasiliensis*) forests in southern Brazil. It was used by indigenous peoples to prepare teas well before the arrival of the Portuguese, and afterwards was incorporated into the traditions of the European settlers. Its economic importance also dates back to pre-Colombian times, as we have historical records of bartering between Guarany Indians from southern Brazil and the Incas in Peru. Beginning in the late 19th Century, the central-southern region of the State of Paraná began its "maté cycle," during which the cultivation of maté became a major influence in determining the local landscape (Souza, 1998). Maté producers settled on small farms in a process that, together with the later arrival of European immigrants, contributed to the consolidation of a land-holding structure based on small-scale farming.

The faxinal system

During the consolidation of family farming in the region, agroecosystems were developed that combined multi-cropping with open-range livestock and the extraction of maté leaves. This latter activity was the main cash generator for farmers. With growing pressure on the land in several of the region's municipalities, the system could no longer support farming and open-range livestock raising. The pressure to separate these two activities led to the creation of "community ranges" in which both livestock was raised and maté extracted. This novel form of technical and economic organisation became a typical trait of family farming in several municipalities, and came to be known as the *faxinal* system (Chang, 1988). The maté-extraction activity was thereafter carried out both in livestock pastures – in the *faxinal* areas – and inside the *araucária* forest areas.

Today, although its relative economic significance for small farmers is much less, maté extraction is still a stabilising factor for family income, since it is less vulnerable to the ups and downs of weather and markets than other traditional crops such as beans and corn. It was the farmers' recognition of this strategic function that led them to preserve major areas of the native forest in their agroecosystems. This is why the central-southern region of Paraná has much more forest cover than neighbouring areas.

Intensification of maté production

Traditional maté-related practices are still largely based on extraction, and the adoption of measures to renew maté groves or revitalise their productive potential is not common. Due to the growing pressure to occupy forest areas caused by the fragmentation of farms as they are handed down from one generation to the next, this traditional system now faces a crisis of productive potential. Recently, in order to enhance maté yields, a few official programmes have disseminated the idea of intensification, by copying techniques developed in Argentina, based on open-field plantations where the forest once stood and the intensive use of soluble fertilisers and pesticides. Initial experiences in using this system in central-southern Paraná shown its incompatibility with local conditions, principally the exponential rise in production costs. These "modern maté groves" are not economically viable. They not only degrade the environment but also break down the farmers' cultural relationship with what is left of the forest.

Developing agroecological alternatives

The need to overcome this crisis led the Central-Southern Paraná Farmworkers' Forum (see Box 1) to develop and disseminate alternative maté-grove management approaches that are compatible with the social, cultural and historical process of maté extraction in the *araucária* forest and under the *faxinal* system. With technical and methodological assistance of AS-PTA (Consultants in Alternative Agriculture Projects), the Forum has promoted a process of experimentation involving local communities that try to adapt the "SAFRA" approach (Portuguese acronym

Box I. Farmers' organisations in central-southern Paraná

With 22 municipalities and a land area of 13,000 km², the population of the central-southern region of Paraná numbers 419,198, 65.6% live in rural areas. The area is set off geographically by its social and political forms of organisation. These were established historically by the farm workers' union movement in the 1980s and culminated in a regional coordination that aimed to plan and implement actions to defend the interests of family farmers through the Central-Southern Paraná Farmworkers' Forum. Unions from 15 of the municipalities participate actively in the Forum as do 200 community associations and informal groups. The Forum's overall activity guidelines are formulated during its bi-annual regional Congresses.

for Regenerative and Analog Agroforestry System) to their agroecosystems (see p14). This method works towards optimising environmental and economic aspects of agroecosystems as efficiently as possible. The approach is partly based on agroforestry practices developed by indigenous people from Asia, Africa and Latin America (Foresta, 1993; Götsch, 1995). Based on observations of species succession, this method seeks to reconstitute a productive forest, analogous to the original forest, through radical pruning to rejuvenate, revitalise and accelerate the system's natural succession process and through the introduction of native species, along with the densification of maté populations, in order to re-establish ecological conditions appropriate to greater production from the maté groves.

Social dynamics of innovation

To launch the process of adapting the SAFRA method to the region, half-hectare test plots were set up in 1995 on 15 farms in the municipalities of Bituruna and São Mateus do Sul, where the typical maté farming takes place both in the *araucária* forest and in *faxinal* areas. When the test plots were established, the areas were at different stages of plant succession: degraded by farming activities and colonised by grassy weed vegetation; fallow land colonized by short-cycle pioneer bush (*capoeira*); secondary forest growth; and *faxinal* areas (a combination of trees at various stages of succession, grassy weeds and domestic animals).

In addition to their experimental purposes, these plots were the bases for creating a broader technical-training programme in an interaction between farmers and the academic-based knowledge contributed by the AS-PTA consultants.

The 35 farmer-experimenters who participated most systematically in the tests were organised into two groups that met regularly at events designed to implement, manage and monitor the SAFRA approach in their respective municipalities. In addition to examining their systems, these events provided an extremely fertile setting for the technical and methodological training of the farmers' families, as well as for planning group activities. The two groups met together each year to exchange experiences and plan common actions.

The test plots did not make use of conventional experimental designs, since the objective was not statistical analysis. Monitoring the performance of SAFRA systems was based on easy to visualise qualitative criteria. This participatory monitoring process generated a large amount of data and information that has been valuable in teaching other farmers interested in applying the method on their own farms. Therefore, the test plots were part of a social dynamic supported by the farmers' organisations.

The process and results of the experiments and technical training activities have been systematised and communicated through on-site training events and visits, as well as to wider audiences through radio programmes, newsletters, videos and newspapers. In the programme's methodological strategy, therefore, experimentation, testing and communication are loosely connected.

Disseminating the process

In addition to spreading the SAFRA approach in the region, efforts were also made to spread the social process that has allowed it to be adapted to the ecological management of maté production. In this way it was hoped to ensure a sustainable social dynamic that would generate and exchange technical innovations. Three years after the tests began on 15 farms, the positive technical results and the social mobilisation achieved in support of the proposal has made it possible to implement a broad regional programme dedicated to training farmers in several of the region's other municipalities and communities. The farmer-experimenters in the programmes' initial groups have now become trainers, unleashing a horizontal, "farmer-to-farmer" based dynamic (see LEISA Newsletter Vol.16 No.2, p.26-27) .

The technical and methodological results accumulated through the experimental phase have been well used by farmers' organisations in their discussions with official agencies working in rural areas. The farmers' objective is to influence the formulation and implementation of public policies for regional agricultural development.

Towards forest management

In addition to expanding the scale of the SAFRA approach to maté production, the farmer-experimenters have recently taken on the study of other native forest species that might be of economic interest. Medicinal plants are particularly interesting here. Through a regional people's medicine programme based on phytotherapy – organised and maintained by the regional Forum of farmers' organisations – over 150 medicinal plants native to the *araucária* forest are now gaining greater cultural and economic value. In recent years, this programme has handled approximately 300,000 medical consultations for both rural and urban residents in the region.

In addition to the social and cultural revitalisation of the value of local biodiversity, the creation of this new front for technical experimentation has increased the economic value of the work done by rural women, since the management of medicinal plants within the farm family has traditionally been their responsibility.

The farmers' organisations involved in the programme are presently organising ways and means of processing and marketing the products of their SAFRA systems. Their development strategy in this sphere is once again based on the methods used to achieve technical innovation, namely to associate an experimental process in pilot projects with an ongoing exchange of knowledge between farmers and technical consultants. ■

Photo: Paulo Petersen

Farmers and technicians working together to improve forest management.

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Artist: Ariel

Traditional slash and mulch in Guadalcanal

Tony Jansen and Roselyn Kabu Maemouri

The Solomon Islands are located in the Western Pacific Ocean. The main islands are volcanic in origin with mountains reaching 2400m. Climate is wet and tropical with an annual rainfall of 2500 to 6000mm. There is no distinct wet and dry season.

Most of the country is covered by rainforest and 80% of the population live in small isolated communities and practice shifting cultivation. Population growth, land degradation and cash cropping have resulted in shortened fallows that today vary from 5-7 years but which in some places are as short as three.

'Slash and burn' practices are the customary way of preparing garden sites but when we look more closely at traditional methods we find there are different approaches to the use of fire. Locally specific alternative practices have been documented. Some are in common use, others are on the verge of extinction. These traditional practices have been used to start discussions with farmers on the role of organic matter in soil fertility. Here, 'slash and mulch' will be discussed.

Yam and pana slash and mulch

Guadalcanal is well known for a 'slash and mulch' system of planting of yam (*Dioscorea esculenta*) and pana (*Dioscorea alata*) in which no fire or staking is used. The natural vegetation is usually mature forest or secondary forest. This is cleared leaving most of the trees standing. Vegetation is spread randomly over the site and yams are planted with traditional digging sticks. The leaves rot into rich organic material and trunks and branches form a mass of crossed 'stakes' that support the growing yams. Bananas and taro can also be planted in this system.

Tasimate slash and mulch

This is a similar method used in Tasimate. The difference is that it is applied with all food crops especially sweet potato and taro. This makes the results likely to be much more widely applicable.

Secondary forests are often dominated by stands of maturing pioneer species such as *Macaranga sp*. and trees with an understorey of soft ginger and banana-like plants. Undergrowth is cleared in a fallow of 4-6 years and the garden laid-out under the canopy of larger trees. The crops are planted in rows in a pattern depending on how the fallow trees that will be cut will fall on the land. After the plants are established, the trees are cut and branches and trunks are placed in wide rows across the garden. Soft leaves and stems are cut into thick mulch (5-10cm thick) and spread between the crop.

Sweet potato cuttings are planted farther apart than is usual in slash and burn systems and the vines grow over the thick mulch and rotting trunks. The first harvest comes from the mulched land, the second from the areas of sticks and trunks where nutrients are released more slowly.
Higher yields are obtained from this system than from other slash and burn systems practiced on similar soils in this area. Yields are also good with relatively short fallows. In fact these short fallow areas are preferred by farmers who practice this method.

Traditional knowledge has an important role in reinforcing sustainable management systems. It provides important links to move from the known to the unknown in development of new practices to cope with increasing land use pressure. ■

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Themes for the ILEIA Newsletter

March 2001 Vol.17-1
Resilience of agriculture

How do farmers prevent disaster and react to the catastrophies of drought, flood, armed conflict, disease and economic crisis? How do farmers deal with variability and risk? How can the resilience of farming and rural livelihoods be improved? What impact does labour migration have on farming systems and gender roles? How can women best adapt farming in areas of labour migration and still optimise benefits and ecological sustainability? How can gender roles be renegotiated? How can women farmers best be reached and supported? How can farming by refugees be supported? ***Deadline for contributions 1 December 2000.***

July 2001 Vol. 17-2
Globalisation challenged

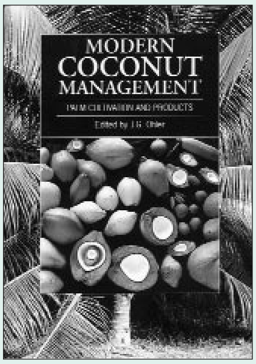
Many farmers in the tropics are negatively affected by globalisation of the world economy and expansion of the consumer culture. To them, this is one step further on the road to marginalisation. In reaction, some farmers, communities and organisations have started to reconstruct traditional 'agri-culture', save indigenous seeds or harvest water. Others focus on development of organic agriculture, local products, empowerment of local institutions or alternative education. Still others protest against genetically modified organisms and international agreements on intellectual property rights.
For this issue of the LEISA Newsletter we invite articles on such reactions to globalisation and on how local communities and farmer organisations can be strengthened to retain the right to their own futures. ***Deadline for contributions 1 March 2001.***

You are invited to contribute to these issues with articles (about 1800 words + 2 illustrations), suggest possible authors, and send us information about interesting issues, publications, training courses, meetings and websites.

Farmers' perceptions and sustainable land use in the Atacora, Benin *by Adegbidi A [et al], 1999, 49 p. GBP 5.00. Collaborative Research in the Economics of Environment and Development (CREED), Environmental Economics Programme IIED, 3 Endsleigh Street, London WC1H 0DD, United Kingdom; Institute for Environmental Studies (IVM), VU, De Boelelaan 1115, 1081 HV Amsterdam, The Netherlands. (Creed Working Paper series ; 22). IIED Bookshop, 3 Endsleigh Street, London WC1H 0DD, United Kingdom bookshop@iied.org.*
This paper documents part of a study on the farming systems in Atacora, North West Benin and is a contribution to the development of appropriate environmental policies for the area. In this survey farmers' awareness on soil fertility decline was examined, whilst an overview of the practices adopted for maintaining or restoring soil fertility was made. The traditional way to combat land degradation is to leave the land fallow, but due to land pressure these fallow periods are being shorter. Alternatives are known, but adoption rates are low. (IHG)

Integrating concepts of sustainability into education for agriculture and rural development *by Bor W (van de) ... [et al.] (eds). 2000. 329 p. ISBN 3 631 36425 3 : NLG 150.00. (Environmental education, communication and sustainability, ISSN 1434 3819 ; vol.6). Kniphorst Boekverkopers, Hoogstraat 49, 6701 BM Wageningen, The Netherlands.*
This publication builds on the proceedings of an international workshop held in August 1998 in Wageningen, the Netherlands titled,'' the Concept of Sustainability in European Curricula for Higher Agricultural and Related Sciences Education'' and expands on the subject with contributions from outside Europe. The target audience are those involved in curriculum development in higher agricultural and rural development education, and who want to integrate aspects of sustainability into teaching and learning. Issues such as biotechnology and market liberalisation demonstrate very clearly the need to deal with complexity and continue the discussion on interdisciplinary teaching and social and environmental impact. The book is divided into two parts: a discussion of conceptual issues and examples of institutions trying to integrate sustainability into their curriculum. The book gives a good overview of the issues involved and their complexity. It is encouraging to note that universities are recognising that they have a critical role to play in creating sustainable futures. (IHG)

Modern coconut management : palm cultivation and products *by Ohler JG (ed.). 1999. 458 p. ISBN 1 85339 467 X : GBP 45.00. Food and Agriculture Organization of the United Nations (FAO), Viale delle Terme di Caracalla, 00100 Rome, Italy; LEAD Progamme, Institute of Cultural and Social Studies, Leiden University, Leiden, The Netherlands. Intermediate Technology Publications, 103-105 Southampton Row, London WC1B 4HH, UK.*



This voluminous book provides a complete overview of all aspects of coconut management. Besides updated information on the general agronomic aspects, breeding and post-harvest treatment and processing, considerable attention is given to the role of coconut palm in intercropping systems and in combination with pastures and livestock. Appendices present an extensive bibliography and a register of institutions and experimental stations involved in coconut research. (IHG)

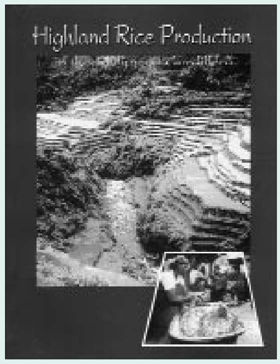
Soil Conservation and Watershed Management in Asia and the Pacific. *APO 2000. 261p. ISBN 92 833 2249 5 Asian Productivity Organization, Hirakawa-cho Dai-ichi Seimei Bldg. 2F, 1-2-10, Hirakawa-cho, Chiyoda-ku, Tokyo 102-0093, Japan. Fax (81-3) 5226-3950 Email: apo@gol.com*
The seminar on Soil Conservation and Watershed Management sponsored by the Asian Productivity Organization (APO) in November 1998 in the Republic of China was a means of addressing related issues in many Asia-Pacific countries. This publication contains the seminar proceedings as well as resource and country papers. Whilst the country papers review the current soil conservation and watershed management situation in the respective countries, the resource papers focus on specific topics such as planning for watershed management, integrated watershed management, soil conservation extension etc. The papers discuss the manner in which each country has tried to tackle the issue, the progress made and some of the bottlenecks encountered in the process. It is interesting to note that soil conservation and watershed management is a priority in each of these countries, and that it is supported by state legislation.

Learning from change – issues and experiences in participatory monitoring and evaluation *edited by Estrella M. with Blauert J., Campilan D., Gaventa J., Gonsalves J., Guijt I., Johnson D. and Ricafort R. 2000. 274 p. ISBN 1 85339 469 6: GBP8.95. Intermediate Technology Publications Ltd., 103-105 Southampton Row, London WC1B 4HL, UK.*
Bringing together a broad range of case studies and discussions between practitioners, academics, donors and policy makers, this book explores conceptual, methodological, institutional and policy issues in participatory monitoring and evaluation. It tackles the common themes and experiences in participatory monitoring and evaluation and shows the challenges – and far reaching benefits – of the approach. Interesting reading for all development professionals, including field workers, practitioners, researchers and policy makers.

Some successful indigenous technologies and practices for watershed management in Thailand *by Thongmee U., Phonpunpao P., Teerapon S. 1999. Royal Forest Department, Bangkok, Thailand/ ASIAN WATMANET/ Participatory Watershed Management Training in Asia (PWMTA) programme, Kathmandu, Nepal.*
Thai civilisation has evolved around sustainable forest, land and water management since ancient times. In the recent past, however, the principle of sustainability has been increasingly ignored. Highlighting indigenous watershed management systems in Thailand, this publication is a contribution to modern watershed management and conservation. It sets out to promote indigenous technologies and practices, particularly in the areas of water harvesting and upland irrigation, agroforestry, community forestry, forest conservation, agriculture and stock farming, and soil and water conservation.

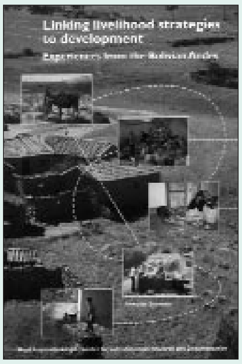
Fertile soil *by Misereor. 2000. 50 p. Misereor, PO Box 1450, D-52015 Aachen, Germany.*
This paper stresses the central role of soil conservation in rural development and gives a general overview of the subject. Causes of soil degradation and soil erosion are given, as well as ways to combat them on the basis of eleven Misereor project evaluations. Soil conservation is suggested as the basis for sustainable systems of land use. (IHG)

Highland rice production in the Philippine Cordillera. *CECAP and Philrice 2000. 213p. ISBN 97 19081 09 0 Central Cordillera Agricultural Programme (CECAP), Banaue, Ifugao and Philippine Rice Research Institute (Philrice), Maligaya, Munoz, Nueva Ecija, The Philippines.*



The Philippine Cordillera Administrative Region (CAR) is famous for its rice terraces – the eight wonder of the world. However, agricultural productivity, especially rice production, remains low. This publication consists of more than 52 field-tested and farmer-approved practices in the Philippine Cordillera. Easy-to-understand and fully-illustrated sheets show how to increase rice production, enhance traditional cropping systems, improve soil fertility and land productivity, construct efficient methods of irrigation, manage different kinds of pests and weeds, increase income through rice products, and many other traditional and alternative examples and practices in highland rice farming. This book is aimed at extension workers, farmers, community groups, NGOs, agricultural planners and researchers. It is also an invaluable resource for all those interested in farmer-tested methods to improve rice production in the highlands.

Linking livelihood strategies to development : experiences from the Bolivian Andes *by Zoomers A. 1999. 108p. ISBN 90 6832 125 0 : NLG 29.00. Royal Tropical Institute, PO Box 95001, 1090 HA Amsterdam, The Netherlands /* kitpress@kit.nl



Why have so many development initiatives failed to improve rural livelihoods in the ecologically culturally diverse *comunidades* of the Bolivian Andes? The book summaries the insights of a study - *Proyecto de investigacion sobre estrategias de desarrolla (PIED-Andino)* - that examined farmer and household livelihoods strategies, and village and intra-village relations over a 15 year period. The book sets out to explain that many development initiatives in the area have failed because they were based on an incomplete view of the local situation and because they assumed farmers were predisposed to resist change. *PIED-Andino* concluded that the significance of farmers multi-earning activities including off-farm employment was usually seen as a flight from poverty rather than as part of a multi-strategy response to environmental degradation. As a result development projects failed to build on farmers realities and livelihood strategies. Most evaluations of rural development projects were based on project goals not on the perceptions of farmers or the dynamic of the farm household. (MM)

Useful plants for land design *by Brazier A. 199?, 112 p. PELUM Association, PO Box CY301, Harare, Zimbabwe.*

This manual aims at the southern African region and describes plant species from the perspective of permaculture. It includes many multifunctional species and species that could be introduced more widely. The different sections deal with: climbing plants, cover crops, soil stabilisation species, shelter crops, pest control plants, dryland fruit trees and irrigated fruit trees. Besides general descriptions it also includes the local names and functions of each plant in the landscape (e.g. erosion control, windbreak etc.). A very well illustrated and functional workbook with spaces for readers' notes. (IHG)

Source book of sustainable agriculture for educators, producers and other agricultural professionals *SAN 1997. 136 p. ISBN 1 888626 03 8: USD 12.00. Sustainable Agriculture Publications, Hills Building, Room 12, University of Vermont, Burlington, VT 05405-0082, USA.*

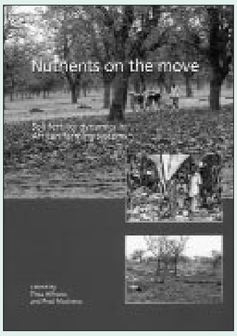
This book published by the Sustainable Agriculture Network (SAN) in the United States is a compendium of books, newsletters, conference proceedings, bulletins, videos, reports and web sites with information on agriculture and conservation. The subjects covered are agroforestry, animal production, cover crops, horticulture, grain production, marketing and farm profitability, nutrient management, soil quality and conservation, education and networking, and water quality and conservation. Each subject has its own icon, which allows for quick reference. The book features over 500 entries organised alphabetically by state, U.S. territory and foreign country. Each entry carries information such as title, author, type of product, abstract, date published, cost, how to order etc. SAN also invites readers to update or add an entry either by mail or through the web. Details are available at the end of the source book. Although most of the entries in the book are related to the U.S., the information can be equally useful to people interested in agriculture and conservation related issues in other parts of the world.

Rethinking soil and water conservation in a changing society – a case study in eastern Burkina Faso *by Mazzucato V. and Niemeijer D. 2000. 378p. ISBN 90 6754 596 1. Tropical Resource Management Papers, No. 32(2000)*

Soil and water conservation projects have had limited success in Africa despite various intervention approaches tried throughout the twentieth century. This study on eastern Burkina Faso, by two scholars from different backgrounds, argues that soil and water conservation is a complex issue in need of an integrated approach. It suggests that forms of intensification in African production systems can be best understood through analytical frameworks that focus on the interplay of social and environmental histories, rather than by assuming a simple trend towards increasing land degradation. The study offers an example of such an analytical framework and how it can be operationalized, leading to innovative perspectives on African land use systems.

From the roots up – strengthening organizational capacity through guided self-assessment *by Gubbels P. and Koss C. 2000. 184p. ISBN 0 942716 10 8. World Neighbours, 4127 N.W.122nd Street, Oklahoma City, OK 73120-8869, USA. Fax (405) 752-9700*

Guided self assessment is designed to help grassroots NGOs and community groups recognize their own potential, identify critical issues for programme and organizational development, and decide for themselves what actions to take, in relation to their purpose, context and resources. The process presented in this guide provides local organizations with the tools and perspectives necessary to strengthen their capacity by regularly reflecting on their performance, diagnosing internal strengths and weaknesses, identify priority capacity areas to be strengthened and designing action plans to improve effectiveness and long-term viability.

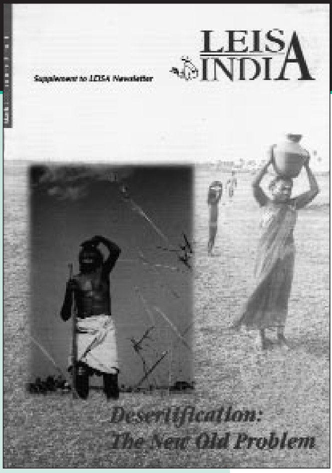


Nutrients on the move : soil fertility dynamics in African farming systems *by Hilhorst T. and Muchena F. (eds). 2000. 146p. ISBN 1 8 99825 56 8. IIED Bookshop, 3 Endsleigh Street, London WC1H 0DD, United Kingdom / bookshop@iied.org.*

NUTNET is a soil nutrient network made up of NGOs, universities, and national agricultural research institutes. Studies in six African countries were carried out with *NUTNET's* principal objectives in mind: to facilitate learning about soil fertility, stabilise soils and identify the conditions necessary for the sustainable production of food and other agricultural goods. In the countries studied agricultural production is in decline, stagnating or has an uncertain future. The *NUTNET* studies found that at farm and village level farmers were using a wide variety of strategies to cope with low levels of soil fertility. Farmers use indigenous knowledge to develop their own ways of conservation with the help of local NGOs and researchers. The editors stress, however, that it is important to study the full local and regional effects of farmers' initiatives. (MM)

Seeding solutions. Volume 1. Policy options for genetic resources : people, plants and patents revisited. *2000. 121 p. ISBN 0 88936 926 7. International Development Research Centre (IDRC)/International Plant Genetic Resources Institute (IPGRI)/Dag Hammarskjold Foundation*

This volume has been produced by the Crucible Group, a highly diverse body of people who came together after the 1993 Conference on the Environment and Development (UNCED) and in anticipation of the finalising of the General Agreement on Tariffs and Trade (GATT). They all shared a common concern for plant genetic resources and were alarmed that availability of these resources for world food security and agricultural development were being imperilled by proposed legislation. The present volume is an excellent source of information for policy makers and those requiring an up-to-date overview on the main issues related to the ownership, conservation and exchange of germplasm. The book begins by outlining the current struggle surrounding genetic resources and goes on to consider biodiversity and the issues of Intellectual Property Rights. Important here is the accelerated loss of bio- and cultural diversity, the commercialisation of transgenic crops and the implications for bioethics and social choice. Part Two discusses the various protocols that have been formulated in recent years including the Convention on BioDiversity and the Leipzig Global Plan of Action. The role of the CGIARs in facilitating access and exchange of knowledge is elaborated as is the role of World Intellectual Property Organisation (WIPO) in relation to knowledge policy making and the preservation of indigenous knowledge. In the final chapter the strategic role played by the World Trade Organisation in many of the issues raised in the book is discussed including the controversial role of the Trade Related Aspects of Intellectual Property Rights legislation commonly known as TRIPS. A second volume in this series dealing with the legal aspects of the debate is to be published later in 2000. (MM)



LEISA INDIA

The response to the integrated agriculture issue has been very encouraging and there has been a 40% increase in the number of contributors. In addition there is a growing diversity in geographical coverage as well as in the background of contributors. We have received contributions from all parts of the country from Assam in the east to Rajasthan in the west and from the northern, southern and central regions of India as well. Contributors include farmers, research students, senior academic, NGO project workers, extension officers, scientists attached to premier research institutions and senior bureaucrats. Presently, we are doing our best to select those articles that best share experiences gained in the different regions, practical field-based experiences and articles that report the successful use of technologies that our readers may also be able to try.

As a result of the LEISA India platform, there is already a lot of information exchange among the contributors and readers. For instance, Shri Narayana Reddi, a well known progressive farmer who contributes a regular column to **LEISA-India** was inundated with mail when he offered a specific seed variety. Similarly, there are a lot of exchanges on network experiences, especially on network models and on efforts to combat desertification and increase biodiversity. The number of subscribers is also steadily increasing and many new names are being suggested for inclusion.

The coming **LEISA-India** edition on Farmer Innovation will include: a report of a farmer innovators workshop (role models in the region); crop based innovations; process based and technological innovations; the philosophy and functioning of pioneering networks like Honeybee and regional partners like Hittalgida and the crusading spirit behind them.

As you know we have always distributed the ILEIA Newsletter and the LEISA India supplement separately. The Farmer Innovation issue will be the first time the two magazines will be brought together in a brand new regional magazine: **LEISA-India**. AME Bangalore will continue to handle its publication and distribution. ■

Those who are interested in **LEISA-India** may write to the following address. K V S Prasad, Coordinator, Info. Systems and Documentation, AME Programme / LEISA - India, 368, 4th cross, 3rd phase, J P Nagar, Bangalore - 560 078. India. email: amebang@giasbg01.vsnl.net.in

News from LEISA El Boletín for Latin America

Despite the changing political circumstances that threaten the stability of democracy and delay its consolidation in some of our countries, the willingness shown by peasant farmers, technicians and professionals in Latin America to search for alternative agricultural strategies continues to generate grass root innovations. However, these are still too few and dispersed to create the impact needed to reverse poverty among small-scale farmers or to stop the erosion of natural resources in many parts of Latin America. Nevertheless, the information being provided by our readers and the steadily increasing number of subscriptions shows that LEISA and Participatory Technology Development are making great strides on this continent. We can see that LEISA, *El Boletín de ILEIA* has come to play an important role in communicating information about sustainable agriculture and LEISA and complements the work of other communication efforts such as the Peasant-to-Peasant experience in Ecuador and Nicaragua, radio programmes and magazines. Although much remains to be done to ensure that *El Boletín de ILEIA* is viewed as the outcome of a truly participatory process, we are on the right track. We are getting increasing numbers of articles from readers based on their experiences, research work and other breakthroughs. Questionnaires asking for readers' opinions about the content and presentation of the magazine are often attached to *El Boletín*. Replies are mostly positive, although it must be said that only about 30% of our subscribers usually respond. Perhaps filling in questionnaires is not so effective in this day and age. We are therefore looking for more efficient ways of obtaining opinions in a situation where rural populations still have very limited access to electronic means of communication. Maybe our colleagues from *LEISA India* and those working on sustainable development magazines in other continents could help us out by suggesting ways in which we can keep in touch with our readers' opinions, so that we can include their criteria in the magazine. We are very grateful for any letters we receive, either via e-mail or by post.

In September 2000, we received more than 100 applications for new subscriptions. Many were from peasant farmers themselves including three peasants from Yucatan in Mexico. All the agro-ecological farmers from Ecuador, Bolivia and Peru who attended the Ecological Farming Meeting held in Lima in September 2000 requested a subscription to *El Boletin de ILEIA.* ■

Teresa Gianella-Estrems, Editor, estrems@amauta.rcp.net.pe

Energia

→ http://www.energia.org

ENERGIA is an international network on Women and Sustainable Energy, founded in 1995 to create an institutional base for galvanising action **to strengthen the role of women in the energy sector**. Energia is open to both men and women from the South and North interested in promoting its goal to "engender" energy and "empower" women, through the promotion of information exchange, training, research, advocacy and action aimed at sustainable energy development that is equitable for all.

ENERGIA News is produced jointly by Energy, Environment and Development (EED, Kurten, Germany), the Technology and Development Group (TDG, Enschede, the Netherlands) and ETC Energy (Leusden, the Netherlands). **The focus is on practice**, with a conscious effort to interpret and learn from this practice.

For more information: Email: ruaf@etcnl.nl Sheila Oparaocha ENERGIA News Secretariat c/o ETC Energy PO Box 64 3830 AB Leusden The Netherlands Tel: +31.33.4943044 Fax: +31.33.4940791

NETWORKING

The Forest Garden Initiative Programme supported by Counterpart International promotes and continues to work on the analog forestry model that fosters the restoration of degraded land through the development of family-owned forest gardens around the world. Community-based ecosystem management, certification and marketing of forest garden products are part of the Forest Garden approach.

For more information:
- Counterpart International, Inc., 1200 18th Street NW, Suite 1100, Washington, DC 20036, USA; Tel: +1 202 296 9676; Fax: +1 202 296 9679; info@counterpart.org ; http://www.forestgarden.org/
- International Analog Forestry Network: http://www.rcfa-cfan.org/
- The Forest Garden of Robert Hart: http://-www.globalideasbank.org/BOV/BV-314.HTML

Soil Fertility Research at Wye College, University of London, UK. The main focus of the research group's work is the legume/rhizobium symbiosis and its impact on nutrient cycling. Its web site provides information on such topics as improved fallows for Western Kenya, improved cropping systems, live-stock-based systems etc. The web site also provides information on the **Organic Resource Database** (ORD), a project initiated by the Tropical Soil Biology and Fertility Programme and Wye College. So far the main plant species covered has been tropical legumes. Decision tools to identify best use options are provided. The database addresses researchers, extensionists and NGOs.

It can be accessed free of charge and can be downloaded from the web site http://www.wye.ac.uk/BioSciences/soil/

Forest, Trees and People Programme (FTPP) supports rural populations participating in developing forest resources, and publishes the excellent periodical Forest, Trees and People Newsletter.

Address: FTPP Network, SLU Kontakt, Swedish University of Agricultural Sciences, Box 7034, 750 07 Uppsala, Sweden; Tel: +46 18 672001; Fax: +46 18 671980; FTPP.Network@kontakt.slu.se ; http://www-trees.slu.se/

Improvement and management of the fallow lands in West Africa is a research programme for the improvement and management of village fallow land. It aims at the intensification of the crop/fallow cycle. Research teams are based in Burkina Faso, Côte D'Ivoire, Mali, Niger and Senegal.

Further information (mainly in French): Institut de Recherche pour le Développement (IRD), B.P. 1386, Dakar, Senegal, Tel: +221 849 3535; Fax: +221 832 43 07 and http://www.ird.sn/act-rech/jachere/projet.htm .

Overstory is a free e-mail journal that serves people working in tropical agroforestry, forestry and sustainable development in 133 countries.

It is published by Permanent Agriculture Resources, P.O. Box 428, Holualoa, HI 96725 USA; Tel: 808-324-4427; Fax: 808-324-4129; E-mail: par@agroforester.com; Web site: http://www.agroforester.com. Past editions can be seen on: http://www.agroforester.com/overstory/osprev.html Some themes discussed are: Traditional agroforestry No.51; Non-timber forest products No. 53; The understory No.56; Value-adding No.63; Twelve tree myths No.68.

Rural Learning Networks in Community Forestry aims at improving farmers' livelihoods by facilitating farmer self-learning and information exchange on indigenous and locally innovated knowledge and practices, farmer-to-farmer exchange and communication. In community forestry, implementation of farmer-led research and extension approaches such as Farmer Field Schools is still in its infancy. The Forests, Trees and People Programme (FTPP) supports the initiation of the Rural Learning Network Approach.

For more information contact ftpp@fao.org and http://www.fao.org/forestry/FON/FONP/cfu/topics/en/learn-e.stm

New Forests Project (NFP) offers nitrogen-fixing tree seeds, technical information and training materials free of charge to groups worldwide.

Address: 731 Eighth Street, SE Washington, DC 20003, USA; Tel: +1 202 547 3800; Fax: +1 202 546 4784; icnfp@erols.com

New website on organic farming
CABI Publishing is pleased to announce the launch of a new organic farmingresearch internet site at http://www.organic-research.com The site contains the latest news on organic agriculture and information on events, research, education, legislation, jobs, network links and cases of organic farms in the North and the South. A search function is also available.

Trop SCORE

The Consortium for Tropical Soil Cover and Organic Resources Exchange, TropSCORE, is an association of regional and international members set up to collaboratively acquire, synthesis, exchange and disseminate information about low-external-input approaches for improving smallholder farming systems in the tropics and managing the natural resource base in a sustainable manner. The main focus is on cover crops, green manure and other organic means of managing tropical soils. Topic covered are of particular relevance to farmers in Africa, Asia and Latin America working in areas where resources are severely limited.

Members of the Consortium include:

CIDICCO, The International Cover Crops Clearinghouse, Honduras, Apartado Postal 4443, Tegucigalpa MDC, Phone: +504 232 3850; Fax: +504 239 5859; cidicco@gbm.hn ; http://www.sdnhon.org.hn/miembros/cidicco. Information, including Cover Crops News and several books, available is available in Spanish and English.
CIEPCA, The Centre for Cover Crops Information and Seed Exchange in Africa, Republic de Benin, 08 BP. 0932 Tr Postal, Cotonou, Phone: +229 350188; Fax: +229 350556; ciepca@cgiar.org . Newsletter and several publications available in French and English.
CIIFAD/MOIST, The Cornell International Institute for Food, Agriculture and Development working group on Management of Organic Inputs in Soils of the Tropics is based at Cornell University, 618 Bradfield Hall, Ithaca, New York 14853, USA. MOIST is an interdisciplinary working group that investigates and exchanges information on cover crops, green manure, managed fallows and mulches in tropical farming systems.
ECHO is a NGO resource centre and global bookstore: 17391 Durrance Rd., N.Ft. Myers, Florida 33917, USA; Tel: +1 941 543 3246; Fax: +1 941 543 5317; books@echonet.org ; http://echonet.org/ . ECHO provides international development resources including publications. It also makes seeds of under-exploited food, agroforestry, and soil-improving crops available on request free of charge.

Other services provided by TropSCORE include:

- TropSCORE Information Gateway Website, an international clearinghouse and search engine for TropSCORE internet resources on soil cover, organic inputs and tropical soil management.
- e-list of active electronic discussion groups in French, Spanish and English.
- print-to-web project providing internet access to "grey" literature and regional newsletters in order to scale up access to local information sources.
- Green Manure Cover Crops (GMCC) seed bank and on-line seed source database (planned for 2001).

For more information on TropSCORE contact: Lucy Fisher, CIIFAD/MOIST, Phone: +1 607 255 2920; lhf2@cornell.edu and http://ppathw3.cals.cornell.edu/mba_project/moist/TropSCORE.html

CAN YOU CONTRIBUTE

Information on Water Harvesting wanted

I am collecting and documenting success stories on traditional and recent methods of water harvesting, soil and water conservation and river-bank erosion control.
I am also collecting information on publications dealing with these issues and on organisations promoting water harvesting in other regions. I am keen to exchange info and photos with like-minded activists in other parts of the world. I would be grateful if there are readers of the LEISA Newsletter who can provide me information or send me the addresses of persons and associations involved in this cause. I am especially looking for cases of groundwater enrichment through reforestation and other in-situ methods. Such case studies are very important in today's context. The information collected in this way will be collected together and passed on to others via appropriate media.

Shree Padre, journalist, Post Vaninagar, Via Perla, Kerala-671552, India. spadre@vsnl.com

Second international competition on Grassroots Innovations

Any innovations attempted by farmers, artisans, fishermen and women, slum dwellers, workshop mechanics, primary or secondary school teachers or local communities on a wide variety of subjects are eligible for this competition. Suggested topics include, for example, managing natural resources, biodiversity, developing new farm implements, herbal pesticides, curing diseases, building houses, reviving culture and enrolling children or improving performance in primary education or any other field of human knowledge.
The award winning entries will be published in the Honey Bee Newsletter and included in the multi-media, multi-language database on Grassroots Innovations. Winners will also be invited to the Honey Bee network meeting in India in February, 2001.

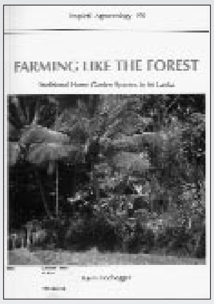
You are invited to send your contribution including information on genesis, background, innovators/s, origin of idea, accompanied by photographs and/or video if possible, to:Prof Anil K Gupta, Coordinator, SRISTI and Honey Bee network, Indian Institute of Management, P.O. Box 15050 Ahmedabad 380 015 India. anilg@iimahd.ernet.in ; http://www.sristi.org
Last date for submission: December 30, 2000

IF YOU WANT TO KNOW MORE

Best practices in shifting cultivation for sustainability and resources conservation in Asia
a resource book produced by the International Institute of Rural Reconstruction (IIRR), Y.C.James Yen Center, Silang, Cavite 4118, Philippines /iirr@cav.pworld.net.ph. Expected to be ready in December 2000 see p.2.

Analog forestry: an introduction
by Senananyake R and Jack J, 1998. Monash Publications in Geography Number 49, Monash University, the publications secretary, Dept. of Geography, Clayton, Victoria 3168, Australia, fax: +61 3 9905 2948, gary.swinton@arts.monash.edu.au ISBN 0 909685 58 4, Aus$ 33.00 + postage, pp.145.
This booklet explores the major ecological processes that underlie Analog Forestry. Much consideration is given to the inter-connectedness of functions within the forest over time and thus the importance of successsional changes and the adaptability of plants and other organisms of the forest ecological system. It postulates that much of the undervaluing of forests derives from an ignorance of the wide range of forest products, most of these from non-woody plants. In consequence the nature of forest products is dealt with in some depth. Much attention is given to the design of Analog forests. It is explained that in the design of Analog forests the strategies and values of indigenous people and the structures and functions of the relevant 'native' forest should be taken into consideration and that it should fit appropriately within the human and natural landscape of the region.
Case studies detail how the approach has been applied in Sri Lanka and Australia. Special attention is given to the possible contribution of Analog forestry to biodiversity conservation.
A challenging introduction to a knowledge intensive ecological approach to (agro-)forestry. (CR).

Farming like the forest: traditional home garden systems in Sri Lanka
by Hochegger K, 1998. Margraf Verlag, PO Box 1205, D-97985 Weikersheim, Germany, Fax: +49 79 348156; margraf@compuserve.com ISBN 3 8236 1293 X ; US$ 40.00
The *gewatta* or traditional home garden system is investigated and presented by the authors as a model for sustainable land use and biodiversity conservation. The forest-like gardens cover 14.5% of the island's total area. They offer a habitat for many plants and animals. At the same time they provide many of the daily needs of a growing population. Typical characteristics are a low need for external inputs and labour, minimisation of risks and a high adaptability to change. It has even survived the development of the monetary market by adding some cash-crop products.



Still further adaptations are needed to keep them attractive to farmers many of who also have jobs outside agriculture as well. To preserve the potential of these gardens more attention should be paid to education and training, the encouragement of local culture and establishing a research institute. This is very detailed and nicely illustrated case study, strongly contributing to better understanding of traditional agriculture. (CR)

Improving smallholder farming systems in Imperata areas of Southeast Asia: alternatives to shifting cultivation
by Menz K, Magcale-Macandog D. and Rusastra IW (eds), not dated. ACIAR Monograph No. 52, 280 pp. ISBN 1 86320 223 4. ACIAR, GPO Box 1571, Canberra, ACT 2601, Australia.
It reports on a research programme on the above subject. It discusses the problem of Imperata invasion, the research methodology followed and a number of case studies on alternatives such as tree planting, hedgerows, incorporation of livestock and fire management.

Imperata grassland rehabilitation using agroforestry and assisted natural regeneration *by Friday KS, Drilling ME, and Garrity DP (eds), 1999. ICRAF Southeast Asian Regional Research Programme, Bogor, Indonesia. ISBN 979 95537 0 9.*
A practical how-to-do booklet based on the above publication.

Fallow management systems documentation and participatory rapid appraisal methodology *by Magcale-Macandog DB et al. (eds). 1999. Workshop proceedings. Fallow Management Network – Philippines, secretariat DB Magcale-Macandog, NRMP – SEAMEO, Phone: +63 49 536 3459; Email: dmm@agri.searca.org*
A literature review and cases of fallow documentation are presented and experiences with different research tools are discussed.

Building upon traditional agriculture in Nagaland, India. *1999. 235 p. ISBN 0 942717 72 4. Nagaland Environmental Protection and Economic Development (NEPED), c/o Intern. Development Research Centre (IDRC), 208 Jor Bagh, New Delhi 110 003, India / mfaminow@idrc.org.in; Intern. Institute of Rural Reconstruction (IIRR), Y.C.James Yen Center, Silang, Cavite 4118, Philippines / iirr@cav.pworld.net.ph.*
One of the practical resource kits produced by IIRR with many very well illustrated practical how to do articles describing the indigenous land use system, farmers' best practices in e.g. crop, fallow, tree and agroforest management and biodiversity conservation. Also experiences with participatory development methodologies are included. Very readable and useful, also for people outside Nagaland (CR).

Kudzu-improved fallows in the Peruvian Amazon: a case study of the impact of technological change on deforestation *by Yanggen DR in: Angelsen A. and Kaimowitz D. (eds), 2000. Agricultural technologies and tropical deforestation. CAB International, Wallingford, UK. To be published in February 2001. ISBN 085199 451 2*
In this empirical research paper, based on a survey of 220 farm households, the economic reality of farmer management of fallow-based shifting cultivation is analysed. Costs and benefits of traditional and improved fallowing practices are compared and an assessment is made of how kudzu-improved fallow adoption affects deforestation in the lowland tropical rainforest areas surrounding the city of Pucallpa, Peru. It was concluded that, by reducing labour needs while increasing yield, kudzu-fallow adoption has been successful precisely because it fits the local economic conditions and is superior to traditional shifting cultivation. It is the land quality constraint and not the land quantity constraint that leads farmers to adopt kudzu fallows. Kudzu-improved fallows are not associated with the intensification scenario typical of land scarcity in the neighbourhood of urban centres. Farmers in older settlement areas may be particularly receptive to adopting improved fallows in order to conserve the remaining primary forest. (CR).

The Amarasi model: an example of indigenous natural resource management in Timor, Indonesia
by Nalan Yuksel, Ali Aoetpah and Imo, edited by Paul Burgers. ICRAF-SE Asian Regional Research Programme, Indigenous Fallow Management Network, Occasional paper 1999/1.
A systematic documentation of successful indigenous intensification of land use by shifting cultivators on West Timor, Indonesia. Beside their land use practices, the farmers changed their indigenous institutions and customary law. Very interesting reading (CR).

A natural ecosystem analog approach to the design of a successional crop system for tropical forest environments *by Hart RD. 1980. Centro Agronómico Tropical de Investigación y Enseñanza (CATIE), 7170 Turrialba, Costa Rica. In: Tropical Succession ; v.12 (1980) no.2 p.73-95.*
A succession crop system is described and compared with a conventional system showing the potential of the analog approach. Further scientific analysis of the approach provides evidence for the hypothesis that the agricultural viability of a particular crop system is directly related to the degree of similarity of that crop system to a natural plant system in the same environment.

Farming in nature's image : an ecological approach to agriculture *by Soule JD, Piper JK. 1992. 286 p. ISBN 0 933280 88 2 (pbk) : USD 19.95. Island Press, PO Box 7, Covelo, CA 95428, USA.*
In the first half of the book the authors analyse why there is a need for ecologically sound agriculture and, though very briefly, discuss experiences with and the benefits of "nature like" agriculture. The book really becomes interesting when the authors start to

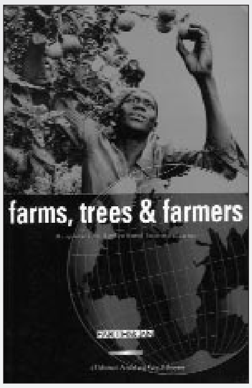
write about the research of 'The Land Institute' which specifically deals with developing agriculture modeled on native North American prairie. In this ecosystem model natural perennial grasses are replaced by perennial seed crops for human consumption. The research deals with basic questions such as: seed yields of perennials; over-yielding in perennial polyculture; the internal supply of fertility and the management of weeds, pests and plant pathogens. Though the research is an inspiring approach which provides hope for future success, a lot of work still remains to be done. A book for people interested in new concepts. (CR)

The forest islands of Kissidougou : social dynamics of environmental change in West Africa's forest-savanna mosaic *by Leach M, Fairhead J ; Millimouno D, Kamano M. 1994. 93 p. Institute of Development Studies (IDS), University of Sussex, Brighton BN1 9RE, UK.*
Kissidougou prefecture of Guinea is an example of West Africa's forest savanna transition zone, with dense forest "islands" encircling villages in the midst of savanna area. To analyse vegetation change during the last century, aerial photographs and remote-sensing, archives and methods for participatory environmental monitoring were used. In contrast with the general opinion of ecologists and policy-makers, the areas of forest and secondary forest vegetation proved to have increased since the turn of the century. People suggested that it was their work to intensify agriculture and encourage forest growth. Officials in the meantime instituted repressive laws to restrict local practices, as they thought the local resource management to be destructive. The authors analysed what happened and why there is a discrepancy between expert opinion and villagers' perspectives. (IHG)

***Sesbania sesban* improved fallows in eastern Zambia: their inception, development and farmer enthusiasm** *by Kwesiga FR et al. in Agroforestry Systems 47: 49-66, 1999. Kluwer Academic Publishers, The Netherlands.*
Several studies since 1987 have demonstrated the potential of two- or three-year sesbania fallows in restoring soil fertility and increasing maize yields. Analysis showed that these improved fallow systems were feasible, profitable and acceptable to farmers. The potential to increase maize production without applying mineral fertilisers has excited thousands of farmers who are enthusiastically participating in the evaluation of this technology. Presently, a strong network of institutions comprising government, NGOs, and farmer organisations is facilitating the adaptive research and expansion of improved fallow technology in eastern Zambia. The paper mainly focuses on the performance analysis of researcher-managed trials. Some attention is also given to farmer-designed and managed trials and partnerships.

Farmer experimentation and innovation : a case study of knowledge generation processes in agroforestry systems in Rwanda *by Biggelaar C (den) ; Hart N. 1996. 123 p. Forests, Trees and People Programme (FTPP), Swedish University of Agricultural Sciences (SUAS/IRDC), Box 7005, S-75007 Uppsala, Sweden. (Community forestry case study series, ISSN 1020 4466 ; 12).*
Active planting and management of woody species by farmers is relatively new in Rwanda. The farmers processes of generating knowledge about agroforestry, particularly their experimental methods, were studied. Locally identified tree experts had different knowledge about tree cultivation than local farmers. The latter had less land and were more likely to experiment with integrating trees in complex systems with field crops. It proved difficult to differentiate experimentation from normal farming practice, as each season is an experiment . Knowledge production by farmers was oriented to use but also to a future beyond the farmers lifetime. Considerable gender differences in knowledge about trees was found. Communication networks for knowledge sharing were weak and here more support it needed. Highly recommended reading for PTD practitioners. (AWB)

Farms, trees and farmers : responses to agricultural intensification *by Arnold JEM, Dewees PA (eds). 1997. 287 p. ISBN 1 85383 484 X (pbk) : GBP 16.95. Earthscan Publications, 120 Pentonville Road, London N1 9JN, UK.*
The uncertainties connected to tenure rights often lead to overuse of communal trees in open-access situations. In addition, serious deforestation has occurred in many places to satisfy the demand for fuelwood. This explains the dwindling number of off-farm trees. To make up for these losses, smallholders have planted trees in their fields or near their homesteads. Though these scattered trees cannot make up for the loss of biodiversity encountered in forests, the trees play an important, but relatively little-known, role in survival strategies of smallholders. In addition to supplying firewood, trees are used to complement otherwise monotonous diets, as windbreaks, to check erosion, and to supply a whole range of miscellaneous products. Many of the original projects that promoted tree planting on smallholders' farms were not very successful: they were triggered by the conviction that the energy shortage would automatically imply a need for more fuelwood. However, this did not take the whole complex farmers' perceptions into account in which decisions go well beyond the energy-from-fuelwood consideration.



More recent projects have showed a better approach. This is presented in this book through case studies from South Asia and Eastern Africa. The focus is on changes in tree management strategies over time and on farmers' decisions in the light of changing supply and demands. The case studies examine the relationship between tree management and subsistence needs, market opportunities and constraints, availability and allocation of land, labour and capital, and exposure to risk and risk management. It is the value of this book that it reveals the complexity of farmers' decision making processes. The book primarily addresses a scientific audience. (WB)

Batak resource management : belief, knowledge and practice *by Eder JF. 1997. 52 p. ISBN 2 8317 0366 2 : USD 12.00. IUCN Forest Conservation Programme, International Union for Conservation of Nature (IUCN), Strategies for Sustainability Programme, Rue Mauverney 28, CH-1196 Gland, Switzerland; WWF Forest Programme, World Wide Fund for Nature (WWF). (Issues in Forest Conservation).*
This report on the Batak of Palawan Island in the Philippines shows how, in practice, Batak belief and knowledge about the environment are inextricably bound up in the resource-use routines of everyday life. Systematic comparison of past and current Batak practices with those of lowland Filipino migrants show that the Batak approach to making a living remains consistently less destructive of the natural resources and ecological integrity of their forest environment than does that of migrant lowlanders. The report also looks at the weaknesses and strengths of the traditional Batak management system as a basis for future sustainable use. The author states that, given that lowland migrants and outside facilitating agents such as Haribon Palawan and IUCN bring additional, complementary strengths, there is considerable grounds for optimism about the future, assuming that significant political progress continues to be made in returning control over local resources to local people. For this continuous collaboration is needed. An interesting case study with a strong focus on non-timber forest products. (CR)

Agroforestry guides for Pacific Islands *by Elevitch CR, Wilkinson KM (eds). 2000. 239 p. ISBN 0 9702544 0 7 : USD 24.95. Permanent Agricultural Resources (PAR), PO Box 428, Holualoa, HI 96725, USA / guides@agroforestry.net; http://www.agroforestry.net.*
These guides written by and for agroforestry researchers, field-level extension workers and farmers provide a real clearinghouse on traditional and modern agroforestry not only for practitioners on the Pacific Islands but are also very useful in other regions. The separate sections deal with topics like multipurpose trees, non-timber forest products, understorey crops, tree integration, species selection, economics of farm forestry and multipurpose windbreaks. They include principles as well as practical implications and information on references, further readings, magazines, addresses, web links, organisations and resource persons. Aspects like forest ecology, indigenous fallow management, analog (agro-)forestry and ecological intensification are not yet included in the publication. (CR).

The full text of these articles can be requested from the authors or from ILEIA.

From slash and burn to slash and mulch

The Manobos and Mamanwas in the isolated Philippine island of Mindanao have traditionally used slash and burn techniques to open new swidden to produce sweet potato, upland rice and other crops. Most of their fields are on relatively steep slopes and average rainfall is above 4000 mm. The swiddens were often left fallow after only one year. Recently, forestry activity has put land for new swidden under pressure. Encouraged by the Tribal Filipino Programme *Surigao del Sur* (TRIFPSS), farmers have modified their practices. For several years they have been growing more vegetables and have planted fruit trees, coconut palms, bananas and abaca in multiple cropping. Today most farmers have replaced 'slash and burn' by 'slash and mulch'.

Local leaders have drawn up a management plan for the KALASAG Ancestral Domain. The farmers decided they would no longer open new swiddens but only cultivate those areas that had been opened up earlier. Fields planted with perennials like abaca, banana and fruit trees in combination with sweet potato are quite well protected. But, despite the practice of covering the soil with organic matter from previous crops, cut weeds and sweet potato vines, soil cover in most cases is not enough to effectively protect the soil. Considering that most fields are located on relatively steep slopes additional measures are necessary to control erosion and maintain soil fertility. The farmers have been reluctant to adopt the system of planting hedgerows along the contour lines of slopes in fields intended for the production of staples. The traditional beliefs and religious practices of the Manobos and Mamanwa reflect a deep respect for nature. The information about sustainable agriculture practices provided by TRIFPSS has blended well with these beliefs. Some leaders agreed with the observation, that if the indigenous people had acted like neighbouring 'Christian' colonist farmers, they would have already cut all the trees around their farms. Obviously the problems of agriculture and their solutions involve cultural and moral issues. For the communities in the KALASAG area, insisting on their specific culture has proven fundamental to their survival.

Winfried Scheewe, Sustainable agriculture and rural development consultant, Quintos II, Mabua, RP-8300 Tandag, The Philippines. Phone/fax: +63 86 211 3602.

Artist: Rolly Nicart

Indigenous Shifting Cultivation in Northern Western Ghats, India

In India shifting cultivation is practised in the Eastern Ghats and some parts of the Western Ghats. In the latter region it has yet to receive serious attention. A two-year study conducted by AERF revealed that most of the families practising shifting cultivation or *dongarsheti* are from low-income groups. At least one person from each family has migrated to cities for jobs or education. There is not enough manpower intensive *dongarsheti*. Moreover, the meagre income generated from inferior quality jobs is not sufficient to run a village household. Out migration is therefore responsible for both the maintenance of these traditional practices and the decrease in area devoted to *dongarsheti*. In 75% of the total number of villages surveyed, *dongarsheti* has been reduced almost to a demonstration scale and there are large tracts of mature fallows. In the more remote areas, however, *dongarsheti* is still the main livelihood strategy.

Assessing the shifting cultivation practices from this region on a larger scale is a matter of great urgency. Improved fallow management and marketing of local varieties could provide supplementary income for the communities.

Archana Godbole and Jayant Sarnaik Applied Environmental Research Foundation, Pune , India. Email: aerf@vsnl.com

Does intensifying pasture management in tropical Latin America protect forests?

This paper is based on data from the Tropileche research and extension consortium using results from three research sites in Colombia, Costa Rica and Peru and compare the adoption and effects of improved feeding systems for small-scale farmer milk and beef production. These systems were: a new Brachiaria grass variety, an association of Brachiaria with a legume called Arachis pintoi, and a cut-and-carry system with Cratylia, a leguminous bush that serves as a protein bank during dry months. To varying degrees in all sites, the improved forages increase both stocking rates and milk production. Although improved pastures require more labour to maintain them, the greatest obstacle to getting small-scale farmers to adopt them is their large initial establishment cost. Intensive pasture systems can be highly profitable but when capital is scarce or cannot easily be borrowed, they are not financially feasible.

Review of the evidence regarding the effect of improved pasture technology on forest cover led to an alternative hypothesis: forest scarcity is a prerequisite for technology intensification. It was found that, where markets modestly value forested land, as in the Peruvian Amazon, a private farmer's decision to raise cattle extensively by converting additional forest for pastures appeared perfectly rational. However, in more developed regions with older forest margins as in Costa Rica and to a lesser extent Colombia, farmers tend to produce livestock more intensively to avoid pasture degradation and the high cost of expanding into uncultivated land.

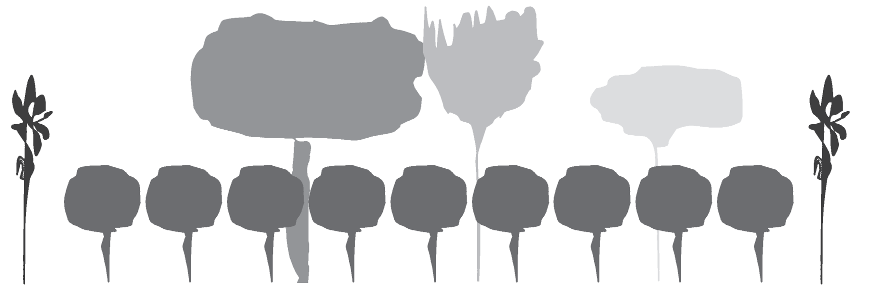
From: White D, Holmann F, Fuijsaka S, Reategui K, and Lascano C. **Does intensifying pasture management in tropical Latin America protect forests? Reversing the question.** In: Angelsen A. and Kaimowitz D. (eds). **Agricultural technologies and tropical deforestation.** CAB International, Wallingford, UK. To be published in February 2001. ISBN 085199 451 2.

Monoculture or polyculture?

Sabirin and Hamdan

North Sumatra is a province in the Indonesian archipelago. Its tropical rain forest has a rich natural biodiversity to which traditional swidden agriculture has contributed a rich agro-biodiversity. However, this richness is steadily being replaced by the monocultures of oil palm and subsidary crops such as cacao, rubber, tea, tobacco and sugar cane on the large governmental plantations (3,359,719 ha.), private estates (498,988 ha.) and smallholder properties (770,408 ha.). On a considerable part of the total land area (7,168,068 ha) the rich biodiversity is being constantly eroded.

Transect of planting structure:



Pinang *(Areca pinata)* as barrier — Petai papan *(Parkia spiosa)* — Kakao *(Theobroma cacao)* — Duku *(Lansium domesticum)* — Durian *(Durio zybetinus)*

Impact of monocultures

Natural vegetation is generally cut and burned to clear the land for plantation crops. This means that biomass and biodiversity of considerable economic value is lost and soil degradation, erosion, and air pollution becomes a problem. Monocultures require considerable amounts of chemical fertiliser and pesticides that also pollute the environment, and the large amounts of water needed for oil palm have created water scarcities. As moncultures destabilise the agroecological system many oil palm pests and diseases have emerged, including *Ganoderma sp*, fire-caterpillar and termite. The cacao moth has become a particularly serious pest in cacao plantations and is very difficult to eliminate. Monocultures have had a deep impact on social relations and culture as well. Traditional community spirit like *gotong royong (a system of mutual cooperation or community self-help)* has been weakened and traditional products like King Banana, *Sirih (Piper betle)* and economic activities like animal husbandry are disappearing. The products of monocultures cannot be used directly for home consumption or home industries. Older farmers find it hard to remain in the production system and the system itself cannot be adapted to the conditions and needs of the local people.

Development of polycultures

The Pesticide Action Network North Sumatra (PAN-NS) began to develop alternative agricultural models to counter the problems caused by monocultures. In this way they sought to generate higher levels of biodiversity and systems that were more environmentally friendly and delivered more economic benefit and profit. Since 1990, PAN-NS has been working with local farmers in different parts of North Sumatra to analyse and experiment with polycultures. Several polyculture models have been developed in which cacao (*Theobroma cacao*) plays an important role. Local trees like durian (*Durio Zybetinus*), duku (*Lansium domesticum*), petai papan (*Parkia spiosa*) or coconut (*Cocos nucifera*) are intercropped with cacao and pinang (*Areca pinata*) planted around the polyculture. In some places cattle can also be integrated into the system. Currently, PAN-NS is experimenting with local coffee as a main commodity crop.

The choice of trees to be interplanted will depend on whether the area is forest or cacao plantation. Banana (3x3 m.) can be planted as a pioneer crop on land where there are no trees. Local trees of economic significance can be planted in between the banana plants at spacing appropriate for the species concerned. In the second and third year banana plants will be replaced by cacao.

Sustainability analysis

The performance of a one hectare based polyculture model planted 10 years ago with 6 head of cattle integrated into the system has been compared to one hectare monoculture models of cacao and oil palm. Table 1 and 2 provide the economic data.

Based on these data and the ecological, social and cultural arguments mentioned above, it can be concluded that monoculture models are not as profitable as they seem and are ecologically and socially unsustainable. Although this is increasingly being admitted, it has not yet resulted in alternative development policies and practices. Sustainability has to be taken seriously in agricultural research and policy making in Indonesia.

Conclusion

Based on our experiences we conclude that small-scale polyculture is a very appropriate model for rural people, particularly in regions with high biodiversity. Polyculture is affordable, it does not need much capital for external inputs and only requires 2-4 hectares of land for each household. Although animal theft can be a serious problem, polyculture is a model for profitable, environmentally friendly and sustainable development. In addition, it is feasible for farmers and NGOs to adapt the *cacao* based polyculture model to other tree crops like coffee, if they are able to get the support of a funding agency through a revolving fund.

■

Table 1. Economic evaluation of the polyculture model

No	Cultivated plant	Plant/animal Population	Production year/unit	Cost/item (Rp)	Total income/ year (Rp)
1	Durian *(Durio zybetinus)*	36	.200	1,000	7,200,000
2	Duku	36	.500 kg	2,000	36,000,000
3	Petai Papan *(Parkia spiosa)*	36	025	1,500	1,350,000
4	Pinang *(Areca pinata)*	133	4 kg	3,000	1,596,000
5	Cacao *(Theobroma Cacao)*	800	2.75 kg	5,000	11,000,000
6	Cattle	6	6	1,000,000	6,000,000
				Total Rp	**63,146,000**

Covert to US$ 9,021 (1US$= 7000 Rp)

Table 2. Economic evaluation of a comparative monoculture (oil palm/cacao) model

No	Cultivated plant	Plant Population	Production/ year/kg	Cost/ item (Rp)	Total income/ year (Rp)
1	Oil Palm	143	27,456	0 ,500	13,728,000
2	Cacao	1000	2,750	5,000	13,750,000

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Livestock and forage management in stabilising shifting cultivation

Phengsavanh, Phimphachanhvongsod and Horne

While acknowledging the complexity and diversity of shifting cultivation systems, some generalizations can be made to illustrate the role ruminant livestock play in stabilising them. In the remoter areas of Northern Laos, rice shortages caused by frequent but irregular climactic catastrophes, are common. Such shortages can last for more than 6 months and have a serious impact on household security. Traditionally, farmers have dealt with these shortages by drawing on the natural capital of the forests, by hunting and gathering, growing less popular food crops such as maize and cassava, and by purchasing rice. Often, these farmers have little to sell but their labour, or opium, some forest products, medicine, herbs, and their livestock - cattle, buffalo, pigs, goats and chickens. The government discourages the production of opium and forest resources are decreasing as population pressure grows and villages are resettled away from their traditional forest resources. Gradually, farmers have become increasingly reliant on livestock for their cash income.

Benefits from livestock

There are a number of benefits in raising ruminant livestock:

- They have an assured market with relatively stable prices;
- They do not need transport: cattle and buffalo can be walked long distances. In one recent example, some H'mong farmers walked their 20 bulls 350 km from Xieng Khouang to market them in the capital, Vientiane;
- Provide a good profit for a relatively low input of labour;
- Are wealth that can be used in emergencies;
- Utilise natural resources (grass, rice straw, tree leaves) that would otherwise be wasted;
- The manure can be used to maintain the fertility of irrigated rice fields and home gardens. Some livestock owners sell manure to lowland farmers.

Serious problems offset these benefits including disease, limited fodder resources, and crop damage. However, the benefits are so substantial that, in almost all areas, farmers continue to raise livestock to help safeguard their livelihood.

Fodder scarcity

Factors that have contributed to the scarcity and degradation of traditional fodder resources include a growing livestock population and the over-utilisation of grassland, rice straw, and forest resources. The expansion of agriculture into traditional grazing land, the reforestation of grazing land, reduced productivity of native grasses and restricted access to forest grazing land are also serious problems.

Options for improvement

Shifting cultivators often have very few alternative ways of feeding their ruminant livestock. Alternative strategies include moving livestock between wet and dry season grazing areas; storing or reserving rice straw for dry season feeding; and cultivating grasses on fallow land to provide cut feed for penned animals.

The first two strategies are fairly well developed throughout the region and there is little potential for adaptation. However, the third strategy, managing forages, offers a promising possibility and can be developed in partnership with farmers. Villagers are most interested in cultivating forage species that can be given as cut feed to penned animals and improving the grazing areas used for community managed herds. Case studies have shown that farmers are particularly interested in having wet season supplementary feed for their cattle, dry season supplementary feed for buffaloes and cattle and more manure for their rice fields. They also want to control the amount of damage animal inflict on crops and minimise livestock losses.

In many cases, farmers are strongly motivated to manage feed resources, but their innovative capacity is constrained by a lack of information and planting material. The successful development of forage technologies, however, does not depend on the quantity of planting material distributed, but on carefully selecting farmers who acknowledge they have a real problem and who are prepared to seek solutions in co-operation with development workers. If this approach is combined with a broad range of robust technologies, the chance of successful adoption is much higher. For example, the upland areas of Bali are renowned for the widespread use of *Gliricidia sepium,* a shrub used as a living fence and source of dry season fuel. Yet this species was only introduced in 1970 in a "hundred cuttings" and owes much of its success to the fact that farmers were able to identify their problem and found the species appropriate, robust and easy to manage.

Forages that stabilise

In Northern Laos, farmers and development workers are exploring ways in which forage species introduced into the area can be integrated into technologies that will help stabilise shifting cultivation. This is being done in two ways. First, by comparing indigenous feeding strategies, such as cutting and grazing, using an introduced species. Second, they are developing new ways of incorporating introduced forages into existing shifting cultivation systems.

Regional evaluation of more than 70 forage species in five locations resulted in the identification of eight broadly adapted and robust species.

- *Brachiara brizantha* (currently cv Marandu with other lines soon to be tested),
- *Brachiara decumbens* cv basilisk,
- *Brachiara humidicola* CIAT6133,
- *Brachiara ruziziensis* cv Kennedy,
- *Andropogon gayanus* cv Kent,
- *Panicum maximilliani* T58,
- *Paspalum atratum* BRA9610,
- *Stylosanthes guianensis* CIAT184.

These species are now being evaluated for their potential in cut-and-carry or grazed systems by about 100 farmers in three northern provinces. At this stage, evaluations are informal and without replication, because the aim is to encourage a greater number of farmers to participate in farmer innovation. Should promising innovations emerge, they will be encouraged by farmer-to-farmer visits and studied in more detail in formal, replicated on-farm trials. At the moment, farmer-managed trials are either in progress or are just beginning. They will evaluate and adapt three potentially useful innovations suggested by researchers on the bases of experience gained elsewhere. These innovations are discussed below.

Forage trees and fences

Crop damage caused by livestock is a major and constant concern in the upland areas of Northern Laos. Farmers already use some living fences (mainly *Jatropha curcas*) either to keep animals in or out of fields. In some areas, especially those managed by H'mong people, enormous efforts are put into building solid, semi-permanent fences of wood, wire and bamboo. Living fences incorporating *Gliricidia sepium*, *Laucaena leucocephala* (on better soil) and *Calliandra calothyrsus* (in the higher areas) have considerable potential and can ease this burden as well as provide supplementary feed. However, the technical advantages and limitations of these trees need to be evaluated by farmers and development workers together and farmers' criteria for accepting or rejecting these technologies must also be carefully explored.

Oversowing upland rice.

Oversowing upland rice with *Stylosanthes guianensis* is not new but it is an innovation that has the potential to improve subsequent fallows and provide benefits such as reduced weeding and increased soil fertility. The use of forage legume species for fallow fields in shifting cultivation areas has been the subject of much detailed and promising research. Although the potential benefits such as reduced weeding requirements, improved soil fertility, easy establishment after a round of weeding and reduced risk of erosion, are well documented, farmers have been slow to adopt it. There are many reasons for this, but probably two are particularly important. First, most of the work done in Laos on *Stylosanthes guianensis* has been carried out on research stations or in researcher-managed trials with the expectation that the technologies can then be "extended" to farmers. There is a need to establish informal oversowing trials with farmers to discover what aspects of oversowing appeal to them and to see what treatments should be studied in subsequent formal trials. Second, sowing fallow fields with forages means they can be better protected from uncontrolled grazing. Fallow improvement with the farmers of Hoauy Hia village would almost certainly fail because of the lack of sturdy fencing. However, in H'mong areas where individual fallow fields are often sturdily fenced, the potential is much higher.

Informal and formal trials with farmers began with oversowing *Stylosanthes guianenses* CIAT184 in upland rice fields after the first round of weeding. The species has demonstrated particular potential. It was able to establish itself rapidly, had a low impact on rice yields if sown late enough, and is able to grow well on poor soils. Several other legume species are also being considered for this purpose.

Oversowing maize

In several areas of Northern Laos, farmers had complained about the burden of weeding maize fields. This is especially true in areas of poor soil where maize growth is slow and the crop cannot outcompete weeds. After the successes of farmers in Makroman village, Indonesia, several legume species, including *Centrosema pubescens, Stylosanthes guianensis* CIAT184 and *Chamaecrista rotundifolia* cv Wynn) were oversown into young maize and evaluated in informal farmer trials.

Conclusions

Farmers in the shifting cultivation areas of Northern Laos are strongly dependent on ruminant livestock for livelihood security. Diminishing feed resources have caused some farmer groups to take steps to manage feed resource, particularly through planting introduced forage species. Others recognise the problems but have not had sufficient access to information or planting materials to help them develop their own forage technologies. Both groups of farmers are prepared to work with development workers to explore ways in which local feeding technologies can be strengthening by introducing new, robust forage species, comparing them to existing species and evaluating new ways of incorporating them into existing farming system. ■

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The information in this paper has been gained from the field experiences of many dedicated development workers associated with the Forages for Smallholders Project.

Adapted from: Horne, P. The role of livestock and forage management in stabilising shifting cultivation in Laos. IIRR Resource Book (see p.30).

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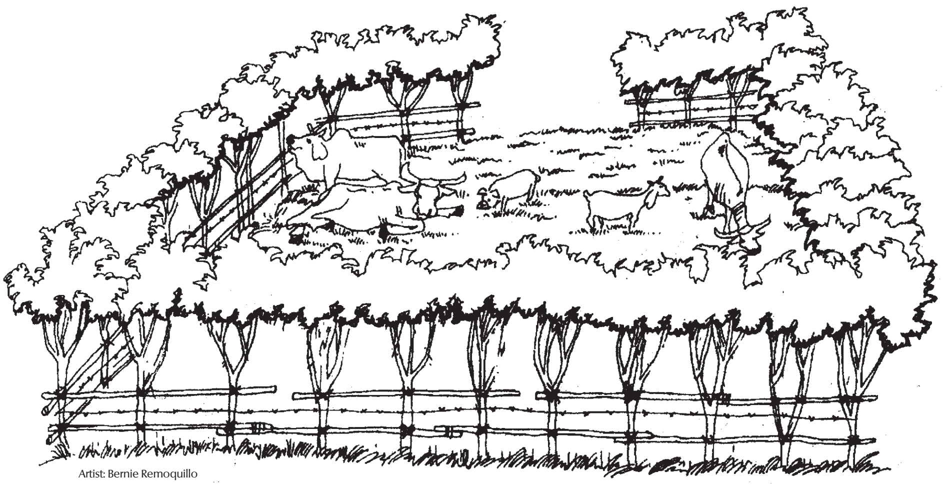

Artist: Bernie Remoquillo

Photo: Barry Pound

Peach palm (Bactris gassipaes) is a native Bolivian forest species with commercial potential. Here the palm is ready for harvest, with a cover crop (Canavalia ensiformis) sown between the rows.

Sustainable agriculture on the forest margin

Barry Pound, Morag Webb, Adalberto Flores, Benjamin Carreño and Rob Paterson

Slash and burn methods used by colonist farmers in Bolivia are unsustainable and degrade soil, forest and bio-diversity resources. In 1994, the Natural Resources Institute (NRI, UK) and the *Centro de Investigación Agrícola Tropical* (CIAT, Bolivia) tried to identify ways of making the present farming systems more sustainable and productive. Participatory on-farm trials combined with researcher-managed trials, case studies, participatory surveys and rural appraisals were used to validate technical options, including combinations of novel perennial crops, leguminous cover crops, agroforestry mixtures and small livestock. Effective technology options were developed but before resource-poor farmers could use them they needed information and technical support provided. In Bolivia, colonist farmers have very limited financial resources, infrastructure is rudimentary, and social cohesion is poorly. These factors hamper the dissemination and implementation of research results.

General situation

The practice of clearing forestland for agriculture is common in the humid tropics. Shifting cultivation, when practised by indigenous forest dwellers at low population densities can be ecologically sensitive and sustainable. At higher population densities the slash and burn methods used by colonist farmers in Brazil and Bolivia cause extensive degradation of soil, forest and biodiversity resources.

Smallholder colonist farmers in the tropical lowlands of Bolivia are extremely poor and have an immediate need for cash and food. While they often have plenty of land (30-50 ha), they have limited amounts of capital and labour and so use extensive farming methods that are wasteful of natural resources but require low levels of input. Forest biomass is used as fertility capital to produce a small range of subsistence and cash crops for one or two seasons. When accessible forest is exhausted, they cultivate in the bush-fallow (*barbecho*). Each successive cycle of slash and burn weakens the land leading to a "bush-fallow crisis". The farmer is then either forced to find new land, change to farming perennial crops (mostly citrus), or keep cattle on perennial grassland.

Farmers abandon their land when pernicious weeds increase and soil fertility declines (Webb & Gonzales, 1989, Barber & Diaz, 1994). The sandy soils are low in phosphorus and nitrogen is quickly lost through leaching and volatilisation. Nitrogen, sulphur and organic matter are lost through burning, and micro-nutrients soon become limited under acid conditions and low soil organic matter. On sloping lands, soil erosion is also a serious problem.

Slash and burn farm households manage several species of small livestock although productivity varies greatly between farms (Chamón *et al.*, 1999). Women and children are responsible for the chickens and guinea pigs raised for food and for the ducks and pigs sold for cash. Tropical hair sheep are also kept for household use and sale. All livestock, except guinea pigs, are free to scavenge for food and receive minimal supplements of grain, household wastes and crop residues. With no veterinary cost and no input apart from labour, the low level of production is almost entirely profit. Where markets are available, dairying is favoured. Profit margins are modest, but regular income from milk sales is important.

Ichilo-Sara project

The *Ichilo-Sara* project was developed by NRI and CIAT in the tropical eastern lowlands of Bolivia. It addressed three major development issues. First, the destruction of moist tropical forest by agriculture; second, natural resource degradation, and third, the lack of locally verified, sustainable agricultural systems suitable for smallholder farmers working in the forest margins.

An "adaptive research network" was set up with local NGO's to implement and evaluate an on-farm trial programme which would test 200 participatory on-farm experiments involving 30 novel cropping, agroforestry and livestock systems (see Figure 1). These trials were complemented by researcher-managed trials that dealt with problems requiring controlled conditions or used new technologies whose potential in local conditions had yet to be verified.

The project relied heavily on participatory methods. This made it possible to combine researcher, NGO and farmer knowledge and to empower farmers, NGOs and CIAT to carry out the type of research they thought to be relevant. Technologies were validated under farmers' conditions and the participatory approach ensured that information was disseminated during the research process.

Sustainability was a central issue in the *Ichilo-Sara* trials and on-farm and researcher managed experiments were designed with the following needs in mind.

- Reduce burning;
- Increase opportunities for perennial crops;
- Increase the efficiency and productivity of the fallow period;
- Develop technologies with low external input requirements;
- Integrate legume covers and green manure to maintain soil productivity;
- Diversify activities and income generating opportunities;
- Initiate a sustainable research effort based on participatory principles

Results

The project verified the local suitability of perennial species, and identified cropping systems and sequences that were economically viable for colonist farmers. The association of perennial tree crops, including citrus, peach palm, and tamarind with annuals, semi-perennials and legume covers proved that it was possible for small-scale farmers, with limited capital, to diversify into perennial systems. The annuals and semi-perennials offset establishment costs, and provide a source of income in the short and medium term. The legume covers prevent weeds building up and reduce the amount of labour needed for weeding. Trials also showed that the financial burden of establishing perennial systems could be overcome if the cultivated area was gradually increased and farmers used home-produced planting material. Experiments with intercropping and rotating rice with legume, food and cover crops proved that weed build-up and the cost of weed control could be significantly reduced. However, these systems did not halt the yield decline. Farmers also tested two novel agroforestry systems. The first was based on the enrichment of bush fallow with native fruit and timber species, while the second took cleared land through a sequence of annual, semi-perennial, and perennial species to a permanent, tree-rich system. After two years, results indicated that these options - whose components can be modified to suit the circumstances of individual farmers - were appropriate for those households that had a positive attitude towards trees and appreciated the income and environmental benefits they could bring.

Promotion pathways

The *Ichilo-Sara* project was designed to help resource-poor farming families living on the margins of the forest. By collaborating with institutions such as CIAT Bolivia and local NGOs it was hoped that experimental results would be widely disseminated. Results have, in fact, been good. Through collaboration, staff training and specially prepared materials the concepts, methods, systems and technologies investigated during the *Ichilo-Sara* trials have been widely adopted and the project has influenced other Bolivian projects and programmes.

The rate of adoption was monitored after 2-3 years (Warren, 1997), and at the end of the project (Pound et al, 1999). Among those farmers who had worked on the trials, adoption rates were found to be high. Adoption rates by neighbouring farmers who had not taken part in the project, however, were low partly because of a lack of community involvement in the way collaborating farmers were selected (Warren, 1997). When the project ended in 1998, high levels of adoption were still being recorded among collaborating farmers.

In 1996, farmers were tending to adopt single component technologies, rather than the complete systems being tested (Warren, 1997). This was a matter of considerable concern because the development and promotion of "sustainable systems" was a major objective. By 1998, the situation had changed and many farmers were including mixtures in their expansion plots. Cover crops were being integrated into perennial systems and perennials were being intercropped with annuals and semi-perennials. A high level of farmer-experimentation was also recorded. Farmers were modifying the components included in the original systems, and were comparing alternative management strategies.

Analysis

Several lessons can be drawn from the *Ichilo-Sara* trials. First, it takes time to clarify objectives with stakeholders, and to design a methodology that meets these objectives. It is important that all members of the research team - researchers, NGOs and farmers - understand the methodological and technical concepts behind the trials and training should be given if necessary. Experience showed that data collection should be limited to the needs of the project and that participatory research requires the same rigour and discipline as conventional research.

There is a potential contradiction between the collection of on-farm research results and providing farmers with an opportunity to adapt technologies. The *Ichilo-Sara* trials showed clearly that a balance must be found between these contrasting objectives.

The project concluded that the qualitative and quantitative information from participatory research can be successfully integrated but that an early feedback of results to collaborating institutions and communities is important. Projects should also plan a strategy to help farmers at the end of the project so they do not feel "abandoned".

Ensuring impact

Locally, the *Ichilo-Sara* project is regarded as having had an important impact. However, during the final project workshop (Pound *et al*, 1999) it was concluded that identifying potential alternative technologies is just one step towards achieving sustainable and stable systems. A co-ordinated strategy must also be identified and implemented to ensure that these technologies are adopted and utilised. Such a strategy might include the following elements:

- dynamic dissemination systems;
- technical assistance, especially for technologies that require long-term investment (e.g. fruit and agroforestry systems);
- accessible credit for small farmers with limited collateral;
- knowledge on adding value to primary products;
- appropriately structured and resourced community-based institutions;
- marketing information and structures;
- a policy environment conducive to sustainable land use.

The *Ichilo-Sara* project succeeded in using participatory methods to identify and validate sustainable technologies and disseminating them to the farmers in the project. Many of them are now using these ideas in their farming activities. CIAT is complementing "conventional" research methods with participatory methods and NGOs and extension projects in the area are promoting and adapting technologies identified by the project. However, further work is needed before small farmers can be assured of technology, resources and market access. ■

Technical areas addressed by the project
- Weed management
- Soil fertility maintenance
- Improved food security
- Income generation

+

Technical principles
- Improved availability of animal protein
- Development of sequences towards perennial-rich farming systems
- Maintenance of ground cover
- Reduction of burning
- Identification of cash generating opportunities
- Labour reduction
- Intensification of land use
- Diversity and integration of activities
- Simultaneous research and dissemination

Technical options pursued by the project
- Temporal and spatial integration of annual crops, perennial crops, cover crops and livestock
- Weed control using integrated manual, chemical and biological methods
- Agroforestry species for income and fodder
- Crop rotations/relay cropping/intercropping
- Introduction of locally novel perennial crops
- Cut and carry grasses
- Renovation of degraded pasture
- Enrichment of bush fallows with indigenous fruit crops
- Fast-growing forest species for wood, NTFP and fence posts (live or dead)
- Imperata control using cover crops
- Erosion control using live contour barriers and cover crops
- Improved husbandry of livestock

Figure 1. The development of technicaloptions

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Marketing of forest and agricultural products from shifting cultivation

Artist: Ariel Lucerna

Madhav Karki, Rana B. Rawal and John Raintree

When shifting cultivation intensifies and the cash needs of producers and collectors increase, more agricultural and Non-Tree Forest Products (NTFPs) will reach local, regional, national and international markets. Some of these products have a high niche market potential because most shifting cultivation areas are rich in biodiversity and can produce high value speciality products. Good examples are red rice from Thailand and the Himalayan Morel Mushroom (*Morchella conica*) from Nepal. There is also a growing national demand for better quality products and, as globalisation intensifies, international traders are seeking new products to satisfy the international market. Marketing is therefore of strategic significance in sustaining shifting cultivation in the uplands of Southeast Asia.

Key characteristics of markets

Experience has shown that potential markets for the products of shifting cultivation have certain characteristics.

- Market demand depends upon the availability of a large range of products of good quality, in adequate amounts that are available at the right time and in convenient places;
- While attractive prices are the strongest incentives for producers, harvesters and processors to produce for the market, competitive pricing is needed to attract consumers to the market;
- Buyers of perishable products and industrial raw materials will invariably try to develop monopolies to avoid paying higher prices to producers, collectors and local traders;
- Sellers are often ignorant of markets, prices, and marketing strategies and do not have the necessary organisations, financial and infrastructure supports to avoid the trap of 'distress' selling;
- Government policies usually favour the traders and existing policies allow outsiders concessions to the forest and impose royalties and collection restrictions which poor collectors are unable to manage. Government officials feel more comfortable dealing with a few large traders than with a large number of small traders trying to market their forest products.

Best practices in market promotion

Certain principles should be followed when promoting the marketing of this type of product. These can be summarised as follows:

- Land and tree tenure rights should be unambiguously handed over to a designated local community with detailed management guidelines. National forest laws should be amended, if necessary, to prohibit proprietary rights, such as resource access and exclusive rights to transport and markets being granted to outside concessionaires;
- Collectors and growers should be provided with credit, storage facilities and transport subsidies;
- Fixing the minimum floor price of major marketable products can provide a strong incentive for collectors and growers because it assures a certain level of income when they sell them. Where 'niche' market products are concerned, however, producers and collectors should be allowed to capture the maximum profits possible because this type of product usually sells at the upper-end of the market;
- Developing markets for raw and finished products can contribute to the over-exploitation of resources, especially NTFPs. Governments should therefore take a strategic approach and maintain the balance between backward and forward linkages;
- Governments should not ban the export of raw materials from areas of shifting cultivation. A good example of the negative consequences of such an approach was the Indonesian government's ban on the export of raw rattan. The ban helped powerful local furniture manufacturers and big traders get greater control over the rattan trade and industry and keep the price of the raw material low. It also seriously set back attempts to mobilise local communities in sustainable forest management because local communities felt they had lost control over NTFP resources.

Market support services

Local communities and local traders find it difficult to get reliable market information. At the local level there is often little understanding of market dynamics and trends and resources and capacities at the local level are often grossly inadequate in this respect. The development of a suitable market support service is therefore essential to the sustainable development of forest communities. The development of marketing infrastructure, including basic communication facilities, simple storage, and primary processing facilities, can help local traders and enterprises to market their products profitably.

Communities of shifting cultivators who sell to the market also need outside support in building up a minimum amount of working capital to cushion them financially against 'distress selling' and to help them establish small and micro enterprises that can provide a guaranteed market for their products. NGOs and donor agencies can play a major role in developing local marketing capacity and facilitating the marketing process in the uplands.

Conclusion and implications

Markets and marketing can provide upland farmers with the chance of earning cash incomes and adding value to their traditional knowledge. However, in the current world of marketing green products, there is not only a lack of transparency, equal opportunity and incentives but powerful local and outside traders have also distorted markets.

■

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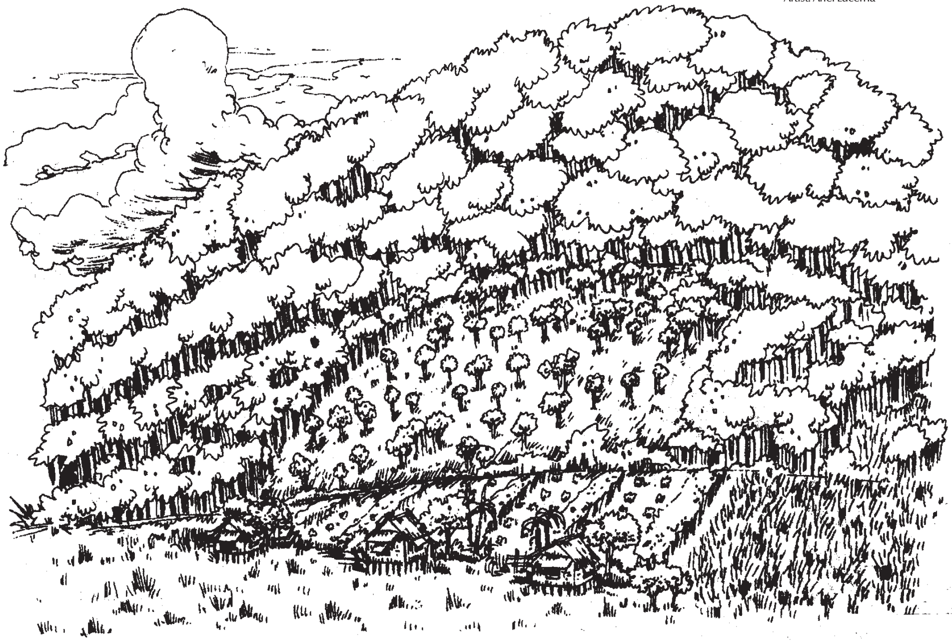
Adapted from: Karki M, Rawal R. and Raintree J, 2000. **Practices in marketing forest and agricultural products: lessons for resource managers.** IIRR Resource Book (see p.30).

The Ikalahan: towards sustainable forest use

Delbert Rice

Artist: Ariel Lucerna



The Ikalahan (*Kalanguya*) inhabit the upper, forested regions of the Cordillera and Caraballo Mountains of Northern Luzon in the Philippines. Traditionally they are shifting cultivators, primarily focused on the staple food crop *obi* (sweet potato *Ipomoea batatas)*. Recent developments, however, forced them to take action to conserve their natural resource base and think of additional livelihood strategies. By enriching fallow vegetation they have succeeded in halving the traditional fallowing period and using 'Forestry Improvement Technology' they have increased the benefits derived from the forest while improving its biodiversity.

To obtain legal control of their ancestral domain and negotiate effectively with the Philippines government, the Ikalahan set up a legal corporation, the Kalahan Education Foundation (KEF), a procedure that eventually led to the creation of the Kalahan Reserve, in Nueva Vizcaya. An area of 14,730 ha has been set aside for about 2500 tribes people. This heavily forested area lies at an altitude of 600 to 1700m. Rainfall is high with 3000 mm falling annually between June and November.

The Kalahan Education Foundation is managed by a Board of Trustees consisting of 13 tribal leaders chosen by the people themselves. The KEF employs about 40 people, all of whom are Ikalahan, as teachers, processors, foresters and development workers. The Ikalahan have established a Kalahan Food Processing Center, the Kalahan Academy (a High School), the Shalom Bible College and several other community welfare programmes.

Fallowing

Although the soils of the Kalahan Reserve are shallow, they have adequate nutrients. However, when used for crop production, heavy rains tend to leach out the bases more rapidly than they leach out the acids. When this happens, the soil becomes highly acidic and the phosphorous in the soil is bound to aluminium and other metals, making it unavailable to the plants. The production of *obi* tubers is greatly affected by this lack of phosphorous and farmers know exactly when they need to let a field go to fallow.

Artist: Ariel Lucerna

The forest being trucked away by loggers

The traditional way of fallowing was to leave a field alone until grass, shrubs and trees had regenerated. After about 15 years the trees would be as big as a man's leg and the field would be ready for cultivation. First, the farmers would cut down the grass, bushes and trees and after the vegetation had been dried, it would be burned in a controlled way. Great care was taken to ensure the fire would not spread and damage any other standing trees or bushes. The ash produced in this way neutralises the acid in the soil, phosphorous is released from its bound form, and is available to the plants once again.

Shortening of the fallow

Recently the Ikalahan started planting small alder seedlings (*Alnus nepalensis)* in the *obi* fields. By the time these fields are ready for fallowing, the tree seedlings are already waist high. The alder trees enrich the fallow vegetation. In this simple way, the time needed for fallowing is reduced from 15 years to 7, thus doubling the amount of agricultural land available. Because the Ikalahan farmers do not need that much agricultural land, these "extra" pieces are allowed to revert to orchards or forest. Other mountain farmers in the region are now imitating this simple technique.

The *obi* cultivation cycle

Several varieties of *obi* are planted in each field. The different varieties probably have different nutritional requirements. Mixing and rotating them helps to preserve soil productivity. Planting is usually done in May or June. The first weeding is done about two months later.

Once the tubers begin to reach maturity they are harvested when needed. Both tubers and leaves go straight from the field to the kitchen. The Ikalahan never harvest an entire field at once. Defective tubers are not wasted because they are cooked and fed to the pigs, which are invariably a part of each Ikalahan household.

Gengen

After about four months of harvesting, tuber production may start to decline. The woman responsible for the field will choose an area of about 10 m.[2] and remove the entire crop: vines, leaves and tubers. The best vines are separated out and left in a shady place to sprout.
All other vegetation, including weeds, is buried in contour trenches across the slopes at about 8 m. intervals. The area is then replanted.

The hump over the contour line of *in situ* composted material is able to catch any soil eroded during the six weeks the newly planted vines take to mature. When one square is finished, the farmer repeats the process in an adjacent area. This cycle continues until the entire field has been cleared. A field is seldom more than two-thirds of a hectare in size. This system is known locally as *Gengen.* It may be repeated two or more times during the life of the field, depending on the circumstances.

Forest management

Besides providing sites for shifting cultivation, the forests are also a source of materials for domestic use, food and products for sale. As hunters and gatherers, the Ikalahan know that logging is not a sustainable way of extracting forest wood. They have, therefore, developed Forest Improvement Technology (FIT) to help them manage the forest and harvest its products in a sustainable and profitable way.

Community forestry

Community forestry is the best way to implement this technology. The forest farmer will probably know which trees should be removed to improve the forest; but it is still wise to have a forester help him to be sure that his choice will truly benefit the forest and not only his pocket. One forest farmer could not raise enough money to pay a forester's salary. A community, however, could easily afford to have one of its own members trained in forestry to serve the community as a whole.

Community land use plan

Community members can make a "community land use plan" to ensure they are all working together in the same way. *Unib*, a community near Santa Fe made such a plan and decided that each family should have a plot of about 8 ha extending from the river up the mountain slope. The flatter lands along the river would be used for rice and vegetables. The gentle slopes above these areas would be used for swidden farms to provide food for the family. Small orchards could also be developed near the swiddens if the family wanted to supplement its food supply or have fruits for sale. On the higher land, each family would have a family forest where timber and other building materials could be harvested for their own use or sale.

The family forests do not reach the top of the ridge. The *Unib* have set this aside as a sanctuary for wildlife. The wildlife could also use the family forest and they would be protected there as long as the swidden farms remained undamaged.

Finding the proper niches

Once the Ikalahan had established control over their resources in the Kalahan Reserve, they started to take measures to protect them. Over a period of several years many experiments were carried out. Everyone agreed that this was an impor-

Forest Improvement Technology

The goal of FIT is to improve the forest, rather than simply improve the short-term income of the forest farmer. In the long run this will lead to more sustainable increases in income. Trees are cut continuously in small amounts rather than all together every thirty years. In this way the forest ecosystem can be maintained.

Each year the forest farmer makes a selection of trees to be cut. He checks the forest for crooked, damaged or crowded trees that need to be removed to improve the forest. When these have been removed, they are sawn into lumber. It may not be first-class wood but it can be used or sold. Simple equipment is used and the sawdust, tops and branches are left to rot because they restore fertility to the forest soil and help maintain biodiversity. The forest farmer does not separate the potential crop trees from the other trees because he knows that all trees have a role to play in the forest.

In natural forests there is a continuous process of rejuvenation. Trees die or are felled by storms. In this way the canopy is opened and, because the microclimate is not damaged, young seedlings get a chance to develop. FIT follows this natural process. Mature trees that have stopped growing are removed to create favourable conditions for forest rejuvenation. If this is done every year, the forest will continue to develop and improve. The removal of individual trees does not hurt the forest or its environment and provides first class lumber.

If there are large open spaces, a forest pioneer species will be planted first. Agricultural crops are not planted between the trees because they would bother the other plants that need to grow to make a good forest. The population of one or two species of large or small plants can be increased by enrichment planting. This can be very favourable as long as the forest is not turned into a plantation.

As the forest grows, biodiversity will continue to improve and many species of insects, small animals, grasses and other plants will move in. This is good because all of these species help each other and the improved biodiversity will encourage the forest to grow faster and become more healthy. The forest farmer will only cut a small amount of growth allowing the forest to improve each year.

The growth-rate presently expected in Philippine forests is about 4.5 cubic meters per hectare per year. Under proper management, using FIT, the forest can produce as much as 15 - 20 cubic meters per hectare per year. Such an analog forest still retains the characteristics of a natural forest. It is not a plantation. It still has high bio-diversity and is an effective watershed with a high percolation rate. It will also provide a sanctuary for many kinds of wild orchids, animals, birds and insects.

If each forest farmer cares for 5 hectares of good forest, he may harvest up to 80 cubic meters of first class lumber every year without damaging the forest. That would provide him with a higher cash income than many professionals and he would still have plenty of time to produce his own food on the farm. Once the forest has developed, it can be sustained indefinitely.

Artist: Rolly Nicart

Sweet potato vines start to cover the field

tant step in developing new sources of livelihood. In the beginning, people had a vague vision of their goal, but not much idea of how it could be achieved. Now, after more than two decades of struggle, they describe the process quite simply: *Homo sapiens*, like all other species, must find its own sustainable niches in some part of the ecosystem and do this without trying to dominate the entire system.

The Ikalahan have been looking for resources in the forests that can be used benignly and sustainably while encouraging the forest to go on performing its other functions. In this they follow the basic principle of ecological balance and biodiversity. *Homo sapiens* should not limit themselves to a single niche but should try and make use of as many different possibilities as they can. Therefore, beside lumber, they have developed several new niches.

Wild fruit

For ten years the Ikalahan have been harvesting wild fruit from the forests and processing them into jams, jellies and marmalades. Their products are sold under the trade mark "**Mountain Fresh**" in all the better supermarkets in Metro-Manila. Some of the fruits they use, such as guavas and *santol* (*Sandoricum koetjape*), are quite well known to the customers. Others, such as *dagwey* and *dikay*, are completely new and the customers have to develop a taste for them before they start to sell well. This is quite a difficult job.

In some cases farmers were forced to plant more trees or vines in the forest because there was not enough wild fruit. Today, farmers can obtain a significant income from selling fruits to the Kalahan Food Processing Centre and there is no reason why they should cut down wild plants and replace them with field crops.

Orchids

In the Kalahan Reserve there are more than 70 species of wild orchid. In the past Ikalahan would gather wild orchids and sell them to outside buyers. This practise was, of course, unsustainable because orchids in the wild do not multiply rapidly. Now the Ikalahan use their forests as a gene bank. They gather a few orchid plants to serve as mother plants, propagate them, and sell their offspring to local farmers who raise them in "backyard forests". The Reserve also has a few very rare species and the Kalahan Educational Foundation is trying to develop propagation techniques that will enable them to sell these species in the same way.

Mushrooms

Several of the more valuable mushroom types are choosy about where they grow and like the cool moist climate the forest provides. At least one of those species, shiitaki, commands a very high price but it prefers a substrate of either oak or alder. Oak takes a long time to grow, but the Ikalahan have large quantities of alder and this grows very quickly.

Other promising niches

Other promising niches are wild meat, organic vegetables, and ecological jewellery. The Ikalahan are presently working on the technologies needed to electroplate leaves and other natural products with gold and silver to make jewellery. This could be combined with the polishing of some of the more attractive stones to be found in the riverbed.

Value adding for employment

The Ikalahan do not want to sell guavas - they want to sell jams and jellies. They do not want to sell lumber - they want to sell tables, chairs and other finished products. Every community has children. These children grow up and many of them go on to college and develop advanced skills. If the communities sell off all their raw materials to the city, the educated youth will be forced to follow the raw materials and find jobs in the urban areas. Therefore, the Ikalahan decided to develop ways of processing raw materials into finished products themselves. They also founded their own Academy because they did not feel that lowland education suited to the needs of forest people. In this way they created a situation where their children can chose to stay at home, become educated, manage local enterprises and later become the leaders who will take care of the community's future.

The experiences of the Ikalahan show that it is not necessary to eliminate swidden farming from the list of forest niches. However, care, ingenuity and patience is required if it is to remain the basis of a sustainable livelihood.

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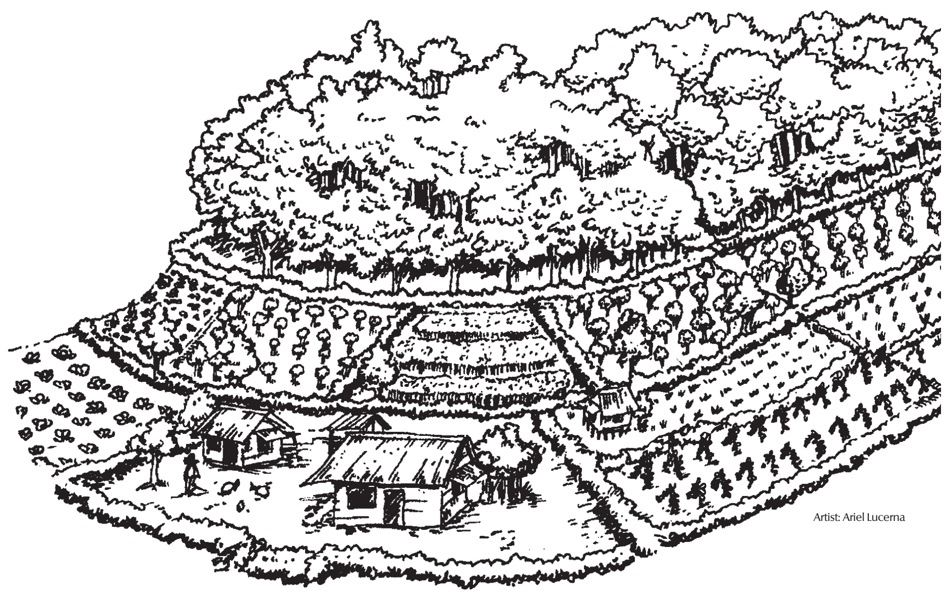


Community land use planning

Catalysing innovation in culturally conservative communities

John Raintree

"The livelihood of the Tagbanwa is swidden, no other. For a Tagbanwa there is no way to get food except swidden. This is the 'office' of the Tagbanwa. Every year you make swidden until you die. Passed down from generation to generation since the time of our ancestors – swidden, no other".

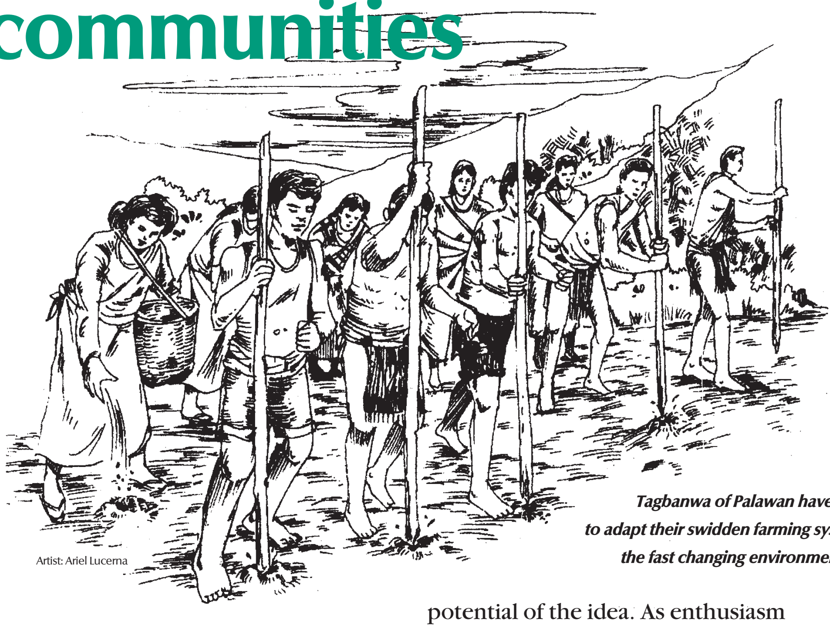
People who work with shifting cultivators are often struck by their dedication to traditional ways. This cultural conservatism often expresses itself as resistance to technological change, even when the old ways of swidden livelihood are no longer sustainable and some kind of adaptive change is necessary. The nature of this resistance must be understood if these communities are to be helped.

Understanding conservatism

Anthropologists see cultural conservatism as a community's way of defending itself against disruptive change. They do this to preserve the core values of their cultural identity and avoid the risks they believe change brings. External factors such as uncertainty about the right to use resources, hostile government policies, feelings of cultural inferiority or military oppression can undermine self-confidence and make people less open to change.

No culture exists in a vacuum and a community's viability depends on its ability to adapt in changing conditions. All viable cultures maintain ways of overcoming their conservatism through appropriate innovation. How these two opposing tendencies are resolved is a fundamental problem intrinsic to the self-regulation of living systems.

Every cultural community has its own particular set of defense mechanisms and external constraints. During my stay with the Tagbanwa, shifting cultivators in a remote area of the Philippines, I observed several mechanisms including low cultural value and lack of incentives for innovation; low self-estimation of ability of individuals to innovate, due to lack of custom; social constraints on the flow of information within the community; traditional technology strongly embedded in spiritual rituals, cultural values and ethnic identity; strong identification with own technology, new technology identified with other ethnic groups and therefore not acceptable; ethnic boundary constraints on access to information outside the community.
There are also important internal constraints on information flow.



Tagbanwa of Palawan have to adapt their swidden farming system to the fast changing environment.

Local knowledge may be difficult to access. People normally don't talk about how to do things, they learn new skills by watching others. Other constraints include functional fixedness: new functions inconceivable until demonstrated; aversion to didactic communication in egalitarian societies ; politeness - people don't normally volunteer unsolicited information and deep technical knowledge may be the preserve of specialists who might keep it secret for prestige or economic reasons. Most perceived strains in swidden life are minor, immediate and social, rather than major, imminent and ecological: discussing major problems is often met with resistance.

Under normal conditions these constraints might not pose problems for cultural viability. But if the whole system is in crisis and under pressure to change in order to avoid the continued degradation of its natural resources, then such defense mechanisms can inhibit innovations that might help the culture survive.

Facilitating innovation

Development catalysts not only facilitate local access to potentially useful information from within and outside a local system, they can also help get information across the barriers presented by automatic defense mechanisms and ensure that the local community is able to assess it in a fair and well-informed way.

The development catalyst must, therefore, tap into the indigenous tradition of shifting cultivation and experimentation. New ideas close to existing practices are introduced to small groups of interested farmers so that connections can be made between old and new ideas. By playing around with the new idea in a model or small-scale experiment a better feeling can be obtained for the real meaning and potential of the idea. As enthusiasm grows, the idea can be discussed and explored further and comparative experiments can be carried out in real life conditions. Each step creates a context for public participation, processing information, and debate. The community uses its own criteria to assess the idea and accommodate it to their own cosmovision. It may even have to modify its perception of how reality functions. The result is a well-thought out community decision in which the idea is adopted, adapted or rejected.

Much of the resistance to adaptive change in conservative communities is semantic in nature. The work of a development catalyst in such circumstances is to find ways to make communities conscious of these structures and encourage enough flexibility to ensure new innovations are evaluated with the insights of local experience and given a fair trial.

Learning to innovate

Overcoming cultural conservatism takes time. This may partially explain why shifting cultivators continue with often contra-productive farming practices. However, once the process of cultural adaptation has gone through the first cycle of innovation, the innovation process may become much easier. The ultimate value of this approach is not what is learned about any specific innovation. It is rather that the community is exposed to the experience of learning how to deal with new information and to innovate within their land use system so they can survive in a rapidly changing world. ■

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Adapted from: Raintree J, 2000. **Catalyzing innovation in shifting cultivation communities: experiences from Palawan, Philippines**. IIRR Resource Book (see p.30).

Farmers in Camamu, Bahia prefer analog agroforestry as it gives higher income and helps sustainably.

Regenerative analog agroforestry in Brazil

Patricia Vaz

In 1985, Ernst Götsch started a cacao plantation in the south of Bahia, Northeast Brazil. The land was in very poor condition. After 40 years of slash and burn agriculture the soil was depleted and the wells had run dry. Five years later the land was covered by a young but productive agroforest and water was flowing again. This was the result of the system of ‘regenerative analog agroforestry’ developed by Götsch and known in Brazil as SAFRA.
The original vegetation in the region was Atlantic rainforest, but now only a few stands remain after years of timber exploitation and slash and burn agriculture. The average rainfall is about 1400 mm with average temperature of 25°C in January and 20°C in July. Soils are poor acidic oxisols and ultisols and classified as being unsuitable for cacao production.

However, as early as 1996, a year in which agricultural productivity in general was low, Ernst Götsch was getting yields of 5000 kg cacao per hectare on parts of his farm, 1400 kg more than average for south Bahia (Penereiro 1999). From the mid-nineties an incurable disease caused by *Crinipellis perniciosa* had been ravaging the cacao plantations in the region, and production had declined dramatically. The disease damaged the cacao trees on neighbouring farms but did not affect Ernst Götsch’s ‘analog agroforestry’ system.

This article will look at the principles and practices behind ‘analog agroforestry’, a remarkable approach that has been used successfully to regenerate abandoned pastures whose soils had become completely degraded. Within a period of 5-8 years they were supporting diverse agroforests and had become highly productive again. These results were achieved without the use of chemical fertilisers, herbicides, pesticides or heavy machinery.

Basic principles

Natural species succession

In essence analog agroforestry attempts to imitate nature. In nature, plant and animal species live in consortiums with other species because they need these species for optimal growth and reproduction. Each consortium creates the conditions for a new consortium with a different composition. Hence, each consortium is determined by the preceding one and will determine the following one. The different consortiums succeed one another in a dynamic, ongoing process called natural species succession.

Species succession is the natural process of quantitative and qualitative accumulation of soil fertility, diversity, complexity, energy and vitality that gradually transforms the colonist consortium into a climax consortium. In nature, pioneer species that are capable of growing in poor soils colonise open spaces. These pioneers, mostly grasses, herbs and shrubs, improve the soil and create the conditions in which secondary herbs, shrubs and tree species can grow. The secondary forests undergo several cycles, during which the life span of the dominant species gradually increases from 3 to 15 to 30 and up to 80 years and their demands on the quality of the environment become more and more specific. The secondary forest species create soil conditions conducive to the growth of primary forest species whose life cycles can be as long as 200 years.

Analog species

Analog agroforestry also identifies natural species, consortiums of species and successions of consortiums. To produce optimal benefits for the farmers, some of the natural species are substituted by more beneficial ‘-analog’ species that occur in similar natural conditions and succession phases. The local natural forest and traditional farming systems are analysed in order to identify situation-specific natural species, consortiums and preferred analog species. The life processes are optimalised to stimulate the greatest possible biodiversity by adapting the vegetation to all micro-environments. This may lead to many different combinations of species. Ernst Götsch, for example, planted pioneer species such as elephant grass, manioc, pineapple and *coarana* to improve the soil and secondary forest trees like Jangada preta, Inga, and many primary fruit-, nut-, and timber species to achieve a prosperous agroforest and secure high, medium, and long-term yields.

It is difficult to design an optimal consortium of plants taking all parameters into account. Help comes from the wild annual and perennial species, often called ‘-weeds’, that establish themselves spontaneously on the plots. These fill in many of the niches that have not been occupied by cultivated plants.

Optimal timing and density for planting is identified so that each species can have optimal conditions to establish itself, grow and contribute to the succession process. It appears that the timing of how plants are introduced into the succession process

Succession of plant consortiums in an analog agroforestry system

is a particularly critical factor in how they establish themselves and develop.

Natural rejuvenation

A degree of stress occurs as different vegetation phases succeed each other. Initially pioneer vegetation dominates because it develops faster than the other species. As the pioneers mature and age, the secondary vegetation is ready to take over but only after the whole system has stagnated for a while. The ageing plants suppress the development of 'young' vegetation. When storms, lightning or floods damage aged or diseased vegetation, the secondary vegetation reacts with accelerated growth and development.

Selective weeding and pruning

In analog agroforestry, the selective weeding, pruning and removal of plants replaces natural rejuvenation. Drastic pruning accelerates the growth of the system as a whole because it increases the amount of light and nutrients available to future generation of plant species. It serves as an instrument to manage species succession by making it possible to influence each plant individually as far as access to light, space and leaf area is concerned. Periodic rejuvenation by pruning, for example, prolongs the lifetime of short-lived pioneer species, and makes them better able to improve the soil. It can also encourage fruit trees to come into flower.

If farmers want to produce annual food crops on a regular basis, it is possible to return to the pioneer succession phase by drastic pruning and (partially) clearing of larger fields when a higher consortium comes to the end of its life cycle.

Soil regeneration

In nature, depleted soils may take many years to regenerate. However, in analog agroforestry the process is much quicker. Critical factors are:
- plant community composition and density;
- order in which species appear;
- timing of when species appear;
- interaction with micro-organisms and wild animals;
- (micro-)climatic factors.

Permanent soil cover

In analog agroforestry leguminous and non-leguminous pioneer species are used to regenerate soils. In addition, the organic material obtained from weeding, pruning and removing plants is used as mulch to protect and fertilise the soil. To enhance soil life and maintain a constant flow of nutrients, rapid and permanent soil cover and regular applications of organic material of different composition and decomposition rates are needed. Under these conditions it is not necessary to plough the soil.

It appears that the critical factors determining growth rates, the health of plants and the productivity of the system, are not the initial fertility of the soil, but rather species composition, planting density, and timing and succession management by selective weeding and pruning.

Analog agroforestry in practice

Preparation

To design an analog agroforestry system farmers analyse the farm system and the wider environment with the help of an experienced technician and then define their needs and objectives. Ideally the system should include species that regularly produce food in the short-, medium- and long-term and others that are capable of rapidly producing soil cover and high amounts of biomass. There should also be species that have multipurpose functions and produce mulch material, firewood, timber, fruits and medicines. Farmers must therefore select a combination of annual and perennial species that can be harvested at different phases of the succession.

Pioneer vegetation has to fit the succession phase of the original vegetation and at the same time species must also be introduced that have a similar function but are adapted to the next succession phase.

Between the species of the first consortium the farmer can introduce other species with longer life cycles and higher demands, although there is the risk that they may be pushed out of the system because they belong to a later phase of succession.

Farmers have different needs and objectives and start work in a wide variety of conditions such as depleted grassland, bush fallow vegetation, mature forest vegetation, fertile alluvial valley soil and eroded upland soil. There are no blueprints for species selection. It is important that the system is seen as a whole; the different phases of the succession process recognised and any gaps that threaten the succession/production cycle are tackled. To do this farmers need considerable knowledge of the species concerned as well as its functions and environmental needs.

Establishment

First, existing vegetation has to be synchronised. This means that, in a given field, all ageing plants will either be removed completely or, if they still have vigour, coppiced. Pruning brings the vertical structure of the vegetation into equilibrium. A week is taken to plant or seed the selected species. If more time were taken the system, which has to develop as one organism, would no longer be synchronised. This means that nearly all pioneer, secondary and higher species are planted

Training course on Analog Agroforestry

A training course on Analog Agroforestry (or Succession Farming as it is called by the organisers) in the humid tropics will be organised by Ecotop Consultants in Sapecho, Alto Beni, Bolivia on 15-29 July 2001. This course, meant for agronomists and practitioners, will combine theory and practice. Important topics are:
- The principles of species succession
- Management of agroforestry systems to enhance species succession
- Management of pests, diseases and other system damages
- Design of analog agroforestry systems
- Quality control for organic products certification

Demonstrations and practical exercises will be organised in agroforestry systems with, among others, cacao, pineapples, banana, oranges and palm trees. Visits to farmers in the region who working the approach will be organised. The course is in Spanish.

For more information:
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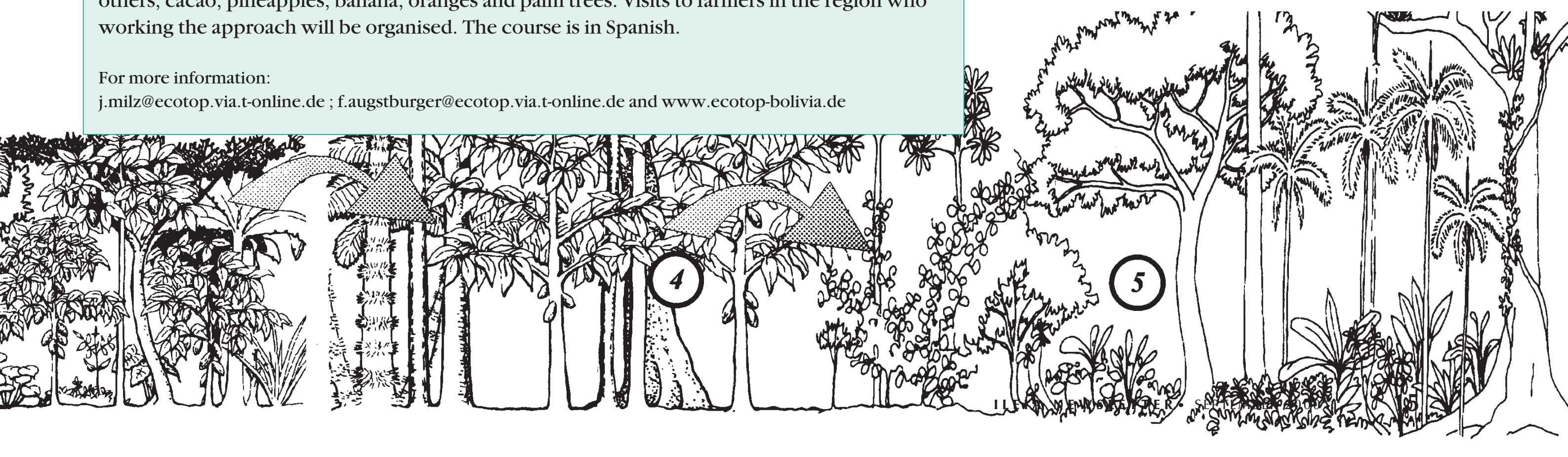

at the same time. Because the same planting distances are kept for each species as in monoculture cultivation, the overall plant density will be very high.

High densities and possible competition can easily be kept under control by pruning or by eliminating the plant completely. It is questionable to what extent there is really competition between plants. Experience shows that plants that function in different succession phases do not compete. Also species that grow at varying rates and end up in different layers of the vegetation do not compete, even if they come from the same species consortium and have similar demands.

Management

If there is good species planning, it will be possible to harvest products at each intervention. In this way, for example, it would be possible to harvest radish, then beans and maize, and subsequently animal fodder, pineapple, banana and later timber, resin and other non-timber products.

At the same time, the system is synchronised again by weeding, pruning and eliminating ageing and diseased plants. Older herbaceous plants are weeded, then fodder grasses are cut, and finally trees and shrubs are pruned and felled.

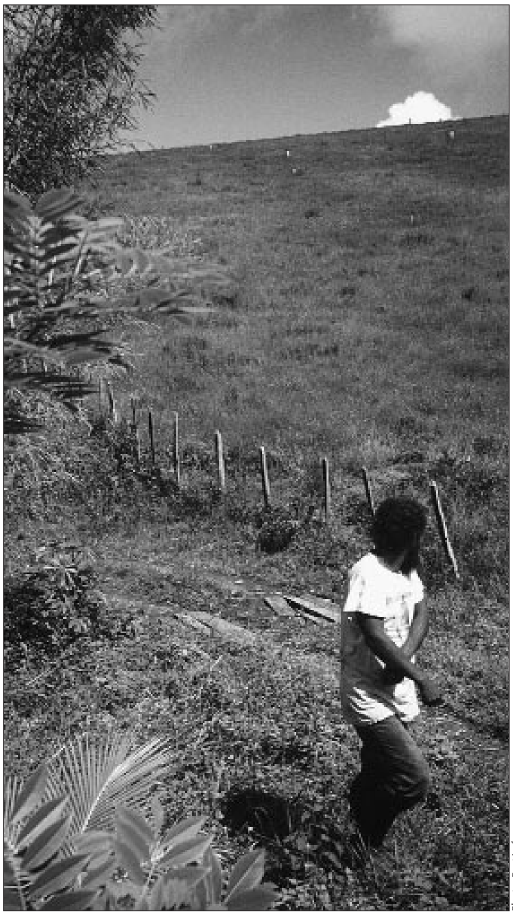

Photo: Bert Lof

Why not change this degraded rangeland into a diverse and productive agroforestry system?

Pruning is an art. Correct pruning requires that the farmer bears in mind particular factors including the characteristics of the plant and the environment in which it grows. There are some basic principles but the uniqueness of each situation has to be taken into account. In general the farmer must take into account:
- the capacity of the species for coppicing;
- its physiological age;
- its place in the succession process and the vertical stratum;
- whether it threatens the development of any higher plant
- any damage being inflicted by predators or parasites

A sustainable system

There are important similarities between indigenous forest farming (see Box p13) and analog agroforestry. Both imitate nature by using analog species and species succession. In traditional shifting cultivation fire is often used for natural rejuvenation. However, where fallow periods are short, natural succession may be halted in the pioneer phase and there will be no increase in soil fertility, diversity or vitality because too much valuable organic matter, plant nutrients and soil and plant life is lost. In modern agriculture chemical fertilisers, herbicides, pesticides and machinery have replaced natural processes. Slash and burn agriculture and modern farming are evolving in ways that lead not only to depleted and degraded soil and loss of species diversity but also to simplified natural environment and decreasing productivity and sustainability. The strength of analog agroforestry and indigenous forest farming is that it is sustainable because it improves agricultural productivity and the environmental health of the production system.

Research results

Penereiro (1999) compared the analog agroforestry system on Götsch's farm with a 12-year-old, natural succession bush fallow. The vegetation in the agroforestry system was more diverse and better balanced and the succession in the system was more advanced. In the analog agroforestry system the topsoil had a high soluble phosphate content. In the top 5 cm layer there was 7 times more phosphate and between 5 and 20 cm there was 4 times as much. At the 40–60 cm level the phosphate content was about the same. These concentrations can be explained by the combined effect of nutrient pumping by deep rooting trees and the effect of soil microorganisms stimulated by pruning and the permanent organic mulch layer.

Spreading the approach

Spreading analog agroforestry concepts requires a different approach to that used when passing on technologies via extension services. The construction and organisation of knowledge plays an important role. Initially, there must be an intensive exchange of knowledge between farmer and technician in order to create a common understanding of how people interact with nature. The older members of rural communities and small-scale traditional farmers know a lot about the species native to their area and are well aware of the interactions that take place between the various plants. Farmers still know how these plants were used for food, medicine and other domestic purposes.

This common understanding can be used to improve the system through continuous farmer experimentation. Several groups in Minas Gerais, Espírito Santo, Paraná (see Petersen et al p17), Rio Grande do Sul, São Paulo and Bolivia are experimenting with anolog forestry. Some farmers will not commit themselves to the whole system and their results are, therefore, limited. Others are wholly committed to the approach and have developed creative solutions that meet local needs and conditions.

Centro Sabiá in Pernambuco, in Northeastern Brazil is one of many organisations working with analog forestry. Here there is farmer to farmer exchange, experimentation and some farmers are being trained on Ernst Götsch's farm. Demonstrations are also held on the farms of particularly successful farmers. Several farmer promoters have been selected from this group and they distribute information on analog agroforestry. These initiatives should be intensified in order to provide an alternative to the present dominant but unsustainable production model.

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Analog forestry:
An alternative to 'clear and simplify'

Ranil Senanayake

Modern agricultural and forestry practices have devastated many natural and traditional ecosystems and their diverse flora and fauna, replacing them with monocultures designed for maximum short-term production. The resulting highly simplified ecosystems are unstable and unsustainable and often require considerable external inputs. It is not only the poor who have ravaged local forest ecosystems, modern development agriculture and silviculture are often more destructive than 'slash and burn'.

The NeoSynthesis Research Center in Mirahawatte, Sri Lanka has examined alternatives to modern forestry and has developed a strategy to intensify agriculture in an ecologically sound way. Twenty years of field experimentation has lead to an approach that tries to work according to nature's designs. The system is known as Analog Forestry (Senanayake 1987). The Center's work proves that moving towards ecologically designed tree crops brings back economic and ecological stability.

Forest home gardens

Forest home gardens are a traditional form of cultivation in Sri Lanka and they are also common in other tropical areas. Forest gardens are patches of cultivated land dominated by trees and perennial shrubs and have a forest-like system appearance. The gardens are usually located close to farmers' homes and provide a wide variety of food, fuel, fodder, wood and medicinal crops. They also provide a cool and pleasant living environment. The composition of tree species varies with climate and elevation and is a product of generations of farmer experimentation, cultural and spiritual beliefs, and economic necessity.

Analog forestry in Sri Lanka draws on the strengths of this traditional paradigm. Many forest home gardens mimic the natural species succession found in local forest vegetation. The use of succession stages of natural ecosystems to design a cropping system was first reported by Hart (1980) who saw this as an analog to natural processes. He recognised the fact that a forest progresses from grassland to climax forest over time and that all of the organisms, from grass to tree represent the forest.

Analog forestry design

The trees and plants in an analog forest will be similar to those in native ecosystems. They will provide food or microhabitat for native species, but can also supply human needs. This requires a careful selection of analog species. In designing the analog forestry system it is important to keep in mind that, because of natural species succession, this will be a dynamic system and one that will mature. Therefore, a dynamic approach to management is needed as well as an understanding of how maturity can be used as a performance indicator. It is also important to identify opportunities for microhabitat creation. Protecting 'keystone' species becomes easier if the farmer develops this knowledge. Planning an analog forest is highly situation specific and will often entail different designs reflecting the characteristics of the local ecosystems. As the system matures it will create production opportunities and maximise species diversity.

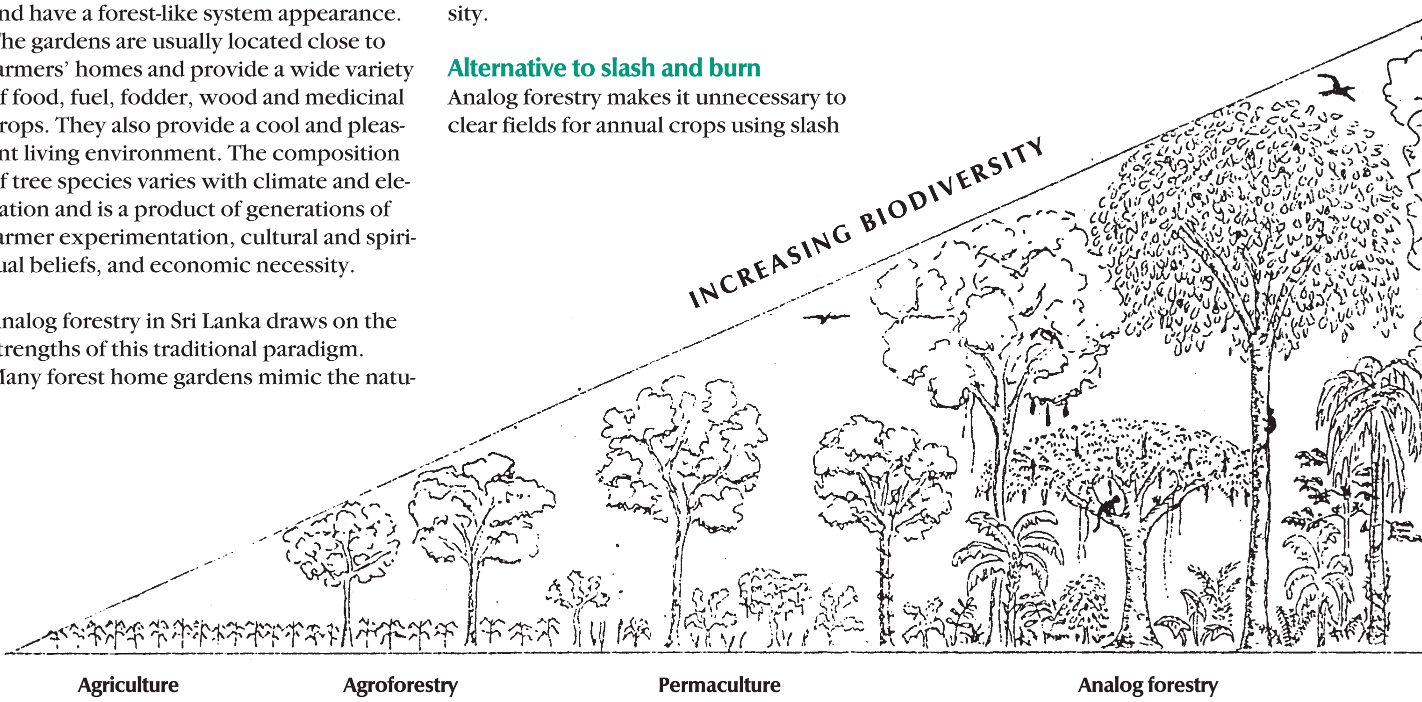
Alternative to slash and burn

Analog forestry makes it unnecessary to clear fields for annual crops using slash and burn techniques. The shade factor provides good conditions for shade loving crops such as cardamom, cloves, nutmeg and pepper which give the farmer more earning potential than annual crops. Once shade cropping has been established, farmers are reluctant to open the canopy because a return to 'slash and burn' will destroy the potential offered by these valuable crops. Increased crop diversity - tree crops included – brings other social and economic benefits, reduce the risk of glut and increase the demand for skilled agricultural labour.

This community of trees promotes environmental stability, conserves biodiversity and facilitates the production of clean water just like a forest. Recognising these functions is an important feature of analog forestry. It has been demonstrated that the environment created by this type of silvicultural system increases biodiversity and ecosystem stability within production systems. In Sri Lanka, records show that many species of flora and fauna have returned to farms with established analog forests.

Biodiversity conservation

While conservation is the ideal way of maintaining original levels of forest biodiversity, resources are too limited to purchase or schedule protected areas.



Establishing protected areas and private reserves is not enough to ensure the sustainability of many native species. In May 2000, a workshop hosted by the Ministry of Forests and a local NGO - Rainforest Rescue – held in Quito, Ecuador made clear that many areas currently described as having 'no forest' on the national forest map, actually contained a very high percentage of forest patches and corridors. In some regions the local NGO reported that forest cover extends over more than 50% of farm area. If the management of forest patches and the extension of corridors are not addressed urgently, the current policy of treating these areas as devoid of forest will become a self-fulfilling prophecy. Analog forestry projects in this region have show how effective reconnecting patches through an 'analog corridor' can be.

In order to re-establish components of natural biodiversity, analog forestry design often goes beyond the farm boundary and farmers are encouraged to think in terms of off-boundary effects, and the continuity of corridors and drainage systems.

Natural forest ecology

Critical elements

Programmes using analog forestry, such as the Forest Garden Programme of Counterpart International identified several factors that were critical in its work in Sri Lanka, Philippines and Mexico.

- A network of local seedling nurseries and community seed banks to provide a diverse range of seed stock and seedlings of plant species to rural farmers wanting to expand subsistence and cash crop tree gardens, wood lots and local tree belts.
- A 'seed and tools fund' to help rural farmers to buy the materials they need to improve their agriculture and land management capacity.
- Technical assistance and training to help farmers design, plant and maintain their analog forests, wood lots and buffer forests.
- Rural education materials adapted for local use and which foster improved farming, farm-based enterprise, community nutrition, family health and the management of the local environment.
- To get better prices extension officers should work together with distributors of niche products to foster national, regional and international markets for the products of 'Forest Gardeners' around the world.
- Certification that guarantees all products have been produced according to organic principles and in systems that benefit rural environments.

Forest Garden Products Certification is a system that sets standards for the certification of crops grown under analog forestry design. This national certification system has been running in Sri Lanka for over twelve years and is presently under international management. There are good markets for forest garden products such as tea, syrup and cashews in Australia and Japan.

The International Network

The International Analog Forestry Network (IAFN) has active members implementing projects in eight countries. Analog forests are being established in Sri Lanka to add value to local products and facilitate landscape management. In Mexico they are seen as an extension of the traditional Mayan land use system. In Colombia analog forests are being used to recover mine tailings left after the destruction caused by gold mining. In Ecuador they have been introduced to stimulate a change in the way cattle-dependent *campesinos* use their land and in Peru they are enhancing the gardens of indigenous peoples in Amazonia. In Canada analog forestry has increased crop diversity and biota in woodland while in Australia it is seen as a component of farm planning. It is clearly a viable approach with a wide applicability.

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(see p.30).

Box I. The frijolar, an indigenous example of the use of species succession

The frijolar system was developed and is being used by the indigenous descendants of the Mayas, in Central America. It is a system where beans – sometimes together with maize – are cultivated near a huge primary forest tree, *Ceiba pentandra*, which is considered sacred. This tree is 70 m tall and has a crown of about the same diameter. Where this tradition is followed, a plot with a dense stand of fast growing leguminous species will be found under the crown of the *Ceiba* tree, all of them showing signs of heavy pruning. Up to 40% of them can be *Inga sp.* a tree that can grow in stormy places or where flooding is frequent.
The ground layer is formed by herbaceous species, mainly *Piperaceaes*.
In the latter half of the rainy season, when the *Ceiba* tree loses its leaves, beans and maize are broadcast on the plot. At the same time, the herbaceous vegetation is moved and all the twigs of the adult fast-growing leguminous trees are cut off. The organic material obtained is cut into small pieces and distributed evenly over the soil. Beans and maize grow vigorously and cover the thick mulch layer within a few weeks. The trees that have been pruned react with a profuse flush of new twigs and leaves within 5-6 weeks. Weeds are unknown in this system. Two months after seeding, at the beginning of the dry season, the *Ceiba* tree renews its leaves. Three or four weeks later the beans are ready for harvest. Two weeks later the maize begins to ripen. Yields of about 2100 kg of beans and 1430 kg of maize per hectare have been recorded. This is quite good when compared to 800 kg of beans and 1000 kg of maize in slash and burn systems in the same region and on similar sites. In the slash and burn system weeding is done twice and only one crop is possible on the same place every 10 to 12 years.

Adapted from: Götsch E, 1995. **Break-through in agriculture**. Rio de Janeiro, AS-PTA

Research by the International Centre for Research in Agroforestry (ICRAF) in Kerinci, West Sumatra, Indonesia identified a flexible system in which a complementary relationship had developed between indigenous forest management strategies and agriculture. Understanding the dynamics of this relationship at household level provides us with insights into how far such integrated agroforestry systems can be promoted among households in the forest margins to help secure rural livelihoods.


Photo: Paul Burgers

If coffee prices are high, coffee trees will be kept on the field.

Options for sustainable agriculture in the forest margins?

Indigenous strategies

Paul Burgers and Dede William

In most of the humid and tropical parts of Indonesia, farming communities have built strong links with the money economy and urban centres. Investments in agriculture, improved access to education, health, agricultural services and entertainment have meant that farm households need a source of cash income. On-going research into the dynamics of these indigenous systems has shown that villagers have been extremely innovative in the way they have applied indigenous strategies to intensify fallow management to balance immediate subsistence needs with long-term ecological sustainability.

Shifting cultivation in Gunung Raya

Gunung Raya is a sub-district on the edge of the Kerinci Seblat National Park. For decades, households in this part of West Sumatra have grown irrigated rice and relied on the surrounding forest for the products they ate and sold. However, in recent years, population growth, the development of the National Park, and improved access and links to urban areas and services, have changed local needs and aspirations.

Farming households in Gunung Raya have developed a highly efficient and productive multistorey tree-cropping system (agroforest) in mutual relationship with wet rice cultivation. Commercial annual crops are rotated with coffee and cinnamon. A “fallow period”, the period when the cinnamon trees are developing towards maturity, allows soil fertility to regenerate. Because of the similarity between these practices and shifting cultivation and the high percentage of commercial crops, these farming practices are often referred to as “commercial shifting cultivation systems”.

In Kerinci, farming households secure an adequate livelihood by consciously integrating forest management with agriculture to produce a combination of local and exotic crops and tree species. They carefully plan how resources of land, labour, capital and time can be optimally divided between these different crops. This results in several management phases of varying intensity.

High management or annual crop phase

This cycle generally begins with the rejuvenation of coffee either by planting new seedlings or coppicing (resprouting) old coffee stumps. Coppicing leads to an earlier closure of the canopy. At the same time, households cultivate commercial crops such as groundnuts, chili and potatoes. These annuals can be grown for about two years or until the density of the coffee canopy hinders growth. This is the time when farmers plant cinnamon trees in between the coffee.

Medium management or coffee phase

The coffee harvest will continue for 2 to 3 years depending upon whether the cinnamon trees have been coppiced or new seedlings are planted. Once the cinnamon canopy has closed, coffee will be unable to produce berries although the bushes themselves will not die. During the cinnamon harvest the farmer can either cut down the whole cinnamon tree or can harvest a number of branches to meet the families immediate cash needs. The farm household will usually decide to cut down the coffee bushes before the cinnamon harvest. If the household expects high coffee prices they may choose to keep the mature coffee trees in the field. After the cinnamon has been felled coffee will produce again a year later. Annual crops can be planted in the open spaces between the coffee trees until the canopy closes again. In this way the farmer can go on maintaining his coffee trees for many years or he can allow the cinnamon to take over. These differences in tree management are the result of a complex decision-making process, in which households try to balance the benefits of annual crops, coffee and cinnamon.

Low management phase or fallow phase

The closure of the cinnamon canopy marks the beginning of a “fallow-phase”. The invasive fallow species *Austroeupatorium* is allowed to establish itself under the coffee and cinnamon. The farmers use this species to increase soil fertility so they can grow annual crops without having to use fertilizers. Some households actively spread the seeds to ensure thick growth.
The length of the fallow period varies considerably. Cinnamon bark is harvested when the household needs large sums of money such as to meet the cost of a wedding or to pay hospital bills. Trees are usually harvested within 6 to 12 years.

Integration with the rice crop

Households in the research area have not only been innovative in choosing perennial species to suit the available resources. They have also capitalised on the fact that they can chose between a short-term high yielding rice variety and a longer-term indigenous variety. This gives a certain degree of flexibility when deciding how resources should be allocated between the management of the rice crop and the agroforest. Chosing to cultivate the high-yielding rice variety means that the farm family is fully engaged in the rice field for four months till the rice can finally be harvested. This is affordable when the agroforest has entered the medium or low management phase and does not need much attention. During the high management phase when the management of the agroforest needs full attention, households often decide to grow the indigenous variety that matures in 9 months. Labour requirements for this variety are more or less evenly spread throughout the growing season.
If the work load becomes a problem, tasks are divided and the women usually continue to work in the rice field while the men concentrate on the agroforest.

Lessons learned from the villagers

This highly complex and precise planning developed by villagers gives us an insight into how more sustainable, integrated farming systems can be developed. Understanding the household economy within a socio-economic, political and environmental context helps us understand the opportunities and limitations confronting farming households when they must decide between developing such integrated systems or focus on food cropping alone. The following key issues have to be considered.

Indigenous strategies

The success of multi-phase agroforestry depends on how it fits into local biophysical and multi-level socio-economic conditions. What is the balance between short-term livelihood security and long-term sustainability and how flexible is the system when local production conditions change. The dynamics of indigenous strategies give us vital information about whether or not sustainable solutions are being developed in changing contexts and the process this involves. Many farmers explained their objectives and management strategies for indigenous agroforestry systems to us. From their experiences we concluded that any development of such systems was dependent on certain opportunities and constraints.

Satisfaction of needs

Households often focus on the satisfaction of needs rather than profit from the crop they chose because of distortions in the wider economy. Households may reject technically feasible, yield increasing, highly profitable innovations because they involve greater specialization, and raise costs and risks. In Kerinci, during the monetary crisis in Indonesia, the price of cinnamon bark rose sharply. Households were expected to cut down large amounts of cinnamon and earn a huge profit. However, there was no large-scale harvesting, on the contrary, farmers argued they now needed to cut only a few cinnamon trees to satisfy their needs.

Flexibility

Usually, indigenous strategies are of a resilient nature. This enables adaptation to change, through a flexible use of resources, land, labour and time. Besides resource use, other components in the total farming system (like coffee and cinnamon in the above system) can be flexibly managed and harvested. These flexible components seem to be crucial for the establishment of multi-phase agroforests, in particular in areas where agroforests add to labour pressure within the total farming system.

Low-input versus high input

Indigenous strategies have evolved with low cost and in most cases with little or no expensive outside technologies or capital. Crops which require relatively high inputs nevertheless may be a viable option if initial investments are quickly repaid. A mixture of higher input short-term output crops with longer-term low input crops may combine well. They can also make multi-phase agroforests a profitable and sustainable option for livelihood security when population pressure intensifies.

Harvest security

Closely related to land availability is the tenure system, which legitimises access to land. Depending on the local situation, land security may or may not be a prerequisite for long-term investment options. The research showed that harvest security of tree crops is a crucial factor for planting trees. Rich households often use sharecroppers to establish the agroforest for them. The arrangements normally last for only one cycle, but since sharecroppers are sure of the harvest, they are willing to set up an agroforest. In fact, these arrangements are quite common in Southeast Asia and have often contributed to the establishment of reconstructed forests.

Box 1: An agroforest is like a championship team in soccer

The preconditions for establishing an agroforest with good prospects of economic, social and ecological sustainability were described by one of the farmers in Kerinci, Mr. Rustam. He compares his agroforest with an "unbeatable" soccer-team.

"A good soccer team has pillars that can be relied on," he says. "They keep our interest in the team. First, we have our attackers, who regularly try to "score goals", and keep our attention. These are our annual crops - groundnuts, chili, and potatoes. We plant them when we begin developing our agroforest and they provide us with an immediate and regular source of income: they score goals for us at regular intervals.
But we must also have a reliable defense for when the "game" starts getting difficult. This is coffee. Although we cannot harvest coffee so often it usually gives us a higher income. There are times though when this defense is not enough and then we have to rely on our goalkeeper: the cinnamon tree. From cinnamon bark we can be sure of a flexible income. If we need small amounts of cash we harvest a few trees or branches. If our needs are greater we will cut down all trees at once."

Lower investment costs

Systems, which include perennials that can be coppiced after "harvesting", result in a decrease in burning of fields. In Kerinci, only small patches of collected biomass are burned, as burning the whole field will destroy the ability of trees to coppice. Coppicing trees save the cost the labour needed for controlled burning and makes these systems more profitable.

Supportive policies

Enabling and guiding such management flexibility by farmers themselves is a challenge for policy makers and scientists who must learn how farming communities are trying to cope and adapt to outside pressures in a sustainable way.

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Photo: Paul Burgers

The farmer can either cut down the whole cinnamon tree or can harvest a number of branches to meet immediate cash needs.

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Buhid shifting cultivators adapt land use

Chris Erni

Photo: Chris Erni

Shifting cultivation is still the main source of livelihood for most upland communities in Southeast Asia. Annual cropping is inter-linked with other complementary livelihood activities like animal husbandry, hunting, fishing, gathering, crafts and wage labour. These indigenous communities have co-existed with their natural environment for centuries, each transforming the other in a dynamic process of change.

Over the last 30 years, the Buhid of South central Mindoro in the Philippines have adapted their shifting cultivation practices considerably. In the upper Fay valley, which is several hours walk from the nearest road, this has led to more intensive and careful land-use practices. These have made it possible to sustain the livelihoods of a growing population on their old ancestral lands. This article looks at the process of land use intensification among the Buhid.

Scarcity of swidden

Traditionally, the Buhid have been highly mobile and a family's response to scarce resources was to move elsewhere. With rich resources, a rather opportunistic shifting cultivation strategy prevailed. Forest and other resources appeared unlimited; only a few permanent crops were planted and little attention was given to preventing invasions of *imperata* grasses and outbreaks of fire in fallow and grassland.

As options to move elsewhere became fewer and fewer some communities developed other responses. The process of adaptation was hastened by an increasing scarcity of swidden land caused by a rapid rise in population. Families evicted by cattle rangers had migrated into the area and laid claim to Buhid ancestral land. There was also some natural population growth. Slash and burn practices had led to large areas of former forest being converted into unproductive grasslands; shortened fallow periods and badly managed fallow land further worsened the situation. While the initial expansion of grasslands created more favorable conditions for some animals, like the deer traditionally hunted by the Buhid, it also attracted the interests of cattle rangers who, until the late 1980s, controlled large areas of Buhid land.

> The Buhid refer to a newly cut and burned field as a *námay*. It remains a *námay* until the cereal crop, rice or maize, is harvested. Although they have more specific terms for the subsequent stages, fields are generally classified as *talun*. This includes fields that are dominated by a crop such as sweet potato (which may be called *talun kamotehan* – from *kamote* for sweet potato), for example, right through each subsequent stage of fallow vegetation to mature secondary forest.

Intensification of land use

A few families were able to create paddy fields but, for most, intensifying land use meant more intensive forms of shifting cultivation. Conscious fallow management has been adopted in which the growth of woody vegetation was encouraged and efforts were made to stop the spread of fire to fallow land.

Furthermore, a more intensive cropping pattern was practiced. The cropping period was extended, new crops introduced and agroforests started to contribute significantly to both food self-sufficiency and cash income.

Three factors contributed significantly to these changes:

- The climatic conditions in the central and eastern uplands with almost year-round precipitation allowing almost continuous root-crop production;
- Flexibility regarding crop preferences. With the absence of a culturally prescribed rice-preference, crops better suited to prevailing conditions could be introduced. The bulk of calorie intake comes from root crops and plantains. Rice for ritual and social purposes is purchased from other farmers with more suitable soils or from the lowland markets.
- Access to new crops and a keen interest in experimenting with them.

The differences between the extensive and intensive forms of swidden farming that has evolved during the last three decades can be summarized as follows:

Fallow management

Fallow is an intrinsic part of shifting cultivation. But for many decades, outside observers, even trained agronomists, have misunderstood its function and value. Fallow land was often seen as "abandoned land". The cultural bias of foreigners or "lowland people" obscured the fact that its function could be compared to a clover crop on a former maize field.

Fallow has the following important effects:

- Eradicates weeds;
- Restores soil fertility and brings back soil-life;
- Provides forage land for livestock;
- Is a source of domesticated, semi-domesticated or wild food plants, and of protein from large or small wild animals;
- Is a source of herbal medicine, raw material for all kinds of domestic tools, crafts and other products of potential commercial value.

Since Buhid shifting cultivators usually create one or more new fields every year, a household usually possesses a number of fallow fields of different ages and at different stages in the natural succession of the forest community. Thus, the diversity of available useful resources is very high, probably even higher than in an undisturbed forest. This has a lot do to with the fact that the fallow vegetation is being "managed". A fallow field is anything but "abandoned". In addition, most shifting cultivators in Southeast Asia have relatively poor upland soils and cannot draw on the type of nutrient stocks available to farmers working on relatively rich alluvial lowland soils. They are therefore strongly dependent on the ecological processes involved in the species succession of fallow vegetation. Good fallow management, therefore, is vital to them.

Management of species succession

The Buhid consciously influence the pattern of species succession in fallow vegetation. In the second or third year of a new swidden cycle plantains, Tania (Cocoyam, *Xanthosoma sp.*), and fruit trees (mainly Jackfruit) are planted. The shady and moist environment that is created in this way helps the preferred fallow plant community, vines, herbs, shrubs and trees to germinate and establish themselves. In this way the fallow is enriched with domesticated plants, its productivity is extended and invasion by *imperata* grasses is halted. Tania, fruit trees, plantains and bananas continue to be productive although this will decline as nutrients decrease.

In the early growth stage, when the field is weeded regularly, species succession is managed quite intensively. As the vegetation becomes more mature, the degree of management is reduced until finally human intervention may be confined to an occasional clearing of competing vegetation to enhance the growth of a fruit tree, or to maintain a banana or plantain patch.

The enrichment of fallow vegetation and intensive management motivate farmers to protect their valuable fallow from fire.

Crucial crops

Crucial for the more intensive planting of perennials was the introduction of a very productive and at the same time hardier variety of plantain, called *sab-a*. This variety can tolerate the presence and shadow of trees and is therefore very suitable for enrichment planting in fields that are left fallow.

Tania was planted for the first time about 30 years ago and spread rapidly among the communities living in the higher and moister parts of Fay creek. Tania is a perennial plant and produces starchy tubers that have become an important part of local diet. It tolerates semi-shadow and is therefore often planted in the forest alongside creeks. But it is mainly planted in swidden fields during the later stages of cropping and is sometimes combined with plantains and fruit trees.

Agroforests

More recently, some Buhid farmers have transformed their swidden fields into agro- or analog forest. This is a form of *talun* that results from progressive species succession management on a swidden field. Eventually the original natural forest is entirely replaced by a man-made forest. Such a *talun* provides food (Tania bulbs, plantains, fruits) but also the much cherished betel nut, coffee and other cash crops such as cacao and bamboo.

Since the Buhid diet is heavily dependent on highly productive root crops and plantains and since some fields have been transformed into agroforests, smaller amounts of land have to be slashed annually for new fields. Today, the Buhid in the Fay valley usually cut only two small fields that measure about 0.3 ha per household.

Land tenure

The development of improved fallow management and the establishment of permanent agroforests was accompanied by changing land rights. Over time, there has been a move from weakly defined communal land rights that approximated an open access regime to individual rights. Intensive fallow management will only work if others can be prevented from using the land while it lies fallow. The increased investment involved in planting perennials was both a reason and a means for transforming traditional land rights. According to traditional law, individuals do not own land: they own the plants on the land. Planting perennials was, and still is used as a way of establishing indirect control over land since swiddening a piece of land with young perennials requires the permission of the owner.

The concept of individual land holdings eventually prevailed. In the early 1990s, there was considerable competition between new and traditional concepts of land rights and there were many disputes. In most areas, individual land rights over swidden land are now fairly well established and is the result of a process that has taken place within the context of indigenous law over the last 30 years.

Outsiders are contesting land resources in the Buhid ancestral domain. The Buhid have managed to retain or regain large parts of the land that had fallen under the control of pasture leaseholders. Some areas in the plains and foothills, however, have been lost to settlers. Since June 1998, the Buhid have a Certificate of Ancestral Domain Claim (CADC) for the entire 94,000 ha ancestral area and have applied to have it turned into a Certificate of Ancestral Domain title. Unfortunately, this has not yet been granted and as long as access to natural resources remains uncertain, it is very difficult to further intensify land use.

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	Extensive form	Intensive form
Cropping pattern and sequence	1) Maize or rice 2) Sweet potatoes, some vegetables and other root crops 3) Fallow	1) Maize or rice 2) Sweet potatoes, vegetables and other root crops 3) Colocasia, plantain, banana or fruit trees 4) Fallow or transformation of fallow into agroforest
Perennials	Some bananas, plantains and fruit trees are planted in settlements	Some fallow fields are transformed into agroforest plots, with a mixture of perennials, amongst others coffee for cash
Subsidiary activities	Hunting, fishing and gathering of wild plants are important	Hunting less important; fishing and gathering of wild plants important
Animal husbandry	Extensive pig and chicken husbandry	Extensive pig and chicken husbandry

Chris Erni, Programme Coordinator Asia, International Work Group for Indigenous Affairs (IWGIA), Classensgade 11 E, 2100 Copenhagen O, Denmark. ce@iwgia.org

Adapted from: Erni C, 2000. **Adaptive changes in upland Mindoro, Philippines: Intensified land use among Buhid shifting cultivators**. IIRR Resource Book on Shifting Cultivation.

The evidence collected by the Indigenous Fallow Management (IFM) Network (see p.5) and the Consortium for Tropical Soil Cover and Organic Resources Exchange (TropSCORE) (see Box 2 on p.6) makes clear that it is time to change our scientific understanding of soil fertility management in the humid tropics.

Conventional scientific thinking is that if farmers apply enough chemical fertiliser and the soil has sufficient capacity to bank accessible nutrients, their land will be fertile and productive. In practice, these fertilisers are often not very effective and between 40 and 70% of the nitrogen applied is lost to the environment (FAO, 1990). On sloping and acid soils worked by shifting cultivators, these losses are probably even higher and make chemical fertilisers uneconomical.

Artist: Rey Cuevas

Nutrient banks or nutrient access

Rolando Bunch

Building up a large stock of nutrients in the soil is often of little value in the tropics. Rather, what is important and often done by farmers, is to maintain a constant, well-balanced supply of a minimum amount of nutrients and ensure that crop roots have unobstructed access to them. This will ensure that even if farmers have very poor soils and the flow of nutrients at any moment is very low (this can be even less than 20% of recommended fertiliser rates), they can still produce good yields.

Farmers' strategies to enhance soil productivity can be described as follows:

- ***Maximum organic matter production***. Frequently farmers can increase the amount of organic matter they produce in their fields while maintaining or even improving their yields. There may be a slight increase in cost but not necessarily. In fact many gm/cc and agroforestry systems increase over-all organic matter production while reducing the amount of labour required for controlling weeds.
- ***Use of natural processes*** like nutrient mobilisation and accumulation, N-fixation, nutrient cycling and species succession. These processes make nature (e.g. soil micro-organisms, plant roots, predator insects, and micro-climate creators) work for farmers and provide free inputs.
- ***Soil cover***. Soil exposed to the tropical sun produces more weeds. These reduce yield and increase the farmers' workload. Unprotected soil also becomes very hot making it difficult for soil life and plant roots to function well. Mulching and shade can provide soil cover.
- ***Zero tillage***. If there is little organic matter, zero tillage systems rapidly become unproductive. But if there is plenty of organic matter, these systems can remain productive for decades saving farmers both expense and work. By using zero tillage instead of ploughing, soil structure and soil life can be maintained and enhanced. The use of herbicides in zero tillage systems should be avoided as it affects soil life. If a sufficient layer of mulch is provided herbicides are unnecessary.
- ***Maximum biodiversity*** is important because it helps reduce the number of diseases and insects attacking crops and will, over the years, help maintain a good balance of available nutrients.
- ***Multifunctionality***. If farm organisms used for the above practices combine different functions, for example, soil productivity management with soil and water conservation and production for home consumption and market, the system will become more resilient and farmers will accept these organisms more easily.
- ***Fertilisation through the litter layer***. If farmers apply enough organic matter and use zero tillage, they will have a litter layer in their fields similar to that found in a forest. This layer will supply nutrients to the crops. In very acidic soils that have too much aluminium and very hard layers, the litter layer is particularly important. Roots have a hard time growing in these soils and therefore it is better for the plants to get their nutrients from the litter. Crop plants, like forest trees, can form a very closely woven root mat just under the litter layer to access nutrients and humidity. If phosphate fertiliser is required, it can be applied most effectively to the litter layer. If further intensification is needed than can be obtained through ecological strategies alone, organic or small amounts of appropriate chemical fertiliser can be applied through the litter layer.

The documented experiences of shifting cultivators and other smallholder farmers in the humid tropics suggest that if their colleagues were to follow their example and adopt the nutrient access approach, their situation would be far less hopeless.

■

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After: Bunch R, 2000. **Changing our understanding of the fertility of tropical soils: Nutrient banks or nutrient access**. IIRR Resource Book (see p. 30)

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Innovation in shifting cultivation in Asia:
Indigenous Fallow Management

Dennis P. Garrity and Chun K. Lai

In Asia and other tropical regions shifting cultivation, characterised by the sequential rotation of forest vegetation and cultivated food crops, was the first form of agroforestry to be widely practised. Shifting cultivators normally use slash-and-burn methods to clear primary or secondary forest to prepare the land for food crops. They alternate fallow periods of either natural fallow vegetation or 'managed' fallow with food crop cultivation in order to suppress weeds and restore soil fertility. Staples such as maize, rice, cassava, and taro are typical of crops grown in this way in upland Asia. In the past, a relatively low population density and abundant forest cover provided optimal conditions for sustainable shifting cultivation practices in which long fallow periods of between 10 and 50 years were not uncommon.

Diversity and change

Shifting cultivation continues to be the economic mainstay of upland communities in many parts of the Asian-Pacific region. It has been estimated that 15% of the region's population, or some 450 million people, depend on the forests for their livelihood. Among these are forest-dwellers whose lives depend on a combination of shifting cultivation and hunting and gathering and those who live outside the forests but rely on them for food, domestic resources and trade goods. Today, the conditions that sustained rotations with long fallow periods have almost disappeared and it has become necessary for many communities to evolve more intensive forms of land use. Population growth and the immigration of 'colonist farmers' have led to a decline in the amount of farmland available. Forests are under increasing pressure from logging, mining, plantation companies and the activities of slash and burn immigrant farmers. The creation of protected areas and parks with their resettlement programmes have added to the pressure on land. At the same time government policies are actively encouraging sedentarised agriculture and discouraging the use of fallow and fire.

Examples of successful, top-down technical approaches to stabilising and improving the productivity of shifting cultivation systems are difficult to find. However, there are many compelling examples of shifting cultivators who are successfully managing local resources to intensify land use. It is therefore important to understand the forces behind change in the Asian uplands and how these should be handled. Among the factors that have had the deepest impact on shifting cultivation are: evolving legislation and policies on land use and rights, particularly those that affect ethnic groups practising shifting cultivation in mountainous and forest areas; trends toward decentralisation of governance and the empowerment of local organisations; the push toward market- and export-oriented commodity production; the effects of globalisation, trans-boundary trade and new information channels; population, migration and employment patterns; trade-offs, tensions and conflicts between upland and lowland watershed users.

Shifting cultivation sustainable?

The annual cycle of slash and burn that characterises land preparation in shifting cultivation systems has often been criticised for being inefficient and causing tropical deforestation. Governments generally consider shifting cultivation to be 'unsustainable' and 'primitive'. To them it is a system that should be 'sedentarised' and 'modernised.' However, most of the policies, strategies and programmes that government agencies have designed for the Asian uplands have been based on lowlander perspectives and solutions.

Detailed anthropological studies, starting with the work of Harold Conklin in the Philippines, provide us with a more positive assessment of shifting cultivation. They present evidence of a rational farming system that has evolved to meet the constraints and opportunities inherent in remote upland areas and, by stressing its long history, give us evidence of its sustainability.

Box 1. Spectrum of fallow management strategies used by shifting cultivators in Southeast Asia

- **Burning** of vegetation for easy clearing and nutrient activation. Also used to rejuvenate rangeland vegetation.
- **Slash and mulch** of fallow vegetation as an alternative to slash and burn to start a new production cycle. (for example, see p36).
- **Green manure / cover crops** for inter- and relay cropping and seasonal fallows in annual systems to improve soil productivity: viney and non-viney legumes, compositae and others (see Box 2).
- **Improved fallows:**
  - **Accelerated fallows**: natural fallow vegetation improved with (N-fixing and non-N-fixing) trees, shrubs, legumes, and others to improve soil productivity.
  - **Enriched fallows**: natural fallow vegetation improved with trees and shrubs of economic value.
- **Interplanted fallow**. N-fixing and non-N-fixing trees or shrubs for soil productivity improvement inter-planted in annual or perennial crops, for example, dispersed trees, alley's, bushes, field borders in 'cut and mulch' or 'cut and carry' regime (with Alder trees, for example, see p.20).
- **Intercropping economic trees** (timber and non-timber) with annual crops or shrubs for cash, shade or increased soil productivity, for example, taungya and other systems.
- **Analog (agro)forestry**, consciously making use of the ecological processes involved in natural forest regeneration such as natural species succession and natural rejuvenation: annual crops, economic shrubs and trees, introduced pioneer (fallow) vegetation (N-fixing and non-N-fixing) and natural fallow and forest vegetation (for example, see p.14).
- **Managed and enriched fodder fallow** to intensify livestock production: trees, shrubs, legumes and grasses. (for example, see p.26 and p.10 for further examples).

(Adapted from the **Spectrum of indigenous approaches to modify fallow vegetation in Southeast Asia**, ICRAF, IFM Programme. This spectrum provides a schematic overview of many examples of IFM strategies, names of species as well as how these strategies are being used.
Source and further information: Indigenous Fallow Management Network ICRAF-Southeast Asia

These studies argued that shifting cultivation is a land-use practice that is based on indigenous knowledge accumulated through centuries of trial and error. In maintaining the intricate balance between product harvest and ecological resilience, the shifting cultivator often succeeds in maintaining an impressive degree of agrodiversity. It is far from being a practice that involves destroying the forest.

Work by the Alternatives to Slash-and-Burn Consortium (ASB) has shown that a remarkably wide-range of smallholder land use options is agronomically sustainable. However, whether or not these options remain sustainable in the present, rapidly changing economic context or are suitable for other farmer communities has yet to be seen. It is clear that the simple dichotomy sustainable/unsustainable is too crude.

Recent studies have identified the custodial role played by shifting cultivators in preserving forest ecosystems and natural species and the close link between biological and cultural diversity. It is unlikely that these two extreme views on shifting cultivation will be reconciled in the near future. It is therefore essential to reframe the debate and move forward to identify research and development interventions that do not only stabilise forest agroecosystems threatened by degradation but that can also improve the standard of living of marginalised, shifting cultivator communities.

Indigenous pathways

A major challenge is to document and evaluate indigenous strategies for intensifying shifting cultivation through research and development. This process involves identifying promising indigenous practices and understanding them in the context in which they are used. Their utility must be validated and the possibility of employing them in other areas must be explored with the farmers concerned.

Strategies used by farmers to intensify their system of land use centre on strengthening the different functions of fallow:

The ecological function – improving the regeneration of soil productivity and the ecological control of pests and diseases, e.g. by introducing leguminous trees, shrubs, or herbaceous vegetation that improve soil productivity and enhance biodiversity. This ensures that the same or greater production benefits are secured in less time.

The economic function – improving direct economic benefits by adding value to the fallow by introducing valuable perennial species of timber, fruit, and fodder trees.

Combinations of the two – both ecological and direct economic benefits can be obtained, e.g. by introducing trees for wood fuel, improving soil productivity, and introducing legumes for green manure and fodder. Effective strategies usually combine the economic and the ecological function.

These strategies may lead to different systems:

- Annual cropping systems in which the ecological function of fallow vegetation is emphasised;
- Agrosilvipastoral systems where livestock is significant;
- Agroforestry systems which alternate annual cropping with annual and perennial fallow and economic shrubs or trees;
- (Agro-) forest systems in which the phase of clearing of forest vegetation and cultivation of annual crops is foregone altogether, as the farmer chooses to focus on producing valuable perennial vegetation, allowing it to develop into permanent (agro-)forests.

It is important to understand the many farmer-generated solutions that have successfully allowed shifting cultivation to be intensified in the face of growing pressure on land use. Unfortunately, these indigenous innovations are little documented, generally unobserved and often misinterpreted.

The IFM workshop in Bogor

Case studies of these practices were collected for discussion in a regional workshop on Indigenous Fallow Management (IFM) organised by ICRAF in Bogor, Indonesia in June 1997. Proceedings from this workshop - **Voices from the Forest** (Cairns, in preparation) - contain a large and fairly comprehensive review of many of these systems. A CD Rom version of the proceedings is expected to be available at the end of 2000.

An overview of IFM strategies was prepared for the workshop on the basis of these cases. An adapted version is presented in Box 1. Follow-up work will explore the value of this indigenous knowledge for researchers and policy makers. This will contribute to strengthening the argument for empowering local communities and enabling them to manage their own natural resources.

Building on the momentum of the workshop, a regional IFM Network was formed as a forum for collaboration and sharing experiences.

■

For more information: IFM Programme, Paul Burgers, Malcolm Cairns, Linda Carmen, ICRAF Southeast Asian Regional Research Programme, Jl. CIFOR, Situ Gede, Sidang Barang, P.O. Box 161, Bogor 16001, Indonesia. Phone: (62-251) 625415 ext. 724; Fax: (62-251) 625416; Email: p.burgers@cgnet.com .

Box 2. Green manure/cover crop systems are surprisingly common and varied

Green manure (gm) and cover crop (cc) systems are now widely used throughout the world. We listed more than 140 different documented gm/cc systems involving 41 different gm/cc species being used by farmers in 23 nations in the tropics. But farmers around the world, shifting cultivators included, use many more systems. For instance, in the very small state of Santa Catharina alone, over 125,000 Brazilian farmers use some 60 different species of gm/cc with dozens of different cash crops. Yet only 11 systems from Brazil are mentioned in our list.

Among the listed systems, more than 60% have been developed by farmers themselves. This gives us a clear impression of how appropriate these systems are for rural households and how interested farmers have become in finding, adopting, and adapting gm/cc's to improve their farming systems.

Gm/cc's are extremely multi-purpose. They are cultivated to enhance soil productivity, provide human food, animal feed, cash income and firewood and are used to help control erosion, regenerate waste lands, conserve water, combat plant disease and control pests.

The most common species used world-wide are:
Scarlet runner beans (*Phaseolus coccineus*). A legume grown by hundreds of thousands of farmers in the highlands of Latin American. They are usually intercropped with maize and the beans are harvested and eaten.
Pigeon peas (*Cajanus cajan*), common beans (*Phaseolus vulgares*), soybeans (*Glycine max*) and oats (*Avena spp.*) are more widely grown than any other gm/cc species.
Velvet beans (*Mucuna spp.*), undoubtedly the most widely grown gm/cc species introduced by development programmes. In Central America, Brazil, and West Africa, this species has been very successful. In many countries in Southeast Asia it is a traditional crop. Here the most common gm/cc's are probably from the family *Vignas*, which includes **mung beans** or **green beans** (*V. radiata*), **cowpeas** (*V. unguiculata*) and **rice beans** (*V. umbellata*). These species are all tasty, easy to grow, and drought resistant.
Jack beans (*Canavalia ensiformis*) is probably the second most widely introduced gm/cc species. They are very useful because most varieties are not such aggressive climbers as the velvet bean. Jack beans are capable of surviving and growing well in very poor conditions. Often, shifting cultivators plant it (or **Tephrosia candida**) in fields soon to be fallowed and after two years the soil is ready for rice cultivation. Furthermore, since jack beans are capable of fixing up to 240 kg/ha of Nitrogen, do not climb and can withstand heavy pruning, they can be intercropped quite easily with many different crops, such as maize, cassava, sorghum, tomatoes, and chili.

After: Bunch R, (2000). **A proven technology for intensifying shifting agriculture: green manure / cover crop experience around the world**. IIRR Resource Book (see p.30)

Further information: ILEIA Newsletter Vol.13, No.3, pp.12-13; and the web site of the Consortium for Tropical Soil Cover and Organic Resources Exchange see p.32.

Intensification of shifting cultivation

Editorial

Shifting cultivation unsustainable?

Shifting cultivation using 'slash and burn' practices is often seen as unproductive and outmoded, destroying forest resources, and causing air pollution, soil erosion and floods. It is clear, forests are being destroyed at a terrifying rate. But are swidden farmers really responsible? What about logging and mining companies, large-scale plantations and ranches (p5) and the destructive impacts of ploughing and monoculture (p.12)?

Indigenous people have practised shifting cultivation or swidden agriculture, as it is also called, for centuries. There is considerable evidence showing extensive nomadic and even more intensive settled shifting cultivation can be sustainable and enhance bio- and agrodiversity. Indigenous people have rich reservoirs of site- and culture-specific knowledge and they use it to maintain a balance between cultivation and their forest's ecosystem.

Generalisation not possible

But, shifting cultivators with site-specific and ecology-sensitive knowledge are often heavily outnumbered by colonist farmers bringing different farming traditions and values. Population growth, land competition, the creation of plantations and nature reserves, and hostile government policies make it difficult to maintain long fallow periods and shifting cultivators are forced into more settled forms of agriculture. Many are unable to intensify land use in an ecologically sound way and adopt destructive practices to produce cash crops. Others decide to leave shifting cultivation and go outside the forest in search of work (Godbole & Sarnaik p.29). It is impossible to generalise about the sustainability or the unsustainability of shifting cultivation and situation specific approaches are needed to enhance the sustainable use of forests and forest margins.

Indigenous fallow management

Considerable energy has been invested in trying to intensify shifting cultivation. But as Garrity and Lai of ICRAF (p.5) complain, there are few examples of successful top-down technical approaches to stabilise and improve the productivity of shifting cultivation systems. However, compelling examples have been documented of shifting cultivators successfully managing local resources to intensify land use. Scientists have ignored the way shifting cultivators manage fallow land. Fallows were often seen as unproductive or unused areas and there was little understanding of their importance in the regeneration and intensification of shifting cultivation. In this issue (see p8, p10, p20 and p36), convincing examples of indigenous intensification using improved fallow management are discussed. In these examples, 'slash and burn' is little used in opening up new fields.

The Indigenous Fallow Management Network (p.5), initiated by ICRAF-Southeast Asia, has documented and analysed many cases and scientists are embarking on similar studies in other parts of the world. The international Consortium for Tropical Soil Cover and Organic Resources Exchange (TropSCORE) (p.6; 32) has identified many successful cases of ecological intensification. Bunch (p.7) concludes that it is high time the scientific approach to soil fertility management in the humid tropics will be revised. Experiences with analog agroforestry (p.14) support his opinion.

Analog agroforestry

Effective approaches to forest farming are being developed in many parts of the world on the basis of indigenous fallow management and the natural processes found in forest ecosystems. (see pps.12, 14, 17, 20). These experiences with 'analog (agro)forestry' demonstrate the potential of ecological soil and vegetation management to regenerate forests and increase their productivity in a sustainable way. Participatory methodologies (p.17& 24) are needed to develop site specific ways of applying these ecological approaches particularly in drier areas.

Livestock can play an important role in shifting cultivation. Improved fallow management can also be effective in intensifying livestock production in shifting cultivation as we see from the Laos example (p.26). These approaches to intensify land use probably only work in situations where ecological regeneration and intensification are absolute necessities and where they can provide attractive alternatives in terms of labour productivity and costs (White p.29). Today, rising fossil energy prices create economic and political conditions that make such ecological alternatives more attractive.

Value adding and marketing

Adding value to and marketing timber and non-timber forest products such as wild fruits, orchids, mushrooms (p.20) and herbal medicines (p.17) are ways in which shifting cultivators can earn money, especially if sustainable production can be guaranteed (p.12). But conditions for marketing forest products are often unfavourable (p23) and considerable policy reform and support from development organisations is often necessary. Market information, communication facilities, storage, processing, credit and training in the skills of managing small and micro enterprises are particularly important here.

Political and cultural processes

However, intensification means more than ecological vegetation, soil management and improving market opportunities. Poorly defined land use rights (p.8), lack of political recognition for the rights, skills, and knowledge of indigenous people as well as a lack of self-confidence and cultural conservatism are all serious constraints. Rice (p.20) describes the self-confident and independent approach of the Ikalahan in the Philippines to sustainable land use and cultural self-expression. Also Erni (p.8) and Scheewe (p.29) report on the pride of indigenous people who have succeeded in intensifying shifting cultivation in a sustainable way using their own indigenous knowledge, values and skills. Modern education and urban migration erode indigenous cultures and knowledge. Therefore, the Ikalahan founded their own academy and started processing and marketing their forest products. They wanted to make it possible for their children to stay in their own villages and culture if they choose. Raintree (p.19) reports on the difficult process of helping culturally conservative communities to innovate and renew their culture and shifting cultivation.

But it is not only shifting cultivators who have to make a mental shift. If the sustainable use of forest land is to develop further, researchers, policy makers, colonist farmers and consumers will also have to change their approach.

Coen Reijntjes

LEISA

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Analog agroforest in Camamu, Bahia, Brazil
Photo: Bert Lof

The editors have taken every care to ensure that the contents of this Newsletter are as accurate as possible. The authors have ultimate responsibility, however, for the content of individual articles.

The editors encourage readers to photocopy and circulate Newsletter articles. Please acknowledge the ILEIA Newsletter and send us a copy of your publication.

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Dear Readers

In this issue, indigenous shifting cultivators and ecological farmers from South & Southeast Asia and Latin America challenge readers to revise their concepts on 'Farming in the Forest'. We did not receive articles from Africa but, probably, similar experiences can be found there as well. The sections 'Sources' and 'Networks' may provide some entry points for further information and discussion.

*This issue has not been produced in the same way as your usual LEISA Newsletter. The articles from Southeast Asia are the harvest of a writers workshop set up to produce a resource book on **'Best practices in shifting cultivation for sustainability and resources conservation in Asia'** that was held in the Philippines from 14–28 August this year. The workshop was a collaborative effort of the International Institute of Rural Reconstruction (IIRR), International Fund for Agricultural Development (IFAD), International Centre for Research in Agroforestry (ICRAF), International Development Research Centre (IDRC) and the Cornell International Institute for Food, Agriculture and Development (CIIFAD). Some 30 participants from China, Honduras, India, Indonesia, Laos, Philippines, Nepal, Solomon Islands, Thailand, United States and Vietnam took part. Together they shared 65 papers on many aspects of shifting cultivation and went on to discuss, improve and revise them in direct interaction with editors, desktop publishers and artists. Many of the drawings that accompany the articles in this issue of the Newsletter were originally made for the resource book which will be published by IIRR in December 2000. Details on how to order can be found on p.30.*

We are glad to be able to tell you that after a productive period of transition we are nearly back to full strength. Anita Ingevall, our new ILEIA Director started work in September. In the next issue we will introduce you to our new team!

The editorial team

Buhid shifting cultivators adapt land use

Chris Erni

Photo: Chris Erni

Over the last 30 years, the Buhid of South Central Mindoro in the Philippines have considerably adapted their shifting cultivation practices. This has led to more intensive and careful land use practices making it possible to sustain the livelihoods of a growing population on their ancestral lands.

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ILEIA is the Centre for Research and Information on Low-External-Input and Sustainable Agriculture. It seeks to exchange information on LEISA by publishing a quarterly newsletter, bibliographies, and books. ILEIADOC, the data base of ILEIA's documentation centre, is available on diskette and on ILEIA's Homepage: http://www.oneworld.org/ileia. Back issues of the ILEIA Newsletter are also available on ILEIA's website.

LEISA is about Low-External-Input and Sustainable Agriculture. It is about the technical and social options open to farmers who seek to improve productivity and income in an ecologically sound way. LEISA is about the optimal use of local resources and natural processes and, if necessary, the safe and efficient use of external inputs. It is about the empowerment of male and female farmers and the communities who seek to build their future on the bases of their own knowledge, skills, values, culture and institutions. LEISA is also about participatory methodologies to strengthen the capacity of farmers and other actors, to improve agriculture and adapt it to changing needs and conditions. LEISA seeks to combine indigenous and scientific knowledge and to influence policy formulation to create a conducive environment for its further development. LEISA is a concept, an approach and a political message.

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Photo: Bert Lof

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Regenerative analog agroforestry in Brazil

Patricia Vaz

Analog agroforestry is an approach to sustainable 'farming in the forest' which builds on the principles of indigenous fallow management and natural species succession. It is being developed by different organisations in the humid tropics, among others in Sri Lanka (p.12) and Brazil. Remarkable results were obtained by Ernst Götsch, who started with analog agro-forestry in Brazil. Starting from completely degraded soils, above average yields of cacao were obtained and biodiversity increased remarkably within 5-8 years. Patricia Vaz explains the principles and practices of this approach which is now being used by a rapidly growing group of farmers (p.17).

The role of livestock and forage management

Phengsavanh, Phimphachanhvongsod and Horne

In Laos, shifting cultivators have become increasingly reliant on livestock for their cash income. Scarcity of fodder has raised their interest in collaborative efforts to improve fallow management by introducing forages such as grasses and leguminous fodder and tree species. The autors report on the experiences of the Forages for Smallholders Project.

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Indigenous Fallow Management

Dennis P. Garrity and Chun K. Lai

Examples of successful, top-down technical approaches for stabilising and improving the productivity of shifting cultivation systems are difficult to find. However, there are many compelling examples of shifting cultivators who are successfully managing local resources to intensify land use. The Indigenous Fallow Management Network, initiated by ICRAF-SE Asia, has documented and analysed many such cases.

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Indigenous Fallow Management
IFM Network

How communities assess local innovators

Yohannes GebreMichael

As part of my doctoral research I studied indigenous soil and water conservation (SWC) practices in Northern Shoa and Southern Wello in Ethiopia. The study covered six rural communities with either high or low levels of government extension support in SWC. A total of 371 household heads (including 10% women) were asked to name at least three local farmers who were innovative in SWC and to explain why they had chosen them. In the survey, an "innovation" was defined as something new, started within the farmer's lifetime - either a completely different way of doing something or a modification of an existing technique. A farmer innovator is not necessarily a "model" farmer. He or she creates or tries new ideas without these having been recommended by extension.

Top innovation

More than 70% of those interviewed thought that, nowadays, every farmer was an innovator, in the sense of trying out something new. When a farmer innovates, the basic idea may no longer be new to the community, but it is new to that farmer, who experiments with it to adapt it to the specific conditions of his or her farm. Less than 5% of the interviewees could not identify any innovative farmers in their community.
In each community, 5-10 outstanding innovators were named. Most were mentioned by several farmers in the same locality. The interviewees said these farmers were chosen because they had:

- few gullies in their plots
- well arranged and integrated physical and biological SWC techniques
- good-quality SWC work, requiring little maintenance
- safe drainage of excess water so that it did not damage neighbouring plots
- a healthy crop stand.

More innovators were identified in the areas with low compared to high extension inputs. This was probably because the government campaigns introduced standardised SWC techniques and did not encourage adaptation to different conditions.

Characteristics of innovators

Most innovators were elderly (over 50 years). Some middle-aged innovators were ex-soldiers who had been resettled in the area. Their exposure to other parts of Ethiopia possibly gave them ideas to try out in their new surroundings. The level of formal education was not correlated with the degree of innovativeness. Family size was also not decisive. Many innovators were single or had only small families. They did their SWC in a way that did not demand a lot of labour at once. They spread it over several months or years. The farmer innovators were ranked locally as "rich" (46%), "medium" (33%) and "poor" (21%) on the bases of their livestock and land holdings. Some farmers explained that the rich can innovate more because:

- they have their own draught oxen and can release family labour for SWC work;
- they can use manure from their stock, adding to the positive effect of the SWC work;
- they are usually elders, more experienced in experimentation and better able to assess the potentials and limitations of SWC techniques;
- they have many plots with different agro-ecological conditions, demanding different innovations.

All interviewees agreed on two basic features of innovators: they work hard at farming as a full-time job, and they have an ethic of devotion to the land.
Many of the innovators' plots were located on steep slopes, at run-on sites, in depressions and near big gullies, i.e. at critical sites where physical SWC structures are indispensable. Land security had little influence on the propensity to innovate. At such sites, short-term survival would be impossible without good land care because the seed would be washed away. It was in the farmers' immediate interest to minimise erosion in the current year, no matter whether the land would be theirs in future years.

Innovators and community values

Farmers who had innovated in ways that could harm the community were not socially recognised. For example:

- In one village, the community criticised some young farmers who planted marginal hillside plots with eucalyptus trees. From past experience, the farmers feared that re-afforested land would be re-claimed by the government.
- In another area, a middle-aged farmer had increased his yields by using fertiliser and imported seed but was criticised through the *Edir* (a traditional institution) because other farmers did not want his success story to be used as a reason to force them to buy inputs at high interest rates - a current government policy.

Only about 4% of those interviewed said they did not know of any innovative farmer in their community.

Photo: Martin Moll

It can thus be seen that farmers were assessing local initiatives according to their value to the community. Research and development agents often assess innovations according to the yield increase they bring to individuals. It was obvious from this study, however, that community members have other criteria.

■

Yohannes GebreMichael
FARM-Africa, PO Box 33569, Addis Ababa, Ethiopia.

Reference

Yohannes GebreMichael. 1998. **The use, maintenance and development of SWC measures by small farming household in different agro-climatic zones of Ethiopia**. Thesis, University of Bern, Switzerland.

Photo: Fetien Abay

The challenge ahead will be to bring researchers, development agents and women innovators together to explore new ways

Women challenge cultural norms

Mamusha Lemma, Fetien Abay and Ann Waters-Bayer

Tensue Gebre-Medhin is a 30-year-old woman who farms at an altitude of some 1500 m in Central Tigray, Ethiopia. Annual rainfall is about 650 mm and falls mainly between May and August. She has 5 dependants and about 1 ha of land on which she grows sorghum, teff, maize and barley.

Ploughing with two oxen is a centuries-old tradition in Ethiopia, but has always been the domain of men. In 1981 the agricultural section of the TPLF (Tigray People's Liberation Front) trained Tensue in oxen ploughing. While her husband was still alive, she did not have the chance to apply what she had learned. After his death she had only one ox and followed the tradition of sharecropping with a man who also owned an ox. This meant she had to give half her harvest to the man. Moreover, for every two days the man ploughed his land, he ploughed only one day on hers.

A donkey-ox draught team

Tensue therefore decided to plough by herself. Her father was not happy to see her do this, because it was against the local culture. Nevertheless, he complied with her request to lend her a donkey to pair with her ox. In addition to breaking the taboo against women ploughing, Tensue thus introduced the idea of a donkey-ox draught team. This was a new system in the area, but she saw certain advantages. Oxen cost at least three times more than donkeys to buy. Donkeys are easier to manage and can live on poorer-quality feed. A donkey can be used as a pack animal to generate income by carrying goods to different markets for petty trading.

In her innovation, Tensue encountered some technical problems but found her own solutions. A donkey has no hump and is smaller than an ox. To keep the yoke in balance and to fix it securely, she put a pile of old rugs over the donkey's neck. The rugs also prevent the donkey being injured by the rubbing yoke. Another problem was that the two species do not understand the same commands. She therefore had to use different words when speaking to the donkey and the ox.

Growing acceptance

When Tensue started ploughing, many people laughed at her and some cursed her, calling her an evil wisher. Because the practice had not come from the ancestors, many villagers criticised Tensue. However, the local development agent defended and encouraged her. Confident in the value of her innovation, Tensue continued practising it, despite what others said. Last year, some women asked Tensue to train them to plough. She has even been asked to plough the land of families whose men have gone to war. The community is starting to accept her as a farmer and innovator in her own right.

Potential for poorer households

Women's innovations often indicate how local resources can be used more intensively, especially by poorer households. In addition to spreading women's innovations and encouraging others to innovate, researchers and DAs could help women improve and spread their innovations. In Tensue's case, researchers could help develop appropriate implements and equipment for donkey traction. DAs could stimulate community discussion about the pros and cons of ploughing with a pair of donkeys, a mixed donkey-ox team or a pair of oxen.

The challenge ahead will be to bring researchers, DAs and women innovators together to explore further the avenues that women are already opening up for the development of smallholder farming in marginal areas.

■

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Ann Waters-Bayer, ETC Ecoculture, PO Box 64, NL-3830 AB Leusden, Netherlands. Email: wb.waters@link-goe.de

Themes for the ILEIA Newsletter

December 2000 Vol.16-4
Ecologisation of monoculture

How can monocropping systems and monolivestock systems be made more sustainable? Can they be transformed into integrated systems? How can the quality of the production chain be improved? Articles are invited on interesting examples of: ecological intensification and diversification of mono-cropping; integrated soil fertility management; ecological pest management; product development, adding value to and marketing new products.

Deadline for contributions 15 September 2000.

March 2001 Vol.17-1
Resilience of agriculture

How do farmers prevent disaster and react to the catastrophies of drought, flood, armed conflict, disease and economic crisis? How do farmers deal with variability and risk? How can the resilience of farming and rural livelihoods be improved? What impact does labour migration have on farming systems and gender roles? How can women best adapt farming in areas of labour migration and still optimise benefits and ecological sustainability? How can gender roles be renegotiated? How can women farmers best be reached and supported? How can farming by refugees be supported?

Deadline for contributions 1 December 2000.

You are invited to contribute to these issues with articles (about 1800 words + 2 illustrations), suggest possible authors, and send us information about interesting issues, publications, training courses, meetings and websites.

EL BOLETIN DE ILEIA

It is surprising what human links can be established when the results of Participatory Technological Development (PTD) experiences are made known. Recently, for example, ***El Boletin de ILEIA*** received several letters from readers in reaction to "Finding Common Ground"
(***El Boletin de ILEIA* Vol 15-1/2**) which reported the results of the ILEIA Research programme. *Shipita* was the subject that generated the most interest. Having read about the way the value and use of s*hipita* has been rediscovered in the Central Andes of Peru readers wanted to contact the researchers who had documented and systematised the related PTD experiences. As editor of *El Boletin* I was happy I could help them get in touch with each other. We have also had letters from readers in Costa Rica, Cuba and Nicaragua who were stimulated to write about their own research experiences.
During the LEISA International Editorial Committee meeting (Bangalore, March 2000) plans were made for ***El Boletin de ILEIA,*** **LEISA India** and the **LEISA Newsletter** (from 1September 2000 LEISA International) for the coming year. It was decided that ***EL Boletin*** should have more secretarial support. This means that we can now devote more time to building up a LEISA readers' network in Latin America. So keep sending us your information, enquiries, comments, requests, opinions, complaints and, of course, congratulations!! But don't forget we need your articles, book reviews, news (for our networking page) and other contributions as well. Each issue of ***El Boletin*** is the product of a participatory
process and reader's opinions play an important role in the decisions we take. ■

Teresa Gianella, PO Box: 18-0745, Lima 18, Peru,
E mail: estrems@amauta.rcp.net.pe

Editors appologise for the fact that in two recent ILEIA Newsletters the names of the authors of the following articles were unfortunately omitted. **Vol 15.1/2:** ILEIA Collaborative Research Programme (p.4 - 8); Stakeholder Concerted Action for LEISA (p. 77-80); Stakeholder Assessment of LEISA alternatives (p. 81-83) were written by Peter Laban, Bert Lof and Coen Reijntjes. In **Vol 15.3/4**: Recent initiatives (p.42-43); CGIAR: Towards gender sensitive research (p. 46) were written by Wietse Bruinsma. In **Vol 15 1-2** photos on pages 27, 28 and 29 were provided by Kalikasan; page 72, 76 and 81 photos by AME; page 79 photo by Markus Staub.

Photo: Coen Reijntjes

Farmers present their innovations to fellow farmers and researchers at the Farmer Innovators Workshop held in Doddaballpur, India, March 2000.

LEISA INDIA

In March 2000 the Editors of the **LEISA Newsletter, LEISA India** and ***El Boletin de ILEIA*** met in Bangalore, India. AME (Agriculture Man and Ecology), the organisation responsible for the production of **LEISA India**, subsequently arranged a field trip that included participation in a farmer innovators meeting. Faced with declining yields and environmental and health problems, innovative farmers had started to develop their own ways of ecological farming inspired by traditional knowledge and the creativity of nature. Some of these farmer innovators are true philosophers and through the attention paid to them by the press, radio and television they have become role models for many others.

AME has identified many such farmers in the Southern Indian states of Tamil Nadu, Karnataka and Anadhra Pradesh and has been working with them for the last fifteen years. This latest workshop was held on the farm of a legendary farmer Narayana Reddy of Doddaballapur near Bangalore city. Twenty innovative farmers from the three states gathered to share their experiences and develop strategies that would encourage innovation. Farmer innovations presented included ecological friendly landscaping, soil conservation, water harvesting, crop rotation, pest, disease and weed management and animal husbandry.

Mr. Tangaswamy, for example, specialises in agroforestry. He grows 60 varieties of fruit trees on his 10-acre farm and plants black gram, finger millet, sebania and paddy. He experiments continuously with new species of trees, crop rotation and weed management and each season brings new discoveries.

Mr. Ganapathi gradually has reduced the use of chemicals on his farm to zero and has developed his own natural ways of fighting pests and diseases in crops, animals and fish. He has increased productivity, profitability and the quality of the food produced on his farm.

Farmers attending the workshop suggested developing a network of innovative farmers in each state. This network would stress active participation of women and young people, facilitate exchange between members and train farmers interested in ecological practices.
The farmer innovators felt there was a need to document and codify innovative practices and make them more accessible to farmers. Publishing this information in **LEISA India**, local farming magazines and

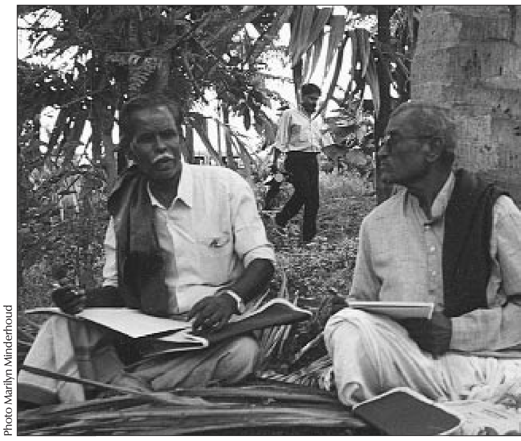


Photo Marilyn Minderhoud

Exchanging experiences during the Farmer Innovator Workshop organized by AME and held in Doddaballpur, India, March 2000.

translating them into local languages would make this possible. Farmers felt that organisations such as AME and ILEIA should pass on the LEISA perspective to educational institutes as well. ■

For a full report of the farmer innovator workshop write to:

N Hari Krishna, AME, PB No.7836,
J.P Nagar, Bangalore, 560078 India,
email: amebang@giasbg01.vsnl.net.in

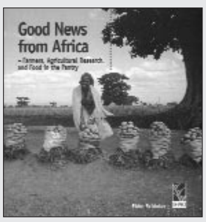
NEW IN PRINT

Participatory extension : insights from three agricultural development projects in Africa *by Schmidt P, Etienne C, Huerlimann M. 1998. 120 p. ISBN 3 908001 77 3 : SFR 25.00. Swiss Center for Agricultural Extension (LBL), CH-8315 Lindau, Switzerland.*
From an analysis of 3 agricultural development projects in Africa, this study tries to identify the main principles of effective participatory extension, as well as practical methods that can be used to implement this approach. Going beyond the field implementation, the study also addresses the wider institutional context.

Innocent farmers? *by Put M. 1998. 427 p. ISBN 90 5538 028 8 : USD 28.50. Thesis/Thela Publishers, Prinseneiland 305, 1013 LP Amsterdam, The Netherlands.*
A comparative evaluation of the "Transfer-of-Technology" and "Farmer First" extension approach as followed in the Maheswaram watershed project implemented by the Andhra Pradesh (India) government and a watershed project implemented by AWARE, a NGO in the same state.

The new middlewomen : profitable banking through on-lending groups *by Harper M. [et al.]. 1998. 124 p. ISBN 1 85339 431 9 : GBP 12.95. Intermediate Technology Publications (ITP), 103-105 Southampton Row, London WC1B 4HH, UK.*
The book describes how banks, alone or in collaboration with NGOs, can organise groups of people into 'micro-banks' that can act as independent banking intermediaries. This is a unique approach to the delivery of financial services to poor people.

Good news from Africa : farmers, agricultural research, and food in the pantry *by Schioler E. 1998. 72 p. ISBN 0 89629 700 4. International Food Policy Research Institute (IFPRI), 2033 K Street, N.W., Washington, D.C. 20006, USA.*



This booklet describes how agricultural research is achieving valuable results by propagating new varieties of grain that have led to greater yields on African farms.

Avoiding the shortcut : moving beyond the use of direct incentives. A review of experience with the use of incentives in projects for sustainable soil management *by Giger M. 1999. 61 p. ISBN 3 906151 32 8. Centre for Development and Environment (CDE), Inst. of Geography, Univ. of Berne, Hallerstrasse 12, 3012 Berne, Switzerland. (Development and Environment reports ; 17). Spanish and French editions are planned.*
A comprehensive contribution to the debate about the use of direct incentives. It reveals that most development projects still make employ direct incentives, even though they produce disappointing results. The objective of this study is to help change this situation.

Good practices in drylands management *by Oygard R, Vedeld T, Aune J. 1999. 116 p. Noragric Agricultural University of Norway, PO Box 5001, N-1432 As, Norway. World Bank, 1818 H-Street, N.W., Washington D.C. 20433, USA.*
The booklet looks at "good practices" in the management of rangelands and dryland farming, pastoral development, community-based natural resources management, and drought preparedness. It points to many possibilities for increasing the productivity of drylands while reducing ecological degradation.

Combatting desertification : conservation and development of dryland resources. *FAO 1998. CD-ROM. ISBN 92 5 004217 5 : USD 50.00. Secretariat of the Interdepartemental Working Group on Desertification, Sustainable Development Department, Food and Agriculture Organisation (FAO), Via delle Terme di Caracalla, 00100 Rome, Italy.*
This CD-ROM is the second edition of the Multimedia collection on desertification, which is to be issued regularly and updated on the occasion of future conferences organised by the parties to the Convention to Combat Desertification. It provides a complete and comprehensive collection of materials offering bibliographies, field photos, videos and an extensive selection of FAO full text publications relating to the sustainable development of human and physical resources in drylands. It can be used on both Windows 95/98/NT and Macintosh.

Trading places, trading ideas: "Dare to share fair" on participatory development approaches *by Posthumus B. 2000. 26p. "Dare to share" Fair committee, c/o ETC Ecoculture, PO Box 64, 3830 AB Leusden, The Netherlands (Postage and handling charged)*
In October 1999 a "Dare to share fair" was organised in the building of the Netherlands Ministry for Development Cooperation. Over 40 organisations, mainly from the South, participated and presented and shared their experiences. This report gives an impression of what transpired during these two days.

Forage husbandry *by Bayer W, Waters-Bayer A. 1998. 198 p. ISBN 0 333 66856 1. (The tropical agriculturalist / Coste R (ed.)). Technical Centre for Agriculture and Rural Cooperation (CTA), PO Box 380, 6700 AJ Wageningen, The Netherlands. Also available in French, ISBN 3-8236-1309-X.*

This interesting book gives an overview of different aspects of forage and livestock husbandary with particular emphasis on pastoralists and smallholder farmers. Included are basic aspects of the farming systems, basic biology of livestock and forage resources, management of natural forage, forage as auxiliary product from cultivated land, cultivated forages, and forage conservation and supplementation. The information explains the way pastoralists and smallholder farmers organise their lives, using livestock as part of their risk reducing and diversification strategies, combining livestock with crops and other - often non-farming - activities. In this sense not only technical and socio-economic aspects are taken into account, but also gender and other characteristics of the cultural dimension of livestock keeping. The last chapter gives an overview of the research and development approaches related to livestock keeping and forage production. This methodological guide includes a combination of traditional practices with outside ideas and technologies, according to the specific characteristics and needs of the farmers. The suggestions for participatory approaches combined with the clear language, practical explanation of technical aspects, and the examples from all over the world make this book a valuable asset for anyone working with livestock and resource poor farmers throughout the world.
(KH)

Research partnerships: Issues and lessons from collaborations of NGOs and agricultural research institutions. *IIRR, 1999. ISBN 0-942717-73-2. International Institute for Rural Reconstruction, Y.C. James Yen Center, Silang Cavite 4118, Philippines. Fax: +63 46 414 2420; Email: iirr@cav.pworld.net.ph*
The workshop recognized that collaboration has been limited and documentation of efforts in research partnerships has been poor. However, successful initiatives do exist, and twelve cases form Asia, Africa and Latin America formed the basis for drawing up lessons in research partnerships. Analysis focused on the collaborative dimension – the partnership process.

Environmental indicators for agriculture. *OECD 1999. Volume 1: Concepts and framework. 45p, ISBN 92-64-17134-7. Volume 2: Issues and design. 213p, ISBN 92-64-17041-3, FF 240. Organisation for Economic Co-operation and Development, OECD Publications, 2, rue André-Pascal, 75775 Paris Cede 16, France. Also available in French. Volumes 3(Methods and Results) and 4 are expected to be ready in resp. 2000 and 2001.*
The OECD is making a major effort to develop a set of policy-relevant indicators to assess the harmful and beneficial impacts of agriculture and policy measures on the environment. The first volume describes the main environmental concepts and the indicators that need to be calculated: the use of nutrients, pesticides, water; land conservation; water and soil quality; greenhouse gases; biodiversity; wildlife habitats; landscape; and environmental impacts related to farm management practices, the availability of farm financial resources, and rural socio-cultural issues. Volume two is on the results of the OECD York Workshop attended by leading experts. It discusses the identification and design of suitable indicators, the methodology to be used in their measurement and issues relating to interpretation. On the basis of practical experiences, there is also a discussion about how indicators can be used for policy purposes.

PROLINNOVA (PROmoting Local INNOVAtion)

Ann Waters-Bayer

Promoting farmer innovation was one of the main themes at the recent Global Forum on Agricultural Research (GFAR) held on 21-23 May 2000 in Dresden, Germany. Over 400 participants from farmer organisations, NGOs, national and international research centres, and private industry concluded that a participatory approach to innovation development in agroecology should be widely promoted. Over the past year, NGOs from both developing and developed countries had discussed by Email and met in Rambouillet, France, to draw up a concept paper for a programme to promote innovation by farmers and their communities. This paper was enhanced further by incorporating comments solicited from various other NGOs by Email. The revised paper served as basis for discussion in Dresden.

A learning network

The main objective is to strengthen research and development partnerships and methods to promote local innovation in ecological agriculture and natural resource management (EA/NRM). A long-term aim is to institutionalise Prolinnova approaches into national programmes of research, development and education. The programme is envisaged as covering six major components:

- Identifying and documenting local innovations and innovation processes related to both agroecological techniques at field/farm level and institutional innovation in collective management of natural resources at landscape level
- Promoting farmer-extensionist-scientist partnerships to further develop local innovations and to scale-up innovation processes
- Training potential collaborators in these participatory approaches and methods
- Promoting the incorporation of Prolinnova into the teaching and research activities of institutions of higher learning
- Jointly analysing the approaches and methods used in the above-mentioned processes and their impacts
- Promoting regional and global R&D networks and the sharing of information on EA/NRM based on local innovation in similar agroecological zones or similar types of techniques or institutions.

Most activities will be implemented through national and regional sub-programmes, defined semi-autonomously and directly funded by different donors. These sub-programmes will be linked at a higher level, using mechanisms for sharing and mutual learning, such as web-based databanks, E-conferences, workshops, exchange visits and publications. Prolinnova will be essentially a learning network.

Apart from encouraging the launching of new programmes to promote farmer innovation in the various regions, Prolinnova will also seek collaboration with relevant existing programmes, databases and publications, e.g. Honeybee, ILEIA, ISWC, PFI, PRGA, and encourage their active involvement in the network.

Links with InterDev and PolicyNet

The Prolinnova initiative has been developed along with two other initiatives:

- InterDev, aimed at developing an internet-based system for documenting and sharing local innovations, initiatives and practice-proven techniques of EA/NRM; and
- PolicyNet, aimed at addressing policy and institutional issues to support local innovation processes, by way of relevant research and information dissemination.

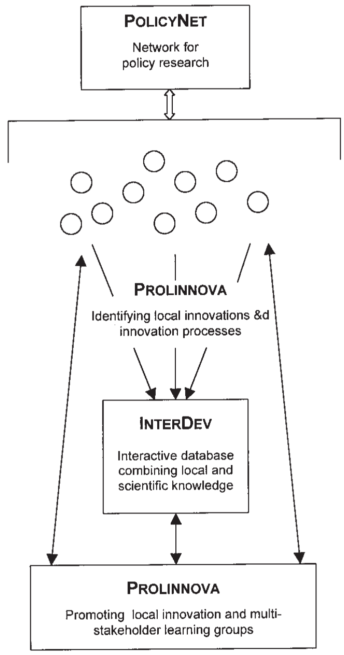


Figure 1: Mechanisms of knowledge management to promote innovation in ecological agriculture and natural resource management

InterDev will be an important platform for collecting and making available the lessons from Prolinnova, while PolicyNet will be vital for creating the political and institutional "space" to allow Prolinnova to blossom.

Initial inventory and consultation

The Rambouillet Group is currently developing an action plan to put the concepts into operation. Start-up activities include an inventory of existing programmes and databases on local innovation in EA/NRM and a consultation process with potential partners to review relevant experiences, analyse these jointly and identify gaps where supportive mechanisms can be introduced or strengthened. On this basis, partner institutions will design a more detailed Prolinnova programme.

This issue of the *ILEIA Newsletter* has already moved ahead in compiling experiences of discovering and promoting innovation by farmers. In the context of InterDev, ILEIA is setting up a website for continued documentation and discussion of relevant methods and processes. ■

All organisations interested in being actively involved in PROmoting Local INNOVation in AE/NRM are invited to contact Laurens van Veldhuizen, ETC Ecoculture, PO Box 64, NL-3830 AB Leusden, Netherlands (l.van.veldhuizen@etcnl.nl).

Advancing PTD: a study and workshop

A growing number of organisations have become engaged in agricultural research and extension that involved farmers at all stages in the process and that are designed to strengthen local capacities to experiment and innovate. Many have developed variations on the "classical" PTD approach: using novel entry points (e.g. indigenous innovators), trying to speed up the process and developing new methods. Some promising efforts have been made to institutionalise PTD within large research, extension and training organisations.

In view of the heightened interest in promoting local innovation (Prolinnova), it is high time to document, compare and analyse these experiences, and to learn from them. The proposed study during 2000/2001 will culminate in a workshop in late 2001.

The organisers – IIRR (Philippines), CIIFAD (USA), ETC (Netherlands) and tINNOVATEc (Switzerland/Germany/Netherlands) – are keen to learn of advances in PTD that help advance the development and scaling-up of PTD. We are seeking new cases from people who have learned from and improved the PTD practices pioneered in the 1980s and early 1990s. Cases should cover several years' experience, and can come from both the South and the North.

If you would like to join this learning activity, please contact ETC Ecoculture, expressing your interest and including a short abstract of the case you would like to contribute. Contact: Ellen Radstake, ETC, POB 64, NL-3830 AB Leusden, Netherlands (office@etcnl.nl).

Promoting Farmer Innovation

Will Critchley and Verity Nyagah

The objective of the "Promoting Farmer Innovation" (PFI) programme is to help formulate a radically new research methodology, while demonstrating the developmental benefits of improved land husbandry in dry areas. The programme began in 1997 in Kenya (Mwingi District), Tanzania (Dodoma Region) and Uganda (Soroti, Kumi and Katakwi Districts).

PFI has been working to establish partnerships of governmental and non-governmental agencies that will focus on farmer innovation. The programme is managed by the UNSO-UNDP Office to Combat Desertification and Drought and is linked to the Governments' National Action Programmes (NAPs), which have been developed under their commitment to the Convention to Combat Desertification (CCD) (see *LEISA Newsletter* 16.1 pp 6-7). PFI has turned out to be a classic case of learning by doing and consists of tailored training accompanied by fieldwork. A "10 steps" framework (Figure 1) was drawn up to guide field activities.

First lessons

On-the-ground identification of farmer innovators (FIs) by extension workers was surprisingly quick and easy. Forming clusters of FIs has proved a good way of organising interaction between innovators and providing a focal point for activities. There is a growing awareness, however, of the potential problem of creating exclusive clubs of "favoured" farmers. PFI is not primarily a programme to help innovators themselves; it's about stimulating innovators to share ideas with their fellow farmers.

Another lesson from the field is that many innovations are already good enough, and attractive enough, to be spread. Other farmers quickly take up these "best-bet" innovations. Thus, joint experimentation by farmers and researchers and adding value to innovations is not necessary in all cases. After all, farmers are the best judges of what is useful to them. If they find an original innovation interesting they will accept or modify it further themselves. Under PFI, certain innovations have spread rapidly (types of compost making; deep-pitting systems for planting sugar cane and cassava, etc) and have outstripped the programme's capacity to technically validate these techniques.

Documentation

A regional review workshop held in Dodoma, Tanzania, early last year in Dodoma, brought together policy makers, extensionists, researchers and innovators from all three countries. The issues debated and experiences analysed were captured in a book that has proved a remarkably useful awareness-raising tool and reference document on innovation. A professional video on the programme is serving the dual purpose of being a "virtual field visit" and raising awareness at all levels. English and French versions are currently in use; a Swahili version is being prepared.

Challenges ahead

There are immediate, and longer term, challenges for PFI:

- More attention should be given to *monitoring and evaluation* (M&E) at innovation level, and to develop such systems with farmers. M&E systems that both farmers and technical staff are comfortable with and that simultaneously yield user-friendly and functional data are not easy to design.
- The second main challenge is to bring *research agencies* more fully into the picture, to complete the farmer-extensionist-researcher triangle, and to strengthen the processes of innovation validation and joint experimentation.
- The third challenge, *impact assessment*, relies very much on the previous two. The impact of the programme must be assessed in the light of cost effectiveness.
- The fourth outstanding issue is how to *involve more women* (and youngsters) in the programme. Initially, there was a strong focus on male farmers. After a sequence of gender studies and sensitisation workshops, more innovations by women farmers were identified.
- Another set of challenges relate to investigating issues such as: ***What stimulates "innovativeness"*** the best? and ***How can we enhance this process?*** These are central to any innovator programme.

Institutionalisation

The ultimate challenge is institutionalisation, both through vertical integration into Government (and NGO) policy and by horizontal integration through partnerships on the ground. Institutionalisation is, encouragingly, well underway. For example in Kenya, PFI now has a formal alliance with FAO's Farmer Field Schools (FFS) programme, entitled "PFI-FFS". In Uganda, the FI methodology has been made explicit in the government's budget policy statement. In Tanzania, Dodoma's Regional Commissioner has given farmer innovators a key role to assist Government extension agents as resource persons. Institutionalisation, however, must be achieved in a non-threatening way: not by hard selling, but by gentle persuasion based on achievement and credibility.

Harnessing and supporting farmer innovation is no panacea, but few can dispute its place in building a better and more productive rural environment.

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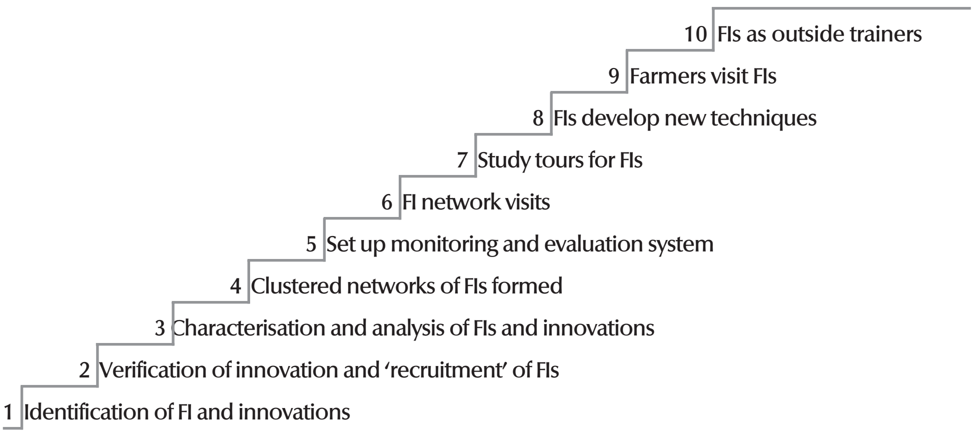
Figure 1 Ten Steps in the PFI Methodology



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- **Promoting Farmers Innovation** (video 26 min. in English Swahili and French, USA$15, inc postage) RELMA, PO Box 63403, Nairobi, Kenya; Fax: +254 2520762; Email: relma@cgiar.org ; Internet: www.relma.org

Book and video available from Lia de Groot, Resource Development Unit, CDCS-ICC, Vrije Universiteit Amsterdam, de Boelelaan 1115, 1081 HV Amsterdam

Mrs Mbirika incubates chicken eggs in cattle dung

Photo: Chris Reij

Innovation by Tunisian women in dryland farming

Noureddine Nasr, Bellachheb Chahbani and Ali Ben Ayed

At the beginning of the Indigenous Soil and Water Conservation (ISWC) project, training was given in Participatory Rural Appraisal and Participatory Technology Development (PRA/PTD) in different regions to facilitate identification of farmer innovators, men and women. One-day workshops were also held at the Ministry of Agriculture's regional department headquarters. Some 160 staff members took part. After these workshops, most of the innovators identified were men.

Identifying women innovators

In the local culture, it is difficult and often unacceptable for men to talk with village women. The ISWC team at the Arid Zones Institute consisted of men, so 15 women were recruited and trained to make a special study. These included teachers and students returning to their villages for the summer holidays. They collected data on women's role in farming and food processing and identified 31 women innovators. Most were found in Gafsa and Sidi Bouzid regions, where population density is highest and agriculture diverse and intensive.

The 31 women were all married and between 23 to 84 years old. Most were in their 30s and 40s and had little formal education. Most came from mountainous areas where, until recently, there were few opportunities – especially for girls – to go to school. Over 70% (all those over 40) were illiterate. However, with the recent spread of electricity and education in rural areas, the women have more contact with a new culture through radio, TV and their school-going children.

Spheres of women's innovation

The women innovate in activities that concern them directly. The main economic activity of all but one of the 31 women was farming, especially livestock keeping. Most also practise handicrafts. Women were innovating in animal husbandry (11 women), cropping (7), handicrafts (6), use of medicinal plants (3), efficient use of energy for charcoal making and improved stoves (2) and processing sheep and goat milk (2).

Handicrafts include making carpets and other products out of wool and weaving mats and other household items from alfa grass. Natural dyes are extracted from leaves, roots and bark. The oldest innovations – in handicrafts and medicines – are rooted in local knowledge but adapted (in design, materials, use) to the new socio-economic context.

The crop-related innovations include fig-pollination techniques and using plastic bottles for irrigation. Mrs Rgaya Zammouri in Médenine region, over 70 years old, uses 1.5 litre bottles to irrigate watermelons and melons. She buries each bottle upside-down in the soil. The cork has tiny holes in it made with a needle and the water infiltrates slowly near the roots of the plant. She fills the bottles from a cistern fed by run-off rainwater.

Hatching eggs without a chicken

Eleven women (35%) innovated in livestock keeping, specifically with sheep and goat feeding, and poultry, rabbit and bee keeping. For example, Mrs Mbirika Chokri, a 70-year-old farmer in Gafsa region, specialises in poultry and incubates chicken eggs in dry cattle dung. She puts the eggs with some straw in plastic bags to preserve humidity. Each bag has 16-20 eggs. She puts the bags in small holes dug in the manure and covers them with cardboard and a thin layer of manure. Each day she opens the bags to check the temperature of the eggs and to turn and aerate them. From day 20, the eggs start to hatch. She puts the chicks into a box to protect them from the cold and feeds them couscous, vegetables and bread. The idea came 5 years ago when one of her chickens, with eggs about to hatch, suddenly died. She put the eggs into a dung pile and they hatched after a few days. She decided to repeat this technique till she mastered it. She did not share her idea with neighbours, but accepted the ISWC team's request to present it in the "Agriculture and Innovation" programme on Gafsa regional radio and later on television. It aroused widespread interest among other farmers.

Potential for spread

Livelihood systems in central and southern Tunisia have changed radically in recent years. New production systems have replaced the traditional pastoralism and links between the countryside and urban markets are much closer. Rural women need more cash to satisfy new needs. Women innovate both to increase their income and to reduce their workload. For example, economising on water for irrigation reduces the time and energy needed to fetch water. Several women stated that their innovations came from their own idea or a chance discovery. Often, their innovations are practical and low-cost, and have good potential for spreading.
More Tunisian researchers, development agents and policymakers at regional and national level are coming to recognise women's innovation. In 1999, researchers and several women innovators began collaborating on experiments. The challenge is to improve and expand this approach in Tunisia and beyond.

■

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Photo: Ann Waters-Bayer

Upright stones in 'devil's tie': local innovation for riverside terracing.

Devil's tie bedevils water: an Irob innovation

Asfaha Zigta and Ann Waters-Bayer

Irobland lies on the steep mountainous escarpment that descends from the plateau of Eastern Tigray (2500 m) to the Danakil depression (-100 m). In Yohannes' home near Alitena, annual rainfall is 300-400 mm, from mid-June to mid-August. The area is rich in rock. Alitena is situated beside a river that flows year-round and carries soil-laden water from the plateau. In the 1960s, Yohannes started building a stone wall in one of the curves in the river parallel to the riverbank, to divert water and soil into the space behind the wall. He saw this as a way of creating and irrigating land. In this 800 m² river plot he grew fruit trees (mainly orange), vegetables (mainly cabbage) and maize.

When Yohannes first tried to claim land from the river, he made a wall like the wall of a house and used large flat stones piled on top of each other (see illustration). But when the river flooded, the water lifted the stones and washed them away. He tried again, and the same thing happened. Then he thought if the water lifts the stones, I can try to set the stones upright before the water mets them. He chose a rocky outcrop in the steep wall of the riverbank as a starting point for building an upright line of heavy flat stones, one standing against the next with larger and smaller stones alternating with each other. He wedged more upright stones in a second storey above the first line, until a small wall was built. He did this as an experiment, to see what the floodwater would do with the wall. He observed that the water roared over the top of the stones but did not dislodge them; Yohannes had outwitted the river by using the force of its own water to push one stone against the other and, in effect, tie them together through pressure. This type of riverside wall became known locally as *seytan madewa* (devil's tie), named after the complicated tie, very difficult to open, that closes the goatskin bag that contains the precious gifts intended for an Irob bride.

Yohannes' field protected by the devil's tie was close to a major long-distance footpath. Over the years, many farmers passed by and saw what he had done. If Yohannes was in the field when they stopped, they sometimes asked him to explain what he had done. The principles were immediately obvious to most farmers, who were accustomed to working with stone to manage soil and water.

In the 1970s, a church-based project deliberately built on the techniques and innovations of the Irob. Yohannes was given the responsibility of supervising community work in building footpaths, wells and check dams around Alitena. When building a large check dam he noticed that floodwater poured over the top and undercut the dam. He suggested using a devil's tie to prevent this. At the point where the water hit the soil below the dam, large flat stones were pounded in upright, slanting towards the top of the dam. The stones broke the force of the descending water and dispersed it, so that some remained in the field while the rest flowed over the next dam down the valley.

Whenever Yohannes supervised teams of community members working on check-dams, he advised them to build the devil's tie wherever appropriate. Many started using the same technology for their own smaller check dams on the terraced fields near their homes. People in nearby villages also observed this technology and use of the devil's tie not only in riverside walls but also below dams spread throughout Irobland.

The devil's tie is an example of indigenous engineering that could stimulate similar innovations in other parts of Ethiopia. In less mountainous areas, it may be difficult to find a rocky outcrop to support the downstream end of the wall of upright stones and other means, such as a cement block, may have to be used. If creative farmers trying to claim land from rivers in other areas met with Irob experts in building the devil's tie, ideas for appropriate adaptation would doubtless emerge. Development agents could help by bringing such farmers together. Also formally-educated engineers could benefit from studying the technical aspects of this ingenious innovation.

Tragically, two years of war has destroyed much of what Yohannes and his fellow farmers painstakingly built up over decades. After the land mines have been cleared, the Irob will have to summon all their creativity and strength to pick up the pieces and reconstruct.

■

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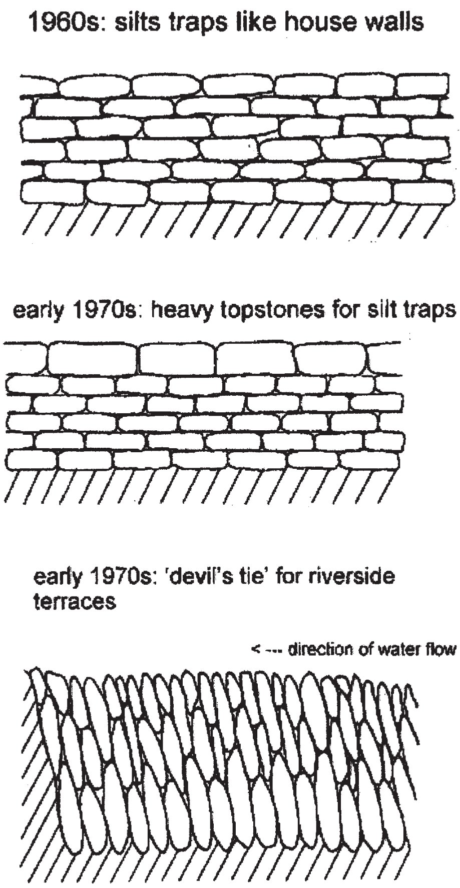


Unleashing the creativity of farmers

The editors

Farmers adapt their farming systems as conditions and needs change. They try out new ideas they have seen or heard about from other farmers, visitors or extension agents, put their own ideas into practice and sometimes work on innovations that have arisen "by accident". Innovations often arise out of necessity, others are born of curiosity. An innovation can be a practical technique or a different way of organising things, like when a farmer makes new arrangements about how land should be used with a neighbouring farmer.

With little or no support from outside – particularly if they live in areas where extension services are poor (p17) – farmers try to solve their problems by putting their trust in their own skills. For example, more than ten years ago, peasant farmers in Central America created the *Campesino a Campesino* (CaC) movement to develop a sustainable agriculture that would make optimal use of local resources by drawing on indigenous knowledge and values (p26). As many articles in this Newsletter show, farmer experimentation and innovation is deeply rooted in the daily struggles of small-scale farmers. Many innovations, especially those made by women, are hidden or isolated but there also can be close connections between them. These connections could be better used to stimulate a continuing process of innovation (p14). There can be serious constraints to farmer experimentation and innovation. Several articles stress that it is important that the community recognises local innovators. Women in particular often have difficulty in winning this recognition (p40).

Widening interest

Farmer innovation is not new, it has always been an essential part of agriculture. Drawing attention to the importance of farmer innovation is not new either. In recent years many books and articles have appeared on local innovations in such magazines as the *ILEIA Newsletter*, *Honeybee* (p5), and *Enlace* (p28). Despite this, formal research and extension has paid little attention to farmer innovation. Now, the tide seems to be turning. Some development programmes have started to go beyond participatory research on techniques originating in formal science. They are deliberately using indigenous innovation as an entry point into joint experimentation to further develop "home grown" ideas. These initiatives involve local innovators, neighbouring farmers, development agents and sometimes even research scientists. International and national research and development organisations are now considering how farmer innovation can best be supported especially for development of ecologically sound agricultural and natural resource management practices suitable for diverse and specific sites (p35).

Seeking complementarities

Ways are being sought to trigger participatory innovation processes in which the knowledge and experiences of small-scale farmers and external advisors are combined in a "learning dialogue" (Hocdé et al., p28). Research scientists have important tasks to play, by bringing in information, methods and analyses which complement what farmers already know and can do themselves. The evaluation of the CaC movement in Nicaragua (p26) revealed that more systematic learning, rigorous comparison of options, and insights from outside are needed to make farmer experimentation more effective. As argued by Braun et al., (p33), seeking complementarity in methodologies could also enhance local innovation processes, e.g. the approach of experimental learning-by-doing (a strength of Farmer Field Schools) could be combined with systematic comparison (a strength of PTD) and with wider sharing (a strength of CaC).

Enthusiasm and ownership

Supporting farmer innovation involves a variety of interlocking activities, as discussed on page 9, 25 and 28. The articles from Latin America in particular stress the importance of "farmer promoters" in facilitating innovation. Farmer promoters help farmers realise that they are capable of recognising and offering solutions, doing experiments and communicating options to others. Promoters can help farmers bring out their ideas and guide them in designing their own experiments. The goal is to promote a culture of enquiry and experimentation among farmers which helps build enthusiasm, self-confidence, pride and hope for the future (p26). Magazines, video, radio, television, fairs, workshops and farmer congresses (pages 18, 28 and 39) have proved to be effective tools for identifying, sharing and analysing local innovations and for stimulating further experimentation. As Hocdé et.al. (p28) observe, the important thing is that innovators do these things for themselves and take pride in them. In Costa Rica, innovating farmers took the initiative to found a committee of farmer experimenters and representatives from the public and NGO sector to support and plan participatory innovation development at regional level that put farmers' organisations in charge of research (p28).

Re-orientation needed

The articles included in this Newsletter make it clear that there are two major preconditions for supporting farmer innovation. First, empowering farmers to take the lead in experimentation, communication and organisation; and second changing the attitudes and roles of researchers and development workers so that they recognise farmer innovators as equal partners, with experiences and skills different to their own. Only then can they facilitate processes of participatory innovation and provide the complementary inputs needed.

Re-orientation is also needed in policy-making from the local to the international levels. The experiences of the CaC movement (p26) and in Tanzania and Ethiopia (p9, p23) show how vital it is to involve all stakeholder groups (farmer organisations, research and extension institutes, universities, development agencies, ministries, banks and the private sector) in platforms for dialogue. This should lead to change in policy relating to research, extension, education, land tenure, trade and many other factors that can stimulate or constrain farmer innovation.

The ultimate aim, as so aptly expressed by Braun & Hocdé (p33), is to stimulate social processes that unleash the creative skills of people and their organisations in order to create a permanent movement of innovation driven by the rural population. ■

Photo: Martin Moll

Indigenous agricultural revolution *by Richards P. 1985. 192p, ISBN 0-09-161321. London, Hutchinson & Co.*
The author demonstrates that many of the most successful innovations in food-crop production over the last fifty years or so have indigenous roots. There should be less emphasis on '-teaching' farmers how to farm and supplying 'improved' inputs, and more emphasis on how to foster and support local adaptation and inventiveness.

Farmer experimentation and innovation: a case study of knowledge generation processes in agroforestry systems in Rwanda *by Biggelaar C den. 1996. Community Forestry Case Study 12. Rome: FAO/FTTP.*
A study of how farmers conduct their own experiments and generate know-

ledge related to tree growing. Knowledge production by farmers was oriented to its immediate use but also to a future beyond the farmers' lifetime.

Soil recuperation in Central America: sustaining innovation after intervention *by Bunch R & Lopez G. 1995. Sustainable Agriculture Gatekeeper Series 55. London: IIED.*
This study shows that aiming to ensure the sustainability of specific technologies may be counterproductive. Much more relevant to farmers' well-being is an attempt to sustain the process of innovation. Productivity will climb only if local-level innovation continues.

Farmers developing technology: the researcher's role revised *by Lopez G and Bunch R, ILEIA Newsletter Vol.16, No.1, p.22-23.*
In Central America farmer experimenters are taking over some of the roles conventionally associated with researchers. The authors have been facilitating farmer experimentation in the hope of finding profitable ways of using micro-catchments for water harvesting. On the basis of these experiences they challenge researchers to support the farmer experimenter movement and adapt their roles.

Traditions and innovations in land husbandry: building on local knowledge in Kabale, Uganda *by Critchley W, Miiro D, Ellis-Jones J, Briggs s & Tumuhairwe J. 1999. Nairobi: RELMA.*
Describes the process and results of a 4-year participatory research programme on soil and water conservation in Uganda. The approach evolved from studying local practices to collaboration between farmers and researchers in developing and disseminating innovations.

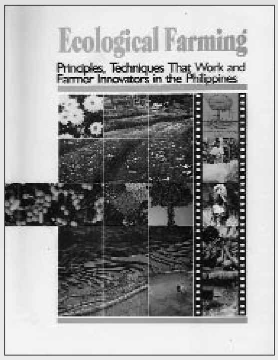
Client-driven change and institutional reform in agricultural extension: an action learning experience from Zimbabwe *by Hagman J, Chuma E, Connolly M & Murwira K. 1998. Agricultural Research and Extension Network Paper 78. London: ODI.*
Describes the ongoing institutionalisation of a participatory approach to innovation development and extension in Zimbabwe. The process requires far more than simply training staff in participatory methods. It needs also commitment from all actors, sound strategies, flexible methodologies, a conducive atmosphere for learning, and a focus on human relationships.

Participatory innovation development and diffusion: adoption and adaptation of introduced legumes in the traditional slash-and-burn peasant farming system in Yucatan, Mexico *by Guendel S. 1998. 133 p. ISBN 3 8236 1292 1. Margraf Verlag, PO Box 105, D-97990 Weikersheim, Germany. (shorter version available from GTZ Tropical Forest Research Project, TOEB@gtz.de).*
Mayan peasants in Yucatan face decreasing productivity in their slash-and-burn (*milpa*) farming system and lack alternative income sources. A system of green manuring with legumes (*mucuna, canavalia*) had been successfully introduced elsewhere in Central America and appeared suitable for the Mayan farmers, but few had adopted it. Sabine Guendel explored reasons for this lack of adoption in three case studies, in which intervening organisations took different strategies to promote the innovation. Her methodology facilitated analysis by the farmers of the functions and potential roles of cover crops within the *milpa* system. A clear picture emerges of how the historical *milpa* system changed in the last century to the current "traditional" one. The comparative analysis revealed that, when farmers were given the opportunity to experiment with an innovation and incorporate their local knowledge, they developed ways of increasing the innovation's contribution to food security and income generation. The methodology of participatory innovation development by farmers, NGOs and researchers is described in four phases: appraisal, convergence, experimentation and reflection. Farmer-to-farmer diffusion of new ideas was found to be much more difficult within communities than between them. The book gives little information about the status of the innovators in their community and their relationship with other community members, which may have helped explain the differences in their behaviour. The research gives considerable weight to local perspectives: farmers' assessments of the process and results of innovation development are often expressed in their own words. This gives the text a particular liveliness. (AWB)

The new frontier: farmers' responses to land degradation *by Amanor K. 1994. London: ZED Books/UNRISD.*
West African farmers faced with land degradation as a result of monocropping made adjustmenst by experimenting with regenerative technologies in agroforestry and managed fallow. Argues for a new structure of R&D that seeks to strengthen the independent research capacities of farming communities.

Farmer participatory extension training workshop: summary of workshop contributions and outputs *edited by Koma YS, Seng S, Solieng M, Shams N, Samram T, Brouwer H. & Bunna K, 2000. 108p. Centre d'Etude et de Développement Agricole Cambodgien (CEDAC), PO Box 1118, Phnom Penh, Cambodia. Email: Cedac@camnet.com.kh*
The first documented discussion on experiences with agricultural extension in Cambodia and the concepts and global experiences of farmer participatory extension.

Ecological farming: principles, techniques that work and farmer innovators in the Philippines *by Padilla HJ. 1999. AGTALON, Nalsian, Manaoag, Pangasinan, Philippines.*
In the introduction the author explains how farmers in the humid tropics can



collaborate with nature. The main body of the book is on farmer-proven ecological farming techniques from Luzon, Visayas and Mindanao. The practical cases on farmer innovations deal with many different topics such as nutrient, water and pest management, integrated farming, vegetable growing, forced feeding technology, herbal veterinary remedies, etc. The book is a strong testimony of the creativity of farmers. (CR)

From process to innovation: land use intensity practices among smallholder rice farmers in eastern Nigeria *by Igbokwe EM. 1999. Indigenous Knowledge and Development Monitor 7 (1): 3-7.*
Examines how smallholders select components of technical packages from extension to use in their own experimentation. Farmer innovations included yam/rice rotation and making mounds to incorporate organic matter in rice fields. Argues that the contact-farmer approach of the T&V system overlooks local innovation.

Farmer First: farmer innovation and agricultural research *edited by Chambers R, Pacey A & Thrupp LA, 1989. 218p, ISBN 1-85339-007-0. London: Intermediate Technology Publications.*
Starting with farmers' own capacity for innovation, contributors from the agricultural and social sciences, ecology, economics and geography, make the case for a farmer-first mode to complement the traditional 'transfer of technology'. One of the classical books on farmer innovation and participatory development.

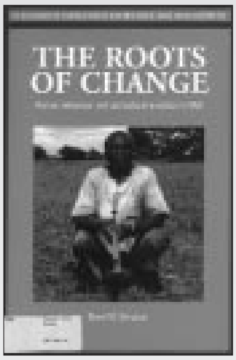
Women's role in technical innovation *by Ilkkaracan I & Appleton H. 1995. New York: UNDP/ITDG.*
A source book on women and innovation in food technology: 23 case studies address women's IK, innovation by women's, and collaboration between women and outside agencies supporting technology development.

Farmer innovators in land husbandry. *ISWC/PFI. Newsletter available from: Chris Reij, CDCS, Free University Amsterdam, De Boelelaan 1115, NL-1081 HV Amsterdam, Netherlands Email: cp.reij@dienst.vu.nl*
Joint newsletter of the action-research programmes "Indigenous Soil and Water Conservation in Africa" and "Promoting Farmer Innovators", reporting on the methods used and the experiences in the 8 countries involved. Includes also articles describing individual farmer innovators and their innovations.

Looking for innovation: post-war agricultural change in Niassa Province, Mozambique *by Levin S. 1996. Wageningen Agricultural University.*
Based on a 3-month study in a remote area of Mozambique, this highly readable thesis clearly explains methodological constraints to systematically documenting indigenous experimentation and innovation.

The neglected uplands: innovation and environmnetal change in Matalom, Philippines *by Anna Lawrence 1995. Working paper 95/11, 33p. Agricultural Extension and Rural Development Department, The University of Reading, PO Box 238, Earley Gate, Whiteknights Road, Reading RG6 6AL, UK.*
The study found that over recent decades farmers have begun to plant more trees, contour the cultivated slopes, and burn fallow less than previously. Information from nearby projects has been very important in stimulating these changes, but the relative isolation of the farming communities has also led to considerable experimentation and innovation on their own. Ecological education by the farming systems research institute has resulted in farmers more motivated to make improvements for ecological reasons rather than profit.

The roots of change: human behaviour and agricultural evolution in Mali *by Simpson BM. 1999. London: Intermediate Technology Publications.*
This study of how change occurred in farming systems in south-western Mali shows that local farmers' creativity, reinforced by social interaction, has



been the major force in the development of local production systems over the last 30 years. Explores patterns of behaviour of individual farmers and groups of farmers in generating, adapting and spreading new agricultural practices, and suggests how the creative potential of farmers and fieldworkers can be stimulated.

Joint learning for change: development of innovations in livelihood systems around protected tropical forest areas. *LISTRA. 1997. Eschborn: GTZ.*
Takes the concept of PTD beyond farm-level experimentation to the participatory development of social, organisational and technological innovations in NRM. All stakeholder groups are involved in analysing visions, problems and potentials for improving, compensating or replacing specific ways of using resources that have been restricted for conservation reasons. Options are screened in workshops, and multi-stakeholder teams experiment with new ways of ensuring a livelihood for people living around protected forests.

Issues in the utilisation of indigenous knowledge in agroforestry research *by Nielsen F. 1998. Thesis, University of Copenhagen.*
In three cases in Uganda, key issues of integrating IK into formal research are investigated. These include: farmers' knowledge generation and experimentation, farmers' networks as sources of inspiration and inputs, and the dynamic nature of IK. In farming systems involving slow-growing and space-demanding trees, farmers generated knowledge through unplanned collective experimentation.

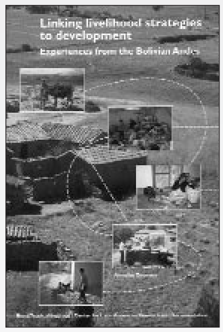
The spirit of innovation: a key to the future: experience of the Campesino to Campesino program (PcaC) in the buffer zone of the BOSAWAS Reserve *by Rivas Espinoza A & Zamora Gonzalez E. 1998. Forests, Trees and People Newsletter 35: 14-19.*
Near a large rainforest reserve, farmers learned from other farmers how to test new crop combinations, including "fertiliser beans" as cover crops. This stimulated innovation that evolved into collection of forest seeds, community forest management and income generation from forest products.

Farmers' experiments: creating local knowledge *by Sumberg J & Okali C. 1997. 178p, ISBN 1-55587-674-9. Boulder: Lynne Rienner Publishers, Inc.*
Critical analysis of Farmer Participatory Research based on a wide literature review and a search for experimenting farmers in Ghana, Kenya and Zimbabwe. The rapid field-work revealed no evidence of research-minded farmers or informal R&D systems. Farmer experimentation could not be differentiated from farming practice. It is argued that farmers need, above all, an increased supply of "raw material" (new seed, ideas and so on) with which they can experiment with their own.

Best practices on indigenous knowledge *by Guchteneire P. de, Krukkert I. & Liebenstein G. von (eds), 1999. 183 p., ISBN 90-5464-031-6. UNESCO-MOST / Nuffic-CIRAN, PO Box 29777, 2502 LT The Hague, The Netherlands. Email: ciran@nuffic.nl ; Website: www.nuffic.nl/ciran/*
This Best Practices Database, available as booklet and on internet, is on programmes working with indigenous knowledge (IK) in natural resource management in Africa, Asia and Latin America. The focus of the database is not on the details of the IK itself but in the ways it has been adapted, applied, and disseminated. The aim of the database is to encourage researchers and policymakers to incorporate IK into their project proposals, feasibility studies, implementation plans and project assessments.

Farmers' research in practice: lessons from the field *by Veldhuizen L van, Waters-Bayer A, Ramírez R, Johnson DA & Thompson J, 1997. ILEIA readings in sustainable agriculture. 285 p. ISBN 1 85339 392 4, London: Intermediate Technology Publications.*
Several cases of farmer-led research show how farmers develop and adapt innovations, try them out in different settings, assess their value for improving farm systems, and spread the new ideas and ways of experimenting to other farmers.

Linking livelihood strategies to development: experiences from the Bolivian Andes *by Zoomers A. 1999. 108 p. ISBN 90-6832-125-0. Royal Tropical Institute, KIT Press, PO Box 95001, 1090 HA Amsterdam, The Netherlands. Email: kit-press@kit.nl ; Website: www.kit.nl*
The author argues to go beyond agriculture and to start development interventions from the indigenous livelihood strategies. Farmers often carry out multiple income-earning tasks in addition



to farming, combining and recombining and renewing these tasks in a diverse and dynamic response to ever-changing conditions. An extensive analysis of information provides the background for far-reaching recommendations about how development interventions can be better linked to the livelihood strategies – the reality – of farmers.

Innovation for development *by Engel PGH & Salamon M. 1996. Amsterdam: Royal Tropical Institute.*
This is about managing agricultural innovation processes through facilitation: creating favourable conditions plus an understanding of social and institutional learning processes. Introduces "RAAKS", a participatory methodology for enhancing innovation.

Complementary platforms for farmer innovation

Ann R. Braun, Graham Thiele and María Fernández

The essential factor in strengthening farmer innovation capacity is not technology *per se* but the construction of social processes supportive of experimentation and learning (see Braun and Hocdé, *in press*; Braun et al. 2000). This means going beyond individual experiences to diverse forms of experimenter groups using different approaches. Several experiences coexist along the farmer-led/interactive research continuum, inviting a multi-tiered approach in which networks of rigorous farmer researcher "experts," less rigorous community-based research networks, and large-scale individual, informal experimentation are integrated.

Complementary approaches

In Latin America coexisting platforms include Campesino-a-Campesino (Hocdé et al, p), DIP, PRIAG (Hocdé et al, p), CIALs and Farmer Field Schools (FFS). Until recently there has been little interaction among them. However practitioners have begun to exchange and collectively analyse their experiences. This article focuses on FFS and CIALs, two platforms that have begun to operate within the same geographic areas, often facilitated by the same organisation. Farmers, researchers and extensionists are asking how they relate to each other and what are their comparative advantages. This article compares their essential characteristics and explores how these can best be articulated.

Local Agricultural Research Committees
A CIAL (*Centro International de Agricultura Tropical*) - originally developed by CIAT-Colombia - is a permanent research service operated by a rural community. Volunteer farmers apt at experimentation make up the research team. The CIAL links farmer-researchers with formal research systems. It increases local capacity to make demands on the formal system and to access useful skills, information and research products.

CIALs have four elected members and a facilitator. Facilitators are trained agronomists from supportive research centres, universities, extension services or NGOs. They can also be trained farmers who have been CIAL members. Facilitators play a key role in developing the CIAL's research competence and they feed back farmers' priorities and research results to formal research and extension services.

Building research capacity

Facilitators visit the CIAL regularly until the CIAL can manage the process alone. The facilitator helps the farmer research team conduct experiments that compare alternatives with a control treatment and with replicating experiments. Training familiarises farmer researchers with terminology that gives results credibility with formal researchers. Training also focuses on planning, management, the running of meetings, monitoring and evaluation, record-keeping and basic accounting. Working in and with CIALs means that profound changes in attitude and relationships are required on the part of farmers, rural communities and agricultural professionals.

The facilitator begins by inviting the community to a meeting where the purpose of the CIAL is discussed. Farmers are invited to analyse what it means to experiment with agricultural technology. They discuss local experiences and experimental results and the possibility of accessing new technologies from outside the community. A committee is elected if the community decides to form a CIAL.

The research fund

Research risks are absorbed by a CIAL fund owned by the community. Usually seed money is a one-off donation, but it may originate from a rotating fund managed by an association of CIALs. The committee uses the fund to acquire inputs for experiments and to compensate members for losses. When an innovation proves successful, the CIAL may add to the fund by selling the harvest or research products (eg seed). As the fund grows, the CIAL can expand its research, share earnings with participants, invest in new equipment or services, or launch a small enterprise.

The research process

An open meeting is held to determine the research topic. The first question is "What do we want to investigate?" The community prioritises topics based on the likelihood of success, who benefits, and the estimated costs.

Facilitators help the committee obtain the information required to plan experiments. Other farmers and staff of formal research and extension services are often consulted. Facilitators work with the CIALs to formulate clear objectives for each experiment. The CIAL then decides what to compare, how and when to evaluate, experimental variables, criteria for evaluating results, data needs, and measurement units.

After the experiment is completed, the CIAL draws conclusions and presents the results to the community. Analysis includes the question: "What have we learned?" Analysis of the process is especially important when an innovation is unsuccessful, or when there are unexpected results.

Three types of experiments

Facilitators guide the CIALs through three successive experiments. An "exploratory" trial when innovations are tested on small plots possibly with several treatments, such as different crop varieties, amounts and types of fertiliser, sowing dates or densities. Exploratory trials help eliminate options that are unlikely to succeed under local conditions. Promising treatments are tested on larger plots in a second experiment. Finally, two or three top-performing choices are planted over a still larger area in the third experiment, often called the production plot.

A small-scale beginning is essential. Small plots provide experience with applying new concepts, such as replication and control. They allow the CIALs to gain confidence before moving to larger and riskier scales. Facilitators gradually reduce the number of times they visit from two per months to once every three or four months as CIALs become more proficient. They visit mature CIALs for feedback on research priorities and results, and to provide information on technology under development by formal research services. Five years ago most CIALs were experimenting with crop varieties. Now small livestock, and pest, disease, soil, water and nutrient management are also being included.

Farmer Field Schools

FFS were initially designed to address problems of pesticide dependency and to develop location-specific management expertise independent of the formal research system. "Classical" FFS for integrated pest management (IPM) of rice is now used for other crops and topics.

Developing agroecosystem management expertise means building up an understanding of ecological principles and processes and the impact of farmer management decisions. FFSs provide an opportunity for learning-by-doing based on principles of non-formal education. Extension workers or trained farmers facilitate the learning process, stimulating farmers to discover key agroecological concepts and develop management skills through self-discovery activities practised in the field

FFS involve 20-25 participants from an existing farmer group or a community. This group forms the basis for collective action and follow-up activities after the school ends. FFS hold regular meetings throughout the crop cycle. Improved decision-making emerges from an iterative process of *agroecosystem analysis* (AEA), making and implementing decisions accordingly, observing outcomes, and evaluating overall impact. This is combined with experimentation aimed at understanding agroecosystem patterns, interrelationships and structure as the basis for problem-solving and decision-making. Observation, evaluation of context, and identification of interactions among different elements in the system are fundamental to FFS experimentation. FFS farmers use drawings and other visual methods to help them understand key self-regulating feedback mechanisms. The FFS approach assumes farmer innovation is constrained by a lack of agroecological knowledge and by erroneous information produced by poorly focused extension programmes and agrochemical distributors.

FFS and CIALs compared

FFS and CIALs share underlying principles. They see farmers as experts, stress respect for local values and knowledge, build capacity through hands-on experience. Both recognise and attempt to reduce the risk associated with learning and research. Outputs are seen as public goods.

Although organised differently, they have several processes in common. Facilitation styles and the role of motivation are similar. Both aim to strengthen farmer experimentation and innovation, but in different ways. CIAL experiments are relatively formal: most are controlled comparisons involving several technological options. Evaluation methods have been adapted to local levels of literacy, using symbols and simple classification and tabulation procedures. Farmers set their own evaluation criteria without influence from professional researchers.

To ensure systematic evaluation of technological options, CIALs are made up of a small group of specialised farmer-researchers, chosen for their reputation as experimenters, and trained to further develop their research skills. FFS unlike CIALs do not focus on identifying solutions from a range of technological options. They develop the communities capacity to better manage ecological relationships. FFS are not directed at a specialised group of farmer-researchers, but try to ensure a permanent learning process by targeting a relatively large and heterogeneous group.

FFS have been effective in addressing problems in agroecological systems that are well understood (eg. irrigated rice in Asia). Where understanding of system components and interrelationships is less developed (eg in the case of non-native crops which lack systemic self-regulation mechanisms), local capacity to evaluate different management options (technologies) is important, and controlled experimentation necessary. The demand for technological options implies the need for strong links with formal research. Here CIALs have a comparative advantage. In line with this demand, second generation FFS have begun to include controlled experimentation, the evaluation of technical options and have established ties with formal research.

Complementarity and synergy

FFS focus on agroecological education while CIALs concentrate on establishing a community-based research service linked to the formal research system. FFS are limited in time to one or two cropping seasons; CIALs are permanent. FFS experimentation is mainly qualitative while CIALs concentrate on experimentation through controlled quantitative comparisons. FFS build agroecological knowledge that could make CIAL research more meaningful. CIALs can generate locally adapted technological options to strengthen the FFS. Both can be established in the same area or community, although the sequence of establishment and linkages should be carefully planned (Braun et al. 2000).

Combining FFS and CIAL

In many countries the value and relevance of agricultural R&D for small farmers is being questioned. FFS and CIAL promote closer engagement with rural society, building local institutional structures and processes for agricultural development. They make R&D more relevant by putting farmers at the centre of development processes and make possible fundamental transformations in agricultural R&D systems. Financing and implementing organisations increasingly see them as viable new alternatives. Under these circumstances we believe that there is considerable potential for making wider use of both platforms and encouraging further evolution and synergy of both.

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"This is my own innovation": the history of Limpo grass

Henri Hocdé and Mauricio Chacón

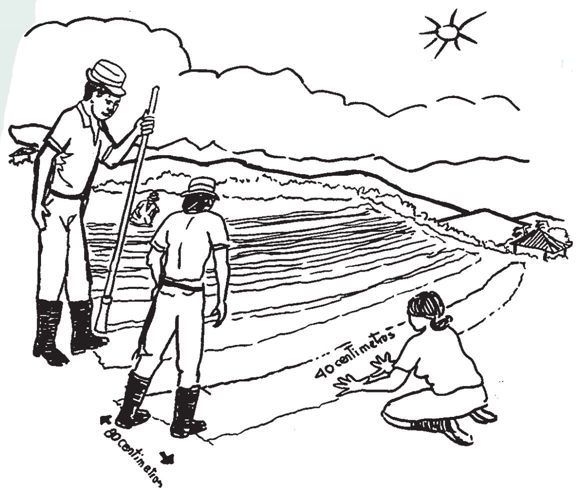
Livestock keeping is important in the Huetar Atlantica region among large- medium- and small-scale farmers and began 40 years ago with the felling of primary forest. Pasture soils are generally shallow with low fertility and farmers have suffered several setbacks in recent years. One of these was the introduction of Ratana (*Ischaemum indicum*). This "improved" variety is now the main grass in the region but it has turned out to be unproductive and low in quality. It is also coarse, resistant to humidity and difficult to eradicate from pastures.

A new grass takes root

During the 1970s, a local farmer brought a new grass from the United States and cultivated it on his farm for 3-4 years without anyone noticing. He then gave up farming and gave samples of the grass to a nearby Experimental Research Station. Here it was tested and eventually discarded in 1982. In 1981, a technical advisor from the Ministry of Agriculture (MAG) took a small sample of this grass to Pueblo Nuevo and handed it to Mr. Nardo Herrera who, having planted it on a damp part of his farm, prepared to test it in his own way. William Ratana, a neighbour who bred and fattened cattle, watched how this grass grew. He noticed that it never disappeared and that it could withstand flooding. He liked it and, in 1992, he invited a recently arrived technical advisor to his farm and asked his opinion.

Limpo grass

The extensionist had never seen anything like it. He took the sample to the university for classification. Researchers discovered that its scientific name was *Hemarthria altissima* or *Moralta vigalta,* it came from Africa and grew in humid areas. The extensionist passed on this information to William Ratana who decided to plant the Limpo grass on a hectare of flood-prone land, near a road, where Ratana had been grown and which was nearly always covered with weeds. Today, he grows 7 hectares of Limpo and is satisfied with the results. *"I watched the Limpo grass covering the ground aggressively, the cows producing more milk, calves growing fatter, the Ratana disappearing and the cultivated area increasing."*



Innovating farmers' workshop

In 1995, MAG staff organised the "*First innovating farmers' workshop on grassland of Huetar Atlantica*". Eighty farmers participated and six gave talks on their experiences as innovating farmers. William Ratana presented his Limpo Grass experience as "his own innovation". The extensionist helped him prepare his presentation. Willam showed photographs of the grass at different stages of growth, in different fields and of pastures developed under different management regimes. Above all, he spoke of the benefits of the grass as he saw them and had no difficulty in communicating his experiences to the workshop even though he had never spoken in public before.

William Ratana distributed the sack of Limpo planting material he had brought with him to the farmers attending the workshop. Neither his neighbours or the other farmers there had heard of the grass before. He is now testing five other grass varieties on his farm: *Briachiaria brizanta, B. dictyoneura, B. radgans, B. humidicola and Panicum maximum*.

Comparing and sharing experiences

In July 1999, technicians held another farmers' meeting to discuss Limpo grass. Twenty-farmers who had experimented with it attended and they told how they had used it in their own specific agroecological situation (altitude, fertility, size and type of farm). They reviewed their 4 years of experience in the context of plagues, diseases, acceptance by the cattle, deficiencies and tolerance. This information will be used to prepare a practical manual.

Fast dissemination

Local farmers are generally hesitant to introduce new grasses because of the high investment involved (about US$200/ha). Nevertheless, Limpo grass is spreading fast. It can be found in livestock farms from the San Juan River in the northern part of the country to Talamanca in the

south. It has partly replaced Ratana. It is good for producing milk and meat and although it responds well to chemical fertilisers, it can also be grown without them. It recovers quickly from flooding and prefers damp, fertile soils although it cannot withstand acidity or permanent flooding.

What did scientific research bring?

From 1987 to 1996, 250 types of grass and 204 varieties of legumes were subject to scientific screening at the Experimental Research Station. They were examined by local experts and researchers from prestigious international centres and all varieties were evaluated by technicians and researchers. The two that proved to be the most outstanding were *Brachiaria brizantha* and *Arachis pintoi*. The former cannot resist humidity and is eliminated by fungus; the latter spreads very slowly. Most of the FEs in the region knew about this collection but, according to them, all planting material of these species had been lost.

Farmers use other indicators

When evaluating the different materials, researchers in the station placed priority on biomass production and resistance to plagues and diseases. The livestock-keepers, on the other hand, take more than ten factors into consideration: resistance to humidity; yield; rusticity, hardiness; duration; resistance to diseases, plagues, rains and drought; ability to recover after cutting; aggressiveness and competition with weeds; sowing facility; propagation; acceptance by different animal species and the capacity to cover the soil.

The research station probably had promising varieties that might interest livestock-keepers. How many varieties were lost because of mistaken research and extension strategies? How much was invested in pasture research that had no positive result?

Growing benefits

Livestock-keepers in the region benefited little from the research stations work. However, through the tenacity of an experimenting livestock-keeper reenforced by the vision and creativity of an extensionist worker, Limpo grass - that had been present in the research station for nearly a decade and finally discarded - was introduced onto some 300 ha. Limpo grass can support twice as many livestock as Ratana and as a result farmers have been able to double their meat production and make a profit of about US$ 200/ha. Annual profits equivalent to US$ 60,000 are already being made throughout the region as a result of the knowledge of Limpo shared at the first FEs workshop. How many benefits to-morrow?

Supportive technical advisors

The moment when Limpo grass began to spread in this area is well defined. The starting point is precise, the names of the responsible livestock-keepers are well-known, and working mechanisms implemented by extensionists very clear. Rapid dissemination was boosted by agents who encouraged the monitoring of farmer experimentation, organised a second farmers' meeting and promoted farmer cross-visits. These extensionists fought against the guiding principles of their institution. They stopped giving talks on grasses and started to organise events at which farmers were allowed to talk and discuss their doubts, achievements, results and misgivings with extension workers.

Change in working methods

As a result of these promising experiences, the group of extension agents began changing their working methods. First of all, as professionals, they understood the need to document these types of activities. Second, as they become convinced that farmers form part of the chain that creates knowledge, they are reversing the conventional research organisation system. Gradually, they started to encourage farmers in the region to use their ability to observe, experiment and share, and to form groups of FEs. Third, they have started to gain more confidence in the value and usefulness of exchanging knowledge between livestock-keepers, technical advisors, public and private researchers and academic centres, in order to promote local innovation.

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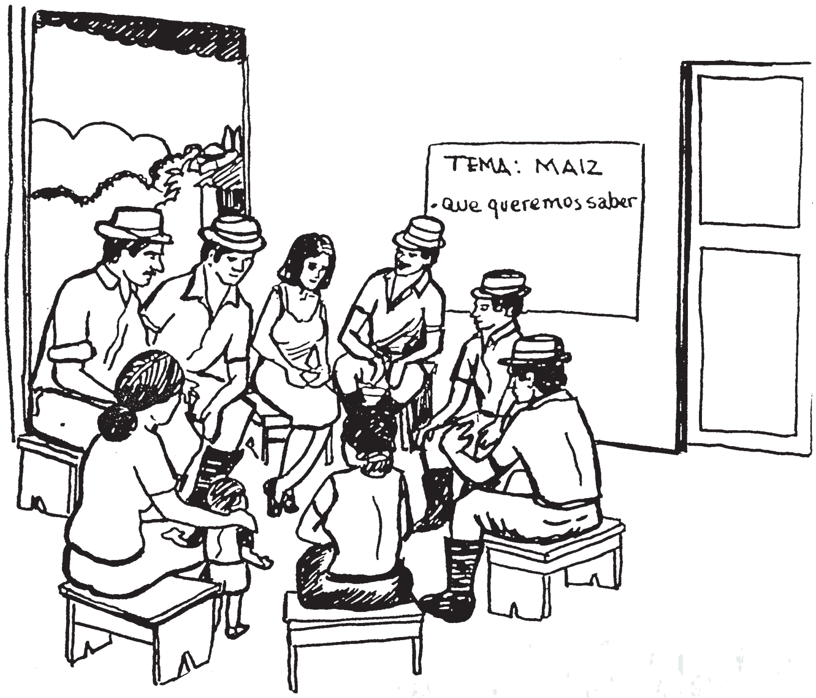

Farmer experimentation: a challenge to all!

Henri Hocdé, David Meneses, and Byron Miranda

PRIAG or the Regional Program for Reinforcing Agronomic Research on Basic Grains in Central America was an European Union-funded regional collaborative project between EU and the six countries of Central America (1991-1999). Its mandate was to improve the efficiency of the national research and extension systems and make them more responsive to farmers' needs.
It built on an approach known as 'farmer experimenter' (FE) in order to strengthen farmers' capacity to investigate and innovate at the local level, and to enhance their capacity to dialogue with researchers and extension agents. In this way they could create their own specific space and role in the research-extension-farmer chain. By strengthening farmers' capacity to produce, identify, obtain, modify, adapt, share and use information, agricultural technologies can be developed and spread.

PRIAG had teams (researchers and extension workers) in Panama, Guatemala, El Salvador, Nicaragua, Honduras and Costa Rica. Annual work plans were negotiated between farmer experimenters (FEs), formal researchers and extension agents and PRIAG also helped farmers organise, communicate and facilitate their experimentation. For PRIAG, farmer experimentation is a combination between experimentation, communication and organisation.

The first condition to secure this goal is to establish a climate of confidence between FEs and professionals and make it possible for farmers to speak for themselves. PRIAG devoted considerable attention to ensuring there was effective communication among FEs. This articles demonstrates this development in a Central American perspective and goes on to discuss the scaling-up of the process.

Farmers' testimonies

For several years, the Ministry of Agriculture (MAG), Costa Rica assisted by PRIAG has promoted a "Farmer Experimenter" project in two regions, Brunca and Huetar. In 1998, it decided to publish on this process both to reveal farmers' innovating skills and to show how the extension agents involved were willing to change their working methods and to see farmers as producers of technological innovation and agents of dissemination.

With this in mind, it was proposed to draw up a document that would contain the technical and economic results of farmers' experimentation and their views on their role as FEs. The important thing was to give them a chance to speak for themselves.

Field agents in the lead

The task was not entrusted to researchers from universities or foreign research centres. Despite their limited writing skills, grassroots extension agents working directly with the FEs were given the task.

In both regions, local MAG staff set up preparatory 2-day workshop attended by 20 field agents from the region and some interested researchers. Participants began by discussing the implications of the task before them, discussed how they could best help the farmers in their area to write up their own testimonies as FEs, and explored how this should be organised. They all agreed that the final text should be short -between 4 and 6 pages- illustrated, and pleasant to read. Each testimony should have the same structure, but individual style and creativity would be encouraged. The PRIAG facilitator proposed a structure for the testimonies. Field agents set guidelines for interviews and the order of the final text. These focused on four aspects:
My life. Who are we, my family and I? Where did we come from? Why and how did I become involved in experimentation?
My experiments. What am I proving? How did I design my experiments? What do I observe and measure?
The benefits of experimentation. What did my family, association and community gain from being a FE?
Dissemination of results. What would I recommend to other FEs from my area, my country and Central America?

Not an easy task

Each agent chose one or two farmer experimenters from their own area. They were free to choose their own way of obtaining information from the farmers in order to document experience. Some made long interviews, others made three or four visits and tape recorders were also used. Some presented the guidelines, explained the reason for the work and left the tape recorder with the farmer until the recording was ready for transcription. They used their own creativity to decide on the most appropriate method. The work aroused considerable interest among most FEs. The confidence established over the years between the farmers and the field agents was a crucial factor for success.

The field agents were enthusiastic about the task, but faced many difficulties. They realised that it was not enough simply to gather information during an initial interview. They had to complete and enhance farmers' statements, refresh farmers' memories, ask relevant questions, find the best illustrations, identify the titles that would most appeal to readers and highlight the main ideas. Most of the field agents confessed that this was far from an easy task.

Farmers found it fascinating to talk about their origins and were very voluble in this respect. Obviously, it was difficult for them to analyse their own experiments and the future of these initiatives. The field agents were amazed to learn what farmers thought about them and to see it written forthrightly in black and white. *"Previously we had no interest in technical advisors, we thought they were lazy and that their experiments were a waste of time ... now we understand the meaning of the experiments and have no desire to see our advisors go away."*

My life

FEs describe themselves as humble men and women working in adverse situations, risking their fragile economies, but eager to move forward to create a new and better future. Some regard themselves simply as curious, experimenting observers who talk about their observations and in this way get ideas for future experiments. Others see themselves as being disseminators or as being more interested in organising farmer experiments.

The bulk of these testimonies show clearly that the farmers live a very hard life. They relate how farming was introduced on this young frontier less than 50 years ago. They tell of migration, the number of farms they farmers went through before they established themselves on their present holding, the impressive size of their families (as many as 19 siblings) and the desolate state of the roads. In just a few pages readers get a clear picture of the true circumstances in which farmers live and work and can be brought close to the way farmers feel. Technical documents, reports and socioeconomic studies are unable to provide this sense of immediacy.

Through these testimonies, one realises that farmer experimentation is deeply rooted in the daily struggles of small-scale farmers. They reflect the reality of all FEs in Central America, and confirm the latest document published by the *Campesino a Campesino* Programme in Nicaragua (UNAG, 1999).

My experiments

It is evident that, in the eyes of the FEs, farmers' experiments go beyond setting up trial plots and studying and interpreting concrete results. The FEs stress the process as a whole and the impact it generates: creating an atmosphere of confidence between each other, generating a community movement, even though they still do not know where it will lead. *"FEs have become personalities"*, said one. They have acquired tremendous self-esteem and fuller awareness. They insist on the fact that they can now teach their neighbours and their children. They feel useful and the meetings, workshops and exchanges have broken their isolation.

Finally equal

The climate of confidence also had a positive effect on MAG field staff, researchers and others involved. Farmers who had previously tried to avoid them because they felt they were wasting their time now extended their friendship and sought their help. Relationship were now 100% better.

The oddest thing was the difficulties encountered in launching the task of getting testimonies. The approach provoked amazement. The testimonies were a sharp rebuke for those who felt there was no need to interview farmers because field agents had been working in this area for the past 10-15 years. They proved the farmers' force, conviction, faith and high sense of commitment to building a better world. They also showed the limits and bias in the knowledge of many MAG staff.

PRIAG financed the publication of some of these testimonies and delivered them to the farmers personally. The farmers use these documents as instruments to encourage others to accept the challenge to innovate. They had to try and find solutions to their problems themselves because they could not expect the solutions they needed to come from outside. They were proud to see their names and photographs in a book and to feel that, at long last, they were on an equal footing with the researchers who visited their farms.

Communicating innovation

Exchanges between FEs, local, regional and national meetings, fairs, congresses for FEs, written or visual testimonies (photos, TV, videos), regularly published magazines, local radio programmes, calendars, almanacs, T-shirts, caps and specific training workshops reflect the unlimited types of actions being invented and implemented in Central America to disseminate information on farmer innovation. There are many interesting examples.

Radio broadcasting

Panamanian FEs got involved in a radio programme in which they transmitted the results of their experiments themselves. In addition to their role as FEs, some of them have taken on the responsibility – together with MAG agents - of becoming radio correspondents. Equipped with a portable tape-recorder provided by PRIAG, they record their stories and send them to the main town in the region for the Sunday radio programme.

Filming own experiments

Farmers became involved in producing a video of their experiences. The idea originated in the Baja Verapaz region of Guatemala, where a group of 60 FEs attending a training workshop had just watched a technical film. When it came to analysing the film, several of them diplomatically stressed the importance of what they had just seen, but expressed concern about always having to watch the experiences of others. They suggested talking about their own experiences as FEs. They were then invited to answer the following question: "What images of your own activities as FEs would you like to see on the screen? Explain your reasons and argue your point." This was a long task that required several sessions, but a script was produced, the desired pictures were decided upon and filming dates were set. This resulted in the videos mentioned below.

Publications

In Nicaragua, many valuable experiences regarding the work of FEs are worth recording and making available to others. The monthly magazine Enlace, published by SIMAS (Central American Information Service on Sustainable Agriculture), has been reporting the history of one or several innovations in each of its issues since 1990. SIMAS also made up a "methodological basket" and distributed the publication to a large number of organisations and peasant outreach workers in the country. Its objective was to offer as many of the methodologies used by various Central American outreach workers as possible in the interests of promoting farmer experimentation.

Exchange fair

In 1997, the *Campesino a Campesino* Programme of UNAG in Nicaragua organised an "experience-exchange market" involving farmers and indigenous peoples in agricultural frontier areas. This was a meeting point for 140 innovating farmers from Central America. For two days, the participants displayed their work, using panels of photographs they had taken themselves. Each participant offered and asked for information as if they were actually in the main marketplace.

Television

Groups of FEs supported by the NGO Unicam in northern Nicaragua are also great believers in photographs seeing them as a practical and inexpensive way of showing their work to neighbours. As they become more involved in communicating their innovating activities, many farmers lose their fear of speaking in public and, every so often, they surprise others by appearing on television in Esteli, the region's capital city. *"Are these farmers really capable of standing in front of 150 people and talking about their experiences, using numbers, drawings and everything?"*

Farmers' diary

For the past few years, the National Extension Bureau of the MAG in Costa Rica has been publishing and distributing a type of log-book to farmers. Known as "My farm book", it enables farmers to keep daily records of their activities and to calculate their costs at the end of each month. Inserts with stories of innovative projects undertaken by farmers in different regions are interspersed throughout the book.

Ownership essential

Documenting and distributing information is one thing, but the use made of these documents is something else. A well-worn photograph much used by the innovating farmer is worth much more than a video of impressive quality that is confined to an air-conditioned room, a thesis containing congratulations from the awarding committee or a published article shelved by readers. The important thing is for innovators to do things for themselves and to be able to boast about their actions: *"I took these photos, I showed the video of our experience, I distributed primers, I handed out our testimonies…."* and so on. Ownership is an essential part the sharing, experimentation and communication that characterised all farmer innovation activities.

Broadening the process

In 1994, the Huetar Norte Regional Office of the Ministry of Agriculture and Livestock (MAG), assisted by PRIAG, introduced its technical advisors to a new working method with the aim of improving services and establishing closer relationship between advisors and farmers. A team of farmers and advisors set out to identify FEs, explore their innovating skills and to find out about their experiments. The team then went on to evaluate the impact of these innovations and experiments on production costs, pesticide use and environmental and soil degradation. Workshops were held for FEs and technical advisors. Experiments, results and experiences were discussed and plans made for further experimentation.

To broaden the scope of farmer experimentation, the working models were put into practice throughout the region Huetar Norte. The First Regional Congress for Innovating Farmers in the Huetar Norte Region was organised in August 1999. At the end of the event, the eighty participant FEs elected a regional, legal and permanent committee with the clear mandate to reinforce the research capacity of farmer organisations. It calls itself the Regional Committee of FEs of the Northern Zone (-CRAEZN). The Committee comprises five representatives of farmer organisations and two agronomists (one representative from the public sector (MAG), and one from the NGOs). An advisor from CIRAD supports the group.

A clearly defined mandate

The following mandate was given to CRAEZN:

- promote the creation of a Technical Experimentation Committee (comprised of FEs) in grassroots organisations
- negotiate and obtain economic and other resources in order to encourage and support the experiments conducted by farmer organisations, and create sustainable self-financing mechanisms to improve farmers' experiments
- draw up a regional farmer experimentation programme
- design projects that combine farmer experimentation with agro-industries and other economic activities
- provide training on farmer experimentation to farmers and agronomists
- organise the negotiation, collection, processing, management and dissemination of information on farmer experimentation
- promote the exchange of experiences between producer organisations through, e.g., discussion fora, field trips and local, regional and national congresses
- identify all farmers who are conducting experiments.

A significant step forward

Although this new initiative can be considered a continuation of other activities carried out in Costa Rica in the last decade, it is a significant step forward in qualitative terms. First of all, it was designed by the farmers themselves, representatives of producers' organisations and experts from the public and NGO sectors of the Huetar region. Second, in order to put farmers in charge of research and technology development, it focuses on farmer research methods and research financing controlled by producers' organisations rather than agricultural support services. Consequently, it is supposed to get more capacity to solve problems and influence public policies.

A challenge for all!

This new situation poses a challenge for researchers and technical advisors because it demands a radical change in their working methods. It means they will have to be more creative, communicative, tolerant, patient and capable of listening and sharing information and knowledge and apply these same values in drawing up and designing projects and realising their joint ideas and dreams. Field agents and researchers have to become facilitators committed to the educational process, combining the knowledge and experience of farmers and field agents in a ***learning dialogue***. This involves moving from a linear pattern of communication to a relationship of mutual cooperation where the contributions of each actor in the knowledge system are clearly acknowledged. ■

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- PRIAG. 1997. **Sow less, harvest more!!! A history of farmer experimenters in Arco Seco**. Panama. 44 min.
- PRIAG. 1997. **Hillsides, producer associations and experimentation: a history of farmer experimenters in Brunca.** Costa-Rica. Part I: 24 min.; Part II: 34 min.
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Towards a social movement of farmer innovation: *Campesino a Campesino*

Henri Hocdé, Jorge I. Vasquez, Eric Holt, Ann R. Braun

The "*Campesino a Campesino*" (CaC) or Farmer-to-Farmer programme was founded in Nicaragua in 1987 by the National Farmers and Cattle Ranchers Union (UNAG). It started with exchange visits between farmers from Nicaragua and Mexico in order to promote and diffuse appropriate technologies among poor farmers. The programme was a reaction to the top-down transfer-of-technology model that prevailed in Nicaragua during the 1980s promoting expensive technology packages involving improved varieties, irrigation, imported chemical fertilisers, pesticides and agricultural machinery. The programme sought to improve soil fertility, productivity and living standards, while reducing production costs and external dependency. The method has taken root throughout Central America and is applied by many NGOs and in some R&D projects. Over 10,000 farmers identify in one way or another with CaC and thousands more have been influenced by it (Holt-Giménez 2000), as they believe that farmers are capable of developing their own sustainable agriculture.

Farmer promoters

The key elements in the CaC approach are the "farmer promoters" and the mechanisms of communication used (Hocdé *in press)*. Farmer promoters are volunteers who conduct experiments in their own fields and share their knowledge and experience with others. Each takes responsibility for guiding a group of experimenting farmers from his/her community and visiting them regularly to help with planning, implementing and interpreting their experiments. They also organise exchanges between farmers and give training on topics determined by their own accumulated experience and concrete results that range from soil conservation, cover crops, husbandry, forestry and organic agriculture to cropping systems and diversification. Farmers themselves define the research agenda, manage the experiments and assess the results, either individually or in groups. Generally, they do not apply formal scientific methods such as the use of control plots or replications. Today, there are 700 farmer promoters working throughout Nicaragua in a wide range of agro-ecological and socioeconomic contexts.

Experimentation and communication

The farmer promoters' basic functions are to find technical solutions to problems in smallholder agriculture and to communicate them to neighbouring farmers who are also seeking solutions. In order to have credibility as communicators, promoters need to have tested recommendations on their own land. The two functions and processes -experimentation and communication- are therefore interdependent. Promoters do not recommend technical recipes or packages, but rather give suggestions and ideas to stimulate experimentation by others. A promoter's main tool for convincing others is through mentoring and setting an example rather than through the organisation of workshops or training events *per se*. The goal of CaC is to promote a culture of enquiry and experimentation among smallholder farmers.

Enhancing sharing and dissemination

Sharing and disseminating knowledge horizontally is a central responsibility of each promoter. Each communicates intensively with other farmers as well as with other promoters using traditional communication media such as sociodrama, theatre, poetry and music. A diversity of mechanisms such as fora and exchange visits are used and a wide variety of Participatory Rural Appraisal tools are used.

Exchanges are visits organised by promoters involving farmers, promoters and communities. They may involve small or large groups and may last between one and several days. In this way, farmer experiments are exposed to the critical eye of a variety of people, each with his or her own perspective. These are intensive training and learning opportunities and their pedagogical content can be considerable. During exchanges, participants explain and discuss results, methods and procedures, often amid criticism, argument and debate. Each participant analyses the strengths and weaknesses of his or her ideas and results before the group. The atmosphere of mutual reinforcement and encouragement permeates these events and helps motivate farmers to continue experimenting. Learning from mistakes is encouraged, as is the idea that each person follows his/her own problem-solving path. The art of facilitating these situations consists not only of creating a constructive and productive atmosphere, but in helping to bring out these ideas and synthesise them in such a way that the design of new experiments is oriented and guided . This requires that promoters be highly skilled in facilitation techniques.

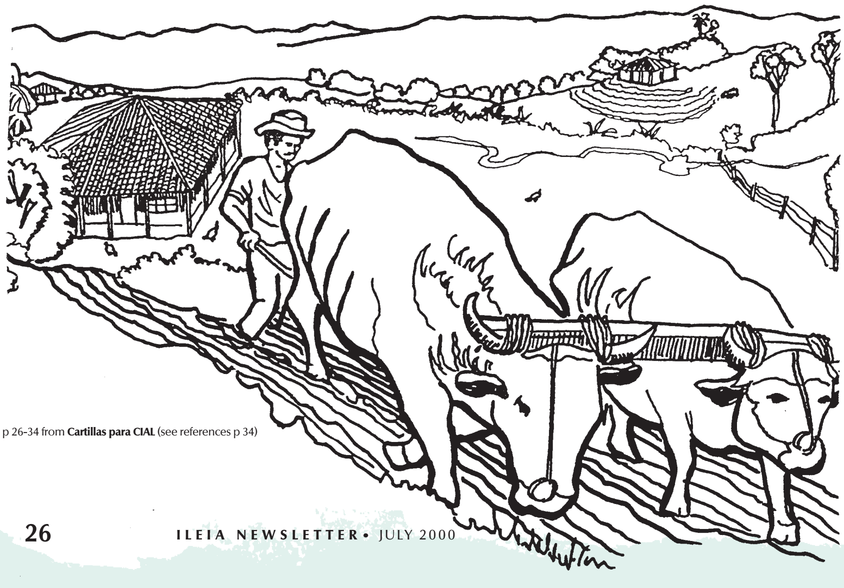
Radical changes

The CaC process can result in a radical change in the mental map farmers' have of their role in the process of technology generation and diffusion. Through involvement in the programme, farmers realise that they are capable of experimenting, offering solutions, communicating and transmitting technological options to others (Merlet 1995).

The CaC process builds enthusiasm, self-confidence, pride and hope for the future (*Programa de Campesino a Campesino* 1999). Motivation grows as creative capacities are tapped, and the attitude of dependency on external actors diminishes as farmers begin to identify themselves as experimenters. The most radical of the farmers involved in the programme view it as a way of breaking the monopoly of technology-development process held by agricultural professionals.

Technological lessons

The following lessons were derived. Farmers' research themes tend to concentrate on agronomic, animal husbandry and technical issues, not on socioeconomic aspects. In some cases, the advent of a



Drawings p 26-34 from **Cartillas para CIAL** (see references p 34)

We still have much to learn!

While more than 10,000 farmers and dozens of NGOs are part of the *Campesino a Campesino Movement*, hundreds of thousands more are not. The question is if CaC works so well, why hasn't it spread more? A recent, region-wide, participatory study (Holt, 1999), involving 40 institutions and 2,000 agroecological and conventional farmers, concluded that the obstacles for scaling up agroecology or 'sustainable agriculture' have less to do with technologies and methodologies than with national policy contexts and institutional behavior. But to further "scale out" sustainable agriculture, it also needs to be "scaled up" into existing agricultural policy frameworks. Some important constraints for up-scaling are:

- There has been little documentation and *systematization* done in a way that actually provides feedback to practicing technical advisors, promoters and farmers. This limits institutional learning, resulting in many projects "re-inventing the wheel". Furthermore, lateral learning by government and private sector institutions is generally poor and inconsistent, resulting in little headway for CaC outside of the informal social networks connecting remote villages and the NGO world.
- Not only is most formal agricultural research largely out of touch with sustainable agriculture and the farmers who actually practice it, comparatively few professionals are being trained in agroecology or in working with small farmers. This limits their ability to address agroecological problems, design effective on-farm agroecological experiments and accompany farmer innovation.
- Many NGOs adopted CaC participatory methodologies. However, this has not always led to greater farmer input or control over the program itself neither has farmer-led development necessarily become a guiding approach for NGOs. NGOs are still primarily accountable to donors, and few of them have direct mechanisms for accountability to farmers. The combination of "participation" and one-way accountability prevents clear strategies for farmer organization and empowerment.
- Despite its important program presence in one of the largest farmer's union in Central America, CaC has not been very successful in scaling-up its agenda within national and regional farmer organizations. Basically, promoters from CaC have been unable to penetrate decision-making circles dominated by medium and large-scale producers interested primarily in conventional agriculture. CaC remains a "special project" directed at smallholder clients, not a policy-setter or decision-locus for organizational policy.
- There are many policy mechanisms that could be brought in to improve conditions for sustainable agriculture and farmer-led development. However, the lack of effective political will on the part of governments and research centers makes this a remote possibility. Developing this political will depends largely on pressure from civil society. Unfortunately, the trans-institutional nature of CaC has not lent itself to forms of organization that could exert pressure on governments or research centers. NGOs are organized to implement projects not pressure governments. Farmer organizations can and do put pressure on governments, but not for policies that favour sustainable agriculture over, or even as much as, conventional agriculture.

Perhaps the most pressing lesson is simply that agriculture in general will change not only when farmers change, but when farmers and their allies are capable of changing the institutions that hold change back. We still have much to learn about just how to do that.

Adapted from: Holt-Giménez E. **Scaling-up sustainable agriculture: lessons from the Campesino a Campesino Movement in Meso-America.** Paper for workshop on "Going to scale" 10-14 April 2000, IIRR, Silang, Cavite, The Philippines.
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solution generated by promoters leads to excessive promotion of the technology over an ongoing search for solutions to other limiting factors. The strong emphasis on low-external-input techniques can be a barrier that dissuades some farmers from participating in the CaC movement, thus impeding its growth. More systematic agroecological learning and information on experiences from outside the farmer community, e.g. innovations developed by farmers operating in similar conditions or from scientific research, could provide new options for experimentation.

Methodological lessons

Farmers' concepts of the experimental process are different from those of formal researchers. For example, farmers may not limit what they regard as experimentation to plots specifically designated for that purpose.
The relationship between CaC initiatives and the formal research sector have traditionally been limited, with a few notable exceptions. Opponents of CaC approach contend that most formal researchers consider the experiments conducted by farmer promoters as an extension mechanism rather than as bonafide research. Advocates of the CaC approach complain that promoters have found few useful elements in the technical solutions offered by formal research. Overcoming the mutual reservations between promoters and researchers would undoubtedly constitute a leap forward, thereby improving and enriching the work conducted by both. Potential gains from the joint development of realistic solutions to concrete problems in farming lie not only in the better design and management of experiments, but also in the increased diversity of options that would become available.

Historical significance

Beside the technical and methodological limitations, Eric Holt-Giménez also mentions important policy and institutional constraints (Box). Despite all these limitations, the CaC experience constitutes an important reference point for both the farmers themselves and the formal agricultural services, in terms of demonstrating the potential of smallholder farmers as researchers and communicators. This approach is of historical significance, because it made a significant break with the conventional models of knowledge and technology transfer, rejecting passive knowledge banking in favour of active knowledge acquisition and generation.

Towards a social movement

A number of initiatives in or outside of Nicaragua are supposedly applying this approach. Innovation processes are social and collective actions. They are stimulated when a group of people share the same sense of purpose, learn to manage hazards and uncertainties, apply resources to develop their creative skills and socialise their results. The experience in Central America clearly shows that the old myth about creativity and innovation being a special gift reserved for geniuses has been overcome. The results reveal that we (all of us, not only farmers) are capable of being creative. The key factor is to support social processes that unleash the inventive skills of people and their organisations in order to create a permanent movement of innovation driven by the rural population.

■

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Bringing Farmer Innovation to policy levels

Lobbying for policy support to local innovation

Photo: Will Critchley

Mitiku Haile

In 1996, the "Sasakawa Global 2000" campaign was launched in Tigray. This offered farmers a package of external inputs on credit and has focused on the better-watered areas. More and more farmers are being drawn into this scheme. Some farmers observed yield increases, especially in the initial years when rainfall was favourable.

Many farmers, however, are withdrawing from the scheme. They found that inputs were too expensive given uncertain rainfall and yields, and the lack of transport and marketing facilities. Some farmers question the suitability of chemical fertilisers for their conditions and want to use manure and other organic resources to enhance soil fertility. In pest management, many farmers find that Global 2000 methods ignore their indigenous techniques. The development agents (DAs) working directly with these farmers and Mekelle University, which offers development-oriented training began to recognise that farmers want extension to consider their own knowledge and creativity in land husbandry. It was evident that the approach to extension needed to be re-considered.

Research disregards potential partners

Agricultural researchers in Ethiopia usually set their own agenda on the basis of their own assumptions. With the recent decentralisation of research, the scientists were supposed to focus on alleviating the constraints to agriculture in their particular region and to solve local problems. However, no consideration was given to the fact that farmers might want to take part in the search for local solutions. Farmers have, of course, been experimenting on ways to manage soil, water, plants and animals for centuries, long before formal research began. They have developed an intimate knowledge of their environment and found new and better ways to manage local resources. Any research on agricultural intensification needs to consider this local knowledge and innovation.

Biased agricultural training

Agricultural education in Ethiopia, with few exceptions, has paid little attention to local knowledge. Course content and structure have been based on western concepts and large-scale commercial systems of production. The Ethiopian agrarian system is, however, highly fragmented and dominated by smallholders who are orientated mainly to subsistence. Education and training need to be transformed to reflect this reality and raise admiration for the farmers' abilities to produce under adverse conditions.

ISWC-Ethiopia recognised the need for policy change so that local knowledge and innovation would become the basis for formulating agricultural extension, research and training programmes. Therefore, besides identifying farmer innovation, extending promising local innovations and promoting participatory research to validate and develop them further, ISWC-Ethiopia tried to influence relevant policies.

Several targets

Different activities in lobbying for policy change were targeted at various levels of decision-making in several institutions:

- ***Baito*** (local council) The *baito* is the lowest level of government and together with the community it determines land use and management. ISWC-Ethiopia works closely with the Tigray BoA in organising village-level workshops, in which *baito* members become aware of the importance of farmer innovation.

- **Extension agents, specialists and supervisors** Through training sessions, field-level seminars and dialogue, extension staff in various positions are shown the processes and dynamics of local innovation. They are led to recognise innovations in their extension areas and the contribution of innovators to improving land husbandry. They are encouraged to integrate innovators into their extension work.

- **Research scientists and policy-makers** Researchers from Mekelle University, Mekelle Research Centre and the Ethiopian Agricultural Research Organisation and policy makers from BoA and the Ministries of Agriculture (MoA) and Education (MoE) are exposed to local innovation in land husbandry. They are drawn into discussing their policies on research and education.

- **The media** Representatives from the mass media are approached to spread information about innovative farmers and about promising innovations to a wider audience.

Strategies to invite policy dialogue

The major strategy is to arouse curiosity and enthusiasm among DAs, researchers and policy makers about local innovation.

DAs in particular have been quick to recognise innovators and invite them to be partners in extension. Researchers are challenged by DAs and farmer innovators to look more closely at certain innovations and, together with farmers, to work on them further. Policy makers are stimulated to recognise the importance of local knowledge and innovation in strengthening the extension system and in guiding research to help farmers improve what they already know.

ISWC-Ethiopia decided to pursue Participatory Technology Development (PTD) by introducing the concepts and spirit gradually on a wide front. Progress is slower than would be possible by focusing on a pilot area, but we will not face the problems of trying to scale up from a few isolated experiments. We do not impose PTD. Instead, researchers are challenged to open dialogue at every possible opportunity. We emphasise forging a functional link between researchers, DAs, *baitos* and innovators.

This emphasis has guided the choice of members in the ISWC-Ethiopia Steering Committee, which discusses and approves the annual project plans. Influential and committed persons were chosen who could foster partnership between stakeholders. The members include the Head of the BoA and individuals from research institutes and NGOs who have long experience in land husbandry research and development.

Examples of lobbying activities

Various types of activities were designed to influence policy either directly or indirectly. For example:

- **Network shops** bringing together researchers, DAs, policy makers and innovators have been organised at Regional, Zonal and District levels, and a national workshop is being planned; field trips to innovators are included;
- **Media coverage** the TV, radio and press are invited to make the achievements and aspirations of innovators more widely known; recently, journalists have, on their own initiative, visited innovators and interviewed them in their villages and at village-level workshops, as well as at fairs and conferences, such as the Anglophone Africa workshop on farmer innovation held in Mekelle earlier this year;
- **Newsletters** dealing with farmer innovation and written in the local Tigrigna language are produced twice a year for the farming communities, *baitos* and DAs;
- **Research reports, proceedings and journal articles** are written and distributed to researchers, BoA and MoA staff and policy makers;
- **Personal visits** are made to Government Ministries, Embassy officials and NGO heads to brief them about project approaches and activities;
- **Travelling seminars** bring farmer innovators, DAs and researchers to the sites of innovation and give innovators a chance to interact with village-level policy makers.

Some signs of change

Thus far, three years after the programme started in Tigray, we see signs that local innovation in land husbandry is being recognised and promoted.

Integration into BoA activities. Village-level seminars, during which villagers assess local innovations, are now being organised as part of BoA extension activities. Views of innovators are taken into account during land-use planning at village level. The BoA now organises awards not only for Global 2000 farmers but for local innovators (often, farmers who do not accept Global 2000). Innovators are involved in regional field days to show what they have achieved on their land and so gain recognition by researchers, DAs and policy makers. This encourages the innovators, creates opportunities for them to disseminate their innovations and stimulates discussions between different actors in agricultural development.

Increased openness in extension. Extension approaches and packages are becoming more open to local knowledge. DAs are recognising - and some are even documenting - farmers' informal experimentation in land husbandry. Concerns raised by farmer innovators are no longer hushed-up but brought to higher levels by DAs and the innovators themselves e.g at conferences. In the past, only farmers involved in the Global 2000 scheme were invited to regional farmers' conferences; now farmer innovators are invited too.

Official support to local initiatives. The BoA supports local initiatives, such as the activities started by communities to divide up rights to sloping land among community members. *Baitos* have responded to innovators' concerns about their rights to use improved land (see Box).

Change in attitude of researchers. Some researchers recognise that farmers do experiment and can be partners in research. A few are exploring farmers' innovations further in technical terms and are arranging PTD experiment with farmers. However, this aspect moves very slowly.

Incorporation into university teaching. A module on PTD has been incorporated into the "Research Methods" course given to all students of agriculture at Mekelle University. Several national and international MSc and PhD students are making field studies on farmer innovation and experimentation. Students doing their compulsory 5-month practical attachment are increasingly interested in documenting indigenous knowledge. In-service students from the BoA, NGOs and development projects are keen to continue examining local innovation when they return to their posts. Some of them even use their own resources (time, energy and material) to document innovations.

Local innovation for food security. Particularly in the drier areas of Tigray, farmers and DAs are criticising Global 2000 technology and find it unsuitable. DAs in southern Tigray actually challenge the targets being set for bringing farmers into the scheme. Now the Integrated Food Security Desk is exploring the potential of farmer innovation in identifying appropriate technologies for the 16 most drought-prone districts of Tigray.

How we influenced policy: testimony of a woman innovator

During our travelling seminar, we visited a fellow farmer in Southern Tigray in Raya Valley, where there was a very big and wide gully. It was not considered useful land during land allocation. A farmer had worked on the gully and made it productive, but when he started to grow crops there, the *baito* took the land over, saying he had enough land and that this reclaimed gully should be distributed to others. We saw this problem during the seminar and discussed it. The *baito* in Raya Valley reviewed the mistake it had made and gave the land back to the farmer. This is how we influenced policy.

Ms Leteyesus Gobena, ISWC Anglophone Workshop on Farmer Innovation in Africa, February 2000, Mekelle, Ethiopia

What next?

The various activities have been documented and a database of farmers' innovations has been established. However, it is still necessary that the documented observation be critically analysed in the field. This will help identify successful innovations that can already be disseminated and promising innovations that could be improved. It will be especially important that more researchers are attracted to support experimenting farmers in assessing and further developing their own innovations. It is our challenge now to maintain the dynamism of the process and to move into PTD on a broad basis.

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Three models of extension by farmer innovators in Burkina Faso

Aly Ouedraogo and Hamado Sawadogo

Farmers in the Sahel zone of Burkina Faso have developed a method of rehabilitating degraded land. It is an improvement on the traditional planting pits known as *"zaï"*. On barren land, the farmers hack holes into the hard soil surface, fill the holes with organic matter and sow a few seeds of grain. A specific type of termite may be transferred to the pits, to speed up the decomposition of organic matter. Sometimes a tree seedling is planted or a tree seed is directly sown in the middle of the cereal plants. When the grain is harvested, the stalks are cut off at a height of about 1 m and this protects the tree seedlings from grazing animals. Over the years, this locally-improved traditional technique has led to the establishment of well-wooded farmland (Photo 1).

Many farmers have experimented with variations on the *zaï* theme, trying out different techniques to improve soil fertility and trying out various crop varieties and woody species to take advantage of the better conditions. A few farmers have taken the initiative to promote the spread of *zaï* and its various improvements. Here, three "extension models" developed by farmer innovators are described. These models are, in themselves, local innovations.

"Market-day" model

In the village of Gourga, 4 km west of Ouahigouya, the capital of Yatenga Region, Yacouba Sawadogo uses a "market-day" model to promote the spread of the *zaï*. He started improving the traditional planting pits around 1980. The *zaï* have since become recognised - also by scientists - as the most cost- and time-efficient technique in the Sahel for rehabilitating strongly degraded land.

Since 1984 Yacouba has been organising market days to share his experiences with *zaï*. These started as small events, but now each market day involves representatives from more than 100 villages. The events are organised twice a year. The first market day is held shortly after the harvest, and the farmers bring samples of the crop varieties (millet, sorghum, cowpea and maize) they have cultivated in their *zaï*. Yacouba stores this seed on his farm. The second market day is organised just before the rainy season. Farmers can then select the species and varieties they would like to plant in their *zaï*, taking into account the improved growing conditions.

Each market day has a specific theme. For instance, during the last market day, the accent was on growing sesame. An earlier theme was the use of *zaï* for growing trees through a system of direct seeding. At each market day, there is also a display of the local tools used to dig the *zaï*. This allows farmers from outside the region to see for themselves which tools can be used and to find out where they can buy them.

Yacouba receives many visitors. This costs him a substantial amount of time. The solution he has found to this problem is to request something from each visitor. People who come from abroad are asked to plant a tree, and groups of farmers from elsewhere in Burkina Faso or West Africa are requested to dig some *zaï* on his land. This works out as a sort of on-the-job training. The main problem, and one that has yet to be solved, is that Yacouba does not have very good seed storage facilities.

"*Zaï*-school" model

In the village of Somyanga, Ousseni Zoromé initiated the "*zaï*-school" model. In 1992 he started training some local farmers in how to make a good *zaï*. He chose the poorest possible site, immediately next to a major road between Ouahigouya and Ouagadougou, the capital city. The farmers managed to achieve a millet harvest of 400 kg per hectare on this very poor land. Anyone travelling along the main road saw this immediately, because it was a year of extreme drought and many crops had failed. The Minister of Agriculture also saw the plot and called in a team from national television to film it. Ousseni Zoromé, who had received no external support except some fuel for his old motor cycle from the regional department of agriculture, began to create new groups, which he calls "*zaï* schools". Each group has to collectively rehabilitate a piece of degraded land. In this way, all participants are trained on-the-job. There are currently 21 *zaï* schools with a total of more than 1000 members, and their numbers are increasingly rapidly.

The *zaï* schools are now organised into a regional union and Ousseni is seeking external support to expand and improve them. Each group has to pay a contribution of 5000 FCFA (US$8) to become a member of the union.

"Teacher-student" model

In the village of Gourcy, Ali Ouedraogo, a very experienced farmer innovator, has invested heavily in improved traditional

Yacouba Sawadogo has used the zaï to directly seed the trees and shrubs he wants on his fields.

Photo: Chris Reij

planting pits (*zaï*) in combination with compost production, tree planting and the protection of naturally-regenerating trees and shrubs. He is training individual farmers in five villages around Gourcy and visits them regularly, showing them how things should be done, giving them advice and exchanging ideas with them. His "students", in turn, train other farmers in improved *zaï* techniques.
Some of the students do not simply adopt what Ali suggests, they go on to adapt and experiment with his original ideas. For example, one farmer felt that the *zai's* Ali made were extremely large and required a great deal of work and physical strength to develop. Not everyone was able to this. The farmer therefore started to modify the layout and dimensions of the *zaï* to suit his capacities.

Voluntary extension

One interesting fact is that these farmer-led extension models were all developed on the initiative of the farmer innovators mentioned above. These farmers receive no remuneration for their time. At the most, they receive some limited external support for travel from local NGOs and individuals. Yacouba, for example, received a small, new motorcycle through his "Association for the Promotion of *Zaï*" (consisting entirely of farmers) so he could reach more villages. These farmers have no links with the government extension service, with the exception of Ousseni Zoromé's regional union that did receive some organisational suppport.

Moving towards wealth

The farmers in Yatenga Region and also in other parts of the densely populated Central Plateau of Burkina Faso are becoming increasingly interested in *zaï*. Under such dry conditions, this is not surprising. The pits collect and concentrate runoff water, and they allow farmers to use small quantities of manure and compost very efficiently.
All three of the above-mentioned farmers have many more trees on their fields than they had 20 years ago. Yacouba Sawadogo has used the *zaï* to directly seed the trees and shrubs he wants on his fields. In this way, he has created a forest of 12 ha with a considerable diversity of woody species. Since he can now feed his entire family even in drought years, Yacouba has shifted the accent from growing cereals to growing trees. When Ousseni Zoromé started to reclaim a large expanse of barren land in1983, there were only 9 trees remaining in these fields, now there are at least 2000. Ali Ouedraogo grows trees mainly alongside the stone bunds on the contours and in this way he has created windbreaks in his fields.
The use of *zaï* allows farmers to expand their resource base and to increase household food security. These three farmer innovators developed their own extension models because they are keen to share their experience with other farmers who, in turn, are keen to learn.

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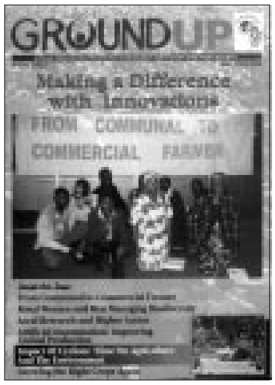
Farmers started to modify the layout and dimensions of the zaï to suit their conditions

Photo: Chris Reij

Pelum Association

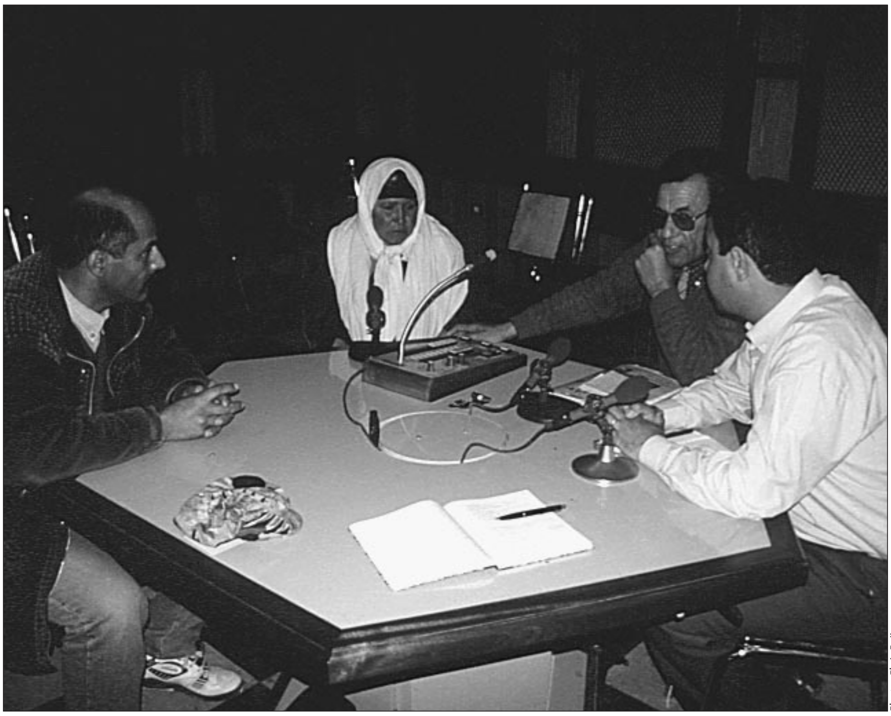
GROUND UP

PELUM is a network of civil society organisations operating in East and Southern Africa. Pelum members work to facilitate learning, networking and advocacy in sustainable agriculture, natural resource management and household food security in order to secure community development amongst small holder families in the region. Members learn through linking their experiences of alternative approaches to agriculture and participatory development.



PELUM'S key startegies are information sifting and distribution, networking, short- and long-term training , off-farm seed saving and advocacy. It runs workshops, trains community development workers, identifies and distributes good books and articles and facilitates networking within the Association itself and among like-minded organisations.
PELUM has just begun producing a quarterly magazine **GROUND UP**. The latest edition is entitled **MAKING A DIFFERENCE WITH INNOVATIONS** and focuses on the theme of "sharing innovations". As the editorial reminds readers farmers have been innovating since time immemorial and today they are no less innovative than in the past. They contribute to innovations both as the sole creators of a final innovation and as contributors (often undervalued and unacknowledge) to improved innovations of researchers and inventors. Farmers are often the source of the (raw) information - derived from their indigenous knowledge and experiences - used by "outside" researchers, engineers and inventors in the process of developing "new" technologies. PELUM argues for a strengthening of partnerships between farmers and researchers making sure that farmers' contributions are openly acknowledged.

GROUND UP can be ordered from: The PELUM Associatin, Box MP 1059 Mt Pleasant, Harare, Zimbabwe. Subscriptions cost US$20 per year.



Mrs Mbirika in the radio studio.

Photo: Chris Reij

Local innovation and wider development in Tunisia: Gafsa regional radio

Noureddine Nasr, El Ayech Hdaidi and Ali Ben Ayed

The Indigenous Soil and Water Conservation (ISWC) project in Tunisia is coordinated by a team from the Institut des Régions Arides (Arid Zones Institute), a research organisation working in central and southern Tunisia. Here there are regional radio stations in the cities of Gafsa, Tataouine and Gabès.
The project selected Gafsa for two reasons. First, two-thirds of the innovators identified live in the zones covered by this station and second, the new programme "Agriculture and Innovation" could replace a programme on "Agricultural Extension".

The new 2-hour programme went out on the same day and at the same time as the old one and the presenter of the earlier programme (El Ayech Hdaidi) took over responsibility for the new one, which helped to maintain the link with listeners. A sociologist from the Arid Zones Institute worked with him.

Bringing stakeholders together

When "Agriculture and Innovation" started in March 1999, it was itself an innovation. It was the first time that a radio programme in Tunisia systematically invited farmers to present their knowledge and experience. Usually it was researchers and technical advisors who passed on information and recommendations to farmers. Agricultural extension in Tunisia meant teaching and training farmers, not listening to and learning from them.
The radio programme not only invites farmers to present their innovations. It also involves researchers, training specialists and development agents in debates about the innovations. Sometimes, these stakeholders in development sit together in the studio, but specialists can also call in by phone. This means that innovators do not need to travel long distances to the radio station to share their ideas with others. Several radio programmes were presented in this way from a distance. Sometimes, innovations from different regions were presented in the same broadcast. Innovators and listeners with telephones can take part in the debate from anywhere in the region. To stimulate the participation of as many listeners as possible, the contents of each programme is announced in the weekly magazine of the National Union of Agriculture and Fisheries. The Arid Zones Institute also makes sure that all regional Departments of Agriculture in central and southern Tunisia know what will be in the next programme and invites staff to take part.
In its first year, 100 farmers (85 men and15 women) presented a wide range of innovations, including economising on water use in cropping, soil fertility management, fruit-tree husbandry (grafting fruit trees on the root system of a shrub which indicates good soil fertility and soil humidity), small livestock rearing, breed improvement, and bee and poultry keeping.

Prizes for good listeners

To encourage the listeners to follow the programme closely and to get some feedback, a system of prizes was introduced. Once every two weeks, a prize of 50 Tunisian dinars (about US$ 45) is awarded to a listener who has responded by mail to a question posed by the presenters. The questions are usually about the innovators and innovations. Sometimes, listeners are invited to report on new innovations. This has proved a good way of identifying additional innovative farmers, both men and women. The prizes are provided by the project and by research and development institutions and local organisations.

Letters to the radio

After each broadcast, the radio station receives 20-30 letters from listeners, mostly from rural areas and especially from women (90%). In the case of the older, usually illiterate women, the letters have been written for them by their school-going children or by younger women in the village. The letters include:

- answers to the presenters' questions about the innovations discussed;
- information from listeners about new innovations, often asking if they can be described on the radio. Innovations

identified in this way include techniques for planting cactus and fig trees, local remedies for diseases of fowl and small livestock, and managing rainfed vineyards to produce table wine;
- requests for more details about specific innovations, because the listeners want to try them out;
- descriptions of how listeners tried out innovations presented on the radio; these include hatching chicken eggs in piles of dry manure, grafting prunes and peaches on the roots of jujubier (*Zizyphus lotus*), planting olive trees on cactus paddles, and drip-irrigation using plastic bottles;
- suggestions of new topics for the radio programme, such as pruning fruit trees, growing early crops under glass, artificial insemination, milk production, and keeping poultry and rabbits;
- congratulations and encouragement to the presenters;
- proposals of field visits or interviews.

Some listeners have suggested starting a parallel TV programme to show the best innovations.

Impact of extension by radio

A survey was made to evaluate the impact of the radio programme. The mail received was analysed for content. The men and women who had presented their innovations on the radio were visited to find out whether they had continued to develop their innovations and whether other farmers or extension agents had visited them. The listeners who had received prizes were visited. Farmers in villages along the Gabès-Gafsa and Gafsa-Maknassy-Mazouna roads were interviewed at random in places where farmers frequently meet, such as shops, reforestation sites and local extension-service offices. The programme had four major types of impact.

Provided incentives for innovators to continue innovating

For most of the men and women farmers who had presented their innovations on the regional radio, the experience had been an important social incentive. After the broadcast, several innovators continued to develop their innovations or started to develop new ones. For example:

- Mr Béchir Nasri, an innovator in Médénine Region (Nasr et al. 1999), invented a new system for pumping water from cisterns and a new technique for conserving wax honeycombs in beehives; he is now working on a technique to filter sediment from runoff water in order to avoid deposition in cisterns;
- Mr Khlifa Dadi, an innovator in Mareth Region (Chahbani & Nasr 1999), developed new irrigation techniques which economise on the use of water. These are adaptations of an innovation he saw during a visit to another innovator featured on the radio;
- Mrs Mbirika Chokri and Mrs Naziha El-Fahem (Chahbani & Nasr 1999) have increased their production efforts since they were on the radio. Mrs Naziha produces chicks and supplies them to about 10 other women who want to raise poultry using a micro-credit scheme developed by a project in Mazouna as a result of her radio presentation.

Encouraged visits to innovators

Since speaking on the radio, most innovators have been visited by other farmers and agricultural technicians. During his presentation, one innovator who distils cosmetic plants made an appeal to other farmers to grow these plants on a contract basis. A few days later, he was visited by a group of farmers. This visit was organised by the Presidential Pilot Project on Agricultural Extension based in Gafsa, which records all broadcasts of "Agriculture and Innovation" for use in their extension workshops. A few months later, when the farmer was interviewed on radio again, he mentioned that he had already signed production contracts with 20 farmers. Four innovators (including one woman) were visited by the Director of the Gafsa Regional Department of Agriculture. These visits were incentives to both the innovators and the extension agents, and indicate that new relationships are developing between farmers, development workers, research scientists and policymakers.

Adoption and adaptation by listeners

Analysis of the survey results and of the letters to the radio station showed that several listeners had adopted and, in many cases, adapted the innovations presented on the radio. For example, more than 50 men and women farmers were trying out the bottle-method of drip irrigation, and 5 women were hatching eggs in manure.

Changed attitudes

The radio broadcasts have also started to influence the attitudes of researchers and development agents. When the ISWC programme started in Tunisia in August 1997, the approach of seeking out local innovations as stimuli for rural development was strongly criticised and some research and extension staff even ridiculed it. After the first innovators had been identified and particularly since the radio programme started, it is evident that there is growing positive interest in this new approach.

Mass media and innovation

Listeners request that the regional radio programme be continued and extended to other regional stations and to national radio. This can be done only when development agencies and, in particular, farmers' organisations accept responsibility for and "ownership" of these radio programmes by making contact between local innovators and the radio station, encouraging farmers to listen to the programme, and so on. It is important that other mass media (the press and TV) also be used systematically to convey the message that men and women farmers are taking initiatives in developing useful technologies and improving their livelihoods.

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Urban Agriculture Magazine

→ **http://www.ruaf.org**

Growing cities and populations are one of the big challenges of the future. The importance of Urban Agriculture (UA) in sustainable urban development is growing. **The Resource Centre on Urban Agriculture and Forestry (RUAF-) Programme** was developed to fill this information gap. The **Urban Agriculture Magazine (UA-Magazine)** is one of the ways the RUAF project intends to facilitate the flow of information and discussion on the actual and potential roles of intra-urban and peri-urban agriculture. The first issue of the UA-Magazine gives an overview of UA concepts and cases, and discusses UA as a mechanism applied by disadvantaged families to secure their livelihood under adverse conditions. The UA Magazine is **published on the RUAF web-site and in hardcopy form**. The RUAF web-site also provides reviews of recent publications, databases of institutes and persons and an bibliographic database.

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Photo: Chris Reij

Innovator Samuel Toh explaining the night paddocking technic to a radio agent during a study tour in Babanki. The paddock has just been tilled. A visiting farmer listens attentively and makes notes.

Chains of innovation by farmers in Cameroon

Paul Tchawa

Samuel Toh's farm in Upper Babanki is almost 2000 m above sea level and receives about 1500 mm of rain each year between May and September. Population density is about 150 persons/km². The "grassfields", where Bororo Fulani pastoralists keep their cattle, lie above the farming areas. In the early 1980s, Toh saw that his soils were becoming poorer and that, with population growth, there was less space for traditional long fallow to restore soil fertility. Bororo cattle grazed in the surrounding hills and he began to collect manure and transport it in jute sacks to his field. As this was strenuous work, he decided to build a fence around his field and to ask a Bororo herder to bring his cattle there each night for about a month. Afterwards he cultivated the fertilised area and the bumper crop he was able to harvest showed him that his new system worked. Over time, Toh improved his system. For example, he noticed that the animals tend to concentrate in one corner of the field and the manure was not well distributed. He subdivided the paddock, and the cattle were moved each night to different subdivisions.

Toh's innovation met with extraordinary success. One plant in particular is grown regularly after manuring: black nightshade or wonderberry (*Solanum nigrum*). Its leaves are eaten like spinach and are highly appreciated in Northwest Cameroon and in the cities of Yaounde (Central Province), Kumba (Southwest) and Douala (Coastal). Almost all farmers in Upper Babanki (more than 500 families) have adopted the night-paddock system, and a stream of traders in "bush taxis" weave through the villages to collect the leaves and take them to the city markets. Usually, the farmers grow nightshade for two years and then maize for another two years. The cattle then return and the fields are manured again.

New harvesting tool

Besides bringing direct benefits in terms of income, the innovation has borne other fruits as well.

With better soil fertility, farmers had five times as many nightshade leaves to harvest several times per season. It is hard work to break off the stems by hand. In the early 1990s, another local farmer, Phillip Ndong, tried to harvest with a knife but it was not sharp enough. Moreover, because the women and children were involved in harvesting several knives were needed and this was expensive.

He then tried using a razor blade held directly with the fingers. This cut the stems better, but also often cut into the fingers. He therefore took a piece of bamboo about 20 cm long and attached the razor blade to the end. After trying out several types of blade, he settled on one with three holes, which could be fixed firmly to the bamboo with thread. With this tool, which costs less than 25 FCFA (FF 0.25 or US$ 0.04), the price of a razor blade, the nightshade leaves can be cut quickly and efficiently and, because the stems are not damaged, leaf re-growth is stimulated.

Neighbours were sceptical at first, but now all nightshade growers in the area use Ndong's innovation. It spread spontaneously. Then another farmer in Babanki, Christopher Vitsuh, noticed that market demand for nightshade leaves was not being satisfied in the dry season and the price therefore increased threefold. This inspired him to develop a system of irrigation by gravity, so that he could produce nightshade leaves in the off-season.

Market demand

Since the 1960s, small canals have been dug in the Babanki area to conduct water towards brick-making yards. In 1986, Vitsuh thought of using the same technique to lead water to his farm. The night-paddock system had greatly increased nightshade leaf production in the wet season and the fertility could still be used in the dry months if there was water. Vitsuh started a small irrigation system, that expanded as additional families wanted to be connected to it. In 1999, the system was irrigating more than 10 ha to the benefit of some 40 farm families.

When Vitsuh had first thought of this idea, he contacted some advisors in water engineering. After examining the site, these experts estimated it would cost six million FCFA (60,000 FF) to set up the system. As Vitsuh could not afford this, he had the choice of giving up the idea or working out something himself. He did the latter and his initial network of 5 km of canals cost him only 110,000 FCFA (1100 FF).

To begin with, Vitsuh identified streams that could be diverted into canals. Depending on the location of the plots of the other farmers involved, the most

Participatory research on night-paddock manuring

A team composed of members of ISWC Cameroon, CIPCRE (a local non-governmental organisation), the University of Dschang, the Institute of Agricultural Research for Development (IRAD) and farmers has been formed to examine the production of nightshade (*Solanum nigrum*) in Babanki. The village lies
30km from Bamenda on the road to Nkambe. Here, market gardening is an important income-generating activity,and nightshade is the major crop.
Farmer innovators and the ISWC coordinator organised a workshop in June 1999 to identify priorities for joint experimentation. About 50 men and women farmers met at the palace of the traditional chief (Fon). During this workshop, the farmer innovators said they knew that the researchers' priorities differed from their own, but stated clearly: "Let's work first on our priorities; then we can help you with yours". They specified which aspects of the night-paddock system they wanted to address.
The farmers were paddocking 50 head of cattle overnight for one month, but suspected that these plots were being too well fertilised, while manure was needed for other plots. They wanted to know how many cattle should be kept in a paddock and for how long to ensure the best level of soil fertility, and what was the best crop succession to follow after manuring. The researchers agreed that they would address these questions first. During a second workshop in July 1999, details of the experiments were discussed and everyones task was defined. The researchers were so impressed by Samuel Toh's analysis and presentation at this workshop that they gave him the nickname "The Professor".
The experiments were carried out on the fields of four farmer innovators. They make their own recordings although this does not mean that they are the only ones involved in experimentation. They receive considerable support from the Fon and the villagers.
After they have dealt with the issue of maximising the benefits of manure, the researchers were keen to address their own priorities, such as examining the nutritional quality of the nightshade leaves, studying how increases in the cattle population was affecting the environment, and evaluating the forage species available to cattle. As long as farmers are also interested in these questions, participatory research can continue for the benefit of both local farmers and the larger world of research and development.

Paul Tchawa, Chris Reij and Ann Waters-Bayer, ISWC Programme

appropriate routes were chosen. As the land is prone to erosion and the canal sides could cave in, the farmers planted live hedges to stabilise them. When they had to cross a deep gorge or major watercourse, they used hollowed-out logs as pipes to link the two steep banks.

Community control

The new technology also led to social innovation. A management committee was set up in the community to arrange the distribution of the water to the different plots and to solve possible conflicts. Water is distributed on the basis of strict rules set by the farmers themselves. If the rules are not respected fines are levied. Farmers who have not contributed to digging the canals must give the management committee 20 litres of palm wine, a basket of maize flour and a cock if they want to irrigate their plot.

This innovation is characterised by people coming together because of a certain problem, the simplicity of the means used and a great potential for improving income. There was no outside intervention in building and managing this new irrigation system. Farmers in other parts of the village still seek the innovator's support to be linked to the network. Vitsuh conveyed this request to the Indigenous Soil and Water Conservation (ISWC) programme. As a result, a geometrician joined Vitsuh, helped survey the entire system and helped him improve and extend it.

Mutual inspiration

This case shows that, as isolated as some farmers' innovations may seem at first glance, there may be close and logical connections between them. In Babanki, one innovation triggered a series of innovations. The explosion in nightshade production led to a high demand for cattle manure and a more than two-fold increase in the number of cattle kept in the area. To reduce the cost (in terms of materials and time) of enclosing the animals overnight, some farmers have begun to experiment with live fencing. Under the in contract with the herders, the farmers have to feed the cattle for one month and some have started to plant fodder grasses.

Chain of innovations

Babanki farmers developed a chain of innovations:

- Night-paddock system
- Contracts between farmers and herders
- New harvesting tool
- Irrigation system
- Live fences for paddocks
- Growing fodder grasses

The relationships between the sedentary farmers and the mobile Bororo herders used to be tense, because the cattle sometimes damaged the crops and farmers expanded their fields into grazing areas. The contracts between the Babanki farmers and the Bororo for enclosing the cattle overnight on farmers' fields for a month each year has improved the relationships between the two groups.

It is also interesting to note that the links between innovations also link innovators, and they admire and respect each other. The development and mastery of an innovation by one person stimulates others. As a farmer in Babanki said: "After fertilising a patch of ground, you lose a lot if water cannot reach it". The farmers obviously do not regard these innovations as isolated developments. It is therefore not surprising that Samuel Toh, Phillip Ndong and Christopher Vitsuh support each other actively in developing their innovations.

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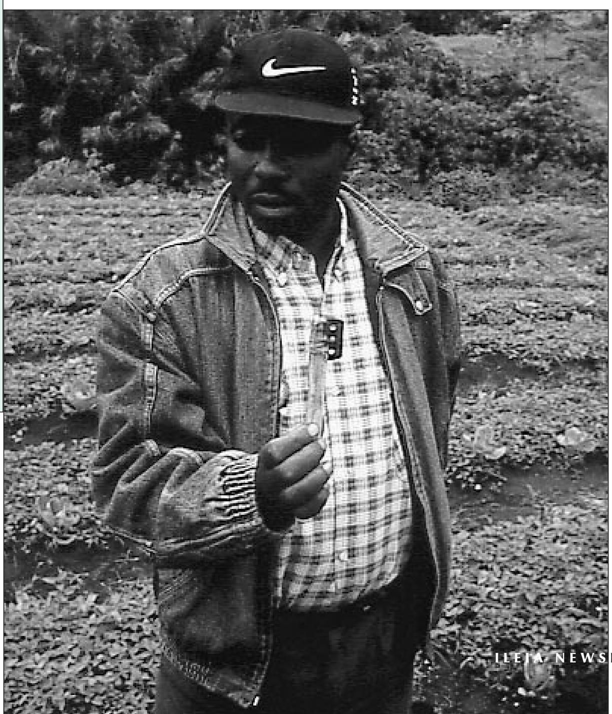

Phillip Ndong showing his innovation, a razor-blade knife to cut nightshade leaves quickly and efficiently.

Photo: Chris Reij

Photo: Anderson Temu

Digging the pit

Sowing maize in pits: farmer innovation in Tanzania

Anderson Temu, Zacharia Malley, Salome Mwigune and Norsis Kinabo

Wilbert Mville, a 34 year-old farmer, lives in Itulike Village in Njombe District in the Southern Highlands of Tanzania. This is an area of sloping and undulating land at an altitude of between 990-2200 m. Temperatures range from 13 to 18ºC, and annual rainfall (November-April) varies with altitude from 600 to 1500 mm. The dominant soils are red kaolinitic clays with moderate natural fertility and medium to high water-holding capacity. Under continuous cropping, they degrade quickly through compaction, and plant rooting is shallow.

Research-minded farmers

In these and similar areas of southern Tanzania, the Indigenous Soil and Water Conservation Programme (ISWCP) set out to identify farmer innovators. This was the first step in establishing a process of Participatory Technology Development (PTD). Researchers and extensionists were trained in tools for farmer-led analysis and experimentation, an approach very different from the scientist-led research that dominates the official level in Tanzania.

Two PTD training workshops in March 1998 and April 1999 were crucial to changing the attitude and behaviour of researchers and extensionists from a conventional transfer-of-technology approach to a more participatory one. Workshop participants learned about innovation and informal experimentation by "research-minded" farmers. It was stressed that these should not be confused with "progressive" or "contact farmers" who had the resources to adopt techniques suggested by extension officers. Farmers who are less responsive to such messages often have fewer resources, but may still be very active in trying out new things in their farming system (Veldhuizen et al. 1997).

Locally-developed LEISA

A field trip during the 1998 workshop in Njombe exposed researchers to farmer innovation. Godson Lupenza, a village extension officer (VEO) in Njombe who had seen Mville's maize pits, suggested that a field-work group should visit him. The group members marvelled at Mville's willingness to speak, listen and answer questions, and his amazing knowledge. He had developed several innovations, e.g. different ways of planting maize, a pipe system to distribute water and cattle urine to his fields, a tree nursery and fish ponds. The scientists were keen to analyse these innovations and start joint research with Mville, who had already – on his own initiative – outlined topics for experimentation:

- comparing maize yield from large and small pits;
- trying bigger pits, each seeded with up to 30 plants, without thinning;
- sowing on raised seedbeds in old pits (from the previous season) to observe yield response to residual fertility;
- using compost instead of manure and crop stover as organic fertiliser;
- one top dressing of slurry compared with three top dressings.

Closer look

When two of the researchers (Temu and Malley) visited Mville again in February 1999, he explained that his ideas came from seeing that extension officers recommended sowing 2-3 seeds together in rows if there were enough nutrients (organic or inorganic). He reasoned that it must be possible to sow many more seeds in a pit that was rich in organic matter and still obtain a good yield. Since the soils on his farm are exhausted and because he had enough farmyard manure (FYM), plant materials and animal feed refuse, he set about designing the pit method. A year later, in 1997, he tried it on a small scale and modified it in 1998.

His technique involves digging pits 60-120 cm in diameter, 30-60 cm deep and 75-100 cm apart. Crop residues and manure (one bucket of 20-litre) are put into each pit and mixed with topsoil. 20-25 maize seeds are then sown in each pit and later thinned to 15-18 plants, depending on the size of the pit. He top-dresses the maize with a mixture of manure slurry from the kraal floor and urine collected with his piped system, diluted 1:1 with water. On each of three consecutive days, he applies about 2 litres of this mixture per pit. The following season, he makes new pits on the undisturbed soil between the previous season's pits. In this way, he hopes eventually to saturate the field with organic manure and thus improve the soil. Mville noted that he harvested 20 bags/acre (5 t/ha). When he planted in rows his yield was less than 5 bag/acre (1.25 t/ha).

Mville's wife works with him and has introduced her own experiments. For example, after the maize was harvested, she planted leafy vegetables irrigated by the pipe system to see how residual fertility could be used.

Technical staff

In the 1998/99 season, Mville began a trial to compare the effect of pit size on maize yield, a topic he had mentioned during the first workshop. He and his wife jointly monitored the trials, and she kept the records. A neighbouring farmer, Rose Kitamkanga, saw what Mville was doing and decided to experiment on her own to find out whether pit planting with manure produces more local maize than conventional row planting. The technical staff (researchers and extensionists) joined these experimenting farmers in the middle of the growing season. We had still been trying to work out mechanisms for participatory research, so the farmers started their trials without us! We helped them identify simple assessment criteria so that, at the season's end, they could use them to interpret the results. The farmers were able to record many parameters, the researchers only had to record a few including pit dimension, grain yield and soil analysis. Grain yield was measured at harvest in the presence of the innovators, VEOs and researchers.

Results

The results of these two trials, plus more from other farmer innovators, were presented in two farmer experimentation workshops held in November 1999 in Iringa and Mbeya Districts. Assisted by researchers and VEOs, the farmers used flipcharts to present their data to the other innovators. Results were discussed in a plenary session.

Farmers' comments

Mville and his wife noted that the larger pits produced better results than the smaller ones (8.8 compared to 3.6 t/ha). Rose noted that the maize yield from pits was 50% higher than from rows. The other farmers made the following comments on the trials and the results:

- the plot size for large pits was smaller than for small pits;
- the exact amount of FYM in Mville's trial was not known;
- the fertilisation schedule differed in the comparison of row and pit planting;
- the amount of urea applied was not specified.

Table 1: Results from Mville's experiment, using introduced maize variety

	Size of pit	
Parameter	Large	Small
Area of maize plot (m^2)	28	100
Number of pits	8	56
Number of plants	192	448
Depth of pits (cm)	60	30
Spacing between pits (cm)	105	85
Diameter of pits (cm)	123	58
FYM applied at sowing	not known	not known
Top-dressing (manure slurry)	15	3
Maize cob weight at harvest (kg)	19.8	14.9
Grain yield (bags/acre)	35	14.4
Grain yield (t/ha)	8.8	3.6

Table 2: Results from Rose's experiment, using local maize variety

	Sowing method	
Parameter	Pits	Row
Area of maize plot (m^2)	100	100
Number of pits	40	13
Number of plants	480	303
Depth of pits (cm)	60	-
Spacing between pits (cm)	60	90
Diameter of pits (cm)	59	-
FYM applied at sowing (l)	10	-
Top-dressing (manure slurry)	-	Urea
Maize cob weight at harvest (kg)	16.1	16.4
Grain yield (bags/acre)	24.0	16.0
Grain yield (t/ha)	6.0	4.0

Observations

It was interesting to note that farmers saw the need to standardise non-experimental factors so that fair comparisons could be made between treatments. During the workshops, researchers guided farmers to brainstorm about other rules that could improve experiments in the next season. The importance of design, replication, randomisation, controls and plot area for trials, for example, were discussed. We all agreed that these principles would be put into practice when joint experiments were conducted in the 1999/2000 season.

Innovation spreads

The pit-planting technique spread quickly and was made known through:

- visits by individual farmers (mainly neighbours) to Mville's farm;
- farmer-exchange visits facilitated by the ISWCP;
- farmer-innovator and farmer-experimentation workshops;
- publication in the Swahili newsletter *Pambazuko* produced by a national farmer network (MVIWATA);
- presentation by Mville at the NANE Annual Agricultural Show in Arusha in August 1999;
- publicity through church congregations.

A quick survey made in Itulike and Wikichi Villages in Njombe District in June 1999 found that 71 farmers had already adopted or were adapting the innovation. Three farmers in Iringa District, who had seen it during exchange visits were trying out pit planting for themselves. However, while farmers are keen on the technique, it was agreed during the farmer-experimentation workshops that the innovation will be studied again in the 1999/2000 season and that the rules of experimentation decided upon in the workshop should be applied. Initially, only two treatments were selected: row vs. pit planting. We agreed on factors to be kept constant and data to be monitor. There are 11 farmers (replicates) doing the trial in Njombe and 3 in Iringa District. The trials are being closely monitored by farmers, extensionists and researchers.

Advantages to explore

Mville's data suggest that his technique may be a promising alternative to conventional row planting. However, labour input comparisons are needed. Pit planting cannot be easily mechanised; it may therefore be more suitable for farmers who cannot afford mechanisation. From our point of view, the advantages of this innovation appears to be:

- improved soil productivity over time;
- simpler weeding, as weeds only need be hand-pulled from the pits;
- reduction in labour for field preparation, because tillage is minimal: only in the pits;
- less erosion, as less soil is detached from non-pitted area;
- the pits collect runoff, allowing it to infiltrate and be conserved in the spongy organic fraction of the soil in the pits;
- concentration of nutrients in the pits and looseness of the soil favour maize root growth and nutrient absorption.

After analysing the results of the initial PTD trials, we will start working with the farmers on further studies to explore the potentials of this local innovation.

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The result, healthy growth of maize

Photo: Anderson Temu

Forging partnerships with innovative farmers in Tanzania

O.T. Kibwana

New ideas are the key to agricultural development. In today's dominant model, researchers develop and test new ideas, extension agents package them into "messages" and farmers are told what to do. A very specific status hierarchy is perceived by all the actors. While the ineffectiveness of this linear model is now recognised, the question of how researchers find out the relevance of innovations at field level remains open. Mechanisms have been introduced to feed back farmers' opinions via the extension system to researchers, but they have done little to change the assumption that new ideas originate from experts working at a superior level.

The Indigenous Soil and Water Conservation Programme (ISWCP) in Tanzania (see Box 1) recognises that such experts are an important source of new ideas. But it also believes and has concrete evidence that farmers are very resourceful in generating and testing new ideas.

Agricultural development demands continual innovation. All farmers innovate in their struggle to make a living from the soil. However, not all farmers innovate to the same extent. There are always those who lead the way. ISWCP's challenge was to identify these farmers and to forge a genuine partnership between them, and researchers and extension agents.

Before ISWCP began there had already been interactions between these actors, and the attitudes, behavioural patterns and role definitions that had developed were being taken for granted. To change these attitudes meant creating a "new order". ISWCP tackled this task in the following way.

Breaking the ice

One of the first activities of ISWCP was to bring together researchers and extension agents in a **Joint research-extension workshop on PTD**. "Experts" in agriculture believe they are more open to new ideas than farmers, and see themselves as "Agents of Change". The workshop aimed at getting researchers and extension agents to agree on a new concept of farmer innovation (as they were still thinking of "innovators", "adopters" and "laggards" in the terminology of transfer-of-technology extension), and at introducing and offering training in participatory methods. A longer-term objective was to nurture a working relationship between research and extension. The workshop gave participants the opportunity to understand and appreciate each other's roles and points of view, and led to the setting up of mixed teams to identify farmer innovators.

Opening eyes

Farmer innovators and innovations had to be identifying and analysed. ISWCP began by selecting two or three divisions within each district according to the extension staff's evaluation of the general level of innovativeness in the area and whether village-level extension staff who had attended the PTD workshop were based in the division.

Research and extension teams were formed. These consisted of the divisional extension officer (DEO), selected village extension workers (VEWs) and a researcher from one of the two research organisations in ISWCP-Tanzania's National Steering Committee (NSC). As only one researcher works in each region, that researcher takes part in all the divisional research-extension teams in that region. VEWs were selected according to their interests, capabilities and disposition to regard farmers as creative. Team leaders were people from above the divisional level who were known to be interested in participatory research and extension.

The different approaches adopted in identifying innovators reflected the composition and orientation of each team. In some areas, the teams asked the local VEWs to identify local innovators. Others asked the VEWs to convene a meeting of community leaders to discuss the general topic of farmer innovation and experimentation. Community leaders were then asked to identify local innovators. In Njombe, for example, 12 innovators were identified in this way.

The teams visited the farmers identified as innovative and saw and documented their work. In the case of the more technically-oriented teams working through VEWs, the teams screened which innovations were interesting to document. Where community leaders were involved in identification, they met with the identified farmers and the research-extension team to discuss techniques and distinguish between innovations and traditional practices.

Innovator Profiles

The VEWs, assisted by the researchers, created innovator profiles using a format provided by the ISWCP. Profiles consisted of bio-data, economic status, social influence, neighbours' perceptions and motives for innovation. They found that:

- Most innovators had responded to problems they faced during their daily work, i.e. their motivation was to solve problems;
- Most innovators were middle-aged men with families, but the more striking

Photo: Laurens van Veldhuizen

Farmers discussing their experiences of "partnerships"

Partnership in action: planning future activities.

Photo: Laurens van Veldhuizen

innovations were undertaken by males in their early 30s;

- Some of the older male innovators held official positions in their localities; the younger ones were seen as being wayward. One was nicknamed "Pwagu", a popular character in a radio play who is always trying out new ideas but with little success;
- Better-off innovators embarked on more expensive innovations requiring purchased materials and hired labour, the poorer ones on simpler, less resource-demanding innovations; however, many who started resource-poor became richer through their innovations;
- Fewer women were identified as innovators, and their innovations tend to be homestead centred (e.g. mixing urine with manure from stall-fed cattle);
- Most innovators claim to have been inspired by their own ideas and curiosity; few admit to having been inspired by other farmers or extension agents; only later did it become possible to trace the origin of any particular innovation.

Let's get together

Parallel workshops for farmer innovators were organised at regional level (Iringa, Mbeya and Ruvuma), bringing together farmer innovators from several districts The general design of the workshops was made by a researcher, a PTD trainer and a woman who heads the national farmers' organisation. The main objectives were to provide a forum for exchanging experiences and to stimulate networking among the innovators. This was important because innovators often felt isolated within their own communities and unappreciated by the "experts" in research and extension services. The facilitation team for each workshop included a researcher, a PTD trainer, an extension agent and a farmer.

The farmer innovators greatly appreciated the workshops. For many, it was the first time they had travelled across district boundaries and their first opportunity to explain to others what they were doing. They exchanged seeds and planting materials as well as ideas. During the workshops, participants examined some innovations in the field and assessed their strengths and weaknesses. New friendships were made and innovators were enthusiastic to learn more from each other.

Farmers learn from farmers

Cross visits were organised in two stages. First, farmer innovators from one district visited others in the same district for three days and each group member played host in turn. Then, a group of innovators from one district visited innovators in another district within the region. VEWs accompanied farmers on their intra-district visits and the DEO went with them on inter-district visits.

The cross visits took place in December 1998. After each visit, group members evaluated what they had seen and identified the ideas to try out at home. In April/May 1999, teams of VEWs visited the farmers involved to see what they had put into practice. Farmers had been very active. The newly acquired seeds and planting materials had been tested. Some of the innovations had also been adopted, the most striking being the sowing of several maize seeds in a pit, the idea of Wilbert Mville in Njombe (see Temu et al., p.12). Seventy-nine farmers trying out this technique were identified in Njombe District alone. No wonder one farmer commented that "Learning from exchange visits is better than being visited by a VEW".

Agreeing on topics

Researchers and farmers often have different ideas about what problems should be studied first. Negotiations are needed to reach consensus on the relative importance of problems. Only then can joint action start. This process requires that each stakeholder group has the capacity to express its own position. Preparatory work is needed if fair negotiations are to take place. ISWCP tackled this on two fronts: by confronting the "experts" and addressing the farmer innovators. A series of workshops were held to help experts appreciate the farmers' potentials. Meanwhile, the process of identifying innovators, regional workshops and cross visits had served to strengthen the position of the farmers, who had became more confident, assertive and better able to argue their interests.

Negotiating priorities

Once these two parallel processes had matured, priorities could be set for joint experimentation building on local innovations. Multidisciplinary teams consisting of researchers (agronomists and soil scientists) and the VEWs visited individual farmers and discussions took place in the fields. Clusters of innovations were identified, for example:

- mixed cropping involving food crops and fruit trees;
- agroforestry systems;

- replenishing soil fertility with organic materials;
- testing different sowing systems;
- tapping underground water for irrigation;
- diverting waterways and managing the water;
- harvesting run-off water;
- production of agricultural tools.

Results were summarised and presented at a research-extension workshop for further negotiation. Finally, the proposals were reviewed by the NSC, which monitors the general orientation of the action research. The woman representative of the farmers' organisation had a special responsibility for ensuring that the farmers' agenda was maintained.

Learning together

During the first cropping season, a few farmer-experimenters were identified in each action area. Research teams consisting of a farmer-experimenter, the local VEW and a researcher were formed. The general framework for sharing responsibilities had already been agreed upon during the earlier workshops, but the teams still had to work out the details to fit their own situation.
Most experiments involved crops and some had been set up after the growing season had begun. In order to improve research in the next season, a workshop was held for the farmers, researchers and extension agents involved in the first experiments. The main aims were:
- to review the process of joint experimentation: How was it planned? How was responsibility shared? What happened?
- to derive lessons learnt so far: What went well? What problems had there been? How were these dealt with? What should be done differently next time?

Generally, participants and especially the farmer experimenters were satisfied with the process. For them, the most gratifying part of the experience was that they had been treated - at long last - as partners and equal to the "educated elite".
Of course, some problems were also identified. A major one was that it had been assumed that, simply by dividing responsibilities, the partners would be able to play their roles effectively. As it turned out, even in cases where the partners were clear about what they were supposed to do, they were not always prepared to do it. The participants therefore requested that, in each district, practical "hands-on" training be given. This should focus on the tasks that the farmers, researchers and VEWs should undertake in the next cropping – hence, experimenting – season. These workshops would also serve as planning sessions for the next season – a good way to complete the reflection-action-reflection loop.

Just catch words?

Participation, stakeholder involvement, empowerment are concepts that have gained popularity, but there is a danger that they become catch words. ISWCP-Tanzania is being implemented by partners – including research institutions and extension agencies, both governmental and non-governmental - who have claimed from the beginning that they believe in participation. However, experience shows that old habits die hard. Deliberate efforts have to be made to achieve a common understanding of the vision, philosophy and strategies of genuine participation. The terminology used must have a clear and shared content. Mutual trust is also critical in genuine partnership. You trust people whom you respect and understand. The mixed workshops were powerful tools for building trust, but it is wise to remember that farmers are old hands at uncovering deception. They may decide to keep quiet. And this would be a very dead end.

■

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Box 1: Indigenous Soil and Water Conservation in Africa (ISWC II)

The first phase of ISWC focused on indigenous knowledge (IK) in land husbandry. The second phase (ISWC II) focuses on dynamics in IK: discovering and promoting farmer innovation. The programme operates in Burkina Faso, Cameroon, Ethiopia, Tanzania, Tunisia, Uganda and Zimbabwe. The main objectives are:
- to improve the effectiveness of ISWC practices and innovations through joint experimentation by farmers, researchers and extension agents
- to initiate research on ISWC, spread research results, and create lobbying platforms to show policymakers that building on ISWC practices and innovations is an effective option for development.

Local innovators, who develop new ideas without direct influence from formal research and extension, are often overlooked as a source of inspiration for development. Innovators already in the midst of informal experimentation can be entry points into a process of Participatory Technology Development (PTD). The major components of ISWC II are:
- identification and analysis of farmer innovators and innovations
- networking between farmer innovators
- participatory research involving men and women farmers to develop improved land-husbandry technologies and systems
- setting up farmer-based monitoring and evaluation systems
- dissemination of tested technologies through farmer-to-farmer visits.

In each country, researchers and extension agents are trained in PTD methods. The researchers' role is to support experiments by farmers. Extension agents participate in planning the experiments. They help the farmers to monitor them, and organise farmer-innovator workshops and farmer-to-farmer exchange visits.

In each country, a government agency or NGO concerned with agricultural research or development acts as the lead agency. It establishes links with other local research, development and teaching institutions interested and experienced in participatory approaches to improving land husbandry. A National Coordinator in the lead agency manages programme activities. A National Steering Committee, involving representatives of the collaborating organisations, approves plans and evaluates the activities.

Annual review meetings and regional workshops in Anglophone and Francophone Africa bring national programmes together. An informal newsletter (*Farmer Innovators in Soil and Water Conservation*) also allows exchange between the participants. Advisory support is provided by a European consortium involving the Centre for Development Cooperation Services (CDCS), Free University of Amsterdam; International Institute for Environment and Development (IIED) Drylands Programme, Edinburgh, Scotland; Institute for Development Studies (IDS), University of Sussex, UK; and ETC Ecoculture, Leusden, Netherlands.

Funding is provided by the Directorate General for International Cooperation (DGIS) of The Netherlands Ministry of Foreign Affairs. Each partner country manages its own fund for activities such as training in PRA and PTD, farmer-innovator workshops, participatory research and farmer-to-farmer exchange visits.

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Pacific Islander agriculture is dominated by root crops such as taro and yams and islanders face many problems with their cultivation. In Samoa, the introduction of leaf blight disease in 1993 devastated taro production and caused a dramatic decline in supplies of this staple food and export commodity. In Tonga, yam anthracnose continues to be a major problem. Island farmers, however, are important innovators and experimenters when it comes to solving the production problems associated with these crops. In Samoa, farmers have used their own innovations to ensure the rapid multiplication and availability of disease tolerant taro varieties, while in Tonga farmers have devised ways of minimising anthracnose disease and ensuring the vigorous growth of yams.

Photo: by authors

The Reverend Tauvela Suafoa alongside a patch of taro in his homegarden.

Farmer Innovation in the South Pacific

Steve Rogers, Tolo Iosefa, Taniela Hoponoa, Steve Hazelman and Danny Hunter

In 1996, the Samoan Ministry of Agriculture identified and released PSB-G2, a leaf blight tolerant taro variety from the Philippines. In general, taro is propagated vegetatively, and headsetts (also called tops) or large suckers are the best planting materials. However, the multiplication of PSB-G2 is enhanced because this variety also produces runners (stolons). The runners can be left attached to the mother plant to produce multiple suckers or cut and subdivided into pieces about 10 cm long. These are raised in nursery beds until they are ready for field planting (Figure 1). In Samoa, farmers received planting materials from the Extension and Research Divisions of the Ministry of Agriculture or from other farmers. Because there was a limited supply of planting material, most farmers received about 25 tiapulas (headsetts or tops) each.

Successful multiplication

In 1998, the European Union - Pacific Regional Agriculture Programme (EU-PRAP) Farming Systems Project and the University of the South Pacific (USP), in conjunction with the Research and Extension Divisions of the Ministry of Agriculture, carried out an impact assessment into the multiplication and distribution of PSB-G2. In the two-year period following the release of PSB-G2, the survey recorded an almost 75-fold increase in numbers with some farmers achieving a 700-fold increase. Although they had been provided with basic information on using runners for multiplication, the survey found that several farmers had been particularly successful at multiplication by innovating and adapting the above methods.

The innovations of Tauvela Suafoa

Reverend Tauvela Suafoa from Malaemalu village in Falealili district is an excellent example of a farmer who developed his own approach to multiplying and growing the new taro. He only received 50 *tiapula* in May 1997, yet in less than a year he had more than 3000 mature plants. Reverend Tauvela attributes this success to his mulching methods and sheer hard work. He described his method as follows:

- Remove the taro runners and cut them into node sections of about 5 to 10 cm long.
- Place node sections horizontally on a prepared nursery soil bed and cover with a thin layer of soil.
- Cover the nursery bed with a thin layer of cut *Erythrina* leaves. Good shoot growth will appear after 3 to 4 weeks.
- When the shoots are 25 to 30 cm long, transplant them to the field plot and mulch with “Samoan Manure”. This consists of a layer of cut banana leaves and a layer of *Erythrina* leaves and lawn cuttings, followed by another layer of banana leaves and a final covering of coconut fronds.

Reverend Tauvela has also experimented with the spacing of the new variety. Instead of the traditional spacing of 100x100 cm, he recommends a closer spacing of 50x50 cm. With this spacing he observed that PSB-G2 grows well and produces more runners. This means that more taro can be grown on a small area with less mulching material. Moreover, he not only succeeded in getting more taro plants, he also noticed an increase in the size of his Sunday congregation. This he attributes to his Sunday *To’onai* feast where he serves up *faalifu talo* and *luau* (taro corms and leaf in coconut cream). The Minister and his congregation all agree that the new variety has an excellent taste.

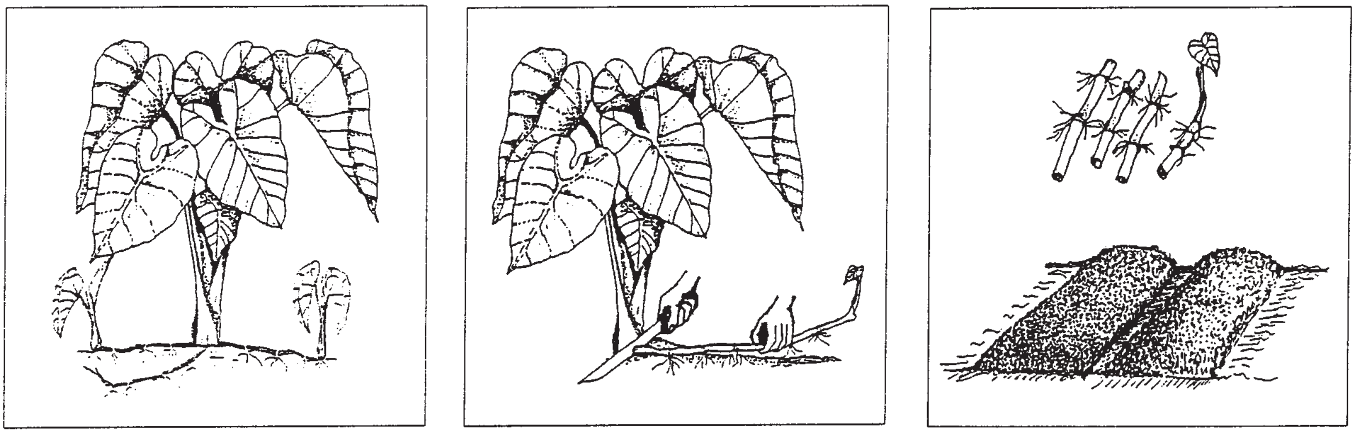
Food security increased

Farmer innovation in multiplying taro has meant a considerable increase in the availability of planting materials for other farmers. Because the area under taro cultivation - mostly using PSB-G2 – is increasing, there is more taro on the local market and at cheaper prices. This is great news for Samoa. For the first time since 1993, more people have the opportunity of eating their favourite food on a regular basis. Farmers are now selling planting material for half the price it was two years ago. Today, the Ministry of Agriculture estimates that there are about 10 million *tiapula* available in the country.

Superior yam planting materials

In Tonga, during on-farm yam trials to investigate ways of managing yam anthracnose, considerable variation in plant growth was observed. This was the result of non-uniform sprouting. Discussions between farmers and researchers resulted in the identification of local techniques for preparing and multiplying superior yam planting materials that could ensure a uniform vigorous growth and minimise anthracnose disease

Figure 1



Runners left intact on mother plant.

Runner removed from fully grown taro plant.

Runners cut into single or double nodes and planted in nursery.

problems. The expertise of Tevita Tui, a prominent yam grower and experimenter from Ta'anea village was a major input and other farmers cooperating in the on-farm trials also provided information.

Selection improved

Farmers identified five selection steps to ensure that superior planting materials are used:

- Select disease-free plants that are growing vigorously. Before reaching full maturity, cut off and remove the whole shoot to ensure the tubers remain disease-free.
- After harvest, select the best tubers. Keep the tubers separate from the rest of the yam and store to avoid further disease infection.
- When yams are in storage make a further selection and remove tubers with undesirable characteristics.
- Only prepare mini setts when yams have reached optimum dormancy time. This can be tested by cutting off the end of sample tubers and placing these horizontally on the floor overnight. If no fluid comes from the cut surface the tuber is said to be dried (*matu'u*) and ready for cutting. Setts with discolouration or signs of injury should be discarded. Many growers see this as the final step before yam setts are planted in the field. However, Tevita carries out a further innovative step that improves the selection of planting material.
- Incubate setts in a circular pit (*tanu*) until they are uniformly sprouted. This can take up to 2 months. Place setts horizontally in the pit up to three layers deep. A dried stick of 5 to 10 cm diameter and 100 cm long should then be placed in the centre of the pit. This stick is often referred to as the "nose" for it ensures ventilation. Tevita recommends that there should be no more that 200 setts per pit. Several dried sticks (*fetaki*) can be put across the top of the pit to ensure proper ventilation. Finally, dried banana leaves should be placed on top of the pit and covered with loose soil (Figure 2).

Multiple benefits

The *Tanu* method provides the following benefits for Tevita and other yam growers:

- sett size can be reduced to one quarter of that normally used for field planting without sacrificing crop yield. This means that more tubers are available for home consumption and sale;
- uniform crop growth can be achieved by selecting pre-germinated mini setts and eliminating diseased setts;
- one or two months of early field weeding can be avoided by germinating the setts in the Tanu pit;
- setts can be kept in the pit during periods of unfavourable weather.

Tevita has freely shared his knowledge with other farmers and extension staff. His enthusiasm and skill in giving practical demonstration of his innovations have encouraged other farmers and several Ministry staff to try these methods for themselves.

Important resources

Farmer innovation, and the knowledge and skills generated, are important resources in agricultural development. Ways should be found to build on these resources in national research and extension programmes. The innovations described in this article have formed the basis of farmer-to-farmer training and extension programmes to provide community-based training opportunities. This has led to a wider adoption of innovations and has also encouraged other farmers to experiment and innovate in a similar way. ■

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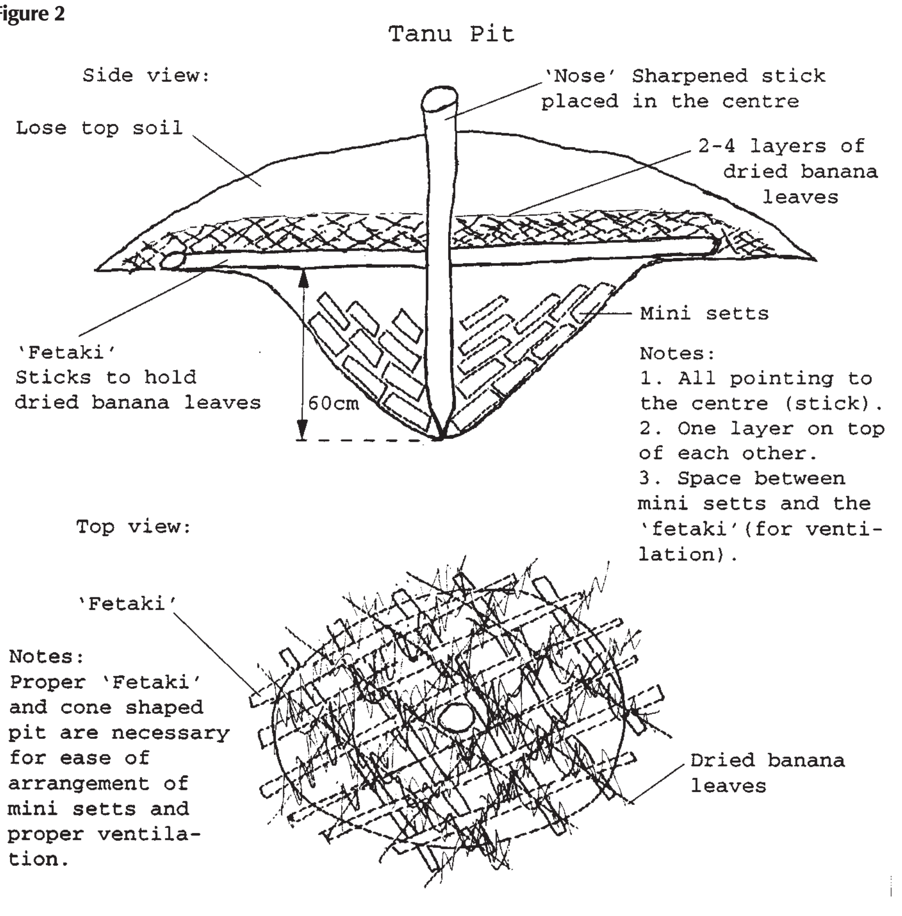
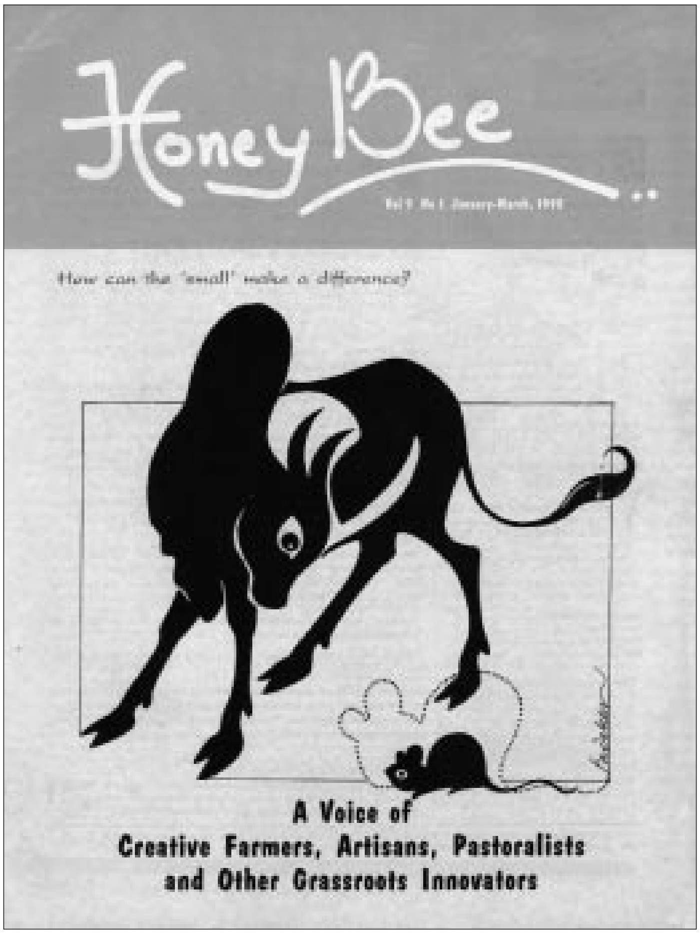
Figure 2





Grassroots innovations for survival

Anil K. Gupta

Although participation is much discussed, poor people rarely get the opportunity to develop their own agenda and vision or set terms for the involvement of outsiders. The entire participatory paradigm illustrates that people are participating in plans and programmes that we – outsiders – have designed. Not only is there little opportunity for them to articulate their ideas, there is also seldom an institutional space where their ingenuity and creativity in solving their own problems can be recognised, respected and rewarded.

Poor people must be inventive to survive. However, sometimes their coping strategies are inadequate and then they have serious difficulties in meeting their basic needs, educating their children and generating sustainable employment opportunities. Nevertheless, there are clear signs that within their local knowledge they have a tremendous potential for restoring the economic and ecological balance.

The Honey Bee network

Ten years ago, this awareness motivated me and some of my former students and colleagues to set up the Honey Bee network. Metaphorically the Honey Bee represents the ethical and professional values that most of us often neither profess or practise. A honey bee does two things that we intellectuals often fail to do: it collects pollen from the flowers and they do not complain, and it connects flowers in pollination. In the Honey Bee network, it is a matter of principle that we always credit the knowledge we collect from people and we share any benefit that arises from this knowledge fairly with them. We insist that this knowledge is transmitted in vernacular languages thus ensuring people-to-people communication. Honey Bee is a knowledge centre/network pooling solutions developed by people working in different sectors from all parts of the world. It creates links not only between people but also between formal and informal science. Honey Bee has collected over 10,000 examples of contemporary innovations and outstanding examples of the use of traditional local knowledge in the sustainable management of natural resources. These innovations are shared with local communities and individuals in over 75 countries through the Honey Bee newsletter which is issued in eight different languages (English, Spanish, Hindi, Gujarati, Tamil, Kannada, Pahari, and Telugu. SRISTI (Society for Research and Initiatives for Sustainable Technologies and Institutions), a global NGO based in India, was set up in 1993 to provide support to the Honey Bee network.

Of course, people cannot solve all their own problems and sometimes the solutions they find will be inadequate. Often there is scope for adding value and improving efficiency and effectiveness. However, it is clear that a development strategy that does not build upon what poor people are rich in, their knowledge, institutions and creativity, will never be ethically sound, professionally accountable or efficient.

Finding the odd balls

Our local innovation database has been developed using methods and approaches that people can use without much difficulty. We believe that learning has to be mutual and patient. The categories used must be those that people work with in defining their worldview. What Honey Bee has done is quite simple. During their summer vacation we ask students to help us find the odd balls, the farmers in the villages who are experimenting and doing things differently. Many of these farmers have found very creative and innovative solutions to their problems. The unusual thing about these innovations is that they remain so localised that even farmers in the same village sometimes do not know about them. However, this lack of diffusion does not mean these innovations lack validity.

We use several other methods to scout out innovations including competitions among functionaries of agricultural departments, NGOs, and educational institutions and information stalls in cultural and agricultural fairs. 'Shodh Yatras' or walks through the villages are organised every year in summer and winter for ten days to identify as well as honour the innovators and traditional knowledge experts at their doorstep.

We have come across technological, socio-cultural, institutional and educational innovations that contribute to the conservation of local resources, generate additional income and reduce or prevent losses. Farmers have developed unique solutions for controlling pests or diseases in crops and livestock, conserving soil and water, improving farm implements, various kinds of bullock carts for performing farm operations, storing grains, conserving land races and local breeds of livestock and conserving aquatic and terrestrial biodiversity. Below are some examples.

Strip-sowing equipment

Amrutbhai Agrawat, an artisan, makes farm implements in Pikhor Village, Junagadh District, Gujarat. He had developed several innovative farm implements including a wheat-sowing box and a groundnut digger. In most sowing equipment, the seeds fall on the ground through the lowest pipe-shaped portion. The spacing devices are located in the seed box. In dry windy regions, lodging can be a problem in irrigated fields. Amrutbhai devised a box that spreads the seeds in a strip. While the seed rate remains constant, the distance between the seeds is increased and they do not fall on one another. With better root growth, there is more efficient nutrient uptake and the crop does not lodge. With a stronger root network, the crop is better able to withstand water stress and also does not lodge. Similarly, the groundnut digger was designed with the help of a flexible blade hoe that allows the distance between the two rows to be changed and the depth at which the hoe enters the soil to uproot the groundnut pods to be adjusted.

Venture capital

Amrutbhai also tackled another centuries old problem. On most tropical plains, farmers cart farmyard manure to the field. They have to spread the manure by carrying it by basket to the right place. This demands much time and labour. By modifying the bullock cart Amrutbhai created a cart that the farmer could easily tilt so he could gradually distribute manure single-handed over the entire field. He discussed the idea with us and defined the risks. This was an idea worthy of the support of Venture Capital Fund (VCF). There are many programmes on micro-finance but no program on micro-venture finance. SRISTI recognised the gap and, with the support of a grant from the International Development and Research Centre (IDRC) and using its own resources, decided to experiment with the VCF idea. A proposal was prepared and reviewed and the cart was developed through a small risk-taking venture of Amrutbhai and SRISTI.

Later, this innovation received support from the Technoprenurial Promotion Program (TePP) of the Department of Scientific and Industrial Research through the efforts of Gujarat Grassroots Innovation Augmentation Network. GIAN helped in filing the patent on behalf of the innovator and in licensing the innovation to three entrepreneurs for five districts and for five years netting about US$ 2,000 as a license fee to Amrutbhai.

Many other ideas and inventions remain undeveloped or inadequately developed because there is no VCF to support them.

Cross-cultural exchange

This knowledge has great potential for generating cross-cultural and regional linkages. For instance, pastoralists in Mongolia make an animal lick out of onion leaves with wheat germ, sodium bicarbonate and dried milk. This lick is rich in selenium. Selenium deficiency, for example, can cause young calves to die prematurely. When the Honey Bee network idea was discussed with Akwasasne people in Canada it emerged that they had a livestock problem which could be traced to selenium deficiency. This shows the potential of the Honey Bee network: a practice in Mongolia, documented by a professor in Scotland and published in Honey Bee, was made available to indigenous peoples in Canada and provided a possible solution to local problems.

Rewarding creativity

The intellectual property rights of local communities and individuals have often been usurped by national and international corporations and professionals without any regulation or restriction. Not only were the contributions of local knowledge not recognised but when profits were made nothing was shared with the people. An example of unfair extraction: about 70% of plant-derived human drugs are being used commercially in the same way as they were used by the native people who discovered them. What modern science did was to improve the method of extraction or develop a synthetic analogue of the compound. The basic R&D was done by the people but they were never compensated.

There is a clear need to correct the unfair and unjust system of extracting local knowledge from people for corporate benefit. It should be noted, however, that many local communities do not necessarily seek material rewards but this is no reason for keeping people poor.

International registry

At present, any innovation once published comes into the public domain and becomes non-patentable. At the same time, people-to-people networking requires dissemination of ideas in numerous different languages to promote learning and experimentation. An international innovations registry INSTAR (International Network for Sustainable Technologies Application and Registration) was set up to prevent conflict developing between the need to protect intellectual property rights and dissemination for people-to-people networking. This registry, like the ISBN number for books, can provide a quick and inexpensive way of gaining some protection (say for ten years) for innovations. Later, with the help of an international fund for promoting sustainable technologies, more detailed patent applications could be filed on behalf of the innovators. Securing benefits also may raise the interest of younger people in green technologies, which may help this knowledge system not just survive but grow.

Recently, the Government of India has set up the National Innovation Foundation to make a national register of innovations, help link innovations with investment capital and enterprises, and to forge links between formal and informal science. Perhaps the time has come for setting up a Global Innovation Foundation as well.

Restructuring required

For most marginal communities in fragile environments, the standardised solutions developed for high-potential "green-revolution" regions are unworkable. However, in general there are no organisational arrangements that provide incentives to encourage scientists to work with the people to develop technologies that limit the potential for diffusion. Restructuring of international and national research organisations is required if technology development and diffusion is to become relevant and meaningful for marginal environments and disadvantaged communities. The Honey Bee network, with its limited resources and experiences, has demonstrated that such a transformation is feasible.

■

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LEISA

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COVERPHOTO
The cover photo shows W/ro (Ms) Tsige GebreAbezgi who lives in Central Tigray, in the small hamlet of Adi-Nefas, in the village area Maybrazio. The Latin name of the local plant Da"kuia in the picture is not known. She introduced this wild species to protect her fruit trees from termite attack.
Photo: Fetien Abay

The editors have taken every care to ensure that the contents of this Newsletter are as accurate as possible. The authors have ultimate responsibility, however, for the content of individual articles.

The editors encourage readers to photocopy and circulate Newsletter articles.

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Dear Readers

This is a special on 'farmer innovation'. In earlier issues, innovations developed by creative farmers without the support of development programmes have been regular features. But never have we devoted an entire issue to farmer innovation. Having often experienced that conventional research does not 'deliver the goods' for smallholder agriculture, an increasing number of farmers and development workers are building on local innovation, experimentation and communication.

This issue bears witness to the creativity of farmers. It also shows how they can be inspiring communicators using different media. Participatory Technology (including institutional) Development, Farmer Field School and Farmer-to-Farmer approaches are presented as powerful complementary ways to enhance farmer innovation and, thus, to develop Low-External-Input and Sustainable Agriculture. Readers are invited to support this ongoing process through regional farmer-to-farmer movements and international exchange of practical information on local innovation.

The theme of this issue was suggested by members of the Indigenous Soil and Water Conservation (ISWC) programme working on farmer innovation in several Anglophone and Francophone countries in Africa. Two members of this network, Nourreddine Nasr of the Institut des Régions Arides in Gabes, Tunisia, and Ann Waters-Bayer of ETC Ecoculture in the Netherlands, are guest editors. Beside the regular English and Spanish editions, there will also be a French edition.

The next issues of the ILEIA Newsletter will focus on intensifying agroforestry (deadline 15 August), ecologisation of monoculture (deadline 15 September) and resilience of agriculture (deadline 1 December). For further information, please turn to the back cover. Your contributions are most welcome!

The editorial team

ILEIA is the Centre for Research and Information on Low-External-Input and Sustainable Agriculture. It seeks to exchange information on LEISA by publishing a quarterly newsletter, bibliographies, and books. ILEIADOC, the data base of ILEIA's documentation centre, is available on diskette and on ILEIA's Homepage: http://www.oneworld.org/ileia. Back issues of the ILEIA Newsletter are also available on ILEIA's website.

LEISA is about Low-External-Input and Sustainable Agriculture. It is about the technical and social options open to farmers who seek to improve productivity and income in an ecologically sound way. LEISA is about the optimal use of local resources and natural processes and, if necessary, the safe and efficient use of external inputs. It is about the empowerment of male and female farmers and the communities who seek to build their future on the bases of their own knowledge, skills, values, culture and institutions. LEISA is also about participatory methodologies to strengthen the capacity of farmers and other actors, to improve agriculture and adapt it to changing needs and conditions. LEISA seeks to combine indigenous and scientific knowledge and to influence policy formulation to create a conducive environment for its further development. LEISA is a concept, an approach and a political message.

Grassroots innovations for survival

Anil K. Gupta

Honey Bee

The Honey Bee network has collected over 10,000 examples of innovations and examples of traditional local knowledge in the sustainable management of natural resources. These are shared with farmers and scientists through the Honey Bee newsletter. The author presents some of these innovations. Given the unjust practice of extracting local knowledge from people for corporate benefits the author stresses the need for an international registry of farmer innovations and the restructuring of international and national public research.


Photo: Laurens van Veldhuizen

9

Forging partnerships with innovative farmers

O.T. Kibwana

The Indigenous Soil and Water Conservation Programme (ISWCP) focuses on discovering and promoting farmer innovation in Burkina Faso, Cameroon, Ethiopia, Tanzania, Tunisia, Uganda and Zimbabwe. Kibwana discusses the different steps involved in ISWCP in Tanzania in which governmental and non-governmental research and extension organisations participate. Awareness among participants was raised, innovations were identified, analysed and documented and a start was made with Farmer-to-Farmer exchange and Participatory Technology Development

Gafsa regional radio

Noureddine Nasr, El Ayech Hdaidi and Ali Ben Ayed


Photo: Chris Reij

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By early 1999, a growing number of innovators in dryland farming had been identified by ISWCP in Tunisia. Visits of farmers to innovators were organised, and some of these were broadcast on national TV. However, the major strategic activity was a weekly regional radio programme on "Agricultural and Innovation". This radio programme not only invites farmers to present their innovations for farmer-to-farmer exchange. It also involves researchers, training specialists and development agents in debates about the innovations to create links between farmer innovators and formal research and extension.

Farmer experimentation: a challenge to all!

Henri Hocdé, David Meneses and Byron Miranda

Since 1994, PRIAG in Central America has facilitated and strengthened farmer innovation through documentation, participatory experimentation, communication and organisation. By describing some of the practical approaches of the programme the authors show how farmers are being empowered and take the lead to develop topical and regional networks for farmer-to-farmer exchange, farmer experimentation, communication and planning. This approach is a real challenge for all as it requires new working methods for a 'learning dialogue' between farmers, scientists and the other stakeholders involved.

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CONTENTS

Photo: Laurens van Veldhuizen

Christina Karuru in Kenya experimenting with integrated agriculture.

From the regional newsletters

LEISA INDIA INLAY

The second issue of **LEISA India Inlay** ***Stakeholders in research*** reported on experiences with low-external input-practices and research. It complemented the India section in the ILEIA Newsletter 15.1/2 *Finding Common Ground.* **India Inlay** contributors from a wide variety of backgrounds focused on the various stakeholders in research. The initiatives reported were essentially collaborative efforts between institutions, NGO networks and farmers. Articles covered farmer-centred PTD; the structure, functions and ideologies of the large Tamil Nadu LEISA network; farmers experimenting with methods to achieve sustainable groundwater usage; three cases of collaborative PTD in the field; participatory technological innovations, such as the development of seed drills, and a column by a well-known organic farmer discussing the role of livestock in sustainable agriculture.

The response to the **Inlay's** research issue has been encouraging. This has been reflected in the specific responses received as well as a steadily growing number of subscribers. Formal research organisations too are showing increasing interest in the **Inlay's** content.

New website: For readers interested in the environment and development debate in India there is the new **Centre for Environment Education** site: www.cee.envirodebate.org

For more information: KVS Prasad, PO Box 7836, Bangalore, 560078, India
E-mail: amebang@giasbg01.vsnl.net.in

El BOLETIN DE ILEIA

On the western slopes of the Andes and in other dry and semi-arid areas of Latin American, water scarcity is a daily challenge. Desertification in this part of the world is the history of how large areas of dry forests became desert and how agricultural soils have been eroded. The main and most intensive cause of desertification is the misuse of natural resources. Inappropriate settlement patterns and methods of production - both rural and industrial –have deliberately disregarded the insights and experiences of indigenous and local knowledge on conserving water in dry regions.

Desertification is largely a problem in the South. Here LEISA can contribute to reducing its risks.Through El Boletin, international and regional experiences of working to combat desertification are being exchanged. Indigenous wisdom and local scientific knowledge is being shared to the benefit of stakeholders in comparable agroecosystems. El Boletín editors are anxious to receive news and personal experiences from our readers in Latin America and other continents. Recently we received a letter from Abdella Dawuo Yusief of Ethiopia, who is interested in sharing and receiving information on animal breeding and particularly the production of cattle and poultry in dry areas. Readers who would like to exchange experiences with him should write to: Babile Agricultural Development Office, Abdella Dawuo Yusief, Babile past. Agent Babile - Eastern Hararge, Babile, Ethiopia.

One of readers has written to tell us that he has included an article from **El Boletin** in his doctoral thesis (Agricultores e investigadores en camino hacia el manejo integrado de los nutrientes, Laming, J. et al p6-8). We are delighted to share information and knowledge on low-external-input and sustainable agriculture in this way. You can contact Dr Olman Quirós Madrigal, an agroforestry expert at: Dirección Regional Central Sur, Ministerio de Agricultura y Ganadería, Apdo. 85-6000, Puriscal, Costa Rica, E.mail: upap@grecia.infoagro.go.cr.

For more information on El Boletin contact:
Teresa Gianella-Estrems, LEISA El Boletin de ILEIA, c/o ETC Andes, PO Box 18-0745, LIMA 18, Peru.
Phone: +5112413787 Fax: +5114225769
E.mail: estrems@amauta.rcp.net.pe

Themes for the ILEIA Newsletter

June 2000 Vol.16-2.
Farmer innovation
Second deadline for contributions 1 April 2000.

September 2000 Vol.16-3.
Integrated agriculture
How can unsustainable slash and burn systems evolve in more sustainable and permanent integrated systems? How can such an evolution process be supported and what are the economic and social preconditions for developing integrated systems? Articles are invited on: eg examples of (indigenous) strategies to intensify agroforestry systems; the spiritual, cultural and social dimension of indigenous integrated agriculture; role of animals in integrated systems; value adding and marketing of indigenous or new crop, tree or animal products; economic comparison of the performance of integrated systems.
First deadline for contributions 1 May 2000.

December 2000 Vol.16-4.
Monoculture systems
How to make monocropping or monoanimal systems more sustainable? How to develop them into integrated systems? How to improve the production chain? Articles are invited on interesting examples of: ecologisation and intensification; diversification; integrated soil fertility management; ecological pest management; processing; input supply; product development and value adding; marketing. Deadline for contributions 1 September 2000.

March 2001 Vol.17-1.
Resilience of agriculture
How do farmers prevent disaster and react to the catastrophies of drought, flood, armed conflict, disease and economic crisis? How does this influence their farming and livelihood strategies? How do farmers deal with variability and risk? How can the resilience of farming and households be improved? What impact does labour migration have on farming systems and gender roles? How can women best adapt farming in areas of labour migration and still optimise benefits and ecological sustainability? How can gender roles be renegotiated? How can women farmers best be reached and supported? How can farming by refugees be supported? Articles dealing with such questions are invited. Deadline for contributions 1 December 2000.

You are invited to contribute to these issues with articles, suggestions for possible authors, and information on interesting issues, publications, training courses, meetings and Websites. An ILEIA style guide available on request or at www.oneworld.org/ileia. Please do not wait until the last minute to send in your contributions. Send them as soon as possible! Accepted contributions will be published in the ILEIA Newsletter or on the ILEIA Website.

A-WEEK COURSE: PARTICIPATION IN LOCAL DEVELOPMENT

Date: 5-9 June/11-15 December 2000
Location: Nijmegen, The Netherlands

Agromisa is a knowledge centre for the south, focusing on small-scale sustainable agriculture. Agromisa has been organising a course on Participation in Local Development since 1994. The A-week is an intensive five days course which aims to give an introduction to Participatory Approaches that can be used to facilitate local development. Topics that will be treated during the course are: RAAKS (Rapid Appraisal of Agricultural Knowledge Systems), PTD (Participatory Technology Development), PRA (Participatory Rural Appraisal), Theatre for Development, Monitoring and Evaluation and Intercultural Communication.The role of a development worker as a facilitator and the cultural problems that can be encountered will be highlighted. There will be group discussions and practical exercises. Applicants invited from those working in development programmes who have as yet little experience in using participatory methods. The course will take 20 participants and is conducted in English. The A-week is held twice a year. This year the course will be given from 5-9 June and from 11-15 December.

Fees: NLG 2950.00 or US$1500 for institutions; NLG 940.00 or US$470.00 for individuals. (Fees include meals, accommodation and course materials.) Local tailor-made courses can also be given on request.

For more information: Agromisa, P.O. Box 41, 6700 AA Wageningen, the Netherlands, tel. (+31) 317 412217, fax (+31) 317 419178, E-mail: agromisa@wxs.nl

AGROMISA QUESTION AND ANSWER SERVICE

Land degradation concerns

Agromisa has received many questions on problems of land degradation. Soil and wind erosion, soil depletion, watershed management and water harvesting are issues that effect the sustainability of farming communities throughout the world. UNEP estimates that, every year, nearly six million hectares of previously productive land in arid, semiarid and dry sub-humid areas loose their capacity to produce food (Atlas of Desertification, UNEP, 1992).

The question

Last year, for example, we received a detailed six-page request for advice from a non-profit technical centre in Malawi. The centre provides practical knowledge and skills on different aspects of land use to small holders (including women groups). Soil erosion, declining soil fertility, inappropriate soil use, and food insecurity were becoming major problems. Due to a decline in soil fertility, the expense of chemical fertilisers and pesticides, yields from maize, beans and sweet potatoes, the three main crops, were in decline. Forested areas were shrinking as the villagers' demand for agricultural land, poles, fuel wood, and timber for sale increased. In the absence of adequate reforestation and regeneration plans, soil erosion and a falling water-table were becoming serious issues.

The Answer

Agromisa's advisors prepared detailed replies on each of the issues raised. From the letter it was clear that crop rotation was not common in the area. Adequate crop rotation to assist soil fertility and help against pests was there fore stressed. It was suggested that some catch crops and biological pesticides like fish bean, effective against caterpillars, should be used. When maize is harvested substantial amounts of nutrients are removed (especially nitrogen). It was suggested that a nitrogen fixing crop like beans should be used before maize was planted.

Strategies for increasing self-reliance were recommended such as reducing dependence on high-cost inorganic fertiliser inputs, for example. Composting, agro-forestry and promoting soil fertility were offered as alternatives. Organic farming and agro-forestry are indispensable techniques for small-scale farmers in the tropics. The main goals of organic farming are to keep the nutrient-cycle in equilibrium and to maintain soil fertility. Adding chemical fertiliser to the soil year after year has a negative effect on soil structure because soil organic matter declines. Agromisa's advice stressed the importance of soil organic matter; increasing water-holding capacity, the release of plant nutrients, the better storage of nutrients and improved soil workability. A good topsoil cover is important to minimise the loss of external inputs. Uncovered dry soil can be blown away by the wind or washed away during rain. Soil cover can be provided by a crop or by crop stubble and residues. Farmers working on steep slopes were advised to use crops, shrubs and trees along the contour lines to reduce soil erosion. To benefit from the crops used, legumes (nitrogen fixation) are recommended as contour planting.

In March 2000 Agromisa will join forces with several other Question and Answer Services to increase the number of experts available to answer your questions. More about this next time. The next issue of the ILEIA Newsletter looks at **Farmer Innovations** (see p36). If you have questions on this subject, please write to us at: Agromisa, Postbus 41, 6700 AA Wageningen, Fax: + 31 317 412 217, E-mail: Agromisa@wxs.nl

Agrodoks on problems of land degradation

The demand for information on desertification or land degradation related topics has been such that Agromisa has developed a set of practical booklets in its **Agrodok** series.

- Agrodok 2 **Soil fertility management,** Laura van Scholl, 1998
- Agrodok 8 **The preparation and use of compost,** M.Inckel et al, 1998
- Agrodok 11 **Erosion control in the tropics,** Hil Kuypers et al, 1999
- Agrodok 13 **Water harvesting and soil moisture retention,** J. Anschutz et al, 1997
- Agrodok 19 **Propagating and planting trees** , H.Schreppers et al, 1999

NLG65 or US$32 per set. NLG13.00 per copy from Agromisa (inc. postage).

TO ILEIA SUBSCRIBERS

Privacy of information

ILEIA sometimes gets requests from local NGOs, publishers and other concerned with sustainable development issues for the names and addresses of those Newsletter subscribers who might be interested in working with them or receiving information from them. In principal ILEIA wants to encourage this sort of networking and we would like to put people in touch with one another. At the moment, we work within the laws governing the privacy of personal information and we do not pass on the names and addresses of our subscribers to third parties. However, we want to encourage the flow of information and experiences on LEISA whenever possible. We would therefore like to have your permission to make your name and address available to selected organisations involved with LEISA and sustainable agricultural issues when the occasion arises. If you object to us passing on this information please let us know by 1 June 2000. If we do not hear from you, we will assume you have no objection to us passing on your name and address.

Address to contact is: subscriptions@ileia.nl or ILEIA Foundation, PO Box 64 3830AB Leusden, The Netherlands, or phone +31 33 4943086

New subscription policy

ILEIA's has a new subscription policy. From 2000 a yearly subscription will cost EURO 25.00 or US$25.00. Organisations and individuals in the Third World EURO10.00 or US$10.00. Those who currently receive the Newsletter at a concessionary rate will go on receiving it free of charge until arrangements have been made for them to pay a local rate in their own currency.

For further information about subscriptions please contact Nicole Kunz, Subscriptions, E.mail Subscriptions@ileia.nl; ILEIA PO Box 64 3830AB Leusden, The Netherlands

Websites on desertification: What can they offer?

Internet is promoted as being able to bring a solution to all the problems we have in technology development as far as information is concerned. Indeed, the seemingly free access to information offers tremendous scope. In practice, however, Internet has a relatively short history and many organisations possessing highly relevant subject matter information on combating desertification have not been able to put it all on their Website. The issue of copyright also plays a role. In the past, information had to be bought in the form of documents or advice, and provided a source of income for the owner or producer. Procedures and tools for buying information on Internet are steadily developing in the commercial sector. However, the non-commercial sector is still hesitating about investment. Website development is time consuming and funding is not always easy to acquire. As a result, there is a tendency to feature general information. To get detailed information direct contact must be made with the organisation concerned. Some websites resemble bulletin boards. Their announcements include documents on the texts of treaties and conventions, agendas and minutes of meetings, special events, addresses of relevant organisation including links to other sites. Most websites allow the downloading of relevant documentation. This can contribute to the improvement of the exchange of information between interested parties.

Only a few sites contain databases. Some databases, mostly national or international public organisations or organisations sponsored by international donors, require that users be registered but do not demand payment. However, it often takes considerable time to find data that fit ones requirements. Down-to-earth information for practitioners at the local level is often poorly represented. The problem of information management was specifically recognised by the third Conference of the Parties (COP) to the Convention to Combat Desertification (CCD) held in Recife October 1999.

Beautifully styled sites and animated applications are often a hinderance because they slow down access and use. This is particularly so for those working with older and slower computers and/or confronted with an expensive and perhaps unreliable telephone infrastructure as is often the case in developing countries.

A selection of websites relevant to desertification is presented below. They have been chosen for their accessible, search capacity and possibilities for further linking.

Club du Sahel:
http://www.oecd.org/sah/
The Club du Sahel, a forum for reflection and dialogue of the Organisation for Economic Cooperation and Development (OECD) was set up in the 1970s after the great droughts in the Sahelian zone of Africa. The site is accessible in French and English. The site focuses on cooperation and exchange possibilities, and some links to more practice-oriented organisations are displayed.

Convention to Combat Desertification (CCD):
http://www.unccd.ch/
This easily accessible website is well documented and provides details on the convention, the secretariat, signatories and ratifications, official documents of the Conference of the Parties (COP) and Committee on Science/Technology, recent conferences, list of meetings, public information (eg. the CCD Newsletter and specific fact sheets can be downloaded) and links to other sites.

Center for International Earth Science Information Network Columbia University (CIESIN):
http://www.ciesin.org/
If you want to directly access the site in a text only version to save time and costs:
http://www.ciesin.org/index_text.html
CIESIN was established in 1989 as a non-profit, non-governmental organisation to provide information that would help scientists, decision-makers, and the public better understand their changing world. CIESIN specialises in global and regional network development, science data management, decision support, and training, education and technical consultation services. CIESIN is the World Data Center for Human Interactions in the Environment.

An interesting and easily accessible site although somewhat USA in focus. The site highlights links to other interesting sites and interactive databases on important development issues in the South. It also provides extensive information on desertification.

ELDIS:
http://www.ids.ac.uk/eldis/eldis.html
This is a gateway to online information on development in countries of the South funded by DANIDA. Coverage includes social, economic, political and environmental issues. ELDIS makes a qualitative selection of materials and structures it for easy access. Its comfortable search function makes it a powerful site and one worth starting with. It providing access to many relevant document and organisation sources.

Office of Arid Lands Studies (OALS):
http://phylogeny.arizona.edu/OALS/oals/oals.html
The OALS is a multidisciplinary teaching, research, and information unit at the College of Agriculture in the University of Arizona, in Tucson, USA. OALS conducts interdisciplinary programmes that address local, state, national, and international problems related to understanding, regenerating, and managing the world's arid lands. It runs the Arid Lands Information Center
http://ag.arizona.edu/OALS/oals/alic/resources/resources.html
which publishes the Arid Lands Newsletter (can be downloaded), maintains a specialised 30,000-item document collection and provides links to a good number of interesting relevant organisations. This site is worth a visit.

International NGO Network on Desertification or **Réseau International des ONG sur la Désertification** (RIOD):
http://riod.utando.com/
The RIOD network was set up in November 1994 by the NGOs that were involved in the negotiations towards the Convention to Combat Desertification, It was felt that NGOs and Community Based Organisations would be more effective in fighting desertification if they could exchange of information, experiences and ideas more easily. RIOD requested UNSO to provide assistance to strengthen the efficiency of the network. The global focal point is at the Environment Liaison Centre International (ELCI) at Nairobi. The whole site is in English and contains interesting links. Visiting recommended not only for those with an NGO orientation!

REDESERT:
http://www.mma.gov.br/ingles/SE/redesert/hdeserti.html
The site of the Desertification Information and Documentation Network in Brazil, it can be accessed in Portuguese and English. It describes amongst other things the CCD in relation to the Brazilian programme to combat desertification. It also gives information on other relevant institutions in Latin America and provides links to other sites. Apart from one reference to RIOD it has a strong emphasis on government institutions.

UN Development Programme, Office to Combat Desertification and Drought (UNDP/UNSO):
http://www.undp.org/seed/unso/index.htm
The UNSO is responsible for UNDP's work in desertification control and dryland management. Based at UNDP headquarters in New York, the UNSO team of specialists works within the Sustainable Energy and Environment Division (SEED). Interesting site with easily accessible and well-presented information on concepts, National Desertification Funds (for local level initiatives), an Environmental Information System, Drought Preparedness and Mitigation, the National as well Subregional and Regional Action Plans, publications and contacts and links.!

EarthAction:
http://www.earthaction.org/index.html
and its resources and links on
http://www.earthaction.org/en/resources.html
Because environmental destruction, hunger and war are global problems, there are some areas of policy-making where simultaneous, world-wide public pressure is urgently needed. EarthAction wants to generate the political will to solve them. Interesting site for those who involved with the policy and politics of successful environmental management. It contains interesting links to other useful sites.

ELDIS Conflict Guide:
http://nt1.ids.ac.uk/eldis/conl/cfl.htm
Informative site with many links to other sites with interesting information on conflict resolution.

Swiss Peace Foundation (SPF):
http://www.swisspeace.ch/
Interesting site for getting information on conflict resolution models as well as some links to other sites involved in conflict management.

The World Bank:
http://www.worldbank.org
A site with an enormous amount of information on a wide variety of development issues, eg environment, sustainable agriculture, dryland and water management, community-based natural resource management, decentralisation & local development, empowering producer organisations, WTO 2000 negotiations, etc. The site gives access to World Development Sources, the World Bank Publication Catalogue and the World Bank database JOLIS with information on publications, research, projects, policies, conferences and case studies. Links are only made to partner organisations.

Partnership in the elaboration of the National Action Plan

Juan Luis Merega

The development of partnership between governments and NGOs, a relatively new phenomenon in Argentina, is the result of increasing democratisation following the fall of dictatorship, fifteen years ago. However, the process of participation has not yet reached all levels. Not all areas of government have put into practice the widely proclaimed participation and partnership between government and civil society.

Reasons for success

In elaborating the National Action Plan against Desertification, the Argentine Government, working through the Soil Conservation Directorate has adopted an open and receptive attitude towards NGOs from the beginning of the process. The NGOs, for their part, have proved to be reliable actors and have been able to offer considerable help without compromising their own positions. This experience has been a success because of three positive factors:

- The Argentine NGOs were able to achieve an efficient mechanism for representation and organisation through the Argentine Chapter of the '*Reseau International de ONG sur le Desertification*' (RIOD-Argentina). The result has been that the participation of NGOs has not been limited to one or two privileged institutions. On the contrary, the structure of the network with the democratic election of representatives at national (Asociaci'on Civil Los Algarrobos), subnational (CENEP, FUNPROVE, AMAD and Fundaci'on Patagonia Natural) and provincial level has made it possible to develop a transparent structure that has integrated some thirty institutions. In this structure each of the parties is entitled to speak for all in the different consulting instances.
- Conservation Directorate consistently accepted suggestions and proposals from NGOs. It has discussed these openly in many different formal and informal situations. Partnership is not synonymous with equality, but the commitment of working together and preserving the peculiarities and contributions that each can offer has made it possible to enrich the whole process.
- The United Nations Convention to Combat Desertification (CCD) has had a catalysing effect on the Argentine process. Not only because the Convention promotes participation and partnership, but also because the Intergovernmental Negotiation Committee sessions provided a framework that motivated the beginning of collaboration.

The process

The Argentine National Action Plan process was implemented through a participatory methodology involving a significant number of people dealing with the management of natural resources. Farmers, agricultural producers, indigenous communities and technical experts from NGOs worked together with scientific researchers, professors, state officers and political leaders. Thirty preparatory meetings and regional workshops were held in the period 1996-1997. More than 2000 people, representing national, provincial and local government, NGOs, universities, research centers and producers' unions participated actively. The result of this process was a draft document that was discussed at a national plenary meeting where the final text was ratified.

Preconditions

As far as the NGOs were concerned, this process involved some special features.

- In the first place, the political will of the Soil Conservation Directorate should be emphasised. This political will proved essential to obtaining concrete and continuous results.
- Second, the NGOs had the capacity to prepare feasible proposals that avoided sterile rhetoric.
- Another important element is institutionalisation. In the Argentine case, this institutionalisation was achieved through the presence of NGOs in the National Plan Committee. Recently, this institutionalisation has been increased, as NGOs have accepted positions on the commission that monitors the development of the Programme.
- Finally, it should be emphasised that the partnership between government and NGOs should not be reduced to participating in a couple of plenary meetings once or twice a year. The process shows its real potential in informal and permanent contacts, in consultations on both sides, in the revision and preparation of combined documents and in mutual support.

Only the beginning

It is clear that the work is not over. On the contrary, it is only the beginning and there is still a lot to do. Perhaps the most important thing needed now is time. Time for this partnership to evolve and consolidate, time to face new challenges. But above all time to ensure that today's political will becomes tomorrow's effective state policy. There are still many difficulties that government and NGOs will have to face.

Undoubtedly, the government should take the actions needed to institutionalise the process without delay. In particular the National Desertification Fund should be implemented. This should be an agile mechanism at local level capable of mobilising and channeling enough resources from the national budget. It should also be able to activate international cooperation.

Pending matters

NGOs have still many matters to attend to. Perhaps the most important is to increase the participation of community based groups and poorest farmers and to reinforce public awareness. However, in spite of the fact that there is still much to be done, Argentine NGOs are determined to face the future with hope. The work that has been done so far has allowed us to lay the foundations for a solid collective structure that should enable us to achieve the sustainable development of the drylands.

■

Juan Luis Merega, Director Ejecutivo, Fundacion Del Sur, Cochabamba 449 (1150) Buenos Aires-Argentina, Tel&Fax: +54 1 361-8549 or 307-0545

The United Nations Convention to Combat Desertification

The Convention to Combat Desertification (CCD) is a UNCED convention. Unlike the Convention on Biological Diversity and the Framework Convention on Climate Change, the CCD is still low on the political agenda. Its potential and importance for sustainable development is generally underestimated.

The term 'desertification' falsely evokes the image of advancing deserts. While a desert is a unique ecosystem, desertified areas are not: they are disrupted ecosystems. Desertification means land degradation, loss of soil fertility and structure as well as the erosion of biodiversity in drought prone areas.

When the negotiations for the CCD started in May 1993, little was known about the dynamics of desertification and the social, political and economic aspects of desertification were poorly understood. Major causes of desertification are unsuitable, poverty-induced agricultural practices; monocultures; the use of agrochemicals; the neglect of traditional knowledge; overgrazing; deforestation; over-pumping; salinisation and climate change, resulting from the greenhouse effect. Land degradation in dryland areas results in increasing amounts of unproductive land. At the socioeconomic level social and cultural structures deteriorate, food security is lost, migration becomes prevalent as incomes prove increasingly inadequate and debts grow. All these factors undermine a community's capacity to exert self-determination and control over its own resources.

The CCD came into force in December 1996 and has been ratified by more than 150 states. Considerable research, awareness raising, monitoring, lobbying and finance will be needed before it is possible to implement it.

Some strong characteristics of the CCD are:

- participatory, bottom-up approach
- integrated approach and gender sensitiveness
- addressing global dimension of desertification
- linking environment and development
- partnership building between stakeholders
- linking to other conventions and relevant agreements to create synergy.

National Action Programmes

Those taking part in the CCD are obliged to make a National Action Programme (NAP) along the lines laid down in the Convention. In November 1999, the third conference of participants took place in Recife, Brazil. African countries reported on their progress in developing and implementing NAPs. Although all African parties had started on NAPs, only 10 had reached the implementation stage. Donor countries also reported on their activities in support of NAP at the conference. Their reports showed the difficulties of putting the concepts and policies of the CCD into practice. Major bottlenecks to the participation of local communities in the NAP process were shown to be inappropriate and unfavourable laws and regulations at state level, a lack of funding, experience, expertise and the necessary political will. Monitoring progress provides countries with the opportunity to correct the way NAPs are developing.

Argentina (Merega p7) is a good example of how raising awareness on gender issues has influenced the NAP. A few years ago, the NAP process in Argentina was not gender sensitive. Today, Argentina strongly supports the incorporation of gender issues into the NAP.

The International NGO Network RIOD

NGOs have been taking part in the negotiation process that lead to the CCD and have contributed positively and strongly to the text and content of the convention. In November 1994, NGOs established RIOD (a French acronym for the international NGO network to combat desertification), a network to enable the international exchange of information, the raising of awareness and to encourage learning from experience as well as North-South cooperation and joint activities. NGOs have been instrumental in initiating and setting up consultative structures at country and (sub-) regional levels. They have helped raise awareness, involve local communities and create links with local and national authorities, institutions and donors. Many NGOs have contributed research and capacity building to participatory methods.

In August 1999, five years after it had been set up, the first RIOD general meeting was held to review the objectives and structure of the network. One of the conclusions of this review was that as the constraints to implementing the CCD became more visible, it was necessary to emphasis lobbying, campaigns, the creation of synergy and international political action to compel the creation of more favourable environment for combatting desertification.

Structurally changes are being made to improve efficiency at regional level. In the past RIOD had national, sub-regional, regional and global focal points. In the new structure there will be more emphasis on focal points at the national level. Fifteen regional representatives will form a Global Coordination Committee (GCC) for international coordination.

The NGOs in RIOD have recognised that although activities to combat desertification are not new, the CCD approach has great potential. By putting the people of affected areas at the centre of the process and pushing for an enabling environment at the national and (sub-) regional levels, it may be possible to boost those development processes that create more sustainability in environmental, social, economic and political terms.

However, there are many pitfalls. The dangers that the CCD will become just another time-bound document slowly moving from the desk to the bookshelf or that it will turn into a talking circus are very real. There is also the problem of hidden agendas. It is therefore necessary to mobilise and join forces and take action when necessary. There is too much at stake to allow this opportunity to slip by.

■

Edit Tuboly, Caretaker Regional Focal Point Europe, Both Ends, Damrak 28-30, 1012 LJ Amsterdam, The Netherlands. Phone: +31 20 6230823; Fax: +31 20 6208049; Email: et@bothends.org

Reference
- **The United Nations Convention to Combat Desertification**. Secretariat of the Convention: Haus Carstanjen, Martin Luther King Strasse 8, D-53175 Bonn, Germany, Phone: +49-228-8151000.

(Names and addresses of caretaker GCC members can be obtained from the author)

NEW IN PRINT

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Farmers, NGOs and lighthouses: learning from three years of training, networking and field activities. *1998. 74 p. Sustainable Agriculture Networking and Extension (SANE), 201 Wellman Hall 3112, Berkeley, California 94720, USA.*
This report brings together the findings of the first phase of SANE, a network of regional and local NGOs in nine countries, all utilising an agroecological approach to assist small, resource-poor farmers in the establishment of sustainable farming systems. Central to the SANE programme is the "lighthouse", the concept of the agroecological sound farm or project, which serves to demonstrate the viability of the concept and spread the approach more broadly up to watershed, region or even country level. This diffusion was supported by the SANE programme by the training of NGO technicians in agroecological concepts and technologies, the strengthening of local institutional capacities and the establishment of new agroecological lighthouses. An overview of the first three years of this process is given and described in depth for the continents and countries involved in Latin America (El Salvador, Cuba and Peru), Africa (Senegal, Uganda, Cameroon and Mali) and Asia (Laos and the Philippines). A clear and open description of a difficult but valuable approach. (IHG)

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Farming like the forest: traditional home garden systems in Sri Lanka *by Hochegger K. 1998. 203 p. ISBN 3 8236 1293 X : USD 40.00. (Tropical Agroecology ; 9). Margraf Verlag, PO Box 1205, D-97985 Weikersheim, Germany.*
Karin Hochegger presents a detailed study of the forests gardens of Kandy in central Sri Lanka. She first examines concepts of nature and conservation within the context of the beliefs of the inhabitants. She then traces the history of Sri Lankan agriculture before, during and after the colonial period, and the important role that the traditional home garden continues to play in ensuring family food supply. Most of the book is devoted to a detailed ecological study of 158 gardens: floristic composition, ethnobotany, structural features, nutrient cycle and wild fauna. Hochlegger emphasises that "farming like the forest" maintains harmony between nature and mankind. The gardens had an amazing biological diversity: 640 species were identified in the 158 gardens. In three gardens in which the efficiency of production was examined, inputs were found to be extremely low (mainly labour for harvesting) and the various outputs provided most of the family's subsistence needs. She predicts that additional off-farm earning opportunities would give the traditional home gardens a chance to continue to survive in their full richness. If, with their increased consumer demands, farmers would want to live from income derived from the farm, they would have to devote more land to cash crops, and intensify gardening by using fertilisers and pesticides. The book is very much focused on botanical knowledge, both of the farmers and of scientists, and has several line drawings of plants by Shanta Jayaweera. This will be of particular interest to those interested in botany and natural farming. (AWB)

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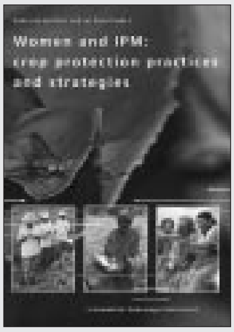
Women and IPM: crop protection practices and strategies *by Fliert E (van de) and Proost J (eds). 1999. 108 p. ISBN 90 6832 710 0 : DFL 29.00. Royal Tropical Institute (KIT), PO Box 95001, 1090 HA Amsterdam, The Netherlands, e-mail: kitpress@kit.nl; Intermediate Technology Publications (ITP), 103/105 Southampton Row, London WC1B 4HH, UK, e-mail: itpubs@itpubs.org.uk.*
This book builds on the different contributions made to the symposium on Gender Issues and Crop Protection, which was part of the 13th International Plant Protection Congress held in 1995 in The Hague, The Netherlands. On that occasion for the first time the importance of gender issues in crop protection was acknowledged. It soon became clear that most contributions related to integrated pest management (IPM) and that was probably not by chance. It is common



practice for women to do most of the day to day crop management, so the close monitoring required by IPM takes place quite naturally. IPM practices mean direct health benefits to the whole community, as the women, who prepare the food and bear the children, are protected against toxic pesticides. IPM cases from Bhutan, Vietnam, Indonesia, Costa Rica, Honduras, Zanzibar and Ghana are presented and other chapters deal with pesticide hazards and the role of women in the new agricultural economy in Russia. From the contributions it becomes clear that the IPM extension and training programmes should be made more accessible to women and they advocate the continuing support for IPM. The concluding chapter provides a broader view on the presented cases, including a plea for a new kind of external structuring of decision making, using mechanisms such as Farmer Field Schools. (IHG)

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Participatory rural appraisal and planning : workbook *by Selener D, Endara N and Carvajal J. 1999. 146 p. ISBN 9978 40 814 2 : USD 25.00. International Institute of Rural Reconstruction (IIRR), Apartado Postal 17-08-8494, Quito, Ecuador / daniel@iirr.ecuanex.net.ec.*
Guia practica para el sondeo rural participativo *by Selener D, Endara N, Carvajal J. 1999. 132 p. ISBN 9978 40 248 9. Instituto Internacional de Reconstrucción Rural (IIRR), Casilla Postal 17-08-8494, Quito, Ecuador / daniel@iirr.ecuanex.net.ec.*
This work book contains valuable experiences with the use of PRA tools in Latin America. It draws on the fieldwork of IIRR staff involved in participatory rural development activities, notably their activities related to participatory planning. The particular value of this workbook lies in the fact that it focuses on the action part of PRA, rather than the usual appraisal. That is why the authors refer to PRA as Participatory Rural Appraisal and Planning (PRAP). The book was written for technical staff of development organisations and for community leaders. The language is easy to understand and the wealth of practical experiences compiled in this book makes it a great asset to all development practitioners interested in the use of participatory methods. The book contains a general section explaining the concept of PRAP and its guiding principles and gives an overview of the results obtained by applying PRAP. It also indicates what the limitations are and discusses who, where and with whom PRAP should be applied. Time requirement for PRAP application and gender aspects are also treated in this section. In section two the PRAP tools are discussed in more detail. The information gathering and analyses tools are clustered according to their suitability; for collecting spatial information, time information, socioeconomic information, production and technical information, identifying problems and solutions, project planning. All tools are treated in a fixed format: What sort of tool is it, What are its uses; what kind of information does it contain and how is the tool applied? Apart from PRA tools, tools from other (project planning) methods are included as well. The last section contains two case studies, illustrating the process of problem identification and project planning in detail. The two examples give good insights and lots of ideas about how participation in the planning process can be enhanced. This is done by looking at crucial factors like process design, profile of participants/stakeholders and actual PRAP application. Each case concluded with a summary of the main lessons learned. (WvW)

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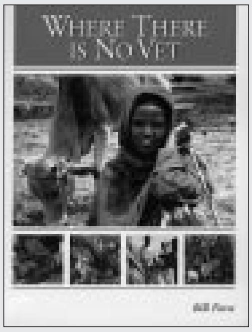
Where there is no vet *by Forse B. 1999. 368 p. ISBN 0 85598 409 0: GBP 14.95. Oxfam, 274 Banbury Road, Oxford OX2 7DZ, UK.*
Oxfam and CTA supported the preparation of this guide to first aid for animals. The author is a veterinary practitioner and farmer, and does a commendable job of explaining an impressive number of livestock diseases and their causes, symptoms and treatment. The numerous drawings make the text easy to understand. Although some information is



given on care, feeding and the handling of animals, the recommendations focus on curative measures. Important mechanisms of specific (often local) livestock species or breeds, such as tolerance or resistance to a particular disease, are mentioned only briefly. Anyone wanting to use the information provided in this book would need a good pharmaceutical kit and cooling facilities, as frequent reference is made to antibiotics, which have to be kept cool. If the antibiotics work, they can indeed lead to the animals making a spectacular recovery. However, their frequent use can stimulate the development of the disease agents resistant to antibiotics. This danger is not stressed sufficiently. Although it is clear that a general book on simple veterinary medicine for the tropics cannot cover ethnoveterinary treatment in any detail, it would be desirable if more emphasis were placed on local medicines which people can prepare themselves and which do not need to be kept cool. The book raises ambiguous feelings. On the one hand, it is desirable to have a reference work that deals with so many diseases and possible cures. On the other hand, it proposes diagnoses and treatments that require specific tools, such as microscopes, and treatments such as intravenous infusions, which require substantial skill and special materials. Where there are microscopes and infusion solutions, a vet is probably not too far away either. Despite these critical remarks, the book will doubtless be useful for field-based development workers, to guide them in making routine treatment and in handling emergencies. It frequently points to the limits of what can be done where there is not vet and where assistance from more experienced people is necessary. I hope that future editions will correct some of the errors that slipped through the proof reading, eg. in the illustration on page 297, the "zebu" cow has a conspicuously straight back, whereas the "N'dama" cow has a hump! (Wolfgang Bayer)

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Searching for women's voices in the Hindu Kush-Himalayas *by Gurung JD (ed.). 1999, 407p. International Centre for Integrated Mountain Development (ICIMOD), GPO Box 3226, Kathmandu, Nepal. E-mail distri@icimod.org.np; Web http://www.icimod.org.sg ISBN 92 9115 855*

This book contains 11 case studies carried out in villages in the Hindu-Kush Himalayas. The research was an ICIMOD initiative implemented under its Gender and Development 2000-2002 programme. ICIMOD set out to gain a deeper understanding of the views held by women living in the mountainous area that stretches from China to Alfganistan. The information collected was intended to facilitate more gender sensitive and constructive development planning in the region. Previous research had been conducted by 'professional researchers' who did not speak the local languages. This made it difficult for them to access the private lives and economic and civic position of the women in the various mountain communities. In this sense the ICIMOD research is unique. The women who conducted the three month study and the subsequent desk reviews of local and national policies not only spoke the local languages, but had grown up in mountain communities. They had gone on to further education and were now active in gender and development programmes in the area. As the editor admits, it was difficult to find researchers with this type of background. The book proceeds from the assumption that mountain women, although often more autonomous than women from the lowlands, are the main agents in resource management, yet they are socially, politically and economically disadvantaged and ignored. The book draws attention to the important role women play in the management of natural resources in the mountains and the impact their management practices have on lowland economies and natural resources. The book also stresses how their rich fund of local and indigenous knowledge can, if accessed, be of great value to those concerned with the development of the 140 million people who inhabit the Hindu-Kush. In many countries in the region the political status of women is uncertain. This is graphically illustrated by the editor who observes that data collection on women in Alfganistan was luckily completed before the Taliban took over. Such research by women on women would certainly never have been tolerated by such a regime. This is an accessible, factual and committed introduction to a little known region. This book provides a well-annotated and referenced introduction for those who wish to know more about the development problems of the Hindu-Kush and its women. (MMJ)

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Information exchange in networks: analysis of individual communication behaviour and communication structure *by Weiligmann, B. 1999. 211p, ISBN 3 8175 0288 5, DM63.00 Institut fur Landwirtschaftliche Betriebslehre der Rheinischen Friedrich-Wilhelms-Universitat, Bonn; Arbeiten zur Agrarwirtschaft in Entwichlungslaendern, Wissenschaftsverlag Vauk, PO Box 4403, D-24043 Kiel, Germany, www.vaux.de*

The reader will quickly realise that this book is an unedited thesis. Its subject matter is particularly interesting for those in development organisations who are part of, or responsible for, information networks. In development work, networks play an important role in facilitating the circulation of information and experiences. Weiligmann studied the Tanzanian Vegetable Production Network (TVPN) to establish the reasons for its success, stability and effectiveness. The TVPN is typical of a network in a developing country. Great distances and poor communication infrastructure are major problems in Tanzania yet the TVPN, set up in 1993 by the Tanzania Government and GTZ, has been able to improve communication flow in the horticultural sector. It now includes all the important opinion makers in Tanzanian horticulture and its members have been able to enlarge their contacts with many different types of people. Weiligmann's study shows that, to be successful, a network should be able to offer its members widely accepted, concrete targets; incentives to contribute information and be able to stimulate a sense of trust. TVNP invested much effort in arranging meetings, workshops and presentations where members could meet each other face to face. Working in an environment of information scarcity the greatest incentive to participate in the TVPN was this type of contact and exchange. The personal information networks of TVPN members who had studied, worked or had contacts outside the country were particularly valued. Weiligmann's study comes to two instructive conclusions. First, it seems that direct contact made at TVPN meeting and workshops often facilitated the acceptance of technological change. Second, in constructing networks in situations of poor infrastructure and over great distances, consideration should be given to emphasising small, subnational/regional networks rather than networks at national and international level. The book contains a useful bibliography on communication and agricultural innovation with particular reference to Africa. (MMJ).

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Organic cotton: from field to final product *by Myers D and Stolton S (eds). 1999. 267 p.ISBN 1 85339 464 5 : GBP 16.50. The Pesticides Trust, Eurolink Centre, 49 Effra Road, London SW2 1BZ, UK. Intermediate Technology Publications (ITP), 103-105 Southampton Row, London WC1B 4HH, UK E-mail itpubs@itpubs.org.uk.*

As cotton is one of the world's major cash crops, many farmers are confronted with the negative environmental impacts of its production such as reduced soil fertility, loss of biodiversity and especially the problems related to pests and pesticide use. Along the processing chain pollution also occurs, especially during the bleaching and dying of the cotton fabrics. This book describes organic cotton production and processing and is the first complete overview of its kind, since the first organic cotton was marketed some 10 years ago. Still in a rather preliminary stage, there are signs that it is moving into a mass market. The book provides a very good and complete picture of the insights gained up to now and it draws from case studies from all over the world. Besides cultivation (including the growing of genetically engineered cotton) and processing, economic and marketing aspects, the conversion process, certification and support requirements for projects are also discussed. Judging from questions about the environmentally friendly cultivation and processing of cotton that have reached ILEIA in recent years, we can predict this book will become a best-seller. (IHG)

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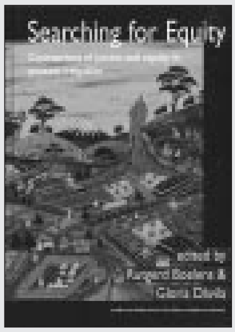
Searching for equity : conceptions of justice and equity in peasant irrigation *by Boelens R and Dávila G (eds). 1998. 472 p. ISBN 90 232 3385 9: USD 27.00. Van Gorcum, PO Box 43, 9400 AA Assen, The Netherlands. Buscando la equidad : concepciones sobre justicia y equidad en el riego campesino by Boelens R and Dávila G (eds). 1998. 506 p. ISBN 90 232 3386 7: USD 27.00. Van Gorcum, PO Box 43, 9400 AA Assen, The Netherlands*



This book is about equitable water distribution and appropriate water management in irrigation. In the field of irrigation it is the indigenous populations in particular who, although most involved, are losing control over the process of water management, as national policies and development interventions decide what should be done over their heads. So, the intricate diversity of equitable rules and practices grown in history and culture are pushed aside, resulting in an often less sustainable and more unequal water tenure. In the first part of the book many viewpoints related to equity, justice, power and peasant rights with regard to irrigation are presented. The second part goes into detail with a wealth of examples from the Andes. Fascinating reading, although the addition of some photo-material would have made it more tangible. (IHG)

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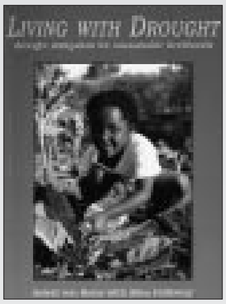
Manure management in the Kenya Highlands: practices and potential *by Lekasi JK [et al.]. 1998. 35 p. ISBN 0 905343 255. Henry Doubleday Research Association (HDRA), Ryton Organic Gardens, Coventry, CV8 3LG, UK.*

Description of a survey among 60 farmers cultivating high potential land in the Central Province, Kenya for their manure management and their perceptions of manure quality. Their livestock is traditionally kept in permanent confinement allowing the easy collection of excreta. Manure is highly valued as the crop cultivation is intensive and the purchase of artificial fertilisers is limited, due to the high costs. The purchase of stall-feed however, is common. This study reveals that due to the continuous intensification the need to enhance the nutrient turnover will become more important. Suggestions for improvement are given. (IHG)

'Participation villageoise au développement rural'. *'Réseau Africain sur les Approches Participatives'. 1999. KIT/World Bank, ISBN 90 6832 131 5. Distribution: ANANDER, BP V 183, Abidjan, Cote D'Ivoire; DIFOV, 03 BP 0712, Cotonou, Benin; DVA, BP 257, Antananarivo (101) Madagascar; DVA, BP 7018, Ougadougou, Burkina Faso; IER, BP 258, Bamako, Mali; IRAG, BP 1523, Conakry, Guinnee; Royal Tropical Institute (KIT) (contact: Aad Blokland), PO Box 95001, 1090 HA Amsterdam, The Netherlands; World Bank (contact: Jan Weetjens, AFTAI1), 1818 H Street, N.W. Washington, D.C. 20433, USA. An English version,* **Village participation in rural development,** *is expected to be published in May 2000. This publication can be ordered from KIT and World Bank.*
This is a Tool Kit for participatory rural community development consisting of a handbook, a set of 18 coated files with methodological tools and a trainers guide. The first part of the handbook explains the principles and steps of a participatory development process at community level. For each step methodological tools (eg mapping, semi-structured interview, transect, village history, seasonal calendar, visualisation and discussion of sensitive problems, problem tree, analysis of objectives and opportunities) are provided which help communities to better understand their situation, problems and opportunities, set priorities and objectives and plan effective actions. The diagnosis is at a general level giving space to whatever problems are being experienced by various groups of the population. Attention is also given to analysis and strengthening of institutions at community level in order to assist in the coordination of the implementation, monitoring and evaluation of planned activities. The second section of the book discusses the role of each actor, training needs and the necessary coordination and support required from the upper hierarchy. The last section discusses the consequences of the approach at the level of the national institutions involved in rural development. The objective of the trainers guide is to help trainers to design a participatory training programme to increase the skill of development agents to implement a community-based participatory development process and to use methodological tools. The training modules presented can be combined in various ways depending on need.
The Tool Kit is well designed, very readable and based on practical experience. Further development of the Tool Kit can be expected from the international support teams. For specific problems (eg health, water, soil fertility, soil conservation) additional, more focused learning tools are needed. (CR).



Living with drought : drought mitigation for sustainable livelihoods. *Learning pack comprising: a book and a video with three films: Letsatsi le eme (The sun is standing still), Banga dam and Mooka granaries by Kotze A (von); Holloway A. 1999. 206 p.; 29 min., 18 min., 14 min.; PAL. ISBN 0 86486 388 8; ISBN 1 85339 470 X : GBP 19.95. Disaster Mitigation for Sustainable Livelihoods Project (DiMP). David Philip Publishers, 208 Werdmuller Centre, Claremont 7708, South Africa, e-mail: dpp@iafrica.com; Intermediate Technology Publications (ITP), 103-105 Southampton Row, London WC1B 4HH, UK, e-mail: itpubs@itpubs.org.uk.*
The pack is a combination of participatory learning activities and written and visual case studies from 5 countries in southern Africa. The pack is the result of a participatory process that involved many different people from the region. The primary aim is to stimulate participants' thinking around issues of relief and development, and enhance their understanding of drought mitigation. The perception that drought is a disaster that ends with the next season's rains is challenged. As drought is a recurrent event in southern Africa sustainable development can be achieved only if drought mitigation is an integrated part of development practice, education and policy. The pack is intended for training of extension workers as well as for those involved in the participatory development of sustainable agriculture and in disaster management. It has been designed to be flexible, and to meet a wide range of training, education and facilitation needs. Users are assumed to have basic knowledge of the participatory learning processes.
The participatory learning process followed introduces learners to the terms and concepts of drought mitigation, understanding of vulnerability and risk including impact on women and children, and planning and implementation of community-based strategic drought mitigation. Practical options as well as institution-building, negotiation and policy advocacy are included as well as practical training materials. A very practical, participatory and user-friendly publication. More attention could have been given to assessment of traditional and recent indigenous strategies on coping with drought. (CR).

Farmer Field School on Integrated Soil Management, Facilitator's manual. *Produced by Farmer-centred Agricultural Resource Management (FARM) Programme 1998. FAO-RAP (ask the Regional Soil Management and Fertiliser Use Officer), Maliwan Mansion, Phra Atit Road, Banglumpoo, Bangkok 10200, Thailand, Phone: +66 2 281 7844; Fax: +66 2 280 0445; Email: FAO-RAP@fao.org*
The Farmer Field School (FFS) approach on Integrated Soil Management (ISM) has been successfully experimented with at field sites in China, Philippines, Thailand and Vietnam. This facilitators' manual was developed on the basis of these experiences. The objective of the manual is to assist facilitators by providing a basic framework and materials on FFS-ISM. The farmer field school aims to build each farmers' capacity to analyse their soil and other related crop management practices, to identify the main constraints, and to test possible solutions to their field problems, eventually identifying and adopting the practices most suitable to their farming system. The training materials help farmers to make their own decisions, to organize themselves and their communities, and to create a strong working network with other farmers, extension workers and researchers. The manual is meant for field-based extension officers, farmers' leaders and field-level development workers and their trainers and coordinators. It contains a large number of FFS-ISM exercises on general FFS related topics and a selected range of soil management topics.
Although the approach focuses mainly on fertility management, indigenous concepts of soil management are not well integrated (eg completely overlooking farmers own soil classification system) and linkages to related issues (eg. water, crop, livestock, credit) are few, the manual provides a very useful, instructive and flexible set of learning modules and reference materials. (CR).

Learning together through participatory extension, A guide to an approach developed in Zimbabwe *by Hagmann J, Chuma E, Murwira E and Connolly M. 1998. Harare: AGRITEX/GTZ/ITDG, 59 p. Order against mailing costs from: Universum Verlag, Germany, Order No. A-021-E, Fax: +49 611 9030556; Email: horst-dieter.herda@universum.de*
Learning together through participatory extension, A video to an approach developed in Zimbabwe. *Producer/director John Riber, executive producer Jürgen Hagmann. 1998, 42 min., English. Media for Development Trust, 135 Union Ave, POB 6755, Harare, Zimbabwe, Fax: +263 4 729066; Email: MFD@Mango.zw*
This booklet, written for field staff and middle-level extension managers, describes a community-oriented approach to rural extension based on farmer experimentation and learning. The action-learning cycle integrates four main phases: social mobilisation through a situation analysis carried out jointly by insiders and outsiders, community-level action planning, implementing of activities and farmer experimentation, and monitoring and evaluation through sharing experiences and ideas. A major focus is on local institutional development. The process in practice - with all its steps - is described and clarified through examples from the field.
The video shows the steps taken by a development agent in practicing a participatory extension approach (PEA) with farmers in Zimbabwe. The agent and the farmers together learn and develop innovations in technical and social fields. The video can be used to create general awareness of PEA or as an aid in facilitating training/learning programmes for extension agents.

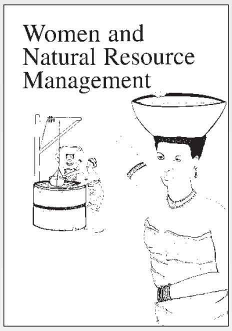
Holistic management: a new framework for decision making *by Savory A and Butterfield J. 1999. 616 p. ISBN 1 55963 488 X : GBP 24.95. Island Press, Washington, DC. Center for Holistic Management, 1010 Tijeras, NW, Albuquerque, NM 87102, USA. Fax: +1 505 843-7900; Email: center@holisticmanagement.org ; Website: www.igc.org/holisticmanagement.org*
This is the revised and updated version of the first edition of Holistic Resource Management published in 1988. The experiences of the many thousands of people now practicing Holistic Resource Management have strongly

enriched this second version.
The framework developed by Allan Savory intends to help people and communities to make better decisions on how to use their natural resources based on the perception that humans, their economies, and the environment are inseparable. The people involved start with defining all their resources under management and a common vision that reflects what they genuinely value and hope to accomplish. At the heart of the approach lies a simple cyclic testing process that enables people to make decisions that simultaneously consider economic, social, and environmental realities, both short- and long-term. A number of critical tools and management guidelines have been identified to influence ecosystem processes in such a way that optimal win-win results can be expected. Originally the framework was developed for holistic herd and range management in semi-arid regions for which Allan Savory had developed a challenging new approach. In this second edition of the book ideas for environmentally sound crop management are presented. Much attention is given to the holistic planning of land and financial resources. The use of the holistic management model is now being expanded to business and policy as well. The book presents a creative, practical and holistic approach to the development of sustainable resource management. Holistic Management has become very popular in the USA but is now re-discovering its roots in Southern Africa. By merging Holistic Resource Management framework with the participatory approaches for development of sustainable agriculture – livelihoods both could benefit considerably. (CR)

Changing views on change: participatory approaches to monitoring the environment *by Abbot J and Guijt I, 1998. SARL Programme Discussion Paper 2. International Institute for Environment and Development (IIED), 3 Endsleigh Street, London WC1H 0DD, UK. Email: bookshop@iied.org £8, available in English, Portuguese and Spanish.*
The booklet is a review of participatory approaches to tracking biophysical changes in projects focusing on environmental regeneration and draws on published literature, interviews with practitioners and experiences of action-research project in Brazil. It examines the roles of different stakeholders at each stage of the monitoring process. Wide interpretations of these roles and diverse purposes of monitoring have led to many forms of participatory monitoring. Compromise is inevitable when stakeholders with different expectations come together. Supposed trade-offs, eg. between scientific rigour and maintaining local participation are discussed. The book describes methods 1) based on visualisation techniques of PRA, 2) that use oral testimony to understand patterns of environmental change, and 3) that adapt methods of ecological assessment for use by local people. Ten experiences of monitoring are compared in terms of the role of local people in the process. The review highlights several areas for future research and improved practice in the participatory monitoring of environmental change (IHG).

Microplanning manual for joint forest management areas *B Singh & Varalakshmi (eds.). 1998. 112 p. ISBN 81 85419 45 0. TERI, New Delhi 110 003, India.*
The leading concept of this book is that local communities can effectively exploit forests while maintaining the regenerative capacity for sustained production. Genuine involvement of all (groups of) people concerned at the level they can practically manage, is seen as the key condition for success. In addition to the need for changing the roles and attitudes of extensionists (from conveying messages to facilitating communal processes), the basic tools for the different phases of participatory diagnostics are described including PRAs, transect walks, village profile or ranking. Special attention is given to different types of maps for resource use, forest conditions, forage conditions, soil erosion, command area for water harvesting purposes. The final outcome of the diagnostic exercise is the management map visualising the ideas for the agreed intervention. The appendices providing details of various formats used in specific cases, serve as practical examples to be used and adapted by the reader in other situations. (KM)

Capacity building: an approach to people-centered development by *Eade D. 1997. 226 p. ISBN 0 85598 366 3 (pbk) : USD 14.95. Oxfam. Oxford OX2 7DZ, UK.*
This book builds on the experiences gathered in Oxfam's numerous projects and programmes in analysing capacity-building issues. Thus, capacity building should start from essential principles such as people-centeredness, acknowledgement of human rights, empowerment and participation, interdependence between people and societies, sustainability and the acceptance that social change may involve risks. The book goes on to elaborate consequences for the orientation, contents and methodology of investments in people, organisations, and networks. The special chapter on capacity building in crisis situations introduces the concept of "capacities and vulnerability analysis" stressing the necessity to carefully balance the complexity and extent of intervention activities with the existing capacity in the societal groups concerned. Worthwhile reading if you are motivated by the "why to" question and involved in the debate (either individually or with other people) on the potential role of capacity building towards genuine development. (KM)



Women and natural resource management: a manual for the Africa region *C Jackson, McCracken J, Kabutha C and Ogana W. 1996. 176 p. ISBN 0 85092 465 0. Commonwealth Secretariat, London SW1Y 5HX, UK.*
The four sections of this training module subsequently address general introductory issues, lessons learned from rural women, women's organisations for conservation and conservation techniques. The book does not aim to be a cookbook that has to be followed precisely. It gives ideas, proposes methods and depicts specific tools but always invites adaptation and experimentation. Section two of the book contains the central message and provides an explicit and elaborate account of ways and means to learn from rural women. The third section describes in detail six case studies for different agroecological zones in Anglophone Africa. Because it depict many farming techniques rather succinctly, Section Four somewhat underplays possible limitations. The special notes for trainers at the end of each chapter provoke reflection on how to set up relevant training in the different fields. Even though it is a reprint of a 1992 manual, much of the information is still valid. (KM)

Africa's valuable assets: a reader in natural resource management *by Veit P (ed.). 1998. 447 p. ISBN 1 56973 258 2: USD 40.00. World Resources Institute, Washington, D.C. 20006, USA.*
A sociopolitical perspective on the state of Africa's natural resource management. Optimistically highlighting the availability of resources and the opportunities for future use. It analyses in generic terms basic aspects of development over the past decades and definitely contests the view, often adhered to in America as the authors state, that Africa is far from being a flourishing continent. Large amount of national data on economic indicators, development aid, population dynamics, education, health, land use, ratification of international conventions as well as human rights are presented to support the analytical chapters. The latter cover a wide range of issues such as participation, ownership and accountability, roles of GOs and NGOs, legislation and the mutual relationships between global agreements and national development priorities. Improved communication, nationally and locally but also through electronic networks, is seen as an essential element for the continuation of positive impacts. All chapters end with conclusions and/or recommendations which, by the nature of the Sub-Saharan focus, are somewhat general. Recommended if you are interested in the political dimensions of natural resource management. (KM)

Participatory forestry: the process of change in India and Nepal *by Hobley_M, 1996. Rural Development Forestry Study Guide 3, 337 p. ISBN 0 85003 204 0 : GBP 14.95. Overseas Development Institute (ODI) Regent's College, Inner Circle, Regent's Park, London NW1 4NS, UK.*
This publication analyses the historical evolution of forest management in India and Nepal from colonial exploitation to participatory forestry. Although there are many positive developments, Community Forestry and Joint Forest Management (JFM) have not been successful everywhere. To analyse the constraints the author raises the question of 'who benefits?' A multi-stakeholder and multi-resource approach needs joint micro-planning and innovative management. The complexity of the problems related to joint forest management are discussed from a technical and institutional perspective including scenarios for the future. Appendices are included describing exercises for use in training courses as

well as useful video material on the subject. (IHG)

Shared management of common property resources in the Sahel: a regional action-research programme

The SMCPR programme aims to research and identify how common property resources in the Sahel (eg community forests, rangeland) can be managed in an equitable, sustainable and peaceful way by the many people who rely on them for their livelihoods. It was developed in response to difficulties expressed by many projects setting up natural resource management systems where resources are important to both nomadic and sedentary groups. Mobile groups, and transhumant herders in particular, often depend on "village lands", "community forests" and other strategic resources, but their rights of access are being reduced. This is threatening their livelihoods, the sustainable use of the resource, and is contributing to conflict between different user-groups.

The programme works with seven operational projects in Niger, Mali, Sudan and Ethiopia. Four of these are forest-resource management projects, two are working specifically on pastoral development and one is working more generally on natural resource management in the context of decentralisation in Mali. All are working in areas used by pastoral and agricultural communities alike. The programme will research and identify natural resource management systems which take mobility and multiple user rights into account, and which reinforce local people's capacities to manage common property resources in an equitable, peaceful and sustainable manner.

A six-monthy Newsletter 'Browse' is being published to inform partners and other interested persons on the advances of the programme. A first issue has been published in September 1999 (CR)

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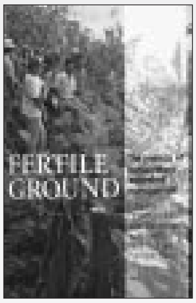
Alternative irrigation: the promise of runoff agriculture
by Christopher J Barrow, 1999. ISBN: 1 85383 496 3 (pbk) : GBP 15.95, 172 p. Earthscan Publications Ltd., 120 Pentonville Road, London, N1 9JN, UK. Fax: +44 171 278 1142; Email: earthinfo@earthscan.co.uk ; http://www.earthscan.co.uk

Runoff agriculture, the practice of concentrating surface runoff for cultivation, forestry, livestock or other human use, is being re-discovered as an alternative to conventional irrigation. Traditionally, this type of water harvesting has been widely used in drought-prone regions but due to changing economic, institutional and cultural conditions it fell into disuse in many places. This book gives an excellent presentation of the wide variety of techniques developed by farmers over thousands of years. A distinction is made between soil and water conservation techniques, runoff harvesting & storage techniques and flood water farming. Special attention is paid to the breakdown of traditional runoff agriculture (with an overview of the actual situation by country) and the opportunities and constraints for rehabilitation and expansion. The value of runoff agriculture and water harvesting in general have been widely demonstrated. Given the expected increase in drought and water shortage the relevance of runoff agriculture and this publication can be expected to grow.

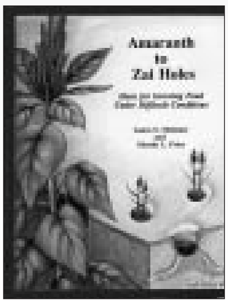


Fertile ground: the impacts of participatory watershed management
by Hinchcliffe F, Thompson J, Pretty J, Guijt I and Shah P (eds.). 1999. 385 p. ISBN 1 85339 389 4 : GBP 15.95. IT Publications, London WC1 4HH, UK.

This collection of case studies provides a wealth of information on different approaches and techniques in watershed management. The book covers resource conserving technologies and practices, enabling government policies, NGO led actions and institutional aspects. Concrete examples from all over the world illustrate the principal issues at stake in effective resource management aiming at long-term sustainability such as integrated soil fertility management, biodiversity management, scaling-up from village to higher levels, supportive policy measures, possible incentives and participation of all relevant actors in decision making. The cases do not present ready made solutions but provide informative insights into successful processes and techniques (as well as the necessary conditions for their application) which can support both GO and NGO initiatives in their endeavour to plan the proper management of watersheds and thus to avoid desertification. (KM)

Options for soil and farmer friendly agriculture in the Highlands of Northern Thailand
by Keer K (van), Comtois JD, Turkelboom F and Ongprasert S (eds.). 1998. 184 p. ISBN 3 9806467 0 X : DM 20.00. GTZ, 65726 Eschborn, Germany.

This easily readable final output of a collaborative effort between the Catholic University of Leuven (Belgium) and the Maejo University (Thailand) describes the highlands, their people and the way they manage soils, vegetation and animals and defines the challenges ahead. Part II depicts in considerable detail the practical lessons and principal conclusions to be drawn from the management of forests, fallows, crop residues, soil use (erosion control, nutrients) and pests and diseases. At the heart is the optimal use of locally available and affordable resources and methods. Part III then portrays challenges for the future of highland agriculture. Although the conflicting roles of protection and production seem to complicate sustainable highland development, an opportunity for creating the necessary balance is sought in the full incorporation of the idea of diversity: the best approach is to mix and match several of the various agricultural, ecological economic, social and cultural options available. (KM)



Amaranth to zai holes: Ideas for growing food under difficult conditions *by Meizner LS and Price ML. 1996. 404 p. ISBN 0 9653360 0 X : USD 29.95. ECHO, North Fort Myers FL 33917 2239, USA.*

If you are working directly with communities and farmers in the tropics or subtropics, and if you are looking for practical livelihood techniques, this book is warmly recommended! It is based on fifteen years of experience published in ECHO's exchange bulletins and is a real gold mine of data on general growth conditions, and the way they can be adapted for a multitude of staple crops, vegetables, fruits, and pasture crops. Furthermore, it describes basic aspects of healthy soil and water management under dry land conditions, mainly focusing on small-scale situations. The chapter on animal husbandry emphasises animals that usually receive little attention such as camels, bees, local chicken, fish and rabbits. However, it is too brief to be used as a basis for experimentation. However, this deficit is recognised by the publisher and covered by interesting references. The wealth of ideas and references in to more in-depth documentation (including audio-visual materials) and/or contacts for information or training make this book a valuable resource kit for practitioners however much experience they may have (KM)

Land tenure and resource access in West-Africa: issues and opportunities for the next twenty five years. *IIED. 1999. 44 p. ISBN 1 899825 31 2. International Institute for Environment and Development, London WC1H 0DD, UK.*

This report is part of a programme by the British and French governments. It divides the region into four distinct zones, ie the Gulf of Guinea, the Atlantic forests, the land-locked Sahel and the Atlantic Sahel. Typical topics are the contradictions between customary and statutory systems, the implications of gender sensitiveness, the impact of migration and urbanisation trends, the role of pastoral management systems and the possibilities and drawbacks of irrigation. Special attention is reserved for resource conflicts, especially in peri-urban areas, wetlands and areas where arable crop farmers have immigrated in large numbers. Two crucial elements in the management of common property resources are at stake. First, how can different user groups agree on the management, the degree of exploitation and on cost/benefit sharing? Second, how can governments successfully devolve sufficient and adequate powers to these groups in negotiating and enforcing agreed terms for resource use and management? Based on local consultations the report identifies three critical leverage points for a way forward: decentralisation, clarification of customary and statutory tenure systems and encouragement of local debate (KM)

Analysis and planning using Strategic Environmental Analysis

Jan Joost Kessler

Given the growing need for systematic participatory environmental analysis, planning and stakeholder coordination of activities to combat poverty and land degradation, AID Environment and the Netherlands Development Organisation (SNV) developed the Strategic Environmental Analysis (SEAN) methodological tool kit. In this article, the main characteristics of SEAN are discussed, using its application in Atacora Province in Northern Benin as an example.

Photo: JJ Kessler

Active community participation in strategic environmental analysis and planning.

In regions with limited economic potential where there are environmental problems such as desertification, there is a growing need for systematic environmental analysis to answer such questions as:

- What are the insights and interests of different actors as far as the proper management of natural resources are concerned?
- What level of land degradation is acceptable and can be considered as reversible?
- How can coalitions of stakeholders be formed to deal with the root causes of land degradation?
- Are there any so-called win-win opportunities that can improve both the economic and environmental situation?
- How can environmental priorities be integrated with economic, social and gender priorities?

In many places the absence of a clear vision of the future has led to confusion, lack of coordination and the setting of incorrect development priorities. This is especially so when many activities have been undertaken by different actors. Poor experiences with national environmental planning have made clear that the analysis and planning of rural development must take place at sub-national level and actively involve the population. There is a need to pay more attention to root causes rather than symptoms and to make use of existing opportunities, ongoing changes and the promising initiatives being taken at various levels.

SEAN has been designed to meet these needs. It is a comprehensive and practical methodology with the long-term objective of including environmental issues in development planning. Concrete short-term objectives are:

- to analyse the environmental context of human development, its potentials and constraints,
- to integrate environmental key issues with economic, social and institutional aspects of sustainable development,
- to provide inputs for planning sustainable development policies and strategic action plans during the early stages of decision making.

SEAN aims to achieve these results by initiating and supporting a participatory process of mutual learning and by generating insights and creating transparency on the complex interrelations between the environmental context and other dimensions of land use.

Box 1: Some key underlying factors for the environmental problems in Atacora

- Increasing incidence of drought even in sub-humid zones
- High-level of seasonal rural emigration and lack of investments of revenues in the area of origin
- Low-level of education among rural farmers
- Poverty and poor access to credit
- Lack of organisation and power in civil society
- Predominance of traditional regulations of access and control of land resources
- Leveling, a strong social phenomenon discouraging private initiative (jealousy)
- Prevailing negative elements of local traditions
- Poor organisation of production sectors other than cotton
- Limited income opportunities outside the agricultural sector
- Non-application of organic fertilisers to improve soil fertility
- Absence of a good pastoral legislation and planning in which relevant actors have been involved
- Poor quality of urban development plans, poor management of urban wastes
- Poor agricultural extension services

Procedural and analytical principles

There are a number of procedural and analytical principles relating to the application of SEAN. First, there is need for broad participation, including actors from different institutional levels (vertical integration) and different interest groups (horizontal integration). Analytical principles include, for example:

- the multi-functionality of the environment: elements (fields, trees, etc) have multiple functions and attract varied amounts of interests from different actors;
- limitations to exploitation and the use of environmental elements;
- linkages between the different dimensions of sustainable development.

Box 2: The 10 analytical tasks of the SEAN methodology

Cluster I: Ecological system – human society context analysis
- **Task 1**: Identification of the main stakeholders within an area (including gender distinctions), identification of the main environmental functions (environmental production, carrier, regulation and cultural functions) upon which stakeholders depend, setting priorities among environmental functions and stakeholders.
- **Task 2**: Assessment of past and present trends in environmental functions (quantity and quality), using various types of indicators. Elaboration of environmental impact chains to clarify linkages between different environmental trends.
- **Task 3:** Assessment of the consequences (impacts) of current trends on stakeholders, as well as outside communities (off-site impacts), future generations (by extrapolating current trends) and natural values (eg biodiversity).
- **Task 4:** Defining the norms, standards and thresholds involved, to assess whether and when current trends may lead to the collapse of the environmental function, or to unacceptable change for certain stakeholders. As norms are difficult to assess, standards may be absent and thresholds not yet clearly defined. Generally qualitative assessments are made using insights and views from different actors involved.

Cluster II: Environmental problem analysis
- **Task 5:** Definition of the main environmental problems, using information from Steps 1-4 in a way that is as objective and specific as possible. This based on shared insights into the impact of current trends, a risk analysis and the type of stakeholder affected.
- **Task 6:** Listing the main causes and actors involved; analysing the underlying factors explaining actor's motivations. Underlying factors are mainly sociocultural, economic and/or institutional. This definition of underlying factors is essential if the root causes of environmental problems are to be tackled and key actors addressed. Priorities are set among those underlying factors identified.

Cluster III: Environmental opportunity analysis
- **Task 7:** The definition of main environmental opportunities is essential in order to look at the environment in a positive way. Opportunities occur in the ecological sphere (eg the potential for irrigation), economic (eg demand for certain products), institutional (eg new legislation), socio-cultural (eg women's potentials) and at the local level (eg an innovative community initiative). Priorities are set and packages are formed.
- **Task 8:** Analysis of the potential of opportunities to contribute to both solving environmental problems and solving or improving underlying factors ('win-win options') using insights from previous steps and a systematic approach (opportunity-impact matrix). Priorities are set on the basis of the potentials and constraints that surround realising opportunities in a sustainable way.

Cluster IV: Strategic planning and follow-up activities
- **Task 9:** Synthesis to define a vision and strategic priorities, defining inputs for strategic action planning, including both sectoral and inter-sectoral programmes. Operational plans based on the strategic plan can be worked out using a logical framework.
- **Task 10:** Formulation of a follow-up strategy, including issues internal to the implementing institution, establishment of an environmental monitoring system with indicators and procedures to adjust strategies or policies, external communication and capacity building.

The concept of sustainable development is made operational by long-term goals:
- ecological: stability and diversity
- socio-institutional: autonomy, health, security and equity
- economic: production and efficiency.

For each of these goals specific criteria are defined. These vary according to specific situations and context factors. SEAN takes the ecological dimension as its starting point for making the inventory and analysis of the potentials, constraints and risks. This starting point is justified by the need to overcome a historical and apparently intuitive human bias towards neglecting environmental issues in development planning. Second, it can be argued that environmental well-being is the basis for any sustainable socioeconomic activity. This is particularly important in many developing countries, where day-to-day life in the rural areas depends on the quality of the environmental resources in the immediate surroundings, and where, in urban areas there is considerable dependence on food supplies from the surrounding rural areas.

Objectives and participants

SEAN has been used in a number of countries. Each time the objectives are different. The objectives of applying SEAN in Atacora province were:
1. To analysis the problems and opportunities within the region;
2. Elaborate a vision and strategic orientation for sustainable development that integrates environmental issues with economic and socio-institutional issues;
3. Creating synergy and coordination between ongoing development projects and activities by involving local decision makers and other relevant actors;
4. Strengthening regional capacities as part of the decentralisation process;
5. Addressing the poverty and environmental fragility of the province.

Participants and parties involved were the following:
- *Funding agencies*: The 'Centre Béninois pour le Développement Durable' in Benin and SNV who runs several projects in the province.
- *Steering committee*: including representatives from the Ministry of Planning, Local Government and NGOs.
- *Owner of the SEAN process and outputs:* The elected '*préfet*' of the province.
- *Participants*: during workshops and field work representatives of local communities, projects, NGOs, local government, private sector, donors and central government were involved. Special attention was given to gender equity.
- *SEAN executive team*: a local moderator (GERAM Bureau d'Etude), two staff from local projects and 2 staff from provincial services, one SEAN expert (AIDEnvironment).
- *Technical advisors:* on an ad-hoc basis advice has been obtained from University experts.

In total, about 25 different organisations have participated, and several actors joined voluntarily. Participants were involved in workshops (debates), joint analysis and feed-back. These were used to set priorities.

The 5 phases of SEAN

The SEAN process has 5 phases. In Atacora they were applied in the following way:
1. *Preparation and initiation*: this critical phase included defining of objectives, lobbying at national level, the selection of participants, discussion on ownership and reviewing of relevant experiences.
2. *Scoping*: during this phase, a five-day workshop was held and existing knowledge was captured by going through the SEAN methodological steps with selected participants.
3. *Fieldwork*: fieldwork focused on increasing the level of understanding on a number of issues identified in the previous phase. Particular attention was given to women, pastoralists and children, to urban areas, and to critical issues such as soil fertility, migration patterns, trans-boundary pastoralist movements, agricultural extension and local traditions and views.
4. *Synthesis and planning*: this phase brought together the insights and views of the actors involved to define a common vision and 'strategic orientation' (Box 3) on sustainable development in the province.

5. *Follow-up*: this is an ongoing phase and focuses on supporting and strengthening the way the strategy is applied, working out of action plans, ensuring a feed-back of results to all stakeholder levels, and the setting-up of a monitoring system.

The 10 analytical tasks

The SEAN structure consists of ten distinct tasks within 4 clusters. These tasks are mainly used during the process Phases 2 to 4, to structure discussions, debate, field assessments and workshops. The ten tasks are briefly elaborated in Box 2. The SEAN toolbox has a set of guidelines, tips, tools and suggestions for each task that should enable potential practitioners to decide for themselves what task is relevant and how these can be worked out.

Some results in Atacora

SEAN has been applied in Atacora province in a very elaborate way. The process involving Phases 1 to 4 has taken almost 2 years. However, it has frequently been stated that processes that genuinely pay attention to participation and the objectives of interactive learning take a long time to mature. Some concrete results include:

- A diagnostic analysis of the situation including environmental, economic, social and institutional trends. These have been projected into the future; problems have been listed and causes identified. In Atacora, the main environmental problems are declining soil fertility; cotton production competing with the maintenance of food production; deforestation and the decline of urban living conditions (see Box 1);
- A vision for the coming 10 years has been developed for 4 distinct zones within the province.
- About 20 strategic areas were defined where improvements could be made. Objectives, development priorities and environmental and social criteria for designing integrated programmes were established and the implications for sector and territorial policies elaborated;
- Strategy for monitoring environmental change and progress developed together with impact indicators.

SEAN has succeeded in showing that an environmental analysis can help define relations with other dimensions of sustainable development during a participatory process. Considerable vertical and horizontal integration was achieved.
At national level, awareness of the importance of decentralised planning has increased and some key issues such as illegal gold exploitation were highlighted.

A flexible and holistic approach

SEAN is a holistic approach that can be called a 'sustainability analysis' (Dalal Clayton, 1993). It provides a logical structure for analysis and planning and can be used as local needs and experiences demand. It also has the capacity to guide processes involving long-term negotiation. SEAN has been effectively used in initiating negotiations, creating stakeholder platforms and to create transparency by setting objective criteria for establishing priorities and taking decision.

Marginal areas in complex and unpredictable situations need management systems that are adaptive, and that can respond quickly to new threats and opportunities. Planning in these situations has limited value because many unpredictable factors are involved. Such an adaptive management system should be based on a broad and accepted vision and strategic orientations, a monitoring (or early warning) system that focuses at key issues, and flexible institutions and planning systems. SEAN can be helpful in defining visions and strategic orientations, and in identifying which factors and actors to monitor.

The level of participation in a SEAN process can vary greatly. Donors and development organisations often want such processes to be finalised quickly and this can limit broad participation. In most cases SEAN is used for a period of six month, enough to achieve a limited level of participation.

In some situations there is enough general knowledge available and the emphasis is put on tools to analyse the links between environmental, social and economic issues. Even if this is done quickly at a workshop of key actors, for example, it can be an important added value. An outline for such 'quick scan' workshop setting has been developed.

Certain challenges remain.

- To establish more explicitly linkages between local level problems and constraints and opportunities at higher levels, including global markets and international policies;
- Policy analysis and institutional analysis (in principle, this is part of Task 6);
- Elaborating a monitoring system that is simple but able to address key threats and opportunities.

Documentation available

There is a reader on the SEAN methodology available in English, French and Spanish. A toolbox has recently been published in English. This is based on recent experiences and should allow potential practitioners to use SEAN with minimum external assistance. The toolbox consists of a presentation, educational cards on analytical tasks, the process phases and checklists, a SEAN case study and a booklet containing theoretical background. Price about US$50-. All publications can be ordered at SNV (E-mail: informatie@snv.nl). More information and order forms can be obtained from SEAN website (www.seanplatform.org) or with the author of this article.

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Box 3: Some of the main strategic orientations resulting from SEAN

Each orientation has been worked out in detail and objectives, linkages with other dimensions, actors, opportunities and impact indicators are carefully defined.

Ecological orientations
- Maintenance and management of water balance
- Maintenance and management of biodiversity, plants and animals
- Maintenance of soil fertility
- Maintaining and improving the integration of trees in land-use systems
- Better control and management of grazing and livestock densities
- Improvement of urban living conditions

Social orientations
- Improvement of literacy rate
- Improvement of the level of education
- Control of the negative aspects and strengthening of the positive aspects of tradition
- Control of demographic growth and rural migration
- Promotion of gender awareness

Institutional orientations
- Support to existing structures and services to improve negotiation and communication capabilities
- Adaptation of current legislation on natural resources to prevailing socioeconomic conditions
- Support to decentralisation processes
- Support to NGOs and community-based organisations as intermediary structures
- Support to improve morality of civil society
- Improvement of means and systems of communication and information
- Technical and logistical support to existing services
- Improvement of technical and professional training

Economic orientations
- Development of promising markets and cash crops
- Promotion of off-farm income opportunities (eg. gold exploitation)
- Improvement of road system and opening up of remote parts of the department
- Improvement and adaptation of credit systems to improve access by all social groups
- Improvement and introduction of transformation, storage and conservation technologies
- Support to existing organisations and creation of cooperatives (economic structures)
- Diversification and promotion of renewable energy resources

National strategies for integrated soil fertility management in Africa

photo: J Lamers

The World Bank estimates that a 4% growth in agriculture is a precondition for rural development in Africa given it has a population growth of 3%. The International Institute for Soil Fertility Management (IFDC-Africa) believes that market-oriented agriculture and agricultural intensification based on the use of external inputs such as chemical fertilisers, improved varieties, integrated pest management, etc., is the only way to achieve development. However, in many regions in Africa the profitability of development packages based on external inputs is too low to attract farmers. Reasons include: the low efficiency of chemical fertilisers because of poor soils and unfavourable climates. Fertilisers and other external inputs are relatively expensive (eg., in 1997 the farm-gate cost of urea was US$ 350 in Burkina Faso compared to US$ 100 in India). Marketing of agricultural products is costly and difficult because local transport systems are poorly developed and the domestic market for agricultural products is of relatively small size. In addition, there is neither the buying power nor the capacity to develop a larger consumer market by creating jobs outside agriculture. Beside others, these factors contribute considerably to the stagnation of agricultural development in Africa.

Integrated soil fertility management

In nearly all African countries agricultural production is based on nutrient depletion, shows a negative nutrient balance, and is therefore unsustainable. In order for the yield-enhancing technologies to be applied in a profitable way, improvement of soil fertility management is necessary. Re-capitalising the soil by applying chemical fertiliser is not enough to improve soil fertility management. The efficiency of chemical fertilisers and their economy have to improve as well. This is possible by integrated use of soil amendments and chemical fertilisers. Different amendments exist, and their requirement depends on the need for improved soil organic matter status, improved P availability and/or improved pH. Lime and gypsum are the products most frequently used to improve pH; soluble sources of P and rock phosphate can be used to increase the availability of P. The more difficult challenge is to improve the status of organic matter in the soil. More and better organic manure is needed. However, it is difficult to get organic matter when inappropriate agricultural practices cause soil degradation and cost of organic matter transportation is high. A combination of chemical fertiliser with crop residue recycling, green manure, fodder crops or agroforestry can eventually improve the availability and quality of organic matter.

Zoning for strategy development

The viability of different options for soil fertility management depends on their economic profitability. Local agroecological and socioeconomic conditions make a considerable difference to the profitability of chemical fertilisers. This can be seen not only between regions but also between and within fields. A three-zone division can be made: Zone I chemical fertilisers are a profitable option; Zone II chemical fertilisers are only profitable after 'eco-intensification' through soil amendments as described above; Zone III chemical fertilisers even when combined with soil amendments cannot be used profitable. At present Zone II is by far the most prevalent in sub-Saharan Africa with high financial implications for moving towards zone I. The limits between zones can be influenced by agricultural policy and agro-technologies. Lower input prices, higher output prices and improved management, for example, can shift the cost-benefit break-even point between two zones to lower agroecological or socioeconomic conditions. Ideally, Zone I should be enlarged and Zone III should be eliminated to make market-oriented agriculture and agricultural intensification profitable for all farmers. To what extent this is feasible depends on the costs of support or subsidies necessary for the intervention.

In order to realize the same conditions in Zone II and Zone I at least temporary support has to be given. Support can be given in different ways including a temporary subsidy on local phosphate rock, materials and equipment to facilitate organic matter transport and management, and/or appropriate credit mechanisms. The cost of these socioeconomic measures have to be seen as an investment in the re-capitalisation of soil fertility in order to make the use of chemical fertilisers and agricultural intensification in the interests of rural development and food security feasible. Soil fertility improvement is not simply a technology. It requires profound adaptations of agricultural policies, stimulating farmers to invest in their soils and the private sector to invest in agricultural input and output market development. Such investments will be cheaper and better achievable than those in irrigation in most Africa (Breman 1998).

The 'Soil Fertility Initiative'

The Soil Fertility Initiative (SFI) was launched in 1996 under the aegis of the World Bank and in partnership with many institutions including IFDC during the world food summit in Rome. The SFI aims at helping sub-Sahara African countries achieve sustainable increases in agricultural production while preserving the environment. These countries have been called upon to elaborate national strategies and action plans to secure improvements in soil fertility. Burkina Faso and Ghana were the first countries to formulate National Action Plans (NAPs).

The National Strategy in Burkina Faso

The first step in the formulation of the National Strategy was the creation of a Soil Fertility Management Unit (SFMU) attached to the cabinet of the Ministry of Agriculture. The SFMU was assigned the following responsibilities:

- The promotion and creation of awareness of the need to create a favourable environment for investments in soil fertility;
- The elaboration of a national strategy for integrated management and the restoration of soil fertility;

- The elaboration of action plans to operationalise the strategy and
- The coordination of all soil fertility-related activities in Burkina Faso at national level.

The SFMU consulted extensively with the stakeholders (farmers, decision makers, input suppliers, agro-processors, transport operators, extension agents, researchers, development agents). A series of grass-roots workshops were organised during which discussions were held with stakeholders on the need and urgency for soil fertility restoration. These workshops provided the opportunity for developing a common understanding about the problems of soil degradation and for examining current practices in the light of what needs to be done. They also served as fora where ideas could be exchanged between research, extensionists, NGOs and others working on projects in the area of soil fertility maintenance. Awareness was also created through the publication of a bi-monthly magazine 'Sustainable Agriculture', which set out to inform stakeholders about soil fertility restoration. The SFMU also undertook a series of surveys to obtain information on farmers' strategies on soil amendments, accompanying technologies and developments in marketable products.

The process of sensitisation, inventorising the state of knowledge on soil fertility work in Burkina Faso, and setting up specialised committees to provide advice culminated in the creation of a national strategy. The process of the strategy elaboration was iterative and involved all stakeholders from the initial stages to its final adoption by government.

The strategy describes a vision and approach to restoring, improving and maintaining soil fertility. The action plans involved in the national strategy were as follows:

1. Action plan for the promotion of soil amendments
2. Action plan for the promotion of technologies that accompany soil amendments, and
3. Action plan for the development of input and output markets.

Action Plan 1 is based on the use of the rock phosphate and dolomite that occur naturally in Burkina Faso.

Action Plan 2 is based on available and proven technologies such as improved cultural practices with cereal-legume rotations, anti-erosion control techniques, the "zaï" traditional planting pits, mulching, use of organic and chemical fertilisers, crop-livestock systems, agroforestry and water retention.

Action Plan 3 aims at creating the conditions necessary for farmers to invest in soil fertility improvement. It includes actions that will raise the value-cost ratio of purchased inputs such as fertilisers. On the output side the action plan seeks to create effective demands for the products through agro-processing and value adding activities (Debrah 1998).

Lessons learned in Burkina Faso

In Burkina Faso experience reveals that the commitment of government, donors and technical assistance is extremely important in addressing the problem of soil fertility. The sensitisation, consultation and awareness creation process, although useful, was long, complicated and expensive. The large number of stakeholders involved made reconciling different positions and interests – including the role of SFMU vis-a vis the country's traditional soil research institute - difficult. Nevertheless the consultative and participatory approach to the formulation of national strategy was crucial. Many research and development projects designed to increase food production in SSA have failed because stakeholders were not involved in the process from start to final evaluation.

The Burkina Faso experience has shown that with the necessary elements in place it is possible, with consensus, to elaborate a concise strategy that provides an orientation for the regeneration of soil fertility. ■

For more information on the 'Soil Fertility Initiative' contact IFDC-A, BP 4483, Lomé, Togo.
Fax: +228 217817; Email: ifdctogo@cafe.tg

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Managing Soil Fertility: A Resource Guide for Participatory Learning and Action Research

Toon Defoer and Arnoud Budelman (Eds)

This resource guide is based on extensive work done in several African countries. It is intended to provide user-friendly ways of gathering, managing and analysing information and data by using participatory learning and action research. It suggests ways of using this knowledge to develop strategies for integrated soil fertility management.

The Resource Guide has been developed to provide broad-based support for analytical and experimental work with farmers. It focuses on understanding how farming systems work, and outlines frameworks for analysing diversity - and particularly resource flows - in agroecosystems. However, it is intended to be much more than an analytical handbook. Hands-on experience is one of the most effective ways for farmers to learn new approaches, so the Resource Guide also outlines tools and procedures for each step in participatory learning and action research.

The main aim of the Resource Guide is to give field workers practical advice on how to work with farmers to improve soil fertility management. It is intended as a source of inspiration and help to field practitioners working to facilitate positive changes in farming communities. One of the greatest challenges is the wide variety of ecological and socioeconomic conditions found in neighbouring sites. With this in mind the Resource Guide provides advice on efficient ways of managing all possible sources of soil fertility, in other words, integrated soil fertility management.

The Resource Guide consists of five parts:

Part 1 – Building common knowledge: A Textbook for Participatory Learning and Action Research (PLAR)
Part 2 – PLAR and Resource Flow Analysis in Practice: Case Studies
Part 3 – Field Tools for Participatory Learning and Action Research
Part 4 – The CD ROM: ResourceKIT (software package) and Detailed Field Tools (electronic version)
Part 5 –Detailed Field Tools for PLAR/User Guide to the ResourceKIT

The Resource Guide will be published by The Royal Tropical Institute in March 2000. Contact: Toon Defoer, Royal Tropicial Institute (KIT), PO Box 95001, 1090 HA Amsterdam, The Netherlands, Tdefoer@wanadoo.fr

Farmers developing technology: the researcher's role revised

Gabino Lopez and Roland Bunch

In Central America farmer experimenters are taking over some of the roles conventionally associated with researchers. COSECHA has been facilitating farmer experimentation in the hope of finding profitable ways of using micro-catchments for water-harvesting. On the bases of these experiences the authors challenge researchers to support this trend and adapt their roles to the farmer experimenter situation.

As the number of Central American farmer experimenters gradually grows into the thousands, certain questions have emerged. These can also be expected to arise in the future in other parts of the world. Most important among these questions are: 'What will be the role of professional researchers in the future?" and "How can farmer experimenters and professional researchers best work together?" Professional extensionists once feared they would lose their jobs if villagers became promoters. Now some researchers are also beginning to fear for their jobs because farmer experimenters are not only developing new technologies, but have proved themselves capable of both basic and adaptive research.

Experience shows, however, that in research and extension both villagers and professionals have unique contributions to make. Villagers are not learning how to experiment because they want to take over the job of the professional, but because they want to supplement and complement what professionals can do best. In this process the role of the professionals will probably change. The experience of COSECHA, a Honduran NGO, gives some insight into how this process may work in the future. COSECHA has been involved in the development of new water harvesting technology for small farmers.

Gabino Lopez convinced that water-harvesting in micro-catchments can make a return on costs.

Photo: Roland Bunch

Micro-catchments for water harvesting

Since the early 1980s, COSECHA personnel have been aware that the greatest need of villagers in semi-arid areas is to overcome the problem of deficient or irregular rains. In 1997, COSECHA decided to try and develop an inexpensive technology with which farmers could capture rainwater and hold it on their fields for up to six months. The water could be used for supplementary irrigation during the growing season and to extend the growing season by a few weeks if necessary.

Through its previous work, COSECHA had discovered that it was possible to dig 0.5 cu.m micro-catchments in the ground that would hold water for a number of days. However, we did not know how water could be kept for longer periods or how to do this at little expense. Experiments were carried out to find the size and shape of catchment farmers would be like best and how they would like to use the water. It was also important to find out under what conditions this technology could be economically feasible.

Preparing the technology for farmer experimentation. With most technologies, farmer experimenters can begin work right away. However, some technologies are less attractive to farmers in the beginning: they are too complicated; they are based on laboratory findings; the initial investment is too high; or they do not produce immediate economic benefits.

COSECHA did not know whether micro-catchments would be cost-effective. We made a series of micro-catchments of varying sizes and lined them with different materials (burnt clay, plastic, cement, and the sap from a local tree) and then tried using them to irrigate crops. They made a cost-benefit analyses of each alternative. We concluded that although eventually cheaper materials might be needed, the cost-benefit ratio for the farmers was attractive even if cement were used to line the catchments. The cement could easily hold 90% of the water for six months or more. It was decided to try two methods of lining the micro-catchments with cement. One using a mixture of cement and sand and another using cement, lime, sand and stones.

A small group of known experimenters were selected to begin the experimentation. COSECHA selected a group of 12 farmer experimenters from those interested in the catchment idea. These farmers were known to have considerable creativity, to have taken great care with their experiments in the past and to have benefited significantly from COSECHA's past PTD efforts. They would be able to take small risks without endangering their family's food security and were generally considered good farmer experimenters. An attempt was made to ensure that farmer experimenters would try out a reasonable number of alternative approaches and would be prepared to put in enough effort to maintain the catchments. The farmers selected were considered capable of recognising and collecting the necessary and relevant information and of promoting the water harvesting idea if and when the experiments were successful.

At first, we exchanged materials for information. Still farmers were reluctant to invest the US$15.00 to $20.00 needed to line the micro-catchments while there was no proof that the technology worked. COSECHA wanted to get as much information as possible for these experiments. Therefore it gave the experimenters cement, sand, lime and rocks and in exchange it was agreed that COSECHA would receive information on the problems, costs, benefits, and possible uses of the micro-catchments. In this way, COSECHA openly recognised the value of the farmer experimenters' research and the time they would have to spend recording information. Farmers felt more comfortable with the risk they were taking by participating in the experiments and the programme received a considerable amount of important information.

COSECHA maintained constant communication with the farmer experimenters. Constant communication with the farmer experimenters was very important. Discussions were held with farmers about aspects of the new technology and they were encouraged to try out potentially useful modifications. In doing so they were able to collect important data. It was found that farmers needed specific types of help. Some needed help to ensure they included all costs incurred in their reports while others needed help in keeping accurate records. Farmers also needed help in detecting sources of rainwater (eg from patios, footpaths, natural temporary waterways) and in recording how water was used. Sometimes estimating the size of the area that could be irrigated also presented difficulties..

Juan Atz, a farmer experimenter, lines a micro-catchment to prevent seepage.

Photo: Roland Bunch

COSECHA constantly promotes the cross-pollination of ideas, experiences and technological modifications among farmer experimenters. For example, one farmer experimenter tried using fill to support the downhill side of his catchment, but this caused the cement to crack. Another farmer experimenter found a very simple way of repairing small cracks. Many farmer experimenters decided they preferred 1-2 cu.m micro-catchments. More important still many farmer experimenters began to use water for their domestic needs and to fill backpack sprayers, for home construction and for watering animals and their perennial home gardens. These problems and ideas were immediately shared with the other farmer experimenters.

COSECHA is preparing to share the technology with farmer experimenters throughout Honduras. Now that micro-catchments have been found to be economically feasible for most crops and uses, several other NGOs in Honduras and El Salvador have begun promoting them. COSECHA has received a grant to maintain its work with farmer experimenters throughout the country, to organise conferences so farmer experimenters can share their new ideas with each other and document the results and to encourage water harvesting and other technologies being developed by farmer experimenters.

The future role of researchers

Because there are many potential farmer experimenters it is more than likely that they are carrying out most of the agricultural research in Guatemala and Nicaragua and that this will soon be the case throughout Central America. Nevertheless, this does not mean that professional researchers will have no work to do. On the contrary, farmer experimenters will be able to provide an important link with professional researchers and help ensure that their technology will be rapidly incorporated into the practices of village farmers.

As COSECHA's work with micro-catchments shows, professional researchers will still have plenty to do. Strategic activities include:

- Carrying out research that requires complicated theoretical understanding or laboratory equipment and research that farmer experimenters are not prepared to undertake eg research that is expensive or has doubtful or long-term paybacks,
- Organise groups of farmer experimenters to investigate different aspects or modifications of specific promising technologies, sometimes offering inputs in exchange for information,
- Carry out studies to explain the results and investigate the possible long-term impacts of farmer experimenter-developed technologies,
- Collect information and technologies developed by farmer experimenters and analyse them using systems such as "Modified Stability Analysis," computer software in order to establish the statistical value of the information collected
- Publish and disseminate information on particularly promising technologies developed by farmer experimenters through the traditional media as well as through events such as cross visits and conferences of farmer experimenters.

This brave new world of research has already arrived in Central America, at least as far as technologies such as green manures, natural pest control, and water harvesting are concerned. It will take some time before it reaches other parts of the world. But when it does, the chances of finding the technologies needed to maintain the multitude of low-input technologies desperately needed by the world's complex and diverse small-scale farms will increase substantially.

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Water, first step towards combatting desertification

JA Soccal

Access to water is an essential condition for human development in the semi-arid zone and for combating desertification. Civil society in Brazil has successfully promoted some very inexpensive but effective technologies for water management. These are now beginning to be included in the federal public policies for the semi-arid northeast of the country. This article presents three of these technologies.

Photo JA Soccal

A plate cistern being built in Pedra Lavrada county, Paraíba, Brazil.

The Brazilian semi-arid zone

Brazil has a land surface of more than 8 million km^2, 980,000 of which are susceptible to desertification. Most of these areas are in the northeast of the country. Many of the rivers in this region are seasonal, groundwater reserves are scarce and water salinity is high. The climate is characterised by a short rainy season and total rainfall is less than 800mm. There is a period of drought every year that lasts from 7 to 9 months. Average annual temperatures vary from 23 to 27^{o} C and insolation is very high (2800 hours/-year). Since 1900 there have been fourteen serious droughts, each of which has lasted for several years. The consequences for the local population are extremely serious and many have left for the cities in search of work. Of the approximately 17 million inhabitants in the semi-arid zone, more than 10 million live in the rural area. The northeast has the largest rural population in the country and it is one of the most densely populated semi-arid regions in the world.

Causes of desertification

Approximately 180,000 km2 of Brazil are already seriously affected by desertification which has been caused by deforestation (for building, domestic and industrial fuel and agriculture), overgrazing and mining. The main causes of desertification, however, are structural. These include the concentration of lands, natural resources and income in the hands of a few people and the absence of development policy that focus on small producers and their working conditions. Behind these unfavourable structural conditions lurks a political elite, established in colonial times, that profits from the fact that the population is dependent on them particularly in dry periods. This structure, which has undermined the feasibility of any development in the region, is known as the drought industry. Traditionally, during times of drought, local political *honchos*, distribute water in trucks. This is an extreme *assistentialist* approach that can survive because of the strong feeling of gratitude so ingrained in the Brazilian people.

Technologies that work

Determined to break the chains that have held the strong and creative people of the northeast in dependence and underdevelopment for so long, the NGOs, CBOs (Community-Based Organizations) and Work Cooperatives active in the region developed simple, inexpensive and efficient technologies to address the problems of the area. These technologies - the plate cistern, the underground dam, and the pile driver well - have lead to the sustainable development of several communities and are beginning to be included in federal public policies for the region.

Plate cistern

This is a technology that can be used by a household to harvest rainwater for human consumption. It differs from traditional cisterns because it is relatively cheap. The model that is being spread throughout the northeast by civil society organisations has a capacity of 10,000 to 20,000 liters and costs less than US$ 150.00. It is easy to build because it is made of large cement plates, local sand and water rather than bricks.

The beneficiaries provide their own labour and materials are inexpensive. Some organisations such as PATAC (Programme for Applying Technologies Appropriate to the Community) and MOC (Community Organisation Movement) support a rotating credit system as a way of multiplying the number of these cisterns in the northeast at minimal cost.

These cisterns can ensure the supply of water for human consumption during the annual drought. The quality of the water is far superior to that provided by the water trucks. Trucked water is usually dirty because it often comes from weirs used by animals and is full of pesticide residues from plantations in the vicinity.

If we consider that a person uses an average of 4 liters of water a day for personal hygiene, cooking and drinking, a family of 6 people would use 11,000 liters in 10 months. Cistern technology has made a great difference to women who traditionally fetch water and it has proved to be an excellent way of dealing with the dry periods (Comunidade Solidária, 1999).

Underground dam

The underground dam is a technology that is more than 2000 years old. The idea is to build a semi-permeable wall, below and across the seasonal river bed or on the drainage lines (Figure 1). This allows ground water to be retained or accumulated closer to the surface. In this way it is made more available to plants and humans. Agricultural fields are created in the river bed or on the river margins and the dams are extremely useful for agricultural production - and even pasturing - during drought periods because it becomes possible to grow crops all year round.

On a smaller scale underground dams are used to provide water for human and animal consumption. Tubular pipes are inserted on the side of the dam. The NGO CAATINGA has considerable experience with dissemination of this technology and has developed a type of underground dam using local material and labour that, on average, costs just US$250.00. Compacted clay and stones are used to build a wall of about 2 meters (to the substratum), since the soils of the region are mostly shallow (Comunidade Solidária, 1999).

Pile driver well
This technology is not as widely disseminated as the cistern and dam already mentioned, but its has been very successfully implemented. Its use has spread throughout the municipalities of Sub-Mid São Francisco, and the states of Bahia and Pernambuco. It has a basic premise: to simplify modern systems for drilling wells, replacing motors by animal and/or human traction. With a simple system of pulleys and pipes with perforating blades to dig and remove the earth, wells are opened without the need to hire companies or spend money on machines and fuel. The communities of the region have an important asset when it comes to identifying the best location for drilling. The rural producer, Manoel dos Santos, director of the Syndicate Center (Pólo Sindical) of Sub-Mid São Francisco was trained as a water diviner (hydrostesys with aluminum rods) and has already successfully identified appropriate sites for opening more than 100 wells some of which have reached a depth of more that 100 meters. Mr. Santos also mobilises, organizes and trains communities in well drilling.

In 1996, when the pile driver well activity first began, the wells were opened and water removed by the system of pulleys and human or animal traction. Today, the system has been perfected and uses solar energy to remove the water. A pulley system operated by a stationary bicycle is used to reduce the effort needed to drill the well (Alves Júnior, 1999). It is an ideal system for arenite terrain (it cannot be used in granite areas) with good quality groundwater.

Reduced dependence
The in situ technologies for catching and using water described above represent a significant landmark in the history of Brazil's semi-arid communities because they break away from the traditional dependence on expensive technologies and traditional relationships. They should not be seen as an isolated event, but as part of a set of technologies developed and disseminated by organisation of civil society. These technologies include traditional, modern or alternative technologies for agriculture, ranching and agroindustry as well as approaches to management, capacity building and conquering markets.

Providing local communities with water without making them politically dependent is the key to developing technologies and approaches that promote local sustainable development. These technologies also promote the development of citizenship because the producer becomes responsible for the management of a scarce asset (water) and has greater responsibility for the development of his community because of such collective instruments as rotating credit, joint community actions and capacity building.

Plate cisterns have become particularly important because they have been incorporated into some federal and state public policies (Comunidade Solidária, 1999). They form a precedent for a more systematic implementation of other proposals put forward by civil society. This is decisive for the survival and development of the third sector in the semi-arid zone. Up to now its work has been restricted to a few communities and families. As its proposals are transformed into policies, activities may spread to more communities either in partnership with the private sector or government.

Chances for sustainable development
These experiences may also influence an old tendency within the Brazilian administration. Trying to solve regional problems by building enormous works at very high cost. In the semi-arid region, for example, huge weirs, dams and water mains have been built. They may have helped to solve part of the problem but they have also become a source of corruption and have lead to the concentration of resources in the hands of a privileged elite. They have also had far-reaching and dramatic environmental impacts.

At the same time, local works, smaller, less expensive and more accessible to the population have always been under-valued. With the success of the cisterns, the NGOs can expand the implementation of alternative technologies considerably not only in water works but also in sustainable development in general. These have a much greater chance of promoting the human development of the most needy sections of the population.

After an intense mobilisation before and during the Third Session of the Conference of the Parties to the Convention to Combat Desertification – COP3 in Recife, Brazilian civil society handed the Minister of Environment a document entitled "The Semi-Arid Declaration" in which all the proposals that had been discussed since the 1993 drought were brought together.

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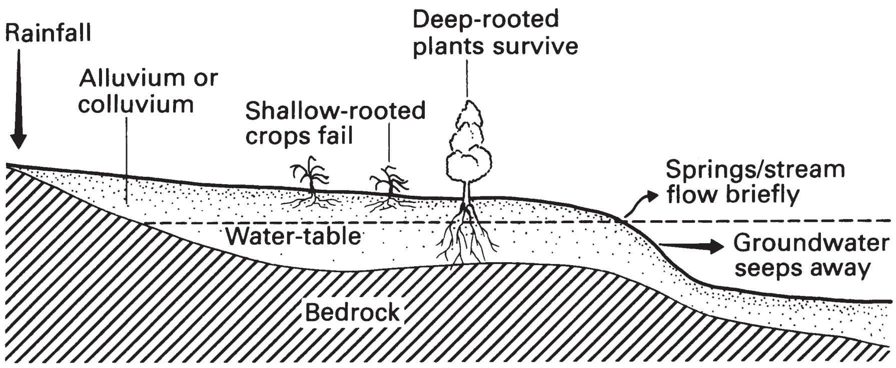

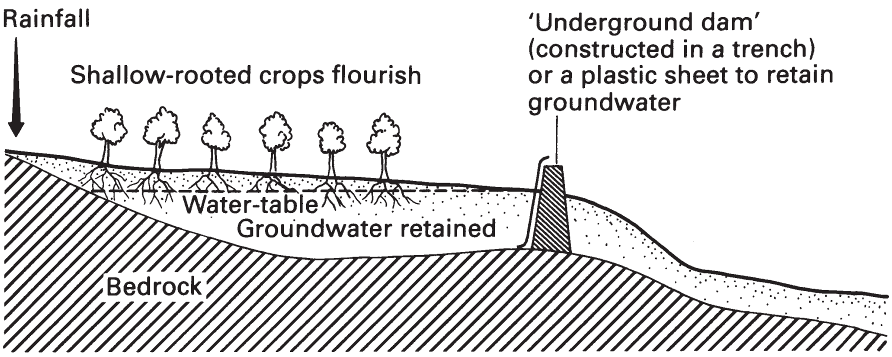

Figure 1. Use of an 'underground' dam to raise flowing groundwater to within the reach of the roots of crops (Barrow 1987).

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Orchard development gives tribal communities new chances

Sharad Mahajan, Madhuri Newale and Pratap Pednekar

In 1995, BAIF Development Research Foundation initiated the Adivasi Development Programme in Dharmapur, South Gujarat, India. The programme, which involved more than 11,000 families and 4000 ha of marginal land, is based on community-led participatory livelihood development. It seeks to promote horticulture, forestry species and crops. The WADI (orchard) model, as the approach is known locally, is becoming a very popular way of regenerating degraded lands and developing sustainable livelihoods for the rural poor. The programme has been selected for presentation at the UNDP Forum of Ministers on Poverty and Environment in New York, USA and EXPO 2000.

New economic perspective needed

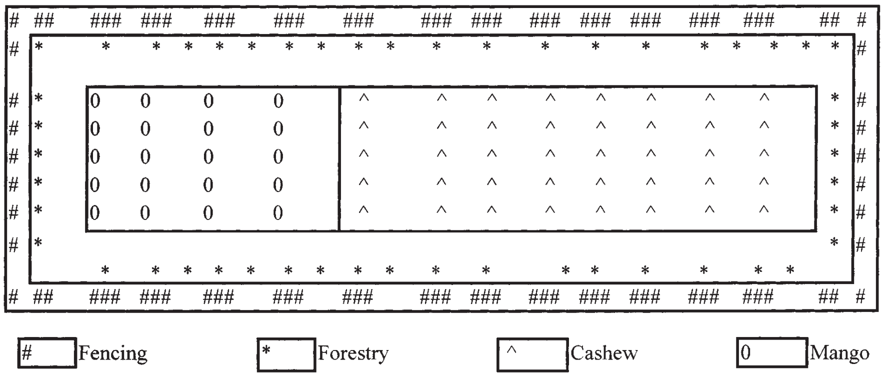
Dharampur is one of the tribal blocks in Valsad District, South Gujarat. Over 90 % of the population is tribal. Most of the tribals live in a forested hilly region. In former times there were dense teak forests but today tree cover has been reduced considerably and in the period 1986-1991 alone the forest was reduced by 8 %. Part of this area has been brought under cultivation and about a third has turned into wastelands or is being used for settlement.

In spite of high rainfall (about 2000 mm), there is a water scarcity each summer. Most of the rainwater disappears in unchecked runoff. Tribal families have marginal land holdings often less than 1 ha and cultivate only rainfed crops: paddy, coarse millets, pigeon pea and oil seeds. Productivity is low because they practice low input agriculture under unfavourable land and water conditions.

Poverty in India is closely linked to a degraded environment. This is especially true for tribals, as they have a symbiotic relationship with the forest. Increasing population and the fact that they had little or no stake in forest management has resulted in the depletion of forest cover and the further reduction of ground water levels and increased topsoil erosion.
As a result, food shortages are common and many people resort to labour migration leaving the area for nearby towns. Many loose hope and alcohol addiction is a serious problem. To provide tribal communities with more hope for a secure future a new, ecologically sustainable, economic perspective was urgently needed.

The Strategy

Land, Water and Manpower are the three major resources available in the area and an individual tribal family generates about Rs.6000 or US$120 each year by making use of them. This output is well below what families need to survive. Local people needed an assured income and livelihood. This could only be achieved by involving tribal families in the upgrading of their resources in an effective way.



Schematic layout of an orchard development plot

A three-pronged programme strategy was developed covering:

- Upgrading wastelands through orchard development
- Effective utilisation of available resources
- Involving and empowering people to manage their own resources

The orchard development programme provides long-term sustainable income for the family whereas effective use of available resources through soil and water conservation and crop cultivation provides the income needed to meet immediate demands. The programme aims to organise people and build-up their capacity for decision making and management. BAIF developed the basic concept underlying the programme during its work on the adjacent tribal block in Vaserda which started in 1982.

The Programme

- ***Upgrading wastelands through orchard development***
  The hilly terrain with limited water resources means that it is possible to develop either horticulture and forestry development on the tribals own land. A programme for individual families has been designed taking into account average land holding size and the minimum income needed for subsistence. Each participating family cultivates horticultural plants in particular mango and cashew - on 0.4 to 0.6 ha of land. Some 600-1000 trees are planted on the border of each plot. A mixture of species are selected. These include teak, bamboo, *gliricidia, Leuceana leucephala, Acacia auriculiformis* and *eucalyptus* to provide firewood, timber, fodder and green manure. The plot is protected by a live hedge of cactus or *Caesalpinia crista*.

- ***Effective utilisation of available resources.***
  Land development: Heavy rainfall and poor vegetation cause severe erosion. Therefore, orchards are protected by building slope-specific, soil conservation treatments. Trench-cum-bunds are constructed on land with slopes less than 15 %. Where slopes are more than 15%, trees are first protected by platforms and subsequently overall plot treatments such as trenching, gully plugging, and terracing are applied.

Water harvesting and utilisation

The area experiences two extreme situations - heavy rainfall during the monsoon and water scarcity during summer. Therefore, activities for harvesting available water and its efficient utilisation have been developed. These include:

- *Temporary check dams:* Immediately after the monsoon, the run-off water is harvested by constructing temporary check dams across the rivers and streams. These are constructed

Orchard trees protected by platforms.

Photo: Sharad Mahajan

Looking forward to a rich harvest.

inexpensively by using empty cement bags filled with sand and silt.

- *Spring development*: A number of well-dispersed perennial springs exist in the hilly areas. Though ground water resources are poor, the springs provide sufficient water to irrigate the orchards and cultivation of cash crops on a small scale.

- *Pot drip*: Pot drips are used in order to reduce the drudgery of irrigating orchards from head-loads of water and to reduce losses from evaporation and infiltration. The pot drip system consists of four clay pots dug in around the plant. The water in the pot diffuses into the soil through a hole in the bottom of the pot and in this way becomes available to the plant. This can result in water savings of over 50 %.

Water resources development and land shaping through soil conservation measures are also used to encourage the cultivation of additional crops. Improved crop varieties are used and participants are given both training and the necessary inputs.

The Effect

- *Development of marginal lands :* The programme operates in 133 villages in the Dharampur Block. The measures have helped to turn 4253 ha of marginal lands and wastelands into productive orchards. Over 200,000 mango and 400,000 cashew trees have been established. About 30 % of the plants have already started to produce fruit. At the same time the 5 million forest trees also planted are developing well.

  Soil conservation measures have started showing results and treated plots show less soil erosion, improved plant growth and a better conservation of soil moisture.

- *Effective utilisation of land and water :* 200-250 temporary check-dams are built each year. Spring development work is in progress and more than 1500 families have started to use pot drips.

  The effect of land and water resource development is clearly reflected in the changing cropping pattern of those participating in the programme. Rainfed cropping practices are now combined with irrigated cropping. The type of crops grown has also changed. Participants used to meet their basic food requirements by cultivating only paddy and coarse millets. Now, they cultivate wheat, groundnut, turmeric, onion, watermelon, bananas and vegetables for the market.

People centred approach

The programmes main entry point is *the people*. The approach aims to encourage:

- *Peoples participation* by generating awareness and motivation,
- *Peoples education* to stimulate thinking and training and
- *Peoples capacity building* to create a basis for making independent decisions and monitoring work.

It includes:

Farmer to farmer extension: Exposure visits are arranged so farmers can visit similar or new activities established by other farmers both within and beyond their region. This provides an opportunity for direct interaction with fellow farmers and also motivates participants by making them feel: *We can do this as well*!

Peoples choice first : The overall programme has been planned with full regard to the peoples needs. Peoples perceptions and choices are carefully considered when implementing the programme. Activities are selected or modified in the light of these requirements. Decisions relating to the selection of land for orchard development, the choice of tree species, the type of water resource development and soil conservation to be undertaken and the choice of crops to be cultivated are taken by all participants collectively.

Local resources development: Local resources have to be developed to ensure the success of the programme. In this context local youths have been trained as field guides (to provide agriculture- related services); technicians to repair hand pumps and engines; masons; barefoot accountants (for village-level record keeping) and health guides (to provide health services to the villagers).

Village planning committees: Village-level participant planning committees are formed to organise village-level activities and develop local leadership. These are representative bodies of participants set up to plan and review programme activities, identify participants needs and develop appropriate mechanisms to fulfill these.

Each planning committee has between 10 to 15 members and each member represents a group of 5 to 6 participants. The members of the committee are selected on the basis of specific criteria, such as having a good orchard or having a good rapport with villagers. In this way the right candidates are selected.

The committee holds monthly meetings to review ongoing work and plan work for the coming month. Village-level problems are sorted out and participants needs are discussed. Planning committees are in operation in all programme villages. All the programme work, from the selection of participants to providing them with credit is routed through these committees. Their range of activities now include the provision of inputs for inter-crop cultivation, grain bank development, the operation of Agro- Service Centers, and the collection and processing of cashew nuts. Members from all these committees meet once in a year to share the experiences and find new directions. The synergetic effects of these joint efforts are leading to sustainable development!

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UHAI, a model for sustainable livelihood

CDK Muhia

UHAI in Kiswahili means livelihood. It is the name given to a "model" designed to empower people to manage their natural resources sustainably and to enhance their livelihood through dynamic people's forums. The approach was developed in the early 1990s by KENGO (Kenya Energy and Environmental Organisation) as an alternative to failing conventional development. Conventional approaches tend to over-emphasis economic development at the expense of indigenous culture, wisdom, spirituality and social values, knowledge, technologies, experiences, skills and aspiration of the people. The UHAI model has been established in 15 Kenyan communities both in rural and urban settings and has proved to be an effective approach to regenerating the natural environment and to controlling desertification. This article discusses the main elements of UHAI and the experiences gained using this approach in the community of Wamburi.

The rural base of many Africans implies that their livelihoods are directly supported by natural resources. The availability, access to and control of those resources are critical if these livelihoods are to be sustained. Sustainable livelihoods, however, also involve the relationship between people and nature. In most African societies culture and the environment were closely linked. Sustainable livelihood, in the UHAI approach, is seen as having its roots in the unique culture of the people. It focuses on the past, present and the future of life and it draws its strength from internal justice, morality, and collective community spirit and responsibility.

Culture central to development

The UHAI model argues that a people's culture must be at the center of development efforts. It recognises that authentic development springs from the collective visions, experiences, decisions and practical actions of the community. It seeks to empower local communities to take charge of their natural resources by using their indigenous systems, knowledge, wisdom and skills.

The UHAI model asks: "Why have many communities in Africa, at regional as well as at national level abandoned or look down upon their indigenous foods, mode of dressing, systems of reward and honor, engineering, education, art and music?" With consciousness about their traditional culture and historic development people are better placed to sustain their livelihoods and conserve their natural resources responsibly. The UHAI model will work in situations where this has taken place.

Guiding principles

To realise these ideals, the UHAI model offers certain guiding principles. These should form the basis of all relationships between people and the natural world. These principals include the recognition of:

- *The supremacy of nature:* Nature as the basis of life is supreme and all encompassing. All elements and beings must therefore recognize and respect it as a sacred endowment that should be conserved and sustained.
- *Peoples cultural heritage:* Culture defines the identity, dignity, pride and cosmology of a particular people. Therefore, its disintegration and disruption threaten the very existence of society. The cultural diversity and uniqueness of each ethnic nationality is the most valuable endowment of people throughout the African continent.
- *Eldership and sagehood:* Elders and sages are the keepers and custodians of knowledge, wisdom and the ethical dignity of human societies in Africa. Their wise council and vision should form the principal basis of moral guidance, local governance and stewardship of the society as well as the natural resource base.
- *Negotiation:* Any being that is primarily dependant on a particular resource for survival shall not be deprived of this livelihood. Man must, therefore, not only negotiate with man, but also with other creatures by studying, understanding and fully appreciating their source of livelihood.

By providing these principles, the UHAI model makes it possible to develop a framework that can restore respect for the values of natural resources and local culture.

The eco-cultural forum

The UHAI model seeks to restore and strengthen sustainable livelihood by reintroducing governance and decision making mechanisms. Through communal eco-cultural forums all stakeholders and resource-user groups within a community will have access to an open democratic space. Subsequently they will be able to directly influence decisions taken about the management of local natural resources. At the moment there is no such space at the level of community resource development.

The community eco-cultural forum consists of a council of elders, key resource-user groups (stakeholders), indigenous institutions and experts and representatives of facilitator (development) organisations.

The community eco-cultural forum takes on such activities as:

- Identifying and deliberating on issues, conflicts, opportunities and prospects relating to the utilisation, conservation and management of local eco-cultural resources.
- Defining, developing and evolving local solutions to the problems and conflicts that have been identified drawing on indigenous traditional knowledge as well as appropriate modern management systems and policies.
- Mobilising communities to undertake appropriate actions for the management of eco-cultural resources that can enhance their livelihood.
- Safeguarding the people's rights and access to resources in their struggle and search for nature conservation and a dignified livelihood.
- Monitoring the use and abuse of natural resources and advocating appropriate policies and actions.
- Researching and documenting past and present indigenous knowledge, skills, and technologies in natural resource management.

As an empowering model, UHAI tries to promote and invigorate the creative and innovative energies of the members of each community. The community must be able to create, innovate and develop new knowledge, skills, and techniques within its own environment. There must also be room to work towards achieving sustainable livelihood and efficient resources management systems. This is probably the most critical challenge of the UHAI model.

Wamburi community forum

Of the fifteen UHAI community forums, Wamburi is one of the best examples of a regenerated community and a regenerated environment. Wamburi is in the Nyika eco-cultural region. The communitty's catchment area includes the 200 households of Wamburi and Kithumba. These two villages lie between the Muojonzwe and Nthilani rivers and draw water from the Kyangeto. These rivers are subterranean for most of the year.

The natural resource base at stake

In the 1970s, villagers paid little attention to soil and water conservation. Their animals overgrazed the fields and bare, sun-baked soils were characteristic. Villagers ignored the importance of the sand basins along the rivers. These basins functioned as water reservoirs and prevented excessive evaporation. Soil erosion had silted up the only earth dam that had been dug in the late 1940s and had covered the water pipe and animal watering troughs. Lorry after lorry took sand away from these basins for housing projects in Nairobi and there was little understanding of the way they functioned in the local ecosystem.

Twenty years ago, villagers began to suffer food shortage, water was inaccessible and the number of livestock fell because there was little grazing. Rivers ran dry immediately after the rains ended and community life was out of balance.

From reflection to action

In 1990, having gone through several preparatory meetings and resource assessments, villagers decided to take the initiative to regenerate their communities and natural resources. Their first action was to stop sand collection and they threatened to burn any lorry coming to collect sand. Villagers went to the District Commissioner and asked for reinforcement. As a result five lorries and their crews were grounded for a week and were eventually forced to return to Nairobi empty.

Having organised themselves in the Wamburi Eco-cultural Community Forum the community acquired an identity. Operating as a forum, it identified training in soil and water conservation, agroforestry, natural resources management and wood energy conservation as urgent priorities. They selected key individuals for training and asked KENGO to provide it. During training, participatory exercises in resources mapping, strengthening group solidarity, and analysing strengths and opportunities were carried out. Plans were developed to build terracing to control runoff and a tree nursery was established by the dam site to provide seedlings (multipurpose tree species) for reforestation. River-beds were rehabilitated, the earth dam desilted and the cattle watering troughs renovated.

A project proposal was developed to support the desilting of the earth dam and to establish an improved stove production unit. Seedling production was improved by seed purchase and support was given to further encourage training in empowerment and capacity building. After the forum had been assessed, its programme was accepted for UNDP-GEF funding.

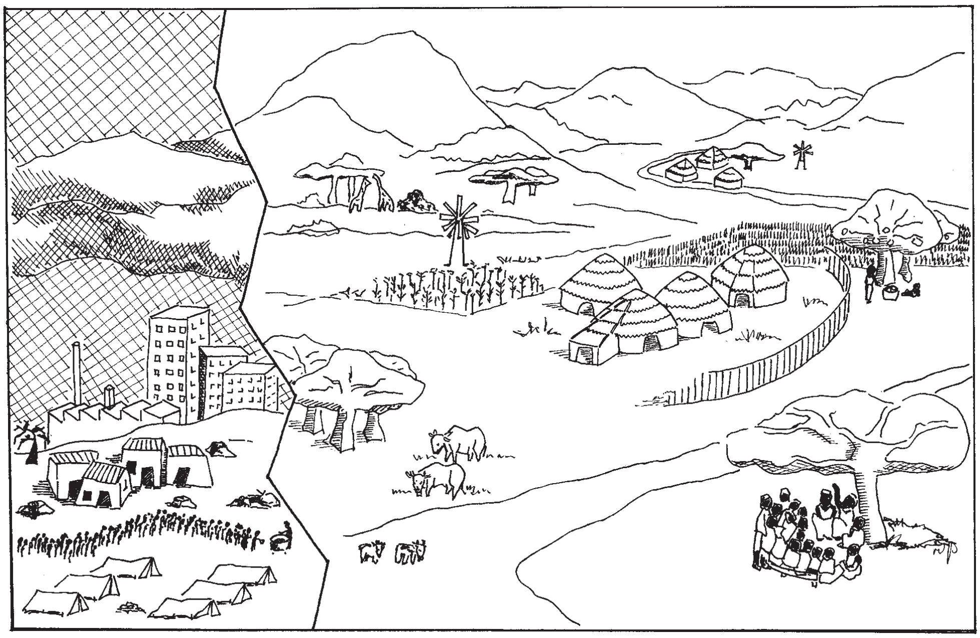
Impressive results

Within two years forum members constructed 10 kilometers of terraces, cut-off drains and bench-terraces in the catchment area. A tree nursery was established and members started to plant trees along the boundaries, terrace embankments and roadsides. Forum members made one of their experienced trainers a supervisor and bought him a bicycle to help him move around the area.

By 1996, the physical and human environment of the Wamburi catchment area had undergone a transformation. Members were heavily involved in food production, tree planting and the adoption of energy saving stoves. Most of the households had planted more than 200 trees, riverbeds had been rehabilitated after the construction of concrete tie-ridges that held sand and retain water over the dry period. The water stored behind the earth dam was now able to support an enlarged tree nursery (150,000 seedlings). In general there was more water available for domestic use and for livestock. Twenty percent of the households in the area have bio-intensive kitchen gardens and are self-sufficient in wood-fuel. Zero grazing is now a common farming practice.

Wamburi eco-cultural community forum is a source of strength to farmers in the area. Its members include professionals, retired chiefs, and working civil servants. Eighty percent of the membership is female. This explains why there is so much diversity in the food available in the community.

"Go and give these foods to your friends and tell them we have bid goodbye to relief food" villagers told me during one of my many training visits and offered me maize, beans, pigeon peas, millet, sorghum, onions, cowpeas and sweet potatoes. A neighbouring catchment is currently trying to copy Wamburi community as they try to regenerate the sunbaked patches that were formerly shambas (gardens).



Limitations

The UHAI model has its strengths and weaknesses. In Wamburi most of villagers were kinsmen and belonged to the same ethnic group. Trust was built up quite quickly. A common language and culture makes sharing and communication easier. If this is not the case it is much more difficult to create unity and agree upon a common action plan.

Promoting the participatory approach especially if it is being well articulated, is a time consuming business and makes the community preparation phase quite costly. In addition, cash benefit expectation in the short term can impair the implementation of the UHAI model. Donors for one reason or another, are not keen to give their support to community initiatives.

Patience and persistence are prerequisites for an effective facilitation of the UHAI model and for the participatory regeneration of the natural environment. Without a good facilitator participatory community development becomes impossible. This function, however, is not accepted by donors. Now the need for community participation is being recognised by the Convention to Combat Desertification and the National Action Plan, we hope the funding of participatory community development will become easier.

■

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PO Box 3395, Thika, Kenya. Fax: +254 (0)151-30935.

Reference:

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Shree Padre

In 1985, the Tarun Bharath Sangh (TBS), a conservationist orientated NGO, started an initiative in Alwar district to combat rural poverty. In the years that followed, they mobilised the rich experiences of traditional water harvesting and created one of the largest nature regeneration movements India has seen. Revitalising the water harvesting tradition and reforestation recharged wells. This set in motion a whole chain of economic and ecological improvements that created new hope for the local villagers .One of the results of this initiative was the transformation of local rivers from ephemeral monsoon waterways into perennial rivers.

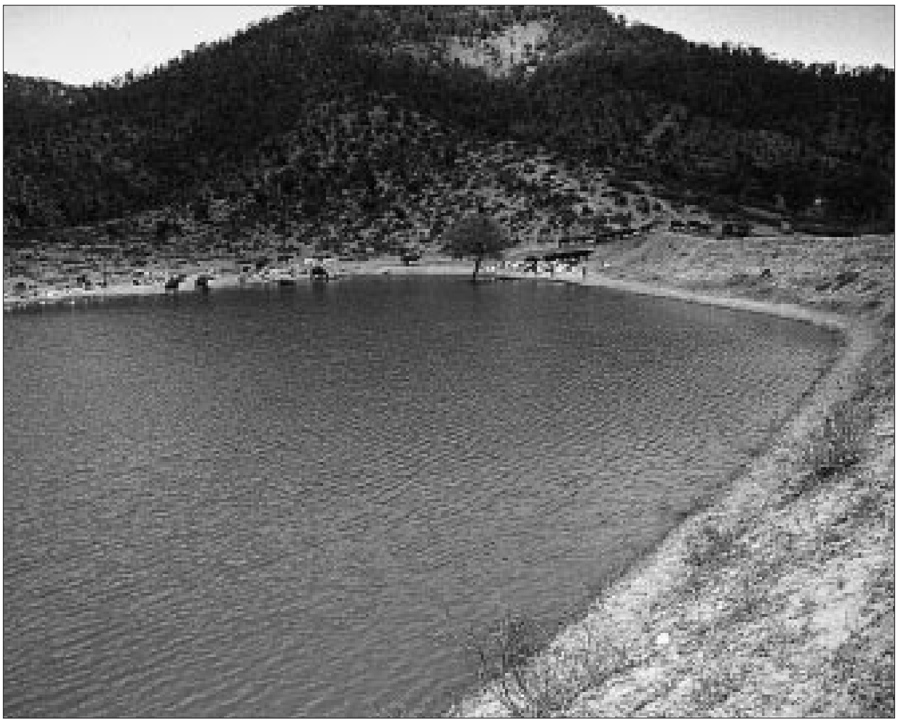

Photo Shree Padre

The Johad is a structure bound on three sides by the natural slopes of the hill. The fourth side, a mud wall - usually semi-circular in form – holds back the monsoon run-off.

Harvesting the monsoon: livelihoods reborn

Degradation and poverty

Alwar district lies in the Aravali mountains, 400km SW of New Delhi, in the Indian desert state of Rajasthan. The dense forests that covered this watershed were an integral part of the local rural economy until the 1930s when the colonial government abolished communal rights to forest land and allowed timber companies to exploit their resources. The hills were stripped of the timber that protected their thin soils from the fierce erosion of the annual monsoon. As water flowed away unchecked, rivers dried out, the ground water level fell, and the region's agricultural potential was seriously affected. When TBS first came into contact with the local population, villagers were living in poverty. Their main form of subsistance was small-scale herding and cultivating. Most men of working age had migrated to the cities in search of work and the women spent long hours walking to collect water. Community life was severely impoverished.

Gram Sabhas taking control

The TBS identified the lack of water as the major cause of poverty (Box 1). In their discussions with the villagers ways of tackling drought and erosion where explored. Regular village meetings or *Gram Sabhas* were established and each household sent its representative. During these meetings the elders described the water harvesting practices used in the past. Among these was the *Johad* (see Photo 1), a man-made tank built at strategic locations in the hills.

The TBS encouraged the re-establishment of such traditional techniques but it was also committed to waiting for the full participation and support of the local people before offering financial or material help. It was the villagers who had to decide whether or not they wanted to build and maintain *Johads* and check dams and they would only do so if they were convinced of the benefits.

The TBS worked towards developing a high level of understanding, commitment and participation.

Building a water harvesting structure like a *Johad* required cooperation and planning. The best location for catching the maximum amount of run-off had to be selected, soil characteristics studied and the relationship between the amount of water expected and the size of the *Johad* accurately assessed.

Once a village decided it would build a water harvesting structure with TBS help, it had to pay 25% of construction costs itself either in cash or in *Shramadan* (voluntary labour). Members of the *Gram Sabha* then made a list of the families most likely to benefit from the *Johad*. They were expected to provide the *Shramadan* and, if necessary, the land on which the *Johad* would be built. The TBS would then accept responsibility for providing external inputs such as tractors to trans-

Box 1. Tarun Bharath Sangh

Dr Rajendra Singh is head of Tarun Bharath Sangh. As a doctor practising in the ancient tradition of *Ayurveda* he was familiar with treating imbalances in the human body. As a farmer and conservationist he saw that imbalances in the way man used Nature's resources often lead to chronic poverty. In the drought-ridden district of Arwali he asked himself the most basic question: "Where is the water". The only water available was rainwater.

His interest in watershed development came from the people's need for water. If there had been no traditional water harvesting knowledge in the area, TBS would not have been successful in harvesting rainwater or in regenerating forest cover. The local elders, however, remembered the *Johad* and with the help of TBS volunteers and funds they were able to made successful use of the traditional knowledge that been ignored by government and western science.

An important element in the success of TBS's water harvesting efforts was the attitude of the villagers. They felt that the *Johad* was their own asset and that their future was linked to it. They were ready to struggle to re-establish their traditional ways of resource management and to draw up the regulations necessary to protect their environment and forests. The TBS supported the villagers with the funds it received from foreign contributions, assistance and volunteer labour.

port soil, diesel, cement, and the money to pay the masons. All other inputs had to be raised locally.

Once the *Johad* has been built, the members of the *Gram Sabha* discuss management and maintainance. *Johads* have a number of water outlets that enable villagers to regulate the flow of water to the fields and initially the fields closest to the village will receive the most moisture.

Jal-Jameen-Jungal

While the *Johads* improved water availability, the problem of erosive run-off continued and sediment gradually clogged up the new water storage space. The problem was taken up by the *Gram Sabhas* and, working with the conservationists of the TBS, villagers became increasingly more conscious of the relationship between *Jal, Jameen and Jungal* (Water, Land and Forest). This consciousness was further reinforced by the street plays and *Padayatras* (foot marches) that the TBS organised each year for those unfamiliar with the nature conservation movement.

The *Gram Sabhas* decided to raise a green cover and allow the forests to regenerate. Together with the TBS they tried to create conditions which would allow dormant root-stock and existing tree cover to re-establish itself and grow. Rules were established. The first step was to prevent camels and goats from grazing new growth. No one was allowed to cut live twigs and only dried branches and leaves could be sold. No living branches could be cut without permission from the *Gram Sabha* and penalties were strictly imposed. Villagers also expressed their common commitment through ritual, celebrating *Rakshabandhan*, for example, by tying a knot around trees and plants as a token of their commitment to protecting greenery. As a result of their efforts the proportion of forest cover on the Aravali mountains has risen to 40%, an increase of 34% in 15 years. Their target is 66% cover.

Rivers reborn

One of the most spectacular and unexpected results of this revitalisation has been the gradual return of water to the rivers in Arvari. The TBS did not start out with the aim of bringing perennial flow to dry rivers like the Aravati. When *Johads* were built and water run-off arrested, percolation gradually recharged underground aquifers and as these slowly filled up, excess water started to flow into the rivers. Traditional water harvesting techniques have realised the full, natural benefit of percolation from the catchment. In the 503 sq. km catchment of the River Aravati, for example, villagers built some 200 water harvesting structures over a ten-years period. As a result the river began to flow for longer and longer period each year until, in 1995, it flowed the whole year round, a phenomena that even took even the village elders by surprise.

But with the water came the bureaucracy. In 1996 the villagers of Hamirpura living along the Arvari were told that a contractor had been given a licence by the state government to start fishing in the river. Under law the river is the property of the government and now that there was water, the government was ready to take 'control' of its resource. But the villagers demanded a say in its management. Working with TBS they recently set up a River Parliament, locally known as the Arvari Sansad – an association of all the villages built along the river. They adopted a constitution to manage the river. If it succeeds this 'people's river parliament' will be an important example for the future (Mahapatra 1999).

Livelihood reborn

The ideas developed by villagers and the TBS have had considerable success. Now, more than 15 years later, 650 villages in the Alwar district have a *Gram Sabha* and 3000 water harvesting structures have been established. *Johads* have proved both durable and effective. In the floods of 1995/6, for example, villagers saw many government built dams being washed away while their carefully built *Johads* remained intact. Revitalising the *Johad* tradition and regenerating forest cover have brought many benefits. In 36 villages the water table has risen six metres. Wells have been recharged and moisture levels in the fields have been improved. Today, villagers no longer wait for financial support from the TBS: they take the initiative themselves and as their standard of living slowly improves, they are better able to meet the costs of building and maintainance themselves.

With water more readily available, buffalo breeding has received a new impetus. The supply of milk increased and regional milk products are again being offered for sale. Grain production is growing and the district which once imported grain now sells it to its neighbours.

One villager told 'Down to earth' magazine: *"Forests were cleared for the urban people. I lost my agriculture and had to slave for the same people who destroyed it. The freedom of the country doesn't mean anything to us. I became free in 1995, when I cultivated my land again for the first time. For villagers, freedom means freedom from poverty. This comes from self-sufficiency"*

Men who were pursuing menial jobs in the cities have started to return to their homeland. Women, freed from the time consuming task of fetching water, have more time to invest in community life and in one of the poorest states in India where the average literacy rate is 20%, more and more children are attending school. Along with these improvements came a renewed sense of 'self-respect'.

■

Box 2. Women at work

Women are often the ones most affected by a lack of water and TBS found that they were quick to respond to water harvesting ideas. Gyarsi and Phoola, for example, were the last two women in their village high in the Sariska hills. Together they set out to build a traditional water harvesting structure or *Johad*. They did all the physical work themselves and once every ten days they were visited by a TBS volunteer. Construction took them four months, but now water can be stored for longer and longer periods.

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Reference:
- Mahapatra R 1999. **The Arvari, coming back to life**. *Down to Earth, March 15*. Society for Science and Environment, New Delhi.

Photo Shree Padre

Women have taken outstanding initiative in water harvesting work.

Water harvesting: community-led natural resource management

Anil Agarwal and Sunita Narain

India is in water crisis despite its relatively high average rainfall. Water harvesting can offer a solution. If 5-10% of the land were used for rainwater collection there would be enough water for irrigation and household needs. Recent initiatives, both at community and government level, have made use of long-neglected water harvesting traditions. The results show that reviving water harvesting systems stimulate rural development and restores local ecosystems. This article discusses some of these initiatives and explores how community-led natural resource management can be facilitated.

Photo: S. Rajam / CSE

Tanks (eris) once watered one-third of the irrigated land in Tamil Nadu.

Water crisis

Forty percent of the world's population currently experience serious water shortage. India is one of the 80 countries bearing the heavy social, political, economic and environmental costs of this crisis. Water quality problems affect some 44 million people in the subcontinent and there is widespread pollution. Fluoride, arsenic and iron have entered the groundwater and seawater pollutes groundwater aquifers. In the summer when the situation is particularly acute, women and young girls have to walk long distances to fetch water. Wells are dug deeper and deeper lowering the groundwater table still further and gradually wells dry out. Fifty years ago there was twice as much water available per capita as there is today.

Water is not only vital for human survival, it is also essential for sustainable biomass-based economy. Although India has made substantial investments in an effort to exploit river and groundwater resources to service large-scale irrigation systems and urban water supplies, these systems have rarely reached the rural poor. Often large-scale water developments have led to inefficient and inequitable distribution of water resources and to forced re-settlement.

Decline of water harvesting

There are water-harvesting traditions in many parts of the (developing) world. India's traditional water-harvesting structures are treasures of ingenuity. Over the centuries, people in different types of ecosystems throughout India have used basic engineering skills to develop a wide variety of techniques to meet their water needs. Today, when the art and science of 'collecting water where it falls' is needed to help ensure an adequate, sustainable and equitable distribution of fresh water, it has become a dying wisdom. Serious efforts must to be made to combine water-harvesting traditions with the insights of modern science and technology (Agarwal and Narain, 1997).

Decades of British rule ravaged the peoples' water knowledge heritage. The consequence of British determination to maximise its exploitation of India's riches resulted in impoverished rural communities and the destruction of their resource management systems. Water management structures were also seriously disrupted.

Technological changes such as the introduction of tubewells put richer farmers in command of the tank area. Those who could afford to install these wells no longer have an interest in cooperating with the rest of the community in managing the tanks. Many central and southern Indian cities like Hyderabad, Chennai (Madras) and Bangalore grew up around traditional water harvesting systems. In the urban areas these systems have either disappeared because of pressure from real estate lobbies or have become heavily polluted. Today, traditional water harvesting systems are only important in remote areas such as the Himalayan states which are beyond the immediate reach of water bureaucracies.

Learning from experience

During the 1980s, several successful community-based resource management ventures emerged in response to the water management crises. Some of these are described below. They show the policies needed to turn ecological poverty into sustainable economic wealth. Today, these initiatives are particularly important because they have now matured. An advanced level of ecological succession has been reached and their economic impact is clearly visible.

Sukhomajri village

Sukhomajri, near the city of Chandigarh, is the first village in India to have income tax levied on earnings from the ecological regeneration of its degraded watershed. In 1979, when the nation was facing a severe drought, the villagers built small tanks to capture rainwater. They agreed to protect their watershed to ensure the tanks did not get silted up. The forest department's assurance that they would have the right to use forestland and its grass was a major incentive. The villagers had argued that they should benefit from the biomass

Photo: Ganesh Pangare / CSE

In Konkan region water flows from one farm pond to the other during rainy season.

Photo: Ganesh Pangare / CSE

A bihar (rectangular catchment basin with embankments on three sides) still used by farmers in Bihar.

produced in return for protecting the watershed. The state forest department agreed to give the villagers these rights if they paid the forest department a royalty equivalent to the average income it had earned before the villagers started watershed protection.

The combination of public, private and community investments and the participatory efforts of the villagers have resulted in a rate of return of 19% according to one cost-benefit analysis. The tanks have resulted in a threefold increase in crop production. The amount of grass and tree fodder available to cattle in the protected forest has increased considerably and as a result more milk is being produced. As prosperity increases, Sukhomajri's economy has also changed. "Who could imagine that televisions, tractors and bicycles could be had for mere grass and water?" asks one of the villagers.

One of the most impressive results of the project is that the cost of desilting Lake Sukhna, which supplies water to downstream Chandigarh, has fallen dramatically. The inflow of sediment has been reduced by more than 90% saving the government Rs7.65 million ($0.2 million) each year in dredging and other costs (Chopra et al., 1990).

Ralegan Siddhi village

Ralegan Siddhi is a village in a drought-prone area of Maharashtra. The annual rainfall is between 450 mm and 650 mm. Villagers could never confidently rely on a regular harvest. In 1975, the village was poverty stricken and there was less than half a hectare of irrigated land per family. Krishna Bhaurao Hazare, a retired driver from the Indian army, began constructing storage ponds, reservoirs and gully plugs. Due to the steady percolation of water, the groundwater table began to rise. Simultaneously, government social forestry schemes were used to plant 300,000-400,000 trees in and around the village. Because of the increased availability of irrigation water, fallow land was brought under cultivation. The total area under production increased from 630 to 950 hectares and average yields of millets, sorghum and onion increased substantially.

The village made every effort to ensure equitable access to the resources generated. Water is being distributed equitably and only crops with a low-water consumption are grown. Today nobody in the village is dependent on drought relief. Incomes have increased substantially and income distribution is more even than in other parts of rural Maharashtra.

Ralegan put more emphasis on participatory democracy than representative democracy. The village created an impressive system of decision making and some 14 committees ensured that people participated in all decisions. A *Gram Sabha,* a participative democratic institution, was established to take community decisions and ensure that each household was involved in the development process. It was also able to exercise social pressure when necessary. (Mahapatra,1997).

A dead river back to life

Rainwater harvesting has brought the River Arvari in dry and drought-prone Rajastan back to life. (see Shree Padre p14). The river flows through a drought stricken region - villagers living on the margins of survival are desperately poor and find sustenance by migrating to cities to look for work. According to historical records of the region, the river Arvari used to provide groundwater recharge to wells in the area. But nobody can remember seeing it flow except during the short monsoon period. The river – in its 45km journey to its confluence in the reservoir of a dam on the River Sainthal – flows through about 70 villages. Its source lies in the degraded hills near the village of Bhaonta-Koylala.

In 1986, working with a local NGO, the Tarun Bharat Sangh (TBS), the villagers of Bhaonta-Koylala built a rain-water harvesting structure or *Johad* to trap the rainwater and use it to recharge the groundwater. Since then many more water harvesting structures have been built in the Arvani catchment. These small dams have helped to recharge the river and since 1995 it has been perennial.

Jhabua District

Transformation of rural ecosystems with people's participation, such as the cases described above, has remained isolated and scattered, and usually led by remarkable NGO leaders. Governement efforts in afforestation and watershed management have rarely been able to reproduce these successes. The problem is often that the devolution of power to local communities has been half-hearted and inadequate. People's participation has remained largely stuck in the 'you participate in my programme' mode.

In Madhya Pradesh, however, the government's watershed management programme (the Rajiv Gandhi Watershed Development Mission) has become an outstanding example of government interventions promoting public participation in environmental management. The statewide programme was initiated by the chief minister Digvijay Singh who was inspired by Krishna Bhaurao Hazare's work in Ralegan Siddhi. The programme is integrated and participatory in its approach. Today trees are flourishing in a district that 15 years ago looked like a moonscape and wells are literally overflowing with water in a place that was described as chronically drought-prone (Agarwal and Mahapatra, 1999)

The programme created several tiers of institutions: policy coordination at state level; implementation and coordination at the district and macro-watershed level, and work at village level to ensure that all villagers are involved in the effort. Some 1748 women's groups, for example, have been created in 374 villages in Jhabua and together they have 25,506 participants. Most important, however, serious efforts have been made to give local communities power over decision making and control over resources. Villagers play an active role in the management of watershed programme funds. Nearly 80% of the programme's funds are put in a bank account managed by Watershed Development Committees made up of village people. The Watershed Development Committee brings together the important interest groups in the village in a way similar to the *Gram Sabha*.

Eco-restoration is possible

These case studies show clearly that eco-restoration is possible even in highly degraded lands and that it can regenerate local rural economies and alleviate poverty in a sustainable and cost-effective way (Agarwal and Narain, 1999). In other words, helping the people to help themselves by improving their local natural resource base is a viable and effective strategy for poverty alleviation. The key to eco-restoration lies in good management and use of the local rainwater. This must be supported by community decision-making systems and institutions. There must also be legal and financial structures to enable and promote community action.

Examples such as those referred to above remain scattered because the governance system needed to foster people's control over natural resources does not exist. Locally-led instances have emerged despite and not because of the system. Effecting change at the micro-level requires enormous perseverance and effort on the part of an individual initiator especially if the governance system does not empower local communities to improve and care for their resource base. However, the government of Madhya Pradesh has now shown that the state can reproduce community-based efforts if there is adequate political will and pressure on the technical and administrative bureaucracy to deliver. The transformation of Jhabua is a fine example of the results that can be expected when a government seriously starts working with people.

Conclusions

The potential of water harvesting is enormous. The cases mentioned here show that improvements begin with increases in the quality and productivity of croplands as available water increases. This leads to better grass production from the local grasslands and slowly increased production of fodder and timber resources from tree and forestlands.

But for water harvesting to support sustainable rural development, there will have to be a change in the governance of water systems (Box 1). Decentralized systems of water management are needed. These in turn demand a community-based system of natural resource management. The only way this objective can be achieved is by deepening systems of participatory democracy and expanding people's participation at village-level. Every settlement must have a clearly and legally defined environment to protect, care for and use. It must also have an open forum in which all can get together to discuss problems and work to common solutions. By strengthening and emphasising the importance of open forums, common solutions and common natural resources, the developing world can make a determined bid to revive dying community spirit and to rebuild its devastated environment. ■

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Box 1. Steps towards a community-based system of natural resource management

- *Maintain water as a community resource*. Water as a common property resource is the crucial link for improving the productivity of private croplands. It is vital to maintain the use of local water as a community resource and not allow water distribution to follow the inequity in land holdings.
- *Adopt an integrated approach to village resource development*. Current rural development efforts are extremely fragmented, focusing mostly on agriculture, and often efforts are contradictory and counter-productive. Yet the 'village ecosystem' usually consists of several integrated components: crop lands, grazing lands, forest and trees, local water bodies, livestock and various energy sources. What happens in one component invariably impacts on the others, and all is maintained in a delicate ecological balance. Thus development must focus on the holistic enrichment of the ecosystem, whereby attempts are made to increase the productivity of all components, from grazing and forestlands to croplands, water systems and animals.
- *Ensure people's participation in the regeneration of village assets*. All new plantations and grasslands have to be protected, but this will need the support of the people. Without this support the survival rates for village assets like check dams and tanks will be poor.
- *Strengthen village institutions to enable people's participation*. Rational use and maintenance of village land and water resources requires discipline. Villagers have to ensure that animals do not graze in their protected commons and that local water body catchments are conserved and properly used. They must also ensure that the common produce from these lands is equitably distributed within the village. Villagers can only achieve this if there is an effective village-level institution to give them an impetus and involve them in controlling and managing their environment. Deepening democracy at the grassroots is critical in the process of ecological regeneration and local water management. The village-level institution must work with a high order of democracy and transparency in decision-making in order to engender cooperation and discipline within the group members. In India, village-level institutions have worked best when they are built along the lines of the Gandhian concept of a *Gram Sabha*, a village institution that empowers the adults of the village to take decisions.
- *Promote decision-making forums*. Open public forums are more transparent and accountable and promote more confidence in community decision-making than small, elected village councils. Resolution of intra-village conflicts and coordination are invariably easier in open village forums where equitable community decisions can be taken than when organisations are closed and secretive.
- *Develop a legal framework that supports local rights to manage resources*. The Indian government owns a substantial portion of the land and water resources. As a result village communities are often alienated from their management or protection. This can lead to massive denudation of forests, overexploitation of grazing lands and neglect of local water systems. Laws dealing with natural resources like land, water and forests will have to be changed to give people the right to improve and develop the village natural resource base. The legal framework should encourage people to take the initiative to develop their natural resource base without waiting for government to act first.
- *Channel government funds directly to village institutions*. In the present system, various functionaries and agencies of the government control the finances upon which village development depends. Ultimately, only a small proportion reaches the community and it is often spent on projects over which the village has little control and which are not local priorities.

This article is derived from a study on the interaction between humans and their environment in the arid Sahel region of northern Senegal. It compares the pastoral community of Maka Ndandary to the sedentary agriculturists of Teud Bitty. Both villages are situated in the Pal-Mérinaguène sylvo-pastoral reserve, an area of declining rainfall. In the period 1931-1960 average rainfall was 473 mm. Twenty years later average rainfall had declined to 258 mm and was considerably more variable. The research was part of the Long-term Environmental Monitoring in Senegal Project and was carried out by EROS Data Center (EDC), the Centre de Suivi Ecologique (CSE), and two local NGOs. The study analysed information collected by remote sensing techniques (satellite and aerial photographs) and Rapid Rural Appraisals in both communities.


Photo: EROS

In Teud Bitty the landscape has become almost treeless.

Cattle and cultivators: conflicting strategies for natural resource management

Living side by side but following different livelihood strategies, the communities of Maka Ndandary and Teud Bitty come into increasing conflict over the use of the areas diminishing resources. The pastoral livelihood system is essentially conservationist in its approach to natural resources while the agriculturists of Teud Bitty employ more extractive methods. The different impacts these communities have on their environment is startling. The study focused on how the two communities managed their natural resources and examined the causes and consequences of recurrent resource conflict. It also examined the role played by the state.

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The village of Teud Bitty

Teud Bitty was founded in the early 1900s by Wolof settlers and today has an official population of some 600 people. Only about 100 people actually live in the village all year round because at least 200 villagers are permanent labour migrants and the rest return to the village during the agricultural season but leave again when the long dry season begins. Migrants find work in the industrial rice, tomato, and sugar plantations along the Senegal River and take on any odd job they can find. Some are able to earn a reasonable livelihood in this way, the majority earn very little.

The social consequences of this seasonal out-migration are substantial. Family life is disrupted and the village is no longer able to engage in collective decision making and action. Out-migration also has several economic implications. The absence of labour has meant that certain activities like animal husbandry are no longer viable because there are not enough people left to care for them. Migrants usually take the family horse or donkey cart with them. This means there is no transport available to haul potable water to the village. The few with carts charge high rates for water transport thus impoverishing the rest of the village.

Resource management

The territory of Teud Bitty is organised along the lines of a classic Wolof village. The village is at the center of the territory and is surrounded by fields. These are in the form of two concentric circles, the smaller of which is immediately next to the village (*tooker* or house fields). The *tooker* is surrounded by the much larger circle of outer fields. Traditionally, *tooker* fields were the most intensively cultivated because they were well fertilised. Today, however, the village does not have enough animals to provide the necessary manure and the *tooker* yields little more than the fields in the outer circle where millet, cowpea, melon and groundnut are grown. In the past, when most of the villagers participated in farming, most of the land was cultivated every year. Now, because soil fertility is low and there is a lack of labour, a significant amount of land is left fallow.

Although the amount of cultivated land is falling, village fields are gradually extending over a larger and larger area. As traditional village fields are abandoned because of abysmal soil fertility, villagers seek to expand into new and more fertile areas. In many cases this has meant expanding into areas that were traditionally used as passageways by herds in the area.

Around the settlement are many varieties of trees which villagers use for shade, fruit and a variety of purposes. Trees within the village and *tooker* are generally protected and cannot be cut. The limits of these inner fields are marked by fences of live shrubs and trees and because these are close to the village and villagers work regularly in the vicinity they can be kept under rigorous surveillance. Beyond the *tooker*, however, there is hardly a tree to be seen. There are many inter-related reasons for the lack of trees. Many of the less drought resistant species died out progressively between 1945 and 1965, as rainfall slowly declined. A large number of trees also then died during the droughts of 1972-1973 and 1983-1984. Charcoal makers, attracted by the dead trees, set up kilns in the area but moved on when the supply of dead wood was exhausted. However, local families, whose agricultural output remained low after these droughts, began to turn to charcoal production, cutting live trees to supplement their income. Before long all the woody species disappeared because there were no rules to prevent villagers cutting trees on the outer fields.

The household economy

Average yields for millet in the region are less than 250 kg/ha and the study suggests that Teud Bitty's yields may be even lower. Residents estimate that the cereals produced by a "typical" family in a good year (two out of ten), will last about three months.

In the past, part of the deficit was compensated by the sale of groundnuts. Groundnut seed is now difficult to obtain, however, and yields (less than 300 kg/ha) are low. Much of the money earned from groundnut production is used to pay off the debts accumulated the previous year. What remains is used to pay taxes, medical expenses, clothes, and buy seeds for the next season. Most families maintain between 3-12 sheep and goats. Villagers admit that fattening one sheep is of more use to them than cultivating a field. The proceeds from the sale of one animal can generally purchase between 50 and 100 kg of grain. However, there are considerable constraints to keeping livestock. Villagers have difficulty in getting enough money together to invest in animals when the family is hungry for most of the year and there are the problems of poor pasture and maintaining herd size.

The money needed to feed the family for up to nine months of the year must therefore come from a patchwork of off-farm activities the most important of which is labour migration.

Lack of integration

The production system in Teud Bitty has always focused heavily on natural resource-based activities: growing crops, exploiting trees and raising animals. Yet there is little integration between these activities and each element of the production system is essentially extractive. At the moment there are no systematic ways of maintaining soil fertility and the cultivation of groundnuts has left the soil denuded and vulnerable to wind erosion further reducing soil fertility. As trees were cut and removed there was no longer leaf litter to replenish soil nutrients. In the past farmers made "fertilisation contracts" with pastoralist. Herders would tether their animals on particular fields at night in order to ensure the ground was well manured. This practice has now been abandoned because farmers claim that in years of very poor rainfall, fields that have not been heavily fertilised will produce better than those that have been intensively manured.

Livelihood strategies in Teud Bitty have become nothing more than a desperate attempt to squeeze what little remains from a depleted resource base. The population is aware that their current livelihood strategies are not viable. As one villager observed out-migration is destined to increase: "You see that few remain here now. We are afraid that even these last ones will soon have to leave."

The Community of Maka Ndandary

The residents of Maka Ndandary are Pulaars of the Wodaabe lineage. The first families settled in the area in the mid-nineteenth century. Today some 150 to 200 people live in the *hurum* (a settlement or 'that which is ours). Maka Ndandary is a scattered assortment of straw huts, animal enclosures, and pasture lands. Despite its apparently haphazard layout, Maka has a strong sense of community identity.

The population of Maka is proudly pastoralist. Nearly all families own cattle, sheep, and goats. Cattle herds can contain up to 60 animals although average herd size is about 25 animals. Sheep flocks vary in size from 10 to 80 animals. An average flock will have between 30 and 40 animals. Most families also have a few goats. Livelihood strategies are partly dependent on transhumance. Some of the *hurum* migrate seasonally with the community's livestock to find better pasture and water elsewhere. Each family also cultivates some crops and, as the study shows, they actually produce more grain than most of their Wolof neighbours.

Each household has a portion of land in the *hurum gese*. This is the most intensively used part of their territory and is roughly equivalent to the inner fields of Teud Bitty. This land is used for building houses and corrals for livestock and crops are planted in fields surrounded by hedges. The animal manure deposited at night in the *hurum gese* makes these lands particularly fertile. Families rotate their fields after five years, switching back and forth between two sites on either side of the homestead, a system that maintains soil fertility. The principal crop is millet. In addition, most families cultivate small quantities of beans, hibiscus, melon, squash, and a very small amount of groundnut for home consumption. The estimated average yield for millet was about 300-400 kg/ha, considerably higher than the 240 kg/ha considered average for the region.

Many families are able to produce enough grain to feed themselves for four to six months of the year. For six months each year they sell a sheep or goat once a week to buy food and other supplies. Even so they still manage to keep the herd size at between 30 and 50 animals. Cattle are only sold in case of emergency. There is hardly any economic necessity to look for work outside the *hurum*.

Resource management

Resource management practices in the Maka *hurum* have evolved progressively over the past 50 years. The rate of change has accelerated dramatically since the 1970s as environmental and human pressures began to increase significantly. From the mid-1950s Maka pastoralists began to be increasingly concerned about tree devastation in the areas where they pastured their

Photo: EROS

Participatory mapping combined with air photo's from earlier dates stimulate lively discussions on the evolution of land use

animals. They noticed that charcoal makers were coming into the area and beginning to wreck havoc with the vegetation. They also realised that there was no basis on which they could act to stop these incursions because they had no boundaries around a territory they could call their own. The heads of family gathered together to discuss the problem. They sent out a delegation to identify trees that would, in future, mark the boundaries of their *hurum*. In doing so, Maka became the first Pulaar community in the area to define its territory.

During the droughts of the 1970s, many Maka pastoralists left the arid north and moved their cattle further south. When they returned to their territory they were shocked to see the devastation that had taken place during their absence: many trees had been cut down by charcoal makers. Once again the community was galvanized into action and surveillance was intensified to control wood cutting. The residents decided that they would abandon the practice of moving entire families out of the *hurum* during transhumance. In future a few members of the community would stay behind with the explicit function of protecting the trees.

It was not only outsiders who were responsible for damage, but also some of the villagers themselves. Therefore, the community established a number of rules to control how the natural resources of the *hurum* should be used. No tree product, whether from live or dead trees, can be cut or collected in the *hurum gese* without the express permission of the land-holder. On the *hurum ladde* (outer pastures) people may harvest tree products for their own personal use, but they are prohibited from using them for commercial purposes. The same rules apply cutting grass because, in years when rainfall is low and fodder is scarce, there is a big demand for hay and outsiders come into the region with their carts searching for grass that they can cut and sell in the cities.

There are currently about 15 tree species found in Maka, considerably more than in neighbouring farming villages although far less than in the past when there were as many as 50 species in the area. Dense concentrations of trees are found in the *hurum gese* that occupies about a third of the *hurum* lands. Villagers patrol part of the outer pasture, the lesser *hurum ladde.* This has quite a few trees though not as many as the *hurum gese*. In the largest part of the outer pasture (the greater *hurum ladde*) there are significantly fewer trees, but there are signs of regeneration.

Conflicts over land and resources

Currently, depleted soils in the home territories of neighbouring villages are pushing Wolof farmers to expand onto new lands. Land in pastoralist communities such as Maka is relatively fertile which makes grasslands very attractive to neighbouring farmers. When pastoralists see a farmer cutting trees to prepare a field for crop production they try to reason with him to leave the territory. If the farmer will not leave voluntarily, the herder's only recourse is to ask the authorities to intervene. Maka residents report two cases where they notified the authorities and actually received a favorable ruling. However, the victory was illusory: the cultivators did not retreat and the authorities did nothing to enforce their ruling despite continued pressure from Maka residents.

While in these two instances State authorities did recognise the rights of Maka residents – at least in theory – they did so to avoid conflict between two neighboring communities. In general the State has cast a blind eye to the extension of cultivated land into Pulaar *hurum* grazing land. The authorities follow the principle that land should be allocated to those who will make it productive. "Productive land" is considered to be land that is cropped or planted with orchards…and does not include zones that are used for extensive grazing.

In fact, there are no plans for how land should be used in the area or what the rights of different populations and interest groups should be. Instead of managing the land, the Rural Community Council manages conflicts as they arise. Its main objective is to reduce the number and severity of disputes.

While the Maka residents have had only limited success in protecting their space from aggression by neighboring farmers, they have been substantially more successful in protecting the trees and grasses of their territory. They note with pride that when they confront someone found cutting a tree, the person almost always stops and leaves the territory without creating further disturbance. They feel that this is due to the fact that, for the last twenty years, they have systematically insistenced on their right to control the cutting of wood.

Pastoral livelihood threatened

The pastoralist livelihood system as practiced in Maka is essentially in harmony with its environment. This can be explained by two related factors. The first is the essential integration of all elements of the production system. Animals, trees, and crops are integrated in such a way that no resource is subject to sustained extraction without there being some compensatory input. The second ingredient is the explicitly conservationist approach of the local community. As the pressure on resources increases due to population growth, reduced rainfall, and a variety of other factors, these collective and protective strategies have become progressively more stringent and systematic. The aggressive and expansive use of land in neighbouring agricultural villages is currently threatening the sustainability of the system.

While the threat to the environment and to the pastrol livelihood is very real, it is not too late to put policies in place to improve the situation and protect the resources and the economic interests that depend on them. Time is running out, however, and only by a concerted effort that mobilises activists at the national, regional and community level can progress be made. The residents of Maka have not given up and those who share their concern for maintaining the fragile ecosystems of dryland northern Senegal should not give up either.

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This article is based on: ***Cattle and cultivators: A study of competition over natural resources in northern Senegal.*** *Karen Schoonmaker Freudenberger and Eric Wood, 1998, EROS Data Center, Sioux Falls, South Dakota, 57198 USA.*

Karen Schoonmaker Freudenberger with Eric Wood, Amadou Moctar Dieye, Pape Meissa Diop, Moussa Drame, Fary Ka, Mamadou Ly, Daouda Ndiaye, Gray Tappan, and Moustapha Thiam.

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Kandia: threatened forest, threatened livelihood

by Freudenberger K, Hadj A, Ndiaye T and Trappan G. 1996. 43 p. Eros Data Center, Sioux Falls, South Dakota 57198, USA.

This study describes clearly the positive side of the forestry situation in the southern part of Senegal an area that receives between 800 and 1000 mm of erratic rainfall. The study used participatory methods to identify and quantify vegetation resources. Typical tools such as village mapping, wealth ranking and individual farm sketches, were checked with secondary data from existing soil maps and satellite imageries. Special emphasis was put on resource allocation and benefit sharing issues in relation to food security by applying a gender differentiated historical matrix on roles. Villagers gave considerable attention to the issue of burning vegetation especially with regard to control strategies and their implementation. Institutional aspects such as legislation, procedures and relationships with higher administrative levels were also being examined. The study provides an interesting framework for the implementation of inventories at village level, serving as an effective tool for the participatory establishment of elementary baseline data. (KM)

Communities combatting desertification: livelihoods reborn

Editorial

Desertification, better defined as land degradation, is of major and continuing concern to communities living in dry regions. It is the cause as well as the effect of poverty and endangers the welfare and livelihoods of future generations.

In 1993, the United Nations launched the 'Convention to Combat Desertification' (CCD) (p6). Most signatories to this convention are now formulating 'National Action Programmes' (NAPs) to deal with the problem in their own countries and some have reached the stage of implementation. The Convention sets out to address land degradation and its socioeconomic dimension - poverty - in an integrated and embedded way. It emphasises a "bottom-up" approach that sees civil society participating fully in decision-making and in doing so has raised hopes that concerted action will be possible.

Under the terms of the Convention, community-based organisations and NGOs are supposed to elaborate Local Area Development Programmes. These will subsequently form the basis of action plans at the national and regional level. Experiences with the formulation of NAPs indicate that some countries such as Argentina, for example, (Merega p7) have made an important break-through as far as the participation of people's organisations and NGOs are concerned. However, there are many countries where the lack of peoples' participation and the absence of planned integrated and concerted action and funding for such activities are major constraints. At the same time, unaffordable and non-sustainable technologies such as chemical fertiliser and large dams are still being recommended as solutions (Soccal p20).

This issue of the ILEIA Newsletter focuses on community action to combat desertification and on participatory methodologies to support communities in their efforts to devise effective ways of regaining their livelihood. What did we learn from the articles?

Causes of desertification

It is generally acknowledged that the causes of desertification are mainly human in origin. To combat desertification effectively, we need to understand these causes and underlying socioeconomic and cultural processes (Kessler p26). The articles offer significant insights.

Agarwal and Narain (p11) and Freudenberger (p8) point to colonial intervention. Foreign powers ignored traditional indigenous resource management, established the western concept of market agriculture, reoriented education and research and centralised state power. In the process community lands were expropriated and forests decimated. Most post-colonial government elites continued to operate with these foreign concepts and policies as they pursue the global 'development' dream.

- In the relatively fertile central region of Senegal, export-oriented groundnut monoculture has largely replaced traditional land-use practices. Forest, livestock and cropping are no longer mutually supportive. Pastoralism is increasingly difficult as the rangelands needed for transmigration in dry years are being taken over by sedentary farmers who have the support of government policies. At the same time traditional decision making, land tenure and management often lack the flexibility to adapt to new needs.
- In India, traditional water harvesting systems - once the backbone of Indian agriculture - have been replaced by deep wells. Rural communities and tribal people in particular have lost access to forest resources as most forests have been cut down and the monocultures of market-orientated agriculture have become common practice.

Such changes have resulted in the ecological degradation and poverty of local communities, important push factors stimulating a steady stream of outmigration. As Muhia (p16) stresses, combating desertification is more than a technical issue; it has fundamental political and cultural implications.

Opportunities recognised

Among the positive developments mentioned is the growing recognition of the need for cheap, ecologically sound technologies adapted to local conditions such as applying organic fertiliser and rock phosphate (p24) and using local materials to build water harvesting structures (Lopez and Bunch p22; Soccal p20). Traditional resource management strategies, such as those for rangeland management (Freudenberger p8), for example, are being re-valued because economically and ecologically they often prove more sustainable than conventional practices. Some governments have accepted policies that empower communities to manage their own natural resources (eg Joint Forest Management, p30). In addition, they increasingly disseminate technologies developed by NGOs and POs (Soccal p20) and enhance massive investment in watershed development (Agarwal and Narain p11).

There is growing awareness of the economic potential of ecologically-sound management and communities are starting to adapt their land use practices. Development workers, researchers and policy makers can strengthen such initiatives and create conditions favourable to local, natural resource management and farmer innovation. This may mean that professionals will have to reassess their conventional role. However, as Lopez and Bunch (p22) make clear, researchers who support farmer innovators need not be afraid of loosing their jobs. They are needed for the tasks farmers are unable to do themselves.

Communities recreate livelihoods

The contributors to this Newsletter describe successful community-led action where farmers have regained control over their natural resources and been able to recreate livelihoods.

- When Pulaar pastoralists in Northern Senegal became aware of the way their natural resource base was being degraded, they started to protect it against outsiders and those misusing it in their own community. This resulted in the conservation and regeneration of natural vegetation on which they depend for their livelihood (Freudenberger p8).
- Communities in dryland India, after becoming aware of the potential of watershed management to raise income and rebuild communities, have started to redefine rural development (Agarwal and Narain p11). Farmers in Rajastan, India, finally felt 'free from poverty' when conditions improved enough to allow them to return from the city to take up farming again (Shree Padre p14).
- Tribal communities in Gujarat, India, supported by BAIF, started to re-value their degraded forest land after achieving profitable, stable and sustainable livelihoods from growing fruit, fodder and fuel-wood trees (Mahajan p18).
- In Kenya, communities supported by KENGO are becoming more aware of their traditional cultural roots and values. This motivates them to regenerate the natural resource base which now provides them with sustainable livelihoods (Muhia p16).

Preconditions for regeneration

There are important preconditions for community-led regeneration of the natural resource base as the articles in this Newsletter show.

- Muhia (p16) refers to the importance of reviving traditional African values of respect for nature in order to motivate communities to regenerate their environ-

ment. However, he admits that without economic benefits motivation cannot be sustained.
- Affordable 'win-win' technologies that provide acceptable, competitive economic benefits and have positive effects on the environment should be available. Water harvesting is one such win-win technology. Information on indigenous and scientific win-win technologies must be accessible.
- Social unity and equity, strengthened by (traditional) social values and democracy are crucial to enhancing community action and peoples' participation. The benefits of regeneration should be shared and not reserved for the rich and powerful.
- Effective village institutions are needed to ensure full participation in decision making, coordinated community action, conflict resolution and access to governmental support.
- Legal frameworks and policies are needed that support the right of the local community to manage resources equally and that support participatory farmer innovation and the development of locally affordable solutions derived from indigenous and scientific knowledge.

Water and soil management

Although water management is crucial in combating desertification, soil management is equally important. This is particularly so where soils are poor and eroded, their organic content neglected and soil nutrients are exported without any compensation from external inputs of organic or chemical fertilisers (negative nutrient balance). All these factors undermine soil fertility. This situation is common in West Africa and scientists indicate that if no serious attention is paid to soil fertility management it will be impossible to halt land degradation and declining productivity and the poverty and communal disruption it brings. To break this vicious circle an international "Soil Fertility Initiative" has been launched which aims to facilitate the formulation of NAPs for Integrated Soil Fertility Management. Burkina Faso is one of the first countries that formulated – in a participative way - a national strategy to re-capitalise its soils (p24). Such strategies should be an integrated part of NAPs to combat desertification.

At farmer level further differentiation is needed to adapt soil fertility management to the specific local conditions. Resource Guides on participatory learning and soil fertility management (Defoer et al. p25; FARM p26) can be helpful tools in designing farmer-specific strategies.

Cartoon Anil Achar, India from **Comics to Combat Desertification**, Secretariat UN Convention to Combat Desertification, Geneva

Deforestation or making way for the camels

Balancing market and subsistence

Like the Soil Fertility Initiative, most (inter) national programmes to improve agriculture focus on developing market agriculture. It is assumed that this is the way to increase surplus production and raise the standard of living. *However, is it not time to officially admit that, in many economically marginal and ecologically vulnerable regions eg. in Africa, market agriculture based on external inputs is neither economically profitable nor ecologically sustainable and is often at odds with local culture* (Zone III, Breman p24). This may be the case even where investments in recapitalisation of soil fertility are being subsidised as in Burkina Faso. This also would mean admitting that agriculture in these regions should be based on the locally available resources, diversity and prevention of resource depletion - in other words, the basic foundation of traditional subsistence-oriented agriculture. This does not exclude new strategies for raising production and income. Selective production for market, labour migration or eco-tourism can be considered but only after a careful analysis has been made of what is ecologically affordable, culturally acceptable and economically feasible. The articles by Freudenberger (p8), Agarwal and Narain (p11), Shree Padre (p14) and Muhia (p16) provide examples of communities that are successfully building their future on their own traditional wisdom and experience in natural resource management. When external inputs become increasingly expensive and inefficient the need for this approach becomes even more apparent.

Conserted action needed

There are many organisations active in the broad field of combating desertification and stimulating rural development. An important aspect of NAPs should be the coordination of activities. Participatory environmental analysis and planning tools such as SEAN (Strategic Environmental Analysis) (Kessler p26) can help to reach a deeper understanding of the local economic and environmental situation. At the same time it can facilitate the development of strategies to reduce poverty, improve human welfare and regenerate the natural resource base and coordinate concerted action. In doing so, desertification can be combated in an effective and sustainable way.

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Themes for the ILEIA Newsletter

You are invited to contribute to these issues with articles, suggestions for possible authors, and information on interesting issues, publications, training courses, meetings and Websites. The ILEIA style guide is available on request or at www.oneworld.org/ileia. Please do not wait until the last minute to send in your article. Accepted contributions will be published in the ILEIA Newsletter or on the ILEIA Website.

Photo: Ramprasad

March 2000
Vol.16-1
Desertification
Deadline for contributions 15 January 2000.

June 2000
Vol.16-2
Farmer innovation
How to support farmer innovators to enhance the adaptation of land use - agriculture to changing conditions and needs: e.g. innovator networks, farm radio, rural communication programmes, rural information centres, participatory technology development, platforms for innovation. How to create a social and economically benign environment for farmer innovation and farmer – researcher collaboration. How to enhance up-scaling of innovation. Interesting examples of innovations developed by farmers.
Deadline for contributions 1 March 2000.

September 2000
Vol.16-3
Integrated agriculture
How can unsustainable slash and burn systems evolve in more sustainable and permanent integrated systems. How can such an evolution process be supported and what are the economic and social preconditions for developing integrated systems. Interesting examples of: indigenous agroforestry systems and their evolution; indigenous or agroecological strategies to intensify agroforestry systems; the spiritual, cultural and social dimension of indigenous integrated agriculture; role of animals in integrated systems; value adding and marketing of indigenous or new crop, tree or animal products; economic comparison of the performance of integrated systems.
Deadline for contributions 1 May 2000.

December 2000
Vol.16-4
Monoculture systems
How to make monocropping or mono-animal systems more sustainable. How to develop them into integrated systems. How to improve the production chain. Interesting examples of: ecologisation and intensification; diversification; soil fertility management; pest management; processing; input supply; product development and value adding; marketing.
Deadline for contributions 1st September 2000.

January – March 2000
Vol.17-1
Resilience
How do farmers prevent disaster and react to the catastrophies of drought, flood, armed conflict, disease and economic crisis. How does this influence their farming and livelihood strategies. How do farmers deal with variability and risk. How can the resilience of farming and households be improved. What impact does labour migration have on farming systems and gender roles. How can women best adapt farming in areas of labour migration and still optimise benefits and ecological sustainability. How can gender roles be renegotiated. How can women farmers best be reached and supported. How can farming by refugees be supported.
Deadline for contributions 1 December 2000.

ILEIA Newsletter: new subscription policy

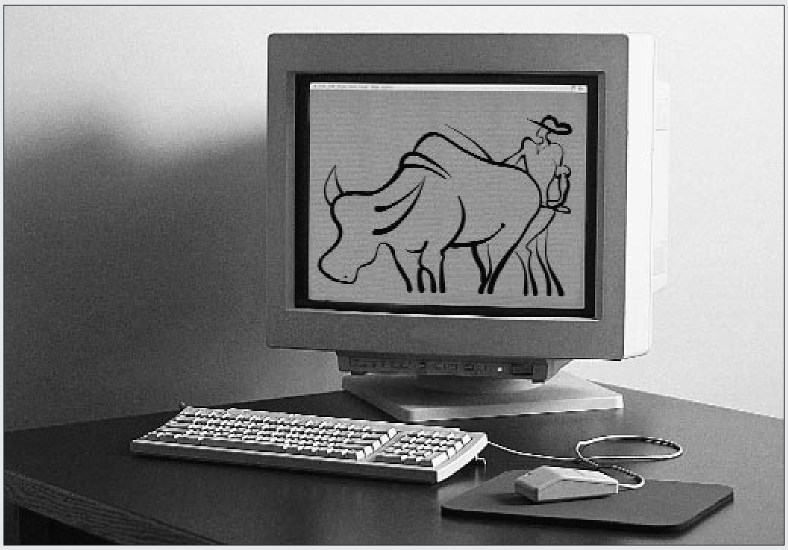
Bert Lof writes: A new institution dealing with sustainability has to ensure its own sustainability and financial future. The ILEIA Board has decided to change the Newsletter subscription policy. So far, 92% of all those who read the ILEIA Newsletter receive it free of charge, thanks to ILEIA's donors.

ILEIA will gradually introduce paid subscriptions at affordable rates. We are trying to initiate local currency payments in order to avoid heavy bank charges. When it becomes possible for you to pay in this way we will get in touch with you immediately and provide you with details about rates and method of payment. Those in developing countries who now receive the Newsletter free of charge will go on receiving it free of charge until paid subscriptions in local currency are introduced into their region.

We have set the yearly subscription for the quarterly Newsletter at EURO 10.00 or US$10.00 for organisations and individuals in the Third World and EURO 25.00 or US$ 25.00 for all other subscribers (or equivalent in local currency).

For further information about subscriptions and concessionary rates please contact Nicole Krutz, Subscriptions, E.Mail Subscriptions@ileia.nl, ILEIA, PO Box 64, 3830 AB Leusden

Building an Information Web



ILEIA is planning to develop its Internet Website into an interactive information and discussion platform on the development of LEISA. As the development of sustainable agriculture is a very broad subject and information management is a time consuming business, this will only be possible if ILEIA focuses its information gathering and distribution activities on specific themes. ILEIA will need to work in close cooperation with other information organisations that deal with specific aspects of sustainable agriculture.

ILEIA will specialise in particular themes relevant to sustainable agriculture but it will not loose its holistic perspective. Step by step, ILEIA will put information on these themes on the ILEIA Website. To maximise the efficiency of our work, the themes on the Website will be the same as the themes chosen for the ILEIA Newsletter. For example, the present issue of the ILEIA Newsletter is concerned with ‘agrobiodiversity’. An agrobiodiversity information platform will be opened on the ILEIA Website. The information published in the ILEIA Newsletter will be put, in full, on the Website; linkages with other sources of information will be made and additional information on agrobiodiversity will be added regularly. ILEIA will make use of the interactive potential of the Web to keep in touch with the agrobiodiversity debate. A monitored discussion site and links to established question and answer database will provide readers with opportunities for introducing new information and developing the issue further from their own perspective.

In the coming year, regional LEISA Websites will be established, beginning in Latin America. These, together with links to other sites and media, will speed up the process of assembling a growing body of information that can be used by farmers, extensionists and policy makers involved in the LEISA approach to sustainable agriculture. At the same time ILEIA will continue to collaborate with regional information centers to improve the two-way flow of information on LEISA between those involved in social, economic and political aspects of agriculture at regional, national and the global level.

The ILEIA Newsletter plans to deal with a series of thematic issues in this way. Each issue will be a springboard to constructing a new platform, the opening of new thematic dossiers, the building of another shelf in the LEISA virtual library, and creating more opportunity for online discussion.

‘Desertification’, ‘farmer innovators’, ‘integrated agriculture’, ‘monocropping systems’ and agrarian ‘resilience’ have been chosen as the themes for the next five ILEIA Newsletters. These themes are linked in many ways and can be approached from a multitude of perspectives. Keywords - ‘agroforestry’, ‘soil fertility’, ‘gender’ ‘groundnuts’ can provide entry points to the information, links and digitalised information that will be built up on the ILEIA Web. Gradually ILEIA hopes to develop platforms that will evolve into one international, multi-organisational and multi-entry-point information Web on the development of sustainable agriculture. Information that links ideas, stimulates action and supports policy.

ILEIA intends to build an information web that is as participatory and interactive as possible. Software for interactive information sharing is developing fast and ILEIA intends to use its experience with INTERDEV, a European initiative concerned with a broad range of development issues, to further consolidate its capacity to profile LEISA as a viable basis for rural and agrarian livelihoods. For those who have no access to Internet, CD Roms will be made available, and ILEIA will continue with its established publication and information services.

ILEIA Foundation: Forging LEISA

After 15 years of steady support from the Dutch Government the ILEIA project – initiated and guided over the years by ETC – has been transformed into the ILEIA Foundation. A new and challenging time lies ahead.

Since May 1999, the ILEIA Foundation has been able to continue the tasks of the ‘old ILEIA’ thanks to the generous support of the Dutch cofinancing organisation NOVIB, and a long-term commitment from the Swedish International Development Authority (SIDA). The ILEIA Foundation intends to further emphasis it role in collecting and systematising information on LEISA and to increase the scope of its regional programmes. The busy ILEIA offices will be staffed by many of the same experienced people already well-known to Newsletter readers. There will be new faces too. At the moment ILEIA is looking for a Director and, hopefully, in the next issue of the Newsletter, we will be able to introduce this new team member to you.

The Board of the new ILEIA Foundation has been “installed”. At the moment there are four members: Sunita Narain, Centre for Science and Environment, New Delhi, India; Professor Eric Goewie, Wageningen Agricultural University, The Netherlands and Dr. Stein W. Bie, Director General of the International Service for National Agricultural Research in The Hague. As well as ensuring continuity, their task will be to help chart an effective course for ILEIA in the coming years.

The ILEIA Foundation has already begun work on its new programme. In November 1999, the ILEIA Latin American regional programme got the go-ahead. This programme will include the further development of the Spanish language version of the ILEIA Newsletter and is supported by three Dutch cofinancing organisations - ICCO (lead donor), NOVIB and HIVOS. It is the first of some five or six regional programmes that ILEIA intends to implement. Other regional programmes are being developed for South Asia, Southeast Asia, West Africa, Southern Africa and the Middle East & Northern Africa. In these areas, regional editions of the ILEIA Newsletter will be produced. Regional Newsletters will carry some of the material published in the International version of the Newsletter but at least 50% of the contributions and information on publications and networking will come from the regions themselves. Regional editions in Arabic, French and other languages are a real possibility in the near future! A regional editorial committee will be responsible for producing these Newsletters locally.

If you would like to know more about ILEIA’s plans for the future have a look at our Website www.oneworld.org/ileia or get in touch with us here in Leusden.

Stein W. Bie
Chair, ILEIA Foundation

Bert Lof
Director ad interim

AGROMISA and ILEIA:
Your questions, our answers

Agromisa has come to the ILEIA Newsletter. In each issue, the Agromisa's Question and Answer team will deal with a selection of readers questions on themes planned for coming editions of the Newsletter. This year these include the relation between LEISA and the issues of desertification, farmer innovation and integrated farming as well as the problems associated with restoring ecological balance in areas of monocrop cultivation (see p64).

Introducing Agromisa

Agromisa's Agricultural Advice Service began in the mid-1930s and 65 years later it is still answering questions sent in by agricultural extensionist, rural community development workers farmers and training organisations. Agromisa focuses on issues that affect the sustainability of agriculture in the tropics and every year it provides detailed answers to many hundreds of questions from farmers and their organisations throughout the developing world. Questions are answered by a team of specialist volunteers made up of researchers, academics and agriculturalists. Once questions have been answered they are systematically classified and stored in a large and easily accessible database. The information provided gives a rich insight into the problems faced by small-scale farmers often working in economically and ecologically difficult conditions.

Biodiversity

This issue of the ILEIA Newsletter is concerned with biodiversity. Biodiversity is not a word often used by farmers. It is better suited to the desks and studies of researchers and policy makers. Agromisa has never received a question that directly refers to problems of biodiversity yet it does receive questions that can only be dealt with in the context of biodiversity.

In this first edition of the Agromisa column, we give one or two examples of the type of questions sent to us that concern biodiversity. Most of those we have received in the past have to do with maintaining plant vigour and preserving the potential for further strengthening and developing crops for a diverse and secure food supply. Some farmers want to know how new farming technologies can be combined with traditional practices "Can we combine hybrid seeds with our traditional seeds?' Others, more concerned with improving cultivation practices, ask how they can select seed with specific qualities (eg drought resistance). There are also farmers who admit they have lost touch with their traditional farming practices and need help to rediscover local resources and ways of propagating and storing local seed and plant material.

The ILEIA team hopes this column will generate a steady stream of questions to the Agromisa service and that we will be able to use some of them in the Newsletter. Each question we receive will be acknowledged. Questions selected for publication in the ILEIA Newsletter and those from individuals and organisations working with farmers at grassroots level will be answered free of charge by Agromisa's Question and Answer team. Questions from other organisations will be charged US$125.

For more information see www.agralin.nl/agromisa/
or contact Marijke Kuipers, Director, Agromisa Question and Answer Service, PO Box 41, 6700 AA Wageningen,
The Netherlands, Tel +31 317 412217,
Fax: +31 317 419178, E-mail: Agromisa@wxs.nl

Left to right: KVS Prasad and Chitrah Suresh (LEISA India Inlay) and Teresa Gianella (El Boletin) attending the international editors workshop in The Netherlands, March 1999

From the Regional Newsletters

Teresa Gianella *El Boletin*, Lima, Peru writes:

The theme of this Newsletter is of considerable interest to Latin American readers. They are well aware of the enormous genetic diversity within our native agriculture. Farming and livestock breeding practices in different Andean and Central American ecosystems made this continent one of the rich focal points from which food crops such as corn, common beans, sweet potatoes (Central America), potatoes, butter beans, peanuts (Andes) and cassava (Brazil, Paraguay) have spread throughout the world.

Today, however, just like small farmers in many other developing countries they are currently among the world's most poverty-stricken inhabitants. Their biodiversity is now at risk because they lack the political and economic power to challenge the powerful international consortiums of the biotechnological industry.

This double issue on Agricultural Biodiversity is the first of a new series of El Boletin de ILEIA. Over the next two years El Boletin will gradually become an independent regional Newsletter. One of its made objectives will be to foster the exchange of experiences of sustainable agriculture between the different countries of Latin America and other parts of the developing world. We plan to follow the concept for ILEIA regional Newsletters and carry both regional and international sections.

We invite our readers - and anyone interested in the ecological, cultural and economic viability of sustainable farming practices in Latin America - to write to us, and tell us what they think of this edition of the Newsletter. Please feel free to propose topics and make suggestions about language, text, design, illustrations, layout and anything else you think might improve El Boletin. Some of our readers have already written to us and we have a lively correspondence with Mexico, Cuba and Bolivia. As editors, we are very grateful for these comments.

Teresa Gianella-Estrems, LEISA El Boletín de ILEIA, ETC Andes, P.O. Box 18-0745, LIMA 18, Perú
Phone:+51 1 2413787; Fax: + 51 1 4225769
Email: <estrems@amauta.rcp.net.pe
Subscrptions: Aldo Cruz; LEISA El Boletín de ILEIA; ETC Andes; PO Box 18-0745, LIMA 18, Perú

KVS Prasad *LEISA, India Inlay* Bangalore, India writes:

The LEISA India Inlay, the first all India supplement to the ILEIA Newsletter, came out in March this year. It contained 16 pages of articles, news and information on the theme of marketing organic products in the subcontinent. The Inlay has received an enthusiastic response and circulation figures for the ILEIA Newsletter in India are climbing steadily toward the 4000 mark.

It looks as if the basic objective of moving the distribution and production of the ILEIA Newsletter to India as a first step towards developing an independent South Asian regional Newsletter has been a success. In line with the plans for other regional Newsletter's it is hoped that the LEISA India Inlay will eventually become an independent periodical publishing both international and regional LEISA articles and news of interest to readers in South Asia. Certainly, local distribution and publication activities have proved successful in attracting the attention of agricultural researchers, extensionist and community development workers.

The Inlay will publish articles on themes selected by the international editorial committee. This year these will be Desertification, Farmer Innovation, Integrated Farming, and an issue dealing with the problems associated with restoring ecological balance in areas of monocrop cultivation.

For more information or for a copy of the India Inlay:
KVS Prasad, PO Box 7836, Bangladore 560 078,
India. E-mail: amebang@giasbg01.vsnl.net.in

NETWORKING

4th National Congress on Organic Agriculture

17-19 May, 2000, Cuba. The congress will be organised by the 'Grupo de Agricultura Orgánica' of the 'Asociación Cubana de Técnicos Agrícolas y Forestales (ACTAF) in coordination with the 'Ministerio de la Agricultura' and the 'Asociación Nacional de Agricultores Pequeños' in EXPO-CUBA, Ciudad de La Habana. Main themes will be: Cuba in the world of sustainable agriculture; contributions to sustainable rural development in Latin America and the Caribe; from integrated production systems towards agroecology; contributions of small farmers to agroecology and food security; production potential and market opportunities of organic products; promotion of organic agriculture; economic assessment of agroecological technologies; conservation and regeneration of soil fertility; organic agriculture at the start of the 21st Century: the state of the art in Cuba. Study tours (10-16 May) and a training course (20-24 May) will also be organised.

More information: Marta Pérez Pérez, Secretaria Ejecutiva, Grupo de Agricultura Orgánica – ACTAF, Apartado Postal 4029 C.P. 10400, Ciudad de La Habana, Cuba. Tel/Fax: +537 845387; actaf@minag.gov.cu

Reconciliation and renewal: through collaborative learning

5th World Congress on Action Learning, Action Research & Process Management, 9th World Congress on Participatory Action-Research 10-13 September 2000, University of Ballarat Victoria, Australia. The Congress will deal with Reconciliation & Renewal in relation to: inequalities in global communities, the environment, the experiences of indigenous peoples, work, religion, the personal position in society, and diverse value systems. Participants are likely to be involved in: creating & facilitating change, creating reconciliation & renewal through participatory action learning & action research, developing alternative learning processes and new capabilities required in the global scene of the 21st Century.

More information: ALARPM/PAR World Congress Secretariat, c/- The Conference Organisers Pty Ltd, PO BOX 1127, Sandringham VIC 3191 Australia. Phone: +61 3 9521 8881; Fax: +61 3 9521 8889; conforg@ozemail.com.au ; www.conferenceorganisers.com.au

IFOAM 2000. The World Grows Organic

The 13th International Scientific Conference IFOAM 2000 will be organised by the Research Institute of Organic Agriculture (FiBL), 28-31 August 2000, Basel, Switzerland. IFOAM 2000 will explore ways in which organic agriculture can gain global momentum in production, processing and trade in the new millenium. The conference will be accompanied by seminars, exhibitions, excursions and public events.

More information: IFOAM 2000 c/o FiBL, PO Box, CH-5070 Frick, Switzerland. Fax: +41 62 865 7273; ifoam2000@fibl.ch ; www.ifoam2000.ch

Land conservation and food production in the third millenium

The 11th International Soil Conservation Organisation Conference will be organised by the National Institute of Agricultural Technology and the Faculty of Agronomy, University of Buenos Aires, Argentina. The ISCO 2000 meeting will be held October 22-27, 2000. Four main themes have been defined:
- Extension and intensity of land degradation processes. The challenge of the new causes of degradation.
- Scientific and technological advances for the protection of the environment and sustainable land use.
- Socioeconomic factors of human interventions and their consequences for food production and the environment.
- Policies for environment conservation. Scientific cooperation, education and extension.

More information: Secretaría Científica ISCO 2000, FAUBA, Av. San Martin 4453, (1416) Buenos Aires, Argentina, Tel/Fax: +54 11 4481 1688; isco2000@cirn.inta.gov.ar ; www.agro.uba.ar

Globalisation and local development: challenges to small-scale production

The International Farming Systems Association (IFSA) will hold the 16th symposium in Santiago, Chile 27–29 November 2000. Simultaneously, the 4th Latin America Farming Systems Research and Extension (IESA AL – IV) symposium also will take place. The main theme of these symposia is the interaction (conflicts as well as opportunities) between global and local processes, which are shaping the rural regions of the world and their relation to the impact on small farmers' production systems and their technical, social, economic and cultural behavior. Main themes will be rural poverty and food security; small farming systems, markets and competitiveness; environmental sustainability; institutional development. Spanish and English will be the official languages. Abstracts of contributions are due on 29 February 2000.

More information: IFSA/IESA, Casilla 228 Correo 22, Santiago, Chile. Phone: +56 2 236 4557; Fax: +56 2 236 4558; IFSA@rimisp2.cl ; www.rimisp.cl/ifsa_iesa2000.htlm

Cultures and biodiversity congress 2000

21-31 July, 2000 in Kunming, PR China. The specific objectives of the CUBIC congress are:
- To provide the opportunity for researchers to exchange experiences with each other, as well as with representatives of local cultures, policy makers and development staff, on the interactions of cultural values and practices and the management of biodiversity. What insights have been gained about these interactions and what impact do external forces have on these processes.
- To create a dialogue with one another and an image of the future that supports prosperous local cultures using and sustaining biodiversity in traditional and innovative ways. What do we think a better world would look like with regard to local cultures and the management of biodiversity?
- To develop appropriate approaches in which 'outsiders', government and non-government, can act differently and ways in which 'insiders' and local communities can be strengthened in their ability to govern their natural resources and secure their livelihoods.

The ten day programme will combine presentations, workshops, group work, field trips, arts and crafts.

More information: Therese Grinter: Xujc97@public.km.yn.cn or Xu Jianchu: CBIK@public.km.yn.cn

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The International Agricultural Centre (IAC) is offering a two weeks course on: '**Plant variety protection**', 14-27 May 2000, 13-26 May 2001. Many countries are developing a legal framework for protecting plant varieties. The Uruguay Round of GATT gave an important impetus to this development. The execution of such a legal system requires sound procedures and profound knowledge of variety testing and variety registration. The course aims to assist emerging plant variety protection systems in their human resource development. The course focuses on legal, institutional and technical aspects of plant variety protection. The IAC has no funds for financing participants, funding must therefore be secured elsewhere.

More information: IAC, PO Box 88, 6700 AB Wageningen, The Netherlands, Phone: +31 317 495495; Fax: +31 317 418552; Training@IAC.AGRO.NL ; www.iac.agro.nl Closing date for application: 15 March 2000.

In April 1999 IAC has launched **a new information system, WISARD, on 'Agricultural Research for Development' on the WWW**. It contains information on research projects as well as institutes. It addresses the needs of organisations and networks in developed and developing countries to have updated and quick access to information on activities and potential partners searchable by country, keywords, institution etc. It is possible to enter and update information online.

More information: www.iac-agro.nl/wisard

Internet Conference: '**Material flow analysis of integrated bio-systems**' (March-Oct. 2000). The conference will be organised by the Institute of Advanced Studies of the United Nations University (Tokyo) (www.ias.unu.edu) and the UNU/IAS Integrated Bio-Systems Network (www.ias.unu.edu/proceedings/icibs/ibs/ibsnet) in cooperation with other organisations. The internet conference will focus on the analysis of material flows in integrated bio-systems. The organisers welcome abstracts of papers that can describe and quantify the flow of materials in existing and conceptual bio-systems under such themes as: Municipal biodegradable solid recycling and conversion systems., wastewater treatment and utilisation systems, integrated aquaculture systems, small-scale farming systems, large plantations, farms and feedlots, tools and methodologies for the design and analysis of integrated bio-systems.

More information: Mr. Jacky Foo foo@swipnet.se or www.ias.unu.edu/proceedings/icibs/ic-mfa/

SOLUTIONS TO POVERTY:

FROM MALTHUS TO BIOTECHNOLOGY

This year Zed Books published The Malthus Factor by Eric Ross. It is a major critique of the way Malthusian thinking has influenced capitalist development policy in modern times. Among other themes the book e xamines how the political economy of underdevelopment has been left unanalysed as public alarm focuses on the more visible effects of overpopulation.

Since the publication of Thomas Malthus's *Essay on the Principle of Population* in 1798, poverty, death and environmental degradation has been seen as the product of human population pressure on the means of subsistence. Malthus, writing in Great Britain at the beginning of the Industrial Revolution, suggested it was primarily the irrational reproductive and productive behaviour of the poor themselves that caused their material deprivation. He ignored the role of the economic system in the creation of poverty much as we in the North today ignore the role played by globalisation, trade liberalisation and the agricultural policies of leading industrial nations in entrenching poverty and food insecurity in the developing world.

In his book, **The Malthus Factor**, Eric Ross argues that Malthusian ideas have surfaced at critical moments in recent Western history and today they are being used to justify political and economic policies designed to promote the market economy. He questions, however, whether their objectives can ever provide the infrastructure necessary for building economically stable and socially just societies in the South.

Political instability, economic disorganisation and food security problems are frequently seen by international policymakers as the consequence of unwillingness on the part of developing countries to check population growth. Ross demonstrates that these problems are more often the consequence of social injustice and inequality in the distribution of resources.
It is in these terms that he introduces his analysis of the consequences of the Green Revolution. He argues that the transformation of labour-intensive peasant food production into capital-intensive commercial agriculture is regarded by some as a humanitarian response to the effects of supposed population pressures on food and income security in the Third World. A more realistic assesment would be that multinational companies and investors see the Green Revolution in more opportunistic terms.

Ross suggets, for example, that the Green Revolution was an integral part of a constellation of strategies that were intended to ensure the security of US interests worldwide. He suggests that the first targets of the Green Revolution were those countries where US strategic interests seemed most threatened by rural unrest: Colombia, India and the Philippines. In each, Malthusian arguments about the destalising effects of overpopulation comprised a major part of the rationale for why the livelihoods of peasants, dismissed as backward and unproductive, had to be subordinated to the interests of large commercial farmers. This despite widespread evidence that the latter actually tended to underutilise vast tracts of prime arable land, while peasant cultivators were often capable of extraordinarily intensive food production.

Ross concludes that the commitment to capital-intensive agriculture that the Green Revolution strategy involves ultimately undermines food security in developing countries, has displaced millions of peasants and driven many to become part of an international labour reserve army. Evidence suggests, he argues, that from its formal beginnings in Mexico in the mid-1940's, the Green Revolution was never intended to secure the subsistence of the rural poor, but rather to transform Third World agriculture in a way which would ensure its dependence on international capital.

The apocalyptic Malthusian scenarios that helped to secure such ends have persistently denied any real opportunity to consider alternative explanations - or solutions - for Third World deprivation. Yet, as Ross observes, the need for such debate may now be greater than ever. Prominent policymaking organisations, such as the International Food Policy Research Institute and the Council on Foreign Relations, are calling for a revival of the Green Revolution to combat the effects of the failure of developing countries to curb population growth. Multinationals such as Monsanto conveniently justify their business agendas on the grounds that an over-populated world needs all of their technical innovation. Such arguments, Ross concludes, once again obscure the reasons for Third World poverty. They chiefly address the current needs of global capitalism, rather than the interests of land-hungry and undernourished people in developing countries.
He sees the advocacy of increasing dependence on biotechnology as speeding up the decline of what is left of viable peasant communities. If unchecked this will consolidate the control of the world's food-production system in the hands of a few giant agro-industrial corporations.

Marilyn Minderhoud. Adapted from "The False Premises of Agricultural Modernisation", Eric Ross, unpublished 1999 (available from ILEIA)

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The Malthus Factor: Poverty, Politics and Population in Capitalist Development (London: Zed Books) Eric B. Ross US$ 25 (pkb) 1999

Eric Ross is Senior Lecturer and Convenor of the Population & Development Programme at the Institute of Social Studies (ISS), Kortenaerkade 12, 2518 AX Den Haag, The Netherlands. Tel: +31 (0)70 426 0799 E-mail: ross@ISS.NL

New in print

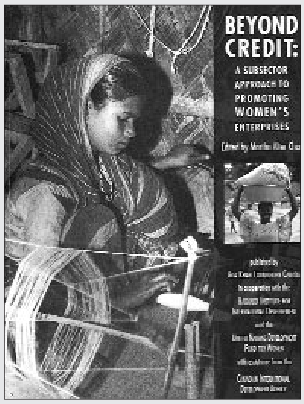
The seed keepers *by Shiva V. [et al.]. 1995. 156 p. Navdanya, Research Foundation for Science, Technology and National Resource Policy, A 60 Hauz Khas, New Delhi 110 016, India.*
This publication gives an account of the work of Navdanya, an Indian movement to conserve agricultural biodiversity by in-situ genetic resources conservation. By placing the farmer at the centre of the conservation, indigenous seeds as well as indigenous knowledge are conserved. The farmers involved in this program have often marginal resources, but also farmers disappointed with the green revolution technologies are very motivated. Individual farmers and their approaches are presented. A community seed register has been compiled and included, to facilitate exchange of organic seeds, and as a document of indigenous resources and knowledge. Besides, developing such registers across the Third World, could serve as a political tool against the privatisation of biodiversity. (IHG)

Creative training: a user's guide*. 1998. International Institute of Rural Reconstruction (IIRR), Y.C. James Yen Center, Silang, Cavite, Philippines.*
This is a very original manual on how to organise training courses. It is the outcome of a workshop that had as its objective the joint publication of a guide to creative training techniques that could easily be translated into local

media and languages and tailored to specific training purposes. A consultative and participatory process was used to develop the guide. The Philippine branch of IIRR had producing a number of successful training kits on a variety of subjects and it was against this background that the workshop took place. As the editors put it: this guide is not a recipe book, it is merely a selection of appetisers. After an introduction on basic facilitation skills, and evaluation techniques accompanied by exercises, come chapters dealing with specific issues. These include mind-mapping, timelines, map-making, producing & interpreting case studies, how to do action research, and conducting field trips. These are all useful skills valuable in a wide variety of situations. A very original book. (WB)

Farmer field schools on integrated soil management: facilitator's manual*. 1998. 218 p. Farmer-Centred Agricultural Resource Management Programme (FARM), FAO-RAP, Maliwan Mansion, Phra Atit Road, Banglumpoo, Bangkok 10200, Thailand.*
Farmer Field Schools (FFS) have had great success as a learning tool for the extension of integrated pest management techniques and approaches, especially so in Southeast Asia. The FFS approach in rice cultivation showed that farmers can become experts at ecosystem analysis and make informed decisions about necessary interventions. From there to applying the FFS concept to other realms as well seemed only a small step. This manual is about integrated soil management and relates the experiences of FFSs in China, the Philippines, Thailand and Vietnam. The publication has a practical approach with much detail on how to shape the courses. While this may be useful as a guide for many, the danger is that the course programme may be seen as a blueprint. It is difficult to judge the effect and the shape of the courses at a distance with only the facilitator's guide in hand. (WB)

Beyond credit: a sub-sector approach to promoting women's enterprises *by M Chen (ed.). 1996. 151 p. ISBN 0 969662 0 2. US$ 19.95. Women Ink., 777 UN Plaza, New York, NY 10017, USA.*
Explores interventions to promote enterprises amongst women in the Third World with low incomes that go beyond providing credit or financial services. Apart from insufficient access to credit facilities, women in developing countries, both in cities and in rural areas, are faced with many constraints when setting up businesses of their own. Micro-enterprise development programmes have tended to favour credit over technology and training or intervention policies. This is all the more so in development programmes targeting women. Women have turned out to be better at repayment than men and therefore, credit programmes that target women are expected to perform better. This publication reports on the experiences of two Asian NGOs that successfully supported the enterprises of low-income women: the Bangladesh Rural Advancement Committee (BRAC) and the Indian Self-Employed Women's Association (SEWA). Both are highly

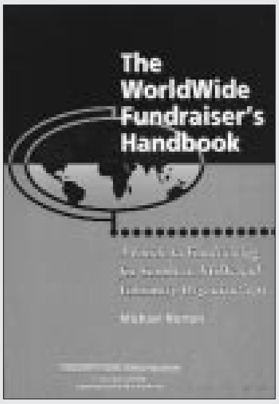


successful: BRAC administers a rural credit enterprise programme for over 800,000 poor women; SEWA developed a comprehensive employment-social security programme for over 100,000 self-employed women, both in the urban and rural areas. The publication looks at the reasons for these successes. The authors provide guidelines for an 'incremental and participatory subsector approach' to promoting women's enterprises. A key element is to undertake the mix of interventions demanded by the women themselves. Constraints are subsector-specific. The publication has a strongly educational focus. In appendices, practical, concise step-by-step tools are given for carrying out the analysis within the framework of the incremental and participatory sub-sector approach. Key concepts are presented as well as questionnaires, steps to follow and a framework for impact assessment. The book is accompanied by a 30-minute video that is frequently referred to in the text. A very practical, well laid-out publications and one that is important to those involved in providing support to women's enterprises. (WB)

Living farms: encouraging sustainable smallholders in Southern Africa *M Whiteside. 1998. 224 p. ISBN 1 85383 590 0. GBP 13.95. Earthscan Publications, 120 Pentonville Road, London N1 9JN, UK.*
Examines the agricultural situation in Southern Africa, where agricultural production has to cope with a population that doubles every 25 or 30 years. Production is often achieved at the expense of the environment and is, therefore, not sustainable. Much of the agricultural production is in the hands of smallholders, who have managed to maintain themselves despite harsh natural conditions and less than cooperative authorities. The author presents a wide variety of ways to encourage a more sustainable agriculture in Southern Africa that will be capable of playing a greater role in the eradication of poverty. The challenge is how to bring about this transition while supporting the basic needs of the population. Solutions must be sought in a skilful combination of resource-conserving technologies. So far, research into sustainable agriculture has been insufficient both in quality and volume and often those involved in research and extension are not well trained for the task. Finally, a great deal of present-day research is initiated by suppliers of external inputs who emphasise the use of bought inputs. All new technology development can only thrive in a local and national environment that provides incentives for sustainability. Appropriate state interventions and clearly defined property rights for natural resources are needed. States have to come to grips with the pressure being exerted on land and traditions. Communities have to be empowered, and new partnerships have to be created. This publication is primarily for policy makers and development professionals. The book includes a list of useful addresses and sources of information relevant for Southern Africa. (WB)

The worldwide fundraiser's handbook: a guide to fundraising for southern NGOs and voluntary organisations *M Norton. 1996. 270 p. ISBN 1 873860 75 7. GBP 12.95. Directory of Social Change, 24 Stephenson Way, London NW1 2DP, UK; International Fund Raising Group, 295 Kennington Road, London SE11 4QE, UK. Adapted from:* ***The complete fundraising handbook****, Sam Clarke (1992).*
This type of manual is hard to find and, therefore, very welcome. Fundraising is an extremely important part of an organisation's success and necessary if it is to survive, develop and reduce its dependence on any one source of fund. Fundraising is more than just getting money: it involves building a constituency and finding supporters with whom one can openly discuss both successes and failures. The author emphasises the need for a degree of humility and a sense of responsibility both when seeking

funds and when funds have been acquired. The book gives the reader a number of suggestions on finding donors. Many good ideas are never realised because those seeking financial assistance do not know how to identify or to approach the donor or how to properly 'package' their proposal. The main problem in fundraising is not so much the lack of opportunities but knowing where to start building a fundraising (or income generation) scheme. This book



provides ideas, techniques and the necessary skills to be successful. It shows readers how to set out a fundraising strategy and how to analyse and present their organisations to donors. Address lists of donors are included in the book. These have a certain anglophone and UK bias but it should not be difficult to substitute them with a more tailor-made selection. There is an important chapter on income generation. Many NGOs now find themselves in situation where this is essential in order to complement subsidies and project funding. Developing some sort of commercial enterprise, the profits of which are used to support the main work of the organisation, often requires a fundamental change in the attitudes of staff involved. An important book, strongly recommended. (WB)

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Village voices, forest choices: joint forest management in India *M Poffenberger & McGean B (eds). 1996. 356 p. ISBN 0 19 563683 X. US$ 28.80. D.K. Agencies, A/15-17, Mohan Garden, Najafgarh Road, New Delhi 110059, India.*

There is a global crisis going on in forest management that will produce major changes in the near future. This book examines these changes by describing the situation in India, a country that is of particular importance because the human-to-forest ratio there is one of the lowest in the world. In India, Joint Forest Management (JFM) programmes are a feature of the last few years and are based on the local management of forests. These programmes have led to the renewal of once badly degraded ecosystems, often without outside assistance. This has not been achieved without conflict. Those in control and commercial companies are not happy to give up power. Management by state forestry institutions is often based on techniques introduced in the last century from the temperate industrialised world. In order to understand these structures, the authors argue, one must look at the historical roots of deforestation. The key to management lies in the transition from open access to controlled access and in monitored utilisation through user group centred controls. As the authors put it: 'as tenurial rights and delineated responsibilities become vested in the user group, conflicts are reduced, communications improve, and local knowledge once again informs decision making'. JFM programmes involve a process of institutional capacity building. This goes beyond social forestry programmes that involve the local population but which do not necessarily lead to improving the condition of the nation's natural forest. How will management priorities change under community control? What are the daily practices within JFM programmes? The process is still not well documented as most of the data gathered concerns production figures. (WB)

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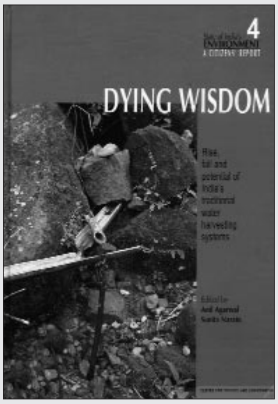
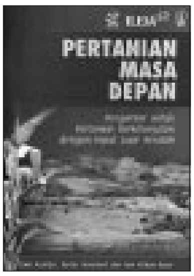
Dying wisdom: rise, fall and potential of India's traditional water harvesting systems *A Agarwal and Narain S (eds). 1997. 404 p. US$ 12.00. Centre for Science and Environment (CSE), 41, Tughlakabad Institutional Area, New Delhi 110 062, India. (State of India's Environment, a Citizens' report No. 4).*



Examines and documents traditional water harvesting systems in India. These are often centuries old. This monumental work is the fruit of a decade-long project by CSE. Material was collected during the course of many field trips, studies of historical documents, and was completed with input from a national workshop held in 1990. The undertaking, as the editors state, was triggered by the strong anti-dam movement in India. The question of whether there were viable alternatives needed to be answered. The book appears at a time when India faces the threat of serious water shortage. It will help to make people aware that a solution to this crisis may well lie in their own traditions. The greater part of the book is taken up by exhaustive descriptions. These are categorised into 15 major ecozones. An impressive number of pictures, drawings and tables help to guide the reader through this vast subject. The second part of the book is devoted to a minute description of the historical rise and fall of water harvesting in India, coinciding with the transition from community control to state intervention. The text offers much more than a technical description. Links are constantly being made with cultural beliefs and the way these express themselves in Indian society. Solutions centre on the (re)installation of a huge number of water harvesting systems including water diversion systems; hill slope rain water collection into ponds; diversion of springs and streams; rainwater retention; rainwater harvesting from rooftops; check dams and percolation tanks. There is a glossary, essential for non-Indians. The book ends with a statement of shared concern. A standard work. (WB)

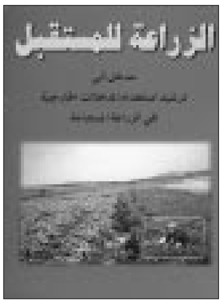
New→FFF in Bahasa and Arabic

The very successful ILEIA publication *Farming for the Future: an introduction to Low-External-Input and Sustainable Agriculture* by Coen Reijntjes, Bertus Haverkort and Ann Waters-Bayer is now available in Arabic and in Bahasa.



The Bahasa version, ISBN 979-672-453-7, can be ordered from KANISIUS, Penerbit – Percetekan, Kotak Pos 1125/Yk – Yogyakarta 55011, Indonesia. Fax: +62 274 563349; E-mail: office@kanisius.co.id ; Price: Rp 55,000

The Arabic version can be ordered from PARC, POB 25128, Shu'fat, The West Bank; Fax: +972 2 5831898; E-mail: pr@pal-arc.org
Contact person: Mr. Yahin abu Sharif



***Farming for the Future* provides an excellent introduction to the principles of low-external-input and sustainable agriculture based on making optimal use of local resources and indigenous - traditional knowledge and, where affordable, complementing this with modern ecologically sustainable technologies. It also provides a step-wise introduction to Participatory Technology Development, an approach for collaboration between researchers and farmers to strengthen local capacity to adapt and innovate agriculture. As the book contains many practical examples, references and the addresses of organisations where more information can be obtained it has become very popular with development workers, researchers and students.**

Farming for the Future is also available in English, French, Spanish, Portuguese, Chinese and Thai.

IF YOU WANT TO KNOW MORE

Encouraging diversity: a synthesis of crop conservation and development *WS de Boef & Almekinders CJM (eds). (forthcoming May 2000). Intermediate Technology Publications, London. 320 p. Price: 20-27 USD.*
Presents some 80 brief contributions with perspectives and experiences in plant genetic resources in the South and the North, from established institutions, researchers, pioneers and activists. These experiences illustrate the apparent conflict between crop conservation and crop development, and contribute to the understanding of opportunities that new approaches and activities in this field offer. There are similarities between problems in the South and the North. Experiences and perspectives of genebanks, plant breeders, seed programmes and NGOs involved in crop development and conservation are analysed and placed in the context of new approaches in local and global PGR management by the formal and informal sector. The latter part of the book takes the reader a step forward in the debate concerning PGR management. It discusses the implications of integrated and adaptive management approaches to PGR including concepts to be used and the institutional organisation required to bring about change. These must be able to stand up to the pressures being experienced by farmers and professionals in the PGR management.

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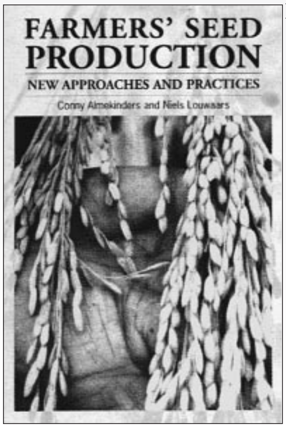
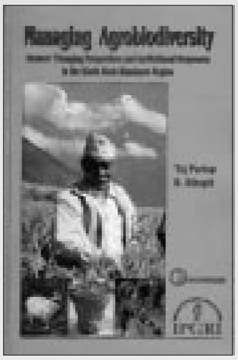


armers' seed production: New approaches and practices
CJA Alekinders & Louwaars N, 1999. 290 pp. ISBN 1 85339 466 1, USD 29.95. Intermediate Technology Publications Ltd., 103-105 Southampton Row, London WC1B 4HH, UK, E-mail: orders@itpubs.org.uk
This handbook covers a whole range of theoretical and practical issues relating to improving the local seed systems of the main tropical food crops. It suggests and explains many approaches and methods to support local seed supply, conservation and improvement by small farmers in developing countries. There is a growing awareness of the fact that most seed is produced by farmers themselves and that new objectives and approaches are needed: taking the local seed system as starting-point, making use of farmers capacities and knowledge, linking farmers' seed system with the formal system, and selecting and adapting what is suitable from the formal system. Linking informal and formal seed systems and looking for complementarity between them offers challenging opportunities for overcoming the weaknesses of both systems. This approach makes the book a practical guide for participatory improvement of the local seed system, including participatory variety selection and plant breeding.

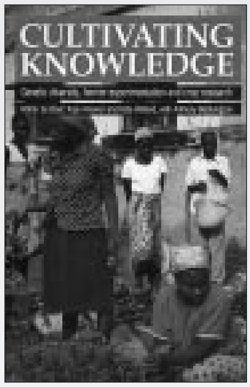
The book explains the informal and formal seed systems and the many technical and methodological issues in a very accessible, informative and extensive way and therefore deserves to become a standard work not only for those involved in the participatory development of small-scale agriculture but also for students and policy makers. (CR)

Technical and institutional issues in Participatory Plant Breeding - done from a perspective of farmer plant breeding
S McGuire, Manicad, C & Sperling, L. 1999. CGIAR Systemwide Programme on Particicipatory Research and Gender Analysis for Technology Development and Institutional Innovation (PRGA), Cali, Colombia. (Working Document No. 2). 88 p. (To request a copy contact prga@cgiar.org).
Gives a good overview of concepts, issues and farmer-led plant breeding. The last term covers a range of activities that have a strong basis towards drawing on farmers' capacities and initiatives to maintain and develop crop varieties. In contrast, in breeder-led approaches breeders take the initiative. The 11 cases described and analysed were all supported by NGOs or GOs in one way or other. Issues fundamental to PPB, such as local vs. broad adaptation, introgression and other forms of recombination, are briefly discussed. The publication has a number of well-structured sections, which certainly contribute to providing a good overview of the issues related to PPB. If it were only for the definitions and the reference list, this is a publication to have on hand. (Conny Almekinders)



Managing agrobiodiversity: farmers' changing perspectives and institutional responses in the Hindu Kush-Himalayan region *by T Partap and Sthapit B (eds). 1998. International Centre for Integrated Mountain Development (ICIMOD) & International Plant Genetic Resources Institute (IPGRI). ISBN 92 9115 841 0. 439 p. ICIMOD, PO Box 3226, Kathmandu, Nepal.*
Agriculture in the Hindu Kush-Himalayan region is in transition. Agrobiodiversity is adversely affected –although the exact extent is not known- by deteriorating economic and environmental conditions, especially habitat destruction, and by the adoption of new cash crops by farmers which replace the old ones. To fill the lack of information, ICIMOD and IPGRI have launched an initiative to document knowledge about agrobiodiversity in the region, both at species and agroecosystem level. Simultaneously, information was gathered and analysed about alternative strategies for the conservation and management of agrobiodiversity. (WB)

Technical and institutional issues in Participatory Plant Breeding – from the perspective of formal plant breeding. A global analysis of issues and current experiences *E Weltzien, Smith, M, Meitzner, M & Sperling, L 1999, CGIAR Systemwide Programme on Participatory Research and Gender Analysis for Technology Development and Institutional Innovation. (Working Document No. 3). Can be ordered from: prga@cgiar.org.*
This is a 'sister' paper to the McGuire, Manicad and Sperling publication and is a review of what has been done in PPB from the perspective of formal sector institutions such as national plant breeding programmes, CGIAR institutes, and extension services. It contains an inventory of 48 PPB cases from all over the world as well as detailed descriptions of a dozen illustrative cases, an analysis of key technical and institutional issues, and an assessment of the gaps in current knowledge in respect of PPB methods, organisation, and results.

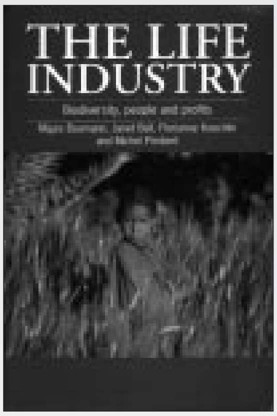


Cultivating knowledge: genetic diversity, farmer experimentation and crop research *W de Boef, Amanor K, Wellard K & Bebbington A. 1993. 206 p. ISBN 1_85339_204_9 (pbk). Centre for Genetic Resources (CGN), Wageningen, The Netherlands. Intermediate Technology Publications (ITP), 103-105 Southampton Row, London WC1B 4HH, UK.*
A collection of case studies that were originally presented at a seminar on Local Knowledge and Agricultural Research held in Zimbabwe in 1993. This seminar was the starting point of the Community Biodiversity Development and Conservation Programme (CBDC) described elsewhere in this issue. The papers address the relationship between farmers and researchers in local crop development from three perspectives. First, the socio-cultural environment in which local crop development occurs. Second, the biological and genetic rational underlying farmers resource use. Third, political frameworks in agricultural research and development. The case studies examine the importance of local knowl-

edge, documenting new approaches and methodologies that have been developed for building linkages between farmers and researchers. A number of cases deal with policy issues in relation to the expansion of agribusiness and its effect on small-scale farmers. This book has proven itself to be an important source for those interested in farmers' experimentation with regard to conservation and the development of local crops. (WB)

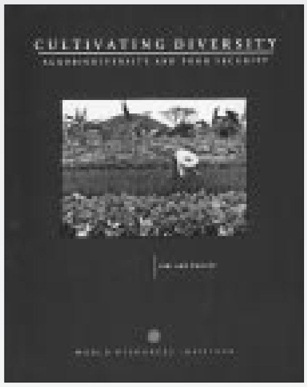
Farmers, gene banks and crop breeding: economic analysis of diversity in wheat, maize and rice
M Smale (ed). 1998. Kluwer Academic Publishers, Boston, 270 p. ISBN 0 7923 8370 2.
Series of papers based on presentations at a conference in Palo Alto, California 17-19 August 1997.

Biological and cultural diversity: the role of indigenous agricultural experimentation in development *by GD Prain, Fujisaka, S & Warren MD (eds). 1999. 218 p. ISBN 1 85339 443 2. GBP 16.95. (IT Studies in Indigenous Knowledge and Development series). Intermediate Technology Publications (ITP), 103-105 Southampton Row, London WC1B 4HH, UK.*
Farmers in developing countries do much to preserve diversity, even if it is not their first goal in farming. The role of indigenous knowledge and experimentation in agricultural development is now an accepted fact in development practitioners circles. With the advent of modern agriculture, much intricate traditional knowledge is disappearing. Likewise, biological diversity is seriously threatened although it has been high on policy and research agendas for a number of years now. This publication originated in the International Conference on Creativity and Innovation at the Grassroots, held at the Centre for Management in Agriculture, Indian Institute of Management, Ahmedabad, India, in 1997. Among the many papers presented there, this particular collection of papers emphasises the importance of indigenous agricultural experimentation in fostering biological diversity and cultural knowledge of that diversity. The fifteen papers describe a broad array of settings and experiences. They show the intimacy of the relationship between cultural and biological diversity. It is argued that farmer experimentation must not be regarded as a substitute for conventional on-farm research, but as a valuable approach to local knowledge creation through site-specific learning. Some authors believe there is little synergy to be had from linking formal research and farmers' experimentation more closely implying that farmers' participation has its limitations. (WB)



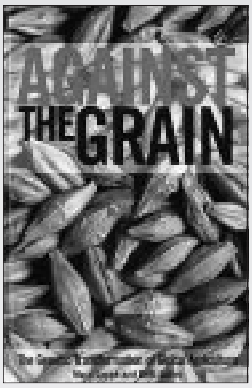
The life industry: biodiversity, people and profits *by M Baumann, Bell, J Koechlin F & Pimbert M 1996. World Wide Fund for Nature (WWF) & Swissaid. 206 p. ISBN 1 85339 341 X. Intermediate Technology Publications (ITP), 103-105 Southampton Row, London WC1B 4HH, UK.*
Contains papers presented at the international symposium 'Patents, Genes and Butterflies' jointly organised by Swissaid and WWF Switzerland in Berne, 1994. This book examines policy aspects of conservation of biodiversity. The commercialisation of biological resources poses a serious threat especially to smallholders in the South. A number of treaties have been concluded that protect their rights (see elsewhere in this issue) but their effect is questionable. The book examines the impact of current trends in legislation on the self-determination of peoples; biodiversity conservation; the relationship between science and society; the growth of the biotechnology industry; and development models in general in the North and the South. The challenge is to reconcile the conflicting perspectives of the various social actors. It has been written in three parts.
Part one examines 'the tools of control': uses made of genetic engineering, bioprospecting, biotechnology, and patenting issues. Part two looks at the thin line between bioprospecting and biopiracy. The contributing authors come from various organisations, including commercial ones. It is this openness that gives this book its weight. Part three looks at the future: 'Which way now?' Three main strategies are presented and compared: compensation or reward; intellectual property rights; or reclaiming the commons. The first two approaches imply working with the current system, adapting it to make it more equitable. The last strategy involves a rejection of existing mechanisms and advocating a much broader, stewardship-based approach to bioresource management requiring a more radical reversal of the existing approach to biodiversity management.
The problems associated with intellectual property rights mechanisms are enormous. Differences and implications are difficult to grasp and often fall in the juridical domain. This book succeeds in setting out these problems clearly. As such, it is extremely useful for those involved in policy aspects of biodiversity because it presents a wealth of facts and figures and many different opinions. (WB)

Culture, conservation and biodiversity; the social dimension of linking local development and conservation through protected areas *B Furze, De Lacy T & Birckhead J 1996. 269 p. ISBN 0 471 94902 7. GBP 55.00. John Wiley & Sons, Baffins Lane, Chichester, West Sussex PO19 1UD, UK.*
Even the most 'natural' habitats are in fact cultural habitats and created largely through human influence. Seeking to maintain these areas in their current state is a cultural response – a purposeful intervention by people to maintain something they value. Under the threat of an ever-increasing world population, dwindling natural resources and reduced maintenance budgets, modern management of protected areas must adapt, however threatening this may seem. The major issue is how to bring development and environmental protection together. Protected areas can no longer be development free zones, but must come to terms with ecologically sustainable development activities within and around them. The authors use case studies of local level participation in development activities within ecologically sensitive protected areas in different continents to illustrate that in sustainable environmental management environmental and economic goals can be integrated. For example, cultural attractions that show how people live among nature can be just as interesting for visitors as nature itself. The ultimate objective is to find the means to ensure that humans behave in ways that are consistent with conservation objectives. The challenge is to reach an agreement between the various stakeholders involved in defining the objectives for any particular area. Often, it will be a hard task to match all these interests and to choose the best option. The only chance of success is through participatory methods right from the start, through informed debate and a process of negotiation. Reading this book can provide many new insights in these problems. (WB)



Cultivating diversity: agrobiodiversity and food security
by LA Thrupp. 1998. 80 p. ISBN 1 56973 255 8. World Resources Institute, 1709 New York Avenue, NW, Washington, DC 20006, USA. http://www.wri.org/wri/
Gives a very complete picture of agrobiodiversity in a dense, but well laid out publication. After tracing the history and position of agricultural biodiversity, the author examines its benefits and importance and what its loss implies by using eloquent examples from the past. She argues that integration of agricultural development and biodiversity conservation is beneficial and even vital for food production, ecosystem health, and economically and ecologically sustainable growth. Apart from best practices, participatory approaches in ecosystem management, strategies to merge agriculture and habitat diversity, and *in situ* community-based conservation, the book describes in detail the policies and institutional

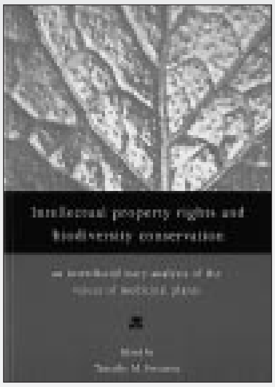
changes developed to confront the underlying causes of agrobiodiversity loss. The book is packed with information and especially useful for those interested in the policy aspects of biodiversity. Boxes, tables and figures help the reader to keep track. (WB)



Against the grain: the genetic transformation of global agriculture *M Lappé & Bailey, B 1998. ISBN 1 85383 576 5 GBP 15.99. Earthscan Publications, 120 Pentonville Road, London N1 9JN, UK.*
A valuable, politically oriented contribution to the debate about biotechnology, genetic engineering and transgenic crops and animals. The book examines new developments and their implications, looking in particular at developed countries. The achievements of commercial science have penetrated into our lives at an enormous speed and on an extensive scale, whether we like it or not. This publication helps to shape our viewpoint by thoroughly analysing the situation. Contains a glossary of terms, very useful in this difficult field.

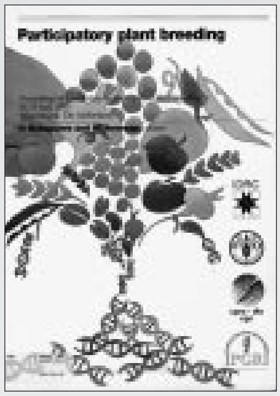
Seeds of choice: making the most of new varieties for small farmers *JR Witcombe, Virk DS & Farrington J (eds). 1998. 271 p. ISBN 1 85339 447 5. NLG 65 (approx. US$ 32.50). Krishak Bharati Cooperative (KRIBHCO), Indo-British Rainfed Project West, A8-10 Sector-1, Noida 201301, Gaziabad UP, India. Intermediate Technology Publications (ITP), 103-105 Southampton Row, London WC1B 4HH, UK.*
A compilation of experiences from the All-India Coordinated Crop Improvement Projects of the Indian Council of Agricultural Research from about 1990. These projects have provided experiences for a number of researchers who have catalysed advances in the field of participatory breeding. The experiences show the limitations of present practices of diffusing breeding varieties. Also, constraints of the regulatory framework are demonstrated, for example, the way variety release is organised in India. One conclusion is that the state-wise and centralised procedures for the testing and release of varieties do not adequately identify those that are useful for the diversity of farming conditions in India. A variety that is successfully released in one state may not be released in another with similar conditions. The book also presents cases in which farmer participation in setting goals, testing varieties and selection for location-specific adaptation has proven very successful. Suggestions for modifications to the system are formulated on the basis of these experiences. Variety release might benefit from information on similarity between agro-ecological conditions in different states. The upscaling of the results of Participatory Plant Breeding (PPB) and Participatory Variety Selection (PVS), and the role of seed diffusion and NGOs in this upscaling, is addressed in the last part of the book. The book contains an impressive amount of information on variety testing, diffusion and adoption in India and methodologies for acquiring this information. For people interested in PPB the experiences are very relevant, and for breeders in South Asia this book is a must. For others, the book provides insights in the multitude of factors that play a role in PVS as far as the formal sector is concerned. (Conny Almekinders)

Recent policy trends and developments related to the conservation, use and development of genetic resources *SH Bragdon & Downes DR. 1998. (Issues in Genetic Resources No. 7, June 1998). International Plant Genetic Resources Institute (IPGRI), Rome. 42 p. ISBN 92 9043 380 9. (Downloadable version: www.cgiar.org/ipgri/policy/ipr7.htm).*
A comprehensive, clearly written overview and analysis of the rapidly evolving policy and legislative issues related to the management and control of (plant) genetic resources. The publication first outlines the history and essence of the various treaties and fora: CBD, WTO and TRIPPS, International Undertaking, UPOV, WIPO and the UN Working Group on Indigenous Populations. It goes on to describe the issues that have emerged and that relate in different ways to the various treaties and fora: farmers' rights, interests of indigenous and local communities, benefit sharing, patenting and *sui generis* protection of plant genetic resources. This publication is an important support to policy makers in understanding different objectives, interests and key decision points. It is a valuable and readable introduction for anyone who wants to get a better understanding of the discussions surrounding the legislative aspects of conservation and the use of plant genetic resources. (Conny Almekinders)



Intellectual property rights and biodiversity conservation: an interdisciplinary analysis of the values of medicinal plants
TM Swanson (ed.). 1995. ISBN 0 521 47112 5, Cambridge University Press, The Edinburgh Building, Cambridge CB2 2RU, UK.
Argues the need for biodiversity conservation drawing on information on the use of medicinal plants in the pharmaceutical industry. Two papers deal with the issue of cultural diversity in relation to medicinal plants, an issue of obvious importance given the role of plants in traditional medicine. This book will be of relevance to a wide range of conservationists, from research students to policy makers.

The economics and ecology of biodiversity decline: the forces driving global change
TM Swanson (ed.). 1995. ISBN 0 521 48230 5 162 p. Cambridge University Press, The Edinburgh Building, Cambridge CB2 2RU, UK.
Contains papers originally presented at a symposium held at Cambridge in 1993. This publication looks at global change with regard to climate change and biodiversity decline.



Participatory plant breeding: proceedings of a workshop on participatory plant breeding, 26-29 July 1995, Wageningen, The Netherlands *P Eyzaguirre and Iwanaga M (eds). 1996. International Plant Genetic Resources Institute (IPGRI), Via delle Sette Chiese 142, 00145 Rome, Italy. 162 p. ISBN 92-9043-269-1.*
The workshop was convened to crystallise an approach that plant breeders, genetic resource conservationists and social scientists were demonstrating with increasing success. That approach is to place knowledge about genetic resources, as well as enhanced germplasm, directly at the disposal of farmers for them to use and develop according to their own needs and practices. Experiences indicated that in using this approach, biological and social scientists were learning a great deal about the useful diversity in target crops and farming systems. Farmers were also benefiting from access to greater diversity and from the partnerships they were forming with plant breeders. Three particular fields were discussed during this workshop: (1) how to institutionalise and legitimise this participatory approach, thereby creating a real partnership between breeders and farmers; (2) how to achieve actual participatory and decentralised breeding thereby conveying an actual crop management role to farmers; and (3) to learn more about the state of the art of participatory breeding in a global context. Suggestions were made during the workshop on ways to foster interest in implementing such approaches within the CGIAR and NARS. (WB)

Web sites

There are a large number of web sites dealing with aspects of biodiversity. We introduce a few of them here.

Rural Advancement Foundation International (RAFI)

http://www.rafi.org

RAFI is an international NGO with its headquarters in Winnipeg, Canada. RAFI is dedicated to the conservation and sustainable improvement of agricultural biodiversity and to the socially responsible development of technologies useful to rural societies. RAFI is concerned about the loss of genetic diversity - especially in agriculture - and about the impact of intellectual property on agriculture and world food security. RAFI is an important site to visit for those who are interested in policy aspects of biodiversity. RAFI produces a number of publications that are of interest to people around the world. **RAFI Communiqué**, RAFI's principal publication, provides original, in-depth research on biodiversity, new technologies, and intellectual property. It is published 4-6 times a year and is available on their web site. RAFI's **Occasional Papers** are irregular publications presenting independent RAFI research studies and information on RAFI work in progress. In addition, there is a list of other publications available. There is a section that gives visitors the opportunity to air their views about biodiversity and other concerns relating to policy. RAFI's recent activities include: the launching of a postcard campaign to fight the Basmati rice patent and the issuing of a very successful call for a "Seed Sovereignty" ban on Terminator patents. RAFI publishes a beautiful and very instructive map **Creators and Conservers of Diversity**, available at US$ 15 (folded) or US$ 35 (laminated). More information about this map can be found on the web site.

RAFI, PO Box 68016, RPO Osborne, Winnipeg MB R3L 2V9, Canada.
Tel.: (1) 204 453 5259, Fax: (1) 204 925 8034. Email: rafi@rafi.org.

International Institute for Environment and Development (IIED)

http://www.oneworld.org/iied/

IIED is an independent, non-profit making organisation that promotes sustainable patterns of world development through collaborative research, policy studies, consensus building and public information. With a focus on issues of equity and justice, and the rights and needs of poor people, the Institute works in an interdisciplinary way, addressing the connections between economic development, the environment and human needs. IIED's principal aim is to improve the management of natural resources so that communities and countries of the South can improve living standards without jeopardising their resource base. IIED believes there is a need for biodiversity to be "mainstreamed" into development policy and practice.

IIED works with partners around the world to address key constraints to the sustainable management of biodiversity resources, to explore the contribution of biodiversity to local livelihoods, and to encourage greater integration of biodiversity issues into mainstream policy-making. An example is IIED's Evaluating Eden initiative, which explores experience of community wildlife management. New research will explore mechanisms for local participation in the development of policies for access to biodiversity and benefit sharing. The biodiversity programme develops work on three thematic areas crucial to the successful implementation of the CBD:

- Integrating biodiversity into sectoral policy-making and practice
- Finance and incentives for sustainable biodiversity management
- Re-negotiating the roles, rights and responsibilities of stakeholders for sustainable biodiversity management

Other information on the Biodiversity Group to be found on the web site:

- Projects such as E*valuating Eden, Integrating Biodiversity Conservation with Livelihoods, and Developing Policies for Access to Genetic Resources*;
- Partners;
- Publications, such as *Wildlife and Development* and the *Evaluating Eden* series.

IIED, 3 Endsleigh Street, London WC1H 0DD, UK. Tel.: 44 (0)171 388-2117, Fax: 44 (0)171 388-2826, Email: mailbox@iied.org.

Genetic Resources Action International (GRAIN)

http://www.grain.org

GRAIN is an international NGO established in 1990, to help further a global movement of popular action against one of the most pervasive threats to world food and livelihood security: genetic erosion. The loss of biological diversity, particularly in the "gene rich" countries of the Third World, undermines sustainable agriculture as it destroys choices for the future and robs people of key resources. Genetic erosion is more than just the loss of genes. It is the loss of options for development.

GRAIN works to meet its aims through:

- Promoting popular control of agricultural biodiversity.
- Stopping the destruction of diversity by industrial agriculture.
- Support to agricultural biodiversity-based programmes.

GRAIN publishes a quarterly, ***Seedling***. Seedling aims to provide a platform for the exchange of news and analysis among people engaged in these issues. This publication is also accessible via the GRAIN site. ***Seedling*** is available free of charge to groups and individuals in the South, as well as to the NGO community at large, upon request. Institutions and others in industrialised countries are charged a subscription of US$35 per year, payable by cheque to GRAIN.

There are also other interesting publications on the GRAIN web site. **Global Trade and Biodiversity in Conflict** is a series of exposés produced jointly by the Gaia Foundation and GRAIN. The series examines critical points of conflict between the privatisation of biodiversity, which is being driven by corporate interests and the WTO and peoples' efforts to empower local communities in biological and cultural diversity management, particularly in developing countries. To our knowledge, 3 issues have been published so far: **TRIPs versus CBD** (No. 1, April 1998), **Ten reasons not to join UPOV** (No. 2, May 1998), **Intellectual Property Rights and biodiversity: the economic myths** (No. 3, October 1998).

GRAIN runs a list server on Intellectual Propert Rights (IPRs) accessible via the web site. Its purpose is to circulate information about recent developments in the field of intellectual property rights related to biodiversity & associated knowledge.

- GRAIN, Girona 25, pral, E-08010, Barcelona, Spain. Tel.: (34 93) 301.13.81, Fax (34 93) 301.16.27, E-mail: grain@bcn.servicom.es.
- The Gaia Foundation, 18 Well Walk, Hampstead, London, NW3 1LD, UK. Tel: (44 171) 435.50.00, Fax: (44 171) 431.05.51, E-mail: gaia@gaianet.org.

International Plant Genetic Resources Institute (IPGRI)

http://www.cgiar.org/ipgri/

The International Plant Genetic Resources Institute (IPGRI) is the world's largest organisation devoted solely to the study and promotion of agricultural biodiversity. IPGRI's mandate is to advance the conservation and use of plant genetic resources for the benefit of present and future generations. IPGRI's mission is to encourage, support and engage in activities to strengthen the conservation and use of plant genetic resources worldwide, with special emphasis on the needs of developing countries. IPGRI works in partnership with other organisations, undertakes research and training, and provides scientific and technical advice and information. IPGRI operates three major programmes:

- The Plant Genetic Resources Programme
- The International Network for the Improvement of Banana and Plantain (INIBAP)
- The CGIAR Genetic Resource Support Programme. This Programme comprises two main elements: support for the CGIAR in the area of genetic resources policy and the System-wide Genetic Resources Programme (SGRP).

The IPGRI site contains a large amount of downloadable information sources ranging from scientific publications to press releases and training materials. Geneflow, IPGRI's popular journal, is also available electronically on their site.

IPGRI, Via delle Sette Chiese 142, 00145 Rome, Italy. Tel: (39) 0651892, Fax: (39) 065750309, Email: ipgri@cgiar.org.

System-wide Genetic Resources Programme (SGRP)

http://www.sgrp.cgiar.org/

This programme was created in 1994 to focus the CGIAR's response to dynamic and rapidly evolving practical and policy challenges in the realm of biodiversity. The SGRP embraces all of the genetic resources activities of the Centres of the Consultative Group on International Agricultural Research (CGIAR). These include Centre programmes on livestock, forestry, aquatic and crop biodiversity. The SGRP provides the mechanism for the CGIAR to take an effective, united approach to the challenges posed by the Global Plan of Action for the Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture, and other international strategies and plans governing the forestry, fisheries and animal sectors. Its goal is to strengthen the CGIAR's contribution to emerging global systems for genetic resources.

The CGIAR Centres hold more than half a million accessions of crop, forage and agroforestry species of importance for food and agriculture in trust for the world community. Information on the collections housed in 11 CGIAR genebanks is available through the

System-wide Information Network for Genetic Resources (SINGER). This network provides common access to information concerning the collections of genetic resources held by the CGIAR Centres. SINGER links the genetic resources databases of the CGIAR Centres and allows searches for information relating to the identity, origin, characteristics and distribution of the genetic resources in the individual Centre collections and access to further specific data on the collections. The categories of genetic resources data available in SINGER are described. The infrastructure of SINGER ensures that the central network database is kept current relative to the individual Centre databases.

The SGRP web site gives access to SINGER, gives a list of collaborative research activities and gives a list of (non-downloadable) publications.

Coordinator SGRP: Jane Toll (j.toll@cgiar.org), c/o International Plant Genetic Resources Institute (IPGRI), Via delle Sette Chiese, 142, 00145 Rome, Italy. Tel.: +39-06-518921, Fax: +39-06-5750309.

IRRI Genetic Resources Center (GRC)

http://www.cgiar.org/irri/GRC/home/home.html

The Genetic Resources Center (GRC) was established in 1989 to bring together two important components of IRRI's work – the long-term conservation of rice genetic resources and the international exchange and testing of elite germplasm. IRRI has conserved rice genetic resources since 1962. The IRRI genebank was opened in 1977, and became known as the International Rice Germplasm Center (IRGC) in 1983. A major renovation of the genebank facilities was carried out during 1993 and 1994, including expanded screenhouse facilities for the maintenance of the important wild species collection. In 1995, it was renamed the International Rice Genebank (IRG). The site holds descriptions of ongoing projects including Genotype x Environment Interactions. There is a long policy statement on Intellectual Property Rights (IPRs). There is a list of (non-downloadable) publications by the GCR. An interesting feature is that requests can be made for the germplasm of rice varieties.

GRC, c/o IRRI, MCPO Box 3127, Makati City 1271, Philippines. Tel.: (63-2) 845-0563, Fax: (63-2) 891-1292 , E-mail: irri@cgiar.org

Top 5

It is not easy making a Top 5. But after I had asked myself which books I would like to have on my own bookshelves it was not so difficult either. Top 5 books are those that do not age easily and ones that will be of value to me for a long time. Many of the publications I like to have at hand are books that do not directly relate to agrobiodiversity and cover fields that have become important to activities that support the use and maintenance of agrobiodiversity. I'm thinking of books like Participatory Learning and Action (J. Pretty, Guijt, I, Thompson J & Scoones, I, 1995), and Farming for the Future (C. Reijntjes, Haverkort B, & Waters-Bayer, A 1992).

This is not to say there are no publications available on agrobiodiversity, but most of the valuable ones have appeared in series or as journal articles. There are relatively few books with 'best practices', which is probably a reflection of the complexity of the role of biodiversity in sustainable agriculture. Here are a few exceptions.

Crops and man *(1992) JR Harlan, American Society of Agronomy, Madison, Wisconsin, USA. (Second ed.)*

I was already fascinated by seeds and evolution when I read parts of *Crops and Man* for the first time. Reading it really leaves one with the impression of the grandness and fascination of plant evolution and plant-man interaction. It describes plant evolution and how man has influenced it through gathering, cultivation and seed selection. The book is probably as valuable to read as Darwin's *Origin of Species* and is certainly much more enjoyable.

Agrobiodiversity: characterisation, utilisation and management *D Wood & Lenné JM (eds). (1999) CABI Publishing, Wallingford, 1999 ISBN 0 85199 337 0. USD 120.*

This book has a strong agroecological perspective and covers the entire field of agrobiodiversity. It collects together information that, until now, was scattered over many different articles in a wide range of journals. It is not a 'best practices' book, but it makes one understand interactions and functions connected with the use of agrobiodiversity. The book gives a good coverage of the different aspects of agrobiodiversity from an ecological perspective. It includes chapters on crop origin and traditional management; soil, pathogen and insect biodiversity but also on plant breeding, seed management systems, *in situ* conservation and the regulatory framework. The book is written in very readable language and is therefore accessible to non-specialists. The connection between the different chapters and cross-references are carefully edited and the references themselves allow the reader to go more deeply into the subject.

Seed savers' handbook *J Cherfas &. Fantan M&F Grover Books, Bristol, UK. ISBN 1 899233 1996, 01 6. 168 p.*

I like and use this publication a lot. In the first place because of the practical information it contains on how to reproduce seeds of vegetable varieties and herbs. I use this in my own garden. The book addresses cottage and hobby farmers in moderate climates, particularly in Britain. However, I think the book will also be very useful for grassroot organisations in developing countries. It presents simple and practical information in a clear way and it should be possible to use the information on seed production, selection, and harvesting in other conditions and with slightly different varieties. After all, many of the vegetables and herbs grown in Britain including beetroot, carrot, cabbages, tomato, mustards, peppers, potatoes are grown elsewhere in the world as well. With some understanding of the basics of seed production (also included in this book), of the similarities among crop relatives, and of differences between cross-, self- and vegetatively- propagated crops, the book is applicable to almost all crops. The drawings and layout make the book friendly and very accessible. A short overview of the significance of maintaining traditional varieties in relation to the discussions on biodiversity issues in agriculture is included as well.

Technology options and the gene struggle *T Berg, Björnstad A, Fowler C and Skröppa T 1991. A report to the Norwegian Research Council for Science and Humanities (NAVF), Oslo. (Development and Environment No. 8). (NORAGRIC Occasional Papers Series C).*

I really appreciated reading this book. It is already a few years old, but the history of how farmers have always utilised genes and how the formal system tried to get hold of genetic diversity is as valid today as when the book first appeared. The section on technical breeding and genetic diversity issues is very informative and written in such a way that non-breeders can also understand what is going on.

Genes in the field: on-farm conservation of crop diversity *SB Brush (ed.) Lewis Publishers, IPGRI and IDRC. ISBN 1 56670 405 7. 2000 US$29.95.*

Although it has not yet been published, I have included this book on my list. It provides an account of groundbreaking research, experiences and perspectives on the dynamics of genetic diversity *in situ*. Examples are drawn from the Fertile Crescent and Ethiopia, the work of Louette with maize in Mexico and Zimbabwe. The book promises an interesting introduction by Brush on *in situ* conservation. The second chapter by AHD Brown is on population biology and social science. It will probably be a newer and more 'agriculturally' focused elaboration of *'Plant genetic conservation; the in situ approach'* by Maxted, Ford-Lloyd and Hawkes (1997, Chapman & Hall). I suspect this book will be a reference work for many years to come. It is not only interesting for researchers but for all those fascinated by the subject.

Conny Almekinders

Biodiversity Conventions

The technological advances in genetic manipulation have increased our capacity to use genetic resources enormously. At the same time, however, human society, and its law, has difficulty in keeping up with the pace of development and coming to grips with it. New actors have also appeared on the scene. Until some ten years ago, the conservation and development of genetic resources was mainly the domain of public sector institutions and national seed enterprises. Recently, however, multinational companies have increased their involvement in research and the development of genetic resources dramatically. This was done in anticipation of the huge profits to be gained from manipulating genetic resources and has lead to conflicts of interest over the rights to these resources and the responsibilities these rights entail. The legal implications of the ownership and use of genetic resources are extremely complex in an increasingly globalised market. In this context, basic questions of ethics and equity arise. A large number of treaties and declarations in the past five years reflect the changed policy environment in which the management and control of genetic resources takes place. In an attempt to clarify these complex issues we have set out to describe a few of these conventions (Bragdon & Downes, 1998):

Convention on Biological Diversity

Signed in 1992, in the wake of the United Nations Conference on Environment and Development held in Rio de Janeiro. Currently, some 170 countries plus the European Union adhere to this convention. Objectives of the CBD are the conservation and sustainable use of biodiversity and benefit-sharing arising from its use. These objectives are to be achieved through a range of general, flexible obligations that emphasise the national sovereignty of each country over its own genetic resources. Although a framework of general principles has been set up to structure the international exchange of genetic resources, the implementation of objectives is difficult. Individual governments have their own priorities and there is no implementing agency.

International Undertaking on Plant Genetic Resources (IU)

A non-binding intergovernmental agreement to promote conservation, exchange and utilisation of plant genetic resources based on free access. Farmers' rights and *ex situ* germplasm collections are not addressed by the CBD, but they are by the IU. In 1998 about 110 countries were IU signatories. The body overseeing the IU is the FAO Commission on Genetic Resources for Food and Agriculture. The Commission is currently engaged in negotiations to revise the IU and bring it into harmony with the CBD. In 1994, the Consultative Group on International Agricultural Research (CGIAR) and FAO concluded an agreement under which the FAO would host, in trust, 'designated materials' in the 16 International Agricultural Research Centres that are part of the CGIAR. In this way, some 600,000 seed samples, possibly as much as 40% of the world's unique germplasm in storage would be conserved. The IARCs have pledged not to take out any form of intellectual property rights on this huge reservoir of genetic resources and they oblige those who use this material to do the same.

Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS)

This agreement, signed in 1994 under auspices of the World Trade Organisation (WTO), requires all parties to meet certain minimum standards for protecting Intellectual Property Rights (IPRs). Trade liberalisation is the underlying objective of the WTO, and TRIPS deals with effective legal mechanisms for enforcing patenting, a precondition considered necessary for free trade. TRIPS and other WTO agreements are binding on the 131 countries that are members of the WTO. Parties are required to protect plant varieties either by patents or by an 'effective *sui generis* system or by any combination of these mechanisms. A simplified explanation of *sui generis* legislation would be 'a form of intellectual property right designed to account for the unique nature of a new kind of innovation'. Plant Breeders' Rights as applied in many countries can be considered an example of such *sui generis* legislation for plant genetic resources. Implementing TRIPS has proved to be difficult. Promotion of IPRs, in the broad sense of the word, is the main concern of the World Intellectual Property Organisation (WIPO), a specialised agency of the UN. As WIPO had little to do with indigenous knowledge and genetic resources until recently, it has not been involved in the TRIPS Agreement.

International Union for the Protection of New Varieties of Plants (UPOV)

An intergovernmental organisation based in Geneva, Switzerland, with some 30 members mostly from the developed world. UPOV encourages the adoption of *sui generis* laws for protecting new plant varieties by creating its own distinct system outside the realm of patent law. UPOV aims to maximise plant breeding efforts and, as such, provides a model for securing protection for Plant Breeders' Rights for plant varieties. The 1991 revision of the UPOV Convention for the Protection of New Varieties of Plants gives members the option of allowing farmers to save seed for their own use, This is an important amendment.

National legislation

In response to the requirements of the treaties and agreements mentioned above, national legislative systems are emerging that define ownership of and access to genetic resources on a national level. Ideally, such legislation should also become proactive and in this way capable of, exerting an influence on the international debate. Bringing together questions of protection, use, ownership and benefit is a difficult process.

Indigenous & local communities including farmers and farm communities

A number of agreements address the rights of farmers and farmers' communities. In all previous agreements, negotiations have taken place either at governmental or institutional level, leaving indigenous communities to struggle to get their concerns introduced into negotiations. Examples of agreements that address the issue of farmers rights are: 'In Safe Hands: The Leipzig Commitment to Agricultural Biodiversity', an agreement of NGOs and People's Organisations, and the Vignola Declaration, in which IFOAM and IUCN played a major role, and which defined the role of organic agriculture in biodiversity and nature conservation.

In Safe Hands - Commitment to Agricultural Diversity

Representatives from 124 NGOs and peoples' organisations from nearly 40 northern and southern countries met in Leipzig, Germany, to discuss the future of agricultural diversity and how it could be conserved, used and developed in an sustainable way by farmers and indigenous communities. The conference preceded the 4th International Technical Conference of FAO on Plant Genetic Resources (4th ITC/PGR) held in 1996. The result of this NGO conference was the *Commitment to Agricultural Diversity*. The declaration summarises the views and demands of many NGOs and People's Organisations. A declaration 'In Safe Hands - Communities Safeguard Biodiversity for Food Security' was adopted by the conference.

In this way the conference committed itself to creating alternatives to intellectual property systems capable of safeguarding the rights of farming and indigenous communities. Long-term security of critical gene banks and their accessions would be ensured under the legal framework of the CBD to be implemented by the FAO. Removing agriculture, food security, and policies affecting life forms from the WTO is seen as a vital step in this process. The conference was strongly in favour of removing agriculture from the Uruguay Round agreement and to eliminating TRIPS.

The complete text of the Declaration can be obtained from: Forum Umwelt und Entwicklung, Am Michaelshof 8-10, D-53177 Bonn, Germany, forum.ue@t-online.de, fax +49 228 35 97 04.

Vignola Declaration and Action Plan

An Action Plan to join the organic and nature conservation movements was announced early in 1999 in Vignola, Italy. The Plan was the result of a three-day meeting convened by the World Conservation Union (IUCN), the International Federation for Organic Agriculture Movements (IFOAM), and AIAB, an Italian organic agriculture organisation that includes most of Italy's organic groups amongst its members. Seventy participants from 24 countries attended the meeting. The declaration embraces the objectives of the Convention on Biological Diversity (CBD) and concludes that organic agriculture is essential for biodiversity and nature conservation. In its Action Plan it recognises the link in expertise and experience between nature conservation and organic agriculture and provides guidelines for accelerating the growth of organic agriculture. These should be implemented at all levels of the private and public sector.

The full text of the Action plan can be obtained from: IFOAM (International Federation of Organic Agriculture Movements) Ökozentrum Imsbach, D – 66636 Tholey-Theley, Germany, Phone: +49 6853 5190; Fax: +49-6853-30110, E-Mail:IFOAM@T-Online.de http://www.ecoweb.dk/ifoam

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Sustaining biodiversity in wetland paddy

In conventional wetland paddy cultivation all natural vegetation is removed during the establishment of the crop. This in turn eliminates all natural animals living within the ecosystem. In the humid tropics where wetland paddy is widely grown and the natural ecosystem can be very rich, this complete elimination of biodiversity could have serious repercussions. To reduce the loss of biodiversity, bunds can be left with vegetation. Our experience is that this is a profitable and ecologically sound approach.

G.K.Upawansa

Biodiversity eliminated

Paddy is normally grown in marshy land or converted to marshy condition by irrigation not because paddy needs inundated conditions but because it can tolerate such conditions. This ability has been used to control weeds by keeping paddy fields inundated. In Sri Lanka, a paddy field consists of several small units known as *liyaddas*. A *liyadda* is encircled by bunds and is perfectly leveled to retain water at a uniform depth. Bunds take 15-30% of the land area, depending on their slope.

Bunds are cleaned during preparatory tillage. The sods are thrown into the *liyaddas*, incorporated into the muddy soil and the colonies of ants that inhabit them are drowned: this reduces the ant population. After cleaning, the bunds are repaired, planed and plastered. The *liyaddas* are puddled and kept submerged for 3 to 4 days before sowing or transplanting takes place.

Between cleaning the bunds and three weeks after sowing or transplantation there are hardly any plants other than paddy in the *liyaddas*. During this period all animals, insects, worms and reptiles either leave the area or die of starvation. Hardly any birds are seen, as there is no food for them. Only insects and microbes that live on paddy plants thrive well. Though there is food for some predators and parasites, there are no plants to host them. In this condition pest attack and disease is unavoidable. The use of agrochemicals to combat pests and diseases degrades soil life. When high doses of chemical fertilisers are used, plants become even more vulnerable to pests and disease.

Weedy bund management

The '*new kekulam*' method of paddy cultivation, described in the ILEIA Newsletter Vol.13-3 provides an alternative to this disastrous conventional method of paddy cultivation. In this method weeds are kept on the bunds. Repairs are made with sods from the base of the bund. Vegetation gradually becomes more natural and after a few seasons the bunds become solid contours unlike those that receive regular seasonal cleaning and plastering. Bunds become so strong that they are able to resist damage by wild animals and floods.

Farmers experience many benefits from weedy bund management:

- Much of the natural vegetation is retained at least on the land covered by bunds.
- Together with the natural vegetation all forms of animals, insects and worms reappear. In this way the natural ecological balance is brought back. This is important for pest control in paddy cultivation. In Sri Lanka we have six dominant insect paddy pests. To keep their population down there are 27 predator insects. Both types of insects live in equilibrium on the bunds. In this way damage to the paddy crop and hence pest control can be kept to the minimum.
- Ants collect weed seeds from the fields during the harvest period when paddy fields are dry and store these seeds on the bunds. This reduces the amount of potential germinable weed seed in the next cultivation seasons. In the *kekulam* method weed control on the *liyadda* is further enhanced by mulching. Mulch of rice straw and loppings from the *Gliricidia* for example, are applied directly after sowing. Irrigation is applied once to soak the mulch. Thereafter, during the vegetative period, the soil is kept moist to ensure its aerobic condition and to enhance soil life. In this way the growth and yield of paddy is enhanced and weeds are controlled effectively without the use of herbicides and with minimal labour input. In addition there is a 50% saving on irrigation water.
- Also predators like birds, owls, reptiles and mongeese are attracted so that damage from crabs, rats and also to some extent from insect pests is reduced.
- Labour requirements are reduced by about eighteen to twenty man days per season and this brings down the cost of production.

The practice of weedy bund management is very simple, it saves labour and money and regenerates biodiversity.

■

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Reference:

- Upawansa GK, 1997. **New Kekulam rice cultivation: a practical and scientific ecological approach**. *ILEIA Newsletter*, Vol. 13-3 pp. 20-21.

photo: GK Upawansa

Effect of mulching on rice root systems

More rice with good soil fertility management

photo: Ana Primavesi

Many people believe that lowland rice produces best when it receives water and minerals as if hydroponic techniques were being applied. But rice does not grow in water. It grows in soil and NPK fertiliser adds only 3 of 45 minerals needed for full development. Green Revolution technology has caused soil degradation and this is becoming increasingly visible. Sooner or later this will lead to stagnation or a decrease in yield. Degraded soils produce low quality food and this has a direct effect on human health. Far from rescuing populations from famine, the Green Revolution is becoming a threat to food security.

Ana M. Primavesi

However, soil productivity can be recovered. In southern Brazil we developed an alternative concept of irrigated rice production based on soil aeration, crop rotation, the restoration of organic matter and micro nutrients.

Soil reduction and growth

In submerged condition the amount of minerals available is reduced and oxygen ions are replaced by hydrogen ions. Some of these reduced minerals - SH2; NH3; CH4 and MnH2 - are extremely toxic to plants. A high pH in wet soil indicates that a very strong reduction in mineral compounds has taken place. In all low yielding soils, agronomists found dry soil was low in pH. In submerged conditions, however, it was high. In reduced conditions rice is poorly nourished and yield decreases.

Impoverishment of the soil can be halted if soil is drained just after the rice plants begin to emerge. Rice roots follow soil moisture and in doing so they penetrate below the reduced top layer. When plants begin to wilt, the field is irrigated and resubmerged for a short time. In this way rice grows in the oxidized rather than in the reduced soil layer. In sandy soils this is impossible because the reduction layer may extend to a depth of 70 to 80cm and roots rarely go so deep. The longer land is kept under monoculture the stronger the reduction effects will be.

Controlling soil reduction

Soil reduction can be controlled if soils are drained completely after rice has been harvested. In addition irrigated rice should be rotated with crops such as barley wheat soya beans and vegetables that do not need ponded irrigation. Organic fertilisers such as Sesbania, compost, farm yard manure and mulch should be applied to the 'dryland' crop. It not only fertilises the crop but it also saves water. Rice soils, it is believed, do not need liming because pH increases in submerged condition. However, lime does not only neutralise pH, it also nourishes the plant. Liming can raise rice yield considerably.

The reduction process in the soil layer can be brought under control if the soil layer is broken by roots and small soil organisms such as earthworms and insects. Soil must become porous again to allow minerals to oxidise and only the rice ears should be harvested because most of the straw should be incorporated into the top 8 cm of soil. In that way the straw will be able to contribute to oxidation, fertilisation and the improvement of soil structure. If ploughed in to a depth of 15 to 20 cm, straw will fix the nitrogen present in the soil and repress crop growth for a period of 3 months or more.

Nutrient deficiencies

If only NPK fertiliser is applied the soil will become depleted of the other nutrients rice extracts from the soil. Three to five years of NPK fertiliser is enough to exhaust the soil. Vegetables and fruits loose their biological value, taste and smell, and require at least 15 additives when canned to make them palatable. Cereals produced in these conditions are poor in proteins, fatty acids and higher sugars.

Soil nutrients have to be balanced. High doses of ammonia fertiliser lowers potash, calcium and magnesium absorption while high doses of nitrate fertiliser lowers the absorption of phosphorus and sulphur. This seriously disturbs the metabolism and productivity of the plant and reduces its resistance to parasites. Nutrient balances are best maintained with organic fertilisers. Very pronounced nutrient deficiencies, however, must be corrected chemically.

Rice frequently lacks copper, manganese and zinc. This is indicated by rice blast (*Piricularia oryzae*). Leaf analysis of blast-sick plants shows deficiencies in both manganese and copper. Spraying seeds with a solution of 1.0% of copper sulphate and 0.5% of manganese sulphate makes them able to absorb these nutrients. When 2.5 to 3 kg/ha of copper sulphate and 5 kg/ha of manganese sulphate are applied with the irrigation water no blast appears. When husks emerge without grain, copper is lacking. If varieties are used that are not well adapted to the soil some micro nutrients are nearly always required.

Herbicides

The two most problematic weeds in irrigated rice production are *Echinochloa* and red or bitter rice. Bitter rice can be more or less controlled by using pre-germinated seeds and seeding in slightly submerged soil. Crop rotation also helps. *Echinochloa* species can be combated with herbicides but this is not strictly necessary as *Echinochloa* plants are adapted to reduced soils. When reduction is strong, *Echinochloa* are more difficult to control. When this is the case, soil drainage and green manuring provide the best control.

When drainage, organic amendments, crop rotation and micronutrients are applied, yields can increase from 4,000 kg/ha to more than 11,000 kg/ha and the percentage of entire grains after husking can increase from 48% to 62%. Good soil fertility management is the basis for high yields and quality. ■

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References:
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Revolution in rice intensification in Madagascar

Justin Rabenandrasana

A very productive System of Rice Intensification (SRI) is being developed in Madagascar. Over the past four years, some hundreds of farmers around Ranomafana have increased their irrigated rice yields from 2 tons/ha to up to 8 tons/ha and more. Instead of relying on the 'Green Revolution' recipe, which they could scarcely afford, they have followed innovative soil, plant, water and nutrient management practices. They continued to use their own seeds and compost and even though these intensified management practices costs them 40-65% more labour, they had a very high return.

The system was developed in 1983 by the late Fr. Henri de Laulaníe, who observed a strong increase in tillers and yield after an accidental early transplanting of rice. He went on to combine early transplanting with other practices that provided an optimal rice plant environment. In 1990, Fr. de Laulaníe helped to establish Association Tefy Saina (ATS), a NGO to promote and improve SRI in Madagascar.

photo: Association Tefy Saina

Close-up of well-developed rice plant

Basic principle: strong plants

With SRI, practices are followed that make a positive contribution to increasing production and, by combining them, production is increased still further. The success of SRI is based on the synergetic development of both the tillers and roots. With a more vigorous root growth, plants can become fuller and taller, and get better access to the nutrients and water they need to produce tillers and seeds. With more growth above ground to carry out photosynthesis, more energy is available for root growth and the stronger the plants, the more resistant they are to attacks by pests and diseases. In Madagascar, where soils are deficient in nutrients, a dense and extended root system gives plants many advantages.

Capture full potential for tillering

One of the "tricks" in SRI is that it capitalises on an in-built pattern of development in rice that had been identified many years ago by the Japanese researcher T. Katayama. He studied the patterns of growth and development in rice, wheat and barley and found that these plants put out tillers in a regular sequential pattern. In rice, each tiller produces another tiller two phyllochrons later (a phyllochron is an interval of plant growth, usually about 5 days but it can be longer or shorter depending on temperature and soil conditions). When soil and other conditions are favourable, the rice plant can go through as many as 12 phyllochrons (or more) before it moves from the vegetative growth phase to the reproductive phase (marked by panicle formation and flowering). The number of tillers can increase exponentially with as many as 84 or more forming on a single plant. The full potential for tillering can be captured by:

Early transplanting

Transplanting after the fourth phyllochron begins (after 12-18 days) sets back the growth momentum of rice plants so that their full potential for producing tillers, roots and grains is not achieved. If the 10th through the 12th phyllochrons of growth does not materialise because of late transplanting, 75% of a rice plants' potential tillering is lost. If transplantation is done poorly and the first two tillers get damaged, one cannot expect more than 16 tillers to grow. Transplantation should be carried out carefully and early, about 8 to 12 days after sowing when the seedlings have only two leaves. It should be done very soon after removing the seedlings from the seedbed and within 15 to 30 minutes after the tiny plants have been gently uprooted. The tiny roots should be placed horizontally in the soil so that the tip of the root can easily resume its downward growth. In this way the leaves of the seedlings will not become yellow and the plant will start to grow again within a few hours. The plants have time to adjust to their new environment before the first tiller starts to grow.

Planting one by one

If two, three or more plants are transplanted together in a clump, competition among their roots limits tillering to 5 per plant at the most. The close planting common in traditional rice cultivation could be considered anti-tillering rice cultivation. To enhance the development of roots and tillers and minimise competition between plants, seedlings are planted one by one in SRI.

Wide spacing

Farmers often believe they can boost their yields by planting rice more densely with 50 or more than a 100 plants per square meter. However, wider spacing encourages more rooting, more tillering, and more grain filling. In SRI, spacing follows a square pattern of between 25x25cm and 50x50cm. In this way a considerable amount of seed can be saved. In SRI, 5 to 8kg of seed is sufficient for one hectare of transplanted rice, whereas in Madagascar it is quite normal to use

100 to 200kg/ha. Rice plants grown under SRI management have between 50 and 80 tillers and routinely produce 150 to 200 grains or more per fertile tiller.

Capturing full root growth potential

For centuries rice farmers have kept their paddy fields inundated when their rice is growing. In this way they suppress weeds and reduce the amount of labour needed. This lead farmers and scientists to believe that rice plants benefit from being continuously flooded. However, rice is not an aquatic plant, and although it can survive with its roots submerged it does not really thrive. During its reproductive phase, when plants go through flowering, panicle initiation, grain filling and maturation, maintaining 1 to 2 cm. of water on rice fields has a beneficial effect. But during the preceding growth phase, rice plants grow better in unsaturated soil. The reasons are simple. When there is no standing water and there is air in the soil, the roots can acquire oxygen much more easily through the *aerenchyma* (air pockets) in the root cells. Lack of oxygen in the root zone leads to soil acidification that causes the destruction of *aerenchyma* and hampers nutrient up take, assimilation and plant growth. The nitrogen cycle in the soil is disturbed as well, and all kinds of toxicity will develop. Scientists from IRRI have identified the problems caused by anaerobic decomposition in continuously irrigated rice systems as one of the main causes of yield decline (Pingali et al, 1997). The full potential for root growth can be captured by:

Alternative wetting and drying of the field modifies the growing environment of rice: improves soil structure, gets more oxygen into the root zone, and enhances active soil life. As the soil dries air replaces water and when it rains or irrigation is applied this air is pushed downwards. Periodic water stress and the availability of oxygen facilitate root growth, and the volume of soil penetrated by the roots increases. In rice production, an effective drainage system to evacuate excessive rainfall and irrigation water from the field is as important as the irrigation system itself.

Minimum irrigation

At the beginning of tillering, there is still not much vegetative growth and the plant only requires a small amount of water. When the root system has been developed, 3 or 4 days of superficial dryness should not cause alarm even if some cracks develop in the field. During growth irrigation will only be needed if rainfall is inadequate and then should be applied in moderate amounts and at favourable times - preferably at night. In this way, irrigation requirements can be reduced by up to 50%.

Early and frequent weeding

Whatever the crop, early weeding is always important for a good return. In rice paddies, where traditional methods are used, hand weeding is usually done one and a half months after transplanting. This is far too late for two important reasons. Not only are weeds replacing half the expected harvest by this time, but farmers also loose the opportunity to bring oxygen into their soil. Aeration of soil by weeding may be even more important in rice cultivation than the removal of weeds. With SRI, simple mechanical push-weeders are used and these churn up the soil. In Ambatovaky, the community near Ranomafana where SRI has been adopted most enthusiastically, 75 farmers experimented with weeding during the 1997-98 season. The two farmers who did not do any weeding got almost 6 tons/ha; the 35 who did the recommended minimum of 1 or 2 weedings averaged between 7 and 7.5 tons/ha; while the 24 who did three weedings averaged 9 tons and the 15 who did four weedings averaged over 11 tons. This showed how early and frequent weeding is very important in enhancing the development of the root system and the entire rice plant. The extra labour needed for additional weeding more than pays for itself at harvest time.

Application of compost

SRI was first developed in the 1980s using chemical fertiliser. But after the price of fertiliser skyrocketed in the early 1990s, Fr. de Laulaníe began experimenting with compost. He used cattle manure where this was available, but mostly he used any sort of decomposed biomass, including rice straw. Cuttings from leguminous plants and shrubs proved particularly beneficial. He found that using organic sources of nutrients could help achieve levels of production that could not be obtained using conventional practices. In the north of Madagascar, a private company conducted trials to determine the best levels of chemical fertiliser for rice. It reported achieving average yields of 6.2 tons with modern methods and seeds. At the same time 27 farmers using SRI in the same area averaged 10.2 tons/ha.

It is still uncertain how and why these high yields are possible on such poor soils. Around Ranomafana, pH values are between 4.2 and 4.6 with extremely low levels of exchangeable bases [Ca, Mg and K] and phosphorus levels that average between 3-4 ppm, which is considered very deficient. Possibly this can be attributed to the large volume of soil penetrated by roots and the high activity of soil-life brought about by aerobic soil conditions and organic fertilisers.

Approach not package

In the past 10 years, SRI has been used with similar success in many places in Madagascar and under different production conditions (elevation, temperature, soil types). Currently, SRI is being promoted by several development programmes. The University of Antananarivo's *Ecole Superieure des Sciences Agronomiques* (ESSA) has supported field studies to evaluate and analyse the method. The Cornell International Institute for Food, Agriculture and Development (CIIFAD) has been working with ATS since 1994. Outside Madagascar interest in SRI is growing and SRI as a methodology is still being evaluated. ATS insists that it be treated as an approach, a strategy, even a philosophy, rather than a "package". It is the combination of practices that is important, more than any specific single method. These practices need to be tested and, if need be, adapted when introduced to new environments.

Even if such high increases in yields cannot be obtainable everywhere because of constraints such as water control, substantial gains in rice production should be possible by applying SRI insights and practices. By mobilising the experimental capacity of thousands of farmers to adapt the technology to different conditions, SRI could become one of the most beneficial innovations in agricultural practice this century.

From: oral presentation by ***Justin Rabenandrasana****, Association Tefy Saina*
Edited for the ILEIA Newsletter by
Coen Reijntjes*, ILEIA*

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Further information:
- **Association Tefy Saina** (ATS), B. P. 1221, Antananarivo 101, Madagascar (only in French).
- **Institute de Promotion de la Nouvelle Riziculture** (IPNR), B. P. 8417, Antananarivo 101, Madagascar, ipnr@simicro.mg, http://www.simicro.mg/ipnr
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photo: Association Tefy Saina

MASIPAG - Farmer-Scientist partnership

MASIPAG is a farmer-led network of farmer organizations and local communities, representing more than 30,000 farmers in the Philippines who all believe in the sustainable use and management of biodiversity through people's control of genetic resources, including the associated knowledge.

Emmanuel Yap

In 1980, the glaring fact of rural poverty prompted NGOs (principally ACES Foundation) and a group of progressive scientists to initiate consultations among farmers in different parts of the Philippines. They discussed the impact of high yielding varietieson small farmers as well as other issues related to the rice industry. Starting at village level, these discussions were extended and coordinated throughout Luzon, Visayas and Mindanao and culminated in the BIGAS Conference in 1985.

In 1986, a farmer-NGO-scientist partnership was formed. A group of professors and researchers at the University of the Philippines, Los Baños, took the lead in establishing a "technical pool": the farmer-scientist partnership. In 1987, the Farmer-Scientist Partnership for Agricultural Development was formally registered and ready to embark on the MASIPAG programme - *Magsasaka at Siyentipiko Para sa Ikauunlad ng Agham Pang-Agrikultura*.

Quality and empowerment

MASIPAG tries to improve the quality of life and to empower resource-poor farmers by enabling them to regain control over strategic economic factors particularly seeds and the production process.
It also creates a legitimate space where farmers can meaningfully participate in policy formulation and decision making.

MASIPAG seeks an ecological balance on-farm by using local and renewable resources and promotes people's control over biodiversity to secure the sustainable use and management of genetic resources. MASIPAG also transfers the fundamental skills of breeding and farmers' research to farmers so they can share in the efforts of researchers' as they work to improve crops. It also creates a sense of patriotism among farmers by encouraging them to adopt cultivar diversity, in effect establishing a nationwide on-farm gene bank. In this way, farmers take an active role in conserving a national patrimony: the seeds.

Through its trial farm strategy, MASIPAG makes a diversity of crop cultivars available to farmers. From these they can select those best suited to local conditions and in doing so extend the range and selection of appropriate rice varieties available locally.

MASIPAG broadens the perspective and reinforces the knowledge and skill farmers need in order to develop their own farming system in the interests of better nutrition and more income. It also assists network members to formulate and advocate policy alternatives that will create an environment that will help promote MASIPAG.

Programme components

CIMME

Collection, Identification, Multiplication, Maintenance and Evaluation of lowland and upland rice cultivars and maize as well as the collection of vegetables, livestock, poultry, fruit/wood trees and rootcrops is an ongoing activity as MASIPAG works towards diversification. Collection is nation-wide in order to halt the rapid disappearance of biodiversity. After testing, the species and varieties collected are maintained in farmers' seed banks . This gives network members greater access to a wide range of choice both for production and breeding and helps stimulate the most appropriate cultural management practices.

Breeding programme

Crossing and selection of farmer-selected cultivars of rice and maize encourage and sustain farmers participation in the work of breeding, management, evaluation and selection of varieties. It also enables them to produce seeds according to their resources, priorities or needs breaking farmers dependence on seed companies.

Agroecosystems conversion

The approach that guides the sustained process of conversion from monocropping to diversified and integrated farming, and from chemical to organic farming both in lowland and upland rice systems.

Other activities focus on monitoring, evaluation, farmers training, institutional development and linkages, and the documentation and publication of farmer developed and adapted technologies.

Achievements

MASIPAG has made significant headway in research into and the development of rice seeds and sustainable production systems.

- A collection of 1196 traditional and improved rice cultivars 60 % of them grown in the MASIPAG network areas.
- 146 new rice crosses made between 1987 and 1997.
- There are 75 MASIPAG Trial Farms in 35 provinces throughout the Philippines. Varietal trials have been conducted at these sites for several years. MASIPAG also maintains three national back-up research farms in Nueva Ecija (lowland rice), Negros Occidental (upland rice and vegetables) and Cagayan de Oro (maize).
- Over a thousand farmers/NGO/GO representatives have been trained in the MASIPAG approach.
- Documentation of 50 indigenous knowledge systems (farmer-developed/ adapted technologies).
- At least 5000 farmers within the network are in various stages of converting their farms.
- Over a hundred orientation and technical training-workshops have been conducted involving more than 5000 farmers. Echo training and workshops have also been conducted by farmer-trainers themselves.

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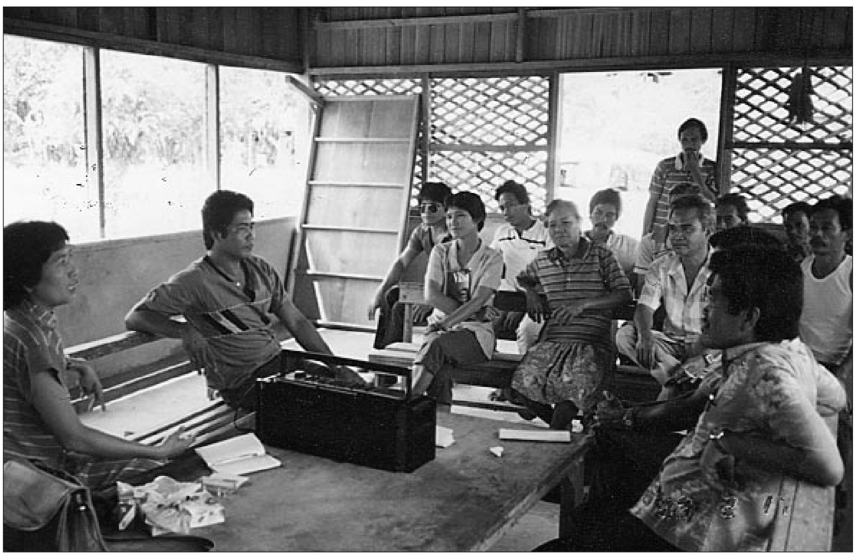

Informal discussion with villagers

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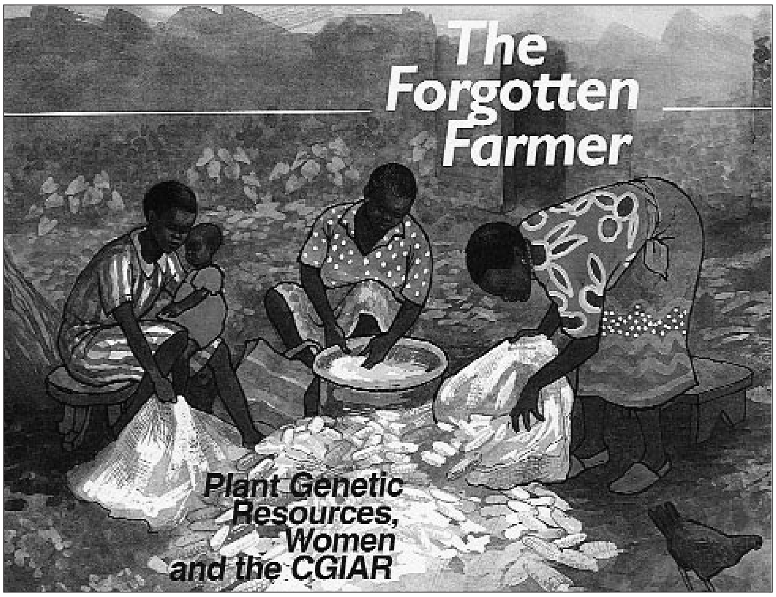
CGIAR: Towards gender sensitive research



"We have no idea what is being lost in genetic resources due to 'gender blindness'. Plant collectors miss a lot if they only talk to men"

Dr Susan Potts, CGIAR social scientist Ecuador

The mission statement of the Participatory Research and Gender Analysis (PRGA) Programme is to assess and develop *'methodologies and organisational innovations for gender-sensitive participatory research in plant breeding, crop and natural resource management"*.

The programme pursues a new kind of partnership between farmers and scientists. It aims to move farmer involvement "upstream" in the formal research process by involving farmers earlier in technology design and development. A related objective is to move scientists towards greater involvement in supporting, strengthening and complementing farmers' own research processes with specialised scientific input. This requires the attitudes and practices of agricultural researchers to change and that they become more supportive of farmer participation and gender analysis as a normal feature of research. This will benefit farmers as well as formal research. The benefits include quicker solutions to real problems, more efficient use of research resources, and better farmer-scientist relations.

Women play a vital role in the conservation and sustainable use of biological diversity and they need to participate at all levels of policy making and implementation for biological diversity conservation

Preamble, Convention on Biological Diversity

Poor women farmers are the main programme beneficiaries. Rural women form a growing proportion of the very poor, a trend known as the 'feminisation of poverty'. Household food security is deeply affected by women's access to income-generating technologies. Therefore, this new programme twins gender analysis with the development of participatory research methods. Gender analysis goes to the heart of participatory research by addressing a key issue: who exactly should participate? In helping to answer that question, gender analysis can contribute to making agricultural research more efficient.

The programme assesses the current practices of including different types of users at different stages of Participatory Plant Breeding (PPB) and Natural Resource Management (NRM) and is organised in a PPB, a NRM and a Gender Analysis work group. Each work group involves practitioners from international agricultural research centres, national agricultural research institutes, NGOs and government research organisations. They also include indigenous farmer research systems interested in implementing studies consistent with the PRGA work plan. Working group members interact through email conferencing, they meet face to face in periodic research workshops, or site visits, and members contribute to the programme's bi-annual international seminars.

PRGA uses competitive small grants to stimulate innovation in methodology development, institutional design and capacity building. Plant Breeding Small Grants support new studies which address knowledge gaps in participatory plant breeding. The NRM Small Grants support activities that seek to involve rural women in research and development for natural resource management including the appointment of three regional support persons to work with the action research, training and workshop components of these workshops.

PRGA programme partners in the international agricultural research centres, NGOs, national research institutes, universities and government research organisations have the capacity to contribute to the development of methodology. CIAT hosts the programme and CIMMYT, ICARDA and IRRI are cosponsors. The programme's planning group consists of eight elected members and one elected member from each of the three working groups; four representatives elected from each of the four stakeholder groups and one member from the Convening Centre.

For more information on PRGA: http://www.prgaprogram.org/prga or <prga@cgiar.org>.

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Edited by **Wietse Bruinsma**, ILEIA

Carchi, Ecuador's northern-most province is distinct in its culture, terrain and agricultural practices and was never under Inca influence. The countryside has relatively little Quichua, or indigenous, influence. Unlike the other sierran provinces which are dominated by high snow-capped volcanoes, Carchi has

Larry M. Frolich, Stephen Sherwood, Arlo Hemphill, and Esmeralda Guevara

well-defined western and eastern cordilleras bordering a rich agricultural central valley. Both cordilleras are topped by an extensive alpine plain, or *'paramo'*, with grasslands. On the western side this region forms one of the country's largest national

photo: Larry Frolich

"Eco-Papas": through potato conservation towards agroecology

natural areas, "the El Angel Ecological Reserve." On the eastern side, the inter-Andean slope boasts an extensive 40,000 hectare stretch of forest that is perhaps the best example of relatively pristine inter-Andean vegetation encountered in the northern Andes. The forest lies on steep slopes between cultivated agricultural land and the alpine *paramo*.

Small pre-Colombian populations probably used the *paramo* for trade routes and undertook limited small-scale agriculture in the flat inter-Andean valley floor. Even today, the population of Carchi is small for a sierran province and pressure to cut forest for fuelwood is relatively limited. Colonial population centres formed with large haciendas in the valley floor around the cities of San Gabriel and Tulcan. But colonisation of the valley sides, in rural towns where small-scale farms predominate, only started in the last century.

Initially, rural colonisers -mostly hacienda workers- cleared small patches of land and planted a mix of potatoes and other Andean tubers in a trade and subsistence economy, the classic *"huasipungo"* system. Transport and communication infrastructure was primitive or non-existent and industrialised agricultural techniques were unknown. As highways improved and secondary roads were built, chemical fertiliser and pesticide businesses were among the first to capitalise on the accessibility of a new market.

Loss of productivity and biodiversity

Hard statistics do not exist, but according to older farmers in the region, chemical fertilisers initially increased potato production yields dramatically, often reaching an impressive 40-60 tons/ha. With time yields dropped, apparently due to loss of resistance to insect pests and fungal diseases. This triggered the large-scale application of chemical pesticides. Today, average yields are only 21.3 tons/ha (Crissman et al 1998) despite the continued, heavy, application of chemical fertilisers and pesticides. The use of pesticides has caused severe cases of poisoning among the farm population. The effects of residuals in food products among consumers are relatively unknown but probably important (Cole et al 1995)

The chemically intensive planting system now predominant in the entire province has led to soil fertility loss. Valley floor land, once among the richest in soil quality and some of the first land to be used for the intensive monocropping of potatoes for cash, is now almost exclusively dedicated to pasture and milk cow grazing. The shallow lower valley slopes, with a 20-30 year history of chemically intensive potato production, require ever-longer fallow period between potato plantings. Even so, yields continue to decline. Highest yields and shortest fallow time are now found in steep newly cleared forestlands high on the valley slope. Thus, although pressure to cut forest for fuelwood is relatively low, farmers continue to move up the valley slope to clear land for better potato production (Frolich et al 1998; Frolich & Guevara, in press).

Carchi is the only sierran province that does not have water shortages, probably due to the presence of the large tract of inter-Andean cloud forest. In addition, the forest is an important source of organic matter. However, if forest clearing and soil damage by use of chemicals continue, the system could easily degrade to the rocky-sandy land seen further south where forest land is completely absent. It would seem then, that in the long run, chemically intensive, potato monocropping is unsustainable.

Trying to overcome the loss of productivity, Ecuadorian national agricultural services have introduced a series of genetically improved potato varieties. These now account for over 90% of total production and usually show an initial increase in production and resistance to pests and diseases, especially late blight. However, over time production declines and resistance is lost. New varieties are generally crossed with genetic stock from the old varieties, thus limiting actual diversity. Farmers still cultivate two or three landraces or *"chaucha"* varieties. These are generally planted in small quantities for home consumption or sale on the local market. Although memories remain of tens or hundreds of varieties that were cultivated only one generation ago, these landraces are no longer found in the area.

The Eco-Papas project

The "Eco-Papas" project has a broad approach: reintroducing biological and ecological farming techniques that decrease the importance of chemical inputs and moving towards a more stable and sustainable agroecosystem. Unfortunately, this is not a simple relearning or reintroducing forgotten planting systems. The reality is that the introduction of semi-industrialised agriculture has completely changed the landscape and its elements requiring a reinvention and adaptation to existing conditions.

There are three lines of action within the Eco-Papas project: soil maintenance and improvement; integrated pest and disease management and re-introduction of crop biodiversity.

The Eco-Papas project's guiding principle is the notion that healthy, living soils will provide a stable base from which other adjustments and improvements to the production system can be made and managed. Perhaps the most significant soil damage in Carchi is a virtual dying-off of soil micro- and macro-organisms after repeated potato plantings. The cause of soil "death" is uncertain but more than likely it is related to a nutrient imbalance brought on by the use, and often over-use, of cheap, chemical fertilisers and, possibly, by pesticide fumigations.

Integrated farming techniques

The Eco-Papas project is investigating this loss of soil biodiversity with test plots distinguishing between the effects of fertiliser and pesticide application. In addition, the project promotes integrated farming techniques, such as the use of green manures especially in badly damaged or "dead" soils; inter-cropping and crop rotation, especially with legumes; incorporation of organic matter and animal fertilisers; and limited tillage and cover crops. With a healthy, biologically managed soil base, it may be possible to break the extreme dependence on external, imported chemical inputs. Fertiliser and pesticide use will continue to play some role, but the ideal is a well-managed farm with strong biological fundamentals and minimum use of chemical inputs.

Together with INIAP, Eco-Papas has conducted experiments on the reduction of chemical inputs. Initial results on a one-hectare test plot indicate average yields of about 10 tons/ha, but at less than half the normal production costs, using resistant varieties, integrated pest management techniques, and good soil management. The experimental site had been fallow for six years before potatoes were planted. The use of animal manure and compost maintained soil micro-organisms and only required minimal applications of chemical fertiliser. After harvesting, the usual diversity of soil microflora and -fauna was apparent.


photo: Larry Frolich

As with the integrated approach to soil management, the Eco-Papas project promotes the use of a range of preventive, biological technologies for treating pest and disease problems (Barrera et al 1998). Trapping techniques are used to reduce adult populations of noxious insects. In addition, the potential for endopathogenic control is being studied. Finally, intercropping and planting hedgerows with naturally anti-insecticidal species have shown positive results. Late blight is a particularly pernicious problem apparently best tackled by looking for resistant varieties.

Re-introducing biodiversity

Perhaps the most important component of the Eco-Papas project has been on-farm conservation and the re-introduction of potato biodiversity. Landraces and genetically improved local varieties may hold the key for natural pest resistance. A strong economic base, predictable over a long term, with many different products to offer is a precondition. An important corollary to the production of a more ecologically produced, healthy potato is the opening up of local market demand for such a potato. Consciousness raising, via farmer field training, schools and public awareness campaigns, is important for the adoption of a healthier potato growing system. A small local agricultural fair organised in 1999, for example, stimulated interest in growing traditional and low-chemical-input potatoes for local on local markets.

In order to re-introduce genetic diversity to the overall potato cultivation system the first step is to develop on-farm, living seed banks of genetically improved potato varieties as well as traditional landraces. This genetic diversity bank needs to be widespread, repeated, adapted to local conditions and managed by local farmers, with help from extensionists. At this moment, some 40 varieties are being cultivated and conserved on two local farms. Ongoing analysis of pest resistance in the landraces that are maintained in the "in vivo" collection is being carried out by farmers in order to assess which varieties can be used in local breeding and genetic improvement programmes.

From an initial collection of 70 cultivars and landraces collected in Ecuador and Colombia, 40 varieties have been found that produce good viable seed and a d esirable tubercle. Of these, 30 are landraces and 10 are genetically improved. Mixed production plots for these varieties employ integrated pest management and other techniques, such as selective thinning of possibly diseased plants, in order to produce high quality seed. Using the harvest from current plots, it should be possible to produce half a ton of seed for each variety within one year. So far, seed production has been entirely managed with local farmers who dedicate small plots to the production of seed in exchange for half the harvest.

Widespread interest

Perhaps the most positive early result of the Eco-Papas project has been the widespread interest and involvement of local farmers. Farmers from the local agricultural cooperative are involved in managing the test plot and in organic seed production. Together with INIAP, these initiatives are now spread to other towns and communities. Several farmers have planted their own gardens with traditional varieties, without the intervention of the project. The next step for the project is to establish local management of the potato variety bank with farmer field courses in the use of new varieties under low-chemical-input regimes.

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Indigenous tuber varieties in the Mekong Delta

photo: Conny Almekinders

Recent initiatives

Biodiversity has been dealt with from many different angles in recent projects. Three programmes - **the Community Biodiversity Development and Conservation** (CBDC), **the Centre for Biodiversity Utilisation and Development** (CBUD) programme, and **Biodiversity Research for Development** (BRD) programme in Mindanao, Philippines reflects this diversity of approaches and objectives.

1. Community Biodiversity Development and Conservation Programme

The CBDC programme involves some 15 countries and is implemented through a series of projects that focus on farmers' livelihood and Plant Genetic Resources (PGR). Apart from the project's immediate benefit to farmers it is also an experiment in cooperation between partners working in different sectors: research and development; North and South; formal and informal; and global and local.

The programme has been designed to produce research tools that can be used to study, validate and strengthen farmers' PGR systems. In addition, the programme aims to develop a framework to enable formal and informal institutions to cooperate more effectively in providing support to community PGR systems. One of the programmes basic principals was that local communities must retain control and complete freedom to decide on the use of their genetic resources and the knowledge associated with them. Projects have been carried out in the Philippines, Malaysia, Vietnam, Thailand, Sierra Leone, Kenya, Burkina Faso, Zimbabwe, Chile, Peru, Colombia and Brazil. An international policy and technical programme coordinated policy and technical support to the projects.

Most projects began with an assessment of the community PGR system, an inventory of present diversity and an estimation of the extent of genetic erosion. Using this information, activities were designed to support community systems. Through community variety trials, traditional varieties were re-introduced into local communities in project areas. At the same time, modern cultivars from research institutions were introduced. There was considerable interaction with other projects: the methodological elements of Participatory Variety Selection (PVS) and Participatory Plant Breeding (PPB) were integrated in Farmer Field School modules and some projects took up the concept of seed fairs.

Four types of associations seem to be emerging among partner organisations involved in the CBDC programme:

- Cooperation between NGOs and formal research institutions. The combination of informal and formal organisations ensures that the perspective of those who regard PGR as a power relations issue is broadly carried. At the same time, collaboration between scientific institutions ensures that organisations concerned with sociopolitical and development issues can be supported by research data and results. Such cooperation makes it possible to exert influence on formal research agendas and ensures that community perspectives and priorities are included.
- Cooperation between Northern and Southern organisations, both NGOs and public (government) research institutions. Partners in the programme represent a wide range of perspectives and this institutional diversity stimulates debate within the programme.
- Cooperation between NGOs working at local grassroots level and those working at national and international policy levels. Local organisation's skills and traditions are based on concrete partnerships with local communities. They confront issues that are specific and practical. In this way the activities of NGOs at the grassroots level are monitored and validated. Organisations that work at policy level are inevitably dis-

tanced from the reality of farmer communities. Local community concerns and interests need to be raised at policy level and the CBDC programme tries to combine all these levels into a single programme.
- Combining various disciplines. Social issues and participatory approaches that focus on power relations and address issues such as access to and control over PGR, are combined with natural science research on gene flow and the conservation of genetic combinations in crops.

The CBDC programme can be seen as an experiment in validating and strengthening farmers' PGR management. Its first aim is to address the concerns of local farmers and support farmers in their management of PGR by, for example, creating a farmer's field manual on PPB and models for Material Transfer Agreements for farmer germplasm exchange. These activities contribute directly to re-strengthening farmers' PGR management and broadening the genetic base of crops. If other farming communities adopt these programme approaches it will augment the programme's impact in other areas. Programme outputs are also expected to have an impact on policy formulation and institutional reforms. CBDC's second aim is to ensure that scientific publications and policy recommendations reach the scientific community and policy makers. The objectives of the CBDC programme are complex and organisations that decide to embark on this experiment open themselves to criticism. However, the collaborative learning process of the partners in the programme is unique and provides an excellent basis for further collaboration.

At present the programme partners are preparing a second phase. Building on the lessons of the first phase of the programme six so-called T(thematic) lines were planned: PVS/PPB, seed supply systems, Non-Domesticated and Semi-Domesticated Biodiversity (NDSDB), gender, mainstreaming, and policy. This thematic approach is meant to facilitate the global integration of country projects and topics and will reflect the future focus of the programme.

For more information:
http://www.cbdcprogram.org.

2. Centre for Biodiversity Utilisation and Development

The Centre for Biodiversity Utilisation and Development (CBUD) in southern Ghana was established in 1999 in an effort to preserve and develop forest resources in the south of the country through as series of projects with a clear market focus. The CBUD acts as an impartial intermediary between a range of very diverse stakeholders.

In the forest belt of West and Central Africa the forest features in all aspects of life. It plays a role in history, religion, medicine, art and language. In many communities, small forest areas have been protected as sacred groves and are sites of *in situ* conservation. In the South of Ghana, the predominant farming system is changing from shifting to permanent cultivation. This shift has serious implications for the practice of hunting and gathering wild forest products and rural people's knowledge of these resources. As areas under shifting cultivation shrink, resources become depleted and the threat of genetic erosion increases. To counter this process, a type of resource management has been proposed that increases the productivity of '-wild resources' and prevents overexploitation. This management can include some cultivation and 'domestication', as well as the development of products that add extra value to resources.

CBUD recognises that programmes to conserve biological diversity often ignore the potential for utilising and developing the products of biological resources. Farmers, foresters, rural and urban households, crop and animal scientists, marketing and processing specialists, development workers and conservationists, extension staff, and policy makers are amongst the many stakeholders involved in the process of utilising and developing forest biological resources. The CBUD functions as a stakeholder platform where actors meet and share their interests. CBUD aims to link conservation and development through a series of projects to develop different products. The project-wise organisation enables CBUD to build changing coalitions of partners.

The CBUD approach includes the following steps:
- identifying potential products and their related markets;
- identifying stakeholders;
- establishing a platform for product development and discussion;
- defining common objectives;
- defining the role of different stakeholders;
- designing appropriate property right systems for the products and resources;
- developing for production, processing and marketing chains;
- monitoring of harvesting and use of natural populations

The CBUD aims to act as facilitator and provides funds for financially viable options. Financial resources for such projects are drawn from the CBUD Trust funds. CBUD is currently being financed by the Netherlands, but is expected to generate its own funds.

Adapted from: Emmanuel Asibey, de Boef WB, Amoako-Atta B, and Quashie SS

3. Biodiversity Research for Development Programme

The Biodiversity Research for Development Programme (BRD), Mindanao, Philippines aims to develop a framework in which biodiversity at eco-system level in highly complex and threatened environments can be better understood. The programme, still in its initial stage, intends to undertake and promote collaborative, participatory and interdisciplinary research that will enable the sustainable use of biological resources, and effective decision-making on biodiversity conservation, to improve livelihood and cultural opportunities.

BRD involves Philippine and Dutch researchers and is committed to collaborative, participatory and interdisciplinary research that will support the sustainable use of biological resources, effective decision-making on biodiversity conservation, and improve livelihood and cultural opportunities. It is hoped that the results of the research programme will be used to influence policy on the sustainable use of biodiversity resources and in educational and development programmes.
The programme is the product of a series of studies, workshops and other activities between stakeholders and researchers.
A National Biodiversity Research Agenda has been developed by a multi-stakeholder group of researchers, government and non-government organisations and this provides the programme with direction and general content.

BRD began by identifying a more specific research site in the Mount Malindang area of Mindanao and by defining research priorities and the role of various project partners. Workshops to define the programme further were followed by a period of research, training and planning.

Three teams were assigned to upland, lowland and coastal ecosystems to conduct further problem analysis. A stakeholder analysis team that included members of the eco-system teams was also formed. All teams used Participatory Rural Appraisal (PRA) methods to get a good description of the research site and post-PRA workshops and a final workshop were held to define the programme's goals and strategies. The research programme will be implemented and tested in the coming years in the Mount Malindang area and will provide a framework, strategies and methods for similar programmes in other valuable but threatened concentrations of biodiversity elsewhere in the Philippines.

Adapted from: Lammerink MP & Smits P ***Getting local communities and stakeholders involved in research for biodiversity conservation and livelihood development: the example of Mount Malindang, Philippines***.

■

Participatory plant breeding for on-farm conservation

Landraces are varieties developed by farmers over many generations of selection without the intervention of formal plant breeding. Numerous landraces provide food security to many people in developing countries and also act as a primary source of breeding material for modern varieties. The use of landraces contributes to stable food production and income,

B.R Sthapit and D. Jarvis

especially in marginal environments where the impact of modern varieties is limited. Therefore, the Convention on Biological Diversity (CBD) has recognised the continued maintenance of traditional varieties *in situ* as an essential component of sustainable agricultural development.

In 1995, the International Plant Genetic Resources Institute (IPGRI) together with partners in nine countries, began to explore the potential of on-farm conservation in a global project. *In situ* (on-farm) conservation is the maintenance of species populations in their natural habitats either as uncultivated plant communities or in farmers' fields as a part of existing agro-ecosystems (Jarvis et al 1997). The project intends to develop insights into how on-farm conservation can best be carried out. This includes an analysis of the ways in which sustainable partnerships between the formal and informal sectors can be developed.

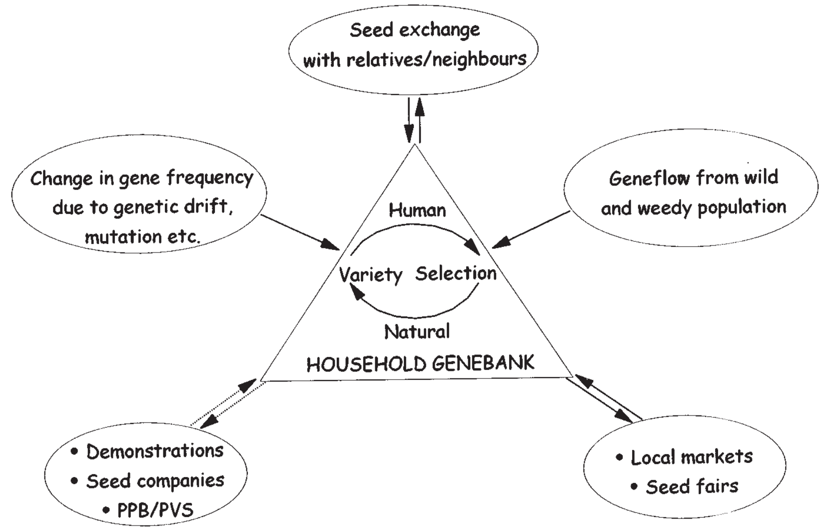

Figure 1 Informal seed supply systems in informal farming systems

Understanding

On-farm conservation is a process (Figure 1) which generates diversity. It encompasses four distinct steps:

- gene flow from wild to cultivated crops or seed flow through exchange of seeds;
- human selection of varieties;
- natural selection of varieties adapted to local conditions;
- seed storage methods for post-harvest assessment, and seed selection for next season's planting.

Traditional seed supply systems are important sources of diversity. Most farmers obtain the seeds of new varieties from informal seed sources generally within their own community. There are examples of widely diffused new varieties that were never officially released. This indicates the importance of farmer-to-farmer seed exchange mechanisms. Migrants, marriage outside the community, and outside job opportunities play an important role in seed exchange, especially over long distances between areas isolated by geographical or cultural barriers. Seed exchange, the introduction of new diversity from informal systems and seed fairs enhance the gene flow in villages and meet farmers' immediate needs (Figure 1).

Gene flow through seed exchange between the formal/informal sectors and through local seed merchants results in a dynamic seed supply system. The number of landraces, farmers' varieties and exotic varieties grown in a given locality, their genetic differences, and the area they occupy over time are important factors for sustainable agriculture. Yield stability is an important objective for farmers and an indicator of sustainable agricultural development. Yield stability is associated with genetic diversity, which acts as a buffer against biotic stresses. Participatory plant breeding (PPB) creates new diversity and provides an opportunity for transferring new breeding skills and knowledge thus strengthening on-farm conservation (Box 1).

Table 1. Role of farmer and breeder during PPB process

Fundamental steps	Nature of participation	Farmer	Breeder
Goal setting	Consultative	• Opinions and views considered	• Identify farmers using Farmer Network Analysis
Generating new diversity			• Key role
Selection	Collaborative	• Site selection for abiotic stress • Rejection of bulk population • Selection within and between population • Post-harvest selection • Trade off multi-traits vs. yield	• Screening incoming germ plasm • Screening for biotic stresses • Selection - early generations • Training - heritability
Variety release and distribution	Collaborative or collegiate	• Informal seed supply system	• Monitoring of spread • Prepare proposal for release

Threats

Farmers will continue maintaining landraces as long as they see benefits, but they may choose to replace them with modern varieties for the following reasons:

- poor yields of local landraces;
- lack of market for local varieties;
- disease and pest susceptibility;
- poor economic returns;

- unwanted traits such as taste;
- access to seeds of modern varieties, input and credit facilities and technical support.

We need to know why farmers grow landraces and where as well as how they maintain and use them. Figure 1 shows that farmers look for new seeds when the varieties they have do not perform well. For a farmer to maintain and use landraces, crop genetic resources must:

- be competitive with other options available to the farmer; and
- provide security and possible increase the farmer's income.

Participatory Plant Breeding (PPB)

When landraces and modern varieties are crossed and when there is a maximum selection by farmers in the target conditions at an early stage of the selection, then the breeding strategy closely resembles *in situ* genetic conservation of landraces (Witcombe et al 1996). A PPB approach using landraces as the source of genetic material for crop improvement symbolises a balance between the two goals of maintaining genetic diversity *in situ* and improving varieties according to the needs of farmers.

Table 1 illustrates four fundamental steps and roles of farmers and breeders in the PPB process. This process has been documented as an output of farmer-researcher interaction in Nepal and is being tested in the project area. The level of participation may vary with the expertise, skills and capacity of participating members. PPB needs to be used when Participatory Variety Selection (PVS) has failed to identify any suitable cultivar or if a new problem is identified in a cultivar. PVS and PPB cycles are inter-linked but still have their own distinct processes

Strengthening on-farm conservation

Does PPB create and conserve genetic diversity *in situ*? Does PPB enhance benefits to farmers? What is the incentive for farmers to collaborate with PPB and on-farm conservation activities? Will adding value to a particular landrace through PPB result in the spread of that variety at the expense of other varieties in the system? Six countries in the IPGRI's global project will address some of these technical questions.

Currently, on-farm conservation is under the domain of the farming community. Strengthening the capacity of farmers and local organisations will enhance on-farm conservation of crop genetic resources, thereby improving farmers' livelihoods. On-farm conservation can be strengthened through activities in the farming community, such as diversity fairs, community seed banks and PPB at grassroots (Figure 2). However, it requires more collaboration between the formal sector of plant genetic resources institutions and the informal sectors including community-based organisations (CBOs). Farmers' ability and knowledge of breeding have been generally undervalued if not ignored by plant breeders. Farmers, like plant breeders, have their own selection criteria to evaluate new cultivars.

Community participation in PPB in villages has empowered farmers. Farmers participating in PPB benefit from early access to new materials, gain recognition from the community and learn new selection techniques. In Nepal, farmers involved in PPB have successfully sold seeds of the new varieties at a higher price than the local landraces (Sthapit et al., 1996). The products of PPB remain under the control of the informal seed system. While a direct recompense to farmers is not intended in the framework of the project, it is important that the global and national investment in farmers' welfare is seen as indirect compensation in recognition of their role in on-farm crop conservation. This kind of indirect compensation may reach more farmers and thus be more equitable than a system of payment to a few farmers. PPB may, therefore, enhance community participation in managing local genetic resources making full use of farmers' knowledge and skills in crop improvement. ■

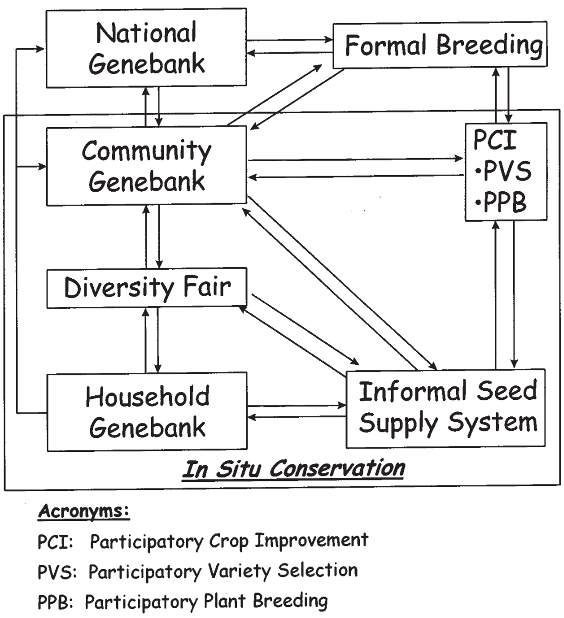

Figure 2 Participatory Plant Breeding and its linkages with *in situ* and *ex situ* conservation

Box 1.
Participatory crop improvement: definitions
(Joshi & Witcombe 1996; Sthapit et al 1996; Witcombe et al 1996).

Participatory Variety Selection (PVS)
PVS is the selection of fixed lines (released, advanced lines or landraces) by farmers in their target environments using their own selection criteria

A successful PVS involves the following four steps:

- identification of farmers' needs in a cultivar;
- search for suitable materials;
- experimentation on its acceptability in farmers' field; and
- wider dissemination of farmer-preferred cultivars.

Participatory Plant Breeding (PPB)
PPB is a breeding process in which farmers and plant breeders jointly select cultivars from segregating materials under target environment.

A successful PPB has the following features:

- understanding reasons for growing diverse varieties;
- identification of expert farmers with skills in managing diversity and seed selection;
- setting up breeding goals (and roles of participants) jointly to meet farmers' needs;
- use of landraces as parent materials;
- decentralised selection of segregating lines by farmers;
- use of farmers' observation and opinions;
- farmer participation at all stages of selection and evaluation;
- transfer of skills and knowledge between breeder and farmer;
- evaluation and monitoring of varietal spread by scientists;
- use of informal seed supply systems for wider dissemination.

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Early attempts at stimulating seed flows in Cuba

Humberto Rios Labrada and Julia Wright

Since the disintegration of the USSR in 1989, the Cuban agricultural sector has had to cope with a drastic reduction in input and trade support, shifting gradually towards more self-sufficient and rational forms of production. Many remarkable technical and social transformations have occurred as a response to this challenge. In the 1980s, Cuba had carried out 87% of its external trade at preferential prices, imported 95% of its fertiliser and herbicide requirements, and owned one tractor for every 125 ha of farmed land. After the collapse of the socialist block, foreign purchase capacity was reduced from US$ 8,100M in 1989 to US$ 1,700M in 1993. This greatly affected the country's ability to buy agricultural inputs. Fortunately, since the early 1970s Cuban research institutes had been aware of the concept of low inputs and input substitutions and soon development and diffusion of alternative fertiliser and pest control measures was put into place.

However, the plant breeding sector has been slower to adapt. The solution is not as simple as technology substitution within the existing top-down infrastructure. The industrialised system had encouraged a vulnerable crop genetic framework with a low level of biodiversity. The homogeneous environment previously maintained with a high use of inputs was now no longer able to support the same crop varieties. The national seed supply system urgently needed to expand, but lacked the financial resources to do so. Between 1989 and now, its seed production capacity for maize and bean had fallen 50%.

The seed and breeding sector continues to operate almost wholly within the centralised state planning system, which does not respond comfortably to rural reality. Today, breeding strategies do take indirect yield attributes and regional variability into account but prioritising the breeding of seed for real conditions of low external input has yet to emerge at the institutional level. There is a need to supplement current dependency on the formal seed supply system with a more informal approach.

Lack of appropriate seed has meant that the informal seed system, operated directly by and for farmers, continues to exist although weakened by the dependencies created prior to 1989. The maintenance of wide variability and adaptation is traditionally carried out in small plots where farmers conserve *in vivo* those plants considered useful to the household. Through the informal system, the production of seeds of the basic staples of the Cuban diet has continued in many parts of the country. These genetic resources have provided a basis for plant breeders selecting commercial genotypes. However, relatively little attention has been paid to this informal seed management system in Cuba, and much genetic variability has already been eroded.

Some plant breeders exposed to contemporary concepts and developments have begun searching for alternative approaches. In eastern Cuba, a plant breeding project emphasising participatory approaches has been established. An independent initiative by a maverick plant breeder in the province of Havana started to take forward similar concepts and to develop the project on which this article is based.

This breeder observed striking differences in crop yields between provinces. These were related to differences in management techniques, support and local agroenvironmental conditions. The hypothesis was that high and stable yields necessitate high genetic diversity within a crop. Seed flows help to encourage this diversity, particularly flows from regions of high genetic resource variability to those of low availability. The isolated nature of many of these high genetic resource regions has protected them from the extension programmes of the formal seed sector but has also hindered informal seed flow networks between distant communities.

PPB at INCA

The aim of the project is to diversify and improve the varietal structure of maize and common bean crops for low input conditions. Prior to the start of the Participatory Plant Breeding (PPB) project, the Plant Breeding Department of the National Institute of Agricultural Sciences (INCA) organised a seed workshop and fair, in collaboration with the (then) Cuban Association of Organic Agriculture (ACAO). The two-day workshop was held in April 1999 at the INCA research institute. Focusing on maize, the researchers hoped to identify the varietal needs of a pre-identified group of small producers, introduce them to a diversity of varieties, encourage the selection of those varieties that were appropriate to their local conditions, and distribute seed for farmer experimentation and multiplication. The role of the seed fair was to facilitate the flow of seed from research institute to farmer,

photo: Julia Wright

rather than between farmers themselves. All the farmers invited came from Havana Province, and the core group from three agricultural cooperatives participating in an ongoing programme developing agroecological 'lighthouse' farms. 'Lighthouse' farmers were relatively accustomed to research interaction and intervention.

Havana Province is characterised by a relatively homogeneous environment. For the last few decades production systems have been dependent on high levels of input and are still dependent on the formal seed supply sector. There is little genetic diversity at present. Alternative seed material would have to come from the neighbouring but more remote province of Pinar del Rio. This province is characterised by a low level of external inputs systems and they have a high level of plant genetic resources and independence from the formal sector. Farmers maintain lines brought into the region over 15 years ago, but many reported regularly 'refreshing' their seeds by introducing desired characteristics from other sources. Many were farming so close to each other that natural cross-pollination occurred easily. Exchange of maize seed between farmers was common practice, particularly between the drier highland farms where there were two crops a year and the wetter lowland farms.

Preparation and methods

Some months before the workshop, two breeders undertook maize seed collection missions to a farming community in the province of Pinar del Rio. A selection was made for hardiness under low-input conditions and 66 landraces were collected including some from the focus communities in Havana Province. In addition, 4 commercial varieties were selected from research institutes. These were planted in December on an experimental plot at the research institute. Each of the 70 lines was sown in 3 rows, and wide border strips were sown with a mixture of different lines. Because of lack of finances, the experimental plot received only one irrigation and no fertiliser or pest control inputs.

Eighteen farmers, formal-sector maize breeders, soil specialists, social scientists from other research institutes, and representatives from the National Small-Farmer Association and the ACAO attended the workshop. Participants were split into 4 teams to identify and rank general problems associated with seed management and use. Farmers brainstormed over a list of problems and ranked the 6 most critical factors. After this, they were asked to name the 5 crops most affected by these problems.

On the second day of the workshop, the farmers were taken to inspect the maize experimental plot and to examine cobs of all the maize lines from this plot in order for each farmer to select 5 preferred lines. Seeds from these lines would later be given to the farmers for experimentation. Short questionnaires were used to gather information on the farmer's evaluation of each line chosen and the results were discussed.

Selection criteria

The main problems associated with seed management and use were identified as seed quality, seed availability, and the incidence of pests and diseases. Availability of training and extension, exchange of seeds, and input availability were considered less of a problem. In the field, the farmers rapidly selected from the large number of lines on offer. They showed an immediate preference for the mixed varietal border stands as these showed a better response to low input conditions than the mono-varietal rows. The importance of each of their selection criteria is shown in Table 1.

In the selection, 80% of the farmers identified different preference criteria for each of the five lines they had selected. Most popular was a landrace from Pinar del Rio province. Landraces from Pinar del Rio province showed a better performance than those from Havana province.

Table 1. Selection criteria for maize varieties, accepted as important by farmer participants.

Criteria	% of farmer acceptation
Plant yield	87.5
Plant height	87.5
Positioning of leaves	62.5
Number of leaves	60.0
Leaf colour	45.5
Leaf size	41.3
Stalk width	76.3
Number of cobs	57.5
Ear colour	32.5
Ear size	40.0
Susceptibility to lodging	31.3
Cob weight	50.0
Cob height	40.0
Cob fullness	40.0
Husk colour	28.7
Cob diameter	37.5
Cob husk cover	55.0
Cob size	42.5
Cob shape	55.0
Insect damage	35.0
Cob length	45.0

Insights

The observed better result from mixed variety rather than single-varietal planting, led researchers to conclude that they would have to work out contradictions using varietal maintenance through strict isolation as advocated by the formal system. It became clear that farmers not only looked at yield but also valued aspects such as plant height, stalk size, number of cobs, and number and position of leaves. This is an indication of the potential for more alternative breeding strategies. Selection criteria chosen for maize varieties indicated that farmers, in general, did not practice seed saving. In fact, during the discussion period, several of the farmers asked how to save seed. Different choices may be made if the farmers begin saving seed.

Further, farmers used different individual selection criteria for the choice of each variety. Researchers interpreted this as highlighting the fact that even in relatively more homogeneous areas such as Havana Province, the PPB approach favours an increase in diversity.

Positive reaction

The general reception given to this new participatory approach was positive, given that farmers are accustomed to a more top-down management style. Farmers had rapidly and easily selected between the 70 lines on show, and a very large range of new seed lines had been extended to them.

The plant breeders involved felt that this workshop indicated the need for new concept in seed management so yields and cob quality under low input conditions could be improved. Stimulating the flow of genetic resource variability had shown the potential available for increasing yield performance on trial plots and farmer acceptance. Further, they concluded that PPB, which was usually associated with more marginal environments, could also be an important tool in more homogeneous conditions. In Cuba, governmental institutions appear open to an informal seed system, but classical plant breeders may need more convincing arguments. ■

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photo: Julia Wright

Participatory varietal selection in the field

photo: Korstiaan Teekens

Decentralised Participatory Plant Breeding

Salvatore Ceccarelli and Stefania Grando

A fundamental problem in plant breeding is the relationship between selection environment and target environment. Direct selection in the target environment is always the most efficient. Selection efficiency is likely to decrease as the difference between the selection environment and the target environment increases.

Therefore, it is not surprising that plant breeding has been much more successful in environments with a great similarity to those where most selection usually takes place: the research stations where breeding material is customarily grown in near-optimum conditions. Plant breeders have considerable success in favourable environments, but they often address the problems of poor farmers living in unfavourable environments by simply extending the same methodologies and philosophies to favourable, high-potential environments. In doing so, they do not consider limitations associated with the presence of large interactions between Genotype and Environment (GE). Plant breeders regard these GE interactions to be among the main factors limiting response to selection and, in general, the efficiency of breeding programmes. When the selection environment is very different from the target environment, GE interactions usually become more important.

Plant breeders distinguish between two types of interactions: the first type changes the ranking of genotypes in the same location over time causing large *temporal* variability. The second type consistently changes the ranking of genotypes between different target environments causing large *spatial* (or geographical) variability. Farmers are mostly interested in avoiding or reducing temporal variability, while the majority of plant breeders (and the seed companies) are mostly interested in avoiding geographical variability.

In the case of temporal variability, the objective should be to avoid GE interactions by stabilising crop yields. One way in which this can be achieved is by breeding heterogeneous populations (genetically similar to the old landraces) rather than uniform cultivars, such as pure lines or hybrids, or by growing different varieties at the same location.

Decentralised selection

In the case of geographical variability, the objective should be to exploit GE interactions by breeding for specific adaptation within target environments. This can be achieved by selecting directly in the target environments: *decentralised selection*. In such cases, the breeding programme has a number of selection sites, with each site representing a different type of target environment. Decentralised selection becomes selection for specific adaptation when it is based on the performance within each target environment rather than on the average performance across all sites and all years.

This strategy has two important consequences. First, crops and cultivars are adapted to the biophysical and socioeconomic environment. Second, the importance of landraces in plant breeding is reassessed: these old cultivars usually do not perform well under the high-input conditions of the research stations, but are very difficult to beat in low-input, marginal conditions (Ceccarelli 1994).

Although decentralised selection is a powerful methodology to fit crops to the physical environment, crop breeding based on decentralised selection can still miss its objectives if it does not consider farmers' preferences and knowledge of the crops and the environment. Unless it becomes participatory, such crop breeding may fail to fit crops to the specific needs and uses of farming communities.

In the initial stages of breeding, breeders create a large genetic variability. Subsequently, farmers' perceptions of their own needs and their knowledge of the crop must be brought in. In this way it is possible to fully exploit potential gains from breeding for specific adaptation through decentralised selection. Farmers' participation in the very early stages of selection offers a solution to the problem of fitting the crop to a multitude of both target environments and users' preferences (Ceccarelli et al. 1996; Kornegay et al. 1996).

The acceptance of decentralised selection as a breeding strategy almost inevitably leads to the acceptance of farmers' participation as a tactical necessity. There are sound reasons for farmer participation to increase the efficiency and the effectiveness of a breeding programme, even though farmer participation is often advocated mainly on the basis of equity.

Barley variety selection project

The objective of this PPB project conducted in Syria is to test an alternative way of producing improved varieties of crops, such as barley, for marginal environments. The project operates in 9 villages chosen to represent variations in annual rainfall (from 200-250 mm), soil types, management practices, farm sizes, types of livestock ownership, and the formal education level of the farmers.

The area shows a range of agroecological conditions varying from high to low-potential cereal production environment. Barley is the main winter cereal. It is the principal feed crop for sheep in Syria. It is planted in autumn, usually after the first rain (mid-October to mid-December) and harvested in May-June. It covers over 2 million hectares with little use of modern or improved varieties. At the wettest end of the spectrum and on fertile soils, farmers can obtain up to 5 tons/ha of grain in a good season by using fertiliser. In very dry conditions where soils are generally poor and input levels low, grain yields only reach 1.5 tons/ha. Syria's national average barley grain yields are stagnant at a low of 0.65 tons/ha.

Landraces are predominant in Syria (99% of the area). They are exclusively two-row types, and known as either *Arabi Abiad* (white-seeded), common in slightly better environments (250 to 350 mm of rain) or *Arabi Aswad* (black-seeded), common in harsher environments (< 250 mm). Considerable phenotypic and genotypic heterogeneity exists both among landraces collected in different farmers' fields (even if designated by the same name) and among individual plants within the same farmer's field. Farmers in dry areas consider the grain and straw quality of the black-seeded landrace is best.

Methodology

In 1997, 208 barley lines were planted in the field of one farmer in each village. The lines were a random sample of those representing the early stages of the breeding process (normally planted only at the research station). The lines represented different types of germplasm such as two-row and six-row, modern and landraces, uniform lines and segregating (heterogeneous) populations, and black and white seed colour. The lines were also planted at 2 research stations, representing a favourable and an unfavourable environment, respectively.

The host farmers carried out the selection together with a breeder from the Syrian Directorate of Agriculture and Scientific Research. Each farmer and the breeder also selected at the 2 research stations. In 5 of the 9 villages, group selection sessions took place in which about 9 farmers scored each plot and indicated reasons for selecting or discarding them. In this way the project compared the following four strategies of selection:

- By farmers in their own fields (decentralised participatory selection),
- By farmers on the research station (centralised participatory selection),
- By the breeder in farmers fields (decentralised non-participatory selection),
- By the breeder in the research station (centralised non-participatory selection).

In the second year (1998), each of the 9 participating farmers planted the lines selected under the 4 strategies, and a second cycle of selection was conducted following the 1997 procedures. This is being repeated in 1999.

Results

The most important findings are the following (Ceccarelli et al., in press):

- In the first year farmers selected, in their own fields, about one-tenth of the number of entries selected by the breeder. On-station, the farmers selected, on average, about half the number of lines selected by the breeder. Farmers' selection was based only on the performance of the lines in their respective fields: they did not use their on-station observations. Breeder's selection was based on the performance of the lines in all 11 environments. Eventually, 2 groups of entries were selected, one for high-rainfall and one for low-rainfall areas.
- Landraces were selected more often in the dry sites and the modern cultivars more often in the wet sites.
- There was more diversity among farmers' selections in their own fields than among farmers' selections on research stations.
- Kernel size, grain yield, and total biomass were the most frequently selected characteristics by breeder and farmers.
- In their own fields, most farmers were slightly more efficient than the breeder in identifying the highest yielding entries.
- There were significant changes in selection preferences (both by farmers and breeders) under two different rotations, indicating an important (yet unplanned) advantage of decentralised breeding, namely the possibility of adapting the breeding material to changes occurring in the farming systems and agronomic practices of the target environments.

Impact

Farmers acquired the ability to conduct the trials without supervision, and were able to formulate suggestions about potential parents for crosses. They were able to explain the project to other farmers. Farmers began to realise that there could be many different types of barley. We showed farmers how crosses were made, and the different types of barley generated by a single cross. In one of the villages, a farmer's wife suddenly started sitting in the same room with us 'foreigners' and began participating in the discussion. Such a change obviously makes it much easier to find out the preferences of women which would otherwise be 'filtered' through the men. These reactions may seem small, but they indicate that this approach can have a major impact on variety adoption, skill building, increased female participation, and the capacity of farmers to redirect plant breeding and shape agricultural research to their needs.

Upscaling

National scientists visiting ICARDA were interested in developing similar activities in their own countries. As a result, there are now participatory barley breeding projects in Tunisia, Morocco, Yemen, Ethiopia and Eritrea and are being developed in Jordan and Egypt.

Conclusion

Plant breeding programmes can be organised so farmers become major actors in selection, testing and multiplication of new cultivars. PPB recognises that it is the farmers who ultimately decide whether or not to adopt a new variety and it reduces the chances of developing cultivars that are unacceptable to farmers. PPB may be the only possible type of breeding for crops grown in remote regions, for crops requiring a high level of diversity within the same farm, or for those considered as minor crops and therefore neglected in formal breeding.

There are a number of considerations, however. First, an important obstacle to PPB seems to be the reluctance of breeders to share with others the paternity of new varieties. Second, a critical step in participatory research seems to be the first contact with farmers during which scientists should be able to establish a relationship in which both partners have equal status. Third, PPB improves over time as scientists and farmers come to understand each other's skills, interests, motivations, problems, and limitations. Increased awareness of what plant breeding can do for them, will inevitably lead to more demands by farmers to formal breeding programmes. ■

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photo: Andreas Gerrits

Biodiversity for income generation

Andreas Gerrits

The Kigezi Highlands in south-west Uganda have good dairy production potential because of reliable rainfall and a moderate climate favourable to both humans and livestock. The Agroforestry Research Networks for Africa (AFRENA) - Uganda is an agroforestry research project in which the Forestry Research Institute (FORI) collaborates with the International Centre for Research in Agroforestry (ICRAF) in supporting smallholder dairy production. The project carries out research and development into producing quality fodder from trees and shrubs. *Calliandra calothyrsus*, an exotic, protein-rich fodder tree, is already widely used by smallholder dairy farmers. However, research on indigenous fodder trees and shrubs is trying to identify suitable alternatives to *C. calothyrsus* and to contribute to the conservation and enhancement of biodiversity. The project also carries out trials with indigenous tree species integrated into cropland to determine the potential for pole and timber production and to assess tree – crop competition.

A growing number of farmers in the Kigezi Highlands produce milk on a small-scale basis. Several NGOs distribute genetically improved heifers which are kept in zero grazing or supplementary feeding units. These are vital alternatives to free grazing in an area of land shortage and highly scattered fields. Currently, more than 300 owners of improved cows in Kabale District use zero grazing. Most farmers use Calliandra leaves as a supplementary source of fodder.

In Uganda, the dairy sector and smallholder dairy development in particular, can be a major catalyst in agriculture-led economic development if it can generate significant and regular income for producers, create employment through the production, processing and marketing of dairy products, and improve the diets of rural and urban consumers.

The Kigezi Highlands

The Kigezi Highlands are a rolling, mountainous region in the foothills of the Virunga Mountains. Altitude varies between 1800-2800 m. Hill slopes are very steep and can exceed 50° (Aluma et al, 1995). Soils were once deep and fertile, but have become degraded by unsustainable farming practices. The region enjoys a moderate tropical climate with an average annual rainfall of 1000-1500mm. The rainfall pattern is bimodal with a long rainy season from March to June and a short rainy season from October to December. Mean maximum and mean minimum temperatures are 23 and 10°C, respectively. Fog is common in the mornings.

Socio-cultural factors

Population density is estimated to be 230 per km^2 (Mugisha, 1997). Between 1980 and 1991, the average annual population increase was 2.17% indicating that the population will double in the next 35 years if this trend remains constant and there is no migration. The population pyramid is typical of developing countries with 60% of the population under the age of 20. The average household consists of 5-6 people.

Agricultural system

Small-scale cultivation to meet household consumption and a little trading characterises livelihoods in most rural households in the area. Land holdings are very small because of high population density and many households live off less than 1 ha. In addition, land is highly fragmented making it difficult to expand and manage agricultural activities. The bimodal rainfall pattern allows two cropping seasons. The main crops are sorghum, sweet potatoes, Irish potatoes, beans, and maize. Plantains are dominant in the lower and drier eastern parts of the Kigezi Highlands.

Indigenous knowledge

Most improved cows kept by smallholder farmers have a rather low milk production due to the poor composition of the fodder. Cultivated grasses, banana stems and leaves as well as vines from sweet potatoes are a common source of fodder but although they provide roughage, their nutritive value is low.

Local and exotic fodder trees could play an important role in a cow's diet. Feeding protein-rich tree leaves to dairy cows can be profitable in two ways: it substitutes expensive dairy meal and increases the production and fat content of milk.

Local trees and shrubs are well adapted to the soils and climate of the Kigezi Highlands. They are generally easy to propagate, grow fast and some show a rapid rate of re-growth after being browsed or pruned. In addition, their leaves are available during the dry season when grass fodder is scarce. Some trees and shrubs are reported useful in soil conservation and soil improvement, they provide firewood and medicines and have a wide range of other uses.

A survey carried out by AFRENA showed that the 82 farms studied sheltered 46 indigenous tree and shrubs species (Gerrits, 1999). Nine of these were actually exotic but introduced into the area so long ago that people consider them to be indigenous trees and have given them local names.

Between 0 and 9 tree species were found per farm, the average being 3-4 local tree species. One fifth of the farmers reported they had no local tree species on their land. The most frequently planted species were *Sesbania sesban*, *Ficus natalensis*, and *Acacia mearnsii.* Many species, like *Indigofera arrecta* or *Vernonia amygdalina*, grow naturally on fallow land.

Twenty of the trees or shrubs are used either as fodder or as veterinary medicine. Trees used as fodder are mainly grown close to the homestead, thus reducing the amount of labour needed to cut and carry the fodder to the cows. Trees or shrubs that form good hedges are especially suitable since they also provide protection, act as boundary markers and make useful browsable fodder banks for cows and goats.

Farmers select species according to whether they need to increase milk production or improve animal health. *Sesbania sesban* or *Vernonia amygdalina*, both indigenous species, contain the high amounts of protein essential for animal growth and increased milk production. The contribution of indigenous fodder trees and shrubs to a cow's diet is less than 10% but the crude protein they provide is crucial.

Most farmers plant local shrubs and trees and feed fodder to their animals on a regular basis. Although many use these fodder sources somewhat irregularly, they maintain that they are important especially during the dry season when less grass is available. Some farmers stated they had not tried to feed local tree species to their cows but concentrated on growing tree species suitable for timber and fuel. Farmers wanted better extension services so they could learn more about practices that help maintain milk production.

Sources of medicine

Farmers use many local trees and shrubs as traditional and cheap medicine for both humans and animals. For example, farmers treat cows with the leaves of *Sesbania sesban, Vernonia amygdalina* and *Dodonaea angustifolia* to cure intestinal diseases like worms and diarrhoea.

photo: Andreas Gerrits

Zero grazing cattle keeping system

Enhancing biodiversity

We observed a relatively low level of indigenous knowledge among farmers as far as fodder was concerned. There are several reasons for this. Few patches of natural forest remain in the area because much of the forest was cleared for cultivation decades ago. *Eucalyptus grandis* now dominates the landscape and has replaced the local tree species used for timber, poles and fuel. Farmers are interested in new, exotic tree and shrub species, some of which grow much faster than local species. Fodder from *Calliandra*, for example, is ready for harvesting in the second year (KARI-KEFRI-ICRAF, 1998). Some farmers also indicated that they had adopted Christianity and no longer believe in the traditional and spiritual uses of trees.

The disappearance of local tree species and fading indigenous knowledge are closely related and form a vicious circle. The AFRENA Project began to investigate the full potential of local tree species and to reintroduce them into the farming system. The survey showed, for example, that *Sesbania sesban, Vernonia amygdalina* and *Indigofera arrecta* are promising fodder trees. However, more in-depth nutritive analysis and feeding trials are needed to determine the response of cows to local fodder. Furthermore, little has been established on the medicinal use of local trees and shrubs for humans and animals. At a later stage, dissemination activities should include high quality local tree species for well-balanced fodder.

Preliminary results indicate that while most indigenous trees grow more slowly, their high-value products make it worth growing them on farms. In future, increasing emphasis will be put on conserving and enhancing biodiversity both in research and dissemination activities. The goal is an optimal combination of suitable indigenous and exotic tree species on the farm. The challenge for the future is to create awareness and disseminate knowledge on the natural heritage of the Kigezi Highlands. ■

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photo: Graham Thiele

Farmers from Candelaria Cochabamba selecting Yaraq oca for the marked

Andean tubers:
from conservation to sustainable use

Franz Terrazas, Rolando Oros, Gonzalo Alfaro, Blasco Vera, Raul Delgado and Graham Thiele

Andean tubers have been called the "lost crop of the Incas" and Candelaria in Bolivia is well known for its tuber production (Cardenas 1989). Farmers grow landraces of four different potato species (*Solanum andigena, S. x ajanhuiri, S. stenotomum* and *S. phureja*), oca (*Oxalis tuberosa*), ulluco (*Ullucus tuberosus*) and mashua (*Tropaeolum tuberosum*). At the local market in Colomi they make an extraordinary and beautiful display of diversity.

Andean tubers form part of different ecological tiers that extend from the 3200m irrigated valley floor to 3900m. Rotations and associations with other crops (faba beans and tarwi) help reduce pests. However, much diversity has been lost with increasing market integration. Farmers in Candelaria and elsewhere in Bolivia, concentrate production on the few varieties of potatoes widely accepted by the market. Monocropping tendencies and poor use of modern agricultural inputs have affected agroecosystem viability and increased pest damage.

The Foundation for the Promotion and Investigation of Andean Products (PROINPA) is custodian of the Bolivian Andean tuber germplasm collection. Its focus has shifted from *in situ* conservation and resolving specific production constraints to promoting the sustainable use of Andean tubers in the context of a complex local social, economic and political environment.

Initial approach

Work with Andean tubers began in 1993. Visits to agricultural fairs, markets and field reconnaissance identified 21 important Andean tubers zones. It was decided, after follow up visits, to concentrate *in situ* conservation work in Candelaria, one of the most important diversity microcentres.

An inventory of Andean tubers in Candelaria lead to the phenotypical classification of 22 landraces of *Solanum andigena*, 5 of *S. stenotomum*, 2 of S. x *ajanhuiri*, 2 of *S. phureja*, 27 of *oca* (*Oxalis tuberosa*), 7 of *ulluco* (*Ullucus tuberosus*) and 9 of *mashua* (*Tropaeolum tuberosum*). Local knowledge on production and use was systematised.

Farmers classify oca varieties according to soil aptitudes, pest susceptibility, production and storage qualities, culinary properties and market suitability. It is important in local diets between May and December and is eaten in many different ways. Most commonly the tubers are left in the sun for several days to reduce the oxalic acid content and become sweet. They are then boiled in their skins, baked or used in stews or for thickening soups. Specific dishes have evolved to exploit differences in flavour, texture colour and cooking time. Lluch'u oca is spread on the ground on cold nights, left to freeze, trodden to remove water and sun dried to make *chuño* which can be stored for months or years. *Chuño* is ground into oca flour for bread, *buñuelos* (a kind of doughnut) and starch for thickening soups. The Puka Kamusa variety has medicinal uses. Other Andean potato varieties are equally versatile. Ulluco is used in soups and stews, "Salsa Lisa" for salads, and mashua is good for fattening pigs and occasionally as medicine.

For two years a study was made of the way 12 families used and managed Andean tubers. On average they kept 8 landraces of oca, 2 of ulluco and 1 of mashua. Each family held between 5 and 11 landraces of oca. Between them they had 22 landraces. Some landraces were widely distributed.

Landraces managed by families varied over time. During 2 seasons, 4 families lost or eliminated one or more landraces and 5 families introduced a new one. Farmers have their own strategies for managing and replacing germplasm. They plant the same variety in different tiers to reduce the risk of loss and replace seed when it has become tired with seed obtained from another farmer, preferably outside their community. Seed is bought, bartered or paid for through labour. This dynamic, mosaic system that crosscuts local communities largely ensures germplasm is maintained. However, some varieties such as the ulluco "Llausa lisa" used for *chuño*, have been lost recently.

In situ conservation

PROINPA's principal support to *in situ* conservation has been the organisation of annual biodiversity fairs. The first was held in Colomi in 1994 in cooperation with the local government. Each participant or group was allocated a small stand where they laid out all the varieties they used. Prizes were given to participants with the largest number of varieties and to those who were most knowledgeable. One family brought 32 varieties of potato, 12 of oca, 2 of ulluco and 6 of mashua. Farmers were encouraged to exchange varieties. A follow-up of six families who had exchanged varieties showed they had planted 2 or 3 new varieties. The fairs helped PROINPA to discover new landraces and to meet the farmers managing them.

Technical limitations

Until recently, agricultural research in Bolivia has ignored Andean tubers. To complement *in situ* conservation, the specific problems confronting farmers were identified, prioritised and investigated. Ulluco is attacked by *roya* (*Aecidium ulluci*), a disease farmers call *"tojtu"*, a term also used to describe potato blight. By 1997, the specific pathogen causing *roya* had been identified and an efficient, but chemical, control strategy developed.

Farmers say that weevil in oca is a relatively new problem. Farmers also reported that some varieties resist weevil. The biology of the insect (*Systena sp.*) was studied and 200 entries in the national germplasm bank were evaluated during researcher-managed field trials. Forty varieties were found to be resistant to *Systena sp.* and two entries were able to act as nematode trap crops.

New approach

Farmers have managed germplasm for thousands of years under complex and changing conditions. The term "conservation" fails to capture the dynamics of adoption and selection, however. Technological interventions that target highly specific problems outside the context of the local agroecosystem do not allow the full utilisation of available biodiversity. PROINPA has tried to develop an alternative approach promoting new and sustainable uses of biodiversity in Candelaria.

PROINPA has joined the San Simon University's (Cochabamba) programme of Food Technology and Natural Products (PAPN) and the Institute for Socio-economic Studies (IESE) in forming the Integrated Candelaria Project (PIC). PAPN had already developed and evaluated a range of food products derived from Andean tubers and IESE had carried out studies on the market, price and demand for them. Within the PIC, realistic, interdisciplinary proposals for the sustainable use of biodiversity are being developed.

Linking farmers and PROINPA

Farmers replace seed when it has become tired. Potatoes, oca and ulluco tuber seed gradually becomes infected with viruses that lower yields. PROINPA has used meristem thermotherapy to produce virus-free seed in 24 potato landraces, and 2 landraces of oca and ulluco from the germplasm collection. Eight farmer families from Candelaria visited PROINPA's experimental station and selected 12 varieties. They were given 20 tubers of each variety and are now multiplying these for their own use. Plans to further improve farmer access to the materials held in the germplasm collection are being made.

PROINPA on-farm research has moved from developing interventions to target specific problems to studying the interactions of rotations, fertility and pests. Nutrient flows in the soil and the movement of pests between sites are being examined and 4 farmers are taking part in a study of the way Andean tubers are managed within the whole farm rather than the single field.

Markets

Accessing better quality germplasm and resolving production problems using an agroecosystem approach must be combined with identifying new markets for oca, ulluco and mashua. As PIC project members analysed market bottlenecks, farmers explained the detrimental effect of gluts on prices. Because ulluco does not store well, it has to be marketed immediately after harvest when prices are low. Farmers wanted to be able to take advantage of off-season prices. PAPN, together with farmers, concluded that improved storage and dehydrated flakes might solve the problem. PAPN developed and tested the technology for flakes and a pilot product, sold in the University store, was well received by consumers. Market studies revealed a potential demand of 437 tonnes per year, easily absorbing current production in Candelaria.

PROINPA has helped farmers select and grade high quality ulluco and oca and IESE has sold well-presented, 100kg bags with ease at local supermarket where consumers were prepared to pay several times the local market price of the loose ungraded product. IESE has also developed new recipes that do not require sun exposure and these are supplied with the packaged product.

Mashua has very high yields of up to 90 tonnes/h. Being a rustic crop adapted to the Andes it requires few inputs. Farmers feed cooked mashua to their pigs and it could replace maize in commercial balanced animal feed. The Bolivian Private University (UPB) has estimated the potential demand for mashua as balanced feed is about 150,000 tonnes per year. PROINPA has undertaken to study yields and select appropriate varieties. UPB is testing gas-drying methods of feed production and preliminary results from commercial pig producers suggest mashua is an efficient substitute. PAPN is now investigating artisan solar dryers for farm use.

Scaling up

The PIC Project is basically a research initiative. To reach more farmers and have greater impact on biodiversity it must work with other institutions including local government institutions responsible for rural development. PIC project members have helped Colomi municipality to organise an agricultural workshop where NGOs, local institutions, private sector food processors and farmer groups can analyse the problems associated with the major crops and explored solutions. Potatoes were voted the most important crop, oca and ulluco were joint third. Four institutions involved in the workshop are working with Andean tubers. As these also work with other crops and livestock, good coordination should make it possible to implement an agroecosystem approach. PROINPA hopes the workshop will evolve into a local forum for agricultural development capable of promoting the sustainable use of biodiversity.

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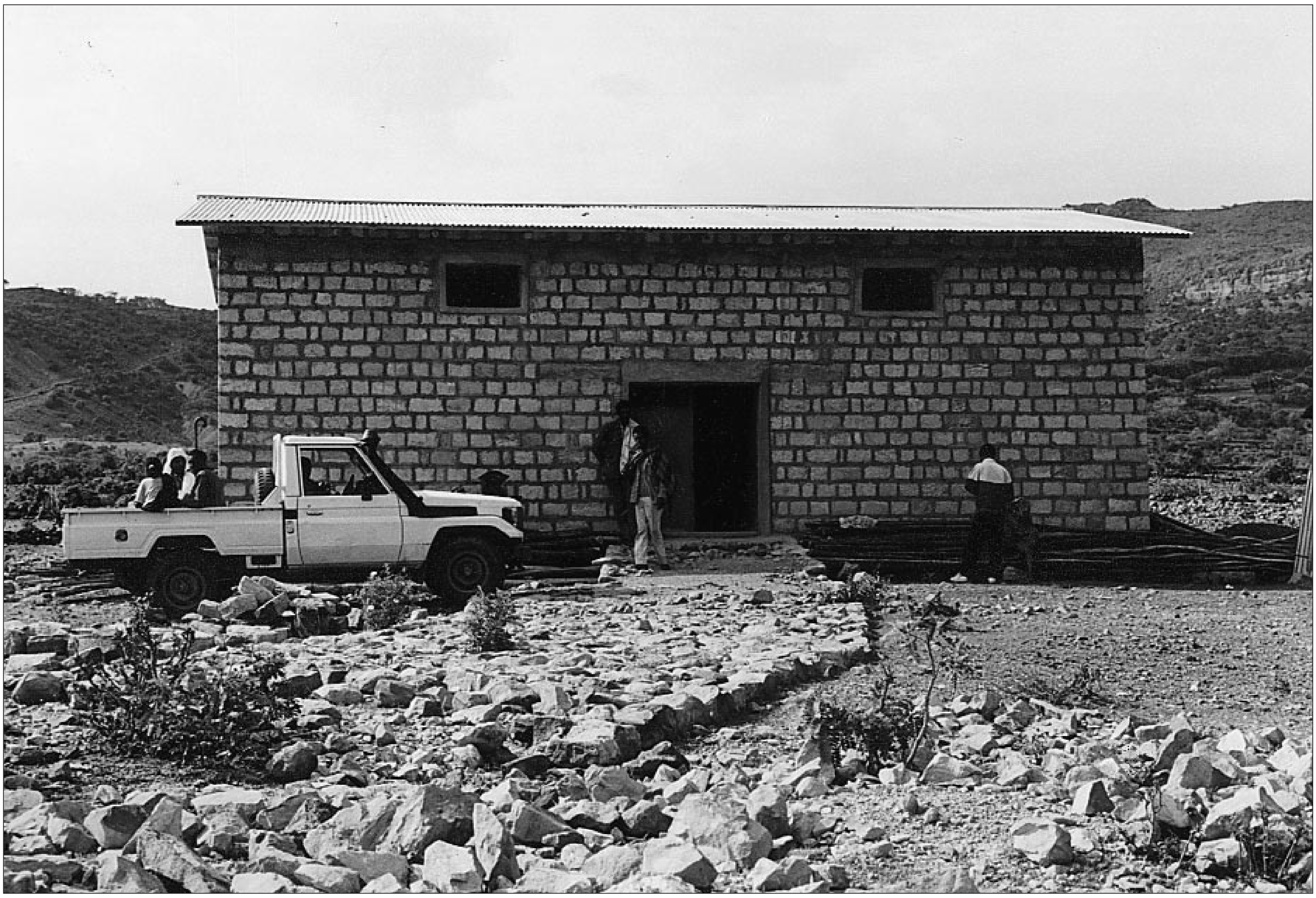

photo: Korstiaan Teekens

Community Seedbank in Hahaile, Ethiopia

In situ conservation: the Ethiopian experience

Abebe Demissie

Plant species of economic importance are not randomly distributed throughout the world. N. I. Vavilov was among the first scientists to conceptualise this phenomenon and identified eight such centres of diversity. Because it has a wide range of ecogeographic, edaphic and climatic conditions, Ethiopia has considerable plant genetic diversity. It is a major world centre of genetic diversity for many regionally and globally important domesticated plant species including wheat, barley, sorghum, teff, chickpeas, coffee, as well as other less-appreciated but potentially useful crops.

The permanent interaction of cultivated crops with their wild relatives under diverse ecosystems, coupled with farmers' practices and socioeconomic factors, have contributed to making Ethiopia one of the richest areas of genetically diverse farmers' varieties in the world. Even crops that were originally domesticated elsewhere exhibit immense variation in various adaptive traits.

Farmers' varieties important

The critical importance of plant genetic resources as a component of natural resources management has been recognised for some time. Plant genetic resources form the basis for food security and sustainable agricultural development. A growing global population needs crop plants with improved tolerance to several stress factors and able to meet the growing need for food, fibre, and clothing. This means that plant breeders must have continuous and dependable access to plant genetic reservoirs. Farmers' varieties, their immediate relatives and related wild species are particularly important sources of new genes for breeding programmes.

Farmers' varieties are uniquely adapted, genetically diverse cultivars. They are repositories of traits that have evolved in local environments over long periods of time as a result of farmers' cultivation and selection. As sources of adapted genes, farmers' varieties have been the raw material from which modern and often higher yielding crop varieties have been developed. The conservation of local landraces is, therefore, of critical importance both for scientific crop improvement and subsistence agriculture.

Ex situ conservation

Two conservation strategies are generally distinguished: *in situ* and *ex situ* (see Box 1, p29). At the global level, genetic erosion has been addressed by efforts to conserve plant genetic resources in off-farm or *ex situ* gene banks, both as seeds and as living plants. To date, nearly all such efforts have focused on conserving crop genetic resources in formal gene banks that are part of an international institutional network. *Ex situ* conservation has limits. Gene banks are limited in what they can store. They have collected only a fraction of the existing genetic diversity and the size of the sample varies and depends on the crop. For instance, relatively large collections exist of the major food crops. Large holdings of rice, wheat, barley, maize, potato and other crops are kept in CGIAR international research centres. In contrast, minor food crops have hardly been collected for *ex situ* conservation even though the genetic diversity in these crops is more threatened with replacement by the principal crops. The disassociation of the material kept in genebanks from their users' communities limits access to the materials by the primary users and original custodian of the material, the farmers. It also terminates the enhancement of the material through the process of natural evolution.

In situ conservation

The primary objective of *in situ* conservation is to conserve the biodiversity of traditional crop varieties on the farm with the help of farmers' knowledge and traditional practices. *In situ* or on-farm conservation of agrobiodiversity is conservation in a dynamic agroecosystem, ideally one which is self-supporting and favouring evolutionary processes. Thus, it allows ongoing host-parasite co-evolution, which is likely to provide material resistant to diseases and pests. This contrasts with the efforts to conserve crop diversity in static off-farm gene banks. However, *in situ* maintained diversity is more difficult to access for breeders who like to use specific materials for their breeding programmes.

Community-based conservation

The objective of the Ethiopian on-farm initiative is to establish a programme linking *ex situ* and *in situ* conservation. *In situ* and *ex situ* conservation are seen as complementary in a way that maximises the retention and continued evolution of the genetic qualities of farmers' varieties. It also aims to avoid the loss of variation during rejuvenation and maintenance in formal gene banks. This means that farmers' *in situ* conservation must be part of the existing cropping system since this is the only way to maintain the complex interaction of genetically diverse traditional cultivated varieties with their associated pests, predators and pathogens. In this setup, both natural and human selection operate in the traditional way.

As part of the *in situ* conservation effort in Ethiopia, Community Seed Banks (CSBs) are being established as pilot projects in 6 different agroecological zones. Like the formal gene banks, conservation of locally adapted traditional varieties in community-managed seed banks will ensure the sustained provision of useful variability to the community and to various breeding programmes complementing the formal network of international gene banks.

The CSBs serve as a springboard for increased extension contact and local participation in the conservation of farmers' varieties. They can be used to organise local support for conservation, train farmers in conservation activities, build low cost and low maintenance storage facilities, and link farmers, extension agents and gene bank staff. In forming CSBs, the first step was to contact local leaders and farmers in selected districts and communities, and organise a local association, the Crop Conservation Association (CCA). The CCA is the principal contact point between the Community Seed Bank, extension agents and the gene bank. The CCA, the district extension agents, and the gene bank join in building the actual Community Seed Bank facility with funds made available by the project.

The next step in establishing a community based conservation programme was to select a local farmer conservator. This was done using criteria developed by the community and gene bank and took place during a meeting/workshop involving the CCA, community leaders, extension agents and local farmers. The farmer conservator belongs to the group of farmers who plant, select and store seeds from local materials. The farmer conservator is the primary local contact and is responsible for managing the CSB. In collaboration with extension agents the farmer conservator and other farmers are trained by gene bank staff in selecting, documenting and storing genetic resources in the CSB.

Community storage is already practised in Ethiopia to ensure seed in times of stress and the CSB builds on this age-old tradition. Farmers store part of their seed in the CSB and this seed is available for retrieval at any time. A small, but representative seed sample is taken for storage at the Community Gene Bank and a duplicate sample is kept in the national gene bank at the Institute for Biodiversity Conservation and Research.

Operational strategy

Initially, subsidies were provided on the basis of the yield differentials of advanced and farmers' varieties. In the long run, continuing *in situ* conservation cannot rely on direct production subsidies to farmers. In order to work towards a sustainable compensation scheme after project funding is over, a reward system needs to be put in place.

The production and utilisation of farmers' varieties is important for Ethiopian farming communities. In this context it would be important to identify where agricultural production and pricing policies are likely to have a negative effect on the continuing use of traditional varieties/landraces. At the end of the day, farmers themselves must feel there are advantages to continuing with traditional crops if they are to sustain their participation in the conservation of farmers' varieties.

Support

Another broad strategy that supports a farmer-based conservation programme is the generation of non-market and market incentives for growing farmers' varieties. Critical here is identifying the specific factors that enhance or limit the continued utilisation of farmers' varieties by farming communities. A key component is to identify special consumer products that make use of farmers' varieties on the local, national and international market. There is much potential, for example, in urban markets in industrially developed countries for organically produced products. Increasing interest in organic products may provide opportunities for the production of farmers' varieties with special high nutrient or culinary quality even though yields may be low.

Major non-market incentives to the farmers involved with the Community Gene Bank will be the increased training and enhanced extension packages received by the farmer conservator and associated farmers. Extension agents and the farmer conservator will not only be available to select and store local seed, but will also work with farmers in improving crop production. A flexible strategy to accommodate both improved crop production techniques and the conservation of local crop varieties is anticipated. Both the extension agents and the farmer conservator will be able to advise farmers on the advantages of different crop varieties and where these might do well. They will be able to help farmers increase production by improved crop management techniques such as soil erosion measures and pest control. They can also be of help in enhancing the material by incorporating desirable genes. Educational material that explains the importance of Ethiopian crop resources should also be developed.

The sustainability of a farm-based conservation of farmers' varieties may ultimately depend on the availability of local and external markets. The local market is unlikely to be large enough to absorb production and it is not sensitive to this type of product at present. The project will seek to identify products that are based on farmers varieties and which can be marketed as value-added products to support their cultivation. Other market niches for farmers' varieties probably exist and warrant special initiatives.

In spite of the low yields obtained, it is obvious from the experience gained so far that local farming communities want to continue cultivating farmers' varieties. This is because of their stable yield and the quality of traditional varieties. The communities clearly appreciated the project. However, it is unrealistic to expect it to be fully sustainable after just four years. This type of project will need international assistance for a long time if it is to make a lasting impact. Meanwhile, the international community should develop an awareness of the value of farmers' varieties for future food security and be ready to promote *in situ* conservation programmes.

This contribution is based on the project "Dynamic farmer-based approach to the conservation of Ethiopia's plant genetic resources" supported by the Global Environment Facility.

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Campaign to Save Traditional Seeds

Oswald Quintal

In India irrigated agriculture and the use of high yielding varieties is strongly supported. This has led to an overproduction of rice and wheat. The Public Distribution System has been selling this subsidised surplus to the poor. As a result, millet had gradually been replaced as a staple food by wheat and rice. Rainfed agriculture in Tamil Nadu has become strongly marginalised and traditional varieties of small and minor millets and pulses have nearly disappeared. The Tamil Nadu LEISA Network* organised a campaign to 'Save Traditional Seeds' and, in the process, they have documented the traditional varieties that still exist. They have also identified those farmers interested in cultivating, upgrading and multiplying traditional varieties

On the road

A campaign "trail" committee was formed to tour the area. It consisted of members of farmer' associations and consumer forums. A core team was made responsible for addressing public meetings in colleges, universities and on the street. This team was also responsible for collecting information about the traditional varieties cultivated in the region and for forming village committees to cultivate and upgrade traditional seeds. A cultural team was responsible for street theatre performances that demonstrated the impact of modern agriculture, the threat to biodiversity and the importance of preserving, cultivating and upgrading traditional varieties.

The campaign was opened by the Vice-Chancellor of Anna University, Madras (Chennai) on 10 December 1997 and reached Kannikumari on 10 January 1998 after covering about 1200 km. Every day, during this 30 day period at least one meeting was held at a college or university and 3 to 4 street performances were given. Meetings often attracted between 2000 and 2500 people a day.

Without the solid support of the farmers, who provided food for 150 people 3 times a day; the NGOs, colleges and universities that provided accommodation, and contributions of grain and cash from the general public, the campaign would not have been possible.

All the daily and weekly magazines in Tamil Nadu and the State television service followed the campaign's progress. Subscriptions to the LEISA Network magazine doubled and some 180 farmers became involved in newly founded community seed conservation committees. The seed committees, in collaboration with the LEISA Network and universities and colleges will use the traditional varieties and the information collected in testing and multiplication experiments. Much information was also collected on traditional agriculture and the loss of biodiversity. This included, for example, inscriptions from a temple wall that indicated that rice yields of 7–9 tons were obtained in traditional rainfed agriculture, thus exploding the myth that the productivity of traditional varieties is low. ■

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* The LEISA Network, founded in 1990, is dedicated to the development of sustainable small-scale rainfed agriculture. Its members are resource-poor farmers and small NGOs living and working in Tamil Nadu and Pondicherry in southern India where rainfed agriculture and livestock keeping predominate.

Box 1 Complementarity and sustainability of *in situ* and *ex situ* conservation

Farmers have developed and shaped landraces through repeated seed selection and production. The *in situ* location for these genetic resources is the farm. For this reason, on-farm conservation is a synonym for *in situ* conservation of crop and livestock genetic resources. The on-farm or *in situ* maintenance of genetic diversity is a conservation strategy that is complementary to *ex situ* conservation in genebanks. The crucial importance of *in situ* conservation lies in the fact that the evolutionary process can continue, whereas the *ex situ* conservation represents a 'frozen and static' situation. Conservationists accept the fact that they cannot conserve all materials and genes *ex situ* because of limited resources and that materials are at risk from power cuts and delayed regeneration. However, *in situ* conservation is not fully adequate for the maintenance of material or genes (see Sthapit & Jarvis p40). First, because farmers may not wish to continue planting particular varieties or crops if better varieties become available. Second, the genetic make up of materials can change when farmers change production practices. This generates such discussions as whether farmers who maintain farmers' varieties/landraces should be encouraged (or allowed!) to use fertilisers or pesticides. From a 'pure' conservation perspective, this is not desirable. On the other hand, farmers cannot be forced or expected to grow particular farmers' varieties/landraces in the traditional way if they are not compensated for extra costs or yield losses.

photo: Conny Almekinders

The Ethiopian genebank of the Institute of Biodiversity Conservation and Research (IBCR) has adopted a compensation approach, at least in the short term. Some argue this is not a sustainable way of maintaining *in situ* conservation because compensation is only available for the length of the project. However, alternatives are not readily available. If the gene bank waits until policy makers have created a socioeconomic environment that favours the use of local genetic diversity by farmers, then many valuable genes will probably be lost as farmers turn to improved materials or abandon their farms in search of a more promising future.

The justification for the *in situ* and *ex situ* conservation of genetic resources is that resources will be used by farmers either directly or indirectly. Both approaches require policy support. A policy that provides for the creation of a regulatory seed framework and market can significantly contribute to the on-farm use of genetic diversity (see Demissie p30).
It is, however, essential that the value and complementarity of *in situ* conservation and the role that farmers play in conserving genetic diversity is recognised.

Conny Almekinders and **Abebe Demissie**

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People's Biodiversity Register

Ghate Utkarsh

The People's Biodiversity Register was initiated in 1995 by the Foundation for the Revitalisation of Local Health Traditions (FRLHT), an NGO in Bangalore. Between 1996 and 1998 the Indian Institute of Sciences coordinated the activities of the People's Biodiversity Register at 52 sites in eight states. This was part of the Biodiversity Conservation Prioritisation Programme, a national initiative (Gadgil et al, 1998).

The People's Biodiversity Register aims to build an open and transparent information system on biodiversity resources from village level upwards. The register can be used to promote the sustainable management of natural resources and support claims of communities and individuals to knowledge about biodiversity resources and their use.

During the course of individual and group interviews and discussions at village assemblies, local biological resources and conservation priorities were explored and biodiversity user groups and knowledgeable individuals were identified. As many as 1000 villagers with extensive knowledge of biological resources became deeply involved in the programme. During these discussions biodiversity resources and practices for the sustainable use of local biological resources were identified. Peoples' perceptions and options for development and their personal and social choices were also discussed.

Over-harvesting and biopiracy

This work entails risks. The availability of easily accessible databases could encourage the over-harvesting of certain biodiversity resources by the communities themselves. Also information on biodiversity resources might be used by those who are not prepared to share the benefits equitably.

Information on biodiversity resources in the People's Biodiversity Registers has facilitated monitoring and provided measures for checking how this knowledge will be used . Establishing rewards for natural resources initiatives has created opportunities for local communities to participate in conservation programmes.

Information from local registers has been computerised at district level and made available to villagers throughout the country. The medicinal and seed industries are allowed access to this information for a reasonable fee. Some of the royalties accumulated in this way have been deposited in biodiversity funds for the support of local initiatives. These efforts will not be successful without publicity, training and education at the grassroots level through a local self-governance system.

Experiences gained

The registers were accepted by local councils as official documents and distributed publicly. This attracted considerable attention in the local media and helped raise awareness about these issues in neighbouring areas. It also worked as a signal to local politicians about the importance of local resource management and their responsibilities towards it.

In some villages people started looking for solutions to problems related to local natural resources. In Kigga village near Sringeri, for example, one trader used to collect moss in large quantities from nearby forests. The people asked him what he earned selling this moss on the urban market and, because he did not give a satisfactory reply, they refused to continue collecting. Mala village decided to ask the government to authorise the local council to charge fees to outsiders who wanted to collect forest products. People also looked for ways of reducing the pressure on the forests caused by the need for firewood. They began, for example, to look for alternative fuel resources for brick making and made efforts to protect sacred groves.

Response

The government of India has prepared a draft 'Biodiversity Act' (Anon 1998) to be discussed during the next parliamentary session. The draft act considers the role of local authorities, the documentation of local knowledge and resources, and the funding needed for conservation. Under the auspices of a local member of parliament some NGOs organised a public hearing on the contents of the draft bill.

As the government takes its time to decide about People's Biodiversity Registers, local NGOs have started promoting them vigorously. These experiences have been widely published both in English and in the local language and as a result many people from all over India have expressed an interest in undertaking similar exercises in their own areas. An informal network called *Srishtijigyaasa Pariwar*, the 'Family of People Desiring to Learning about Nature' has been set up. To facilitate this process, a methodology manual (Chhatre et al, 1998) and resource materials such as the Convention on Biological Diversity have been translated into several local languages.

Meanwhile other NGOs, including the International Union for Conservation of Nature and Natural Resources (IUCN), have expressed interest in undertaking similar initiatives in Nepal, Brazil and South Africa. People's Biodiversity Registers may become a global movement in the near future.

The full text of this article can be found in COMPAS Newsletter Vol 1-2, 1999 or at www.etcint.org/compas_newsl.htm

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photo:

Learning about biodiversity in Peru

Market fairs where products are exchanged are common in the Andes. Competitions are also very much part of Andean culture and the organisation of “biodiversity fairs”, where farmers display their plant varieties and those with the “most biodiversity and knowledge” win prizes, have special appeal.

M. Scurrah, E. Fernandez-Baca, R. Canto, E. Nunez, E. Olivera, N. Zúñiga

One of the first biodiversity fairs took place in 1989 in Aymará. It was held as a competition among farmers and highlighted the diversity of potato varieties. Farmers responded positively to the fairs and they have become annual events. Every year more families enter the competitions and the number of varieties displayed increases.

Today, biodiversity fairs are held all over Peru and have expanded to include diversity in crops other than potato. Fairs encourage farmers to pay attention to the diversity of varieties they grow. On a more practical level, they provide a space where neighbours can exchange seed and plants and, at regional fairs, they bring farmers from more distant communities together ensuring that seed stocks are rebuilt and expanded. Farmers receive recognition from government and NGOs for their efforts in managing their biodiversity and the prizes also provide strong motivation.

Colpar

Grupo Yanapai works with rural communities in Quilcas district in the Mantaro Valley, Huancayo Province. Communities are scattered over two watersheds and three different agroecological zones: the low agroecological zone or valley floor (3000-3500 m.a.s.l.), the intermediate zone (3500-3950 m.a.s.l.) and the high zone (3950-4250 m.a.s.l.).

The Quilcas community is situated on the valley floor. It has some authority over the distribution of communal resources in the area although, over the years, the importance of communal resource management has diminished at lower heights where most of the land is now privately owned. Colpar with 74 families, 47 of whom are officially registered as community members, lies in the intermediate zone. Membership of the community brings obligations, such as the commitment to joint labour in the interests of the community, and rights to a plot of land and grazing areas in the high ecozone.

Families in Colpar practice small-scale agriculture combining it with animal husbandry. Cattle, sheep and llamas are herded in the high ecozones while other animals are kept near the family home. Cattle are a source of capital, manure and traction, pigs are sold when cash is needed, and guinea pigs, rabbits and fowl provide food for household use.

The families manage small privately or communally owned plots situated at different altitudes where they cultivate a variety of crops. The average amount of land owned by each family is 0.5-1 ha. On the steep slopes, soils are generally acidic and low in organic matter and hillsides suffer from varying degrees of soil erosion. Farmers think that since inorganic fertilisers were introduced soil health has declined (Ramos and Kauffman 1997). Subsistence agriculture dominates, surpluses are sold at the market and production depends almost entirely on manual labour.

Biodiversity Fair

Grupo Yanapai’s field team decided to organise a biodiversity fair in Colpar. It wanted to stimulate farmers to maintain crop diversity and variety in their fields, provide them with an opportunity to exchange seeds and knowledge and finally to obtain more information about crops and the diversity within them.

32 participants took part, 25 women and 7 men. Traditionally, women are responsible for selecting and maintaining seed and, therefore, the presence of men at the contest was a surprise. Particularly as the first three prizes awarded for showing the largest number of crops and variability within the crops went to men. This showed that there was close cooperation in each household and that men are also interested and knowledgeable about seed maintenance. The Yanapai team failed to find out how many of the 25 women were heads of households. However, a survey carried out among 20 women in 1995 showed that 45% were either widowed or heads of households (Axman 1996).

Crops and variability

A total of 828 samples from 17 different crops (5 tubers, 5 pulses, 5 grains, 1 fibre-oil and 1 vegetable) were presented at the fair, as well as apples, aromatic and medicinal plants (laurel and aloe) and garden produce (carrots, garlic and *"rocoto"* (*Capsicum pubescens*)). The variety name provided by the producer was taken as a diversity unit. Yanapai was unable to analyse whether more than one name had been given to a single genotype. There were a surprisingly large number of "unique" genotypes.

It is unclear whether the farmers or Yanapai consistently classified native potatoes and improved potatoes in two categories, although native potatoes occupy a different height niche and require different crop management and input levels. If treated as one category, potatoes were the most exhibited crop (92%) with the greatest cultivar diversity (61).

Maize
The most common crop was maize (*Zea mays*). It was present in most exhibits (82%) with 51 different variety names. It is undoubtedly an important crop in the village even though Colpar lies above the cut-off height for maize production. Maize is dominant because people from middle-height villages may have access to land on the valley floor and because ecotypes that are more tolerant to colder conditions have gradually been selected. One of the farmers said: "At first maize hardly gave any grains and was mainly cob but then after five years it began to produce more and the grain was good". Thus, maize seems to be ascending to higher altitudes. Two prize-winning entrants presented 16 different types of grain. Maize is rarely sold and when families find they do not have enough, they buy or exchange other crops for it.

Faba bean
The second most common cultivar at the fair was the faba bean (*Vicia faba*): 27 of the 32 participants had it. The greatest number of varieties displayed was 19 and the average was 6. Farmers sow faba bean by population, planting them together rather than separating them into varieties making possible the recombination of different types through cross-pollination. This management practice has given rise to Andean faba bean ecotypes. Since the faba bean stores well, it is consumed in the period October-December when there are no more potatoes left. Dry faba bean is sold in small quantities when money is needed. It is a nitrogen fixer and an important cleaning crop in the rotation cycle because it does not suffer from the same diseases as maize and potatoes.

Improved potato
The third most common crop was the "improved" potato, which originates from breeding programmes. These are mostly hybrids between *Solanum tuberosum, ssp. tuberosum* and *S. andigena*. 20 participants (63%) brought varieties of "improved" potato. On average each farmer grew 3 varieties. 60% of farmers had '*Yungay*', a late variety planted at the end of November and harvested in May. The *'Amaya'*, selected and maintained by farmers, is a variety unique to the area. *'Revolución'*, an early variety planted in October, is one of the first to be harvested. These improved varieties are grown for household consumption and sale.

Peas
Eighteen participants grew peas (*Pisum sativum*) with, on average, 2 varieties per person. Only 3 farmers had 4 varieties, including a purple mottle that "produces well but doesn't have a market". It is grown for consumption only on small plots in association with maize and faba bean.

Native potato
Native potato (Solanum tuberosum ssp. andigena, S. gonicalix, S. chaucha, S. curtilobum) came in fifth place. 17 people (53%) exhibited this type of potato. One participant brought in 28 different varieties. It is possible that other participants had more native potato varieties, but these potatoes are stored in the highlands and farmers may only have displayed the varieties they had on hand. Two women who had a large native potato collection travelled frequently to the highlands. They had the opportunity to pick up a more complete set of seed tubers from the highland store. This crop had the greatest diversity in the community with an average of 10 varieties per person.

Unlike maize, the native potato is grown in the highlands, which are still communally owned. Potatoes are not separated into varieties, but are planted as a mix designed as *"chagro"*. The community manages a seven-year rotation system and each family is allotted land in turn within the larger rotation field. Native potato seed is usually obtained through inheritance, by exchange and, as its Spanish name *"papa regalo"* suggest, as gifts. This potato is used for food, gifts, ceremonies and festivities.

Andean Tubers
Thirteen farmers (41%) had *ulluco* (*Ullucus tuberosus*) with an average of 3 varieties (one participant had 9). Eight farmers (25%) had *mashua* (*Tropaeolum tuberosum*) with an average of 3 and a maximum of 7 cultivars. Only one participant had *oca* (*Oxalis tuberosa*) and she brought 2 varieties. Farmers had stopped cultivating oca because weevil had become a serious problem and all the seed had been lost. *Ulluco*, mashua and oca are planted in rotation with improved potato, faba bean and cereals. With the exception of *ulluco*, which has a market, they seem to be losing variability and importance.

Pulses
All pulses grown have a high protein percentage and are important in soil fertility improvement because of their nitrogen fixing qualities. Even though the Mantaro valley is too cold for beans, 10 farmers brought them in. Those farmers who brought in maize also brought in a large number of bean varieties because they are grown in association. The maximum number of varieties displayed was 12 with an average of 5. Beans are mainly grown as food and are seldom sold.

Nine farmers brought tarwi (*Lupinus mutabilis*). It is grown for food and to protect small fields in the intermediate zone from livestock. The average number of different types was 3 although one participant had 7. It is the last crop in the rotation before the land is left to rest. Eight farmers brought vicia (*Vicia bilosa* and *V. sativa*) to the exhibition. Yanapai introduced this crop to alleviate the scarcity of forage and it seems to be doing well.

Other groups
Cereal crops showed the least genetic diversity. Wheat, barley, oats, *quinua* and *kiwicha* averaged one variety. 10 farmers presented wheat, 6 presented barley, 4 oats and 3 *quinua*. Land scarcity and climate restricts cereal growth. Seven people brought pumpkin and there were 3 varieties. Aromatic herbs and garden vegetables were not included in the list and only a few brought samples. It should be noted, however, that various families grow garlic, onions, carrots, and a combination of aromatic and medicinal herbs.

Conclusion
Colpar's first fair revealed that farmers grow a surprisingly large array of crops. There is a large diversity of phenotypes within each crop and great heterogeneity amongst them, suggesting contradictions between market and farmer strategy.
On the one hand, the market plays a reductionist role accepting only a limited number of crops and varieties. Farmers, however, aim to maximise crop diversity as well as diversity within crops in order to cope with the complex agroecology of their land, droughts, hail, frosts, diseases, and pests. The fair highlighted once again how farmer strategies are geared towards food security and ensuring the sustainability of their agriculture.

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The Project 'Promotion of small-scale seed production by self-help groups' is a technical cooperation project between the Southern Africa Development Community (SADC) and Germany. The project seeks to develop an approach to achieving seed security at household level given that commercially-

Ortwin Neuendorf

oriented seed enterprises will do very little to supply quality seed from open-pollinated crops to farmers. To achieve its objectives, the project cooperates closely with NGOs, the extension service, farmer associations and other projects already working in the field with individual farmers and farmer groups. The project offers to supplement their activities with a seed component.

photo: Maria Scurrah

Seed fairs:
creating awareness of a rich heritage

After becoming acquainted with the target group, discussions usually shift to exploring the problems the group feels need to be addressed. It transpires that seed issues are an important element in the difficulties facing farming community. When farmers are asked to elaborate on the seed issue, a number of problems emerge: appropriate seed was unavailable or not available on time. What was available was often old and "tired" meaning the seed had been kept too long or had been recycled too many times and that it took too long to mature. In general, there was nothing new to be found especially where early maturing varieties were concerned and certified seed from the formal sector was too expensive.

Seed fair experience

To maintain farmers' interest in seed security concerns, the project finds it helpful to suggest that farming communities make an inventory of crops and varieties used at the local level. The whole community then displays its seed inventory at a 'seed fair'. The seed fairs have acquired their name because they combine the aesthetic values of sample displays with detailed explanations about the performance of a variety or a crop. This culminates in seed marketing and exchange between participants. The occasion is organised in such a way that it is entertaining as well as informative. A convenient time to hold a seed fair is at the end of the cropping season, just after the harvest when details of the crops' performance are still fresh in the farmer's mind. Understanding the farming systems in a particular area is also critical for the timing of such events. It is important that the farmers take heed of mixed crop stands and relay plantings which grow on residual moisture because the main objective is to capture as much diversity as possible.

Seed fairs in Zimbabwe have shown how important they can be in raising awareness about seed issues. Zimbabwe is characterised by a very strong and vibrant commercial farming sector that occupies about 30% of the arable land and a much less commercialised farming sector that is mostly situated on marginal crop land. The commercial sector produces and exports maize, wheat, soybeans, sugarcane, tobacco, cotton, fresh cut flowers, vegetables, fruits, tea, coffee, and beef. It relies on a well-developed formal seed supply system, which, through local production and imports, adequately meets the quality demands for seed and planting material.

However, the majority of Zimbabwe's farmers have to eke out a living in the subsistence farming sector. Here, overpopulation and decade-long poor land management has led to massive environmental degradation and erosion resulting in the loss of soil fertility. The combination of recurrent drought and economic structural adjustment measures has aggravated the problem and reduced state funding for this sector. A major problem has been to provide adequate, appropriate seed for the farming systems practised in these areas because economic liberalisation has increased seed prices to levels beyond the reach of many subsistence farming communities.

With these factors in mind, seed fairs seemed to provide a good opportunity for making farmers aware of and interested in the genetic resources they possess, to enhance diversity and to encourage special care in producing good seed.

Seed fairs began in the early 1990s and followed the most devastating drought to affect Southern Africa this century. There were fears that farmers had lost most, if not all, of their seed and planting material. Acting as an informal inventory, the seed fairs were quick to establish the resilience of traditional farming systems in the face of such major catastrophes. The seed fairs revealed that seeds, even of very old varieties, were still to be found in the farming communities.

Records for the past three years from two drought-stricken districts in Zimbabwe indicate that the number of seed fair exhibitors increased from 90 to 130 families and the number of visitors doubled. Most impressive, however, was the number of crops displayed. The list reads like a Southern African crop compendium. One such fair, for example, displayed 5 different grain crops with 110 different varieties, 6 leguminous crops with 75 varieties, 9 vegetable crops with 67 varieties, 3 industrial crops with 10 varieties and 2 root and tuber crops with 15 varieties. Varieties were distinguished according to the farmers' own standards. They gave names to the different phenotypes and these reflected their understanding of the performance of a crop or where it came from. As a result, there were varieties named after the president of the country because the seed was given as drought relief or with names like "wife does not run away" because the variety was short maturing and helped alleviate hunger. Similar numbers of varieties have since been found wherever a seed fair was held and they are rapidly becoming a popular event in low-input agricultural settings.

When questioned about the difference between seed fairs and the agricultural shows, participants remarked:
- Farmers pay to display their goods at agricultural shows, at seed fairs they can display their seeds for nothing.
- Produce are judged at shows in terms of quality. At seed fairs, the diversity of displayed varieties and their uniqueness is what is most important.
- At shows only registered varieties can be judged, while at seed fairs all crops and varieties are accepted, irrespective of their origin.
- It is easier to get seed from an exhibitor at a seed fair who lives in the vicinity, for payment or barter can be arranged any time before the planting season starts.

The main objectives of seed fairs are to:
- enable farmers in the area to share information regarding the performance of various varieties;
- give access to a wider range of crops and varieties so they can meet their food requirements;
- develop a competitive spirit in food production; and
- share skills and knowledge on how to produce the crop.

In the Zimbabwean context, the variety of crops displayed was impressive, especially given the two devastating droughts the country had experienced. Many farmers visiting the fair had thought that most of the exhibited crops and varieties had been lost. Some farmers remembered the role these crops had played in local food security in the past. Hence, seed was gladly exchanged or bought, so such crops could be grown again.

In a number of districts, seed fairs have become a regular annual feature. Generally they take the form of a one-day event. Organising these fairs are now entirely in the hands of the farming community. Farmers plan when to hold the fair and who to invite. They elect a committee to be responsible for running the fair. There are many things to deal with: money has to be collected for prizes; criteria set down for judging exhibits; knowledgeable persons have to be invited as judges and food and refreshments must be served.

Most of the farmers involved are women and they play a crucial role in setting up the fairs and exhibiting crops and varieties. Many of the crops displayed are the women's responsibility and they play an important role in securing household food security. It can be said that making sure seed is available at household level is mainly women's business.

However, farmers do not feel that they are the custodians of something geneticists want to preserve for future use. Their perception of biodiversity is pragmatic and more related to managing their immediate individual life-styles and economic needs. Two aspects seem particularly important to farmers: first, the search for crop diversity and, second, earliness to increase the farmers' ability to cope with adverse weather conditions.

Seed fairs have strong roots in the past. Zimbabwe has a concept of "zhunde ramambo" literally, 'the king's granary'. Communities were expected to donate seed to this granary. First, farmers had to display their wares for inspection by the king and the community. Then, seed was stored in a communal granary with much traditional ceremony. Because of these customs, each community has a different sociocultural approach to organising seed fairs because they assume a quasi-religious character.

Outlook

The present abundance of crops and varieties being displayed at seed fairs is, however, under threat. The advent of crop commercialisation brought with it the use of improved varieties. Their apparent qualities and uniformity made them seem very attractive and many farmers no longer saw any reason to maintain the old varieties. This trend is clearly illustrated by the fact that there are regularly 70 entries for sorghum and millet but only 4 entries for maize.

This situation is certainly influenced by some factors specific to Zimbabwe where open-pollinated maize varieties are not allowed on the official seed trade market. The environments where sorghum and millet do well are generally not well suited to maize. There is an indication that a more market-oriented crop production infringes on diversity. Still, we may yet witness a gradual change towards an increased use of traditional varieties as depressed commodity markets push farmers towards a farming system that is primarily geared to household food security. This may lead to farming systems that thrive on diversity of crops and varieties. New chances may also come as the demand from affluent societies for long forgotten indigenous vegetables, herbs, root, tubers, and grain increases.

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Local views on genetic resources conservation

Raul Boncodin & Belita Vega

UPWARD studies of community-based conservation of root crops, especially sweetpotato, show there are gardeners, farmers, and traders who, by experience and skill, have developed a local reputation as "experts" in sweetpotato growing, processing and marketing. These local innovators serve as indigenous farmer leaders ensuring effective cultural farming practices and, as providers of new planting materials, they are important links in sweetpotato seed systems.

The significance of local involvement in genetic resources conservation is increasingly recognised. However, several basic questions still need to be explored. The UPWARD Genetic Resources and Biodiversity Contact Group brought researchers and local innovators together to share ideas on root crop genetic resource conservation during a Local Conservationists' Workshop held at ViSCA, Leyte, Philippines (1998). UPWARD's genetic resources projects - supported by IDRC (International Development Research Center) - were also scrutinised.

Genetic resources conservation

How do local people define genetic resources conservation? In agrobiodiversity conservation research it is a clearly defined concept with a definite purpose – stopping genetic erosion and increasing on-farm diversity. Local people, however, have very dynamic conservation perspectives. One workshop insight was that local people view genetic resources conservation in terms of the crop's importance to their lives – conservation cannot be dissociated from crop usage. Decisions to conserve a variety depend largely on its usefulness.

What crops are conserved?

Most participants were concerned about the need to conserve different root crop cultivars but recognised changing local socioeconomic and agroecological conditions limited possible initiatives. In the past, for example, commercial sweetpotato farmers from Leyte maintained several traditional sweetpotato cultivars to satisfy local demand. Recently, however, they were compelled to discard these cultivars in favour of the high starch content varieties needed by the newly opened sweetpotato starch factory. Although several farmers kept some of the discarded varieties for home use, a significant number of traditional sweetpotato cultivars were lost.

The Ivatans of Batanes also had a wide variety of sturdy root crop cultivars. Well adapted to the island's harsh environment, these traditional staple foods had been conserved for generations. In 1970, rice was introduced and rapidly took over. Root crops were relegated to supplementary foods useful during typhoon months when rice stocks were low. Because the Ivatans no longer found them useful, many root crop cultivars were lost as food preferences changed.

Such examples show that socioeconomic and agroecological change increases the vulnerability of local systems of conservation and should be considered in community-based conservation initiatives. Conservation cannot be limited to a formal institution's mandate crop. It must take account of the wide range of crops farmers need to survive.

How do people conserve?

Local farmers conserve preferred cultivars by continuously planting them on their farms, homegardens and plots. In Baloi, Lanao del Norte, farmers transferred some choice traditional sweetpotato cultivars to fertile upland areas when cassava became the dominant farm crop. When cassava farming became less attractive, farmers reintroduced sweetpotato. Upland plots provided the necessary planting material.

Storing planting materials using ancestral, indigenous storage techniques also contributes to the conservation of genetic resources. During prolonged drought, a gardener from Bukidnon, for example, preserves sweetpotato tubers by putting them in a basket covered with dry sweetpotato leaves and storing them, dry and cool, under her house.

photo: Raul Boncodin

Conservation through use was the strategy adopted by most workshop participants. The sustainability of conservation initiatives is enhanced when they lead to concrete uses and benefits. Homegardeners in Baguio City have ventured into sweetpotato-based snack food processing using different varieties of sweetpotato. This provides a livelihood for women gardeners and helps conserve traditional sweetpotato cultivars.

Who are local conservators?

Since conservation is a specialised activity, only a few individuals in a community can be considered local conservators. They are usually key members in the farming community, and have considerable knowledge of genetic resources conservation and a more conscious and systematic approach to crop conservation. Men tend to conserve on-farm while the women's domain is the homegarden. In Bukidnon, young pupils and schoolteachers are helping to conserve local traditional sweetpotato varieties by maintaining a school sweetpotato gene bank. This develops a culture of conservation among the children and provided the community with a source of good planting material. Sweetpotato traders also have a unique knowledge of conservation as workshop discussions made clear. Future initiatives should take this into account.

Two areas of community-based conservation for further UPWARD study were identified at the workshop:

- Developing a user-driven approach to participatory genetic resource conservation by creating market demand that encourages the use of a wide range of root crop varieties. This might be achieved by: a) linking genetic resources conservation to seed systems to ensure healthy sweetpotato planting material is available when needed; b) developing household-based snack food enterprises using home and school gardens as sources of raw materials.
- Investigating challenges in transition agroeconomies. This study should examine how economic, industrial, environmental, and social changes have affected local genetic resources conservation and the role root crops play in changing livelihood systems.

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Creating common ground in collaborative crop improvement

Daniela Soleri, David A. Cleveland, Steven E. Smith

Improving farmers' crop populations may help meet farmers' needs and ensure the continued use and *in situ* conservation of local crop varieties. Collaborative or participatory plant breeding (CPB or PPB) is an approach with the potential to increase the productivity and relevance of crop improvement efforts, especially for low-resource farming households in difficult environments. Two elements are central in CPB. First, the adaptation of crop populations to local biophysical and sociocultural environments and second, interaction between farmers and professional plant breeders. Creating an effective basis for collaboration that integrates the insights and skills of farmers and breeders and ensures mutual respect is a major challenge for CPB. What methods can be used in CPB to help farmers and breeders talk and work together to produce crop varieties that better meets farmers' needs?

What can plant breeders offer?

Many small farmers in the Third World have derived little benefit from modern plant breeding. In part this was because conventional breeding approaches were ineffective, or because of the belief that improving the productivity of higher input systems was a better way of increasing food production and peoples' well-being than supporting low input systems. Modern scientific plant breeding has tended to emphasise the development of modern varieties (MVs) adapted to producing high yields in geographically widespread, but generally favourable environments. However, low adoption rates among small-scale, low-resource farmers indicate that MVs are not appropriate for these communities. Still, when some of the conclusions of modern plant breeding are understood in terms of the contributions of both the values and theory on which they are based, it is easier to see what plant breeders have to offer CPB . Theories, empirical knowledge, and techniques for analysis developed from years of experimentation and observation about plant development, the way genes function in this development, and the influence of growing environments, provide a systematic research framework. Recognising this fact, a small minority of plant breeders are applying plant breeding theory and techniques and CPB specifically to the needs of small-scale, low resource farmers.

What can farmers offer?

Until recently much CPB activity has emphasised the participation of farmers in such plant breeding tasks as selecting from breeder-developed material. Farmers' plant breeding experience and theory has not been brought into CPB because little is known about it, either in farmers' terms or in terms of the theory of scientific plant breeding. Farmers obviously have much to offer CPB. First, they are the ones who will use and judge varieties. Second, farmers' practices and theory frequently represent long-term experience with the plant genetic and environmental variation components of their farming system.

Table 1. Characteristics of the communities studied in the Central Valleys of Oaxaca, Mexico.

Characteristic	Santa Maria	San Antonio
Elevation (msal)	1490	1780
Average annual precipitation (mm)	685	468
Predominant soil characteristics	alluvial, sandy clay	piedmont, gravel
District average maize yield (t/ha)	0.76	0.45
Average maize sowing rate/ha	47,000	40,000
Population (1995) *	2800	2533
Predominant ethnic/linguistic group	Mestizo/Spanish	Zapotec/Zapotec

** 1998 estimates for both communities = 3000, M. Rees personal communication 1998.*

Research approach

In this article we use examples from ongoing research with maize farmers in the Central Valleys of Oaxaca, Mexico, to illustrate how the insights of farmers and plant breeders can be brought together to facilitate a better understanding of local maize seed selection practices. We also explore the implications for collaboration and hope to come to a clearer understanding of what the components of the biological model of selection used by plant breeders looks like from the farmers' perspective. Given the time and often money invested in seed, it seemed likely that farmers expect certain results from the selection process.

Materials and methods

We worked with a sample of eight farm families in a community in the Zimatlan Valley and with five families in the Mitla Valley (Table 1). We tried to make the sample representative of household types in each of these communities in terms of wealth and the gender of head of household. Interviews were conducted with those primarily responsible for agriculture: the wife and husband or mother and son. Younger workers were also interviewed but they usually deferred to the primary pair. In our analysis of these maize seed selection systems we wanted to describe and quantify selection and come to an understanding of the theory that guided farmer seed selection practices.

Quantifying farmers' practice

Through participant observation, informal discussion, and formal interviews with the 13 collaborating households, we identified three categories of selection criteria. First, seed quality and seedling vigour. Second, traits such as ear length, weight and diameter, kernel size and weight as well as the weight/volume of shelled kernels. Third, traits that define a variety type or subtype, which in our sample included such traits as grain type, grain form, and cob and husk colour. Although criteria in the third category varied from household to household and between the communities, the first two categories were universally applicable.

As selection exercises demonstrated, these criteria and particularly the first two categories, were reflected in farmers' selection practices. Using a random sample of 100 ears of the common local white maize variety from a field in their community, we asked households to select ten of the "best" ears for local planting seed. These were then evaluated for a series of traits including ear diameter, length and weight.

We then conducted a field experiment with white maize populations from three households in each community in order to quantify the response to farmers' selection in the maize populations. Since 1996, we have obtained three generations of farmer-selected samples and two generations of corresponding random samples from the same population from each household (Figure 1). All of these samples were sown with eight replications in a completely randomised block design in a field belonging to one of the collaborating households in the Zimatlan Valley. The experimental field was prepared and managed by the household according to local practices.

Farmers' theory

Participant observation, informal discussions and formal interviews all contributed to our understanding of the theory underlying farmers' selection practices. Using maize ears and photographs of maize tassels of different colours to illustrate the scenarios, farmers were asked what the phenotypes of the progeny of particular selections grown in different environments would look like. Questions about the expression of traits in normal and optimal environments provided a way of understanding farmers' theories regarding abstract concepts such as heritability in their maize varieties and environments. We found that the biological model provided a useful framework for understanding local selection practices. However, its utility in terms of supporting CPB appeared best when we tried to deliberately investigate its components from farmer's perspectives.

Common ground

We started to explore farmers' selection practices with the idea that selection is about changing crop populations. When we asked households what they were looking for when they made selections, we were invariably told "los mejores" - the best. When we asked questions about how they wanted to change their populations, the answers we got were often confusing. Looking at farmers' perspectives-exploring farmers' practices, the theory behind them, and their implications for maize populations was more productive. It revealed our own mistaken assumptions and allowed farmers to explain their own understandings, theories, practices and objectives in maize seed selection.

The following findings from the interviews, selection exercises, genetic perceptions scenarios, and field experiment in this study are of relevance for facilitating farmer and plant breeder interaction.

- Farmers' selection criteria as they defined them and their selection criteria as demonstrated by the selection exercises identified ears and, to a lesser extent, seed size traits as important once seed quality (freedom from pest and disease damage) had been assured.
- Selection for these criteria appeared directional and seemed to try to change the populations' mean value for these traits.
- Farmers' answers to genetic perception scenarios, however, showed that they saw traits such as ear length as having no heritability either in their own, variable fields or in hypothetical uniform ones (Figure 2). Most farmers regarded ear length to be product of the growing environment in which the maize population developed. This being the case they expected no response to selection for such traits and implied that they saw no genetic variation for that trait. This did not mean farmers were unable to recognise genetic variation or understand the potential of selection. They pointed out that a trait with a high heritability such as tassel colour, could be selected and change would appear in the progeny as a result of that selection (Figure 3). The presumption that farmers practise selection to change their maize populations, our original interpretation of farmer responses to interviews and selection exercises, was not supported by farmers' theories.
- There was virtually no response to selection in the field experiment. The absence of a response to selection for traits identified as primary selection criteria confirmed farmers' own opinion that their selection would not change their maize populations.

Relevance

Several of these findings are relevant to practice and may change the way in which farmers and breeders work together on CPB. Farmers are concerned with seed quality and seedling vigour at the moment. Farmers would probably be interested in research into improving the pest and disease resistance of maize ears especially during storage.

Second, understanding that farmers do not see the potential of selection to change some of the traits in their maize populations, and, therefore not the purpose of their seed selection, highlights a significant difference between their objectives and those typical of plant breeders. For this reason attempts to improve selection practices may not always seem worthwhile or even logical to farmers. A more affective approach may be to improve heritability for the traits farmers may want to change if they believed they could. This means making genetic variation visible and accessible to them and making it possible to respond to selection.

Finally, helping plant breeders and other researchers achieve a better understanding of farmers' practices and knowledge, including their theory, helps create a basis for mutual respect and collaboration. The genetic perception scenarios were not undertaken to test farmer knowledge, nor ▶

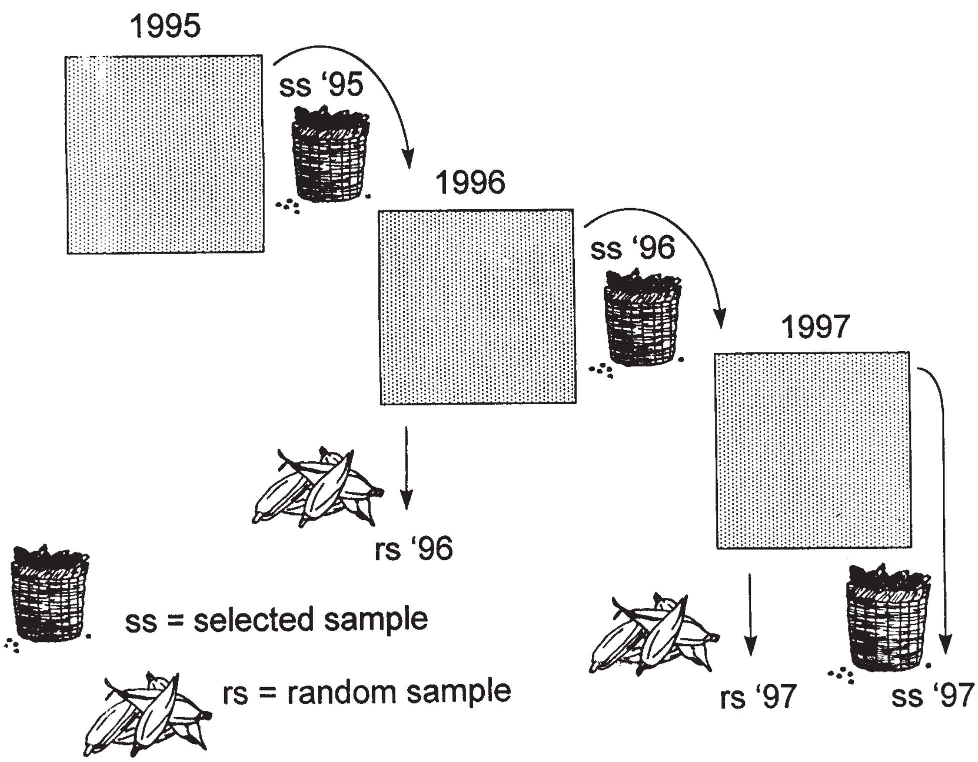

Figure 1 Response to selection: year and type of seed used for each population

was their knowledge compared to any "correct" or "scientific" standard. We recognise that many other factors contribute to farmers' knowledge about their crops including sociocultural, economic and individual variables. The approach described here tries to neutralise the realm of practice—in this case seed selection and crop improvement—to the extent that the dichotomy between "scientific" and "non-scientific" practice is abandoned—and the common elements contributing to farmer and plant breeder practice are recognised.

This is an abridged version of the original article. A full version together with references is available from www.oneworld.org/ileia or from ILEIA, PO 64, 3830AB Leusden, The Netherlands.

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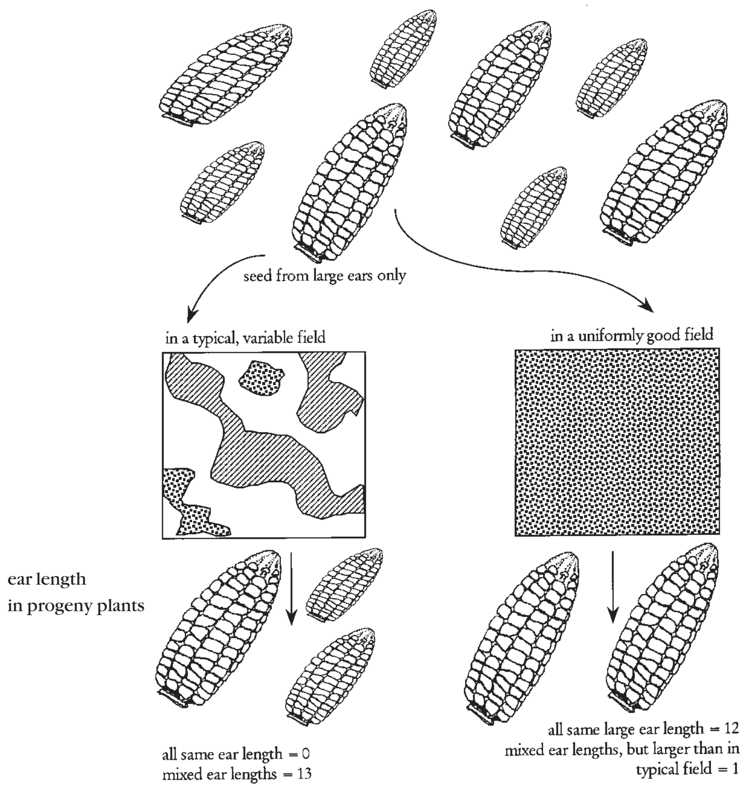

Figure 2 Genetic perceptions: responses to ear length scenarios

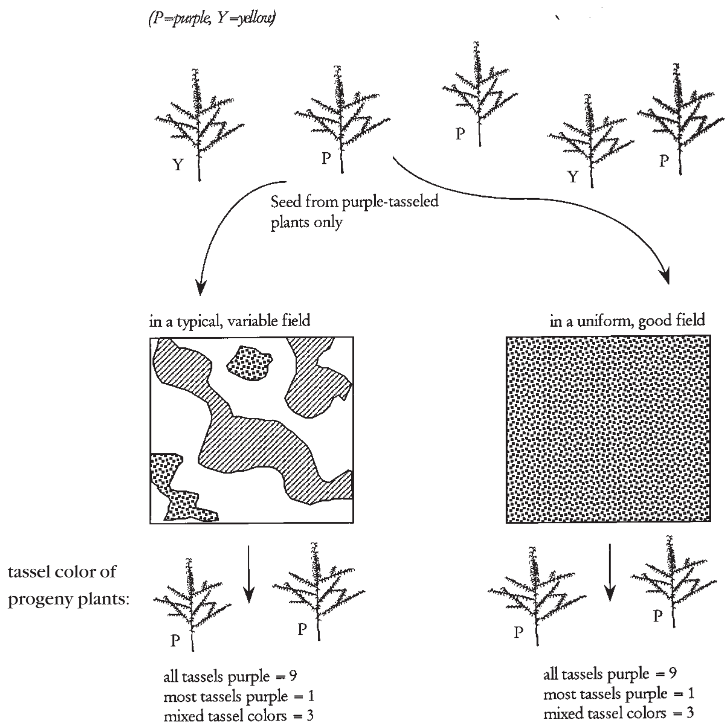

Figure 3 Genetic perceptions: responses to tassel color scenario

Seed selection and biodiversity maintenance by women farmers

The International Center for Wheat and Maize Improvement (CIMMYT) started a maize-breeding programme at the end of the 1970s in southwest China where 25 million poor farmers in remote upland areas depend on the crop for their staple food. An impact study of this ongoing programme was financially supported by CIMMYT and carried out by the author from 1994 to1998.

Yiching Song and Gigi Manicad

Food security in China will continue to occupy a top position on the international food security agenda in the coming century. Sustainable production of staples such as wheat, rice and maize depend on the systematic mixing of crop varieties of various origins and genetic makeup.

Researchers are becoming more aware of the role of farmers' seed systems and their knowledge of crop development and biodiversity conservation. China has followed a modern technology-oriented approach and has relied mainly on its public seed system to ensure national food security, notably in response to the great famines of the late 1950s. The most noteworthy development was the establishment of public agricultural research and extension systems for modern varieties. Some 30% of Chinese food production can be attributed to the development and promotion of improved planting materials, especially hybrid wheat, rice and maize (Lin 1998, Fan and Pardey 1997). China was the first country in the world to plant significant areas of genetically modified crops in the early 1990s (Song 1999).

The Chinese rural economy has experienced a rapid growth since the adoption of a broad programme of rural economic reforms in 1978, and China has been widely acclaimed for its achievements in food production and poverty alleviation. However, in a rapidly changing social context and natural environment, marginalised farmers, especially women, find it difficult to adapt to change. The farmers of the remote upland areas in south-western and north-western China make up a large proportion of the 60 million Chinese who live in poverty.

Feminisation of agriculture

The feminisation of agriculture is an important phenomenon in China. Women constitute more than 80% of the agricultural work force because of the volume of male out-migration (Song 1998). As a result, women are overburdened with agricultural activities that give little or no profit. There are fewer opportunities for women-headed households to adopt modern varieties owing to their limited access to resources and services (Jiggins 1986, Song 1998, 1999).

Furthermore, continuous agricultural exploitation since the early 1960s, guided by the state's single-minded aim of only targeting higher yields in its struggle to secure national food security, has tended to degrade natural resources and agroecology. This has negatively affected the resilience of the ecosystem and the sustainable livelihood of farmers and poor women in particular.

What has been happening in areas where natural resources are limited? How are improved plant materials meeting the needs of poor farmers and what is the role of formal and farmers' seed systems in crop development and biodiversity enhancement? The CIMMYT Collaborative Maize Breeding Programme in south-western China set out to collect information on areas with limited natural resources. The study assessed the impact of modern varieties and analysed the capabilities of public research and farmers' knowledge in dealing with food security, poverty alleviation, and agrobiodiversity conservation issues at different levels.

Impact of CIMMYT material

The impact study revealed that CIMMYT genetic material had had a significant effect both in hybrid development and in direct use. This had been achieved through the formal seed system and farmers' informal systems:

- Public breeding efforts have led to the adoption of CIMMYT-related hybrids but yield increments have been of limited benefit for resource-poor farmers in marginal rain-fed areas;
- CIMMYT's maize germplasm has had a considerable impact on household food security and poverty alleviation through the informal system which has assured the wide distribution of CIMMYT's improved populations.

Tuxpeño 1

Tuxpeño 1 (local name *Mexican 1*) is an improved population that was developed by CIMMYT from a landrace that originated from Tuxpau, Mexico. *Tuxpeño 1* was introduced in Southwest China in 1978, originally as a constituent for variety improvement and hybrid combination. However, *Tuxpeño 1* was rapidly disseminated through south-west China, mainly through farmers' seed exchange systems. Due to its broad adaptability, stability and good stress tolerance, especially lodging resistance, *Tuxpeño 1* became particularly popular with farmers in difficult farming systems in the remote mountainous areas. Here, it has contributed significantly to household food security and poverty alleviation in the last two decades. Meanwhile, due to the poor quality of government supplied hybrid seed, *Tuxpeño 1* has increasingly been adopted by farmers in relatively favourable areas. However, since maize is an out-breeding crop, *Tuxpeño 1* has, in the absence of an improvement effort from formal breeding, degenerated greatly by out-crossing, resulting in decrease of yield, increase in plant height and loss of stress resistance characteristics. Farmers have requested the government to assist them in improving the material but in vain. This has led to efforts by local women farmers to regenerate *Tuxpeño 1*.

Women farmers' initiatives

Geographical variation is a major feature of Chinese agriculture. Regional variability in farming systems and differentiation among farmers are increasing as a result of recent reforms. Different farming systems and other ways of using maize mean different needs for, and thus interests in, technology and genetic diversity. The big gap between the breeders' limited supply and the diversity of farmers' needs has led to indigenous knowledge systems being activated and developed as farmers work on the neglected, improved Open Pollen Varieties (OPVs) and landraces to suit them to their own needs. Socioeconomic factors, including the feminisation of agriculture has meant that local seed selection and landrace maintenance is mainly done by women.

Case studies were carried out in Wenteng and Zhichen villages in southwest China where conditions were representative but contrasted sharply. Wenteng is typical of the relatively better-off communities found in the valleys and flat areas, where farmers are educated and better integrated into the market economy. Pig raising is the main source of income for most villagers and farmers now use maize as pig feed. Zhichen is representative of the poorest and most remote of mountain communities. In this harsh and rugged environment access to market is very limited. Maize is the traditional, staple food crop and there is a large variety of landraces.

Different strategies followed

The following two cases show the initiatives made by women farmers in the two villages in transforming and 'creolising' exotic varieties and in maintaining landraces.

Case 1 Wenteng

Wenteng farmers used to cultivate hybrid maize. However, most of them have recently shifted to improved OPVs mainly as a result of the limited options offered by hybrid varieties, and the decreasing quality of government-supplied hybrid seed. Due to the lack of institutional support and the popularity of *Tuxpeño 1*, women in Wenteng village have been organising themselves to maintain and improve *Tuxpeño 1* since the 1980s. An innovative woman had initiated this activity by trying to maintain *Tuxpeño 1* after it had been adopted. The crop development methods used by the women include spatial separation through the use of plots at different locations, temporal isolation and seed selection. These methods are critical for population maintenance. The women explained that due to the popularity of *Tuxpeño 1* and the women's initiative in selection, it is easy to organise women farmers to grow it in adjoining fields isolated from other varieties. The women mainly select according to mass selection both in the field and after harvesting.

The three steps in seed selection are first to select the best plants in the middle of the field: phenotypes with big ears and other desired agronomic traits. Second, select the best ears (based on cob size, length and number of seed rows) and finally the best grains are chosen from the middle part of the cob according to kernel size, shape, quality, and colour. The women farmers claimed that these techniques have been passed on for generations and they use similar techniques for the maintenance and improvement of landraces. They also added that some of their selection knowledge and skills were gained by their parents or by themselves from the so-called 'bare-footed scientists' during the time of Mao.

As a result, the varietal quality, in terms of preferred agronomic traits and yield of *Tuxpeño 1* in Wenteng village has been maintained and improved in such a way that it is better adapted to local conditions. Most villagers now consider it to be a local rather than an exotic variety. It is not surprising that the improved *Tuxpeño 1* has spread rapidly to neighbouring areas through farmers' informal seed exchange systems. Today, Wenteng is a source for quality *Tuxpeño 1* seed over a large area.

Case 2 - Zhichen

Farmers in the harsh environmental conditions of Zhichen considered improved OPVs and some landraces appropriate technologies with the capacity to meet their needs. *Tuxpeño 1* was introduced into Zhichen at the end of the 1970s and became the dominant maize variety soon after. In contrast to Wenteng farmers, Zhichen villagers, mainly women, did not do much to improve *Tuxpeño 1* themselves. They maintained preferred landraces instead. Zhichen villagers feel that *Tuxpeño 1* has degenerated beyond their skills to improve it. While hoping that the government will improve *Tuxpeño 1* as a foreign variety, they also realise they will not receive any outside help to maintain their local varieties.

The farmers chose to maintain and improve three local varieties in accordance with their complex farming system and livelihood. *Duan 1*, an OPV improved by the county extension station in the 1960s, is maintained for its good drought resistance. Despite its low yield, farmers use this variety during the second cropping season in the autumn because no other variety will survive severe drought. The methods used by the women farmers to maintain the three local varieties include spatial isolation (growing them in isolated gardens or separate valleys) and post-harvest seed selection of the best cobs and kernels. Zhichen villagers say this knowledge has been passed down over the years. Compared with the women farmers in Wenteng, farmers in Zhichen maintain more diversity for risk management.

Fostering synergy

These farmer' adaptive strategies towards *Tuxpeño 1* show that their selection priorities and objectives reflect environmental conditions, market opportunities and institutional relations as well as socioeconomic positions and risk management. Wenteng has maintained and improved *Tuxpeño 1* while Zhichen has chosen to maintain local landraces. Given the fact that maize is their staple food crop, Zhichen farmers chose maize varieties that reflect their risk-aversion strategies. Despite the agronomic popularity of *Tuxpeño 1* other varieties were maintained and improved by Zhichen farmers for nutritional and cultural reasons and because they ensured a reliable supply in the most adverse environmental conditions. In Wenteng, on the other hand, *Tuxpeño 1* fitted the requirements for a commercial crop and a production surplus made farmers more ready to take risks. In addition, Wenteng women's greater skills in varietal improvement and seed selection reflect external influences and their better access to information and education. Zhichen women farmers, by contrast, live in isolation and are often illiterate.

Women expertise vital

These case studies also showed that the feminisation of agriculture was an important phenomenon in the remote upland areas and that women play a predominant role in subsistence agriculture and food security. Seed maintenance and selection are entirely managed by women who draw on their indigenous knowledge and informal systems. Women farmers play significant roles in crop development and agrobiodiversity maintenance. However, their access to resources and public services is much more limited than that of men farmers.

A gender analysis and the involvement of women expertise in technology design and development is vital in meeting the specific needs and interests of women. This can substantially contribute to reducing poverty, ensuring food security and enhancing biodiversity at farmer household level (Jiggins, 1986, Quisumbing, Brown et al. 1995, Song 1998)

Better collaboration needed

The experience of *Tuxpeño 1* and the two case studies related here show the considerable impact CIMMYT's genetic material has had on household food security and poverty alleviation. However, this potential was only fully exploited because of the mediation of farmer's informal systems. This shows the need for better institutional linkage and collaboration between the farmers' and formal systems in crop improvement. In this way local dynamics and the role of farmers can be fully exploited in ensuring sustainable food security and on-farm agrobiodiversity management. ■

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Farmers' management of genetic variability in rice

Anthropological fieldwork undertaken among semi-subsistence rice cultivators in northern Sierra Leone found that a number of farmers practised a technique of intra-specific rice cropping whereby the seed of two carefully chosen varieties – usually a glaberrima and a sativa variety - is intentionally mixed. Farmers who mixed varieties in this

Catherine Longley and Malcolm Sellu-Jusu

way explained distinct gastronomic and agronomic advantages offered by this technique. Although the grain of the glaberrima type retains a slightly hard texture when it is cooked, it is pleasantly filling when eaten. This is because it has high gluten content and is less easily digested. High gluten content is regarded as a positive feature because it makes a person feel full for longer after eating it.

The sativa variety, on the other hand, is much 'lighter' in the stomach, making a person feel hungry again quite soon. The gastronomic advantages of the *sativa* variety lie in the texture and taste of the cooked grain, which is both softer and tastier than that of the glaberrima variety. Thus, the two rice types have complimentary gastronomic qualities in terms of texture, taste, and filling ability. The gastronomic disadvantages of each (hard texture, poor taste, and low filling quality) are reduced when eaten as a mixture.

In the case study area it is not uncommon to see farm plots sown to a mixture of *disi kono (O. glaberrima)* with *samban konko (O. sativa)*. The glaberrima variety is able to withstand drought, whereas the sativa variety is generally higher yielding. A number of farmers explained how they originally mixed the two seed types in carefully chosen ratios for optimum performance and preferred eating qualities. The ratios in which farmers mixed the glaberrima variety with the sativa variety were variable and ranged from roughly 30% to 150%. Seed for the following year is taken from the mixed stands and no particular method of panicle selection is used. Most farmers who intentionally mixed their seed in this way observed that the ratio of varieties in the mixture tends to change over the years, and some farmers add a certain quantity of one of the varieties so as to maintain the optimum ratio. There was considerable difference of opinion as to whether the *glaberrima* or the *sativa* variety became predominant over time. Although *O. sativa* tends to be higher yielding, *O. glaberrima* is considered to be the better upland competitor, particularly on drier soils. In drought years, *O. sativa* may produce a high proportion of empty grains and the more drought-resistant *O. glaberrima* becomes predominant.

Trials carried out over two seasons at the Rice Research Station, Rokupr, Sierra Leone used replacement series analysis. A replacement series experiment contains different proportions of two varieties in mixture in addition to pure stands (monoculture) of each variety. The yields of the varieties in mixture are compared with the yields of the varieties in pure stands to estimate their performance in competition. The purpose was to investigate how one variety influences the other when cultivated in mixtures involving *O. glaberrima* and *O. sativa* types collected from farmers' fields. The experiments were designed to study the effect of water availability on variety mixture; how changes in plant density affect varietal competition under different conditions; and the effects of competition on the agronomic features of the varieties grown in mixture. The results of these experiments are described in full by Jusu (1999). The trials largely confirmed the farmers' observations described below and showed that mixture yields were generally higher than the mean yield of the varieties grown in pure stands.

Varieties imitate one another

Farmers' observations reveal that the rice varieties, when planted together, behave differently than when grown in pure stands. This phenomenon is explained locally by both the competitive nature (known locally as *gbehteh*) and copycat behaviour or mimicry which farmers regard as common among crop species. Rather than a divergence in flowering times and the avoidance of competition, as might be expected, a small number of farmers very clearly report that the varieties appear to imitate one another in terms of flowering and ripening times, panicle size and tillering ability. Experimental results showed that both plant height and the number of tillers tended to converge when the varieties were grown in mixture. The variety that had fewer tillers in pure stand produced more tillers in mixture, and the variety with more tillers in pure stand produced fewer tillers in mixture. Similarly, the height of the shorter variety in pure stand increased in mixture and the taller variety decreased in height when grown in mixture.

When grown on low-fertility soils, the general pattern was that the flowering times of the varieties tended to coincide when in mixture so that they both came to maturity at the same time. This apparent synchronisation in the flowering times of rice planted in mixtures would appear to increase the likelihood of accidental cross-pollination.

Author Malcolm Sellu-Jusu and on-station rice experiment

Competitive interactions and neighbour effects are known to be major factors conditioning adaptive strategy and species diversity (Sano, Sano & Morishima 1984).

Risks decreased

Other agronomic advantages cited by farmers practising this technique of intra-specific cropping include an increased ability to withstand drought, increased resistance to bird attack, reduced lodging, and/or reduced panicle neck breakage. The *sativa* variety, *samban konko*, is known as a rice variety that has little resistance to drought; for this reason it is best planted early on low-lying, moisture-retentive soils. If the rains are late or insufficient, *samban konko* produces empty grains. The *glaberrima* variety, *disi kono*, on the other hand, is better able to withstand drought and can be cultivated on the dry, gravely soils at the top of the slope. A farm plot planted to a mixture of these two varieties will always yield something, even if the rains are insufficient; if the *samban konko* fails, the *disi kono* will succeed. In addition, a small number of farmers suggested that the roots of *disi kono* somehow help the *samban konko* to take up water, thus enabling it to better withstand drought. One farmer explained this by suggesting that *samban konko* sucks water from the roots of *disi kono*.

Most farmers who practised intra-specific cropping also reported that bird damage was reduced on plots planted to mixed varieties. Birds are believed to be attracted to rice as it begins to mature both by its scent and its visual appearance. The slight difference in flowering times and the duration from flowering to maturity on a plot containing *samban konko* and *disi kono* was believed by some farmers to confuse the birds and prevent damage. Other farmers described how the differences in the height and stature of the rice varieties made it difficult for the birds to see that the *disi kono* had flowered and was beginning to ripen. Farmers who did not practice intra-specific cropping tended to cite the same factors as evidence of increased bird attack. They claimed that the *disi kono* attracted birds as it ripened and that the birds not only damaged the *disi kono* but also the *samban konko*.

photo: Catherine Longley

Less yield losses

Farmers also differed in their observations of lodging on a plot planted to mixed varieties. *Disi kono* has a tendency to lodge when it is dry. This can be reduced to some extent on a mixed plot because rather than falling flat on the ground, the rice plants merely lean against the upright stalks of *samban konko*. On the other hand, *samban konko* has a large, heavy panicle and the panicle neck tends to break if the rice is not harvested on time. The damage caused by this breakage can be prevented in a mixed plot because the *disi kono* lodges and causes the *samban konko* to also fall and lie flat on the ground. Once flat on the ground, the panicle neck does not break. It was implied that this was an advantage to those lacking the labour necessary to ensure that harvesting is carried out on time, before the panicle neck breaks. This difference in observations on lodging is most probably related to the different ratios in which the varieties are mixed, and would seem to partly explain the variation in what is considered to be the optimum ratio, mentioned above.

An intermediate rice type?

In sum, it could be argued that intra-specific rice cropping is a risk avoidance strategy adopted by farmers who are short of labour for scaring birds and timely harvesting. Farmers who plant slightly later in the season also incur the risk that *samban konko* may not take sufficient water during its growing cycle. This risk is perhaps reduced when *samban konko* is sown in mixed stands, particularly if *disi kono* does indeed increase the former's ability to take up water. In any case, a farm planted to mixed varieties will always yield something, even if *samban konko* produces empty grains. Research from Nigeria has suggested that farmers practice intra-specific cropping 'because it is safer to obtain stable yields in conditions where the climate fluctuates year after year' (Sano, Sano & Morishima 1984: 253).

It has also been suggested that farmers who practise intra-specific cropping may do so for reasons relating to their choice of farm site (Longley & Richards 1993: 56). In the case study area, crop rotation is practised whereby rice is cultivated in the first year and groundnuts, an important cash crop, in the second year. The slightly gravely, rain-fed sites that are best suited for large-scale groundnut farming are not ideal for the high-yielding *sativa* rice such as *samban konko* which does best on low-lying, moisture-retentive soils. It is possible that some farmers, particularly those who are most dependent on the cash economy for their livelihoods, prefer to select farm sites that are most suitable for groundnut production. Such sites are best suited to lower-yielding *glaberrima* varieties. By planting a sativa variety (e.g. *samban konko*) on such sites, farmers run the risk of low rice yields if the rains are insufficient. However, this risk can be averted if *samban konko* is mixed with *disi kono*.

By intentionally mixing *O. sativa* and *O. glaberrima* rice types in this way, Susu farmers may be providing the conditions under which accidental fertilisation might occur across sterility barriers, giving rise to an intermediate rice type displaying characteristics of both *O. glaberrima* and *O. sativa*. Though cross-fertilisation is rare, such an intermediate type might be highly desirable, particularly if it displayed the sativa trait for high yield together with the *glaberrima's* stability in sub-optimal conditions. Rice breeders have, in the past, tried and failed to cross these species. Viable crosses have recently been made by Dr Monty Jones, a Sierra Leonean rice breeder currently on the staff of the West African Rice Development Association (WARDA) at Bouaké (Jones et al, 1997). Though it has yet to be verified, it is possible that farmers have unknowingly achieved what scientists have been trying to do for decades. ■

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Informal bean seed systems

Frew Mekbib

Informal seed systems cover methods of local seed selection, production and diffusion. Such a system is described as traditional, informal and operates at community level through exchange mechanisms. Limited quantities are involved in each transaction. This corresponds with the traditional seed sector (Camargo et al 1989; Cromwell et al. 1992). According to Almekinders et al. (1994), it is non-specialised seed production, integrated into the production of grains, roots and tubers for consumption and marketing.

Informal seed systems are very important for crop production in Africa. The formal seed sector in Eastern and Southern Africa gives low priority to seed from self-pollinating crops such as common bean (*Phaesolus vulgaris L.*) (Sonia, 1994). For centuries virtually all Ethiopian seed supplies have been generated within an informal system. The country's formal seed system devotes much attention and money to lucrative hybrid producing crops.

Table 1. Farmers' criteria for good seed

Criteria	Percentage
Physical purity (no physical defect, not mixed, pure)	3.4
Seed characteristics (uniform size, red/white/mixed coloured, seed shape)	10.2
Growth characteristics (not climbing, early maturity, synchronised maturity, determinate growth habit, non shattering)	5.1
Performance (productivity, stress tolerance)	3.4
Seed health	1.1
Seed characteristics, performance	5.7
Physical purity, seed characteristics	11.9
Seed characteristics, seed health	8.0
Physical purity, seed characteristics, seed health	17.0
Seed characteristics, performance, seed health	6.3
Seed characteristics, growth characteristics, seed health	3.4
Combination of all five characteristics	37.7

Table 2. Reasons cited for loss of varieties

Reasons for loss	'74–'83	'84–now	Total %
Low productivity	2.3	7.4	9.7
Varietal growth characteristics	8.6	4.0	12.6
Pests and disease susceptibility	6.8	1.2	8.0
Lack of enough land and seed	0.6	4.0	4.6
Introduction of new variety	1.8	6.3	8.1
Marketability	9.3	6.3	15.6
Moisture stress	2.0	4.2	6.2
Problem in cooking	1.8	0.6	2.4

In Ethiopia, there is only one public seed enterprise and the capacity of Ethiopian Seed Enterprise (ESE) in terms of farmer demand is low. The ESE finds it difficult to provide seed cheaply and in time. Because the ESE concentrates on crops that pay well, important indigenous crops such as *tef*, *ensete* and *anchote* as well as horticultural seed are either not produced or do not receive enough attention. Meanwhile, new private foreign enterprises like Pioneer Hi-breed only concentrate on crops like maize (Agrawal and Worede, 1991).

Common bean is an established component of Ethiopian agriculture. It is grown both for export and food. Farmers in the region use beans as a cheap source of protein, a cash crop, an emergency crop in times of crop failures, a supplementary animal feed and as fuel. Beans are used in crop rotations, intercropping and alley cropping systems (Mekbib 1997). As the informal bean seed system had been largely ignored by breeders and seed technologists, systematic and quantitative data on farmers' seed systems was needed for an integrated approach to bean seed dissemination, management and protection.

The survey

In studying the informal bean seed system, a survey was carried out of 176 farmers in Eastern Ethiopia. Beans are produced in every economic class within the farming community. Farmers indicated the characteristics of good quality seed (see Table 1). Characteristics included physical purity, seed characteristics, growth characteristics, performance, and seed health. Nearly 40% of the farmers mentioned a combination of all five criteria for good quality seed. Interestingly, when looking at combinations of various characteristics physical purity, size, shape and colour were considered more important than growth characteristics and performance.

The economic situation of the farmer had a significant effect on the amount of land planted with different varieties. Many varieties have been lost either deliberately or accidentally. Accidental loss in the period 1974-1983 was 4%; by 1999 it had reached 8%. Deliberate loss remained constant at 20% over the period 1974-1999. Lack of marketability and growth characteristics were cited as major reasons for loss of varieties (see Table 2).

Farmers mentioned various initial seed sources: most were purchased or received as gifts and, to a lesser extent, through loans and exchange. When there was a good crop the farmer switched to own stock. Reasons for changing from one variety to another are given in Table 3. Seeds are not often bought, and poor farmers in particular rarely buy seed. Bean seeds are generally purchased every other year. In case of the Coloured Bean and White Pea Bean varieties, 6-8% of the farmers had never bought seed and had used their initial seed stock. Farmers control seed quality by sorting and selecting at different stages.

The informal bean seed system is cheap, accessible to all farmers, and relies on indigenous knowledge of seed production, quality control, processing and marketing. However, farmers know little about seed-borne diseases. Also, there is a lack of landraces in the region. These factors negatively affect the informal seed system. To improve performance, the formal seed system should play a complementary role by providing new varieties and farmers should be trained to recognising seed-borne diseases.

The survey has allowed a clearer characterisation of local seed systems: the varieties grown, their characteristics and the way seed networks function. These insights are opening up the way for an integration of the formal and informal seed systems by introducing new varieties into the local seed system, in situ conservation of varieties with good seed characteristics, and the development of local seed business.

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Table 3: Reasons given for changing from one variety to another

Lack of seed	14.5%
To restore bean production	9.4%
When the whole harvest is used for home consumption or sold	26.3%
For maintenance of the original seed	20.8%
When the seed is destroyed by biotic or abiotic causes	26.6%
To increase yield	8.6%
To maintain quality and purity of the seed	4.3%

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Multifunctional biodiversity in Latin American traditional agriculture

Miguel A. Altieri

Traditional agroecosystems, based on the cultivation of a diversity of crops and varieties have allowed traditional farmers to maximise harvest security using low levels of technology and with limited environmental impact. Many Latin American agroecosystems are small-scale, geographically discontinuous, and occupy a variety of ecological niches. Richly diverse, site-specific farming systems are well adapted to local conditions.

Plant diversity, generally in the form of polycultures and agroforestry patterns, characterises traditional farming systems. Planting several species and varieties of crops in a minimum risk strategy stabilises yields in the long term, ensures dietary diversity, and maximises returns. Traditional multiple cropping systems provide 20% of the world food supply (Francis 1986). In Latin American tropics, most crops are grown in polycultures and produce a higher combined yield than under monoculture conditions (Francis 1986). Yield variability in cereal/legume polycultures is also low.

Many traditional agroecosystems are located in centres of crop diversity and contain populations of variable and adapted landraces as well as wild relatives of crops. Traditional agroecosystems constitute in-situ repositories of genetic diversity (Altieri & Merrick 1987). Considerable documentation exists on systems where farmers, planting multiple varieties of each crop, provide both intraspecific and interspecific diversity and enhance harvest security.

Tropical agroecosystems consisting of agricultural and fallow fields, complex homegardens, and agroforestry plots often contain more than 100 plant species per field. Most diverse homegardens are in reality a collection of domesticated and semi-domesticated plants where perennials like fruit trees are conspicuous features. Homegardens are similar to a tropical forest, with diverse species and a layered configuration.

Agroecosystems and nature

Most studies of traditional agriculture focus on the productive units where crops are grown. This ignores the fact that many farmers utilise, maintain and preserve areas of natural ecosystems (forests, hillsides, lakes, grasslands, streams, swamps) which provide valuable food supplements, construction materials, medicines, organic fertilisers, fuels, and religious items. Crop production units and adjacent ecosystems form a continuum where plant gathering, fishing, and crop production take place.

Many peasant societies consider agriculture to be part of a larger system of land use. For the P'urhepecha Indians of Lake Patzcuaro, Mexico, for example, gathering is part of a complex subsistence pattern based on the multiple use of natural resources (Caballero and Mapes, 1985). They use more than 224 species of wild native and naturalised vascular plants for food, medicine and fuel. Similarly, the Jicaque Indians, (Central Honduras) use over 45 local plant species for their domestic needs. They use slash and burn techniques to grow maize and cultivated fields are widely spaced throughout the forest. While travelling between fields, the Jicaque collect edible wild plants (Lentz, 1986).

Links

When agricultural development takes place in a natural environment, it tends to result in a heterogeneous mosaic of varying types of habitat patches. The bulk of the land is intensely managed and frequently disturbed for agricultural production. However, borders and strips between fields, roadsides, and adjacent natural areas is intensely managed while wetlands, riparian corridors, and hillsides are left in a relatively natural state.

Coffee farmers in Latin America typically integrate many different fruit, fuel and fodder trees into their farms. These give shade and provide a habitat for birds and animals. In Mexico, shade coffee plantations support some 180 species of bird. Some of these are important in pest control and seed dispersal.

Where traditional farming predominates, the minimal use of industrial inputs has produced varied, highly heterogeneous landscapes - possibly more heterogeneous than would exist naturally. In such environments, patches of natural and semi-natural ecosystem included in the landscape can become an agroecosystem resource and help preserve the integrity of natural ecosystems. Many small-scale agroecosystems are designed and managed to be friendlier to native species.

Conclusions

Learning how to combine environmental and productive functions in managing agriculture will require the input of agroecologists, ethnoscientists, conservation biologists, and landscape ecologists. Unless ecologically sound management practices are adopted multifunctional agriculture will be impossible.

By adopting a multiple-use strategy, indigenous farmers manage a continuum of agricultural and natural systems and ensure multifunctional agriculture. Recent research into diversified cropping systems based on intercropping and agroforestry has revealed new evidence to show that these systems are more sustainable and more resource conserving (Vandermeer, 1995). Data also shows that plant biodiversity has a positive effect on the stabilisation of agroecosystem processes.

NGO-led agroecological field projects have demonstrated that traditional crop and animal combinations can often be adapted to increase productivity when the biological structure of the farm is improved and labour and local resources are used efficiently (Altieri, 1995). In fact, most agroecological technologies can improve traditional agricultural yields and enhance general agrobiodiversity.

Basing a rural development strategy on traditional farming, ethnobotanical knowledge and elements of modern agroecology assures continued use and maintenance of valuable agrobiodiversity. It also allows for the diversification of agricultural areas ensuring a variety of ecological services vital for food security, natural resource conservation, economic viability, climate amelioration, cultural preservation, and community empowerment. Many grassroots rural development programmes in Latin America now aim at maintaining and enhancing biodiversity in traditional agroecosystems. The challenge is to promote policies and institutional partnerships that allow an up-scaling of ecologically based agriculture so that its multifunctional impacts can be spread across the rural landscapes of Latin America. ■

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Women guard the sacred seeds of biodiversity

Vanaja Ramprasad

GREEN Foundation, based in Bangalore, Southern India, strives to conserve the agricultural biodiversity that is based on local culture and knowledge. Activities to collect, multiply, characterise, conserve and distribute traditional crop varieties like millet, gram, lentils, fingermillet, rice and sorghum take place in 50 communities. GREEN's Biodiversity Conservation Centre is located in Thalli, a rural area in Karnataka and here subsistence agriculture is researched and documented. Activities include food processing, annual seed fairs, group training, documentation, developing publications such as seed catalogues and strengthening indigenous knowledge. This article deals with some aspects of the complex traditional seed system that is still existing in many regions where subsistence 'agriculture' is dominant.

Wild plants and food availability

An agricultural calender was drawn during a participatory survey amongst women farmers. This calendar was compared with seasonal food availability, the jobs done by men and women and the rituals performed. The calendar showed that during the main rains reserves of pulses and cereals were usually low and the entire farming community depended on the biodiversity of wild plants for supplies of fruits, vegetables, tubers, and shoots. For farmers, biodiversity manifests itself in cultivated foods as well as wild plants. Women in particular have a special knowledge of wild plants.

Food diversity is being threat as traditional genetic materials are replaced and natural resources that act as reservoirs of biodiversity are affected. This trend poses a particularly dangerous threat to people who depend on natural resources for survival for several months of the year.

Ceremonial seed germination test

Women play a major role

The survey clearly illustrated the important role women play in handling and conserving seeds. Seed selection by women is a continuous activity and starts the moment the crop comes into flower. Working in the fields, they observe the plants and decide which seeds to select. They identify plants of good quality on the basis of size, grain formation and their resistance to pests and insects. To cover the risk of drought, women select enough seed to see them through two seasons. They also decide on which method of preservation should be used.

Rituals are essential

Seeds are seen as the sacred carriers of life and are therefore surrounded with ritual. These ritual also have their functional aspects. Before seeds are taken into storage, for example, women ritually evoke the forces essential for a good crop during the coming growing season. This ritual is an important part of seed preservation. In it, water is symbolised by a winnowing pan, protection from pests by certain leaves and soil fertility by cow dung. Weeds are symbolised by grass. Some of the leaves used in the ceremony have insecticidal properties. Lakkli leaves *(Vitex negundo)*, for example, are used when paddy seeds are stored and neem leaves are used as an alternative when lakkli is unavailable.

In some cases paddy seeds are mixed with the seeds of field bean *(Dolichus lablab)* and mustard to help preservation and *Tur* is mixed with sand for the same reason. Sometimes seeds are stored above the kitchen where the smoke helps to keep the pests away.

Ceremonial germination test

Before sowing, a germination test or *Negilu Pooje* will be conducted. In areas where finger millet is grown this test takes place at *Ugadi* or the Hindu New Year. A traditional, sacred combination of nine seed varieties of cereals, pulses and oil seeds are put in a shell together with good manure. These are worshipped and inspected after seven days. If there are only a few shoots or these are too small, the seeds of that particular variety are considered unsuitable for the next agricultural season. The farmer will then exchange or borrow seeds to replace them. It is considered improper to buy seeds with money.

Sowing sacred seeds

Just before they are sown the women take the seeds to the house deity where they are worshipped. On their way to the field, the woman carrying the seeds will visit and make offerings to the seven village goddesses who are known as the 'Seven Sisters'. Women also worship the draft animals and farming implements used in sowing.

None of the above procedures are followed for the seeds of high-yielding varieties bought at the market. Local varieties are considered sacred whereas high-yielding varieties are treated as being impure. They are sent directly to the field where only the men are responsible for sowing them.

For a fuller version of this article see COMPAS Newsletter Vol 1-2, October 1999, pp 24-25.See also http://www.-etcint.org/compas_newsl.htm

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GREEN (Genetic Resource Energy, Ecology & Nutrition) is the bulletin published by GREEN Foundation providing an update on the activities of the organisation, important events and publications.

Cultivating Seed Links is a new CD-Rom produced by GREEN Foundation describing bio-diversity from an ecological, economic, gender and cultural perspective. In a highly informative way, using visual material and traditional Indian music, one can learn about biodiversity and the work of GREEN Foundation. Agro-biodiversity conflicts and on-farm conservation are also explained. Costs US$30.

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photo: Vir Singh

A general view of the Henwal Valley in Garhwal Himalaya, India: in situ conservation of genetic resources

Traditional agrobiodiversity re-introduced by farmers

Vir Singh

In 1989, large irrigated areas in the Henwal valley were planted in rotation with wheat and rice. Two varieties of each crop were used. A considerable amount of arable land in upper rainfed areas was also planted with soybean. Most farmers had made the switch to 'improved' cultivation practices. The valley, almost completely transformed, had been converted into a virtual experimental area for Government-sponsored agencies. They conducted experiments and demonstrations and farmers received 'tested' seeds of modern varieties with chemical inputs and 'improved' implements.

It was only a matter of time before this genetic uniformity revealed its weaknesses and destructive potential. In 1987-88, the valley was struck by an unprecedented drought followed by two years of pest infestation. The modern varieties, with their very narrow genetic base, were badly damaged and farmers experienced some of the worst days of their lives.

Indigenous varieties re-introduced

Farmers confronted the crisis of genetic vulnerability by collecting together the indigenous seeds that had almost disappeared from the valley. Initially, they collected seeds of 10 local rice varieties from remote rural areas and re-introduced them into their fields. These varieties performed remarkably but pest problems persisted even though the damage was less severe.

The following year, more farmers in the valley opted for indigenous varieties. Seeds produced during the first year were distributed to other valley farmers and another 35 indigenous rice varieties were collected and cultivated. By the end of the third year, a total of 110 local rice varieties had been re-introduced, dramatically increasing the genetic diversity in rice. By 1991, local rice varieties occupied nearly 90% of irrigated land in the valley.

The 'Save Seed Movement'

Farmers were satisfied with the results and relieved they could exercise some control over pests and unfavourable weather conditions. They launched the 'Beej Bachao Andolan' (Save Seed Movement) which spread throughout the Garhwal. The Beej Bachao Andolan searches, collects, re-introduces, tests, distributes, and popularises every indigenous variety of mountain crop available. So far, farmers have re-introduced 145 gentically distinct varieties of rice, 110 of kidney bean, 9 of rice bean, and 12 of amaranth.

Under the influence of modern agro-techniques, farmers in the valley had given up cultivating proso millet, pearl millet, and sorghum. These crops have now been re-established in their farming systems. The free exchange of seed within the community has also been revived and has proved to be a lifeline for traditional mountain agriculture.

Old and new varieties compared

The Beej Bachao Andolan keeps record of the performance of all local varieties and compares them with the so-called high-yielding varieties (HYVs) demonstrated by external development agencies. Results revealed that the average yield of local varieties of rice was significantly higher than that of HYVs. Thapachini, a widely cultivated local rice variety, produced as much as 5400 kg/ha. In comparable conditions, but with additional recommended amounts of chemical fertiliser, Saket-4, the best HYV, produced 4100 kg/ha. The GB Pant University for Agriculture and Tecghnology conducted the experiments with HYVs.

HYV varieties produced more husk than local varieties (grain husk ratio of 1.5:1) which is of little use to mountain farmers. Local varieties, however, produced more edible rice grains and had a grain-husk ratio of 2.6:1. Farmers in the mountains do not only grow crops for grain. Straw is an equally important by product and is used for feeding livestock. The straw-grain ratio is one of the factors that make local varieties popular among farming communities. Claims are also made for the rapid development potential of HYVs. However, experiments have showed that in this feature too, local varieties outclass HYVs.

It was because of the excessive external intervention that put emphasis only on HYVs of two major foodgrain crops that led people to believe into 'miracle' seed. Once the farmers experienced the ecological vulnerability and other problems associated with the 'miracle' seeds they started opting out of the Green Revolution type of agriculture and switch over to their biodiversity-based agriculture that has been tested by them over millennia.

Recognition of the role of farmers

For generations, biodiversity in mountain regions has been in the hands of traditional farmers. Traditional systems of management and traditional knowledge have been the way farming communities have developed and adapted their livelihood systems to specific local conditions. Recognising their unique role would help stimulate farmers' interest in conservation activities. Projects on sustainability-oriented biodiversity management could encourage them to set up their own conservation movements, experiments, demonstrations, and extension services, and would also help farmers to strengthen their creative networks. ■

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Seed shortages threaten organic farming

In 1997, following an initiative by several Dutch organic food merchants, the Louis Bolk Institute started work on the Sustainable Organic Plant Breeding project (SOPB). One of the results of that project was *Stichting Zaadgoed*. Set up to stimulate and increase the production of organic plant breeding material, it also concerns itself with policy and ownership issues. Through its Dutch, European (European Initiative for Organic Seed) and international network *Stichting Zaadgoed* stimulates the flow of information on seed breeding activities including the on-farm preservation of organic seed. It organises workshops, and conferences, coordinates research and maintains an international network of information on organic seeds. It ensures that information lists, seed databases and addresses are regularly updated, lobbies for organic plant breeding at the national and international level and seeks amendments to the existing legislation on intellectual property rights, registration criteria, patenting, and licencing to stimulate the transfer of seed and plant material.

Dilemas in organic agriculture

Stichting Zaadgoed encourages the development of an organic plant breeding programme. As the demand for organic products grows, stricter controls are being introduced to ensure integrety at each stage in the organic agricultural chain. In 2001, EU legislation will be enforced to guarantee the authenticity of organic products from seed breeding to food processing. This has highlighted a dilema. Organic agriculture cannot satisfy the demand for more and varied seed bred in an organic environment. At the same time traditional seed sources are drying up as conventional seed merchants move into the lucretative market of genetically modified plant breeding material, and gene-tech seed - unacceptable in organic farming - takes hold of the world's major food crops.

Unmonitored and modified

The Netherlands Association of Organic Traders maintain that, unless action is taken, it will become increasingly difficult to find non-genetically modified seed. The danger of the unmonitored, widespread use of transgenic seeds was emphasised in a recent case brought against the US Environmental Protection Agency (EPA) by IFOAM and Greenpeace. The plaintives alleged that the EPA had failed to carry out environmental impact studies on seed modified with the *Bacillus Thuringiensis* (Bt) toxin although US farmers plant 1.2 million hectares of Bt cotton, maize and potatoes annually. They argued that, in undermining biodiversity and narrowing the genetic basis of the world's major food crops, an unmonitored, market driven, transgenetic seed industry was a threat to public health and food security as well as to organic agriculture.

Investors choose gene-tech

Modern plant breeding and gene technology answer the needs of conventional agriculture and require heavy, long-term investments. Plants must be high yielding, uniform and capable of growing in the highly conditioned, large-field environment of chemical pesticides and fertiliser. Small seed companies cannot compete with the multinational conglomerates that dominate this market and recent seed company mergers have resulted in the disappearance of many of them. As the types and varieties of seeds available decline, concern about the sustainability and ethics of modern seed breeding practices grow. In this context the present Dutch organic plant breeding programme is taking shape.

Sustainable organic plant breeding

In the Netherlands organic food merchants intervened directly in the problem of organic seed breeding. Their initiatives took place in the favourable policy climate of the government's commitment to protecting the consumers right to GT-free food. Their approach to the Louis Bolk Institute - an independent research organisation with considerable experience in organic and biodynamic agriculture - lead to setting up SOPB and *Stichting Zaadgoed*.

Diversity

The Louis Bolk Institute supports the definition of GMO as "organisms in which the genetic material has been altered in a way that does not occur naturally by mating or natural recombination". It views the genetic modification of DNA as a one dimensional and drastic intervention in a plant's genetic make up that destroys its connection with the natural environment.

By contrast organic farmers look for natural reproductive ability, an ability to adapt independently to the environment, and genetic diversity with respect for natural species authenticity and species characteristics in their seeds. They prefer to work with a mixture of varieties to ensure sufficient diversity and economically feasible yields without exhausting the natural resources of the farm and its surroundings. Thus they require fairly heterogeneous varieties that are not only capable of adapting to different regional soils and climates but which are also resiliant to pests and diseases.

Setting up organic plant breeding

Any organic plant breeding programme will be heavily dependent on farmers' knowledge, initiative and participation. Encouraged by the Louis Bolk Institute, variety groups, regional extension groups and national crop groups have been set up to encourage communication between breeders and farmers. In such groups farmers as well other sector representatives, consumers organisations, research institutes, traders and conventional and organic seed companies can share experiences and participate in trial and variety assessments. Questions, needs and bottlenecks can be explored with other members of the chain and it becomes easier to tackle issues such as breeders rights and registration with the National Varieties List. Such participatory approaches, however, are still new to many in the North and there is much that can be learned from experiences of participatory plant breeding available in the South.

SOPB and *Stichting Zaadgoed* want to encourage many different types of breeding programmes including organic programmes set up by conventional breeders, programmes managed by specialist organic breeding companies and programmes in which organic farmers carry out selection *in situ* and in consultation with professional (organic) breeders. They maintain that genetic diversity can be preserved and developed if there is adequate diversity in breeding companies and programmes and if monitoring systems are set up to ensure seed and plant material are propagated in accordance with organic principals.

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KRRS farmers protest outside Cargill, Amsterdam, May 1999

Green Caravan Challenges Gene Giants

Photo: Bangladesh People's Solidarity Centre

"Seeds are the basis of every farmers existence. To have free use of their own seeds of different varieties gives farmers a basic economic independence and ensures that their crops can adapt to changing environmental circumstances" Prof Mahanta Nanjundaswamy, Karnakata State Farmers Association (KRRS), India.

The green shawls and banners of KRRS farmers contrasted sharply with Cargill's austere harbourside building when members of the Intercontinental caravan launched their protest against the growing power of the agrarian multinational last Spring in Amsterdam. Several hundred farmers from all over India used their savings, community funds and farmers' union money to make the journey to the West.

To Professor Nanjundaswamy, president of KRRS, the Intercontinental Caravan (ICC) was an attempt to bring Western decision makers and public closer to the realities facing small farmers in the South. They brought "to the North the views of the South on systems of exploitation imposed by Western governments, the WTO, and multinational corporations" because their livelihoods were at stake.

Travelling in buses equipped with telephones and email they brought across their political and ethical message with emotional force as they lobbied Cargill and Pioneer Hi Breed in the Netherlands, Monsanto's Technical Centre, in Belgium, OECD in Paris, WTO in Geneva and the EU in Brussels. The climax was a mass protest at the G8 conference in Germany.

Seed satyagraha

For many Indian farmers Monsanto epitomised the stranglehold multinational conglomorates have over agricultural resources in the South. The way genetically modified products and seeds were being introduced into India raised issues of permission, information, monitoring and control. These had largely been ignored until Operation Cremate Monsanto was launched by the KRRS and 28 trial fields of GM cotton were burnt. The Ministry of Agriculture has now banned further Monsanto trials. For Kumud Chowahary who left her family and farm in Gujarat to join the caravan the problem is simple and personal: *"Kill Monsanto before it kills families like mine".* Others like Lal Shankar Upadhyaya, Vice President of Gujarat Khedut Samaj sketch a wider context, the *"fight of indigenous agriculture and market systems against Northern dominated gene technology and free market."*

Gene giants

The Farmers Caravan protest coincided with a spate of mergers in the gene industry that further concentrated technologies and patent rights in the hands of a few gene giants. Monsanto's portfolio illustrates the type of dominance protested by the Indian farmers. Ownership of Delta and PineLand with patents for terminator technology; ownership of Roundup (25% of US soyabeans produced from Roundup ready seed); control of 45% of the US corn seed market; grain trading and food processing capacity through takeover of Cargill and, through Unilever shares in the hybrid wheat market. In 1998, when Dupont bought Pioneer Hi-bred the Wall Street Journal observed that the US seed industry had been effectively divided between Dupont and Monsanto. As the gene giants grow, critics point out, public sector seed breeders disappear and farmers have fewer choices.

GM issues

Indian farmers, aware of the consequences of these changes, want a public debate on how to monitor GM crops. Problems include cross-pollination, antibiotic resistance, and resistance to broad-spectrum herbicides and pesticides. The potential dangers of GM maize, soya and potato with high residues of amikacine and, glyphosate in animal food must still be investigated and the monopoly of agricultural resources allow companies to further control farmers choices through patents, contracts and crop and pesticide packages.

Bt Cotton

Bt cotton was major issue for Indian ICC participants. Bt cotton produces a poison that kills pests but, as farmers in Southern India found, pests can develop such resistance that even 50 times the recommended amount of pesticide is ineffective. Crop failure, inability to repay loans and suicides were reported. In the US similar resistance was reported. 50% of GM cotton was damaged by boll weevil and there was no increase in production. Further, no steps were taken to prevent cross- pollination.

Act now

The need for legislation, monitoring and information on GMO is being stressed by an increasing number of organisations and scientists. This year, for example, both Nature and the Lancet have presented research findings critical of GMOs; farmers in America are preparing legal action against Monsanto for not warning them sufficiently of the possible risks of GM seed and in Brazil farmers have rejected GM soya. At the same time food producers and supermarkets across Europe are announcing they will not use or stock foods containing GM material. This Spring, with their Intercontinental Caravan, the farmers from India and Bangladesh brought these concerns to the main centres of European policymaking and industry. In meetings, interviews and direct action they made it clear that it was time for an urgent reappraisal of the effects of GMOs on the safety and security of the world's food supply and the ecology and culture of its farming communities. ■

Marilyn Minderhoud, ILEIA

Biodiversity in agriculture: policy issues

Biotechnology - a bundle of techniques used to exploit life forms and processes - is as old as the first loaf of leaven bread or the transformation of milk to yoghurt. What is dramatic about modern biotechnology is the technical sophistication that allows the selective manipulation of genetic material and the transfer of genes, not only between varieties but also between all plant, animal and microbial species. Proponents argue that biotechnology will solve mankind's food, energy, medical and environmental problems. However, concern centres on the fact that transnational food, pharmaceutical and chemical corporations (TNCs) now control biotechnology research.

GRAIN

Former agrochemical giants have converting themselves into "life-science" companies, eager to broker between humanity and nature. Since 1996, the sector has spent some US$ 34.3 billion to ensure control of the seed market which is currently worth US$ 30 billion (Assinsel's World Seed Statistics). TNCs develop uniform products that give high returns but produce monocultures, homogeneous farming practices, severely decreased biodiversity, and far-reaching environmental damage. In biotechnology, the rush towards private sector collaboration has lead to the reorientation of public R&D programmes to meet the needs of agroindustry while ignoring the diverse interests of wider society.

One of the hottest items in agricultural biotechnology research, for example, is the development of herbicide resistant crops. Between 1996 and 1998, the number of herbicide resistant, genetically engineered crops rose from 23%-71%. In the same period, however, the proportion of genetically engineered crops with insect resistance traits decreased from 37% to 28% and the number transgenic crops with other agronomic traits (virus or insect resistance) fell from 40 to 1%. The biotech industry claims that herbicide resistance makes it possible to reduce the adverse effects of broad-spectrum herbicides (which kill anything green). One obvious effect has been the stimulation of stagnating farm chemical sales and the encouragement of further dependency. Through patents and the development of plants with sterile seeds, the biotechnology industry tries to prevent farmers and competitors from reproducing genetically modified seeds.

Patents for maize

Recent changes in maize illustrate these trends. One of the world's main biotechnology reviews, Derwent Biotechnology Abstracts, reported in 1998 that 333 patents for transgenic maize plants had either been applied for or granted. An examination of patents indicates that R&D efforts are focusing on (Table 1):

- Miscellaneous genetic engineering methodologies including the use of promoters, the control of gene expression, or technologies with multiple practical applications.
- Agronomic characteristics particularly pest (mainly insect) resistance with nearly two-fifths of the patents covering the use of the crystal protein of *Bacillus thuringiensis*. Herbicide tolerance, disease resistance and environmental stress - mainly drought and salinity – are traits much favoured by patent applicants.
- Altering the plant's reproduction. Pioneer has led efforts to obtain male-sterile maize plants that would reduce the cost of producing maize hybrids. Considerable effort has been invested in altering flowering. Apomixis, or reproduction through asexual seeds, has the potential to get small farmers to switch to high-external input dependent hybrids by allowing them to re-plant their seeds with no loss of hybrid vigour. The inclusion of this reproductive mode in maize has been patented by three public institutions: USDA, CIMMYT and ORSTOM.
- Product quality or content of transgenic maize. Maize starch is transformed into food and industrial products including the high fructose syrup used by beverage companies for sweetening and ethylene for petrol. Modifying starch content is, thus, one important research focus. Pioneer Hi Bred, DuPont and Monsanto lead seed company efforts to turn maize into a better source of protein for cattle and research is also being carried out into the lignin, vitamin and phitases content of maize. Maize is becoming a "pharmactory" as patents are taken on maize plants that produce vaccine and human proteins.

Patents are concentrated in a small number of corporate hands (e.g. Du Pont/Pioneer 17% (55 patents), Novartis 11% and Monsanto 8%). By March 1999, after an unprecedented wave of corporate mergers and acquisitions, 47% of the 333 patents on maize now belong to the 6 agrochemical

Table 1: 362 claims made in 333 patents applied or granted on transgenic maize.

TRAIT	CLAIMS	%	LEADING COMPANIES
Agronomic characteristics	162	45	NOVARTIS
Pest resistance	53	15	Novartis
· Not Bt	31	9	DuPont/Pioneer, Novartis, Monsanto
· Bt	22	6	Novartis
Disease resistance	58	16	Novartis, DuPont / Pioneer
· Bacterial and general	22	6	Novartis, DuPont / Pioneer
· Fungal resistance	19	5	DuPont / Pioneer, Novartis
· Viral resistance	17	5	Novartis
Herbicide tolerance	32	9	Novartis
Stress resistance	19	5	Japan-Tob, Monsanto
Plant reproduction	28	8	DuPont / Pioneer
Male sterility	17	5	DuPont / Pioneer
Altered flowering	9	2	Univ. of California, Cold Spring Harbor Lab.
Apomixis	2	1	ORSTOM-CIMMYT, USDA
Product quality	82	23	DuPont / Pioneer
Starch content	36	10	DuPont / Pioneer, Monsanto
Protein content	21	6	DuPont / Pioneer
Oil content	16	4	DuPont / Pioneer, Monsanto
Other content	9	2	Miscellaneous
Crop improvement	10	3	Miscellaneous
Genetic engineering techniques	57	16	Novartis, DuPont / Pioneer, Monsanto
Others	23	6	
Total traits	362		

giants that control agricultural genetic engineering. A group of smaller companies and public institutions – including universities – also have important claims on maize. In total, the top 19 patentees control 66% of all patents applied for or granted on transgenic maize.

Terminator seeds

Novel biological means have also been used to gain corporate control over the first link in the food chain - the seed. New biotechnologies, controlled by corporations, allow the engineering of crops that kill their own seed in the second generation making it impossible for farmers to save and replant. The Rural Advancement Foundation International (RAFI) has dubbed this genetic sterilisation invention "Terminator Technology" and has analysed its serious social, economic and environmental implications (RAFI 1998). Companies are now working on controlling several important genetic traits with a number of external chemical catalysts. The six, transnational agroindustrial firms that control almost 100% of the biotech transgenic seed market will dominate these new technologies. Their ability to insert and externally manipulate vital DNA sequences within crops - and possibly insects and livestock - threatens the sovereignty of nations over their agriculture and biological resources.

Intellectual property rights

Can genetic engineering feed the world or should it be banned? As this heated debate gathers momentum another issue is waiting to explode. Should biodiversity - key resource of the billion-dollar biotech industry and basis for the survival of many in the Third World - be patentable? At the moment industrialised countries allow scientists to claim legal rights to genes and indigenous knowledge plucked from the biodiversity-rich tropics. The rationale for this "biopiracy" is that what comes from the rainforests of Ecuador or farms in Sri Lanka is "natural" and unpolished, while that produced in a lab is "a product of science" and should be patented as an invention.

The battle for and against patenting life - plants, animals, and now human genes – is a fierce one. Arguments against life patents centre on ethical and religious concerns, ownership, cost, and definitions of innovation. The Uruguay round of the General Agreement on Tariffs and Trade (GATT) negotiations was a particularly tough struggle. It resulted in agreements on intellectual property (TRIPS) and the establishment of the World Trade Organisation (WTO) to implement them. TRIPS (Trade-Related Intellectual Property System) requires countries to provide private ownership rights on plant varieties or face hostile action from trading partners. The forthcoming TRIPS review will be the next challenge in the life patents battle.

Delegations from developing countries assert their right to protect their people's biodiversity and indigenous knowledge and argue that TRIPS should allow countries to exclude these from intellectual property law. The conflict between the Convention on Biological Diversity (CBD) and TRIPS has escalated fast particularly in Southern countries. The CBD insists that intellectual property rights (IPRs) should not run counter to the Convention's objectives, namely the conservation and sustainable use of biodiversity.

Problems with TRIPS

TRIPS is problematic. First, studies show that IPRs encourage genetic erosion in agriculture in several ways. They stifle the flow of information and germ plasma; promote uniformity in breeding and exclude farmers from the commercial seed market. TRIPS could be undermining the CBD.

Second, the CBD is rooted in the principle that benefit from using genetic resources should be shared. However, TRIPS promotes the privatisation of genetic resources, not benefit-sharing.

Third, CBD supports the rights of local communities, while TRIPS supports the rights of formal scientists and TNCs. In recent months, countries in Africa, the Caribbean, Europe and the Pacific have made clear they want CBD to take legal precedence over TRIPS. This means changing the TRIPS. Agreement to comply with CBD, not the other way round, as Northern delegations would like.

If the amendments demanded by the United States government are carried, patenting plants and animals will have to be legalised in all WTO member states. All members would then have to implement both TRIPS and the 1978 UPOV Act (Union de Protection d'Obtention Végétale), which gives breeders exclusive ownership over the commercial use of varieties for the purpose of production and sale.

Patenting life is unacceptable to many in both the North and South. They cannot compromise on this principle. Many NGOs wish that governments were less obsessed with IPRs and more prepared to encourage socially responsible research through fiscal schemes and incentives for community-controlled public research. These would not preclude the sharing of knowledge and would be far more democratic and supportive of sustainable development than IPRs.

The "Biodiversity out of TRIPS" position complements the campaigns of those farmers' organisations that argue that agriculture should be taken out of the WTO. Biodiversity and agriculture go hand in hand. As Weeraphon Sopa of Thailand's Forum of the Poor stated at the recent Asia-Pacific Economic Cooperation summit, "Industrial agriculture and patenting of seeds take away the people's freedom to produce their own food." Trade liberalisation agreements on agriculture, investment and IPRs have to be resisted at both regional and sub-regional level: APEC, FTAA (Free Trade Agreement of the Americas), in South Asia, in Central America within MercoSur, and at the global level (WTO, OECD, the World Bank and the UN).

Achievements

The increased awareness of the importance of biodiversity and the role of local communities in its conservation and use is an important achievement. National sovereignty over biodiversity and community rights now needs to be reinforced. TRIPS is a cunning trap: it invites countries to devise *sui generis* legislation in a seemingly open manner but it is clear that any *sui generis* law tabled as TRIPS compliance has to be an intellectual property system. There have been considerable achievements in developing community rights: the OAU's Model Law for Africa; the Philippines' Community Intellectual Rights bill; the Indigenous Peoples' Rights and Traditional Medicine Acts; Thailand's three community biodiversity rights bills, and the new call for a Mesoamerican and Caribbean Convention for the Protection of Community Intellectual Rights. While not yet perfect, these show that alternatives are emerging and they should not be curtailed by calls for industrial-style plant breeders' rights.

Conclusion

Biodiversity conservation and improvement is an integral part of daily life for those practising LEISA. By definition, LEISA is only sustainable if it incorporates the widest variety of soil, plant and animal life, and works to strengthen indigenous knowledge and management systems based on local biodiversity. This diversity allows local farming systems to recycle nutrients, reduce pest and disease problems, control weeds, and handle climatic stress while producing nutrient-rich foods and meeting other livelihood needs. Diversity - both biological and cultural - is basic to these farming systems. Any national policy environment that seeks to sustain this diversity will need to exclude patent-type legislation on plants and animals, broaden democratic control over biotechnological research and introduce anti-trust legislation to limit the power of corporations seeking to control the food system.

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The challenge of collaboration in the management of crop genetic diversity

Crop genetic diversity is only one part of total agrobiodiversity. It refers to the diversity of crops and the diversity of varieties within crops (see Box). Crop improvement has always played a central role in agricultural development. It is now widely recognised that crop and seed improvement in recent years has resulted in both success and failure (Tripp 1996).

Conny Almekinders and Walter de Boef


photo: Conny Almekinders

Improved varieties of the major food crops have been particularly successful in more favourable and uniform agricultural areas, such as the irrigated rice systems of South-east Asia. In these areas, farmers replaced their diverse local varieties with a few genetically improved varieties. These required an increased application of chemical inputs. The combination of reduced crop genetic diversity and the application of fertilisers and chemical crop protection has made these systems vulnerable and in many cases unsustainable.

In more marginal and heterogeneous areas, farmers still manage important portfolios of crops and varieties. In some areas farmers adopted improved varieties in one or more crops to partially replace local varieties - sometimes even increasing the number of varieties grown. In other areas, particularly the most marginal and heterogeneous ones, improved varieties have not brought much gain.

Farmers in these environments have benefited little from agricultural development. In many countries, national agricultural system of research and development are seriously hampered by shrinking funds and this has made it more difficult to address the diverse needs of farmers in resource-poor areas.

At the same time global political and legislative frameworks obstruct the free availability and use of genetic diversity (GRAIN p9). The forces behind developments in biotechnology, patenting, and the commercialisation of genetic resources are not driven by a concern for the development of local farming communities and the influence of multinational companies seriously threaten the way farmers use their genetic resources.

Pioneering farmers, researchers and development workers are looking for alternative ways to improve crops and seeds. By restoring diversity farmers become less vulnerable to pests and diseases, inputs can be reduced and household needs can be met more easily. Diversity also increases farmers' resilience to unexpected environmental and economic change.

This issue of the ILEIA Newsletter presents a range of such initiatives. One of the lessons to be drawn from them is the similarity in their focus: they all address the diverse needs of farmers in varied and location-specific conditions. Another lesson that emerges from these experiences is the need for collaboration between farmers and professionals.

Two systems

Below, we describe the use and management of plant genetic resources (PGRs) from an institutional perspective (Fig.1). This model proceeds from the farmers' role. We also consider an 'institutional system' of PGR management. The two-system model is a simplification of reality that varies from place to place and from crop to crop. It also varies between rich and poor farmers in a community and over time. We use a model to identify the opportunities and possibilities where the institutional system can support farmers because reality is so complex.

Farmers' system

Farmers have always been - and still are - the principal managers of agrobiodiversity. Farmers select crops (usually a diversity of species) and varieties (genetic variation within species) to plant, store and select seeds for replanting. (Figure 1).

Agrobiodiversity defined

Agrobiodiversity can be defined as that part of biodiversity on which man directly depends for food, fuel and fibre, including plants, animals, trees and other organisms that are of direct importance to agricultural production. There is 'planned' or 'intentional' biodiversity in the form of crops and varieties. And there is 'associated', 'incidental' or 'unplanned' biodiversity which includes pollinators, pests , parasites, predators, competitors and soil organisms. Following the definition of biodiversity (UNCED Convention on Biological Diversity, 1992), agrobiodiversity also encompasses (agro)ecosystem diversity represented by hedgerows, ditches, field margins, hillsides and humid depressions. These ecosystems within a farm are often essential for many of the organisms that interact with the crop or livestock.

Farmers producing their own seeds are involved in crop development (selection of the varieties and seeds) and the maintenance of genetic diversity. Simultaneously, they manage plant genetic resources in an integrated way and for a variety of purposes (Almekinders & Louwaars 1999). Farmers' selection, in combination with natural processes such as genetic mutations, crossings between varieties and wild relatives, and the influence of the natural environment, form a system of continuous crop evolution. The system has resulted in domesticated and cultivated varieties of a range of crop species (Harlan 1995; Wood 1999). Studies show that farmers' systems are complex and poorly understood (Longley and Jusu, p16; Soleri et al p18).

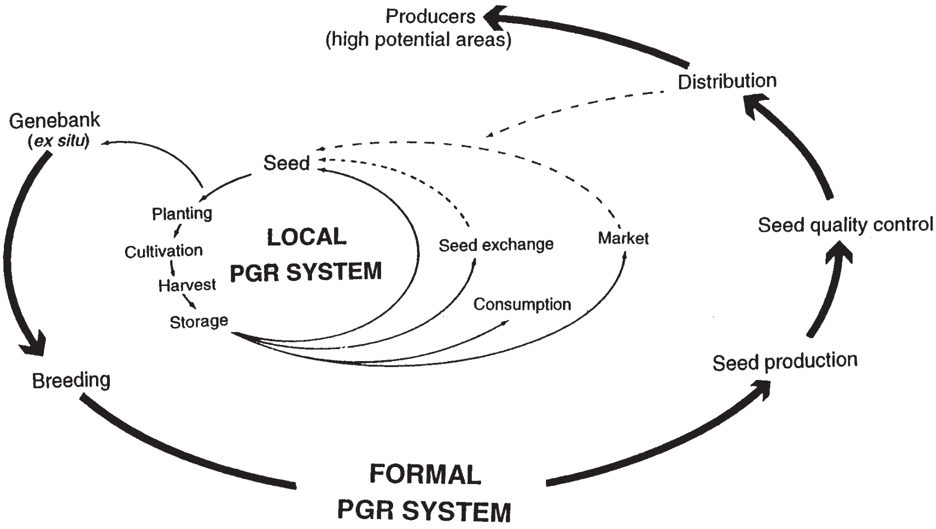

Figure 1 Farmers' and institutional system of management of plant genetic resources
(adapted from De Boef et al, 1997 and Almekinders & Louwaars, 1999)

The institutional system

The institutions involved in crop conservation (gene banks), improvement (breeding programmes) and seed supply form a PGR system that functions parallel to the farmers' system (Fig 1). The institutional system developed after 'genes' were discovered and knowledge about the possibility of manipulating plant characteristics through crossings increased (Kloppenburg 1988). Breeding became a specialised activity, taking place in research stations and carried out by breeder-researchers. Gene banks were set up as institutions to maintain collections of genetic material for ready supply to breeders. Seed programmes were designed to disseminate breeders' varieties to farmers in the form of quality seed. A chain-like organised institutional system developed with clear mandates and less integration than the farmers' system. This system successfully supported agricultural development in Europe and North America and was used as a 'blueprint' for agricultural development in the South. In this '-blueprint' the role of farmers in crop development, seed production and conservation has been totally ignored.

There are only two intentional points of contact between these parallel but separate systems. One is the collection-missions of gene banks to areas where farmers still grow many traditional varieties and where wild relatives occur. The second is during the distribution of improved seed from the institutional system to the farmers system. As mentioned earlier, the institutional plant breeding system has not been very effective where agroecological environments are more variable and the needs and preferences of farmers more diverse. As Ceccarelli (p36) explains, this is because farmers needs are not well understood, there are too few genetically uniform products for on-farm testing, and selections are made on station where conditions are quite different from the farms in the target environment.

Conventionally, seed programmes are required to supply seeds of improved varieties, ie the products of breeding programmes. In many situations these improved varieties are unattractive to farmers because of the mismatch between breeding and farmers' needs. In other situations they are only acceptable when accompanied by subsidised inputs. Conventional seed programmes are also handicapped by the, often good, quality of farmers' seed. Most farmers have no reason to buy new seeds unless they loose their seed, want to try a new variety or grow hybrid varieties of maize or vegetables. Seed programmes have overestimated farmers' interest in buying seed particularly in the case of self-pollinating and vegetatively propagated crops. Accessibility and the remoteness of agricultural production areas add to the problems of distributing seed from the institutional sector. Given these constraints it is not surprising that seed programmes - often copies of 'western blueprints'- were, in general, not successful.

Conservation or development?

The value of conserving the genetic diversity still cultivated in traditional systems is undisputed (Box 1 p29). It is becoming increasingly clear that farmers in both high and low potential areas will always need genetic diversity to buffer them against environmental hazards, changing market conditions and as insurance for the future. The challenge is to combine development with the maintenance of genetic diversity. The Green Revolution introduced improved varieties, which replaced a wide range of local materials, often reducing the number of varieties planted. For most breeders this is an accepted 'trade-off'. Selection of the best variety leads to the elimination of several others that perform less well. The selection of the best genotype in a variety (or elimination of the undesirable ones) reduces genetic diversity in a landrace. Because of this trade-off, many consider that the maintenance of genetic diversity cannot be combined with crop improvement.

Complementarity

Closer evaluation of the farmer's system and the institutional system makes clear that both have their own strengths and weaknesses. Actually, the two systems are quite complementary. The institutional system has had many opportunities to support the farmers' system (Almekinders & Louwaars 1999). History shows, however, that support will not be effective if offered as a standard package, unadapted to location specific conditions and preferences. The contributions in this Newsletter show the potential of decentralised approaches that build farmer and NGO participation. In the following sections we examine support in three conventional areas of intervention: seed supply, crop development and the conservation of genetic diversity.

Support to farmers' management

Better linkage between farmers' and institutional systems offer opportunities for combining the strengths of both systems. Through such linkages the needs of farmers' can be better addressed. There are several examples in this issue that show how such linkages increase the availability of suitable crop genetic diversity and farmers access to it. Such activities also increase the effectiveness of the institutional system by making it possible to address farmers needs more effectively. Key objectives of the Community Biodiversity Development and Conservation programme (CBDC) include exploring opportunities for linking the farmers' and the institutional system (p42).

Seed production and exchange

Use of seed produced on-farm or obtained from relatives, friends or other informal channels is by far the most important seed source for agriculture in developing countries, and is also important in many industrialised countries as well. 80% of all seed in developing countries are estimated to be produced on-farm. This percentage varies strongly from crop to crop tending to be high in crops such as barley that is self-pollinating and whose seed stores relatively well and much lower in crops such as beans or Bambara groundnut where diseases and local storage problems create difficulties. In maize, a cross-pollinating crop, the availability of on-farm seed depends very much on access to and adoption of improved open pollinated and hybrid varieties (Almekinders et al 1994).

Support to on-farm seed production can, for example, try to improved storage practices or seed health (eliminating diseased plants, selecting seed from healthy plants, promoting cultivation practices to suppress diseases). Another important area of support relates to variety maintenance, ie seed production and selection practices that maintain variety characteristics and genetic potential through positive and negative mass selection (Almekinders & Louwaars 1999). Such support activities are particularly useful for landraces. Seeds from these varieties are usually not available from institutional sources and quite often a mass selection can improve the yield of landraces.

Another important element of the local system is seed exchange between farmers (Mekbib p15) Seed exchange and spontaneous crossings between varieties and wild and cultivated relatives are the most important mechanisms ‘feeding’ the local gene pool with new materials and characteristics thus keeping it dynamic and diverse. Seed fairs, for example, are traditionally important events that facilitate seed exchange between farmers and communities and ensure access to a diversity of seed (Scurrah et al p27; Neuendorf p24; Abebe Demissie p30).

Crop improvement

The development of landraces from wild species by farmers’ selection illustrates that local crop development is an effective system of crop improvement. The weakness of the farmers’ system is also apparent. It is a dynamic system, with important genetic variation within and between landraces, but it is also a system with restricted opportunities for acquiring new exotic materials or genes. Introduction of resistance genes that are not available in the local gene pool almost inevitably requires support from the institutional sector. But, as Ceccareli (p36) notes, the introduction of varieties bred by breeders in a centralised breeding system does not necessarily give satisfactory or optimal results. Participatory plant breeding (PPB) approaches are a promising alternative in which farmers’ knowledge and capacity are combined with breeders expertise and access to materials. In this Newsletter Sthapit and Jarvis (p40) outline the relationship between *in situ* conservation and participatory breeding.

photo: Korstiaan Teekens

photo: Conny Almekinders

Conserving crop genetic diversity

The experiences presented in this Newsletters show that opportunities for supporting the agricultural development of small-scale farming do exist and does not have to involve the eradication of the diversity farmers already have and which they apparently need.

Farming households need genetic diversity for many reasons. With increased market integration, farmers tend to specialise, use less crop diversity and become out of touch with their cultural traditions. Since many of these are closely related to the rich use of biodiversity, maintaining local knowledge and culture can support the sustainable management of genetic and other resources.

The challenge now is to move from the innovative, but relatively isolated project activities of professionals and farmers to a situation in which these approaches are scaled-up and become normal practice in formal and informal, national and international institutions. This is not an easy challenge and requires the flexibility and willingness of professionals in government and non-government organisations to cooperate with farmers and other institutional actors. Contributions in this issue aim to share experiences that may serve as a basis for further experimentation and the implementation of activities that support the use of genetic diversity in farmers’ fields.

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Seeds for agrobiodiversity

Several controversial issues have emerged in the current public debate on the management of genetic resources in agriculture. These include genetic modification, patenting and the loss of agrobiodiversity. This Newsletter focuses primarily on biodiversity in crop production but not without looking at the other two issues as well. As an introduction to the subject, Conny Almekinders (guest editor for this issue) and Walter de Boef (p5) discuss the institutional setting of plant genetic resource management and the new developments taking place.

In market agriculture there is an enormous loss of biodiversity both on-farm and in the wider environment. In more favourable conditions, traditional agriculture, highly diverse in functions, crops and varieties (Altieri p14), has evolved into agrarian systems dependent on a few commercial crops and uniform varieties with a narrow genetic base. This development started with the introduction of the Green Revolution but continues today as the market economy encourages farmers to adopt the most economically profitable crops and varieties. New developments such as genetic modification threaten to limit the choice between varieties still further (GRAIN p8).

Organic market farmers in the Netherlands are now complaining that conventional seeds are increasingly difficult to get as seed merchants move into the lucrative market of gen-tech seeds (Minderhoud p11). The need for varieties that are not genetically modified and are less uniform has lead the organic movement to initiate its own breeding programme.

Small farmers affected

Small, market-orientated farmers in regions where conditions are less favourable are most affected by these developments. They are unable to compete with farmers in more favourable conditions who can afford the use of expensive improved seeds and they lack improved varieties adapted to their diverse agroecological conditions. Soil degradation often exacerbates the situation making farmers particularly vulnerable to calamities such as drought (Singh p12).

As subsistence agriculture is less affected by the market economy, the loss of agrobiodiversity is much slower in agroecologically complex and isolated regions. Here, much traditional biodiversity and indigenous knowledge can still be found as indigenous culture and biodiversity are strongly interdependent (COMPAS Newsletter Vol.1-2 and Ramprasad p13). However, where indigenous cultures are disintegrating, biodiversity and the indigenous knowledge concerning its use and management are disappearing as well.

International action

In this context small farmers in many countries have organised themselves to conserve what is left of their rich traditional agrobiodiversity and are campaigning against genetic modification, patenting and the dominance of international corporations. They see these developments as a threat to their survival base, a risk to food safety and in conflict with their spiritual values. They are not alone in their opposition. There is growing international disquiet over the implications of genetic modification, resulting in political actions (Minderhoud p10).

In-situ conservation

In this issue you will find examples of initiatives to conserve and develop agrobiodiversity, especially in regions with less favourable agricultural conditions. Several articles deal with such initiatives and related indigenous knowledge (Boncodin p23), seed fairs (Neuendorf p24 and Scurrah p26), a biodiversity register (Utkarsh p28) and community seed banks (Demissie p30). Still, as Boncondin and Vega (p30) rightly argue, farmers will only conserve genetic resources if they attach value to them. Adding economic value to (agro)biodiversity, as in the cases presented by Terrazas et al (p32) and Gerrits (p34) will contribute to its sustainable use.

Crop development

However, conservation of agrobiodiversity is not enough. Seeds degrade and conditions and opportunities for agriculture change. This means that genetic resources have to be adapted and constantly improved. Seed selection and breeding for crop improvement are traditional practices but farmers do not always have enough skill and knowledge to keep up with changing needs. The scientific insights and breeding techniques of the formal sector could help farmers improve their efforts.

However, the formal sector is mainly interested in commercial agriculture. The varieties developed by the formal sector are often unsuitable for the diverse agroecological conditions and needs of small farmers. To improve genetic resource management in less favourable conditions, much can be gained by strengthening collaboration between the informal and formal sector (Almekinders et al p5).

Farmers and scientists collaborate

Scientists try to understand how traditional farmers manage their genetic resources (see Mekbib p15; Longley p16; Soleri p18 and Song p20). Participatory development approaches build on these indigenous skills. The experiences gained with participatory seed selection and participatory breeding (Ceccarelli p36; Wright p38; Sthapit p40; CBDC p48 & Yap p47) demonstrate this potential.

Towards integrated systems

Seed conservation and crop improvement are important in maintaining and broadening farmers' choice as far as crops and varieties are concerned but to really increase and make functional use of biodiversity farmers have to reconstruct and develop (traditional) integrated agriculture. As Altieri (p14) indicates, integrated agriculture (agroecology/LEISA) is the best option for subsistence farmers who intermittently produce for market and who wish to increase biodiversity and the resilience, productivity and sustainability of their farming system.

This can also be an effective approach in commercial agriculture. But, farmers who become fully involved in commercial farming not only loose their seeds but also their knowledge about integrated farming. As scientists have little experience with integrated agriculture, collaboration between the informal and the formal sector becomes crucial to its regeneration and development as the case of the 'Eco-Papas' project in Ecuador shows (Frolich et al p44).

However, where labour costs are too high, integrated agriculture may not be a viable option. Where this is the case, what approach should be followed to increase biodiversity in commercial agriculture? The articles do not provide many indications on how to resolve this fundamental problem nor on how much and what type of biodiversity is really needed in particular situations. Apparently the last word on agrobiodiversity has not yet been said!

■

Coen Reijntjes

LEISA

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The editors encourage readers to photocopy and circulate Newsletter articles.

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Dear Readers

Again a double issue of the ILEIA Newsletter, this time full of interesting articles and information on 'seeds for agrobiodiversity'. The Newsletters looks at how farmers, often in collaboration with development workers and researchers take special measures or participate in research programmes to try and stop the loss of agrobiodiversity; select and breed new crop varieties and improve seed management. There is information too on the heated genetic modification debate and on patenting and intellectual property rights. Those wishing to go further into these should turn to the Top 5, Sources, WebWorld and Networking pages.

There is much more to write about agrobiodiversity, particularly the genetic diversity of farm animals and 'natural' biodiversity in and around the farm and in the soil. New information is being generated daily. ILEIA wants to keep track of these developments and has decided to open an agrobiodiversity dossier on the ILEIA Website www.oneworld.org/ileia . You can read more about ILEIA's Web plans on our back page.

ILEIA has new funding, and the future of the Newsletter is assured for at least 3 years. Next year we will be back in our regular quarterly schedule. You can read what is in store for ILEIA readers and correspondents on the back page.

The ILEIA editors wish you, your family and friends a very sustainable and happy THIRD MILLENIUM!

The editorial team

The challenge of collaboration in the management of crop genetic diversity

Conny Almekinders and Walter de Boef

The authors give an overview of crop genetic diversity as a crucial element in total agrobiodiversity. Farmers need a certain degree of genetic diversity for their survival and resilience, especially in marginal areas where modern, improved varieties have not brought any profitability. Finding the right mix between (re)creating and conserving biodiversity and introducing improved varieties is the big challenge. Formal, or institutional, seed systems and farmers' seed systems operate parallel to each other. Much can be gained by closer cooperation. Examples of innovative approaches, still rare, need to be upscaled.

ILEIA is the Centre for Research and Information on Low-External-Input and Sustainable Agriculture. It seeks to exchange information on LEISA by publishing a quarterly newsletter, bibliographies, and books. ILEIADOC, the data base of ILEIA's documentation centre, is available on diskette and on ILEIA's Homepage on Internet: http://www.oneworld.org/ileia. Also the ILEIA Newsletter is now available on ILEIA's homepage.ILEIA's Collaborative Research Programme (mid-1995 to mid-1999) focused on assessing the viability of LEISA technology systems. This assessment built on participatory technology development, scientific studies and capacity building. Research took place in four areas of contrasting potential in agro ecological and socio economic terms: the dryland savannahs of northern Ghana, the high mountain valleys of Peru, the humid lowlands of the Philippines and on the semi-arid Deccan plateau.

LEISA is about Low-External-Input and Sustainable Agriculture. It is about the technical and social options open to farmers who seek to improve productivity and income in an ecologically sound way. LEISA is about the optimal use of local resources and natural processes and, if necessary, the safe and efficient use of external inputs. It is about the empowerment of male and female farmers and the communities who seek to build their future on the bases of their own knowledge, skills, values, culture and institutions. LEISA is also about participatory methodologies to strengthen the capacity of farmers and other actors, to improve agriculture and adapt it to changing needs and conditions. LEISA seeks to influence policy formulation to create a conducive environment for its further development. LEISA is a concept, an approach and a political message.

Biodiversity in agriculture: some policy issues

Genetic Resources Action International (GRAIN)

Biodiversity and farmers' intimate knowledge of it has made possible the evolution of agriculture. Today, as world agriculture industrialises, the irreversible destruction of biological and cultural resources raises critical policy issues. This article explores current trends in technology, trade and agricultural research and identifies the problems of local farming communities who, as custodians of genetic resources, are working to develop sustainable alternatives.

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Farmers' management of genetic variability in rice

Catherine Longley and Malcolm Sellu-Jusu

Small-scale farmers manage genetic variability through a variety of different agricultural techniques. This article describes one such technique, that of maintaining varietal mixtures of a self-pollinated crop – in this case, rice. Sierra Leonean smallholders maintain 2 varieties in the same field not only as a risk avoidance strategy – the 2 varieties together perform better than alone - but also for nutritional purposes. Farmers adapt the composition of the seed mixture from year to year according to their own preferences and experiences.

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photo: Bert Lof

Making up the balance

During the last 30 years, farming systems analysis and research has brought researchers closer to the realities confronting farmers and today farmers' knowledge is being explored more seriously. Yet despite Farmer Participatory Research and Participatory Technology Development many development and research efforts fail. This is a signal that development and research agendas have to change. New research partnerships must be forged with many different stakeholders. Providing insights into how these partnership can be developed has been one of the main components of participatory assessment and stakeholder concerted action in the ILEIA's Collaborative Research Programme. Looking back on the ILEIA Collaborative Research Programme there are two significant outputs: the experiences with research partnerships in Stakeholder Concerted Action and the results of Participatory Assessment.

Stakeholder Concerted Action for LEISA

Farmers and their research priorities determined ILEIA's research programme but as issues become more complex and scale increases, a wider range of stakeholders must be involved if development efforts are to be sustained (Rölings & Jiggins 1998). The ILEIA research programme was therefore farmer guided and collaborative. It brought stakeholders together in stakeholder or working groups to deal with concrete activities. Each stakeholder was able to define his or her own interest so that together win-win situations could be created. Working groups of farmers and staff from NGOs, government extension services, agricultural research stations and universities were set up to plan, coordinate and monitor PTD and participatory assessment (PA). Working together, they tried to answer research questions that had been developed collectively. The PTD/PA process provided stakeholder groups with a focus and, through SCA, their experiences were disseminated widely.

SCA can be seen as building on some of the steps involved in PTD (see p 8) in the interests of scaling-up and sustaining this process. The analysis of SCA experiences gained during the ILEIA research programme is interesting in this perspective because there are few such documented experience. In the articles by Abon (p 29), Alebikya (p 40), Canales (p 60), and the AME team (p 74) our research partners have discussed their experiences with SCA and PTD. Below some of the different conditions and dynamics of the stakeholder groups and their development will be brought together and the lessons of these SCA experiences will be examined.

Philippines: Scientists learning from farmers

In the Philippines, KADAMA and KALIKASAN farmer organisations were in the forefront of setting the research agenda and programme decision-making. They had strong political motives for participating in a LEISA working group of university staff and NGO members. First, these farmers' groups wanted to prove - through systematic research - that options other than those offered by Green Revolution technologies would maintain yields. They also wanted to convince policy makers to support such options.

KALIKASAN AND KADAMA had already considerable experience in conducting experiments and they had a strategic interest in verifying and demonstrating the effectiveness of their LEISA or organic agriculture. In this they needed the support of the university staff. The farmers had already made their problem analysis and priority choices before the ILEIA research programme began and with a clear agenda they had an important impact on the PTD process.

It took time, effort and some facilitation from ILEIA during a number of working group sessions to negotiate a balance between farmer' interests and insights, and the demands of formal, scientific research. It was decided that CLSU would provide additional scientific support (context studies relating to sustainability issues and the search for alternatives; documenting the research process and backstopping farmers' groups). The university ensured that the experiments, systematically conducted by about 140 farmers, generated interesting statistical material. Professor Marilou Abon, who coordinated the contribution of the CLSU/LEISA task force, described her staffs' experience of the LEISA Working Group as follows:

"If we try to compare (this) experience with that of the past it is now quite different. In the past it was more the scientist or the academe who imposed ideas or techniques on the farmer. In the ILEIA structure or framework the farmers worked with academics and scientists and each had a role as important as the other" (ILEIA video 'Building Bridges for LEISA' 1998).

Initially, scientists played a limited role in the working group partly because KALIKASAN and KADAMA farmers were afraid of loosing control of their agenda and autonomy. Later more CLSU staff took part in the CLSU/LEISA task force. Any future upscaling of the programme may find it useful to include other partners such as staff from PhilRice and the Ministry of Agriculture in future activities. Although the LEISA working group had its share of tempestuous moments, at the end of the research period there was a general feeling that much had been achieved and that a climate of mutual respect had been developed. Together with CLSU and PRRM, the two farmer organisations have developed project proposals for continuing PTD experimentation.

Peru: Building on farmers' knowledge

Two working groups were established in Peru: GIAREC in Huancayo in the Central Andes and GINCAE in Cajamarca in the Northern Andes. Those who participated in the working groups did so informally. There were no signed agreements and the role of coordinator rotated between the member organisations. Though both groups were interested in coordinating activities, each developed in its own way (see Canales p 60).

In Huancayo, GIAREC coordinated a research programme involving three NGOs and three research institutions. Sharing experiences, developing a clear vision of the future and stimulating an exchange of farming knowledge encouraged synergism. At the community level, the NGO and research institutes had their own, distinctive role. Each NGO had contact with a particular research institute. As a result, each worked with a group of farmers to develop its own process of technological innovation. Regular working group meetings were held during which the process and results from each area were shared with and documented by all six members.

Each member gained a comparative advantage from this arrangement. A platform was created where new ideas could be discussed. The research institutions provided studies, training, technical advice and information. Farmers gave insights into their specific farming systems and NGOs organised, monitored, gave technical guidance and liased between farmers and researchers. Local knowledge played a crucial role in identifying possible experiments and in many cases experiment design was based on or derived from established farming practices. As Norma Canales (p 60) remarked:

"It is obvious that the interaction of peasant and academic knowledge and experiences re-values local initiatives for development and generates trust and self-esteem in both men and women farmer innovators".

In this way it became possible to shift the development and research agendas of NGOs and agricultural research institutes and create new and interesting avenues for development. Different knowledge systems were integrated, sustainability aspects were prioritised and local innovative capacity was enhanced. GIAREC now has plans for the future and is committed to continuing collaborative activities.

GINCAE in Cajamarca had a more difficult time. It was unable to hold out against the individual agendas of its member organisations and align with ILEIA's research programme despite a shared interest in LEISA and the effort of CEDEPAS to keep the working group together. GINCAE comprised four NGOs, a university and a research institute. The internal dynamics of the group made role differentiation, the exchange of information and involvement in each other's activities difficult. All six partners became involved in PTD activities in their respective areas but few showed any interest in receiving scientific support from the research institute. This and the distance between the working areas of Centro Ideas and the other NGO resulted in an isolation that hindered complementarity. In addition it is possible that the presence of large amounts of donor funding in Cajamarca meant that ILEIA's limited funds were insufficient to attract the investment of staff and time in collaborative activities.

Nevertheless, a very interesting PTD process responsive to farmers' needs and involving some 90 farmers got off the ground in San Marcos. Centro Ideas in San Marcos and CEDEPAS in Magdalena have now expressed a keen interest in further developing and institutionalising PTD in their programmes.

Ghana: 'Plugging in' to farmer priorities

The start of the ILEIA research programme in Northern Ghana coincided with and gave momentum to the earlier initiatives of ACDEP in developing closer ties with government extension and research. In 1995, this led to a new, but informal institutional arrangement - the Northern Ghana LEISA Working Group - that brought together various organisations concerned with agricultural development in the interests of joint research, extension, advocacy and learning with farmers as equal partners..

An important motive for all participants was a shared critique of the failures of former, mainly HEIA- oriented attempts to improve agriculture in the region. There was keen interest among all professional disciplines to explore the potential of LEISA. Some of ACDEP's agricultural stations had already experienced PTD. The willingness to use it in the Northern Ghana LEISA Working Group programme was based on a determination to make research activities relevant to the development of farmer livelihoods. Both the orientation (LEISA) and the approach (PTD) contributed to strengthening relations within the working group. The major question was how to access farmers' knowledge, problems and priorities in the search for new ways to tackle the problem of soil fertility. As they looked for answers, mutual respect developed between farmers, NGOs and scientists. A sense of collective responsibility was generated and the confidence of both scientists and farmers in farmer-led research increased.

By 1998, after three years of activity, the working group had changed its character. Individual members who had initially become involved because of their personal interest in PTD and LEISA were now supported by their institutions. This combination of individual working group members participating on the basis of institutional interest but without any formal institutional membership has proved very successful. It created space for experimentation without jeopardising institutional relationships. The NGLWG research committee was responsible for daily management issues such as the planning, implementation and coordination of research programme activities.

The working group provided information and training, and monitored and planned activities. It began documentation and developed extension material. Farmers gradually became more involved in planning activities and in the process of sharing experiences. In a relatively short time the working group had succeeded in raising the interest of other stakeholders as well as district directors of agriculture, universities and research institutes outside the Northern Ghana region. This created a much wider platform where issues of agricultural development and the task of advocating LEISA and PTD could be discussed. In this way momentum was increased at the regional policy level. While farmers see the NGLWG as an organisation that collaborates in experimenting with LEISA technologies: policy makers know it best for its advocacy work.

Encouraged by the positive results of NGLWG, several institutions have indicated that LEISA and PTD will become part of their approach. The University of Development Studies has incorporated LEISA and PTD into its teaching curriculum and the Savanna Agricultural Research Institute and ARI include PTD and LEISA in their research proposals. District Agricultural Extension services also intend to use the approach and a World Bank programme for natural resource management in the Northern Ghana will be using the PTD approach and intends to draw on the experience of the NGLWG.

A factor that contributed to the internal coherence of the working group was ACDEP. As an NGO it had more freedom to promote and experiment with new institutional arrangements, such as the NGLWG, than government extension services or research institutions. ACDEP was readily accepted as working group coordinator. It had the skills needed to ensure that everybody was kept informed and interested. Great care was taken to maintain each stakeholder's sense of ownership as the working group was built up.

NGLWG, as a partner in the ILEIA Research Programme, seems to have contributed to shifting research and development agendas in the direction of LEISA and PTD. By accessing farmers' interests it created new hopes and avenues for agricultural development. NGLWG has decided to continue as a platform under the legal framework of ACDEP. In its new programme it will go on with action-research, platform building, scaling-up and advocacy.

India: Platforms for innovation

In less than five years, the Groundnut Working Group (GWG) on the Deccan Plateau in Southern India has become a platform for a multitude of research and NGO organisations. Meeting together in its annual workshop, the GWG provides a forum for debate and the exchange of ideas and technical support. It is not a consolidated stakeholder group in the sense that all members work together on specific subjects or in specific areas. However, there are subgroups in the GWG that do have special fields of interests.

NGOs do most of the PTD work with AME support. AME also brings in scientists and plays a key role in steering, coordinating and facilitating this stakeholder process. It regards activating a wide range of stakeholders to be of strategic importance. In this way the GWG has reached a very large number of farmers (see p 74). The GWG experience illustrates stages in the PTD/SCA scaling-up process

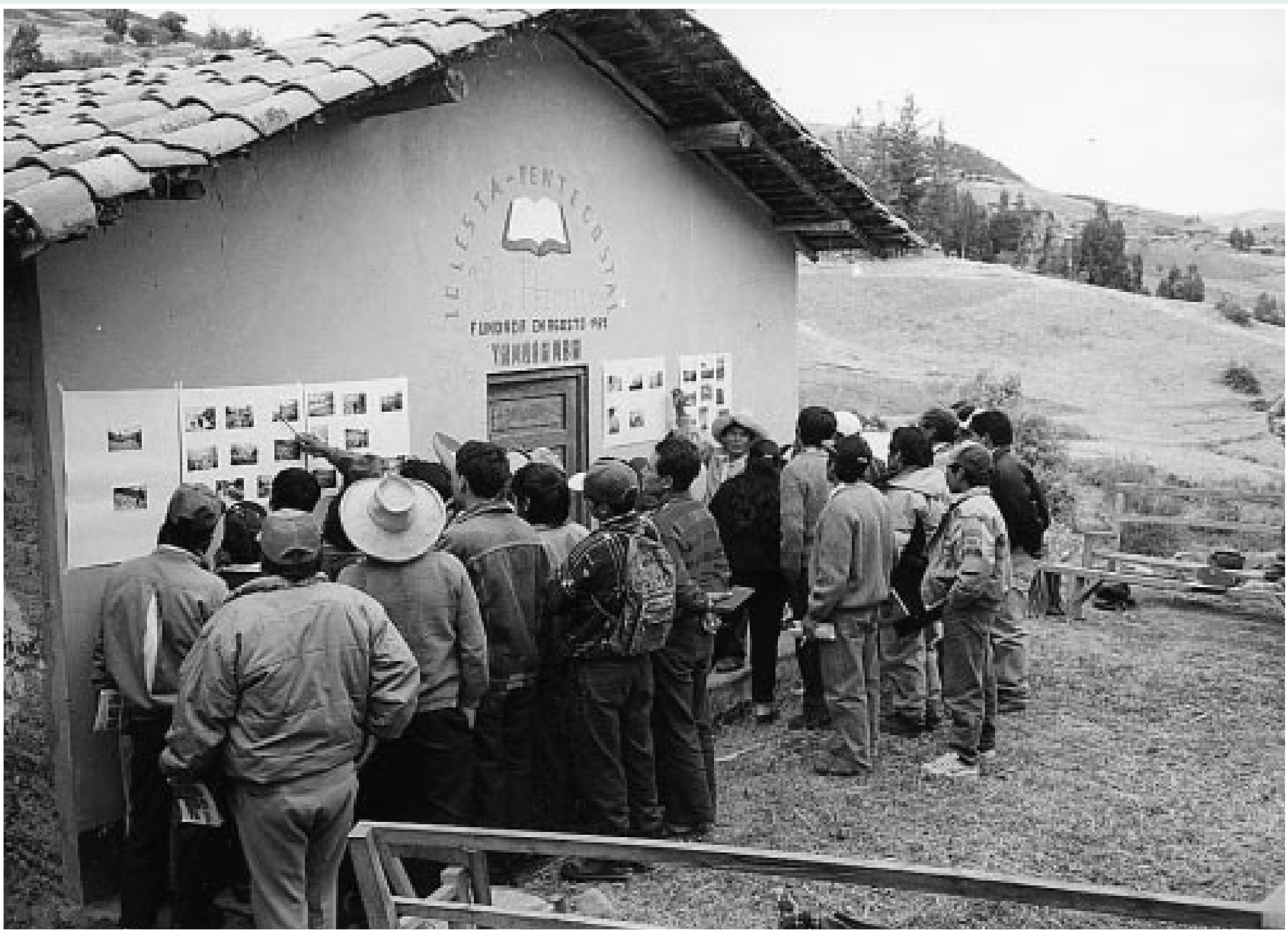


photo: Bert Lof

Farmers discussing experiences gained in farmer to farmer exchange.

Critical steps in scaling up PTD/SCA

- Starting small, local and specific by carrying out one crop /single factor field experiments which, over a two year period, provided a fairly good insight into the factors that affected groundnut production.
- Organising farmers interested in experimenting through NGOs serving also as an interface between farmers and government (and research). Increasing technical and PTD skills of NGOs and overcoming mistrust between NGOs and government and research was also important.
- Building expansion on positive results. Going to other communities in the same area. Having determined problems through PRAs and found similarities 'looking for things to try' is less necessary. More emphasis can then be put on demonstration and further development of found options.
- Recognising the need of scientific expertise and gradually expanding the platform. Learning from each other and establishing important links between NGOs and researchers. In this way the GWG, a platform for SCA came into being.
- Beginning with a single NGO or a homogenous group of NGOs, the steady build-up of relationships with other institutional actors is facilitated including community councils, government departments, input suppliers and credit institutions. This cumulated in the establishment of stakeholder platforms as a strategy for up-scaling participatory and integrated landuse development.
- Demonstrating the benefits of working together contributed to improving synergy between actors in the agricultural (groundnut) knowledge system and stimulated up-scaling.
- Good documentation is essential. On the basis of earlier experiences a provisional groundnut production manual was published in 1997. This laid the basis for further expansion to other areas.
- Not everything scales up automatically. Technologies, once validated by farmers, spread fast. Yet the experimentation process itself which provided the initial insights into these technologies does not scale up so easily. It requires continuous nurturing, able guidance and intensive monitoring.

Lessons learned in SCA

Bringing stakeholders together is not easy. Differences in social background and culture, the distrust farmers and NGO often exhibit towards researchers and competition between NGOs and government/research organisations are some of the factors that contribute to this situation. There are important preconditions for SCA and some of these are discussed below.

It is essential that stakeholders have a ***genuine interest*** in learning from each other and that they share activities, responsibilities and the work of achieving a common goal. Stakeholders may cooperate for opportunistic reasons and this is not a problem in itself. However, when financial benefits are the main reason for joining a stakeholder group, the group will be neither viable or sustainable. Having and building respect for the capacities, knowledge, limitations and institutional concerns of others is a must and a challenge. Such cooperation has added value and removing prejudices strengthens mutual respect.

Common goals are important but not sufficient. There must be concerted action from which all stakeholders benefit professionally. In the ILEIA situation it was the combination of the PTD process and additional studies which kept everybody involved. Stakeholder groups must be realistic about the time and resources available to different members if disappointments are to be avoided.

Leadership in stakeholder groups is a sensitive issue. An organisation or person with considerable credibility, accepted by all stakeholders (such as ACDEP in Ghana) and able to assume a coordinating or leadership role may not always be available. Sooner or later researchers have the tendency to take the lead and this can cause resentment among farmers who want to secure control over technology development. Finding a pragmatic solution - ensuring that the position of chairperson is rotated regularly (Peru) or establishing an external facilitator (the Philippines) - that is acceptable to everyone and that is evaluated regularly then becomes crucial.

Proper management of ***individual and institutional capacities and sensitivities*** is extremely important. Careful attention has to be given to ownership in goals, processes and activities. These matters should be dealt with by an accountable member of the stakeholder group. Considerable investments in awareness building, orientation and training in LEISA and PTD are necessary both at the beginning of the process and also at later stages. Although it is important that stakeholder groups build on the knowledge, skills and experiences of their members, it may sometimes be necessary for an experienced external institution or individual to give guidance and advice on the processes of SCA, PTD and the development of LEISA.

There must be a commitment to ***transparency*** in programme conception, internal decision making and financial aspects and the requirements of financial administration and reporting should not be underestimated. If not handled in an accountable, timely and transparent way there will be serious frustrations.

It has been shown that the ***documentation*** of the process and results together with the organisation of workshops involving a wider audience is an important way of achieving outside recognition and ensuring up-scaling and advocacy. It also gives weight to the stakeholder group itself.

Although every situation has its own dynamics stakeholder groups should not be ***institutionalised*** in a formal way. The 'in practice' recognition of an informal group of interested individuals perhaps with an institutional affiliation may be both flexible and workable (see Ghana p 40). However, more formal working relations may be required later. (see India p 74).

A Stakeholder Group may start with a relatively small number of members in order to ensure that the process is clear and manageable. However, there is the risk that a small group will continue to be inward-looking. In order for full technology development to occur new members from other groups and categories of farmers, scientists and institutions bringing other specialisations and insights must be involved. Such stakeholders may come from the banking world, for example, or from commercial or policy sectors. They will be crucial in broadening the scope of technology development and in ***up-scaling the process***.

Impact of SCA

The four case studies referred to here demonstrate that SCA contributed to the creation of a learning environment for all the stakeholders involved. It was instrumental in ensuring the effective, complementary use of knowledge both from farmers and scientists and lead to both groups acquiring new insights. Subsequent reassessments of the role played by farmers and the contribution indigenous knowledge can make to the development of technology lead to the break-down of the roles adopted by researchers, NGO staff and farmers. This and the building of skills have encouraged the collaboration of a wide range of stakeholders in participatory research and development. SCA has also been important in strengthening farmers' innovation capacities and empowering farmers and farmer organisations such that they become equal partners in agricultural research and grow in self-consciousness and enthusiasm. Finally SCA proved effective in coordinating the definition, monitoring and evaluation of participatory research and development programmes. In some cases it was able to influence land use policies and the scaling-up of research and development programmes. As such SCA seems to be an important pre-condition and methodological tool for developing sustainable agriculture and LEISA.

photo: Bert Lof

Farmers and scientists discussing groundnut production.

Stakeholder Assessment of LEISA alternatives

The studies on history and trends show that in each research zone agricultural development has been influenced by the pressures of market-oriented agriculture and modern technologies. Agriculture in each zone showed specific signs of an increasing lack of ecological, economic and social sustainability. Farmers are being forced to search for alternative ways to meet their food and cash needs.

Ecological degradation

Since the 1970s, rice farmers in the Philippines have adopted intensive Green Revolution practices. However, farmers have found that as the cost of these input continued to rise and the soil was becoming increasingly degraded, yields stagnated and financial benefits declined. Indiscriminate use of pesticides and herbicides has lead to a reduction in the numbers of living organisms and human health suffered. Water sources necessary for irrigation became less secure as water tables fell because of over-pumping and increased runoff in the up-lands.

In the Peruvian Andes the effectiveness of modern inputs has also declined. Presently, these are only being used in irrigated agriculture where market opportunities are good. Their use results in problems similar to those in the Philippines. Rain-fed agriculture faces severe soil erosion, overgrazing, loss of agrodiversity and, as a result, pest and disease incidence is high.

In Ghana, attempts to introduce modern agriculture have failed. In rain-fed agriculture soil fertility and water holding capacity have decreased due to nutrient mining. At the same time vegetation and the amount of organic matter in the soil have been seriously effected by burning and mechanised tillage has caused soil compaction. This has reduced food and cash security. Moreover, population growth has lead to an increase in the cultivation of marginal lands and the disappearance of fallow periods has lead to further deforestation, soil erosion and nutrient depletion.

In India, the cost of modern inputs is steadily increasing. On the Deccan Plateau, soil erosion, a scarcity of organic manures, an imbalance in the way chemical fertilisers are being used and groundnut monoculture have lead to an increased susceptibility to water stress, micronutrient deficiency and a vulnerability to pests and diseases.

Economic marginalisation

Economic transformation and the liberalisation of the market economy are important reasons for the marginalisation of many small farmers. In the Philippines farmers are being forced to look for other economic alternatives and these are often outside agriculture. In India during the last 20 years, small farmers have become strongly dependent on groundnuts for their cash income. As no other profitable crop is available, farmers continue with groundnut production despite the ecological degradation that is threatening their income. Often their only alternative is to leave farming and seek work elsewhere. Many farmers in northern Ghana have reverted to or remain in subsistence production. The difficult economic situation in the country means there are limited opportunities for labour migration and this is forcing farmers to look for ecologically sound strategies to intensify agriculture using whatever resources are available locally. The problems faced by Peruvian farmers are very similar. Food insecurity makes it necessary to look outside farming for an income and many farmers migrate to the coast or the Amazon to work as labourers.

Social disintegration

Many social problems found in the research sites are related to the ecological degradation of the natural resource base and the economic marginalisation of farmers' livelihoods. Social disintegration aggravated by migration (India, Peru, Ghana), land conversion (Philippines, India), indebtedness (Philippines, India), health hazards (Philippines, Peru) and the loss of indigenous knowledge (Peru, Ghana) threaten the future of many rural communities.

LEISA technologies needed

It is clear that the conventional HEIA technologies create many ecological problems and are no longer a profitable option for many farmers. In northern Ghana and the Andean highlands rain-fed agriculture is, of necessity, dependent on locally available resources. External inputs, whether organic or chemical, are necessary in market-oriented agriculture. Situation specific LEISA practices that make optimal use of local resources and ecological processes and, where feasible, complement these to secure ecological, economic and social sustainability are therefore more viable than conventional HEIA and LEIA practices. They are also an absolute necessity for sustainable agriculture.

Most farmers and development workers in the ILEIA research programme are convinced of the need for LEISA in both subsistence and market-oriented agriculture and have shown a keen interest in identifying the LEISA practices most appropriate to their situation.

LEISA technologies that fit

In identifying which LEISA technologies fit best within a particular farming context, local LEISA practices were documented and PTD experimentation initiated. PTD experiments were intended to result in technology innovation that respond to farmers' felt needs. More detailed information on the PTD experiments and results can be found in (Abon p 29; Millar p 43; Karbo et al. p 49; Aalongdong et al. p 47; Reyes p 67; Alvarez p 62; Canales and Canto p 65; AME p 74). Here only some highlights are mentioned:

In the Philippines the use of chicken manure, (improved) traditional rice varieties, natural pest management and diversification (ducks, vegetables, fruit trees) in rice farming proved to be popular alternatives for lowland rice producers. On land with a history of chemical farming about 126 PTD farmers demonstrated that chicken manure could be as productive as chemical fertiliser. On land with a history of organic farming, chicken manure gave even better results. The farmers also showed that improved traditional rice varieties could be as productive as high yielding varieties. Costs and benefits of these levels of chicken manure and chemical fertilisers were identical. However, farmers concluded that organic farming is less expensive: after a number of seasons less chicken manure is needed, there are fewer problems with pests and diseases and natural pest management is much cheaper than chemical pest management. Major constraints still seem to be the limited availability of chicken manure and other sources of organic fertilisers, lack of good quality, improved traditional seeds, a very underdeveloped alternative rice marketing system and few sources of credit for (alternative) rice production. However, experiences with integrated rice farming and the ecological system of rice intensification developed in Madagascar (see ILEIA Newsletter Vol. 15, No. 3/4) suggests there is still considerable potential for improving rice farming.

In Northern Ghana ILEIA Research studies revealed that an increasing number of farmers are adopting non-burning. In both research sites whole communities have decided to stop burning and to protect their fields. One of the major revelations of the research programme for farmers, however, was a visit to Burkina Faso where farmers had adopted many different techniques for water and soil conservation and soil fertility improvement including composting. These techniques could be also viable in northern Ghana where climatic conditions are not yet as dry as in Burkina Faso. Composting and the incorporation of left over biomass into the soil have been particularly successful. In two seasons 88 farmers in Langbensi and 55 in Sandema have taken over these practices. Many farmers are now in the process of further adapting and refining the technology to their specific conditions.

Experimentation with cover crops (*Mucuna, Calopogonium* and *Stylosanthes*) for improved fallow has raised farmers' interest and experimentation is still going on. There are also some isolated but successful experiences with agroforestry and organic farming.

In Peru there was overwhelming evidence that farmers were looking for alternative pest management strategies. In the course of ILEIA research new practices for potato storage and combating pests emerged. *Shipita* is being used to combat distomiasis (*alicuya*), a parasitic disease that has serious economic consequences for sheep breeders. Within a short space of time this practice was adopted both

photo: Bert Lof

Droughts, floods, lack of irrigation water and over-irrigation influence rice production to great extend.

within the community and further afield. In pasture management, farmers have started to grow fodder crops and conserve them for the dry season. Small-scale irrigation systems are being tested. These are low-cost and flexible enough to serve different users. Farmers have also taken up composting crop residues and combining these with cow dung to improve soil fertility. However, not all the new practices have been fully accepted by the communities and so experiments are continuing.

Quantitative underpinning

In all research sites, an attempt has been made to quantify the viability of LEISA practices in specific contexts. This has been particularly successful in the Philippines and India where statistically analysed data was developed. Results were seriously affected, however, by adverse weather conditions. In the Philippines, reliable quantitative data is only available for the first season because of drought and typhoons in the second and third seasons. In India quantitative data are available from 1994 onwards. Less quantitative data are available for Peru and Ghana where conditions in the experimental fields were less homogeneous making quantification unreliable.

As the data obtained from the PTD experiments only covers two or three seasons it is only possible to draw preliminary conclusions about the viability of LEISA practices under specific conditions. However, farmers used criteria and indicators that were important to them and their positive appraisal of LEISA technologies indicate that LEISA technologies better satisfy farmers' needs than current practices. However, the large-scale adoption of these practices by farmers is the best proof of viability and PTD experimentation in Ghana, Peru as well as India has lead to a rapid expansion of new technologies.

From LEISA practise to LEISA systems

The research programme also identified a number of viable transition strategies for a further development towards LEISA systems. In Peru there was shipita; in Ghana compost and other soil fertility management techniques; in the Philippines chicken manure and in India farmyard manure.

In Peru, the positive results of the shipita trials gave way to new experiments in managing the crop and to studies of the disease vector in order to improve natural pasture management. The success of composting in Ghana led to new practices of animal housing near the compost pit so dung could be collected more easily and to investments in donkey carts to transport the compost. Experiments were also carried out with fodder legumes for biomass production. These examples indicate that farmers and researchers have received fresh impetus to look for solutions with a new orientation.

The research partners see many of the results of the PTD experiments as valuable contributions that can help convince farmers, researchers and policy makers of the need for and potential of LEISA. The experiments and studies also helped convince research partners of the value of indigenous knowledge (see Kauffman p 9 ; Alvarez p 62 and Appiah p 44).

PA as methodology

In the ILEIA research programme, participatory assessment - farmers assessment complemented by scientific validation and studies - functioned as an approach that guided and monitored the development of sustainable agriculture at regional level. Participatory assessment is, in the first place, an integrated part of the PTD process in which farmers formulate their own objectives, values, criteria and indicators for the development of (sustainable) agriculture. The evolution of their farming or livelihood system and the impact of their experiments are analysed on the basis of these criteria. In a participatory cyclic process of experimentation, analysis and growing insights, these values, criteria and indicators gradually become more sustainability focused. Scientist can play an important role in participatory assessment by contributing their insights, information, skills and time.

The ILEIA research programme was only able to scratch the surface as far as the potential of this approach was concerned. Further development is needed at several levels including working effectively with criteria, values and indicators for monitoring and evaluating the development of sustainable agriculture. An important issue in PA is how to keep the balance between farmer and scientific assessment. In India a farmers' chance remark left the AME team wondering.

"Are we doing experiments for ourselves or for the researchers? We are convinced about technologies long before we can convince them".

Shifting R&D agendas and scaling-up

At the end of the Research Programme, the research partners and the ILEIA team concluded that the process and results had contributed to a deeper understanding of the need for and the potential of LEISA. The programme had demonstrated the usefulness of LEISA and SCA/PTD approaches for the development of sustainable agriculture.

"Through LEISA and the PTD process farmers gain a lot of self-confidence and self respect. They become more motivated to work by themselves, to identify their own problems and solutions and to transfer this into practical terms. I think this is a sustainable base for development" (Moses Appiah Abaare, Project manager Sandema Agricultural Station).

It also contributed to shifts in research, development and policy agendas something that is urgently needed if there is to be a scaled-up development in sustainable agriculture. In the Philippines, for example ILEIA research has demonstrated how farmer experience can be effectively combined with scientific approaches at a time when researchers are trying to understand why HEIA approaches have such significant weaknesses. Results of the ILEIA research programme and experiences of other organisations were discussed in a countrywide workshops attended by farmers, NGOs and scientists, in May 1999. The proceedings of this workshop will be published in a special IIRR/ILEIA publication towards the end of 1999.

In India the Groundnut Working Group has successfully raised the interest of formal research in farmer-identified problems in the neglected rain-fed areas and has helped lessen farmer and NGO distrust of formal research. Development agendas of NGOs, research institutes and universities are now becoming more sensitive to farmer priorities.

In Peru, new pathways were opened up by using local farmers' knowledge. Research institutes and universities are now doing more serious research on these local solutions, while NGOs are shifting their development programmes to incorporate farmer priorities.

In Ghana it has become evident that conventional extension and research focusing on HEIA solutions has very little to offer to farmers in the region. The dynamics of the NGLWG with their emphasis on LEISA and SCA/PTD has raised new hopes among farmers and development practitioners and stimulated interest among regional policy makers. The NGLWG is receiving recognition as a platform for debate, exchange and advocacy in Northern Ghana and the special publication devoted to the results of the Ghana research programme will undoubtedly contribute to this process.

ILEIA is aware that much more has to be done to understand and develop LEISA. Documenting and assessing strong LEISA cases that involve many more farmers are essential. In the next few years ILEIA intends - with the help of regional networks - to go on documenting and analysing LEISA experiences. The dynamics created in the Working Groups are definitely worth continuing. Some initiatives have already being made and others are in need of funding. The ILEIA team hopes that follow-up initiatives that build on PTD, SCA and LEISA will find active and financial support from regional stakeholders as well as national and international funders.

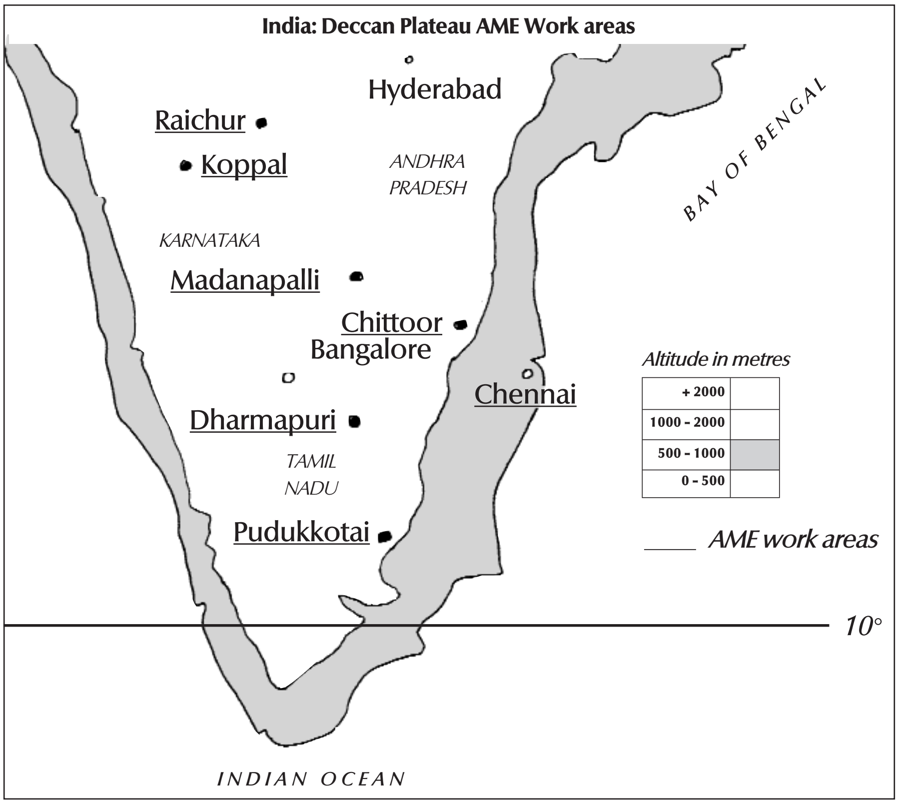
■

A platform for groundnut improvement

To broaden the basis for assessment in the ILEIA Research Programme, ILEIA collaborated with AME. AME facilitates a research platform of farmers, NGOs and research organisations that focuses on the improvement of groundnut production on the semi-arid Deccan Plateau in India. Additional studies have been funded to get more insight into the systems of groundnut production and their dynamic context through the ILEIA research programme. The groundnut platform is one of the platforms facilitated by AME, others focus on the production and marketing of rice, cotton and vegetables. Like ILEIA, AME is a programme implemented by the ETC Foundation

KVS Prasad, Chitrah Suresh & Mans Lanting

This section deals with the groundnut production programme. The first article provides information about agriculture on the Deccan Plateau and the history and sustainability of its groundnut production. The second article will focus on AME's strategy for technology development, the process of stakeholder concerted action and PTD experimentation.



The Deccan Plateau, a vast area of roughly 1000 by 300 km lies at about 600 m above sea level. It is a chronic drought prone and resource poor region, lying in the rain shadow of the Western Ghats, in the states of Andhra Pradesh, Karnataka, Maharashtra and Tamil Nadu. Annual rainfall ranges from 500 to 900 mm and can be very variable with substantial dry spells. Natural soil fertility is generally low. Total population in the region is about 100 million or about 20 million families some 10 million of which are farming families. Another 4 million are agricultural labourers. Eighty percent of the region is under rainfed farming and the rest is under irrigation.

Sustainability at stake

Farms on the Deccan plateau are generally small (one to ten acres) and the majority of farmers have less than three acres. In this vast area many types of farming systems are found. However, on most rainfed farms pearl millet, finger millet, sorghum, sesame, horse gram, foxtail millet, cow-pea, pigeon-pea and groundnuts are grown. Formerly these were cultivated in mixtures but today they are increasingly being grown as pure crops. Rice, bananas, cotton, and sunflowers are cultivated in irrigated areas. Farmers use a small amount of farm yard manure (about 1200 kg/acre) once in four years on rainfed land and the same quantity each year on irrigated land. This is supplemented with Di-Ammon Phosphate and urea. The use made of phosphorus fertilisers is about half what it should be. Micronutrients are generally not applied. About 50% of the farms have access to animal traction. Others rely on hiring bullocks for ploughing or, increasingly, on tractors. Pesticides are mainly used in irrigated agriculture. Trees and animals play an important role in the farming systems of the plateau.

> *Box 1* **Public Distribution System (PDS)**
> PDS provides rations of food at highly subsidised prices. Rice for example is sold in Andhra Pradesh for Rs 3.5/kg through PDS compared with Rs 10/ kg on the open market (1998). A poor family of about 5 persons has the right to purchase 25kg rice each month under this system.

Groundnut is a major cash crop in the three southern states and are grown on about 4 million hectares. This represents 50% of India's total groundnut area and is about 12% of the cultivated area of the Deccan plateau. Groundnuts are usually grown by marginal farmers with limited or no access to irrigation. Groundnut cultivation is favoured because the crop is fairly drought resistant, can be readily marketed and loans are easy to get. Besides it is a cost effective proposition to grow this cash crop and use the earnings to buy subsidised food grain from the Public Distribution System (PDS) (see Box 1).

New farming technologies have helped the richer pockets but this is offset by declining productivity in vast marginal areas. Over-exploitation of the natural resource base is an all-pervasive phenomenon that keeps the majority of farmers trapped in poverty. Traditional systems and resource management institutions have weakened and no alternative options are readily available.

Many marginal farmers and young people have been forced to stop or are unwilling to continue with agriculture as their main occupation. The rapidly growing industrial and service sector in the region has facilitated this economic transition. Male migration is increasing fast and has lead to the degeneration of family, gender and community relations. Many of these developments can be traced back to inappropriate resource use patterns and the inability of research and development organisations and the commercial sector to support farmers in the development of more profitable and sustainable agricultural practices.

A short history of groundnut

The groundnut entered India in the mid-sixteenth century either from China or the Pacific islands. Until 1900 'guarani', a variety which matured in 195 days and required 2-3 irrigations after the monsoon, was cultivated on less than 230,000 ha. During the next decade two varieties that could grow in rainfed conditions - Big Japan and Spanish - were introduced. Thus, spreading, semi-spreading and bunch varieties with higher oil content and maturing in 105-145 days, gained entry and reigned. Later, in the sixties and seventies, the short-duration, bunch varieties (95-105 days) were introduced. These could be grown in drought prone belts with shallow unproductive soils. Literature reveals that the average yield of groundnut (pods) declined from 1200kg/ha in 1920 to about 800 kg/ha in the fifties and remained stable until the late sixties. From the seventies onwards yields gradually rose to about 900kg/ha (see Box 2) .

Declining productivity in the fifties resulted from:

- the proportional increase in acreage of short duration varieties leading to reduction in the period of photosynthesis. The inherent production potential is lower than that of long duration varieties;
- the steady inclusion of low fertility soils for growing short duration groundnut varieties (between 1954 and 1973 the area expanded by 24% while yield increased by a mere 10%).

Until 1970, groundnut was only grown as a Kharif (rainy season) crop. After 1970, however, the area under irrigated (Rabi) groundnut expanded to about 1.5 million ha and this gave an interim increase in average productivity. Today, about 19% of groundnut land is irrigated. Support prices for groundnut also rose from Rs.350/100kg in 1984-85 to Rs.900/100kg in 1995-96 . Groundnuts commanded better prices than other oilseeds and food crops. Improvement in relative profitability during this period could have triggered off expansion into irrigated groundnut cultivation.

Groundnut farming in trouble

Thus far the groundnut story appears promising: increases in average productivity and total production, larger areas and remunerative prices. But in reality the development trends are quite negative.

Soil degradation induces pests

There are slow but definite changes that are progressively endangering sustainability in the rainfed groundnut cultivating areas.

By the sixties farmers moved *en masse* into groundnut cultivation in marginal areas, characterised by shallow (less than 60 cm deep), red, loamy sand soils on sloping (>5%) land. In 50 years an estimated 15-30 cm of topsoil has been lost to erosion.

The fragmentation of farms, the over-exploitation of common lands and the disappearance of cattle and bullocks have led to an acute scarcity of organic manures. This, coupled with an excessive application of nitrogenous fertilizers has depleted the organic matter in these soils. According to scientists, there are extreme cases where soil organic carbon content is below 0.3%, a third of what it used to be. Because groundnuts have been cropped continuously they have assumed a central place and account for anything from 25% to 80% of the crops grown in the farming systems of our operational areas.

The combined effects of these three factors - erosion, rapid mineralisation of organic matter and continuous groundnut cropping are:

- Loss of waterholding capacity and aggravated susceptibility to water stress, especially during dry spells;
- Increased micro-nutrient deficiencies (Zn, B);
- Extreme susceptibility to fungal diseases;
- Increased presence of inoculum of diseases; and
- Increased pest populations.

Box 2 **Irrigated versus rainfed groundnut productivity**

At present average groundnut production stands at 900 kg/ha pods with a shelling percentage of about 70%. There are important differences between production conditions. Under fairly good rainfed conditions on fairly good soils one can expect a pod yield of about 1200 kg/ha. Under adverse rainfed conditions pod yields can be as low as 300 kg/ha with a shelling percentage of 55%.. Under irrigated conditions yields up to 3000 kg of pods/ha would be possible.

Fungal diseases such as leaf-spot (early and late), root collar rot and stem rot are on the increase. Pests like red-hairy caterpillar, whitegrub, leaf-miner and tobacco army worm are creating increasing problems. As a result groundnut yields continue to decline in the marginal areas while production becomes more risky. At present, even in a year with average rainfall, many a farmer just about breaks even with a yield of 600kg/ha. The monsoon fails once in three years and yields fall to a mere 175ka/ha barely enough to replace the seed sown. Over the years the crop has become a loss making proposition for the resource-poor farmer. Ironically, even though many groundnut farmers are heavily in debt they continue with groundnuts because this is the only crop on which money lenders are ready to advance their expensive loans (at interests of up to 120% a year).

Severe competition

Roughly 80% of the groundnuts produced in India are for oil extraction, 15% for seed and only 2% are table grade and exported. Since 1994 the economy has opened up gradually and imports and international competition now play a larger role than ever before. The expensive Indian ground-

photo: Bert Lof

If the government would opt for deregulating groundnut prices, this would lead to losses for most farmers.

nut oil has now to compete with cheaper edible oils such as palm oil on the world market. Malaysia palm oil, for example, is cheaper because:

- palm oil production per unit of land and time is much higher than for groundnut oil, whilst processing costs per unit of oil are comparatively low;
- oil milling in India is far from efficient; most mills run at sub-optimal capacity and are beset by a plethora of administrative problems including over-staffing and weak accounting procedures.

The net effect is that oil millers have difficulty making a profit and staying in the market. Since the government maintains price support for groundnut - something crucial for many poor farmers - millers will have to increase production effeciency - an unlikely proposition at the present time. Some of them may have to close shop unless the government comes to their aid.

Alternatively, if the government opts for deregulating groundnut prices, lower farm-gate prices and decreased profits would lead to declining acreages (particularly marginal land) and losses for most farmers. The livelihood of poor farmers relying on groundnut income to buy food would be seriously undermined. With a loss of food security, migration to urban areas will become inevitable for poor farming families.

Given the gloomy ecological and economic situation as far as groundnuts are concerned and the high population pressure it is clear that something has to be done to improve sustainability of rainfed groundnut production and agriculture in general on the Deccan Plateau.

Getting our act together

Institutional responses to land degradation are gradually increasing and public investment, effort, and the numbers of institutional actors are all growing. The nature of the response is also changing and has moved from the primarily reactive efforts of single institutions focusing on technical interventions, to a more coordinated, pro-active, and people-centered approach. This is most significant in the field of watershed management. It may be noted, however, that dryland agriculture continues to be a relatively neglected area, and efforts to tackle its increasing problems continue to be disjointed.

In Southern India NGOs constitute an important interface between farmers and the government in such matters as agricultural research and watershed management, for example. However, despite significant achievements there is still a long way to go because their geographical spread and expertise in participatory development of sustainable land use is often limited. Further, though there have been instances of government-NGO linkages, the degree of synergy between these and other institutions in sustainable land use is inadequate. AME fills an important niche between these different types of organizations.

AME and its working strategy

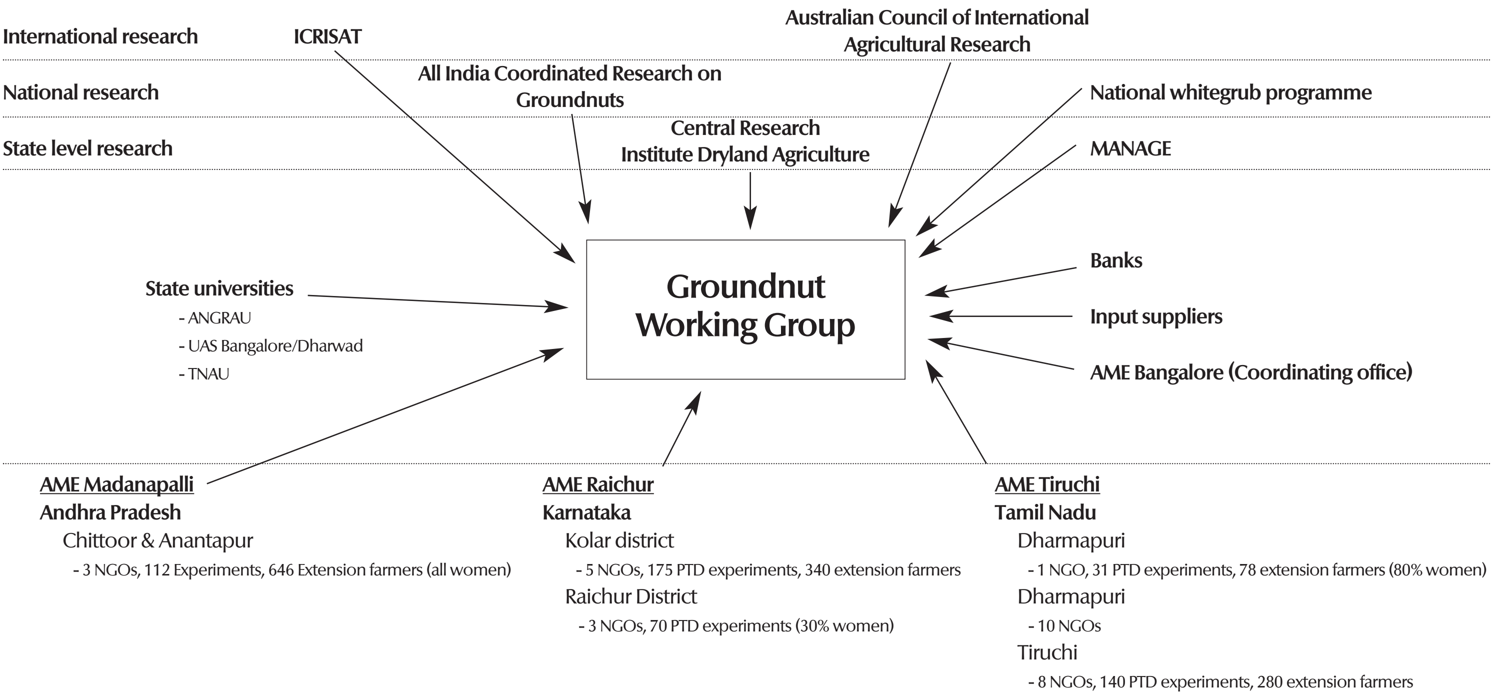
Since 1985 AME has been active in Southern India as an organisation focusing on training and professional support in the development of ecological agriculture. In 1990 PTD and SCA components were added to its programme. Its aim is to assist NGOs through capacity building in participatory technology development and contribute to the establishment of stakeholder platforms for research and negotiation in the interests of sustainable land use. AME believes that, to get a fair share of what the land has to offer or to be more effective in their own development role, all stakeholders in land use should participate in the effort to increase sustainability.

AME's approach is to focus initially on the ecologically sound production of a specific crop. Gradually the approach is broadened to address a variety of issues in the development of sustainable integrated farming systems and watersheds. Beginning with a single NGO or a homogenous group of NGOs, it facilitates the steady build-up of relationships with other institutional actors such as panchayats (community councils), government departments, research institutions, input suppliers and credit institutions. This cumulates in the establishment of stakeholder platforms as a strategy for up-scaling participatory and integrated land use development.

PTD in groundnut: getting started

While initiating a PTD process for groundnuts with small and marginal dryland farmers in south India, we discovered that local knowledge was not necessarily the answer to their problems. Traditionally long duration varieties were cultivated within the context of mixed cropping systems. It is possible that pest and disease problems were not so significant and therefore farmers did not have much knowledge about control measures. Perhaps because they

GROUNDNUT PTD AND EXTENSION PROGRAMME, AME INDIA



Box 3 **Our strategy was to restore soil fertility**

Farmers experimented with cheaper sources of nitrogen (rhizobium bacteria) and phosphorus (mussooriephos plus phosphobacteria) and applied gypsum at the flowering stage. We found yields had increased when compared to control plots where chemical fertilisers (DAP or other compound fertilisers) had been applied. Yields were similar or lower when compared to plots where substantial quantities of farmyard manure had been used. This focused our attention on farmyard manure. We found that when some 5 to 7.5 metric tons were applied per acre the monetary returns were twice as much as the costs involved. Our main problem was to generate the required quantities of farmyard manure as the average farmer has only two head of cattle producing about 4 metric tons of manure annually, not enough for one acre but the yield increases of groundnuts grown with this amount of farmyard manure is such that the area under groundnuts can be reduced without income being affected.

The area freed can be used for green manure production. One of the partners has started green manure production plots to evaluate the feasibility of this approach.

have only recently had to deal with new varieties and because many marginal farming communities are not traditional farmers, their knowledge of groundnut cultivation is limited. Also, the younger generation has lost interest in learning about traditional practices. The PTD process initiated by AME, therefore, had to rely more heavily on formal research.

AME's first experience with a groundnut PTD process took place in 1994 with an NGO and sixty farmers in the Dharmapuri district of Tamil Nadu. Here two groups of farmers decided to implement experiments. A fairly good insight into important factors influencing groundnut production was obtained over a two-year period. By 1996 this work expanded to Chittoor district in Andhra Pradesh where groundnut cultivation faced many problems. Working with 20 individual Dalit farmers in one village proved to be a slow process because their familiarity with farming was less than 25 years old. The Dalit were erstwhile untouchable, landless, agricultural labourers.

Consolidating and expanding PTD

A first sustainability analysis could be made on the bases of the Dharmapuri and Chittoor experiences and a strategy was developed to restore soil fertility and physical characteristics at low cost (see Box 3). With these experiences, a provisional groundnut production manual was published in early 1997 and provided a basis for working in other areas.

Having identified problems through PRAs and found similarities, it was not a question of looking for things to try, but rather a matter of getting started in a demonstration mode. But due to differences in climate and soils, new problems emerged and proper PTD experimentation on these issues started in 1998 and 1999.

Platform building for SCA

In the new areas we encountered the problem of whitegrub and leaf miner. AME had little information about these pests and we approached the researchers. This lead to a workshop in late 1997 which we organised with the National Institute for Extension Management (MANAGE). Representatives from the All India Coordinated Project on Groundnut and Whitegrub, state agricultural universities, ICRISAT and a broad group of NGOs also attended. We learned a lot from each other and established important links with the researchers. In this way the Groundnut Working Group (GWG), a platform for SCA was born. The idea was elaborated to create a platform that would bring together researchers, input suppliers, policy makers, NGO's and farmers on a regular annual bases to create more synergy through the exchange of experiences and information. This whould lead to more 'need'- driven research, an improvement in the knowledge of all parties involved, a better supply of new, environmentally-friendly inputs and improve farmers access to the banking system.

In 1998, NGOs presented findings from the 1997 PTD experiments to researchers and representatives of national programmes at a second GWG workshop organised at MANAGE. Banks and input suppliers were involved in the hope that they would become interested and willing to provide credit and ecofriendly inputs to the experimenting farmers. The workshop focused on whitegrub and leaf miner control and tried to promote collaborative efforts. The result was the birth of the whitegrub programme (see Box 4).

Scaling-up PTD and SCA

The first experiences with PTD experimentation in Dharmapuri in 1994 involved 60 farmers. Now the technology selected by PTD farmers is used on about 5000 acres by an estimated 2000 farmers. AME has also linked with two more NGOs, one in Chittoor (20 PTD farmers in 1997 now about 60 PTD farmers and 150 users) and one in neighbouring Anantapur district (20 PTD farmers in 1997, now about 30 PTD farmers and 700 users) working with the women farmer members of a self-help group and a young male farmers' group.

Now AME partners 14 NGOs and 500 farmers in five districts in Andhra Pradesh, Karnataka and Tamil Nadu in PTD processes. Further, other NGOs and an estimated 1500 farmers have been influenced in their way of cultivating groundnuts as they too use the results of our work.

AME has designed various ways of up-scaling:

- NGO staff train their colleagues in proven technologies which are then disseminated through normal extension.
- Farmers who attended the training take it upon themselves to assist other farmers trying out the proven technologies. Some aspects of PTD experimentation might be incorporated but it is mostly extension;
- New groups of farmers are identified by NGOs and new PTD processes are initiated;
- Farmers who participated in the PTD processes give interviews for radio programmes on agriculture;
- Small, user-friendly manuals with good illustrations are produced in local languages;
- Neighbouring farmers start using part of the technology which they have assessed to be valid.

Box 4 **The whitegrub programme**

One outcome of the GWG workshops was the decision of the Australian Council for International Agricultural Research (ACIAR), the Indian Council for Agricultural Research (ICAR) national whitegrub programme, ICRISAT, the Chittoor and Anantapur NGOs and AME to embark on a joint research initiative on ecofriendly whitegrub management. The objective was to isolate a congregation pheromone for whitegrub adults which would attract them to one spot making it easy to kill them before they could lay eggs. This would significantly reduce the pesticide load and would be much more economical than the present method of control. Such a congregation pheromone has been identified for the species in north India and after two years of control the level of pest infestation was reduced for five years.

At present a systemic insecticide is applied as a seed coating to control whitegrub. This insecticide also controls jassids, white flies and leaf miner to a certain degree but is expensive for farmers.

After the first year there were discussions at the level of the national whitegrub programme. The all India coordinator was not sure how important the pest was in south India. It was suggested that a survey be carried out there. In the third GWG workshop (1999) it was suggested that the NGOs take part in this effort. About 25 NGOs reacted positively and embarked on a systematic collection of whitegrub. Many insects were caught and sent to University of Agricultural Sciences, Bangalore and ICRISAT for identification. A collaborative survey of larval density is being carried out in endemic areas. Recently an area was discovered where damage was observed to be 100%. This observation is in sharp contrast to the prevailing government view that whitegrub is not a major pest in south India.

A major expansion of the PTD programme is presently taking place (see Box 5) since the experienced farmers have assumed the important role of training other farmers. The larger part of the programme comprises extension training in proven techniques of groundnut production, selected by PTD farmers in the area concerned.

New issues are coming up

In the third workshop (early 1999) organised at CRIDA (Central Research Institute for Dry-land Agriculture), problems related to groundnut diseases were explored. Farmers had incurred serious losses due to fungal diseases, mainly collar and stem rot, in the preceding growing season.

Leafspot and stemrot control

During the workshop it became clear that leafspot and stemrot control are interrelated. To prevent stemrot it is necessary to control leafspot. The most common way of controling leafspot is by spraying with chemical fungicides (Dithane M45, Bavistin, etc.) at regular interval starting at about 60 days after seeding and repeating applications at intervals of about 15 days. This means that about 3 sprays are required. This is too labourious and expensive for small-scale dry land farmers .

The early warning system developed by ICRISAT makes a more accurate timing of sprays possible. It can also indicate that conditions are unfavourable for the disease and spraying is unnecessary. This reduces labour and cost. Even so farmers found it still too expensive so we set about looking for alternatives.

In the literature we found that magnesium deficiencies could enhance susceptibility to leaf spot. Thus we tried magnesium fertilisers and saw a moderate decrease of disease incidence in the field. A partner NGO informed us that a concoction of leaf extracts of *Lantana camera* and eucalyptus has fungicidal properties, so we tried this as well. Farmers complained that spraying is difficult and expensive even with botanicals. We discussed the farmers' evaluation in the workshop.

Scientists and NGO agronomists assured us that resistant groundnut cultivars exist and perform well both on station and at farm level. They agreed to supply the NGOs with a basic quantity of seed of five cultivars. Quite a number of plots have been planted, NGO staff and farmers monitor disease incidence and ICRISAT staff visit the plots and train NGO staff and farmers in disease recognition and scoring. Scientists from national agricultural research institutes also presented research results that showed that a high dose of gypsum at planting time (200kg/acre) significantly reduced the incidence of stem rot. Other scientists expressed interest in the scientific validation of botanical extracts and homeopathic medicine in leaf spot control. The whitegrub programme has also decided to test the effectiveness of homeopathic medicine in controlling whitegrub as well.

Partcipatory documentation

We had found that many farmers and NGO staff were confusing the reasons why groundnut plants were dying. The whitegrub team took the initiative to develop a field determination booklet called *'Why are my groundnuts dying?'* This booklet provides a pictorial guideline for determining the cause of death. The draft was discussed in the workshop and comments have significantly altered the layout, choice of photographs and the text. A joint press conference with CRIDA provided newspaper, radio and television coverage which resulted mainly in political interest in our collaborative efforts.

What does the future hold?

Over the past five years we observed that the PTD process which AME initiated in a small way has gradually generated enormous enthusiasm, and spread rapidly to neighbouring areas. Today many organisations are involved. It is satisfying to witness that certain processes have become self-propelling, no longer requiring any effort from our side and that AME could gradually phase out its involvement.

We have also observed that not everything scales up by itself. Technologies once validated by farmers, spread fast. Yet, the experimentation process itself, which in the first place resulted in learning about technologies does not scale up so easily. It requires continuous nurturing, able guidance and intensive monitoring.

Knowing that the number of farmers who have become actively involved are a mere fraction of the total farming population and that much more remains to be done, we conclude that scaling up the capacity to guide experimentation remains a major challenge. It will perhaps require another half decade before this ability becomes self-perpetuating. ■

Box 5 **Involving women in PTD**

After two years of PTD experiments, a federation of self-help groups of women members in the Anantapur area decided to adopt gypsum, rock phosphate and biofertiliser application as proven technologies. They are now disseminating the technology throughout their federation of 120 women's self-help groups that have a total of 2000 members. About 700 of them started to use the tested technology in 1999. The self-help group involved in PTD experiments was able to inform the federation by inviting the leaders to PTD evaluation sessions. Women's groups in particular performed well in our PTD experiments. Men often mixed up their experimental and control plots whilst most of the women maintain the plots separately and collected data meticulously.

photo: Bert Lof

Women groups decided to adopt gyprum, rock phosphate and biofertiliser as proven technologies.

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INDIA

RESEARCH PARTNERS

- More than 2000 farmers
- More than 20 NGOs
- State, national and international research
- State Universities
- Banks
- Input suppliers
- MANAGE
- AME

In southern India, on the semi-arid Deccan Plateau, AME is facilitating a research platform of farmers, NGOs and research organisations on groundnut production. Millions of small farmers with marginal land have become dependent on groundnut monoculture to obtain cash. However, due to soil degradation, pests and diseases and macro-economic issues groundnut increasingly gets an un-sustainable option to them. AME strengthens farmers and NGOs capability to analyse their situation, experiment with alternative practices and interact with scientists, bankers and input-suppliers. Many farmers recognized the viability of several of the soil fertility and pest and disease management practices experimented with. This has resulted in a fast growing coalition of stakeholders who discuss and coordinate their concerted actions in the 'Groundnut Working Group'.

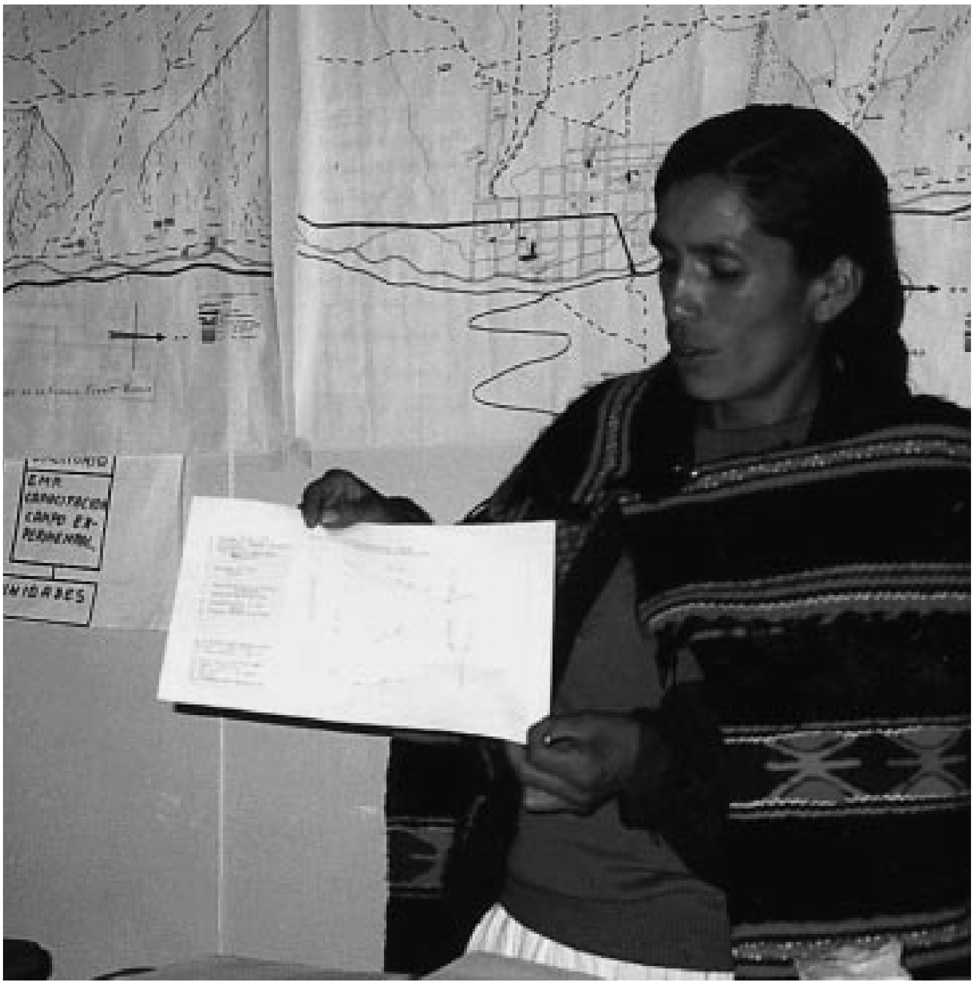

photo: Bert Lof

Farmer explaining PTD results.

Results and impact of the PTD process

After two years of learning, experimenting and sharing results, the stakeholders in the PTD process examined the extent to which they had achieved the goals they had set themselves in 1997. The farmers, NGO staff and researchers who participated in the research programme assessed its impact and results in the following way.

Farmer' capacities strengthened

The majority of farmers showed a keen interest in experimenting, monitoring progress and assessing results. They organised themselves in groups to share and discuss the results and many now wish to go on conducting new experiments. A major attraction for both individuals and groups is having the opportunity to compare different options and learning moments. It strengthened the confidence of farmers in their own ability to find solutions. Traditional knowledge and management capacities were accepted as strategies for reaching production improvements and natural resource management.

Both farmers and technical staff have learned from these first experiments. They have come to a better understanding of such concepts as treatments, controls, variables and factors and farmers are now able to use them effectively. At the same time researchers have learned to adapt their scientific designs to farmers' realities and evaluation criteria. It is clear that farmers still have a lot to learn when it comes to recording and monitoring data. At the same time attention must be given to what are the most suitable statistical methods for analysing the results of farmer-managed experiments.

Experiments helped to develop LEISA

Farmer assessment of various experiments proved a positive move towards improving agricultural livelihoods. This was achieved either by reducing costs through the use of cheaper local inputs (eg herbal treatments for potato disease and shipita for the treatment of liver fluke) reducing dependence on external inputs or by introducing new elements into the production system (see p 67 pasture management). Follow-up experiments have started to identify solutions to related problems such as making silage from fodder legumes and trials to adapt shipita to different locations and altitudes.

During PTD activities it became clear that women possessed important knowledge and capacities when it came to designing and implementing experiments. Women were the carriers of most of the knowledge relating to local herbs and to their usefulness as botanical pesticides. They understood the specific characteristics of different varieties of plant material and were well aware of the treatments locally available for livestock disease. Better use should be made of this specific knowledge.

Farmers, scientists and NGOs

The experiments can be considered as a convergence between formal science and farmer knowledge. At all stages of the PTD process farmers worked closely with NGO staff and researchers from the various agricultural research organisations involved. The joint analysis of the causes and effects of the major problems laid the ground for a common understanding. The presentation of researcher-identified options, such as newly introduced fodder legumes, demonstrated the farmers the important role scientists can play in providing alternative solutions. Scientists can also provide the analytical tools to confirm experimental findings such as the laboratory tests carried out to determine the incidence of liver fluke in treated and non-treated animals.

PTD has facilitated a shift in how NGO partners approach farmer priorities. Instead of focusing on their own agendas, NGOs saw how PTD farmer-workshops brought farmer priorities to light that had not been identified in NGO programmes. It was clear from the beginning that focusing experiments on LEISA alternatives reflected farmers' needs and requirements.

PTD: long-term relationships

PTD experiments showed that there was still considerable scope when it came to finding alternatives to the conventional solutions presented by government agricultural research and extension. Most of the partners involved wished to develop their PTD capacities further and integrate PTD into their operation plans. The Peru experience shows the importance of training staff in government institutions to encourage a wider application of PTD at this level. It was recognised that PTD is a process that requires more time than a few cropping seasons. Creating networks among different types of institutions involves long-term relationships. ■

photo: Markus Staub

Farmers exchanging PTD experiences.

Sharing the PTD approach

Markus Staub Eisenlohr

The objective of PTD is to ensure that small-scale farmers genuinely participate in establishing their technological requirements and develop their capacity to carry out experiments in the field. This method of participation enables peasant families to achieve a more sustainable rural development. After gaining experience in PTD among self-sufficient farmers using few external agricultural inputs, CEDEPAS (Centre for Ecumenical Promotion and Social Action) a Cajamarca NGO, decided to apply the methodology with farmers using high levels of external inputs to grow potatoes. The experiences of two groups of small-scale farmers, who exchanged information about the research methods applied for PTD, indicate that experimenting farmers can be useful promoters of such an approach.

Learning and teaching

In 1997, CEDEPAS began applying PTD methodology in the Magdalena district, a self-sufficient area. The replica of PTD training provided by ILEIA coincided with the migration of peasants to the so-called Yunga (areas below 2300m) to work as labourers in the rice fields at the beginning of the dry season. The first PTD cycle began with only five families because of the experimental nature of the work and the heavy workload of the promoters. These families completed an entire PTD cycle in one year.

Farmers in Magdalena started to discuss the problems of their environment by identifying the natural resources available to them. Four main problems emerged: limited soil fertility, 'Rancha' in potatoes (*Phytophtera infestans*), the lack of pasture land for cattle and endo-parasites in cattle.

In order to further explore the problem of limited soil fertility, staff and farmers constructed a so-called 'problem tree' to describe cause and effect. Areas of possible intervention were pinpointed with a view to finding solutions. In their search for solutions that were within their own resources, farmers decided to plan and implement a field experiment involving the use of cattle dung in potato plantations. This would be applied in different forms: the traditional dry dung core sample, damp dung (kept in a manure heap), and damp dung mixed with straw (kept in a manure heap). The purpose of this experiment was to prove whether an adequate application of manure would increase soil fertility. Apart from other indicators observed during the farming season, yield was the main indicator against which the success of the experiment was measured. The best results were obtained with damp dung, equivalent to a 20% increase in the harvest when compared with the yield achieved using dry dung.

The fact that there were only a few participants enabled staff to closely monitor the entire process and maintain an intensive flow of communication with the farmers. In this way, both promoters and farmers satisfied their interests and learnt from the experiences and discussions. The PTD instrument was thus studied in depth and its characteristics and peculiarities were identified. The interest aroused by the experiment guaranteed the farmers' attention. Through their observations and considerations, with the help of promoters, they absorbed the whole process and adopted the results.

From farmer-to-farmer

Three farmers from Magdalena who were involved in the experiments were invited to accompany two CEDEPAS promoters. The latter were supposed to introduce the PTD methodology to farmers involved in a project promoting market-oriented potato production in another part of the northern highlands. The purpose of this two-day workshop was to introduce the methodology to other promoters and to start the PTD process with peasant families in the area.

The promoters took along panels with photographic sequences of the first PTD cycle to liven up the workshop. However, during the trip they came up with the idea that the experimenting farmers themselves should demonstrate their experience of the methodology to the workshop participants. Guided by the photos, the farmers from Magdalena did an excellent job. The experience gained throughout the process had turned them into PTD experts. As a result of the enthusiasm and conviction with which they showed how they had experimented with different forms of dung, the promoters attending the workshop were convinced of the viability of the PTD methodology. Farmers realised that the technical results of this experiment were better than with chicken manure, a product that was becoming increasingly expensive to buy. It became clear that the workshop participants were more influenced by the experiences of the experimenting farmers from Magdalena than by the explanations provided by the promoters. This was the more convincing as the experimenting farmers had gone through all the steps of the PTD cycle maintaining a constant dialogue with promoters.

The promotion of this experience convinced many families of the usefulness of the PTD methodology and these are now going through a similar process of implementation and learning. Experimenting farmers are well aware of the positive impact of their experiences on other families.

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photo: GIAREC

Farming is not only an economic activity in rural communities, it is also a lifestyle. Over the years, small-scale farmers have established and adapted production systems to sustain their families. They developed techniques by managing the natural resources available and by adjusting them to constantly chang-

Custodio Bojórquez Reyes

ing weather conditions. Andean farmers also organised themselves and planned, controlled and regulated land use collectively. This process gave rise to such practices as fallowing, crop rotation and crop associations, creating biological diversity,

Peasant expertise and formal science

utilising by-products and agricultural residues, livestock breeding complementarity, the use of plants for animal health and the management of microclimates.

The small-scale livestock breeders in the peasant communities of Miravalle, Quilcas and San Juan de Jarpa - joint participants in the ILEIA project - identified the lack of pastures during the dry season as one of the main problems they faced in their production systems and in maintaining their lifestyle. The Veterinary Institute of Tropical and Highland Research (IVITA), a member of GIAREC and mandated to provide advice to producers on matters concerning animal health and animal feed, assisted the farmers in finding solutions through a participatory process of innovation.

Lack of forage during dry seasons

In the Mantaro valley, livestock are bred at altitudes that range from 3200m in the flat valleys to 3800m on the steep slopes of intermediate areas and at 4200m on the high plains and plateaux. Farmers have adapted to these varying geographical conditions and established livestock production systems that are compatible with the various forms of land tenancy such as large-scale enterprises (SAIS), community associations and family farming units.

The tendency of peasant communities to breed more animals than the pastures can bear often result in overgrazing. To make matters worse, to meet the demands of a growing population, food crops are taking over pastures. Comparing the National Agricultural Censuses of 1972 and 1994 reveals that the area of pasture has decreased by 33% in the last 22 years and that farmland has increased by 52.5%. This means that there is less forage available for an increased number of livestock.

Sharing experiences

The application of PTD within the framework of GIAREC to tackle the problem of pastures helped establish a creative interaction between small-scale farmers in peasant communities and the NGOs and agricultural research centres promoting the process. In the process, the cause and effect of the major livestock feeding problems were identified and analysed. The next step was a session that exposed farmers to the techniques developed by IVITA. This made it possible to identify together possible solutions and to plan experiments. Consideration was given to the resources available to the producers. In this way local capacity to carry out experiments on the bases of peasant know-how and expertise and formal science were improved.

Advantage of harvest residues, producing and preserving pastures and forage material and improving the management of native pastures were among the alternative ways of overcoming fodder shortage discussed.

The technologies developed by IVITA and passed on to farmers included the use as feed of cereal straw (barley, wheat and oats) whose protein content had been increased by adding small quantities of green grass or by urea treatment. Cereal straw in the Central Highlands is seldom used for animal feed, mainly because ruminants cannot digest it because of its low protein content. A second option was the production of cultivated pastures and forage material by combining grasses with leguminous fodder. The production and management of oats is limited to the rainy season due to a lack of irrigation facilities in peasant communities. Cultivated pastures, on the other hand, are mainly adopted by intensive dairy-farming systems in intermediate valleys, under a rotational grazing system. The most common association consists of English ryegrass, Italian ryegrass, tangled grass, white clover and red clover.

Incorporation of improved leguminous plants in native meadows is another option and has been used with much success in the Southern Highlands. These crops should be employed in rotational grazing systems with short grazing periods thus preventing a heavy burden on the soil. Under this system between three and nine times more dry material is produced in native meadows.

The technique of sowing cereals alongside annual leguminous crops is based on the fact that in the Central Highlands it is common to find wild plants such as the annual leguminous Medicago species flourishing in fallow land and along the edges of the roads and irrigation canals. This is a high quality fodder similar to alfalfa. Cereals are combined with leguminous plants to produce a haystack that can be used as fodder once the cereals have been harvested. One of the problems with this technique, however, is the limited availability of seeds of these wild species.

The last option presented to farmers was the conservation of forage material. Storing the hay of upgraded feed oats is a simple process and is already used by a growing number of farmers. In order to produce the hay, the oats is cut when the grain is milky. It is allowed to dry outdoors for two or three weeks before being stored in haystacks or barns. Silos are another way of preserving green grass or improving the digestive properties of harvest residues such as dry fodder (starchy corn stubble) on a small scale. There are various types of silos built with local resources, in which fodder or treated harvest residues are stored ▶

and then covered with black plastic to keep them air-tight in order to prevent the fodder from decomposing.

Farmers' expertise

In most of the peasant communities in which rain-fed farming develops, the conservation of fodder is a strategic alternative to ensure a supply of animal feed. Farmers' animal feed practices centre around the use of harvest residues, the cultivation of fodder crops, the management of native meadows and limited irrigation or use of flooded fields. Dry fodder from harvest residues is a resource that small-scale farmers use exclusively for cattle feed during periods of low water. In order to improve this animal feed, farmers mix the dry fodder with alfalfa, ryegrass or green barley, or dampen it with salt water or urine to make it more palatable and improve its quality. Peasant farmers who have access to water usually sow grass: the most widespread species is Italian grass for cutting.

In many parts of the region, farmers have experience with native meadow improvement. This includes the regulation of the number of animals of each species that a farmer is allowed to put out to pasture in community-owned fields. At the same time communities have continued their ancient rotational grazing traditions, selecting their fields depending on the time of year and the ecological area. During the rainy season, all the farmers move their herds to the higher regions where plenty of pastures and watering places are available. When the dry season starts the animals go down to the lower area where the soil retains its humidy longer. This system gives the meadows time to recover. Farmers also divide grazing areas into sectors and rotate the fields, thus allowing the pastures to remain unchanged.

Some peasant communities have irrigated small areas and these enable them to have enough pasture land for their herds, particularly during periods of drought. Such areas include the so-called *'bofedales'* or flooded fields that provide large expanses of good quality natural pastures. Other communities have designed temporary irrigation facilities for native pastures in order to dampen dry meadows and revive the plants that have dried up due to lack of rain.

Farmers' and scientists' combined expertise

As a result of discussions between researchers, NGO extension workers and farmers after various options had been presented by IVITA, experimental groups decided to try producing fodder. They set out to evaluate the performance and adjustment of different species and associations within their own farming environment. In the three research sites, each group made an effort to clearly define the objective of the experiment:

- Miravalle: to compare how five varieties of grass adapt to three companion crop systems.
- Quilcas: to evaluate the performance of various varieties of grass cultivated at different altitudes.
- San Juan de Jarpa: to compare how different forage crop mixes perform, seeking to improve their year-round production and availability.

A total of 42 farmers participated in this experiment: 13 women and 29 men. Each experimenting farmer drew a sketch of their available land and indicated the layout of the trial.

The evaluation of the experiments was based on criteria formulated by farmers and technicians separately. While researchers put more emphasis on quantifiable production factors, farmers in general focus more on the factors determining the incorporation of different species into their production system. At group meetings, experimenting farmers exchanged their points of view on different aspects of the experiments (germination, growth, resistance to drought) and this led to comparisons being made between the different species of grass tested. This helped farmers form their own opinions about the most promising species. More important still, it encouraged them to continue experimenting and complementing their new skills in the conservation of fodder. Box 1 shows some of the results of the experiments in each zone.

The PTD approach proved to be an appropriate methodology for encouraging farmers to carry out collective action to identify and select the best solutions to the problems they themselves had identified. The exchange of experiences and know-how between farmers increased their self-confidence and encouraged them to organise themselves, discuss their problems and to propose a schedule of local experiments. Discussions between researchers, technicians and farmers enhanced peasant skills and improved the chance of obtaining specialised assistance from research institutions.

The positive results of the experiments created good prospects for new ones, thus triggering a collective local experimentation process. In the three sites, farmers have decided to start experimenting with silage techniques for fodder crops. They feel that growing fodder crops during the rainy season can have a beneficial effect and lead to an improvement in the fodder situation during the dry season when these crops are silaged.

Finally, the participatory and collaborative process that developed within the framework of GIAREC revealed that the interaction between peasant and scientific knowledge encourages rural populations to exchange technological and socio political views in a conscientious and sustainable way.

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Box 1 **Results of experiments**

MIRAVALLE

- Red clover proved to be more resistant to the lack of water, whereas Italian Rye grass was the most productive (10.08 kg/m^2).
- Red clover and Italian Rye grass yielded the most green fodder (9.91 kg/m^2).
- The white clover and English rye grass association required more water.
- Alfalfa was not planted in all farms, its growth was slower and it was the most susceptible to the shortage of water.

QUILCAS

- Red clover and Italian rye grass was the combination that adjusted better to local conditions, although red clover only yielded 3.9 kg/m^2.
- Red clover and Italian rye grass were cut every 45 days.
- Alfalfa was the crop most ridden with weeds and proved well established after the second silage.
- The regrowth capacity during the rainy season was evident in all experiments.

SAN JUAN DE JARPA

- Red clover + Italian Rye grass proved to be the most well adjusted and productive combination.
- Red clover + Italian Rye grass proved to be resistant to diseases and tolerant to drought.
- Red clover + Dactylo was the slowest growing combination.
- Alfalfa grew slowly and was affected by aphid and stained leaves.
- The germination of the seeds used ranged from 50% to 90%.
- Soil acidity was a limiting factor which affected the yield. The higher the altitude, the greater the acidity of the soil.

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Moth control with local plants

The high incidence of pests and diseases in potato crops has induced many farmers to apply different sanitation practices to reduce damage to tubers. In 1997, when GIAREC integrated PTD as a methodology to reinforce farmers' experimentation and innovation capabilities, the small farmers of Quilcas

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Peasant Community expressed their interest. This community has a long-standing working relationship with Yanapai, an NGO member of GIAREC. The farmers identified the rate of pests and diseases in potato crops as one of their main concerns. Among these pests was the 'Andes weevil' (*Prennotrypes suturicallus*), the 'potato moth' (*Symmetrischema tangolias Gyen*), and the soil worm known as utushcuro (*Copitarsia turbata*). Of the

Strengthening farmers' research

photo: GIAREC

Harvesting LEISA potatoes.

three, the one that required urgent control was the 'potato moth', particularly during seed storage.

Starting the search for innovations

After identifying and setting priorities for this particular problem, the PTD process enabled the farmers -together with the Yanapai facilitators- to visualise causes and effects, and to recognise why the problem occurred and with what results (Table 1).

After the identification of the causes and effects of moth infestation, the farmers decided which causes to experiment on, what could be learned, and what was beyond their control and could not be changed:

- Things that could be tried (trials): use of plants for moth control in potato storage
- Things to be learned (training): seed selection, biological cycle of moths
- Things that could not be changed: climate

In this way ideas emerged that could be tried in the experimentation phase. Promising solutions arose from farmers' knowledge of agricultural practices. Old ways of controlling moths using local plants such as 'muña' (*Minthostachys spp.*), eucalyptus (*Eucalyptus globulus*), and 'chilca' (*Baccharis sp.*) were recovered. The moment the farmers became aware that traditional solutions using local resources were possible, they became very enthusiastic. Old practices that had almost been forgotten by community members were revived and their usefulness discussed. During these discussions it became apparent that farmers were very disillusioned with the chemical alternatives, mainly because they were too expensive and the concern about their toxicity.

Designing the experiment

The need to develop reliable experimental designs that could be handled and evaluated by the farmers themselves gave rise to the following questions which had to be answered by the farmers involved in the experimental process:

- What has to be solved?
- What is to be experimented with?
- Why is it useful to compare?

This methodology allowed the participants to define the experimental objective: 'To compare three forms of potato seed storage to establish the best way to reduce moth damage'. The treatments were defined with the help of the following questions.

- What is to be tried?
- When will this trial be carried out?
- How is the trial going to be carried out?
- What are the amounts to be tried?

Based on the suggestions of the older, more experienced farmers, the treatments compared were as follows:

- *Eucalyptus*, *'muña'* and *'chilca' ashes*
People in the region used aromatic plants such as eucalyptus, muña and chilca to control potato moths in the storage site. Many people used the fresh branches of these plants while others used dried leaves. For this trial the farmers decided to spread a combination of ashes from these plants over the seeds.
- *Petroleum traps* An alternative way of controlling moths was the petroleum trap. The farmers suggested placing these traps in every corner of the storage site. White, one-litre trays containing 0.25 litre of petroleum were used.
- *Control* (farmers' practice of storage)
The common way of storing seeds was to place tubers over a straw bed without spreading any product on top.

Experimenting

In order to validate the experiment, it was necessary to set up certain basic rules. Constant factors had to be established, procedures that all the farmers would follow in each of their experiments. It was decided that constant factors were the time of harvest, amount of ▶

treated seed, variety and size of seed, the storage site, material in the storage site, amount of ashes, storage period, and the process of monitoring and evaluation.

The farmers designed the experiment using a participatory process. The way in which the trial was to be implemented (size, materials, place) was described. For statistical purposes each farmer represented a duplication of the trial. This allowed experimentation to be simplified but meant that the conditions of the trial had to be the same for all farmer experimenters.

The design consisted of three small storage sites of the 'pen' type (0.70 m x 0.70 m x 0.25 m) made from eucalyptus, a local resource, with 1.50 m between treatments. The storage sites were placed around the dwellings. Each storage site represented a different treatment. Treatments were allotted randomly.

When the scheme was finished, an activity plan and schedule were prepared. Each activity was detailed and programmed in time. Inputs used were described, those who had suggested them, and the names of those in charge of the experiment. Training and evaluations were also included in this schedule. In this way farmers were able to follow each step of the experiment chronologically and were able to start organising the trials to carry on with planning and implementing the experimentation process.

Finally, to systematise the results, simple easy to handle tools such as a peasant's log were introduced. These logs were used by the experimenters once every 20 days to note activities undertaken. In a parallel process technicians used the trial log to record quantitative data and the scientific evaluation of the trial.

Evaluating the experiment

It was decided that both farmers and technician would formulate evaluation criteria in order to seek complementarity and correspondence between the various opinions and avoid any one criteria being dominated by another. Table 1 shows the criteria defined.

According to the farmer experimenters, the results of the evaluation showed that the difference between the three treatments was not very great. However, farmers felt the ashes treatment was better because the moth damage was only observed in the 'guides'. Not many tubers had been attacked. Although the petroleum traps were effective in attracting adult moths, butterflies and flies, and served as a protection in all trials, they were not functional because animals and children could brush against them causing the contents to spill over the stored potatoes and cause loss through tuber pollution. The 'control' also had a low incidence of moth damage; the tubers were well preserved.

Statistical analysis

According to the field technician from the Yanapai Group who was facilitating in Quilcas, a statistical analysis was too complex because it implied the adaptation of a statistical design to small-size peasants' experimentation. The design used was one of random blocks with each farmer being considered a block. The statistical result shows that there was no significant difference in the weight of tubers damaged by moths in the three treatments, but there was a significant difference between the blocks (farmers), which showed a differentiation between the farmers in the control. Although the high variability between treatments and blocks could have been reduced with a larger number of duplications, this was complicated in the peasants' experimentation because of limitation in time, space and resources.

It should be noted that, for experimenting farmers, results from the storage sites alone were not enough. They also had to try the seeds in the field. In the following agricultural season, the seeds were sown and the statistical results showed that there was no significant difference in the yields from treatments. Nevertheless, a significant difference was found between farmers.

The scientific evaluation of the trials was an opportunity for NGO technicians and scientists from the agricultural research centres to discuss which statistical designs were best for farmers' trials. Ways of reducing variability in statistical analysis, and ensuring that these analyses were intelligible to all experimenting farmers, were also discussed. The need to establish statistical designs specifically suited to the farmers' trials was stressed because this was considered a critical factor for the scientific validation of farmers' experiments.

Strengthening farmers' capacity

It is important to observe that the analysis of cause and effect enabled farmers in the Quilcas Peasant Community to clarify such issues as differentiating the damage inflicted by pests and processes such as the moths' life cycle that had not been discussed earlier. This enabled them to differentiate the type of pest in the storage site from that produced in the fields. It helped them to develop a mental model of the experimentation process and to understand why a sequence must be followed. This knowledge allowed them to describe their experience and to share processes and results with other experimenting groups within GIAREC.

Despite these positive aspects which indicated a strengthened capacity of local peasant research, the follow-up process and the way trials were recorded was weak. The farmers were not used to noting down data, and that made it difficult to systematise quantitative information. Sheets from the trial were not always correctly registered because many women were illiterate. This shows the need to create or design more adequate tools for these types of social reality that might motivate a more permanent follow-up and strengthen the capacity of peasant experimentation and innovation from a gender perspective.

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Table 1: Problem tree showing causes and effects of potato moth

EFFECTS:	CAUSES
1. Damage to tubers' eyes hampered budding	1. Not all tubers are harvested
2. Sour/acid taste in potatoes for consumption; not even suitable for animals	2. Use of contaminated manure or plant residues
3. Damage in all growing stages of the plant	3. Lack of knowledge on pests' biological cycle
4. Affects storage and field crops	4. Indiscriminate use of agrochemicals
5. Moths become resistant to agrochemicals	5. Lack of cleanliness in storing sites
	6. Bad selection of harvested potatoes

Table 2: Farmers' and technicians' evaluation criteria

Criteria of farmers evaluation	Criteria of technician's evaluation
Tubers with moths	Number of tubers damaged by pest and disease in the store site
Colour and size of 'guides'	Mechanical damage
The emergence of the tubers in the field	Weight loss per storage site
Quantity of tubers damaged by pests	Type of budding, emerging, height of plants
Quantity of input used	Yield (number and weight)
Yield	Tuber loss
	Pests and diseases

The use of local plants to control parasites

Ida Mendoza Alvarez and Vicente Nalvarte

The sheep-raising family farms of the Andes rely on natural pastures growing at altitudes that exceed 4000m. The extent of grazing land available varies, depending on the access peasant communities have to these areas and the climate. Pastures that flourish during the rainy season are depleted in the dry season. The lack of fodder and difficulties in managing flocks at these altitudes affect animal health and, consequently, the economy of peasant families. Such is the case in the communities of the San Juan de Jarpa and Yanacancha districts in the upper reaches of the Cunas river in Peru's central highlands. Here livestock breeding is the main activity among small-scale farmers. Family-owned flocks consist of sheep, alpacas and some bovine cattle. Although pastures are plentiful during the rainy season, over-grazing destroys them.

In the middle and lower parts of this river basin, peasant families grow potatoes, barley, broad beans and native varieties of tubers and edible roots to feed themselves and to sell any surplus. They also plant exotic fodder to complement their animal feed balance, mainly oats. The farmers have links with urban markets like Huancayo and Chupaca where they take their produce each week.

Diagnosis of farming constraints

Peasant communities in San Juan de Jarpa conducted community diagnosis and a diagnosis of their farms, with a great deal of knowledge and skill, particularly in identifying their main problems. They pointed out the following constraints:

- 'Andean weevil' (*Coleoptera Curlionidae Premnotrypes*) infestation of potato crops, which damaged between 45 and 50% of the production during 1997-98 season.
- Fodder shortage during the early months of the rainy season (November to February) when pastures have still not recovered from the dry season,
- Parasitism affecting sheep and cattle during the rainy season caused by *hepatic fasciola* or *distomatosis*, locally known as *'alicuya'*. Hence the low productivity of the livestock and the consequent negative impact on the family's economy.
- The low prices of meat in urban markets. These low prices fail to compensate production costs, particularly when the animals are sold at a time when pastures are scarce.

The family livestock-breeding system

Sheep breeding systems are based on the availability and extent of the natural pastures owned by each community. These include:

- *Permanent grassland:* Animals graze in a natural pasture assigned to each peasant family. This is capable of sustaining between 50 and 450 sheep and is run by a family member or a hired shepherd. The process is currently improving as management schedules have been established, sanitary conditions are more stable and fields are rotated. This is a mixed breeding, multi-family system (for examples sheep, beef cattle and alpacas) practised in large communities in which each community member is entitled to an average of 15 to 25ha of natural pastures.
- *Rotational grazing:* Sheep graze alongside beef cattle and rotate between two areas, depending on the season. In the higher parts (community pastureland), they graze during the rainy season (September and May), taking advantage of the re-growth of forage and water sources. During the dry season (June-August), they graze in the lower parts, taking advantage of stubble fields, damp meadows and small areas of permanent grassland. This is a multi-family system with flocks of between 20 and 150 sheep, practised in medium-sized communities with an average of 5 to 10ha natural grassland per community member.
- *Grazing on the borders of farm plots:* Under this system, sheep graze outside the farms, alongside roads and in small natural pastures under the control of a shepherd. Flocks range from 5 to 20 sheep per family and family members take turns in taking them out to graze. This system is practised among small communities and families with only a few animals.

Rate of occurrence of distomatosis

In the higher parts of the Cunas river basin, distomatosis is one of the parasitic diseases which has the greatest economic impact on sheep breeders because it results in a high mortality rate, low meat production and a poorer quality of wool.

The following are the main causes of the increasing frequency of this parasitic disease:

- Grazing in infested pastures, whether natural or cultivated. This problem is aggravated by the lack of grassland rotation.
- A lack of preventive treatment of the sheep because farmers cannot afford veterinary products.

A PTD experience in sheep-raising family farms in the Peruvian Andes

- Lack of awareness of the biological cycle and rate of occurrence of this parasite.
- Lack of preventive practices to control the vector (*Lymnea ssp.* snail) which thrives in moist or humid soil during hot periods.

The sanitary aspect is precisely one of the factors that restricts livestock-breeding, particularly if the intention is to improve animal productivity.

Traditional treatment: shipita

According to research studies carried out in the region, producers have traditional ways of controlling distomatosis or *'alicuya'*. These include adding copper sulphate and salt to the animal feed as well as a dose of wild artichoke leaf extract or a combination of bell pepper, red nettle and sharp lemon. Amazing results are obtained from a dose of a preparation made from a native shrub known as *'shipita'* (*Columnella abovata*).

The *shipita* is a perennial shrub that grows all over the southern part of Huancayo province. It has long thin stems which are flexible enough to be used for weaving baskets. It has plenty of small leaves of a dark green colour and has yellow flowers. It can reach a height between 1.5 and 2m and can be multiplied through seeds, by layering and through cuttings.

According to some local community members, treating alicuya with *'jaya shipita'* involves soaking dry leaves from the shrub overnight and, after straining the liquid, mixing it with oil. Half a bottle of this medication is fed to each adult sheep.

Table 1. Design of the experiment and treatment per family

Treatment A :
5 adult sheep that will be given the dosage and remain under observation for 14 days.

Treatment B:
5 adult sheep that will not be given the dosage (control)

Recipe used for the shipita preparation:
- Boil 250g of shipita stems and flowers in five litres of water for one hour at a high temperature.
- Remove the stems and flowers and grind them.
- Place the mixture back in the liquid and continue boiling for another hour until only about one litre remains.
- Let the mixture marinate in a covered container for 10 to 12 days
- Strain and use the extract

Dosage applied:
1cc of extract for every 3kg live weight.

One researcher (Cordova, 1981) recommended the use of one kilo of leaves of this plant per gallon of water (nearly 5 litres), soaked and strained as explained by community members, then mixing three parts of the extract with two parts of oil. The project's veterinarians changed this recipe to adapt the dosage to the limited number of sheep in family flocks and obtained a dosage of 1cc of extract per kilo of live weight.

As this plant is used frequently, communities obtain their supply from cattle merchants, basket vendors or from families who exchange products from the lower part of the valley for produce from the upper reaches.

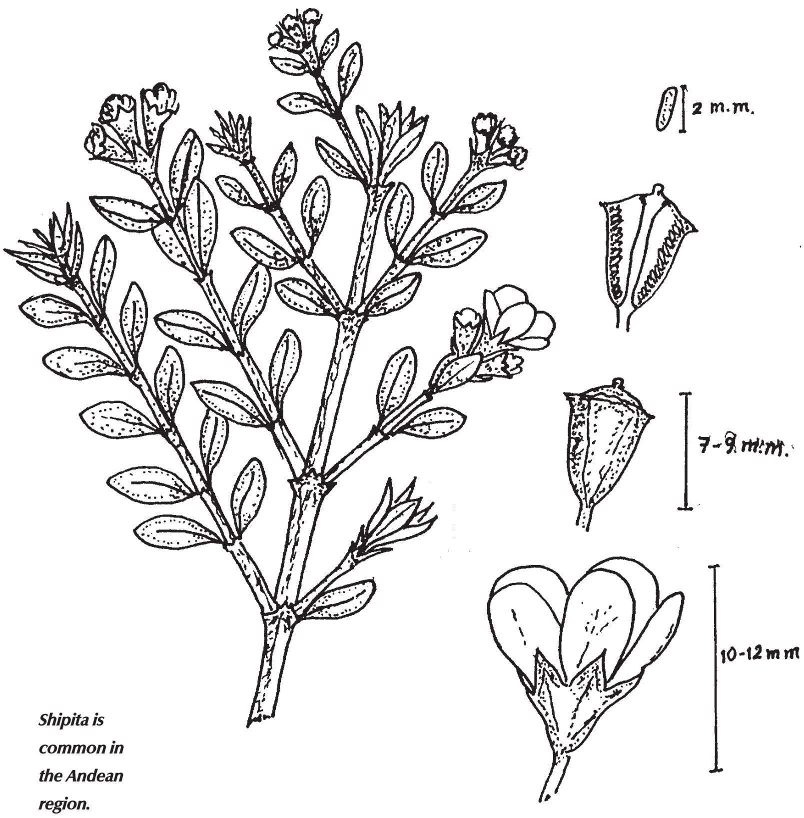
Designing the experiment with shipita

With a view to improving production and reducing the costs of family sheep-raising farms, the NGO staff involved in the ILEIA research programme decided to experiment with the use of shipita in controlling alicuya. To this end, arrangements were made with the Development Committee of the Peasant Communities of Alto Cunas, after the PTD approach had been presented. The Committee decided that the work would take place in six communities with an average of 4 to 6 research farmers - including women - per community. The research farmers were selected at a general assembly in each community, thus ensuring their participation and the replica of the results in each community. The participants formed working groups that were responsible to a coordinator.

The experiment was designed for 10 adult animals from each family flock. Half were treated with shipita and the rest of the animals formed the control group. The experiment was repeated 16 times in six peasant communities (see Table 1).

As experimentation is part of the peasant production system, they had no difficulty starting this 'learning by doing' approach as part of their efforts to improve their production through simple, small-scale comparisons. The close participation of farmers and their families in the implementation of the experiments was important for the assessment of the results.

The identification of evaluation indica-



Shipita is common in the Andean region.

tors for the experiment, such as the weight of the animal, reaction, quality of the wool, feed, quality of the meat and certain symptoms of the disease, were useful for improving accuracy of observation, registration and monitoring activities. The exchanges and evaluation meetings of community working groups also provided an opportunity for discussion. University staff were involved in laboratory testing animal faeces to establish the infection rate.

Results

Results of monitoring and evaluation carried out by experimenting farmers:

- *Weight:* Each animal was weighed at the beginning of the treatment and 30 days later. A 15 to 30% weight increase was recorded in the treated animals.
- *Animal reaction:* After receiving the dosage, many animals felt the impact of the remedy and were motionless. However, two hours later they were back to normal; they started eating and became more active as the days went by.
- *Wool:* some of the sheep had been losing wool. Now they started to recover it and its quality improved.
- *Feed:* After receiving the dosage, the animals acquired a greater appetite as the days went by and started to feed constantly.
- *Quality of the meat:* When the animals were slaughtered a month after the treatment, it was found that the quality of the meat had improved, the carcass weighed more, their livers were better. There was also no evidence of alicuya.

Furthermore, the laboratory tests on the faeces of treated animals proved that the dosage of shipita extract was 87.5% effective in controlling alicuya in adult sheep. Only 12.5% of the animals still had a Grade 2 (low degree) infestation. This shows the effectiveness of shipita in controlling alicuya.

Dissemination of results

Based on the results of the experiment, the NGO staff implemented the following:

- Reproduction and reforestation of shipita: 200 seedlings of that species were brought to the peasant community and planted in hedges and family plots so that shipita would be available to them in the future.
- Sheep handling and sanitation schedules were drawn up based on the results of the experiment and the livestock management system.
- A campaign against alicuya, using shipita was launched: 3248 sheep were treated in 25 farming units run by 60 community families.
- An overall parasite control proposal (MIPAR) based on the control of alicuya in family sheep-raising systems was designed. This included the study by university staff of the transfer of the disease vector. The results were discussed with the farmers.

Conclusions

The experiment confirmed the effectiveness of the natural product *shipita* in controlling *alicuya* as a low cost alternative for family sheep-breeders in Jarpa. The campaign that began with groups of experimental farmers and their families proved that the large-scale use of this method is possible. At the same time, producers were encouraged to continue with their research and experiments - in accordance with their needs - in order to improve their production.

In simpler terms, this process proved that with PTD, actions based on a participatory analysis can begin with a degree of understanding and motivation that reinforces a sense of commitment and guarantees results. At the same time, technologies can be created whilst the promotion is taking place providing they are based on farmers' primary needs.

The integration of local know-how and academic knowledge, cooperation between technicians and peasants and the incorporation of new professionals was another lesson obtained from the PTD exercise. In addition, it strengthened the relationship between research and NGO staff and the population. Finally, it was confirmed that PTD is a process that enhances local skills and resources without restricting external backstopping. ■

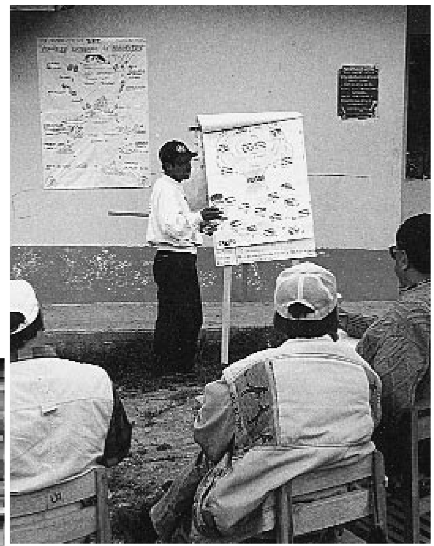


photo: Wim Hiemstra

Farmers and technicians discussing integrated approach to liver fluke control.

photo: Bert Lof

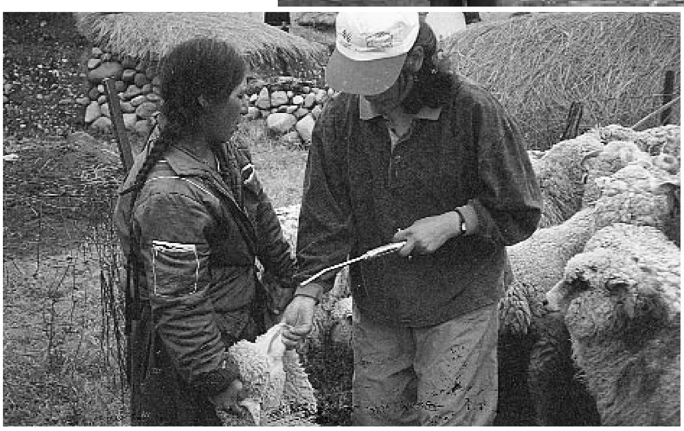


photo: CIAREC

Experimenting with Shipta to control parasites in sheep.

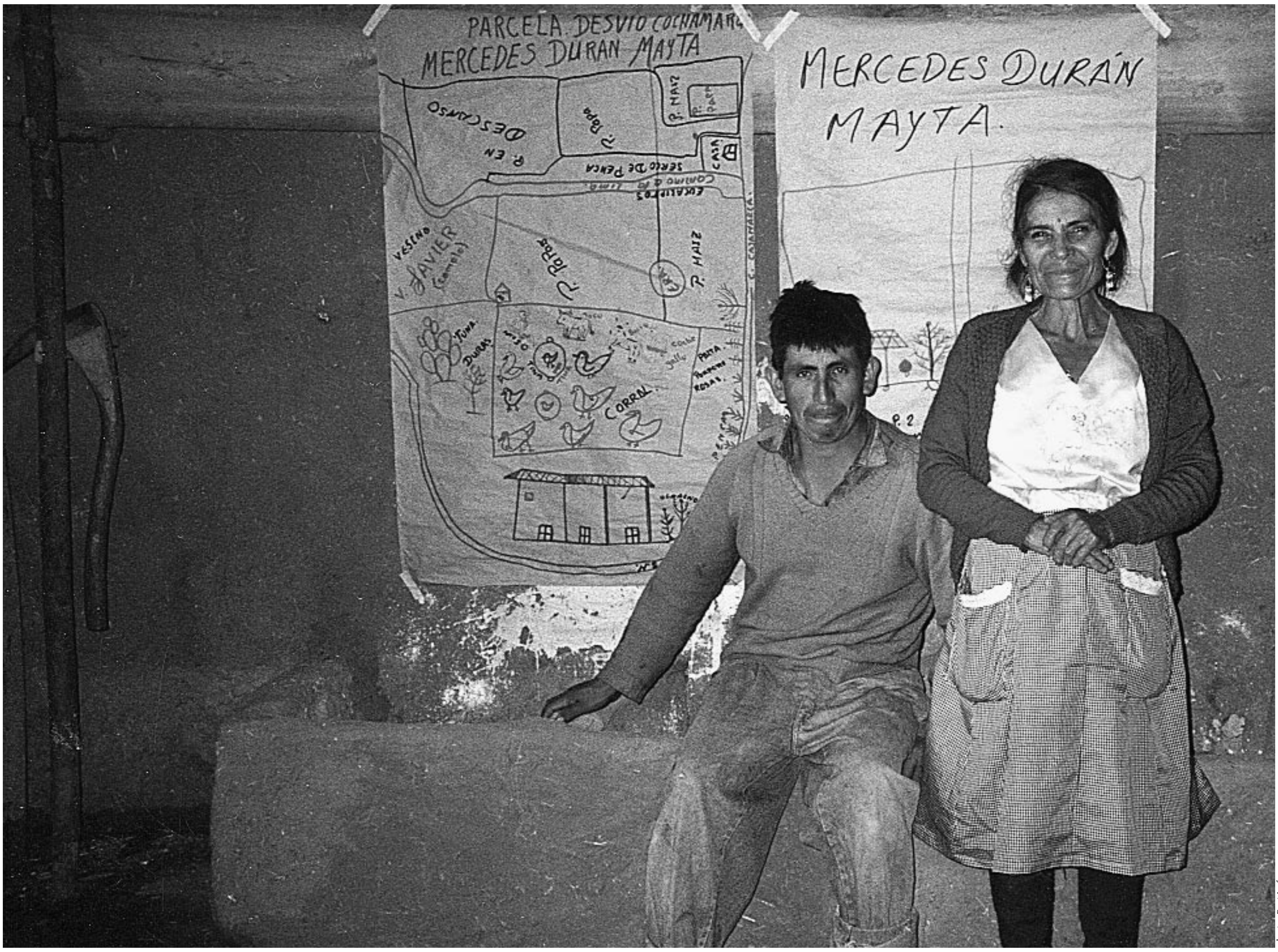


photo: Bert Lof

Farmer PTD experimenters.

Constructing joint action networks

Norma Canales Rivera

In the late 1980s, persisting and increasing poverty, together with environmental erosion, made it clear that a revision and reformulation of approaches and development criteria was necessary. Small-scale agricultural development had focused on technological problems without considering ecological, social, cultural, political and economic issues. The necessity of overcoming the crisis in smallholder agriculture lead to the emergence of the concept of sustainable development and the adoption of environmental, economic and social objectives. This new development approach seeks the active involvement of small farmers in formulating proposals that define what they want from technological, economic and social change. Joint strategies are also being developed among small producers, NGOs, agricultural researchers and local governments to reach proposed development objectives and to promote community empowerment. Individual institutional capacity to integrate the many aspects of sustainable agriculture is limited and only a partnership initiative can have a significant impact on food security, environmental preservation and income generation. The experience of GIAREC (Collaborative Group of Agroecological Research) is one attempt to join forces.

Collaboration for sustainability

In 1995, a group of NGOs (Grupo Yanapai, IDEA-Peru, REDES) and agrarian research centres (CEA-UNCP, INIA, IVITA-UNMSM) - all active in the Mantaro Valley, Central Peru in the vicinity of the town of Huancayo - decided to create an inter-institutional group to promote sustainable agriculture in their area. This working group was called GIAREC. Its objectives were to promote a more rational management of natural resources and to develop LEISA in the peasant communities of the Central Andes.

In 1996, GIAREC - with support from ILEIA - started a process of discussing and analysing various agricultural concepts and approaches with the object of achieving a consensus on criteria relevant to sustainable agriculture. This was to be formulated in a common language readily understood by everyone. It was also necessary to give training in participatory methodologies in order to enhance the participation of farmers in analysing local problems. This process of collective learning enabled farmers, researchers and NGO staff to better understand the rural and environmental reality and how the social organisations involved worked. It also allowed men and women farmers to participate as actors interested in the process and ensured they received credit for the value of their knowledge. Strategic decisions were taken and a plan of action defined that promoted technological change and incorporated ecological principles. In developing this process of conceptual and methodological consensus, GIAREC envisaged becoming a platform with a long-term mission and vision which guaranteed democratic participation to its members.

Mid-1997, the reoriented ILEIA Research Programme proposed strengthening farmers' ability to experiment as an important condition for small farmers' agriculture sustainability. This generated a participatory process to evaluate suitable technologies. The PTD process opened a space in which technicians, promoters and farmers could exchange and share experiences by establishing an interactive communication network among the groups of experimenters, agrarian research stations and NGOs. Both men and women participated in all groups.

Members joint actions

During the 1980s, inter-institutional collaboration between research and agricultural institutions and rural development organisations was difficult for social and political reasons (eg terrorist violence). Trust and solidarity among institutions was affected. However, the need to reactivate small farming production encouraged an approach that would strengthen linkages between peasants' communities, NGOs and agrarian research stations.

The problems of smallholder agriculture were evaluated collectively through discussion and analisis, and ideas and alternatives that offered solutions were sought. Training in participatory methodologies reinforced the analytical capacity of researchers, technicians and small farmers, enabling them to propose strategies to integrate traditional and scientific knowledge while taking into consideration both sustainability and local innovative capacity. The implementation and evaluation of PTD created an opportunity for sharing farming knowledge from three regions (Chupaca, Huancayo and Concepción). It also highlighted various established farming practices as options that could be used to solve the problems described by each group of experimenting farmers.

Each area developed its own process of technological innovation according to its social, cultural and organisational characteristics. In Chupaca (San Juan de Jarpa and Iscos Peasant Communities) the PTD process stimulated agreements between experimenting groups, local institutions (municipality, development committees, community enterprises) and development organisations (NGOs, sector programmes). Together they agreed upon joint actions to solve pests in crops and animals. It also meant the involvement of young university students - acting as facilitators - and the experimenting groups. In Huancayo (Quilcas Peasant Community) the groups of farmer experimenters - both men and women - established close linkages with INIA and IVITA research organisations for consultation and technical training. In Concepción (Miravalle and San Antonio) the groups of experimenters were mainly young people and they established a relationship with the agrarian research stations (IVITA) and the regional university (CEA-UNCP). Through the latter they were able to contact professionals at the graduate school to make an in-depth analysis of veterinary problems and to process the data they collected. This supports the argument that innovative processes are autonomous and cannot be repeated in other spaces or environments.

The experience of joint actions developed by GIAREC with small farmers, researchers and agrarian technicians has shown that through the participation of various actors and the sharing of experiences and knowledge, local experimenting and natural resource management capacity can reinforce local capacity. It is obvious that the interaction of peasant and academic knowledge and experiences re-values local initiatives for development and generates trust and self-esteem in both men and women farmer innovators.

It is also important to highlight the fact that the full participation of state agencies, such as agrarian research stations and universities, and their integration into working groups such as GIAREC emerged very gradually. The participation of key researchers who have decision-making power and who contribute to advocating LEISA concepts within their institutions is instrumental for this collaboration.

However, despite such progress, there is still a need to increase coordination and integration in order to identify key topics for medium- and long-term research and agricultural development common to the agroecosystems of the Central Andean valleys. This will enable the potential capabilities and experiences of every GIAREC associate to be realised. Not only in issues and processes beyond the immediate interest and generating capabilities of the small farmers, but also in formulating proposals for regional policies that will ease the way towards more egalitarian, democratic and sustainable development.

Achievements

The GIAREC working group had many achievements during its first three years. The capabilities and skills of GIAREC members were identified and put to work in the interests of promoting LEISA as an alternative approach to the development of peasant communities' in central Peru. A consensus on the definition of common objectives was also reached. This eased the merging of ILEIA Collaborative Research objectives with those of the associate institutions. GIAREC associate staff members have been trained in LEISA principles and in gender-sensitive participatory approaches. The various participants have learned to interact in an integral and interdisciplinary manner. The LEISA approach to sustainable farming also implies a personal and institutional commitment to generating opportunities that reinforce farmers' capacities despite the restriction of limited resources. This goes beyond formulating collective proposals and obtaining financial resources.

The agrarian research stations (CEA-UNCP, INIA, IVITA) are now recognised as sources of information on technological alternatives that can be adapted to the conditions and local resources of smallholder farmers. This acknowledgement has contributed enormously to the creation of mutual understanding and complementarity between peasant and scientific knowledge. Communication and information are understood to be key factors strengthening interaction inside the GIAREC group and between the group and outsiders. GIAREC is now more flexible in its approach to criticism and recommendations. There is a platform where new ideas can be discussed and where there are willing hands ready to take part in experimentation.

Each space or place has its own dynamics for developmental innovation depending on the problems prioritised, the sociocultural setting and the organisational background of the farmers and technicians involved. This is reflected in the local capacity to coordinate and integrate actions with solidarity, trust and transparency. Local development initiatives are valued and serve to strengthen the self-esteem of both men and women and reinforce experimentation and local management capacity.

Future outlook

The member organisations that have joined this joint-action network to promote sustainable agriculture are quite clear about the future. GIAREC intends to continue developing joint and participatory programmes to improve natural resource management in the Central Andean valleys. They want to increase the living standards of the rural inhabitants. GIAREC's vision is to become an institutionalised platform for development, carrying out sustainable agriculture programmes and contributing to the formulation of research and the promotion of policies, taking equity of gender, social justice and democratic participation into consideration.

In order to achieve this, GIAREC should allow their members to benefit from the comparative advantages of each associate, creating synergism between experimenting farmers, community organisations, agrarian research stations, universities and rural development organisations. Linkages with other institutions should be used to analyse, document and disseminate the experiences of this collective work. This implies a major effort to integrate institutions and independent professionals committed to participatory and sustainable development.

■

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Pesticides in Peru's Highlands

photos: Bert Lof

Farmers in San Marcos using local herbs in preparation of biological pesticide.

Since the late 1960s, pesticides used to control plagues in potato plantations in the Peruvian highlands have unsettled the balance of Andean ecosystems and given rise to numerous cases of poisoning among farmers.

Luis Gomero Osorio & Alfonso Lizárraga Travaglini

Initially, agro-chemicals brought a 'technological revolution' to the farming sector and as a result many farmers changed their techniques because they were encouraged by production and yield results. There were other farmers, however, who continued to use their ancient technologies.

A large variety of pesticides have been introduced into commercial potato production in the Peruvian Andes. It has been estimated that potatoes absorb 20% of the total amount of pesticides used in Peru.

In the highlands, pesticides are mainly used to control the Andean weevils (*Premnotrypes spp.*), potato moths (*Phthorimaea operculella* and *Symmetrischema tangolias*), fleaworts (*Epitrix* spp.) 'rancha' (*Phytophthora infestans*) and various species of nematodes that infest the potato plantations.

When categorising farmers in terms of insecticide use and ties with the market, one can distinguish three types of potato farmers: those who have never used pesticides, those who use them occasionally and those who use them constantly. The most frequently used preparations are fungicides to control 'rancha' and insecticides to control Andean weevils.

The introduction of agro-chemicals

Various strategies were used to introduce agrochemicals into the Peruvian highland markets and potato cultivation in particular. The main strategy was to establish a close relationship with government research centres, producer organisations and centres of higher education. Initially, during the era of large estates, contacts were established through the estate owners. Pesticides were such a breakthrough and were so fast and effective in controlling plagues that farmers soon started using them.

The marketing of agrochemicals has changed considerably over the last 20 years with sales campaigns becoming increasingly more aggressive. In Peru there are approximately 20 companies that import or prepare agrochemicals and most of them reach the potato farmers in the highlands, particularly those in the valleys between the Andes.

Cost has always retricted the use of pesticides especially among low-income farmers. Consequently, more economic products have been created for sale at the weekly markets held in the remoter towns. Low-cost pesticides, such as those made with organic phosphorus compounds, are usually the most hazardous to farmers.

Ecological impact

The greatest environmental problems in the ecosystems of potato farms are caused by the increased use of pesticides. These tend to make pests more resistant and, in a vicious circle, cause new plagues to emerge. Under such circumstances, the economic and environmental impacts are deplorable. Pollution is caused by the pesticides left on the ground and these are spread by the wind to neighbouring areas, contaminating watercourses (ditches, rivers and ponds), causing health hazards and threatening wild animals, pets, pollinating insects and other essential wildlife.

The initial effect in controlling significant plagues was satisfactory. However, pests soon became resistant to the use of pesticides and other substances had to be added. Hence the change from organochlorine insecticides to organophosphates and carbamates. Chitin inhibitors, biological insecticides and botanical pesticides such as pyrethrum were still too expensive to be used in the farming system.

The fact that potato pests and diseases have become resistant to pesticides is a serious threat to farmers. This resistance has developed mainly because farmers have been pressured into selecting pesticides with a specific effect. About 150 species of phyto-pathogenic fungi have become resistant to various fungicides under field conditions. The resistance of *Phytophtora infestans* to metalaxil was reported in 1980.

Another indicator of the level of resistance to pesticides acquired by plagues is the increasing dosage and frequency with which pesticides must be applied. In 1986, 25 kg/ha of commercial aldicarb plus 4.5 litres of insecticide was recommended in Huasahuasi. Ten years later, the technical recommendation was to use 36 kg/ha of commercial aldicarb and 5 litres of insecticides, although farmers tend to use much more than that.

Although the yield obtained with the use of agrochemicals generate more income, the environmental costs tend to be disregarded in profitability analyses. These include the loss of soil quality, the disappearance of essential and pollinating insects, reduced biodiversity as well as water contamination and an increased incidence of poisoning.

Economic impact

Given the state of information at present it is difficult to evaluate the economic impact of pesticides used in agriculture. All the information available on productivity refers to specific experiences. Global tendencies that would allow us to judge their impact on Peru have not been analysed.

The use of pesticides falls into two phases. The first between 1981 and 1987 when a significant amount of pesticides were used. The second began in 1988 when pesticide use levels started to drop sharply (see Graph 1).

The sharp decline in the use of pesticides after 1987 did not affect total agricultural output. Only slight changes were recorded both in terms of cultivated area and the yield. This proves that pesticides did not play an essential role in maintaining production levels and that they had a limited impact on the domestic economy. However, they did have a positive impact in certain regions and on specific crops.

The Table shows that the cost of pesticides varies between 13 and 27% of total potato production costs. After an exceptionally high expenditure on pesticides of US$1053/ha in 1988, costs have more or less stabalized slightly under US $ 400/ha. In general, the gross margin indicates that when less was spent on pesticides the profit margin was greater.

Table 1: Potato production costs in the Peruvian Highlands and expenditure on pesticides 1987-1997

Year	Total costs US$	Expenditure pesticides US$	% of pesticide expenditure	Estimated return kg/ha	Farmgate price/kg (US$)
1987	3 367	456	13.5	14 000	0.20
1988	5 767	1 053	18.2	12 000	0.39
1989	1 390	383	27.5	16 000	0.29
1993	2 630	395	15.0	20 000	0.16
1994	2 809	612	21.7	18 000	0.18
1997	2 536	386	15.2	20 000	0.15

Source: ONA, 1987-1997; Elaboración: RAAA,1998

Social impact

Farmers realise that the constant application of pesticides affects the quality of tubers, changes their texture and sometimes makes them taste bitter. Many farmers prefer not to eat potatoes treated with pesticide. For their own consumption, they grow crops in higher areas and only use fungicides to control 'rancha' (*Phythophtora infestans*).

Farmers are not always fully aware of the negative effect of pesticides and appear to have resigned themselves to believing that it is the only alternative. Farmers in Chaglla confirmed that 75% of the water sources and areas surrounding their farms were contaminated. Another indicator for establishing the social costs of the indiscriminate use of pesticides is the number of people poisoned each year in the countryside. The health sector does not pay enough attention to this problem, mainly because it is unaware of the danger and there is no policy of conducting epidemiological monitoring programmes in farming areas.

Poisoning is not the only problem. Farmers who use these inputs have become dependent on the technologies derived from other cultures and have forgotten alternative technologies and traditional ways of handling plagues.

Responses and alternatives

In order to respond to the environmental crisis generated by the use of agrochemicals and pesticides in particular, many institutions have started replacing chemical inputs with biological ones while maintaining the conventional farming structure based on single crop farming. Replacing chemical inputs with natural ones is a most significant change. Under this strategy, most of the natural inputs are produced outside the farming system. In other words, the system's dependency continues and a recycling of resources and energy in agricultural ecosystems has yet to be achieved. Furthermore, very few farmers, if any, are involved in the production of new inputs.

The experience gained in the Integrated Pest Management programmes promoted by public and private development projects have proved that it is possible to do without extremely toxic inputs when controlling plagues and diseases. Nevertheless, dependence upon external inputs remains and affects the productive stability of the agricultural ecosystems. Efforts are being undertaken to test the cultivation of specific natural pesticides to overcome this problem (see p 65).

Other local experiences show that farmers are trying to develop sustainable farming using limited amounts of external inputs. They intend to recycle local resources in order to generate inputs and techniques aimed at managing phytosanitary problems in potato farms. The combination of various ecological techniques, participatory training processes and the recovery and adjustment of peasant experiences is helping to reduce some of the damage caused by plagues.

Changing national policies

Through its Agriculture, Environment and Amazon Committees, the Peruvian Congress is responding to concerns about the negative impact of pesticides in the Peruvian farming sector. For example, the *Law Promoting Overall Management for Ecological Plague Control* establishes the political and legal framework necessary to start-up the process of reducing pesticides use and lays the foundation for sustainable farming practices. In addition, it has created a number of opportunities for State and private development projects to gain access to State funds and international technical cooperation and to implement actions based on the overall management of plagues.

In this respect, the RAAA (Action Network on Alternatives to the use of Agro chemicals) has made a considerable effort to generate positive attitudes towards initiatives designed to encourage new laws restricting or banning the most toxic pesticides and enforcing standards. Initiatives among civilians have lead to discussions with the agrochemical industry and government authorities on the viability of agricultural production models. Results obtained from civilian activities in recent years have been successful in generating initial changes in favour of sustainable farming practices.

■

Graph 1 Relation between consumption of pesticides and total national agricultural production between 1981 and 1996.

Red de Accion en la Alternativas al uso de Agroquimicos (RAAA), Unidad de Capacitacion RAAA, Mariscal Miller 2622, Codigo Postal 11-0581, Lince, Lima, Tel.: (51-14) 440 4359 or 421 0826, Fax.: (51-14) 440 4359, Email: raaa@perutap.tool.nl

Peru Programme

In South America the high valleys of Northern and Central Peru were chosen to represent the Andes ecoregion. This is one of the worldís most diverse but fragile environments. Running through seven countries it is home to some 135 million people. The mountain system itself has been severely damaged by soil erosion, deforestation, overgrazing, mining waste contamination, and poor water management. As a result more than 60% of rural families in Andean countries live in poverty.

In highland Peru farmers may plant up to 50 different crops and work in several fields each in a different agroecological zone at altitudes ranging from 2500 to 4500 m.a.s.l. Farmers risk aversion strategies ensure that at least some plants and crops will survive despite the pests and diseases virulent under any particular set of conditions.

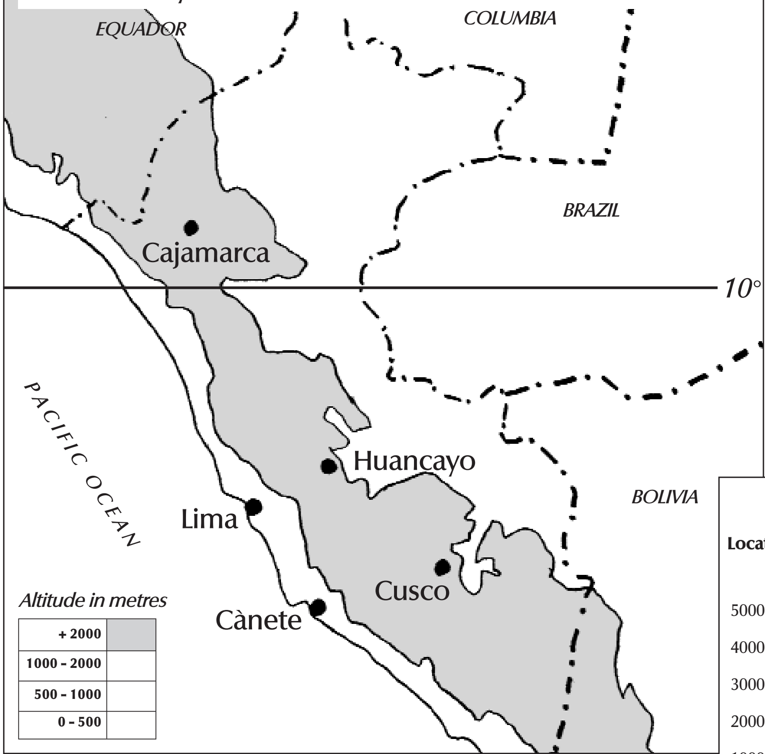
and livestock production. Most farming families live at subsistence level, with only a small part of their production being marketed. Self-sufficient farmers mostly grow rain-fed crops (tubers, corn, cereals and vegetables). Potato is the main crop and there are a large number of indigenous varieties. However, this diversity is slowly decreasing as 'improved' varieties replace indigenous ones. Commercialisation encourages the introduction of high-yielding varieties and the use of agrochemicals to protect them from pests. This process has lead not only to the loss of genetic diversity but crops have become less resistant to certain pesticides. In addition farmers have also been confronted with health problems and relatively high costs (see Gomero Osorio & Lizárraga Travaglini p 58). Abandoning ancient technical and social methods of controlling the way resources are used has also contributed to

central highlands and '*caserios'* or settlements in the northern highlands. The land is usually tilled by individual families. Community land and collective working practices are saved for public works or for work exchange purposes.

Government policies affecting agricultural research and development have, in general, favoured areas and crops that respond well to high external inputs. Together with the accelerated process of 'modernisation' that began with the initiation of land reform in the 1970s, these policies have led to massive migrations to the coastal towns and to the Amazon region.

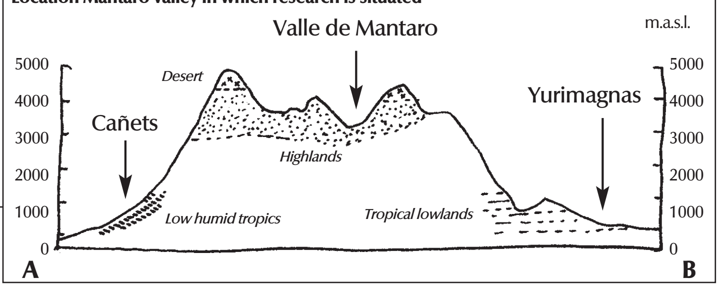
Since the 1980s, these policies have resulted in the abolition of government extension agencies. Apart from specialised agencies such as the '*Pronamachs*' (National Soil Conservation Programme), government involvement in agricultural development has mainly been confined to

Peru: Physical features and sites of LEISA Research activities



The high valleys of Northern and Central Peru were chosen to represent the Andean ecoregion. Altitudes in the research regions range from 2000 to 4500 meters above sea level. More than 80% of the region's available agricultural land is on steep hillsides and soils are very diverse. In Peru, an estimated 21 million hectares - 58% of the country's arable land is threatened by erosion. Weather varies throughout the region. The rainy season extends from November to April with an annual rainfall of between 200 and 1500mm. This gives rise to semi-dry to humid (micro-climates). Peru has a population of 22,350,000 mainly concentrated in the coastal plain.

Location Mantaro valley in which research is situated



Fields are often inter-cropped and crop rotations keep the soil fertile. In general, ecological and socioeconomic conditions are not particularly favourable to large-scale and high-external-input agriculture except in the lower valleys. These are the most productive areas as they are often endowed with irrigation facilities and have relatively better access to markets.

Farming systems often integrate crops soil erosion, over-grazing and firewood shortage. Having to face the various challenges that put the sustainability of their production systems at stake, farmers have been forced to find new ways out of their environmental and economic problems.

Small-scale farmers in Peru are organised in 'peasant communities' ('communidades') whose lands are divided into farming units known as '*parcialidades*' in the specialised research institutes and universities. NGOs have acquired quite a strong position through their search for alternative development models, especially when it comes to more agroecological approaches. In most cases agendas and priorities are determined by these organisations themselves and farmers only participate in the implementation of pre-determined programmes.

Stakeholders join for action

In 1995, ILEIA decided to work in two distinct zones in Peru: Cajamarca in the north and Huancayo in the centre. In both areas working groups of NGOs, universities and agricultural research institutes were set-up: GINCAE in Cajamarca and GIAREC in Huancayo. They started a collaborative programme to explore the potential of LEISA within the cultural, socioeconomic and ecological setting of their working areas. After the initial stage of setting-up stakeholder groups, men and women farmers, NGO staff and researchers made an inventory of agroecological conditions using AgroEcological Resource Mapping (AERM) and participatory soil surveys (see Kauffmann p 9). In the start up phase, technicians, researchers, and key producers were trained in the use of participatory tools and techniques in order to facilitate the process of reflection and analysis.

The dynamics of SCA in GIAREC is described by Norma Canales (p 60). Articles by Alvarez & Nalvarte (p 62) , Canales & Canto (p 65), and Bojórquez (p 67) also give insights into the collaboration between the different stakeholders and their development efforts in the working areas of the different NGOs.

Participatory Technology Development

It was only in 1997 that the two groups in Huancayo and Cajamarca took up PTD. More than 200 farmers (men and women) became actively engaged in a process of problem analysis, prioritisation, experimentation and the identification of possible solutions in trying to find new ways of dealing with their agricultural production problems. After two years, first results show that it is possible to identify adequate solutions that are within the reach of small subsistence farmers and have the potential to be ecologically sustainable. At the same time, the PTD process was important in bringing farmers, NGO staff and research institutes together in a shared action-research activity.

The PTD approach was introduced as a key element of the research programme. ILEIA's partners felt that PTD would contribute to specific goals (see Box 1). The internalisation of the PTD approach took place through an intensive, iterative process of learning by doing in which training and practice followed each other. An external facilitator guided the process of training and backstopping in PTD.

The PTD process was anchored in the following sequence of workshops:

- Training in AERM for farmers (men and women) and staff from the institutions involved in AERM;
- Training of institution staff in PTD concepts and techniques and in the facilitation of farmer' workshops to identify and prioritise problems and identify possible solutions that can be tried out in experiments;
- Training in facilitating farmer workshops to design, plan and monitor PTD experiments;
- Workshops at stakeholder group level to evaluate progress and results
- Joint workshops of stakeholder groups to plan the systematisation and documentation of the PTD process and to strengthen knowledge on PTD.

These workshops included practical sessions with farmers in one of the working areas ('farmer workshops') in order to provide hands-on practice to staff of participating institutions. It is important to note that all these workshops were followed-up by so-called *'replicas'*: farmer workshops repeated in other parts of the working areas. In this way, fast and effective scaling-up of PTD was realised and almost 250 farmers became involved in the PTD process.

The key training workshops focused on internalising PTD concepts, on its stepwise methodology and on communication techniques. The 'farmer workshops', on the other hand, followed a loose set of participatory procedures to identify problems and options (see Box 2). After the farmer-experimental design workshops, farmers started implementing and monitoring the experiments with support from institutional staff.

Box 1 **Expected results of the PTD approach**

- PTD will improve farmer innovation capacities through community endorsed group experimentation, which will permit processes that have a higher chance of generating viable and replicable agricultural technologies;
- PTD will improve existing agricultural production systems through the generation of systematic technological solutions that respond to the real problems of agricultural development and farmer economies;
- PTD will strengthen the LEISA approach permitting an opening towards development alternatives that are economically viable, socially acceptable and technically realistic - also from a gender perspective - and which will permit the development of efficient and equitable technologies;
- PTD will strengthen the convergence of formal science and farmer knowledge, permitting a mutual learning process;
- PTD will improve the capacity of institutions in participatory work by adding new elements;
- PTD will improve and contribute to the LEISA validation process in the ILEIA project's framework of concerted activities with GIAREC and GINCAE.

The articles by Alvarez & Nalvarte (p 62), Canales & Canto (p 65) and Bojórquez (p 67) describe three cases of implementing PTD work in Huancayo. The article by Staub (p 69) indicates the important role played by farmers in expanding the approach. In the final article in the Peru section (Results and impact of the PTD process p 70) , the learning points of two years of working with PTD in the two zones are summed up.

Box 2 **Looking for things to try: a PTD module for designing experiments with farmers**

Procedure:

1. Community meeting for commitment and endorsement of experiments
2. Drawing resource flows for farm enterprises *(Flow diagrams/AERM)*
3. Identifying problems and options for solving them (*Pair wise ranking)*
4. More detailed problem analysis (*Problem tree)*
5. Orienting the farmer experiments *(Ranking)*
6. Agreeing on the detailed design of the experiments (treatments; experiment lay-out; monitoring; etc.)
7. Conclusion: Project idea sheets

Major themes

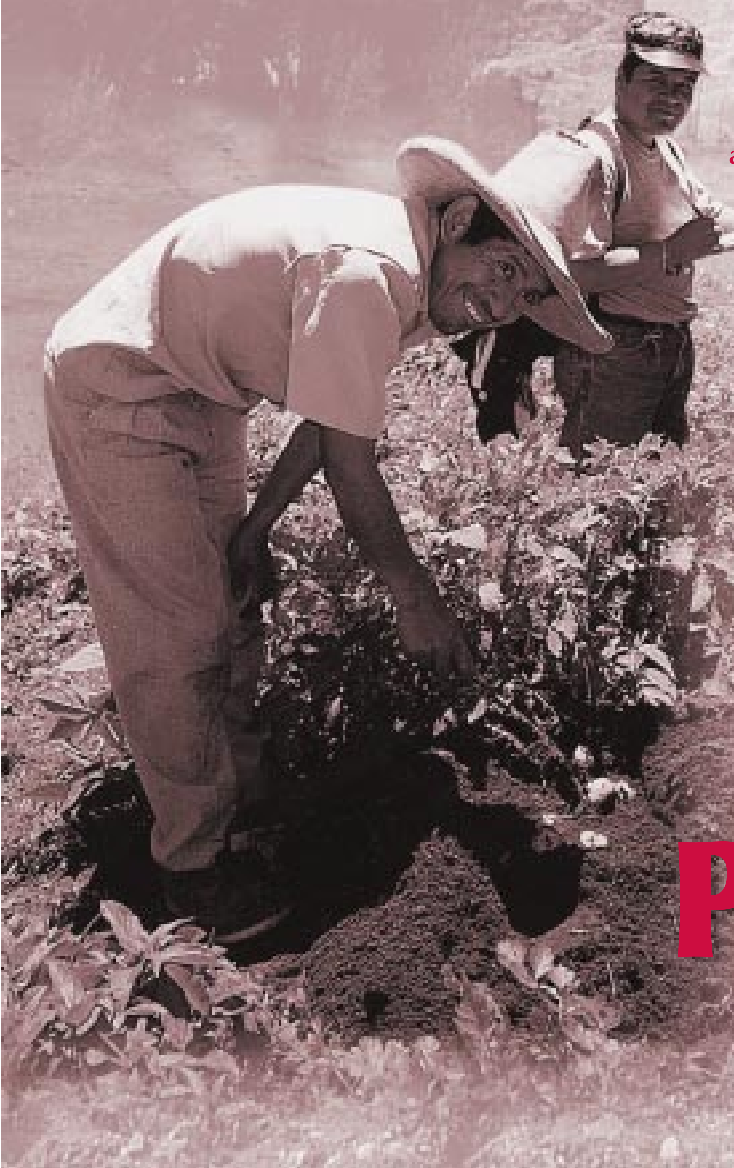
Problem identification in the various research sites in Cajamarca and Huancayo resulted in a number of themes for backstopping research. Farmers considered potato pests and diseases, inadequate pasture management and livestock disease as the most important problems. In addition, one group focused on soil fertility and one group included an experiment with small scale irrigation. In support of the farmers' experiments, the working groups - together with ILEIA - also identified and commissioned a number of studies focusing on the problems brought forward. These studies made an effort to analyse the wider context and sustainability aspects of the constraints and to identify new options for farmer experimentation and cases of alternative development programmes. The studies were divided into three categories: context studies of the two zones (Huancayo and Cajamarca), technical studies covering the specific themes ('Pasture management', 'Ethnoveterinary control of *fasciola*' in cattle' and 'Pesticide use in Andean Potato Production Systems') and a study analysing the experiences with IPM in Cajamarca. In total six studies were commissioned. The study on pesticide use is presented in the article by Gomero Osorio & Lizárraga Travaglini (p 58). Some results of the study on 'pasture management' have been integrated into the article by Bojórquez (p 67).

■

GIAREC PARTNERS

- Various communities
- Grupo Yanapai
- IDEA-Peru
- REDES
- CEA-UNCP
- INIA
- IVITA-UNMSM

In the highland valleys of the Peruvian Andes, NGOs and agricultural research institutes established two working groups, one in Huancayo (GIAREC) and another in Cajamarca (GINCAE). Farmers were invited to take part in participatory technology development. After analysing their situation farmers chose to focus their experiments on improving forage production, pest control in potato storage and parasite control in sheep. On the basis of their own criteria, farmers assessed the performance of different combinations of grasses and forage legumes and developed affordable ways of controlling potato moth in storage testing and comparing the viability of different ashes and a petroleum trap. Experiments with shipita, a traditional herbal medicine to control distomatosis, a serious parasitic sheep disease, were convincing and lead to a series of scaling-up activities to promote reforestation and the use of shipita. A study analysed experiences with the use of pesticides and Integrated Pest Management in potato production in the Andes.



GINCAE PARTNERS

- Various communities
- CEDEPAS
- Centro IDEAS
- EDAC-CIED
- ASPADERUC
- INIA
- UNC

PERU

A future for smallholder farming in the savanna


photo: Bert Lof

Both women and men are keen to continue experimenting.

During the PTD process, the smallholder farmers and scientists working together in northern Ghana agreed that the most serious current problem in agriculture is declining soil fertility. The farming communities involved in analysing their situation, identifying potentials and experimenting with options to improve soil fertility felt that the only realistic approach was to address this problem with primarily local means. Visits to other farmers operating under similar or even more difficult conditions, such as in Burkina Faso, stimulated the Ghanaian farmers to try out new ideas in new cycles of PTD.

Malex Alebikiya and Ann Waters-Bayer

The joint analysis and evaluation allowed the farmers to pinpoint more clearly for themselves and for the scientists involved the criteria they considered important in testing new ideas in crop production. In addition to yield, these criteria included germination rate, weed occurrence, labour requirements, other input requirements, drought tolerance, and seed quality after harvest. The trials showed that applying compost or farmyard manure led to good results, and adding phosphorus enhanced yields still further. The communities involved in the experimentation regarded the more efficient use of local biomass as the most promising option for improving soil fertility, as long as phosphorus fertiliser is not easily available. Analysis of experimental results led to new questions that the farmers were eager to explore and - after their experience in PTD - felt confident to explore. They identified the major problems related to use of compost - insufficient organic manure and higher weeding inputs - and are pursuing research to tackle these problems.

A similar gain in confidence could be seen in the women who experimented with different ways of storing cowpea, and found that wood ash and a local herb were the most effective. After this first experience in deliberate experimentation, they decided to test other botanicals to reduce pest damage in stored crops. The experiments by farmers in Garu to tackle the striga problem led other farmers to try using crop rotation to reduce the incidence of this weed.Thus, the more structured experimentation within PTD appears to stimulate informal experimentation on a wider scale.

Lessons learnt at SCA level

The difficulties in the first two years of the project and the progress made in the second two years indicate the importance of taking time to negotiate the purposes and mechanisms of collaboration. This is true at both the international level (between ILEIA and NGLWG) and locally (within NGLWG and in interaction with farmers). Transparency in terms of motivation and finances as well as good information flows facilitated the process of reaching agreement about what the stakeholders wanted to do together.

The mandate from above (the interest of ILEIA and its donors) to validate LEISA did not mix well with a participatory approach. As soon as ILEIA took participation seriously, the emphasis shifted to strengthening the capacity of farmers and local supporting organisations to conduct research for development.

The best way to learn how to do PTD and to build up a platform of stakeholders to sustain and promote the process is to get started in a concrete activity that demands collaboration (for example,. investigating ways to improve soil fertility), to review the process as one continues, and to learn from this action and reflection.

During the fieldwork conducted in the two-year project period, a process of supporting farmer-led experimentation to develop locally appropriate LEISA technologies was initiated and a wider interest in LEISA and PTD was stimulated within research and development institutions in northern Ghana. However, the period was not long enough to ensure that this approach was firmly institutionalised, although promising beginnings have been made.

Prospects for the future

Through their interaction with farmers and with each other, the NGLWG members have developed a vision of how sustainable farming practices can be developed in northern Ghana and, indeed, in the West African savanna. Their common mission is to promote LEISA as a more viable agricultural production strategy for achieving family food security and poverty reduction than the traditional low-external-input or the 'modern' high-external input systems.

The NGLWG clearly recognises the need for critical rethinking at the policy level of agricultural development issues and strategies, and feels that it is well-equipped to analyse and share information on such issues. It sees the need to internalise PTD and LEISA in agricultural institutions in northern Ghana. The composition of the NGLWG - which brings together people from a wide variety of institutions - should make this possible. Efforts at institutionalisation are already being made by the University for Development Studies, which is incorporating PTD and LEISA into its curriculum.

The two years of collaboration in supporting farmer-led action research have established a good base for continuation - a good base in terms of mutual respect and understanding among all partners and in terms of initial results that point the way to promising options that can be investigated further. The NGLWG is resolved to continue collaboration in this direction. ■

Malex Alebikiya and **Ann Waters-Bayer**,
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The mountains are disappearing

"These visits are an envy to the other communities. We are therefore very glad that you have come to open our eyes to see what we, on our own, can do for ourselves. We hope this will continue". These were the feelings expressed by a farmer from Tangbini near Langbensi during one of the PTD workshops.

Ben Bonzali

The following is a brief description of the research process in Bumboazio and Tangbini, two communities in Langbensi and how the experiences gained are being incorporated into the main-stream agriculture extension programme. The Agricultural Station in Langbensi has had two experiences with PTD. The earlier phase was between 1989 and 1994 and preceded the current collaborative research phase.

The PTD process

In the first phase farmers' participation was limited to problem identification at the field level. Their involvement in subsequent process planning, monitoring, assessment and feed back was taken over by the researcher. The ILEIA research programme made a bold attempt to involve farmers at every stage of the research process.

In the problem analysis farmers identified poor soils as the main cause of yield decline. Farmers identified the direct and indirect causes of yield decline as the consequence of their own activities and bad farming practices. They concluded that the options and the means to address these problems lay close at hand.

To make appropriate and relevant choices they prioritised these problems by matrix scoring and ranking. This was a most interesting and important learning exercise for both the field staff and farmers. Initially, the ranking was treated as an ordinary game but from the discussions that ensued when results were analysed it became clear that it was a useful tool for farmers' participation in decisions making.

The most difficult phase of the process was designing trials. Farmers discussed how they would carry out their experiments, what location they would use, what variables (assessment indicators) should be looked for, and how much time would be needed before they could come to any conclusion about adopting or rejecting a technology. The resulting trial, designed to address the problem of poor soil fertility, was fine-tuned by farmers in the light of their own practices and experiences. It became clear that farmers do experiment, although in a manner slightly different from conventional methods.

The experiences gained

Very early in the research process, we realised that NGO field staff needed to change their general orientation and perception about farmers. They would have to abandon their idea that farmers lacked knowledge, were primitive and resistant to change. Our previous interactions with farmers had invariably put them on the receiving end. A dependency syndrome had been created and many organisations pursuing participatory processes are now trying to reverse this.

At the beginning of the research process, it was essential that external partners familiarise and acquaint themselves with the people and their situation. This was an important step in winning the trust and confidence of the community and ensuring the cooperation on which the success of the research programme would eventually depend. The process involved a series of farmer workshops on topical issues concerning agricultural productivity and sustenance. Periodic assessments of the process, particularly the experiments and the farmer exchange visits, formed a significant part of the research. Group work was the basic strategy adopted to enhance the gathering of adequate, diverse, and rich information for analysis. The groups were usually segregated according to age and sex differences for the purpose of identifying the perceptions of each target group. A major research output was building up the capacity and confidence of farmers to enable them to take their own initiatives in solving problems rather than waiting for solutions from elsewhere.

The research process tried to develop technologies based on farmers' knowledge, capacities, and available local resources. Experimenting with composting was an idea put forward with enthusiasm by farmers. Before the PTD trials, only a few farmers used organic manure to improve soil fertility. When one approached their communities a common sight would be huge mountains of household refuse. Often the biggest ones would be close to the chiefs' compound. Once farmers' had remembered the value of using organic fertiliser to improve soil fertility and productivity, these mountains gradually began to be converted into nutrient-rich soil additives and they started to disappear. At an assessment meeting a farmer in Bumboazio stated:
"Our forefathers practiced it, and handed it down to us. However, you people came in with your chemical fertiliser to discourage us from continuing the practice. You were even giving the chemical fertiliser to us for free. Now its price is beyond our reach you have come back and you are saying use compost".

In contrast to this another farmer declared: *"They are telling us that our practices of old have better potential than the present use of fertiliser, because if you wish to succeed in life you have to work hard and endure suffering. That is our lot, and they are only helping us out".*

Conclusion

Through the PTD process we have realised that farmers do have a vast stock of knowledge, and have very good reasons for whatever they do. Most technological packages in the recent past could not be sustained probably because the potential of the farmers themselves was not recognised. This is the challenge we are confronting now the research programme is coming to an end. The Agricultural Station is trying to meet this challenge by adopting participatory approaches in all its extension programmes. Farmers' participation has been taken on board with the drawing up of community action plans and joint implementation and monitoring. On this basis a new three-year work programme was developed for the Stations' extension activities.

Many of our working communities are adopting LEISA technologies and are asking for a process similar to that followed in Bumboazio and Tangbini to be initiated in their communities.

It is clear that there is a potential for LEISA practices in the area, and it is our hope to continue and sustain the gains of the collaborative research programme so that more mountains will disappear.

■

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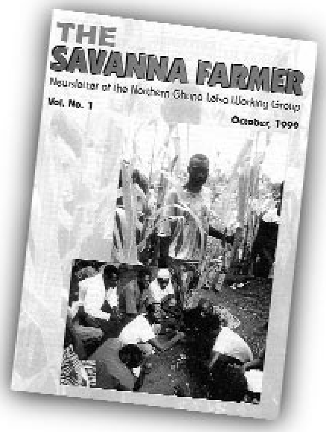
This article has been published in:



This publication on the Research Programme can be requisted from NGLWG, PO Box 1411, Tamale, Ghana.

Sustainable soil fertility management

Lessons from action research

The NGLWG and farmers from selected areas identified the issue of low soil fertility as a priority for their action research. Nutrients removed by cropping were traditionally replaced by bush fallowing and the use of farmyard manure and household refuse. However, these latter sources of nutrients are

Saa Dittoh

becoming increasingly scarce particularly because the number of livestock kept per household is decreasing. Inorganic fertilisers were used as long as they were subsidised, but now subsidies have been stopped. Now, fewer than 30% of smallholders in northern Ghana buy inorganic fertiliser for food crops and purchase small amounts for maize and rice. This has lead to declining soil fertility and unstable farming systems.

The indigenous methods of managing soil fertility probably worked reasonably well under the ecological and socioeconomic conditions that prevailed in the past. Now it is obvious that LEIA is not sustainable and prevailing economic conditions make HEIA impossible. During action research, smallholders in northern Ghana attempted to determine, in quantitative and qualitative terms, the role of organic manure in ensuring the continuity of crop production.

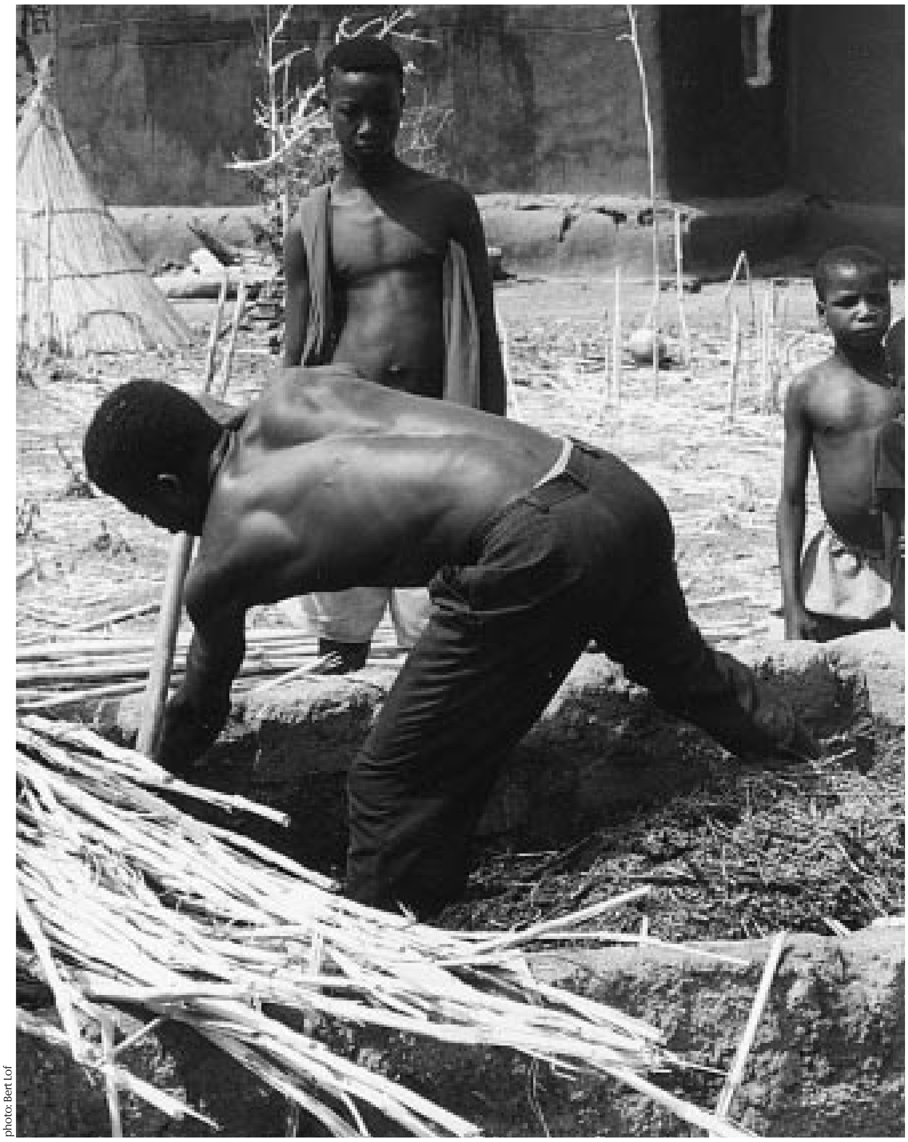


photo: Bert Lof

Recycling organic matter to restore soil productivity.

Sustainability in farmers' terms

Agricultural sustainability is a concept open to a wide range of interpretations. A simple grassroots definition given by Edward Agana from Zuedema, Builsa District in the Upper East Region is that their farming system can be considered sustainable when soils, crops, animals, trees, environment and people 'get better every year' and many other farmers in the area agree. This indigenous definition regards sustainability as something dynamic and suggests that there are degrees of sustainability.

But how should 'getting better' be determined and who should be the judge? The search for answers to these questions constituted a major part of the present research. There is a need to build up farmers' capacity to determine 'getting better' more systemmatically. The criteria developed by those with the highest stake in the process should be used in assessing sustainability. In the research process, farmers' criteria had to be brought to the fore, but it was also necessary to ensure that farmers became aware of other variables.

Managing soil fertility

Many farmers in northern Ghana have cultivated the same land for over 40 years without any significant use of chemical fertilisers. They have obviously been using some soil improvement techniques. They are well aware of the role of FYM, animal droppings and household refuse in crop production. Nevertheless, soil fertility is declining. In the two pilot areas of ILEIA-NGLWG collaboration in northern Ghana, farmers identified this as the most important research issue. "With a dead soil, one can forget about producing enough to feed the family", said a woman farmer at one of the workshops.

The collaborative research was designed to explore differences in the efficacy of the various types of organic manures known to the farmers. Our hypothesis was that LEIA could be transformed into LEISA if farmers would systematically improve their indigenous knowledge of soil fertility management. During this action research, we tried to assess LEISA practices for improving soil fertility. We explored the problems associated with using organic manure and how farmers were tackling or proposed to tackle these problems.

Two complementary methods were used: field plot experimentation (more akin to conventional on-farm trials) and farm monitoring (FARMS) in which the inputs and outputs of all the plots of experimenting farmers were analysed. We felt that, if the farmers could see more clearly what went into production, what came out and what remained in ▶

the soil to be used by crops the following season, they would become more aware of sustainability. Farmers, researchers and extension agents collaborated in monitoring the farmer-managed experiments, sharing ideas and solving problems encountered in the research. Women were fully involved in this community process of identifying problems, seeking solutions and experimenting with improved methods of making compost.

Potentials and constraints of manure

In two years of experimentation, many lessons were learnt. The use of organic manure leads to significant improvements in soil fertility and crop production over time. Farmers' assessments also clearly indicated the potential of organic manure in reducing crop production risks and lowering the incidence of notorious weeds such as striga.

The experimenting farmers realised that organic manures differ in quality, depending on how they are managed. Farmers explored better methods of managing manures and new methods of composting some of which they had seen during their trip to Burkina Faso (Box 2, p 46). This was a vital step towards more sustainable agriculture.

It became clear, however, that most farmers have a problem getting organic matter and that women farmers have virtually no access to FYM or household refuse for their own plots. Manure is probably the most valuable resource for sustainable farming in northern Ghana. However, because many households are without animals or the few they possess are tended by Fulani herders, manure is difficult to come by. The search for ways of better integrating crops and livestock needs to be intensified. The concept of crop-livestock integration is indigenous but was discouraged in the push towards 'modernise' in past decades. It should be possible to regain integration, perhaps in a modified way.

Another potential threat to moving towards more sustainable production is that organic manure is bulky and sometimes needs to be transported over long distances to the "bush farms". Farmers may need financial assistance to acquire donkeys and carts, not only to bring manure to the fields but also to bring farm products back to their homes.

Action research shows the way

In 1997, the first year of experimentation there was drought but in 1998 the rains were adequate. How can sustainability be inferred when conditions vary from year to year? Was the 1998 harvest better because farmers applied organic manure or because the rains were good? This could be difficult to answer with results from field plot experimentation. Taking the farm experimentation as a whole, analysis of the many different plot situations within and between farms indicated the positive effect of better fertility management. It is clear, however, that conclusive statements cannot be made after only two years of experimentation.

Despite this limitation, the action research has been a learning experience for farmers and other stakeholders. All were convinced of the potential of participatory research to help realise sustainable agriculture in northern Ghana. Those involved saw that problems relating to the availability of manure, its transportation to the fields, proper management to conserve nutrients, and the availability of water to make compost were hampering the move from LEIA to LEISA. Action research also led to a better understanding of the issues involved and to a more focussed approach to solving the key constraints to sustainability at farm level. ■

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Internalising PTD and LEISA in agricultural training

The ILEIA-NGLWG collaboration in Ghana involved the building of relationships between farmers, development workers, researchers and university teachers in agriculture and related disciplines. At the outset, these relations were loose and full of (often unspoken) contradictions in terms of beliefs, orientations and biases. It was in the process of concrete action, especially when the stakeholders repeatedly met in rural communities to discuss farmers' problems and to do research together, that points of consensus began to emerge. Mutual appreciation of the different professions and of the strengths and weaknesses of each began to grow. All stakeholders began to understand not only why farmers do what they do, but also why professors say what they say. It was the participatory nature of the methodology that led to the breaking down of psychological barriers. The process of PTD opened the way for better mutual understanding.

We came to the consensus that agriculture in northern Ghana is not likely to experience a 'Green Revolution'. However, if farmers are left to depend on their present LEIA methods, they are unlikely to survive long in agriculture. The only alternative is to work together with farmers in improving present practices and move gradually from LEIA to LEISA. During our collaboration, we recognised that participatory research can lead to a systematic movement in this direction.

The research was unconventional, and many were somewhat sceptical at the start. The Faculty of Agriculture of the UDS has the task of preparing future extension workers to work in rural communities and help farmers to solve their problems. However, most of the academic staff were originally trained in universities where there was little interest in participatory approaches and most government and donor-sponsored development efforts failed to emphasise them. In Ghana, it was left to the NGOs to promote the participatory approach.

Some of the Faculty of Agriculture agreed to become involved in the ILEIA-NGLWG research. Over the past two years, during interaction with farmers in PTD, many new things about agronomy, soil and water management, weed science, economics and sociology were learned. It was observed that farmers gained confidence in what faculty staff said, because they knew that their views and experiences were being taken into consideration.

We are now convinced of the merits of the PTD approach to LEISA. However, no matter how good it is, it is not likely to gain wide acceptance and be followed in mainstream research and extension activities in Ghana if most people being trained in agriculture do not know about it. The agricultural colleges and the faculties of agriculture have a key role to play in institutionalising LEISA and PTD in agricultural development. But first, these approaches have to be internalised by the staff of the training institutions. Professors of agriculture need to discard their biases against the knowledge and intellectual abilities of "illiterate" farmers. This can best be achieved by bringing them into direct interaction with farmers.

In the second year of ILEIA-NGLWG collaboration, it was decided that LEISA as a group of agricultural techniques and the PTD approach to LEISA should form an integral part of the curriculum of the Faculty of Agriculture. The theoretical aspects of LEISA and PTD are now taught on the campuses in Tamale-Nyankpala and Navrongo, and practically applied by university students and staff in NGO agricultural stations such at Langbensi, Garu, Sandema, Tumu, Funsi and Nandom, as well as in several other rural communities. As a result, graduates from UDS are likely to bring about radical changes in the methodology of agricultural extension in Ghana.

For rapid internalisation of LEISA and PTD, the agricultural extension workers with MOFA and donor-assisted projects will also need to be re-oriented toward more participatory approaches. For this reason, UDS is now preparing to offer short, in-service training courses in LEISA and PTD for extension workers.

Saa Dittoh and **Malex Alebikiya**

The role of livestock in sustaining soil fertility in northern Ghana

N. Karbo, J. Bruce & E.O. Otchere

In the northern Guinea savanna zone of Ghana, the predominant farming system is mixed crop-livestock production in smallholdings (Atengdem & Dery p 38). In the gently rolling landscape, cropping and animal grazing are concentrated mainly in the middle and lower slopes and valley bottoms. Growing population pressure has led to continuous cropping and decreasing periods of fallow. The major concern is the decline in the fertility of arable land. Here we look at the role of livestock in the integrated management of soil fertility. This is largely neglected in development efforts, although crop-livestock systems have existed for decades in the zone.

Some history

Before Independence, the colonial government established agricultural research and extension stations in different parts of northern Ghana. The Tamale station was set up 1909, but the majority began operations in the late 1930s. All these stations dealt mainly with crops. Bullock traction was also introduced in the late 1930s and cattle and sheep were introduced later to address the problem of low soil fertility in these areas, which were known as 'farmed out' lands. Soil conservation techniques promoted prior to Independence included contour farming, grass bunding and stone terracing, in addition to the fallow rotation and mixed cropping practised by farmers. Crop yields could be sustained.

In the two to three decades after Independence, government policy sought to achieve a 'Green Revolution' and initially crop yields per unit area increased considerably. Many farmers adopted and relied heavily on external inputs little knowing that conditions would change and sustainability would become a critical issue.

Recent experiences

In the 1980s the market price of external inputs soared as subsidies were removed. Many smallholders could no longer afford to buy them. From 1979 to 1986, the relative increase in input price was 106%. In concrete terms, a bag of maize that could be sold to buy about 7 bags of compound fertiliser between 1979 and 1982 was enough for only 3.5 bags in 1986 (Langyintuo & Karbo 1996). Even with the same rate of application, some soils in the zone do not give the high yields recorded when chemical fertilisers were first introduced. In most cases, application rates dropped. A survey in 1992 showed manuring to be the most popular technique to regenerate soil fertility, followed by chemical fertilisation and bush fallowing (Gyasi 1995). A survey of over 4000 fields in northern Ghana in 1993 revealed that only 16% received some mineral fertiliser (Albert 1995).

During the late 1980s and in the 1990s, most bilateral projects such as the IFAD-supported Smallholder Rehabilitation and Development Project (SRDP), the Land Conservation and Smallholder Rehabilitation Project (LACOSREP) and the Upper West Agricultural ▶

photo: Bertus Haverkort

Development Project (UWADEP) took an integrated development approach, one component of which was small ruminant husbandry.

All these projects, including the current National Livestock Services Project (NLSP), if sustained after project closing, could increase the contribution of livestock to the sustainable management of natural resources in the zone. Animals play an important role in the way farm households manage risk. Animal traction could improve the quality and timeliness of farming operations now done by hand and raise crop yields and incomes, the manure could improve soil fertility, and the livestock sales could generate cash to purchase other inputs.

In farmer-led experimentation in the ILEIA/NGLWG collaboration, various soil conditioners were tested. This confirmed that farmyard manure could increase crop yields, but that yields could be even higher if manure were combined with some chemical fertilisers. Nevertheless, farmers, researchers and development workers in the zone still saw constraints to the contribution of livestock to soil fertility management.

Constraints and coping strategies

During our interactions with farmers and development workers in the field, it became obvious that the use of manure to improve soil fertility varies from one location to the other. It is more important where human population pressure is high and land is scarce, such as in densely populated village settlements and peri-urban areas. The most common constraints and the ways in which farmers are trying to deal with them are summarised in Table 1. Although some farmers mentioned that manuring leads to more weeds, they felt it was easier to pull out the weeds from manured fields than from non-manured fields.

These coping strategies are backed by farmers' rich knowledge of manure quality, soil types and crops cultivated. In terms of nutrient 'strength' or power, the farmers ranked the manure types as follows: poultry → pig → sheep/goat → cattle. Manure from poultry and pigs releases nutrients faster than that from ruminants. Nutrient release to crops is slowest in the case of cattle manure, but its residual effect appears to be higher than in the case of the manure from other livestock species. Farmers said that a field fertilised with cow dung may need re-fertilisation after two or three years whereas when pig and poultry manure are used, yearly applications are necessary. This manure is preferred by farmers who grow vegetable crops because these have a relatively high level of growth energy and need instant releases of nutrients.

Similarly, farmers in Upper East Region explained that sheep and goat manure is most suitable for early millet and sorghum. It was interesting to learn from the farmers that the cow dung obtained in the dry season is of lower quality and is most suitable for trapping termites to feed to poultry. Thus, another link is made in the recycling of nutrients by animals for soil fertility management. Cattle that graze low-quality grass and cereal crop residues in the dry season produce low-quality dung, which is fed to termites, which are, in turn, fed to poultry, which produce not only meat and eggs but also leave concentrated droppings that improve soil fertility.

Poorer people, among whom are many women have few animals and they collect animal droppings to improve the condition of their soil. However, there are more and more competitive uses for cow dung for example, to plaster house walls and as a cooking fuel (both are women's tasks). Some cow dung is also applied in liquid form to crops where it acts as a repellent that protects the plants from being eaten by straying animals.

In most parts of the zone, Fulani herdsmen are hired by farmers to care for their cattle. This makes it possible for the farmers' children to attend school. In most cases, depending on the nature of the contract, the Fulani have the right to the manure. They either sell it or use it to fertilise plots leased out to them for maize cropping by their landlords. In our interviews, such land-cultivating Fulani stated that a maize yield of over 3.0 t/ha could be obtained from manured and continuously cropped plots.

Generally, dynamic kraaling is practised: the cattle are tethered overnight on the field to be fertilised and their location within the field is shifted at certain intervals. The number of nights on each spot varies with the season. Farmers indicated an average of three nights' kraaling in the wet season and ten nights in the dry. This method reduces the labour required to transport the manure. In parts of Upper East and Upper West Regions, widespread cattle theft does not make this an attractive system of manure management. In these areas, head loads of manure are transported to the fields, usually by women.

Table 1: Constraints to manure use and coping strategies in northern Ghana

1.0 Insufficient manure	1.1 Manure collection
	1.2 Composting
	1.3 Alternating plot application
	1.4 Crop-specific application
	1.5 Soil-specific application
2.0 Low quality of dry-season manure	2.1 Integrating poultry and termites in nutrient cycling with manure
	2.2 Grazing orbits involving crop residues and wet valleys
3.0 Insufficient labour to collect manure	3.1 Division of labour by gender
	3.2 Dynamic kraaling

Things to try in PTD activities

The use of manure in composting has already received much attention in the PTD sites of the ILEIA/NGLWG. The quantitative and qualitative aspects of manure raised earlier have been well addressed. Livestock will continue to play a significant role in integrated soil fertility management in the farming systems of northern Ghana. There is a great need to encourage farmer groups and individuals to also try out other technological options that could be adopted and further developed. These could include:

- Introduction of forage legumes (for example, *Stylosanthes* spp) and dual-purpose food legumes (for example, pigeon pea) into the cropping systems to enhance soil fertility and produce good fodder to generate high-quality manure.
- Minimum daytime (3-4 hours) and overnight confinement of small ruminants with some feed supplementation to increase the manure harvest.
- Development of fodder banks (protected areas of grass and sown legumes used for strategic grazing in the dry season) to address the seasonal shortage of feed.
- Strategic animal health-care management to reduce mortality and increase herd sizes
- Animal traction to address labour constraints.

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Assessment of non-burning and organic-manuring practices

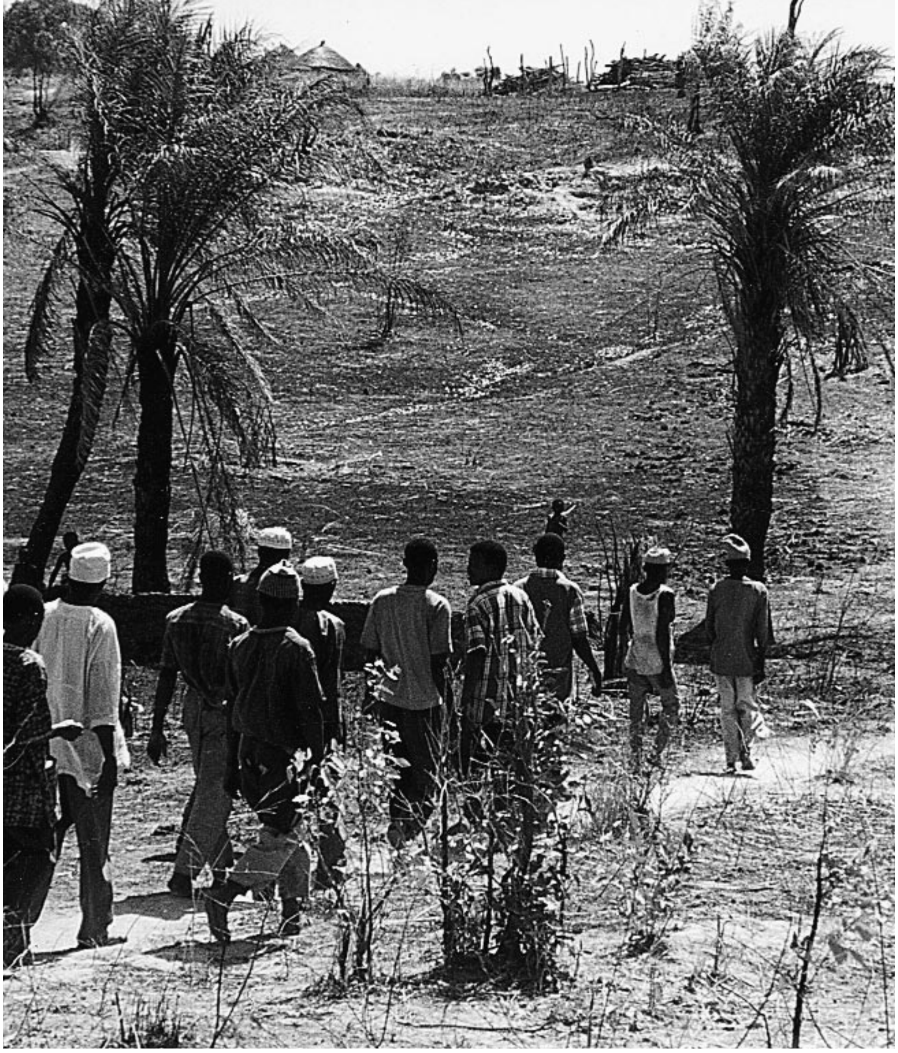

photo: Bert Lof

0.I. Aalangdong, J.M. Kombiok & A.Z. Salifu

Farmers, researchers and extension agents in northern Ghana regard low soil fertility as a major constraint to crop production. Increasing human population has led to the shortening of bush fallowing, a traditional method to replenish soil nutrients. Application of inorganic fertiliser to restore fertility has become non-profitable, as prices are beyond the reach of smallholders. They are therefore being encouraged to intensify their farming through intercropping, crop rotation, agroforestry, soil and water conservation, and organic manuring. Traditionally, widespread dry-season burning of vegetation was practised. Burning as a labour-saving tool to clear land and prevent weed infestation is now being brought into question, because more organic matter is needed in the soil. Many development agencies now advocate non-burning.

Assessment methods

Case studies of non-burning at Goziire (Upper West Region) and of non-burning and organic manuring at Zagsilaari (Northern Region) had suggested that these practices support sustainable agriculture by improving soil fertility and conserving soil and water (Kombiok, et al 1997). Existing experiences in sustainable agriculture can serve as examples for other communities in the same agro-ecological zone. However, other farmers are more likely to be convinced and to try these practices if they had more information on inputs and yields. A follow-up study was therefore designed to quantify the inputs and outputs of non-burning and organic-manuring practices, and to assess the benefits of these practices from the farmers' point of view.

The follow-up study was conducted in the 1998 cropping season (June-November) at the case-study sites chosen with extension agents from MOFA and some NG0s. At each site, four farmers - two who practise non-burning and/or organic manuring, and two who do not but were interested in the study - were selected.

In each farm, four 10x10m plots of various crops were demarcated randomly. Data were collected on labour inputs, plant height and population, and crop yields. During farmers' fora at the end of the cropping season, the communities assessed the advantages, disadvantages and problems associated with the practices. Participatory Rural Appraisal techniques were used to encourage them to discuss the issues and socioeconomic implications freely and to give their opinions.

Table 1: Grain yields (kg) from 10x10m areas on burnt and non-burnt plots at Zagsilaari

Farmer	Practice	Crop	Plot 1	Plot 2	Plot 3	Plot 4	Mean
David Agongo	Non-burning	Maize	27.0	23.0	26.0	24.0	25.0
Iddi Dorkurugu	Non-burning	Maize	11.0	10.0	8.0	11.0	10.0
Yakubu Mbangba	Burning	Maize	10.0	9.0	6.0	7.0	8.0
Alitu Dorkurugu	Burning	Maize	8.0	8.0	9.0	9.0	8.5
David Agongo	Non-burning	Sorghum	3.0	3.0	2.5	3.0	2.9
Yakubu Mbangba	Burning	Sorghum	2.0	1.0	1.5	1.5	1.5

Increased grain yields

At Goziire, sorghum was taller after three-year fallow than in the non-burnt plots. Millet in the non-burnt plots with farmyard manure was twice as tall as in the burnt plots with manure or without. Sorghum yields ranged from 1.1 to 1.4 t/ha and were higher after non-burnt fallow than after non-burnt continuous cropping, even with FYM. Yields of millet were lower (1.1-1.2 t/ha) than those of sorghum with the same treatment, and were as low as 0.48 t/ha even with FYM in the regularly burnt area.

At Zagsilaari, maize yields in the non-burnt plots were more than double those in the burnt plots. Sorghum ▶

yields in non-burnt plots were double those in the burnt plots (Table 1) and the sorghum heads were longer (45 vs. 34cm) and heavier (1650 vs. 1500 g).

The number of years an area is not burnt also affects crop yields. At Zagsilaari, plots not burnt for six years had higher yields than those not burnt for three years. This may be due to the longer accumulation of organic matter and the greater amount of soil nutrients for crop uptake.

More labour for weeding

Data on labour for land preparation, planting, weeding and applying manure/fertiliser were collected at Zagsilaari. All the farmers used bullock ploughs to prepare their land, but only David Agongo owns a pair of bullocks and a plough. The others hired bullock services, paying twenty thousand cedis per acre. Labour inputs for land preparation did not differ between practices, but more labour was needed to weed the non-burnt plots than those that had been burnt regularly (Table 2).

Farmers' fora

The farmers' fora were open to both men and women, but only about 20% of the participants were women. At both sites, the farmers agreed that non-burning and organic manuring bring tremendous benefits.

Table 2: Estimated labour inputs (person-days) in burnt and non-burnt plots cultivated to maize and sorghum in Zagsilaari

Farmer	Crop	Practice	Ploughing	Planting	Weeding	Applying manure/fertiliser
David Agongo	Maize	Non-burning	2	4	13	-
Dorkurugu	Maize	Non-burning	2.5	11	21	6
Yakubu Mbangba	Maize	Burning	3	6	11	-
Alitu Dorkurugu	Maize	Burning	2	3	8	8
David Agongo	Sorghum	Non-burning	2	3	14	-
Yakubu Mbangba	Sorghum	Burning	4	6.5	11	-

Advantages of non-burning at Goziire mentioned by the farmers were:

- regrowth of natural vegetation, especially grasses and trees for grazing and construction
- better establishment of wood lot plantations and improved yields of shea and *dawadawa (Parkia biglobosa)* trees
- good conservation of soil and water, thus reducing erosion, improving crop germination and increasing crop yields
- retention of livestock in village because forage is available during the dry season.

Benefits of non-burning and organic manuring mentioned by Zagsilaari farmers were:

- improvement of soil fertility
- reduction in soil erosion
- increased crop yields and self-sufficiency in food for families
- use of less land, allowing sedentary agriculture.

Disadvantages in non-burning were:

- fewer dead trees for woman to collect as firewood
- inaccessibility, with limited mobility and visibility; bushes become hideouts for thieves
- proliferation of pests such as rodents and insects which destroy crops.

Successful fire control

Conservation of natural vegetation and the protection of other plant material can provide the organic matter needed to enhance soil fertility. This can be achieved by reducing the frequency and extent of burning.

The success story of Goziire in this respect was a result of awareness creation that led the local people to mobilise themselves into a volunteer group to control fire. The community instituted locally endorsed by-laws. Culprits are sanctioned and must pay fines. The community also has the support of the Paramount Chief of Nandom to enforce the by-laws. The heightened awareness spread to surrounding villages, which have now also adopted non-burning.

More action needed

Farmers are seeking improved crop yields with low levels of external inputs. The study has shown that yields are higher where non-burning and organic manuring are practised. The sustainability of soil fertility depends on the availability of organic matter and this is possible only if crop residues and bush vegetation, the major sources of organic matter, are not burnt. We therefore recommend that:

- More education be given by environmental NG0s, government organisations, MOFA and District Assemblies to enhance awareness of the implications of bush burning.
- Traditional rulers, in consultation with their communities, institute bush fire bye-laws endorsed by the District Assemblies.
- Non-burning and organic-manuring practices be incorporated into school curricula.
- Fire-fighting volunteers be trained and supported by the Ghana National Fire Service and the District Assemblies.
- Communities be organised into groups to facilitate the training and adoption of non-burning and organic manuring.
- Workshops, seminars, video shows, and field visits be part of the educational programmes
- Farmers be encouraged to adopt technologies such as oversowing, cover cropping, improved fallow and agroforestry as complementary measures to increase organic matter.

Long-term monitoring of non-burning and organic-manuring practices would allow the quantification of their short- and long-term impact on agricultural production and environmental quality. Comparisons should be made on the basis of simple economic analyses.

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Communities develop strategic burning

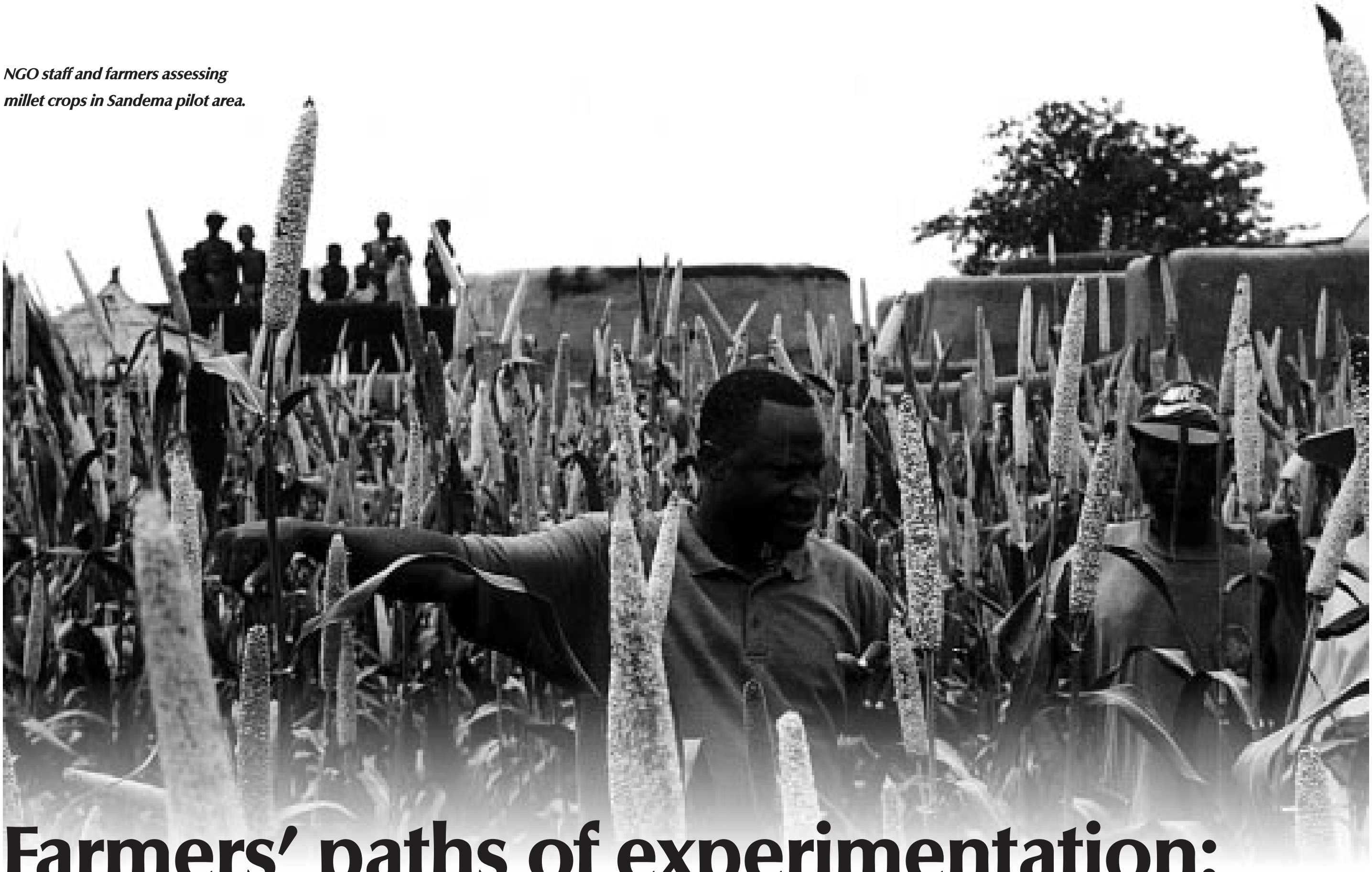
In recent years, the awareness-raising campaigns about non-burning have led to heated discussions in communities in northern Ghana. Burning of grass on fallow and bushland has several advantages: it removes heavy vegetation and reduces labour inputs to bring fallowed land back into cultivation, it reduces the incidence of weeds and pests in cropland, it prevents bush encroachment on grazing areas, it gets rid of low-quality over-mature grass and makes way for fresh regrowth of grass nutritious for livestock, it stimulates the germination of certain tree species, and it reduces the risk of devastating uncontrolled flash fires that can destroy crops and homes. On the other hand, farmers are aware that burning also destroys vegetative biomass that could be used to improve soil quality.

Through their observations and discussions, some communities are now developing a more differentiated view of fire: it is a question not of burning or non-burning but rather of when, where and how burning is practised. Burning at the right time of year, under strict control, can achieve the positive effects and reduce the negative impact of this practice. These communities have drawn up by-laws that stipulate when and where burning is allowed, and have strict social controls to ensure that burning outside these limits is punished. There is still room for action research by communities to determine the best ways to employ burning as a valuable tool when used strategically and with caution.

Source: Discussion during ILEIA research workshop, March 1999.

NGO staff and farmers assessing millet crops in Sandema pilot area.

photo: Bert Lof



Farmers' paths of experimentation: the PTD process in northern Ghana

The Association of Church Development Projects ACDEP in northern Ghana was already working with the PTD approach in the late 1980s to develop LEISA technology with farmers. This received an impetus when an ACDEP member participated in the ILEIA workshop on PTD in 1989.

David Millar

However, the research collaboration with ILEIA that started in 1995 led to the formation of a more structured Northern Ghana LEISA Working Group involving other organisations like the government extension service, local research institutes and the University for Development Studies in Tamale. These people from different disciplines and with a wide range of experience needed to reach a common understanding of PTD.

Preparing for renewed PTD

Some training in PRA methods and an exercise in AERM were carried out during the first two years, but only in February 1997, after entering into collaboration with a new ILEIA team, did the NGLWG start to prepare in earnest to work together with farmers in LEISA assessment. We met to review the experiences gained in PTD in earlier years and to develop a common approach for the new research process planned at the pilot sites.

We recognised that PTD is meant to combine formal science and indigenous knowledge, but the initiative for collaboration comes from external stakeholders (researchers and extensionists), not from the farmers themselves. Entering collaboration means negotiating a balance of power such that outcomes are evaluated according to the interests of all stakeholders. We agreed to centre the new PTD process on building up the capacity of farmers, extension workers and researchers.

The NGLWG as a group was at the 'Getting started' stage of PTD. The farmers, however, were clearly well on their way in problem solving. We had to find out 'where the farmers were coming from' before we tried to introduce anything new. We were entering their ongoing process.

One woman and one man from each of the four communities selected in Langbensi and Sadema (two in each pilot site) joined the NGLWG members in a training workshop, during which the PTD approach was discussed and participatory tools were introduced and practised.

Situation analysis in farmer workshops

The farmers who took part in the training served as lead persons during subsequent two-day workshops held in March 1997 in the pilot areas. The starting point for analysing the current situation was either the AERM maps drawn by local men and women in 1996 or community walks made during the workshop. Four groups (older and younger men, older and younger women) drew problem trees to clarify the causes and effects of farming problems, listed constraints and ranked them by scoring with pebbles. All communities identified land (expressed in terms of availability and/or fertility) as the main factor limiting production. In addition, the women in Sandema identified pest control in grain storage as an important issue.

The villagers then drew a second tree, focusing on the causes and effects of problems associated with land. The causes of soil infertility included shortage of manure, tillage practices, continuously cropping the same land, limited crop rotation, sand collection, indiscriminate cutting of trees, burning of crop residues and bush fires.

Potential solutions

During the workshops, farmers proposed some ways of improving soil fertility based on their own experience and what they had heard earlier from extensionists. Their suggestions included:

- Incorporating crop residues into the soil
- Applying chemical fertilisers
- Legume-cereal rotations or mixtures
- Applying farmyard manure or household refuse
- Sowing cover crops
- Applying ash from burnt bush land
- Controlled burning
- Planting trees.

NGLWG's Research Coordinating Committee met to discuss the farmers' proposals as well as other possible ways of improving soil fertility drawn ▶

from literature and recent field studies. Researchers had shown that soils at the sites were deficient in phosphorous and recommended that the farmers could try to test the affect of including phosphorous in organic matter as one option.

During a second set of workshops held in April 1997, NGLWG members and farmers took a closer look at soil infertility and how farmers were trying to tackle it. They observed eroded places, infertile soils, fields manured by kraaled cattle, and some of the rotations used by farmers. In each community, potential solutions were discussed and ranked.

Drawing experimentation paths

NGLWG members were aware of their limited skills when it came to helping farmers design experiments. In previous attempts to follow a PTD approach, ACDEP staff had designed the experiments in their offices and presented them to farmers for approval. This time, the challenge was to enable the farmers to design the experiments themselves.

Starting from the basic assumption that farmers are already informal experimenters, we devoted the second day of the workshop to exploring local concepts of experimentation. First, farmers were asked to identify a local word for experimentation: they came up with *masim-nya*, which means ‘try and see’. We worked with the idea of a footpath (*sorle*): first, separate groups of men and women drew the path to their village, so that a stranger could find it. They marked important ‘signposts’ and difficult parts with symbols. Then we asked them to map the path of informal experimentation with a farming technology that someone in the group had recently tried in a similar way. The next step was to map the sorle they would take in an experiment to solve the problem of low soil fertility.

The groups presented their paths to each other and compared them. During the discussion, the facilitator probed for relevant features such as starting point, ending point and decisions that must be made along the way. This helped to bring the two designs into one, and to agree on what should be done at what point. Criteria and indicators for assessing the experiments (whether we are still on the path) were discussed, and critical times for collecting data to ascertain this were identified. Some aspects that farmers felt were important to observe are listed in Table 1.

The NGLWG reviewed the farmers’ criteria and the researchers’ and ILEIA’s criteria for assessing the validity of LEISA techniques. An attempt was made to balance quantitative and qualitative data and scientific acceptability without putting undue stress on farmers and extension staff for data collection, yet allowing all partners to compare and analyse the results. NGLWG drew up a proposal for research protocols that combined the interests of the various partners and brought them back to the pilot areas for discussion and revision. The treatments finally agreed on with farmers were as follows:

Table 1: Observations important to farmers for evaluating soil fertility amendments in cereal crops (women’s suggestions marked with ‘W’)

- Timing and amount of rainfall
- Tolerance to dry spells (W)
- Quantity and quality of seed
- Planting dates
- Germination (W)
- Rate of crop growth
- Rate of weed growth (W)
- Size of stalks and cobs
- Colour of leaves (W)
- Time of plant maturity
- Incidence of disease and pests
- Labour required to weed and harvest
- Yield in baskets
- Compactness of seeds on the cobs (W)
- Different uses that can be made of the crop
- Taste of the grains
- Ease of processing the grains
- Incidence of pests in storage.

In Sandema:
- Farmyard manure only
- Farmyard manure + phosphorus
- Phosphorus only
- Household refuse only
- Household refuse + phosphorus

In Langbensi:
- Farmyard manure only
- Farmyard manure + phosphorus
- Phosphorus only
- Control

In Sandema, the experimental plot with five treatments was set in the middle of the field: the rest of the field served as the control. In Langbensi, a control was included in the design.

Community-owned trials

The communities selected men and women to experiment on their behalf. In Sandema, 20 men volunteered to carry out the soil-fertility trials, while 15 women decided to experiment with bean storage (Box 1). In Langbensi, 20 men and 12 women agreed to do the soil-fertility trials.

At the beginning of the cropping season, one-day review workshops were held at each pilot site to ensure agreement on experiment design and on the roles and procedures that should be followed during implementation. The experimenting farmers and field staff were trained in data collection. The farmers provided the major inputs for the trials: land (about 100 m^2), labour and seed. The NGLWG provided the phosphorus fertiliser (25kg/experimenting farmer).

The farmers observed the agronomic parameters during the growing season and informed extension staff when they start-

Box 1 Women experiment with cowpea storage

During community meetings in Sandema to identify farming problems, the women said the biggest threat to family food security was pest damage in stored grains, especially cowpea, millet, sorghum, bambara beans and groundnuts. They drew up a list of locally available options to reduce damage. These included:
- periodic drying
- store in tight bottles and leave them in the sun
- store in pots with ash, sealed with cow dung
- store in cow dung
- store with local herbs (e.g. *kpaliok* and *titibinamagli*; scientific names unknown)
- store with neem powder or extract (solution)
- store with powder or extract of *dawadawa* (from the seed of *Parkia filioida*).

The women discussed the feasibility of these options and decided to compare ash, kpaliok, neem powder and neem solution. They agreed that the trial should be done with cowpea, the crop most damaged in storage. Fifteen women volunteered carry out the experiment. Each kept five small pots of cowpeas in the home: this gave a total of 75 pots (5 treatments x 15 replications, including a control).

After three months of storage and a cooking and tasting test, the women ranked the treatments according to the following previously agreed criteria:
- degree of pest infestation as measured by the number of holes
- colour of the cowpeas
- palatability.

They came to the conclusion that ash gave the best results, *kpaliok* was second best, and neem powder and solution were not very effective. They found that ash from sheanut, neem and *Parkia filioida* wood was particularly effective. This was the first time the women had systematically compared different ways of solving grain-storage problems. They were keen to continue and try out other indigenous botanicals and comparing them to ash and *kpaliok*.

Moses Appiah

ed major farm operations (for example, weeding, harvesting) that required data collection. The church development projects organised exchange visits between the experimenting farmers and the rest of the community. The owners of the research were the communities, not just the individuals experimenting on their behalf. Monitoring also involved cross-visits between the pilot areas, after which the participating farmers reported back to their communities.

Because the experimentation was supposed to provide information for validating LEISA, data for this purpose also had to be monitored. Two types of scientific analysis were planned. The laboratory analysis of soils, organic fertilisers, yields, and total nutrient input and uptake and a total farm input and output analysis in terms of labour, costs, materials and input-output flows between plots within the farm, to be done using a computer model called FARMS. Extension staff took samples for these analyses and made twice-weekly field visits to collect data.

Farmers eager to compare results

It had been planned that the observations, measurements and analyses made by the farmers and scientists would be brought together in end-of-season assessment workshops but farmers already began comparing notes during the regular monitoring sessions. They regarded the experiments as a kind of competition and insisted that the NGLWG visit each experimental plot to see what had been achieved. Some 'non-experimenting' farmers voluntarily joined the monitoring sessions. The farmers were eager to move ahead in discussing their experiments, and not wait for the scientific analysis of results.

The NGLWG organised a two-day assessment workshop in each area. Farmers indicated that the soils treated with farmyard manure (FYM) could hold more water. When rains were poor, crops in these plots were more vigorous than in the other plots. In both pilot areas, farmers judged that FYM plus phosphorus gave the best grain yields: over twice as much as in the control plots. The second best ranking was given to treatment with FYM alone. Quantitative assessment by scientists confirmed the farmers' conclusions. However, because phosphorus must be bought and is difficult to obtain locally, the farmers found that organic manure was the best option for their situation.

Nevertheless, farmers indicated the following constraints in producing and using farmyard manure.

- limited quantity of FYM available
- poor quality of FYM
- large amount of labour needed to produce and apply FYM
- high incidence of weeds in plots treated with FYM
- difficult access to the equipment needed for producing and using FYM.

The villagers expressed satisfaction with the outcome of the assessment workshops and wanted to continue the research. It was agreed that, in the next cropping season, farmers from neighbouring communities would be invited to join the trial-monitoring visits. As farmers and extension staff complained about the time spent collecting data, especially for the FARMS model, this was scaled down.

Continuing and extending PTD

Sustaining the PTD process and scaling it up were concerns of the NGLWG from the start of collaboration. Reports on the research were sent to the documentation centres and libraries of institutions concerned with agricultural development in northern Ghana. At each quarterly meeting of ACDEP, the Country Programme Coordinator briefed members about the farmers' research. This eventually led to plans to scale up the approach to other ACDEP member stations.

The climax of the PTD cycle was a one-week regional workshop, involving key people from the collaborating organisations, representatives of experimenting farmers selected by their communities, and both regional and national policymakers. In addition to being a forum to further analyse and share research results, the regional workshop provided an occasion for the advocacy of LEISA and PTD, and served as a platform for re-planning the general directions of research. Afterwards, the NGLWG helped the participating farmers prepare community workshops to brief their fellow farmers. This led into planning the next PTD cycle.

Feeding into the next PTD cycle

The community workshops in early 1998 combined the PTD phases 'Looking for things to try' and 'Designing the experiment' and were focused on the problems encountered with FYM. During the farmers' monitoring visits and assessment meetings, the communities had already asked for the number of experimenting farmers to be increased. The community workshops therefore started with reviewing the mandates, commitments, roles and responsibilities of all partners in the PTD process.

Discussion about new experiments focused on two main problem areas: insufficient organic matter and weed control. The farmers came up with several options that could be tried out (Table 2).

Based on results of scientific studies that had been commissioned by the NGLWG during the previous year, it was agreed that cover cropping with *Mucuna, Callapogonium* and *Stylosanthes* spp would be included in the 1998 trials. Some farmers also wanted to include the pit compost they had started to prepare after the Burkina Faso trip (Box 2). Weed growth was included as a principal indicator to be monitored in 1998 and a weed scientist was brought in for this purpose.

In 1998, all the experiments were repeated at the pilot sites by all the original experimenting farmers. Some farmers used the compost prepared after the Burkina Faso trip as a substitute for FYM or household refuse, while others used it in addition to these. In Langbensi, seven additional farmers started experiments with cover crops.

Table 2: Farmers' suggestions to improve the use of FYM

Problem	Suggested research directions
1. Insufficient organic matter	a. Compost making
	b. Improving animal health and husbandry
	c. Supplementary feeding and housing
	d. Expanding small ruminant production
2. Weed control	a. Revamping the communal labour system
	b. Using leguminous cover crops
	c. Developing appropriate weeding tools
	d. Animal traction

Farmers working with other ACDEP member projects chose to address issues of particular relevance to their situations such as comparing bush-farm composting with pit composting near the home, with particular attention to water requirements and inputs for transporting organic matter and compost.

The experiments are continuing with more experience, commitment and intensity. New farmers who have joined the PTD process are being encouraged and supported as part of the ACDEP agricultural projects extension programme. In addition, the NGLWG has commissioned a study on animal health and husbandry with the intention of feeding the outcome into the farmers' research.

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Box 2 Ghanaian farmers' excursion to Burkina Faso

An eye-opener for the experimenting farmers in northern Ghana was a visit to farmers in Burkina Faso to see how they coped with low soil fertility. The people who joined the excursion were chosen by their communities and mandated to report back. Before departure, the Country Programme Coordinator told the farmers what they would see and facilitated discussion of possible follow-up activities. The excursion team consisted of the Coordinator, four extensionists (a man and woman from each pilot site), 16 farmers (two men and two women from each of the four pilot communities), the Langbensi station manager and an interpreter.

In October 1997 they travelled to north-east Burkina Faso where vegetation is so sparse that sometimes only pure sandy soils and hard pans with scattered thorn bushes can be found. They spent a week visiting farmers who practise an eight-week pit composting of crop residues, household wastes, animal dung and chaff; the application of compost in zai (holes hacked into the soil); and the demi-lune (half-moon) method of conserving soil and water. The Ghanaians saw how the Burkinabé farmers integrate livestock and crop husbandry although they have even fewer animals than the visiting farmers and thus improve the quantity and quality of compost. They witnessed the important role of animal traction (donkeys) in the farming system. They learned that good compost does not contain weed seeds, as had been alleged by some farmers in Ghana.

The Ghanaian farmers discussed with their Burkinabé counterparts through the interpreter. The other members of the excursion team were largely silent observers. The farmers expressed amazement at what the Burkinabé had managed to achieve under even more difficult conditions than those found in northern Ghana:

> *We are very much blessed and yet are complaining of poor soils. A large proportion of our soils we have even discarded as 'dead' but, to our surprise, such soils are being used here to produce something even better than we are doing on our best soils. The Burkina experience shows that we are just jokers.*
>
> *We are not doing enough back in Ghana to improve our soils and to get more out of our sweat and toil. Yet we are in a better position [ecologically] to do better. We have to wake up. We have to tell our people what we have seen and start doing the same.*

After the trip, the NGLWG organised a one-day workshop in each pilot area. The farmers who had travelled to Burkina explained what they had seen and learnt. They were enthusiastic about the organic manuring practices of the Burkinabé, and some had already started collecting materials to construct compost pits for themselves. Their reports generated much discussion and a strong desire in other community members to have a similar experience.

The excursion to Burkina Faso exposed the farmers to new conditions and ideas, and challenged and motivated them to continue experimenting with ways of improving soil fertility with fresh zeal and commitment. Some of the experimenting farmers in Sandema and

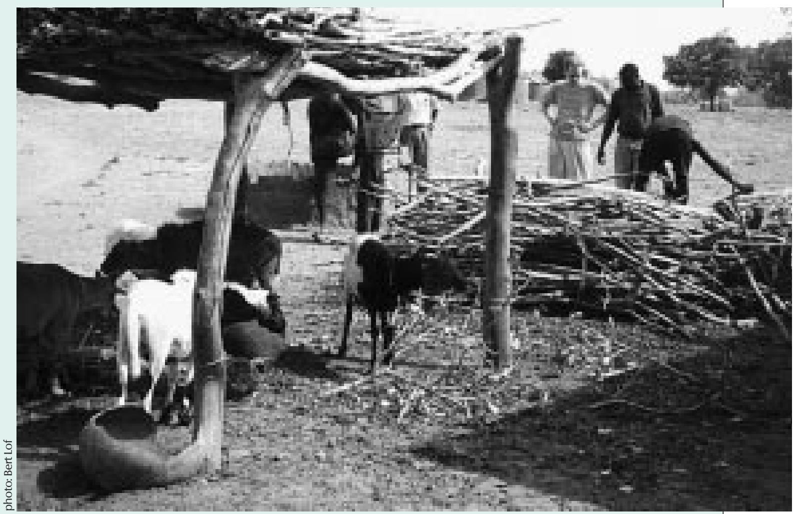

photo: Bert Lof

Seen in Burkino, then tried at home in Ghana: Tying goats near the compost pit.

Langbensi decided to add compost application as a treatment in the second year of their PTD trials. From the 10 x 10m plots in which yields were measured compost could result in a grain yield three times higher than from the control plot and also considerably higher than other treatments. Other farmers in the community who had not travelled to Burkina started to try out and adapt composting techniques on their own.

A number of initiatives arose after the farmers' assessment of the compost trial. With the greater appreciation of the value of compost, some farmers started to experiment with tying goats near to the compost pits. One farmer went as far as investing in a donkey cart, so that he could bring the compost to his remoter fields as well. Two farmers, on their own initiative, started a trial to compare the use of chemical fertiliser and the use of compost.

Malex Alebikiya

photo: Bert Lof

Experimenting with composting near homestead.

A platform developing sustainable agriculture

When ILEIA chose northern Ghana as a site for research for LEISA, it was not only because it fulfilled the agroecological criteria of being a dry land ecosystem. It was also because it was the home of a network, the Association of Church Development Projects, which was collaborating with

Malex Alebikiya

local research and training institutions in a participatory approach to developing LEISA. The ILEIA research project was to be based on the concerted action of stakeholders in agricultural development: governmental and non-governmental organisations involved in research, extension and teaching, and men and women farmers. In northern Ghana, the foundations for Stakeholder Concerted Action had already been laid.

ACDEP worked with governmental institutions in field-level planning of agricultural research and development, trained extension staff and ran joint workshops, and hosted university students doing field assignments. It had created a coordinating unit, the Agricultural Information Service, to facilitate this collaboration. In 1995, the ILEIA research gave ACDEP the impulse and opportunity to strengthen existing linkages and bring the various institutions together to form the Northern Ghana LEISA Working Group as a platform for sustainable agriculture. This article describes the experiences of this platform in its research and development activities, and as an advocate of LEISA in the policy sphere.

The NGLWG platform

The stakeholders that came together in 1995 to form the NGLWG came from development, research, and teaching. In the beginning, farmers were involved primarily as partners and beneficiaries in the experimentation and evaluation in the field rather than at the institutional level in project management and advocacy. Only gradually did the farmers from the pilot sites become more involved in the latter as they gained confidence in their abilities and influence.

The NGLWG wanted to collaborate with ILEIA in the research on LEISA in order to:

- feed into the on-going experimentation by farmers in their efforts to sustain production,
- collect field data to convince policy-makers about the potential of LEISA as an effective strategy for agricultural development, and
- encourage farmers to experiment and improve their skills in experimentation.

All the parties involved had witnessed the failure of past attempts to 'modernise' agriculture. The removal of government subsidies on 'modern' inputs had made them too costly for smallholders. In the meantime, the traditional farming systems based on local resources, including indigenous knowledge, had endured, albeit with diminishing yields. The vast majority of farmers continued to derive their livelihood from low-external-input agriculture.

Organising ourselves for joint action

The NGLWG organised a workshop to review the results of the initial field exercises designed to document socioeconomic conditions and local experiences with LEISA. Further training workshops in Participatory Rural Appraisal (PRA), PTD and Rapid Appraisal of Agricultural Knowledge Systems (RAAKS) gave people from the stakeholder institutions a chance to gain a better understanding not only of the existing situation but also of each other's roles, and to agree on joint action. We worked out our own management structure to ensure transparency, effec-

All stakeholders meet during the ILEIA-Northern Ghana LEISA Working Group workshop.

photo: Bert Lof

tiveness and participatory decision-making while implementing the collaborative research.

Three main activities in SCA

Participatory research. The PTD process (Millar p 43) harnessed the different strengths and expertise of the partners:

- indigenous knowledge and other resources of farmers, male and female, old and young;
- experience in participatory approaches of the NGOs and their rapport with farm communities;
- scientific knowledge and research experience of the research institutes and the university;
- the administrative support of MOFA at district level.

The farmers' knowledge of local conditions and practices and their experience in informal experimentation was combined with the scientists' knowledge in order to design experiments that the farmers could carry out themselves with their own resources. The experiments were jointly monitored and assessed by farmers, NGO staff and scientists, using agreed indicators. Farmers made their own changes in subsequent experiments on the basis of their new experiences. SARI did the soil and yield analyses, and fed the results back to the farmers.

Studies. Field studies were made by scientists as part of the PTD process of seeking options to test, and in order to understand the context, extent, causes and effects of the key problem identified by farmers: low soil fertility. The studies were better integrated into the PTD process after the NGLWG rather than ILEIA took over the tasks of identifying the studies to be implemented, commissioning them and discussing the results.

Advocacy workshops. The NGLWG organised research workshops that were attended by policy-makers from research, MOFA, the university and the NGOs involved in the collaboration, as well as by some regional and national politicians. At three such meetings held between 1997 and 1999, results and experiences from the field were presented. The experimenting farmers were the main resource persons. The workshops served to advocate the role of PTD and LEISA in sustainable development.

Experiences and learning points

Coming to terms with ILEIA. The research collaboration followed a rocky path to begin with. This was due to a lack of clarity in ILEIA and NGLWG about the project goal and strategies, the differing expectations of the collaboration, and conflicting views about roles. This problem was compounded by time pressure to complete the project and the expectations of those funding ILEIA and ACDEP activities.

ILEIA and ACDEP had worked together previously in information exchange. ACDEP saw the research project as an opportunity for more concrete collaboration on LEISA and PTD. The NGLWG developed a programme in this direction at its initial planning workshop before any personal contact with the newly recruited ILEIA research team was established.

That team saw things differently: it sought to understand the conditions and potentials for LEISA within the broad framework of natural resource management, supported by contextual and policy studies. It saw the NGLWG as an organisational structure that would help ILEIA reach the project targets. NGLWG, however, saw itself as a potential platform for advancing LEISA at farmer and policy level. It expected that, by the end of the project, the group's capacity and skills to continue this function would be strengthened. As part of the capacity-building process, it expected a guided devolution of project implementation from ILEIA to the group.

The ILEIA research team did not appear comfortable with this role for the group, possibly because, being new to ILEIA, the team had no previous contact with ACDEP. It saw only the specific outputs that had to be produced by the end of four years. For the NGLWG, any collaboration with external agencies had to benefit farmers directly, and it was not clear how the farmers would benefit from the approach proposed by the ILEIA research team.

The conflict eventually led to a call for an external review of the project. This review led to a new strategy that incorporated the expectations of the NGLWG. It was only then - almost two years after the official start of the project - that agreement could be reached between ILEIA and the NGLWG on programme, outputs, budget and implementation, and PTD work could begin in the field.

From 1997 onwards, ILEIA shared all project documents with the NGLWG and devolved all issues related to project implementation to it. This transparency and trust challenged the group to prove itself. The managers of the institutions involved gave their moral support to NGLWG by visiting the participating farmers and by taking part in the research workshops. ACDEP provided office space and secretarial service (partly financed by the project) as well as senior staff, with many years' experience in project management, to support the group. This played an important role in building the platform.

Reconciling internal differences. Despite the fact that the NGLWG was built on an existing foundation for collaboration, it was - in many respects - a new network. It had to go through a process of negotiating individual, institutional and group interests, building a collective vision, gaining the commitment of all members, and developing its own dynamics, norms, working principles and procedures.

One issue was the status of the group. Was it to be an independent network, or a working group under ACDEP? When the project started officially, the members accepted the lead role of ACDEP and the location of the network within the ACDEP secretariat. They saw the research project as a collaboration between ILEIA and ACDEP, which they were invited to join as resource institutions. However, in the course of project implementation, the group gradually recognised its potential as an institution in its own right and one that could support the fieldwork of NGOs and MOFA and influence policy on a more permanent basis.

Another issue was whether the group was based on individual or institutional membership. ILEIA and ACDEP had invited the institutions that were the most important actors in agricultural development in northern Ghana to form the NGLWG. The institutions were motivated to participate, partly because of government policy favouring closer interaction between government institutions and NGOs and partly because of the benefits they had come to recognise during their previous collaboration with ACDEP. The task at hand and the geographical area being covered fell within their mandate. To form the group, ACDEP deliberately ▶

contacted key allies within these institutions with relevant experience and interests. There was no formal institutional membership. Participation in the group was based on individual and institutional interest. This combination allowed the group to operate as an 'officially' recognised informal platform that functioned on a collegial basis. This accounted for the commitment of group members and the success of the group's activities.

Towards the end of the research project, all members of the NGLWG convened specifically to discuss these issues. We agreed that the future of the group would be best secured under a NGO, and decided to seek this under the legal framework of ACDEP. Furthermore, we sought to interest an increasing number of individuals from our respective institutions to join the platform as a strategy for institutionalising LEISA and PTD within the key agencies for research and development in northern Ghana.

All members of the group and some policy-makers expressed the need to concretise and expand the experiences and benefits of PTD with farmers. The NGLWG appears to be the most suitable platform for facilitating this scaling-up process and for generating information to support policy change at district and national level. The group has therefore drawn up a long-term programme to continue promoting PTD and LEISA in the field and in policy-making.

Achievements of the SCA

Gaining mutual respect. SCA provided an opportunity for experiential learning and appreciation of the knowledge not only of the farmers, who have been the prime teachers in the process, but also of the other professionals. The scientists began to respect the experience of the NGOs who, in turn, began to see that scientists and university teachers can bring useful insights to support farmer-led research. Each profession contributed to the process from a different perspective, thus generating a feeling of collective responsibility and enriching the process and outputs.

Internalising the approach. After only two years of collaboration, the Faculty of Agriculture of UDS became sufficiently interested in LEISA and PTD to include these subjects in its curriculum (see p 52) and a workshop on LEISA and PTD was organised for all lecturers. Several District Directors of Agriculture in MOFA requested a training programme for their staff, and the first such training has already taken place in Builsa District.

Building confidence. Concerted action is bridging the gap between farmers and scientists. The participating farmers realised that scientists use at least some of the same criteria as they do in evaluating technologies. The instruments for measurement may differ, but are mutually reinforcing. PRA methods showed that ranking and scoring with pebbles and discussing the meanings of these scores can bring out important aspects of a technology that go beyond measuring kilogrammes per hectare. During the discussions, scientists found that farmers could understand and expand on scientific interpretations of the results. This experience increased both the scientists' and the farmers' confidence in farmer-led research.

Training in action. Concerted action was an immersion course for the NGO staff in PTD. As the staff had received some training in PTD and had already tried to apply the approach before the research project began, they had a head start over government extensionists. However, during the fieldwork for the project, they realised that they still had a lot to learn about PTD. After two years of supporting farmer-led research, they were unanimous about the great learning effect of the experience.

Influencing policy. The NGLWG is best known to farmers for its collaboration in experimenting with LEISA technologies, but is best known to policy-makers for its advocacy work. The research workshops involving all stakeholders, including farmers, were vehicles for promoting LEISA as a more sustainable land-use system for northern Ghana than high-external-input agriculture. In their concerted action, the stakeholders have been showing how LEISA can be achieved.

Facilitating factors

While a structure for SCA may present a suitable framework for action research at farm level, it will become more than just a 'sum of numbers' only if the members can agree on a collective vision and can recognise that, by combining forces, they are more likely to achieve their individual goals. They must learn to respect the expertise of the different professions involved and the value that each brings into the concerted action. The training in PRA, PTD and RAAKS and the collaboration in field studies of LEISA and in supporting farmer-led experimentation helped the members of the NGLWG to achieve this.

The prior experience of collaboration between the individuals and institutions that joined the platform was doubtless a factor that favoured its development. The working relationship of mutual trust that had already been established between farmers and the NGOs greatly facilitated community entry and collaboration with farmers as equal partners in the research project. The government's encouragement of its institutions to seek closer links with NGOs also played a facilitating role.

The move that ILEIA, as external agency, eventually made towards transparency and devolution of management responsibilities was a key factor in forming the platform. Internally, the efforts of the NGLWG to carry all members along through open information flow and participatory decision-making procedures contributed to lively and sometimes heated discussions that forged our collaboration and resolve to continue.

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Women farmer explaining PTD results from their village to the Minister for the Northern region.

photo: Bert Lof

Malex Alebikiya, NGLWG coordinator, ACDEP, PO Box 1411, Tamale, N/R, Ghana.

Evolution instead of revolution

Northern Ghana represents a dryland savanna ecosystems. Traditional low-external-input agriculture is widely practised in a risk-prone environment where the 'Green Revolution' has failed. This article outlines the sociocultural setting of farming in northern Ghana, traces past attempts at 'modernisation', and describes the context in which smallholders, NGLWG and ILEIA conducted joint research.

P B Atengdem and A B Dery

Sociocultural setting

The characteristic social, economic and domestic unit is the patrilineal joint family. The head of family, usually the oldest patrilineal male descendant, controls family labour and farm produce, and rations it for daily consumption. However, emigration has led to the emergence of female-headed households, especially in the densely-populated Upper East Region. Household members are the main source of labour for the family farm, where staple crops are grown. However, adults also have their own plots where they can generate cash income for their personal needs.

The exploitation of nature (including agriculture) is governed by numerous taboos and social sanctions, enforced by traditional religious institutions. Land is communally owned and a land custodian, the *Tindana*, exercises spiritual power and allocates use rights according to custom. He performs the Earth rituals at the beginning and end of the farming season, or when the Earth must be pacified because taboos have been violated. In recent times, however, social sanctions are being eroded as a result of population pressure, 'Western' education and the coming of other religions, particularly Christianity. Some farmers attribute the low rainfall and declining yields to a breakdown of rituals associated with the use of land, rivers and trees.

Non-revolution in agriculture

In the first half of this century, the colonial government regarded the Northern Territories as a labour reserve for the army, police, mines and cocoa farms in the south. Little investment was made in the north although there was an attempt to produce cotton, groundnuts and sheanuts for export. Recurrent food shortages forced the government to set up agricultural research and extension stations in the late 1930s and early 1940s.

After Independence was gained in 1960, the Ghanaian government established large state farms, introduced tractors and drafted the able-bodied youth as labour. No support was given to smallholder farming.

The 1970s saw a shift from socialist to capitalist agriculture. Large-scale, mechanised rice and maize production on private farms was promoted. Through multilateral and bilateral projects, huge amounts of fertiliser, herbicides, insecticides and heavy equipment such as tractors, combine harvesters and land-clearing equipment were imported. Northern Ghana consumed more than 50% of the country's total fertiliser imports. The programme was backed by credit, subsidies and guaranteed prices. The urban elite, civil servants and entrepreneurs flocked to the north to take advantage of the 'Green Revolution'. Large expanses were cleared of all trees and planted with rice and maize.

From 1974 onward the Savanna Agricultural Research Institute (SARI) bred high-yielding rice and maize varieties (HYVs). The government's extension package was oriented to external inputs: monocropping of HYVs with chemical fertiliser application. The major task of extension staff was to distribute fertiliser and train farmers in its application. In the 1970s, several development programmes helped extend a similar package, including credit for seed and fertiliser, to smallholders.

In 1981, the Government began a Structural Adjustment Programme. Subsidies on agricultural inputs were removed. Procurement and distribution of inputs was privatised. Fertiliser prices rose sharply, and imports fell from 60,460 mt in 1980 to 12,000 mt by 1993. SARI's research agenda was redirected to 'identifying cropping systems that will ensure high and stable productivity under permanent cultivation without creating undue demand for external inputs' (Diehl 1993).

Agricultural extension in northern Ghana has been dominated by the Transfer-of-Technology approach, promoted through 'Contact Farmers' and 'Training and Visit'. Research and extension fall under different ministries: the former under the Ministry of Science and Technology, the latter under MOFA. To improve communication between the two services, Research-Extension Linkage Committees were set up. Even though the communication was still one-way, efforts were made to cooperate in designing and implementing the activities of the different Farming Systems

Farming in northern Ghana

Research (FSR) teams set up by SARI in the 1980s.

NGO reorientation to LEISA

Numerous NGOs are active in agricultural development in northern Ghana. The longest and most widespread effort is that of the church-sponsored agricultural stations. From their establishment in the 1960s and early 1970s, they collaborated with national and international researchers to conduct fertiliser and variety improvement trials. They operated demonstration farms and provided credit so that farmers could adopt ‘scientific’ farming methods including hiring tractor services and buying fertilisers, HYVs and improved animal breeds. To modernise smallholder agriculture, they worked with contact farmers, relying on the ‘trickle-down’ effect: results, however, were disappointing.

The stations began to change strategy and sought a path towards low-external-input and sustainable agriculture. They promoted animal traction instead of tractors, the use of compost and farmyard manure instead of chemical fertiliser, and they encouraged farmers to stop burning crop residues in order to maintain soil productivity. A campaign was launched against bush fires.

Smallholder farming prevails

Despite the attempts first to introduce socialist agriculture and then to revolutionise farming into modern businesses, more than 90% of rural people in northern Ghana continue to practise small-scale rainfed farming oriented primarily to subsistence. The smallholders adopted certain cash crops (mainly groundnuts, cotton and cowpea) to meet their needs for purchased goods. They adjusted their farming systems and practices as conditions changed, above all, as population density increased.

Now, relatively fixed cultivation is practised in the more densely populated Upper East and Upper West Regions, while semi-permanent and shifting cultivation is practised in the Northern Region and parts of the Upper West, where land availability is not yet a constraint. The average holding consists of a ‘compound farm’ around the home and several ‘bush farms’ a few kilometres away.

Depending on the region, the main staples are millet, sorghum, maize and/or yam. In addition bambara beans, cassava and rice are also grown for home consumption or sale. Intercropping is common, but rice is grown mainly by women as a monocrop in seasonally flooded lowlands. Traditional crop varieties, well adapted to the harsh climate and uncertain rainfall, are generally chosen. In the case of maize and, to some extent, sorghum, ‘improved’ varieties are grown. These have potentially higher yields and respond better to fertiliser but are less resistant to drought and the dry spell that falls in the middle of the wet season.

Tillage is done mainly with hoe and slasher (slash-and-burn). Tractors are hired for land preparation only and are more common in the Northern Region and parts of Upper West, largely because cotton companies are located there.

Livestock rearing is an integral part of the farming system. Most households keep some animals, mainly poultry, pigs, sheep and goats. Richer households also have cattle, but often hire Fulani pastoralists to herd them. Northern Ghana has a relatively high concentration of livestock: 75% of the countries cattle and 50% of its small ruminants are found here. Livestock range freely during the day. Smallholders use animals to supplement family diet and to generate occasional cash income. Livestock also play an important part in cultural and religious life. The use of animals for traction is more prominent in the Upper East and parts of Upper West but, even here, fewer than a third of farmers own draft animals.

Current development efforts

The MOFA extension service now emphasises soil conservation measures such as contour farming, ridging across the slope, more efficient fertiliser application, and good land preparation. Researchers at SARI are looking into other agronomic possibilities to improve the land, including cereal-legume rotation and intercropping, agroforestry, cover cropping, alley cropping, and improved fallow. Additional techniques promoted more recently by NGOs and, to a lesser extent, by MOFA include composting, non-burning of crop residues, integrated pest management, increased crop-livestock integration and animal traction. In the last decade, some NGOs - particularly the ACDEP stations - introduced the idea of developing technologies directly with farmers. It was in this context that farmers, researchers, the extension service, the local university and ACDEP started a concerted effort in action research to develop low-external-input and sustainable agriculture.

■

- **Atengdem PB** and **Dery AB**, Ministry of Food and Agriculture, PO Box 63, Sefwi Wfawso, GHANA

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photo: Bert Lof

Sandema pilot site in Northern Ghana.

Northern Ghana Programme

Malex Alebikiya and Ann Waters-Bayer

The original aim of the research collaboration initiated by ILEIA was to validate LEISA as a viable option for agriculture. The dry land savanna site selected for this research was northern Ghana. A network of NGOs known as the Association of Church Development Projects (ACDEP), based in Tamale, the main city in northern Ghana, joined forces with individuals from research, extension and teaching organisations to form the Northern Ghana LEISA Working Group (NGLWG). This was the organisational structure for the Stakeholder Concerted Action (SCA) in LEISA research.

The research sites

Two pilot sites for the research were selected: Sandema in the Upper East Region and Langbensi in the Northern Region. Debates within the group and between the group and ILEIA about how far these sites represented the dry land savanna of northern Ghana led to the identification of four "syndicate sites": Garu, the driest and most densely populated site, where livestock play a significant role in agriculture and soil fertility management and dry-season cultivation of onions under irrigation is becoming a major activity; Tumu, with rich and deep loamy soils, low population density, a farming system based on yam and sorghum, and shifting cultivation to maintain soil fertility; Nandom, a transition area between Sandema and Garu, where animal traction is becoming widespread for tillage; and Tamale, a site with a high degree of urbanisation (Atengdem & Dery p 38).

Stakeholder concerted action

Collaboration began when ILEIA and ACDEP invited various organisations concerned with agricultural research and development in northern Ghana to a preparatory workshop in June 1995.

ILEIA had a mandate to work with local institutions in validating LEISA in scientific terms. This was an interest shared by scientists and academics from SARI, ARI and UDS, who saw the research project as an opportunity for field research and publication. In addition, the UDS staff saw it as an opportunity to strengthen links with NGOs in order to fulfil the mandate of pursuing a grassroots problem-solving approach to development. The MOFA staff were motivated primarily by the possibility of reaching more farmers with the additional resources that the project would provide. The church-based organisations within ACDEP were mainly interested in helping farmers solve their practical problems. The formation of the NGLWG, the long process of reaching an agreement about the purposes and mechanisms of collaboration with ILEIA, and the dynamics of the SCA are described in more detail in the article by Alebikiya (p 40)

The exposure of staff at UDS to the experience of supporting farmers' experimentation with LEISA techniques helped to break down barriers in communication between academics, extension agents and farmers. As Dittoh and Alebikiya (p 52) describe, this led to efforts within the university to incorporate PTD and LEISA into the curriculum in both lectures and practical training.

Participatory Technology Development

The approach chosen to assist farmers to move toward LEISA was PTD. The church-based agricultural stations within ACDEP already had some experience with this approach. Because the other members of the NGLWG were not so familiar with PTD, a series of workshops for information sharing and training was organised by the NGLWG. In northern Ghana, the six phases of PTD were as follows:

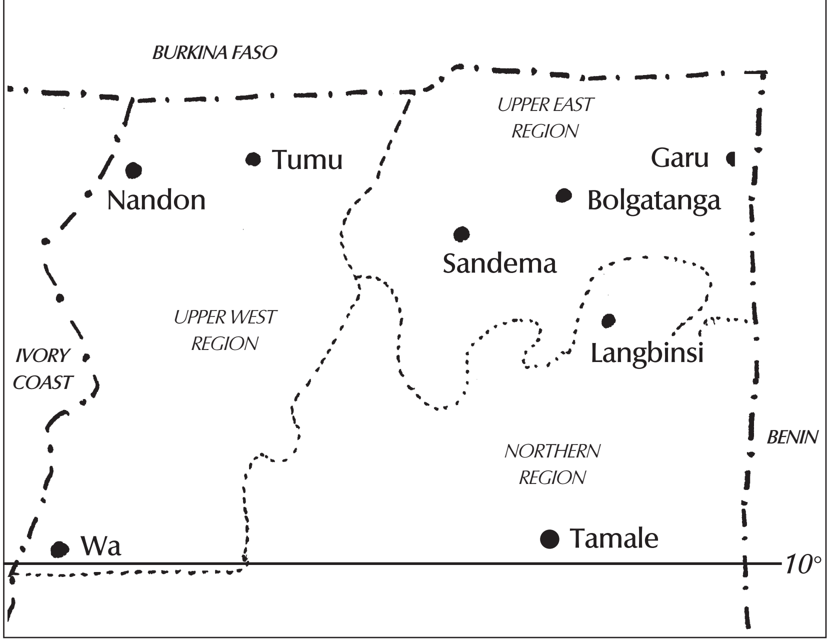
❶ ***Getting started:*** PTD courses for NGLWG members, and the first workshops with farmers to agree on collaboration;

❷ ***Looking for things to try:*** Second set of farmers' workshops, during which the farmers prioritised their problems, agreed to focus on soil fertility improvement, and decided who in the communities should carry out experiments on their behalf;

❸ ***Designing the experiment:*** A series of meetings and discussions between NGLWG members and farmers, during which the path of farmers' informal experimentation was traced and agreement was reached on designs for collaborative experiments: these involved comparing the effect of farmyard manure and household refuse, with and without the addition of phosphorus, on soil fertility.

❹ ***Trying out:*** Laying out the experimental plots for soil-fertility management trials in the fields of 52 men and women farmers, implementation of the trials by the farmers, and joint data collection by farmers and NGLWG members.

Northern Ghana: LEISA Research sites



Northern Ghana lies between 8°N and 11°N latitude at an altitude of 200-300m. Mean annual temperatures are 25-30°C and rainfall is highly variable (800-1300mm/year) with a wet season from May to September.The Sadama research site has coarse sandy loam, moderately acidic soils with low organic matter content. Available N is 10-30 kg/ha and P less than 10 kg/ha. There is considerable sheet erosion. Soils at the Langbensi site are strongly acidic and more suitable for cultivation. Organic matter content, N and P are higher here than in Sadema. Woodland savanna characterises much of Northern Ghana. The administrative regions of Upper East, Upper West and Northern Region account for 41% of the nation's territory and 20% of its population. Population densities vary from 125 persons/km² (Upper East Region) to 25 persons/km² (Northern Region). There is 3% population growth despite the continual out-migration of landless, unemployed youth. More than 90% of the population are farmers. Shifting cultivation dominates the less populated areas (5ha/household) and permanent agriculture the more densely populated regions (0.8ha/household). Millet (food) and groundnuts (cash) are the major crops in Sadema. In Langbensi, maize (food) and cotton and cowpeas (cash) are the most important.

❺ ***Sharing the results:*** Farmer assessment workshops after the end of the cropping season, when farmers and NGLWG members jointly analysed the results of the experiments and made them known to colleague farmers and scientists.
❻ ***Sustaining the process:*** Built into all above phases, in the form of workshops in which farmers were key resource persons and farmer exchange visits (for example, to Burkina Faso) to gain ideas which could be used in further experimentation and to influence policy

Also within the PTD process, a group of 15 women experimented with different ways of storing cowpea (see p 44) and men and women farmers in Garu, one of the syndicate sites, explored ways to eradicate the parasitic weed striga. Similar PTD experiments, mainly on techniques of soil fertility management, but with varying degrees of formal structure, were carried out at the other syndicate sites.

A more detailed description of the PTD process and the major results is given in the article by Millar (p 43). The intensive interaction of NGLWG members in the concrete activities of planning, implementing, monitoring, evaluating and documenting the PTD process made a great contribution to strengthening relations within this platform for concerted action in Northern Ghana. The PTD activities and results provided examples and information that could be used to convince policy makers about the effectiveness of bringing local and scientific knowledge together to improve smallholder farming.

Scientific studies

Various studies, initially commissioned by ILEIA, were undertaken to gain a better understanding of the physical and socio-economic environment. Most of the early studies were done by experts outside of the NGLWG. Later, the NGLWG took over the responsibility of commissioning studies to support the process of farmer-led research.

An exploratory study provided insights into the historical changes in agricultural practices and policies in northern Ghana; principal findings are summarised in the article by Atengdem and Dery (p 38). Agroecological resource mapping (AERM) provided information about the available resources and their interrelationships. A soil classification study (Kauffman p 9) and context studies were made of land forms in the pilot sites. Technical studies provided information on the soils in the pilot areas and on the role of livestock in improving soil fertility. This latter study identified options to explore in farmers' experimentation (Karbo et al. p 49). Case studies were made of ecological farming and non-burning practices (Aalangdong et al. p 47).

In order to carry out a more quantitative assessment of sustainability, data were continuously collected of all inputs into and all outputs out of the various plots of selected farmers by using the FARMS-software (ILEIA Newsletter 13.3). This was then used to determine nutrient and financial balances for the plots and for the farm as a whole. Unfortunately, because the computer software for FARMS could not be made operational during the project period, analyses are not yet available. However, the participating farmers found it enlightening to become more conscious of the inputs and outputs in their farm system.

The following articles describe the agroecological conditions in Northern Ghana and the history of agricultural research and development (Atengdem & Dery p 38); a consideration of the threats to sustainability in the dry land savanna that stakeholders are trying to address through their concerted action in collaborative research and policy influencing (Saa Dittoh p 51) and finally the major lessons learnt over the past four years and the prospects for continuing joint action for sustainable agriculture (Alebikiya & Waters-Bayer p 54).

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GHANA

RESEARCH PARTNERS

- Langbensi and Sandema farmers
- Savanna Agricultural Research Institute
- Animal Research Institute
- University of Development Studies
- Ministry of Food and Agriculture
- The ACDEP NGO Network

In northern Ghana development workers and researchers created the Northern Ghana LEISA Working Group to enhance stakeholder concerted action and participatory technology development. The aim was to improve the productivity and sustainability of traditional smallholder agriculture. Activities focused on farmers' in Langbensi and Sandema and other secondary research sites. In these communities men experimented with farmyard manure, rock phosphate and compost for two seasons. Women focused on cowpea storage compared the effectiveness of ashes derived from three different local trees and a local herb. Studies were concerned with farmers' experiences with non-burning and the role of livestock in the savanna crop-livestock system. A study tour to Burkina Faso opened farmers's eyes to what could be done to improve farming in regions with real drought problems. This made many farmers eager to start experimenting with the production and use of compost. Advocacy workshops contributed to LEISA and PTD gaining wider acceptance as viable approaches in Northern Ghana by the University of Development Studies and the Savanna Agricultural Research Institute amongst others.

A new tone is set


photo: Marilou Abon

Looking for ways to continue collaboration.

It is strongly believed that the stakeholders in the ILEIA-Philippines Research Programme came together for a noble purpose: to prove the viability of LEISA as an alternative option for farming in this part of the world. This was a common goal shared by everyone involved in the programme and it was made concrete by the support of ILEIA Netherlands.

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The farmers' organisations expected financial support from ILEIA and technical and moral support from the NGO and the academe. The academe expected acceptance by the farmers: acceptance of their thoughts, hearts and persons. Both groups were willing to make compromises. The farmers had a stock of learning obtained from a lifetime of farming. The academe had received theirs from books and simulated experiments. Each made a paradigm shift and decided to complement the other's learning in order to come up with concrete and scientifically accepted proofs that would substantiate their belief in sustainable agriculture as a viable option. ILEIA was expected to provide a forum through which this information could be shared with policy makers.

Negotiating working relations

The LEISA Working Groups were not spared conflict. In the initial encounter between academe and the farmers, the latter candidly stated that they felt academics were inexperienced as far as everyday farming activities were concerned. The people from the university felt they were not accepted by the farmers as partners in the programme and were, in fact, seen as competitors when it came to apportioning the budget. Farmers' resistance became more obvious when the academe recommended some scientific indicators and methodology in the experimental design. This resistance was spurred by the farmers' belief that they should be the ones to identify what was scientific and that the people from the academe should follow what they, the farmers, wanted to do in their experiments.

It was difficult to sustain the enthusiasm felt at the beginning of the PTD experiments when farmers, NGO staff and academe had invested a considerable amount of their free time. Not everyone could afford to invest so much time for a long period in activities with little paid compensation. Weekly visits to the farmers' fields by the academe and NGO staff had to be scaled down and were partially replaced by an 'on-call' system. Better payment, funded by ILEIA, made it possible to involve a broader group of specialists from the CLSU. Initially, farmers were disappointed with this development. Later it was understood that this system was more realistic and gave them more freedom to invite the specialists they needed.

The Working Groups went through a long period of adjustment before establishing stable working relationships. CLSU, KADAMA, KALIKASAN and PRRM were not always in agreement on a number of issues during the course of the programme. Issues such as approach, indicators, methodology, treatment of PTD and LEISA were continually being raised and other difficult questions included who should call the shots and who should take the leading role in projects. These differences were settled by continuous dialogue, meetings, and consultations among all involved in the programme and by constant work on 'team building' activities.

Lessons learned

Despite these differences and conflicts, the farmers' organisations and the CLSU-ILEIA task force worked hand-in-hand to accomplish their respective tasks, roles and functions for the sake of sustainable agriculture and in the end the stakeholders all claimed to have learned important lessons.

As a process, PTD - as practised within the ILEIA research programme - was seen to answer the farmers' wish to be involved in the process of articulating their needs and aspirations and having a real share in social and political power. The projects undertaken strengthen the experimental and technology management capacities of local farmers and communities. Farmers played a key role in the process and they participated in and facilitated project activities from problem identification to decision making on experimental designs and parameters. With continuous support this positive step can become a genuinely 'sustainable' progression.

Setting up a research framework based on farmers' perspectives puts farmers in a lead position. In all these activities they need technical backstopping from academe and financial support from organisations such as ILEIA. Stakeholder Concerted Action, through common activities such as planning, monitoring, evaluation, capacity building, networking, library support and documentation of results and lessons, is a support mechanisms that allows the programme to achieve its goal and meet its objectives.

Initial encounters of stakeholders and the mix of negative and positive reactions were seen as part of a natural process that can be found in any development initiative. It is a familiar stage. Mental baggage is unloaded and new ideas gradually accommodated. A new tone is set - one that facilitates better working relationships. It is a stage when new things are learnt and these can serve as the foundation for a new beginning.

We, as academics, have learned many things in the course of this research programme.

- Recognising the capability of farmers ensures their capacities will be developed in technology management.
- A complementary working relationship among stakeholders could serve as a model in any farmer-led development programme.
- The more farmers are exposed to scientific activities, the more they can develop their innovative skills and knowledge.
- Given all the necessary skills to conduct experiments and generate technology, the farmers could easily duplicate what scientists are doing in the interests of sustainable agriculture.
- Training to develop knowledge, skills and the attitude of farmers towards undertaking experimental activities is a prerequisite for programme implementation.
- Internalising farmer-led research is a continuous process that cannot be achieved in a short period of time.

What has been learned here will provide a basis for future activities in similar programmes.

■

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PTD should be routine

Crop cutting on a sample plot.

A concluding Farmers' Forum on PTD was held in December 1998 to assess the results and processes of the PTD experiments and to formulate recommendations for the improvement of the PTD process. Fifty-eight farmers from the 10 farmer experimentation groups participated in the forum.

Carlos S. Basilio

According to farmers, several significant results had been observed after three cropping experimentation seasons of organic fertiliser application. Use of organic fertiliser and ITRV do not necessarily mean lower yields. This strengthened farmers belief that organic farming is cheaper and more profitable particularly because the need for organic fertiliser decreases after some seasons and chemical pesticides are no longer required. However, in the transition from chemical to organic agriculture time is needed to build up yield levels.

Farmers observed that plants produced by organic fertiliser were sturdier and had a healthy green colour. They were better able to withstand typhoons that devastated the rice planted in the area. This sturdiness is as important as high yield to farmers in typhoon-sensitive areas.

The farmers observed that farm organisms like paddy fish, frogs and snails have returned to their farms. Farm soils have regained their natural colour, form and capacity to nurture life. Field flora such as the *burat aso* (*Sphenoclea zeylanica* L.) which had disappeared because of the extensive use of agro-chemicals can now be seen again in farms in the KADAMA and KALIKASAN area.

Soil fertility highest priority

Each farmer group was asked to assess the results of their PTD experiments using their own criteria, indicators and parameters. The parameters were clustered into composite indicators such as crop growth, yield, grain quality, income and the effect on soil, environment and health. Each indicator was scored from 1 to 10 based on the group's perception of its importance or its effect on the experiment. The most important indicator was scored ten.

Farmers gave high priority to improving soil fertility (Table 1). Six groups ranked it first in their priority setting possibly because farmers felt their soil was being gradually degraded through continuous and intensive use. Soil fertility was seen as the best way to secure, improve and stabilise high yield and income in the long-term and farmers are ready to invest in it. Farmers also wanted a return of edible flora and fauna from their fields and saw this as an indirect, positive effect of using fertilisers capable of regenerating soil quality.

The second priority was income and yield. Cost reduction is important because many farmers are dependent on costly loans and indebtedness is widespread. High yield and income are essential, but farmers' are also concerned how farming affects human health and the environment.

Farmers feel empowered

Almost all farmers found PTD a good approach because they were fully involved throughout the research process. Farmers felt empowered by the programme as academe acknowledged farmers' indigenous knowledge, experiences and skills and their leading role in technology development. KALIKASAN-NE and KADAMA farmers became well known for their efforts to develop sustainable agriculture and they felt equal partners in the research programme.

While the farmers' organisations have been strengthened in respect of technology development, the research programme absorbed a lot of their management capacity for long periods of time. This meant that the regular activities of the farmers' federations were reduced to a minimum and many farmers became dissatisfied.

Recommendations to improve PTD

During the course of the experiments farmers made a number of innovations and adjustments to ensure that experiments were adjusted to farm and farmer realities without any loss of scientific rigor. Farmers recommended that:

- There should be agreement among the members of farmer groups on the use of common cultural management practices for the experimental plots. Any deviations from agreed practices should be recorded, reported and discussed within the group.
- Seedlings for all experimental plots should be raised on a common seedbed.
- Transplanting seedlings should be carried out on a specific day and, during transplanting, the group members should work on a mutual self-help basis.
- No replication of treatments is needed within the farm. Each farm serves as a replicate of the group's experiments.

Table 1. Summary of farmers' preference scores and ranks of the different composite indicators of PTD experiments.

Indicators	Total score	Average score	Rank frequency 1	2	3	4	5
Effect on crop growth	85	9.44	0	1	4	2	2
Effect on grain quality	89	9.89	0	1	5	3	0
Effect on yield	142	15.77	1	5	3	0	0
Effect on income	172	19.11	4	2	1	2	0
Effect on soil	195	21.67	6	2	1	0	0
Effect on environment	112	12.44	0	4	4	1	0
Effect on health	118	13.11	0	6	2	1	0

- Limit the number of sample plants and crop cuts to three.
- Increase the size of the plots from 333.33 m^2 to 500 m^2.
- Try to establish dikes between plots that are high and wide enough to prevent the mixing of treatments. Plant vegetables on the dikes to compensate for the loss of land to rice plants.
- Request the presence of the monitoring team at every critical activity especially during community orientation, site selection and evaluation, laying-out experimental plots, designing treatments, and harvesting crop cuts.
- Enforce strict use of criteria for farmer cooperators and put appropriate incentives and disciplinary mechanisms in place.
- Encourage and facilitate cross-farm and cross-site visits.
- Conduct regular, end of cropping season assessment and planning workshops.
- Conduct village level feedback of statistical and economic analysis.

Performance of roles

Farmer cooperators, area-coordinators, process documenters and monitoring team members were evaluated. Farmers observed that their experiments were hindered by their other obligations; shortage of irrigation water; scarcity of chicken manure at critical times; and climatic factors like El Niño and typhoons. Farmers acknowledge, however, that the traditional 'bayanihan' system of group collaboration and the orientation and training they had received were very helpful. In the beginning it was difficult for all farmers to be involved in data collection. After receiving better orientation from the area coordinators their involvement improved. Not all area coordinators could collect data and write reports satisfactorily.

Process documentation was sometimes difficult. Schedules were not followed, farmer cooperators had no time for meetings, data was submitted late and documentors lacked proper training. It was suggested that more attention should be given to proper selection and training of farmer cooperators, area coordinators and process documentors.

Monitoring was complicated by the fact that the team members, area coordinators and farmer cooperators had different working schedules and limited experience as well as by the climate during rainy season. The academe often had commitments at the university. Contradictory comments from members of the technical support group made farmers uncertain. It was stressed that monitoring should be carried out regularly even if area coordinators and cooperators were not present.

Participatory research was new to everyone involved so the learning process was very important. More exposure to carrying out experiments and studies is needed. This type of experimentation should become part of the everyday farming routine.

Table 2. Matrix ranking and scoring of recommended subjects for future PTD experiments

Research topics/activities	Total score	Rank
Plant breeding	9	2
Seed conservation	3	5
Varietal adaptability	11	1
Training in integrated cropping	2	6
Organic fertiliser production	4	4
Botanical pesticide production	4	4
Continue fertiliser experiments	7	3
Experiment with methods of rice planting	3	5
Experiment with Golden Snail control	1	7
Experiment with organic vegetable farming	2	6
Experiment with SALT farming	1	7

Recommendations for future studies

The participants were asked what sort of experiments and studies they wanted in future programmes. Most of the participants were interested in experiments on varietal adaptability of seed and plant breeding. Others wanted to continue with fertiliser experiments or study insect resistance, organic fertilisers, and seed conservation and collection (Table 2).

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This report is based on: Basilio C, San Buenaventura TB, Hibionada RS. & Bugayong FA, 1999. **Farmers forum on participatory technology development.** ILEIA Collaborative Research Programme Philippines.

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Threshing the paddy from sample plots.

Sun drying.

Farmers forum to assess PTD results.

photo: Kalikasan

KALIKASAN planning their research activities for the coming season.

Presenting PTD to the community.

Participatory Technology Development

To introduce the PTD process, the Kadama and Kalikasan working groups conducted community orientations in their respective vilages. Social orientations were conducted by farmer leaders. This orientation familiarised the farmer members with PTD and its objectives. Farmers who attended the community orientations were also given historical perspective on how agriculture in the Philipinnes had evolved.

The process

KALIKASAN and KADAMA farmers who were interested in conducting PTD experiments were identified and selected according to criteria established by the group. These included a willingness to try organic farming and use 1000 m² of their farmland for experimental purposes; access to irrigation and a readiness to follow the research methodologies, activities and tasks required by the PTD process carefully.

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Problem identification

The PTD process started with Participatory Appraisal Tools such as transect mapping, seasonal calendars and problem tree analysis in targeted KADAMA and KALIKASAN pilot sites. In cooperation with CLSU, PRRM and ILEIA, KADAMA and KALIKASAN members were encouraged to use resource flow diagrams and land-use maps developed from their own classification categories. This resulted in Agro-Ecological Resource Management (AERM) maps and descriptions of the prevailing farming systems in the Barangays Rajal Centro, Sta. Rosa and Triala, Guimba. A problem analysis was made, priorities set and the ‘options’ that could possibly resolve these problems was surveyed.

Training and planning

But first the research programme partners received PTD training. Concepts and principles were discussed and implementation plans prepared. Problems and issues affecting the management and implementation of the ILEIA-Philippine research agenda were identified.

Workshops were organised to operationalise the objectives, hypotheses and experimental designs. Methods of data collection, analysis, and the process of overall assessment to be used were established. Farmer cooperators determined the objectives and design of the experiments and decided which rice varieties to use, the type and amount of fertiliser to be applied, and the choice of planting method.

Standardised practices

The Bureau of Soil and Water Management (BSWM) carried out a soil analysis to determine the amount of fertiliser needed. Seedling establishment, land preparation and other cultural management practices followed the farmers’ usual practice. Fields were ploughed and harrowed using hand tractors, harrows and carabao-drawn ploughs. Three days later they were harrowed again. When the land was clod free and had been well pulverised, rice seeds were put to soak in water for 24 to 36 hours. They were given another 12 hours in moist condition to germinate. Seeds were then sown broadcast on seedbeds. Transplantation using the straight planting method occurred 25 to 30 days later. A distance of 15x15cm was left between hills.

Chicken manure was applied before the last harrowing. Chemical fertiliser, however, was applied some 10 to 15 days after transplantation. Botanical pesticides and other traditional and innovative practices were the only pest management practices used (see Box 1).

Variable treatments

Research objectives were identified and formulated by each group. The KADAMA experiments were designed to find the best type of fertiliser (pure organic, pure chemical or mixed organic-chemical) for improved traditional rice varieties (ITRV). KALIKASAN experimenters wanted to determine how traditional and high yielding rice varieties (HYV), planted on two different types of soil, responded to pure organic, pure chemical and a mixture of organic and chemical fertilisers.

Banitan and Tayabo farmers' groups used different levels of organic fertiliser on ITRV and HYV. The PMK and UGNAYAN farmers used different levels of organic fertiliser to cultivate ITRs. These last experiments were only conducted during the wet cropping season of 1998.

Experimental design varied with the type of experiment chosen. Most farmers' groups laid out their experiment in 3 blocks (one block, one treatment) without replication. Scientists asked some groups to use replication (3 replications per treatment). Each type of experiment was repeated on at least six farms. Some 69, 21 and 69 cooperators from KADAMA and 57, 48 and 43 from KALIKASAN undertook experiments during the first, second and third experimental seasons.

Monitoring and data collection

Farmer cooperators were responsible for implementing the experiments. Area coordinators visited the farms regularly to help the farmer cooperators with implementation, monitoring and data collection. Area coordinators ensured that the research process was carefully followed and they provided orientation and guidance where necessary. A monitoring team composed of farmer, CLSU, and PRRM working group members ensured the process and experiments stayed on track and were responsible for facilitating meetings and workshops and writing programme reports. They noted those factors affecting experiments and discussed problems with area coordinators and farmer cooperators. KADAMA and KALIKASAN provided the CLSU-ILEIA Task Force with the schedules of farm visits. KALIKASAN research sites were monitored once every two weeks and KADAMA research sites were monitored during the first week of the month. Indicators for monitoring and evaluation of the experiments were selected (Box 1).

Informal meetings were held during or after monitoring to assess the results of field visits and suggestions and recommendations were made to farmers and area coordinators on what needed to be done. Institutional, working group and programme level meetings were also held to update each partner on the status of the experiments and, if problems had been reported the steps taken.

Members of the CLSU team were consulted when special problems arose and specialist knowledge was required. When pest or disease outbreaks occurred, for example, samples of the affected plants were brought to the CLSU laboratory and farmers were later given the results and advice.

Box 1 **Farmer collaborators indicators for monitoring PTD experiments**

- Growth: plant height, number of tillers, panicle length (30, 50 and 70 days after transplanting)
- Yield: fresh and dry (per m^2 and total field)
- Amount of external and internal inputs
- Amount of chemicals used
- Amount of organic fertiliser used
- Number of beneficial and harmful insects
- Available soil nutrients
- Organic matter content
- Soil pH
- Ease of land preparation
- Weed occurrence
- Extent of moss/algae growth
- Soil colour
- Resistance to natural calamities, typhoons, floods, droughts
- Types, amount and taste of food
- Income
- Frequency of income generation
- Reduction in expenses/need for capital
- Amount of production loans or savings
- Amount of free time
- Health
- Number of natural organisms, plants and animals returning to farmlands
- Depth of water table
- Number of farmers using organic fertiliser

Data processing

Data on plant height, number of tillers and panicle length were collected 30, 50, and 70 days after transplantation. The fresh and dry yield weights per sample m^2 and per plot were noted immediately after harvesting and two days after sun drying. Farmers, guided by the monitoring team, used 10kg weighing scales to record yield data. Scientists used a structured interview schedule to gather additional data. All information was then filed in a database using the Statistical Package for Social Sciences (SPSS) file. The CLSU-ILEIA Task Force analysed all statistical and economic data collected. Results were explained to the farmers in the assessment workshops.

Soil sampling for scientific analysis.

Laying out experimental fields.

Assessment workshops

After each cropping season, assessment workshops to discuss PTD results were held at village and working group level. Results were further evaluated in country research workshops. At the village level, primary evaluation of the quantitative and qualitative data derived from experiments took place during group discussions when farmers discussed the strengths and weaknesses of their own experiments. Farmers' interest in continuing the project was also assessed and the assessment workshops served as stepping-stones to further PTD experiments. In December 1998, at the end of the project and after three rounds of experimentation, there was a final farmer assessment of the PTD results and processes (see Basilio p 32).

Process documentation

Process documentors were responsible for monitoring the PTD process. Photos, videos and voice tapes were used to analyse the research processes and results and to assess the applicability of the research in general. The process documentation team consisted of members of the farmers' groups and staff from the University.

Transplanting.

The results of the PTD experiments

Data collected by the farmers were forwarded to CLSU partners for statistical and economic analyses. The IRRISTAT programme was used for statistical analysis and an analysis of variance (ANOVA) for experiments laid out in Completely Randomised Design (CRD). Treatment means were compared by the Least Significant Difference (LSD) test. For unreplicated treatments, the data per federation was pooled and analysed through ANOVA with farms serving as replicates. Treatment means were compared using the LSD test. Farmers were compared using the Duncan's Multiple Range Test (DMRT). Statistical significance was set at the 5% level.

Full statistical and economic analysis of experiment results from KADAMA and KALIKASAN farms for the three cropping seasons can be found in the research reports (Abon 1999; Mendoza 1999) and the Philippine's Country Report (Abon et al, 1999).

The statistical analysis lead to the following conclusions:

- Within the KADAMA research sites homogeneous results through time were obtained when the effects of the same treatments (pure organic, mixed and pure chemical fertilisers) were assessed for three consecutive seasons. The growth and yield parameters had insignificant differences across treatments. The organic, mixed and chemical fertilisers used in the experiments were statistically comparable in growth and yield when applied to improved traditional rice varieties (ITRV) Ag5 and Ag8.
- Two factor experiments for rice varieties Ag5 (ITRV) and RC28 (HYV) and fertiliser types (pure organic and pure chemical) were conducted in KALIKASAN. With the exception of experiments in Mangandingay during the wet season of 1997, insignificant results were established for the effect of these factors on rice growth and yield parameters implying that the three types of fertiliser used in the experiments were equally suitable for ITRV and HYV.
- Sites in the Mangandingay experiments had a history of organic farming. Pure organic fertiliser was most suitable for ITRVs (Ag5 and Ag8) in clayey and sandy loam soil, for HYVs C18 (planted in sandy loam soil) and C28 (planted in the clay soil). Pure chemical and pure organic fertiliser only gave statistically identical results in the case of Ag5 planted in clay soil.
- In farms exposed to organic farming before PTD experiments started in Triala and Guimba, pure organic treatment out-yielded pure chemical and mixed treatments for both ITRV and HYV varieties. These farms may have already reached a point where soil conditions had more or less stabilised to favour the use of organic fertiliser.
- Experiments in the 1998 wet cropping season compared quantities of pure organic fertiliser (chicken manure in 30, 60 and 90 bags of 50 kg) on land with an organic history. Yield and growth parameters showed no significant difference. This could mean that the minimum level of 30 bags/ha of pure organic fertiliser is enough to secure relatively high yields with ITRVs and HYVs. Padua (1979) reports similar results with the IR-42 rice cultivar confirming the experience of KALIKASAN organic farmers who found that after 5 to 7 seasons of applying organic fertiliser high yields can be maintained with as little as 10 bags/ha of chicken manure. However, there is the risk that soil nutrient depletion may occur because 30 bags/ha chicken manure would be insufficient to fulfill the nutrient requirements of a 5 ton rice yield even if considerable biological nitrogen fixation were to take place.

Given time, the ITRVs treated with pure organic fertiliser or mixed organic and chemical fertiliser could out-yield those treated with pure chemical fertilisers. Mhayamaguru (1998), who observed rice experiments conducted at Phil Rice where experimental fields were exposed to organic fertiliser for three years, supports this contention. He established that plants treated with mixed urea (U) and

photos: Kalkasan

Monitoring growth.

chicken manure (CM) (25:75 and 50:50 U:CM ratio) gave the best grain yield (8.5 and 9.1 t/ha). Pure urea yielded 8.8 t/ha. Raja & Garcia and Garcia et al. had similar results in comparable experiments with lowland rice. Such findings suggest the potential benefits of organic fertiliser and animal manure when applied continuously for several cropping seasons (Obien, et al., 1995).

Multiple Regression

To draw conclusions from PTD research rooted in a holistic perspective, multivariate techniques such as multiple regression and factor analysis are required. Data were measured at site level and, because of the amount of data, the Statistical Package for Social Sciences (SPSS 7.0 for Windows) was used.

The final step in the stepwise procedure for multiple regression revealed that significant predictors of rice yield were gender; farmer-cooperators' education level; extractable potassium and phosphorus; the number of tillers; supplementary and farm irrigation; total rice area; incidence of disease and pests, and the use of mixed fertiliser.

Gender and educational attainment were the two personal characteristics extracted as predictors of rice yield. Male farmers had better yield productivity. This could be explained by the fact that male farmers had more exposure to and direct involvement in farm activities than women. Farmers with a higher level of education produced better yields, had more scientific and practical knowledge and had better access to agricultural information. This, in turn, facilitated a better farming system and better yield.

Extractable potassium and phosphorus were found to contribute positively to yield and were the prime limiting factors in PTD farms. Although nitrogen is the usual element needed for growth and better rice yield, regression did not establish it as a primary yield indicator. This could be due to the fact that all PTD experimental sites were relatively rich and sufficient in extractable nitrogen, as the soil acidification studies confirm (Hipolito p 24).

Factor analysis of the same data showed that the principal component group of factors for yield prediction were farm irrigation; extractable potassium, nitrogen and phosphorus; pH; number of tillers; number of years of organic management; and the farmer organisation. These accounted for 22.1% of total variation.

Correlations were also established between pest and disease incidence and the use of indigenous pesticides. Exposure to organic farming practices was interrelated with soil and water characteristics and suggested that the organic farms studied could be on the road to ecological sustainability.

Factor analysis supports the regression results to a large extent and provides a strong argument for paying more attention to these factors in the next PTD series.

Table 1. Average productivity indicators by treatment in all experimental areas in Nueva Ecija: wet cropping season, July-December, 1997.

Item	Organic	Treatment Inorganic	Mixed fertilizer
Land productivity (cav/ha)	117.82	127.17	135.20
Labour productivity (P/P)	3.54	3.62	3.78
Capital productivity (P/P)	1.85	2.04	2.02
Net income (P/ha)	21,715.31	25,303.00	26,630.11
Return to labour (P)	2.62	2.8	2.91
Return to capital/operating expenses (P)	0.85	1.04	1.02
Net profit margin	0.44	0.49	0.49

Table 2. Typical results for the experiments on fields with an organic history (from Guimba)

	Pure chicken manure 90 bags/ha	Pure chemical urea/16-20-0	Mixed fertilizer	
Total expenses	24,762.34	19,814.02	22,575.74	P/ha
Net profit	38,312.66	35,430.98	33,539.26	P/ha
Land productivity	145.00	127.00	129.00	Cavans /ha
Labour productivity	5.07	4.87	4.89	P/P
Capital productivity	2.55	2.79	2.49	P/P

Monitoring rice before harvest.

Sample plots are randomly selected for harvest.

Economic Analysis

The economic analysis showed that in the first wet cropping season on farms beginning to make the transition from conventional to organic farming a combination of chicken manure and urea/16-20-0 is the best fertiliser to apply to ITRVs (Table 1). This is particularly so in irrigated areas with silty loam soil but appears to be more labour and capital productive. Moreover, earnings per peso revenue generated as well as earnings per peso spent on the production operation were equivalent to results obtained using pure chemical fertilisers. El Niño and La Niña made it impossible to substantiate the results of the second wet cropping season and the subsequent dry cropping season.

Experiments in fields with an organic history showed that chicken manure was most profitable (Table 2). This is certainly the case if the amount of organic fertiliser can be reduced after several seasons.

A series of natural disasters hit the experimental areas during the three-cropping seasons so more experiments are needed before definite economic conclusions can be drawn.

Nevertheless, results established during PTD experiments indicate the importance of improving soil fertility by applying organic matter. There is reason to believe that applying organic manure (OM) to rice fields helps secure sustainable high yields. The KADAMA and KALIKASAN experiments appear to provide an example of how this can be achieved. Liam (1993) presented data from a long-term Japanese experiment showing that in the first ten years yields from plots supplied with organic matter (manure in this case) were clearly lower each year than yields from plots treated with chemical fertiliser. However, during subsequent years, yields in OM plots reached yield levels similar to plots where chemical fertilisers were used. After 30 years, the yield from OM plots surpassed yields from chemical fertiliser plots.

In the Philippine case it may not take so long for organically treated farms to outyield chemically treated farms. Despite their small scale PTD experiments have established consistent comparability trends.

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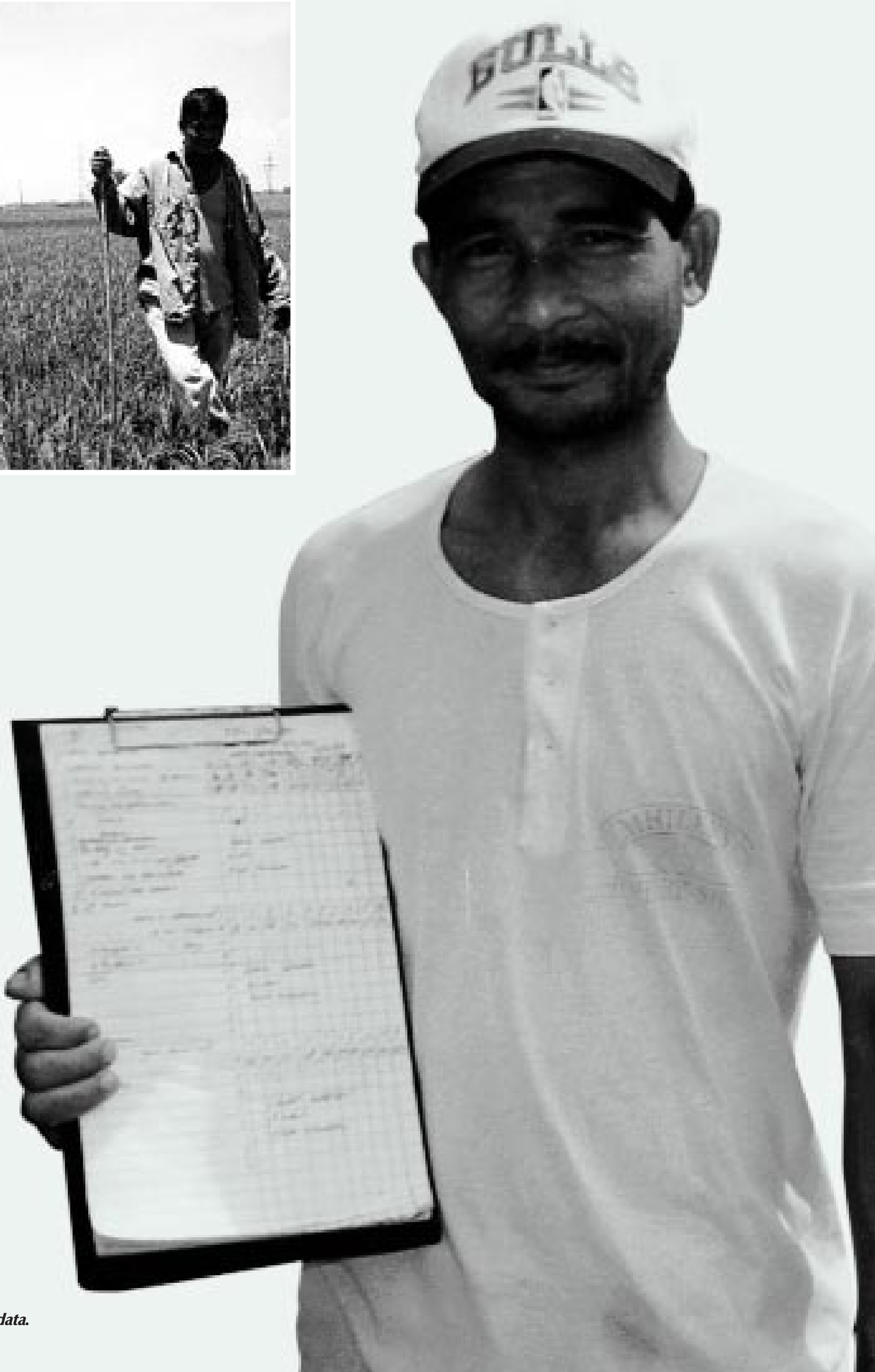

Area coordinators collect data.

Soil acidification: myth or reality?

photo: Bert Lof

Keeping the soil fertile and in good condition.

KADAMA and KALIKASAN farmers complained about 'soil acidification'. They believe it to be one of the factors causing yield decline and why they needed to increase the use of chemical fertilisers to prevent further falls. A study on soil acidification was carried out for the ILEIA Research

Marilene C. Hipolito

Programme to look more closely at the problem (Hipolito et al, 1999).

Focus group discussion was organised amongst 82 farmer cooperators from KADAMA and KALIKASAN. Among the 82 respondents, 61% claimed that they had experienced problems with rice production. The others stated they had had no problems in the last five years. Among the difficulties experienced by farmers a lack of capital (61 respondents) and water shortage (52 respondents) ranked highest. Soil acidification (19 respondents) ranked third.

Changes in the properties of the soil leading to ploughing difficulties (1), poor water retention (2), hard soil (3), a susceptibility to pests (4) and diseases (6/7), many weeds (5) and colour changes (6/7) were identified by farmers as the main indicators of 'soil acidification'. However, some farmers admitted to having no clear concept of 'soil acidification' or any clear indicators. In most cases the term had come from 'technicians'. The farmers understood it to be the probable cause of the soil-related problems they encountered in rice production. Some of them believed that these problems were the result of intensive farming and the slow decomposition of farm residues. The slow growth of rice plants and a hardening of the soil were generally associated with 'soil acidification. However, farmers themselves were not sure whether real acidification was taking place because no soil analysis had ever been done.

Soil acidification

In the Philippines the relationship between soil acidity and plant growth has been the subject of considerable, although not extensive research. Acidification is a process in which the H+ concentration of a soil system increases resulting in a decrease in the observed pH. In the soil system, acidification is related to a complex set of processes that cannot be quantitatively described by a single parameter. One way of looking at soil acidity is through the cation exchange complex. This is the adsorption of positively charged cations on negative charges on the surface of clay minerals and soil organic matter (Reuss et al. 1986). A deficiency in adsorption capacity, CEC (Cation Exchange Capacity), may lead to the accumulation of positively charged ions like those of aluminium, hydrogen and Fe and to acidification.

Problem analysis

To establish the 'truth' about 'soil acidification', the results of the soil sample analysis carried out by the KADAMA and KALIKASAN farmers groups were examined. The analysis showed that the soils were low in organic matter content and medium to low in phosphorous, though hot sulphuric acid extractable potassium was high. Soil pH was either slightly acidic or neutral. The average pH of the soils studied ranged from 5.76 to 6.89 (Table 1), while OM ranged from 1.36% to 2.51 %. The potassium content of the soils at between 113 and 417 ppm was high. The phosphorous content, on the other hand, was between 4.81 to 16.94 ppm and could be considered deficient.

Symptoms observed by the farmers such as stunted growth, chlorosis (yellowing), necrotic spots, ageing, poor tillers, thin and erect leaves and dark green coloured leaves are indicative of nitrogen and phosphorous deficiency. No aluminium or manganese toxicities were observed. At the moment, soil acidification does not appear to be a major problem. However, if the low organic matter content of the soils persists, the buffering capacity of the soil may be lowered and toxicity, together with nutrient deficiency, may occur as a result of acidification.

Nevertheless, the indicators of 'soil acidification' mentioned by the farmers - including hard soil, low water retention, susceptibility to pests and diseases - seem to suggest problems related to 'soil degradation'. These problems are also

Table 1. Average chemical analysis of the surface soils of the KADAMA and KALIKASAN farmer cooperators in the PTD experiments (Bureau of Soils 1997)

Soil samples	pH	OM(%)	Hot K (ppm)	P (ppm)	
KADAMA					
Bunga	6.34	1.94	149	7.32	+
Rajal Centro	6.89	1.89	417	12.11	+/-
San Fernando	6.88	2.51	171	5.85	+
KALIKASAN					
Banitan	5.95	2.40	113	15.3	+/-
Mangandingay	7,6	1.96	130	4.81	++
Tayabo	5.88	1.36	166	16.94	+/-

Legend: ++ severely deficient + moderately deficient +/- slightly deficient mentioned by Pingali et al. (1997) who studied the causes of yield decline in rice production (Kabir p 14). The yield data provided by farmers covered a six-year period and although there was no evidence that yield declined, these problems will have to be taken seriously if the present level of rice production is to be sustained or even improved.

Low fertiliser efficiency

The focus group discussion also revealed that during the wet seasons in the period 1992-1997, the most commonly used fertilisers were ‘complete’ (14-14-14) (30-68 % of the farmers), urea (46-0-0) (55-67 %) and ammonium phosphate (16-20-0) (11-16 %). The percentage of respondents using organic fertilisers gradually increased from 3 % in 1992 to 30 % in 1997. The amount of fertiliser most commonly applied in irrigated rice production was found to be about 90-30-30 kg/ha (N-P-K) in the wet season and 100-40-30 kg/ha in the dry season. This is slightly lower than the recommended amounts of 90-40-40 kg/ha and 120-40-40 kg/ha. Many farmers, however, could hardly afford to buy this amount of fertiliser.

According to Sri Adinigsh (1988) organic matter acts as a biological buffer ensuring that a balanced supply of nutrients are available to the plant roots. Soils that are poor in organic matter lose this buffering capacity and their fertiliser efficiency will decrease. The observed deficiencies in N and P may be caused by low rate of fertiliser application and the low amount of organic matter present in the soil leading to a low efficiency of N and P fertilisers.

Benefits of increasing organic matter

Follet (1981) showed there are many benefits to be derived from organic matter. It serves as the principal storehouse for anions such as nitrates, sulphates, borates, molybdates, and chlorides that are essential for plant growth. It increases the CEC of soils by a factor five to ten times that of clay. It acts as a buffer against rapid changes caused by acidity, alkalinity, salinity, pesticides and toxic heavy metals. Organic matter also supplies food for beneficial soil organisms like earthworms, symbiotic nitrogen-fixing bacteria, and mycorrhizae (beneficial fungi).

An increased and better use of organic ‘waste’ and green manures (animal manure, crop residues, household refuse and leguminous plants collected within and outside the farm) as organic fertiliser would greatly enhance nutrient availability, the biological functioning of the soil and the efficiency of chemical fertilisers. The soil would be softened and water retention improved. It would also make plants more resistant to pests and disease and prevent ‘soil acidification’. In a follow up study (Peñaloza et al p 25) options for organic soil fertility management have been analysed in an effort to find alternatives to current soil fertility management practices.

More studies needed

Soil degradation in rice production is a complex problem and different processes play inter-related roles (Kabir p 14). The solution does not lie in simply increasing and improving the use of organic fertilisers. Monocultures, the indiscriminate use of agro-chemicals, mechanised soil management and continuous irrigation also contribute to soil degradation. Further studies and farmer experimentation should concentrate on finding combinations of practices that best fit farmers needs and the changing conditions under which they work.

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Based on Hipolito MC, Sigua L, Hipolito RR, de Leon R, Lopez. R, 1999. **Soil acidification: problem assessment and control**. **Report to the ILEIA Research Programme.**

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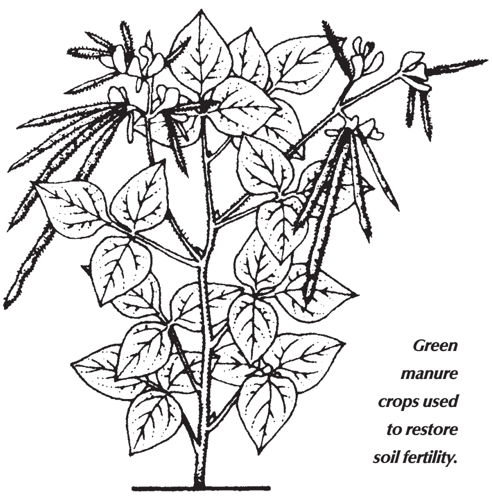
Rebuilding soil fertility

The authors’ task force studied options for appropriate, alternative, soil fertility management techniques. Secondary data were collected and analysed from CLSU, the Philippine Rice Research Institute (PhilRice), the Bureau of Post-Harvest Research and Extension (BPRE) in Muñoz, Nueva Ecija, the

David P. Peñaloza, Helene M. Mescallado and Marilene C. Hipolito



Green manure crops used to restore soil fertility.

University of the Philippines at Los Baños and the International Rice Research Institute (IRRI) in Laguna. Options identified included the use of green manure, farmyard manure (FYM), crop residue, municipal waste, and night soil. Combinations of organic and inorganic fertilisers were also considered.

Studies by Ladha, et al (1989) showed that Asian farmers prefer *Sesbania aculeata* as green manure. It grows vigorously, can withstand a wide range of adverse soil conditions including salinity, alkalinity and water logging and fixes nitrogen via root nodules. The plant can produce 15 to 22.5 t/ha biomass in six weeks giving nutrient yields of 82 kg nitrogen (N)/ha, 11-16 kg phosphates (P_2O_5)/ha and 23-34 kg potash (K_2O)/ha.

Researchers have also studied the green manure properties of Ipil-ipil (*Leucaena leucocephala* Lam.) leaves. Agustin (1978), found the best application level was 3,000 kg dried ipil-ipil leaves/ha. This produced 5775 kg rice/ha. Grain yield increased by about 15% (0.9 t/ha) as applied nitrogen increased from 60 kg/ha using ipil-ipil leaves to 120 kg/ha using either ipil-ipil leaves or ammonium sulfate (Lao-lao et al, 1978)]. Other green manure crops may be more suitable for specific local conditions (Misra and Hesse, 1983)

Long-term experimental evidence reviewed by Webster and Wilson (1966) suggests green manure crops can play an important role in fertility maintenance by acting as cover crops, raising the organic matter content of the soil, holding plant nutrients, and fixing nitrogen. Green manure crops can supply nutrients at the same level as inorganic fertilisers. Labour is the only significant cost, otherwise there are no transport costs and livestock husbandry is unnecessary.

However, several difficulties affect their acceptability. Considerable human, animal and fossil energy is needed to plough in green manure. Providing water to further the growth and decomposition of the crop in the soil can be expensive particularly where water is a constraint. Land under green manure crops should also have a higher opportunity cost than fallow land and land requirements, particularly where population is dense and agriculture intensive as in Nueva Ecija can be a problem. Managing green manure crops requires specific knowledge and skill. KADAMA and KALIKASAN farmers have tried some green manure crops without satisfactory results.

Azolla

Azolla spp., a small aquatic fern that lives in symbiosis with the nitrogen fixing blue-green alga, *Anabaena azollae*, has proved to be a valuable green manure for wetland irrigated rice. It has a high nitrogen fixing ability, grows rapidly and can be grown before and during the rice crop (Ventura, et al., 1992). Farmers using azolla have ▶

stated that rice yields are comparable to those achieved with inorganic fertilisers and production costs are less. A study in Japan showed that incorporating azolla produced a 1-2 t/ha increase in paddy yield.

Azolla can be used in animal feed, cooking, and as food. It provides shelter for fish, suppresses weeds and is an income-generating crop (Pelegrina et al, 1992). Azolla is easily propagated but requires abundant standing water, relative humidity of 85-90%, pH of 4.5-6.5, salinity of between 90-150 mg/L and adequate phosphorus for its nutritional needs. It is labour intensive, grows fast and can clog irrigation canals and rice fields and can compete with the rice crop. Azolla doubles its weight in 3-5 days. From a start of 1t/ha, it can reach a fresh weight of 15-20 t/ha in about 20 days (Khan, 1983). KALIKASAN and KADAMA farmers used azolla in the past but found that growing conditions were so favourable that it was difficult to control.

Farmyard manure

Carabao, cattle, pig and chicken manures are potential sources of nutrients for soil fertility management. An application of farmyard manure (FYM) at the rate of 3.1 t/ha produced rice yields similar to those achieved when chemical fertiliser is applied at a rate of 18.7, 6.5 and 6 kg/ha of N, P and K, respectively (Songmuang, et al, 1989). However, usually farmers only have relatively small amounts of FYM available. This means that it can only be used to improve soil fertility in small areas of the farm and has little impact on overall rice production. Where livestock production is concentrated in pig or chicken bio-industrial units larger amounts of farmyard manure may be available for sale.

Results obtained by Manaog (1965) showed chicken manure gave the highest yield/ha on Macapagai BPI 121, a lowland rice variety. It proved better than horse, cow and carabao manure and ammonium sulfate (21%N). Padua (1979) showed that when different levels of chicken manure (0, 3, 6 and 9 t/ha) were applied to IR-42 rice 9t/ha gave the best results:1650 kg/ha more grain than the control plots.

KALIKASAN farmers started using chicken manure in 1992. After five years they harvested rice yields (5-6.25 t) comparable to or higher than those produced using inorganic fertilisers. Applications could be reduced from 60 bags/ha (3000 kg/ha) to 10 bags/ha without an immediate drop in yield, a great saving as chicken manure costs P40 a bag.

Crop residues

When the grain and straw from a five-ton paddy crop are removed, about 150 kg N, 20 kg P, 150 kg K and 20 kg S is taken from the soil. Almost all the K and about one third of the N, P and S are in the straw. Although lower in nutrients than azolla and chicken manure, crop residues, readily available on the farm, are cheap sources of nutrients. Long-term experiments show that when straw is incorporated rather than burnt or removed, higher rice yields are recorded. These benefits were confirmed in a study of three soils with pH values 4.7, 6.6 and 7.4 and no fertiliser. When straw was incorporation at a rate equivalent to 5t/ha, increases in grain and straw averaged over a seven-year period, were 31% and 71% respectively. However, incorporating straw into poorly drained soils over a long period depresses yields. In order to avoid this, Tanaka (1974) suggested that 6t/ha was the maximum amount of straw that could be incorporated without adverse effects.

Incorporating rice straw into the paddy field is a problem for farmers. They may not have the right machinery and in-situ decomposition of crop residues in anaerobic conditions can be too slow for those planting two to three crops a year. There is also the risk of nitrogen deficiency and depressed yields. Ordinary composting of crop residues is also very slow. However, the IBS rapid composting method introduced in 1986 (Cuevas 1993) speeds up the process with a compost fungus activator, *Trichoderma harzianum*, and procedures that facilitate the rapid decay of agricultural wastes.

Farmers need to mix a source of nitrogen and either animal or green manure, or urea with the straw for quick decomposition and good quality compost. If compost and inorganic fertilisers are combined, rice yields increase 10-15% and incomes rise by 10-20%. These results are better than those achieved using 100% inorganic fertilisers (Cuevas 1993).

Municipal waste and night soil

Municipal and industrial organic waste either as compost or sludge is plentiful in urban areas and is an important source of nutrients. Lardinois and Van der Klundert (1993) found little municipal waste recycling in low-income countries. Technology introduced from Europe for the large-scale processing of waste often does not work and transporting and making compost are often too expensive to compete effectively with chemical fertilisers. Small-scale recycling can provide a feasible alternative. The nutrient content of municipal organic waste varies considerably depending on type, treatment and how heavily it is polluted with plastics, heavy metals and other chemicals. Urgent investment is needed in urban waste recycling to facilitate the better utilisation of this important nutrient resource and to improve the environment and health of the urban population

Night soil, composted human excreta and urine are rich sources of nutrients. Although less important today, night soil is still widely used by many farmers particularly in China. Researchers at CLSU have used night soil fertiliser to produce squash and sunflower. Patricio and Urban (1981) reported that the highest seed yield per plot of sunflowers was obtained when 30t/ha of night soil was added in four applications. The computed net income from this treatment was P3,958.00/ha, an earning of P0.74 on each peso invested. However, whether night soil is acceptable as an organic fertiliser will depend on the cost of labour, health risks and culturally determined attitudes.

Organic-inorganic combinations

Intensive cropping, high yielding varieties and market production increases the demand for soil nutrients. The supply of organic fertilisers and green manures cannot meet this demand because recycling organic waste is only possible to a limited extent and green manures often compete with crop production. Using organic fertilisers alone may not be profitable enough. The best technical and financial option is often to use both organic and inorganic fertilisers. Many studies deal with this issue and countless combinations are possible. Results depend on the materials used and the costs involved.

Individual farmers report interesting experiences in this respect. In 1985, Ricardo Libo-on applied 6 bags of 16-20-0 and 3 bags of urea/ha to his 12ha rice field and harvested an average 7t/ha/season. When he used a mixture of 5t each of azolla, rice hull and sludge from the bio-gas digester and 3 bags of urea plus 2l of foliar fertiliser/ha, he harvested nearly 15t/ha (Pelegrina et al 1992).

AGTALON Cooperative, Pangasinan, produces a commercial organic fertiliser Ag-Bio which cost P135 for 50kg. Yields ranging from 5-6t/ha and returns of P2.90 on investment were achieved with a mixture of 10 bags of Ag-Bio and 1 bag of (14-14-14) inorganic fertiliser. However, pure Ag-Bio organic fertiliser used at a rate of 12 bags/ha yields 4.5-5t/ha giving an estimated return of P3.10 on investment.

Conclusions

Each individual option seems to have its own strengths and weaknesses. The most suitable option will depend largely on local conditions, market opportunities and farmers' preference. In subsistence agriculture and where farmers produce for the organic market, different options for pure organic fertilisers will be needed. Where farmers produce for the conventional market the best way to keep the soil fertile is to combine nutrient sources of different types: organic matter, green manures and commercial inorganic fertilisers (Pandey 1991).

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From: Hipolito MC, Mescallado H. and Peñaloza DP Jr, 1998. **Alternative soil fertility options**. Report for ILEIA Research Programme.

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photo: Ria Miclat-Teves

Alternative Rice Marketing: concerted efforts needed

Aurea G. Miclat-Teves

Farmer cooperators from KADAMA and KALIKASAN found that one of the major economic constraints to improving their economic position was the difficulty of marketing paddy. The National Food Authority can only afford to buy a fraction of the rice produced and it chooses to buy from accredited cooperatives and a few individuals. Farmers are completely dependent on local traders who pay relatively low prices. Getting more control of the rice market and obtaining premium prices for organic and pesticide-free (LEISA) rice and traditional rice varieties could greatly improve the farmers' economic situation.

In 1993, the farmers from KALIKASAN entered a joint business venture with PRRM for Alternative Rice Marketing (ARM). However, they encountered serious difficulties. An exploratory survey was carried out for the ILEIA Research Programme in order to get a better insight into the conditions that determine supply and demand for alternative rice and into current and alternative (LEISA) rice marketing systems (Teves & Liangco, 1999). The study was made in collaboration with five NGOs: AGTALON, PDI, GRASS-ROOTS, GRATIA PLENA and PRRM.

The emerging alternative rice market

NGOs and people's organisations (POs) in the Philippines began campaigning for sustainable agriculture in the mid-1970s as a response and an alternative to the technology introduced by the Green Revolution programme. At that time, the socio-economic programmes being adopted by NGOs were primarily concerned with increasing the production of rice and other crops. These programmes were very popular, particularly in depressed upland communities where TRVs were being grown. Later, without any clear-cut programmes or funding, alternative rice marketing became part of the overall NGO support scheme. At an early stage, efforts were made to involve farmers in the supply of rice stocks, post-harvest activities, milling and transport as well as in the trading and marketing of rice and other products. Although these projects were undertaken only in specific areas and with very few resources, the support extended to farmers helped them gain control of certain aspects of rice production and marketing. NGOs and POs participated in trade fairs and exhibitions. Pilot marketing of large volumes of rice started in the early 1990s and some efforts were made at Fair Trading abroad.

Marketing assistance usually consisted of providing transport and storage for paddy and facilitating the sale of rice either directly or through intermediaries. Most NGOs were relatively new to this kind of work and had limited time, personnel and financial resources at their disposal. The only NGO to have conducted a market feasibility study on organic rice trading was AGTALON. There is very little information available on experiences with alternative rice marketing.

Constraints to production

Members of those organisations involved in the Teves and Liango study produced about 2,412.00t of LEISA rice on 517 ha in 1998. Average yields on irrigated lowlands were about 4t/ha although farmers in Gratia Plena had average yields of 5.5 tons. Most of the LEISA rice produced is consumed by the farmers themselves or sold locally. Only 37% is bought by the NGOs for the alternative rice market. One of the reasons for this is lack of capital; another is that the rice is sometimes rejected as inferior quality. The most significant varieties grown for their favorable traits include Diket (glutinous), Aroma (scented), RC 18 (good eating quality), RC 14 & 18 (early maturing), Ag 5, 8 & 10 and M (MASIPAG) 12 & 40. Different varieties are often mixed and this also reduces the overall quality of the final product (cereal) and the purity of seed.

Processing, storage and milling

Climate conditions are not ideal for the post-harvest drying of paddy during the wet season. Harvested rice is mostly sun-dried on concrete highways or pavements. Sometimes paddy is sold wet at low prices to avoid further crop losses. Since drying facilities are very expensive to establish, this is a common and serious problem amongst farmers.

AGTALON is the only NGO with its own portable moisture-testing unit. NGO staff and farmer cooperators follow certain crude testing procedures when judging quality. AGTALON recently developed 'post-harvest quality standards' in order to upgrade the quality of the rice offered for sale. These included assessing the amount of foreign material present and establishing levels of purity and discoloration. Such factors, together with the scent of the paddy are used to determine its class and price.

It was observed that in NGO storage few measures were taken to prevent attacks by rodents and birds and the build up of moisture could not be controlled. Proper sanitation was also lacking. Good quality milling facilities were hard to find in the study sites and, when milled, NGO

Drying paddy in the wet season is a common problem. Sun drying is often done on the road but in Nueva Ecija this has been prohibited.

rice is seldom of high-grade quality. Lower grade milled rice does not command a good price on the market The prohibitive cost of getting access to large, multi-pass rice mills is another major obstacle. Such mills require a minimum of 3 tons of paddy to run. Starting an NGO milling facility would be very expensive.

Supply still limited

The general market and supply conditions for rice are distorted because of inefficient buying practices in the public sector, unfair practices by rice traders and price manipulation by the rice cartel resulting in low farm gate prices. The importation of good quality rice, i.e. of the aromatic and glutinous type also contributes to keeping prices low.

The premium of P1.00 for pesticide-free (purchase price 1998 P 9.35) and organic rice (purchase price P 9.75), is not sufficient incentive for farmers to go into organic rice production. The retail price of LEISA rice is P 24.00/kg. This is relatively low given that the retail price of commercial rice varies from P 21.36 to P 29.80. Lower costs and production loans of between P 7,000.00 and P10,000.00 provided by the NGOs are the main economic incentives inducing farmers to produce and market alternative rice.

There are several reasons for the small supply of alternative rice.

- Limited availability of organic fertilisers.
- High level of home consumption (20-70 %).
- Lack of government support in the promotion of organic products.
- Lack of loan incentives not tied to the use of chemical pesticides or the use of certified HYV seeds.
- Farmers sell in bulk to local traders to pay off debts.
- NGOs lack capital to buy in rice.
- Farmers sell to local traders in slack months, when higher prices are offered than the ARM system can afford.
- High unit costs for processing, marketing and distribution due to the very low volume produced and the distance to the Manila market.
- Lack of facilities and procedures to improve the quality of milled alternative rice.

Although there is a growing awareness of the need for alternative and sustainable rice production, many constraints still make it difficult for farmers to move in this direction.

Satisfying the increasing demand

There is a growing awareness and demand among consumers for healthy food and alternative rice. We calculated that the potential demand for alternative rice is far higher than present production can satisfy. Since the supply and retail system is still weakly developed, this potential demand cannot be met. Alternative rice is retailed through direct and walk-in sales and on the open market. Only AGTALON and OPTA have developed retail systems. OPTA, whose source of rice also includes GRATIA PLENA, has established market outlets for alternative rice in Makati, Alabang and other parts of Metro Manila.

Relations between farmers and NGOs are based on mutual trust. The NGOs accept what is offered to them. There is no proper labelling of rice. Consumers cannot see if there is a quality guarantee or if the rice has been produced organically and is pesticide free. A certification system has to be set up which can guarantee quality to consumers. In the Philippines there is an emerging movement that supports alternative rice production and marketing. Food Web and AVDF and their member organisations have started discussions about organic product certification.

At national government level and amongst research institutes there is a growing interest in sustainable and organic rice production. Apparently, it is time to invest in its improvement and in the further development of the marketing system.

The following strategies could be applied for the re-organisation and strengthening of the present ARM system.

- A stable supply system of preferred rice varieties should be established by ensuring a steady supply of good quality seeds and organic fertilisers.
- Facilities for production support should cover a block of rice producing municipalities per province;
- A coordinating organisation for marketing and distributing seed should be set up.
- An overall information and monitoring system should be put in place in the target areas.
- Technologies, skills, available equipment and systems for drying, milling and rice grading should be improved.
- A more in-depth analysis of the alternative marketing policy environment should be conducted to plan future courses of action and advocacy work.

The realities of the problems and potentials of alternative rice production and marketing in specific areas must be grasped if effective improvement plans for the different SA/LEISA and organic rice producing organisations are to be developed. The development of site-specific models for alternative rice marketing would be required to effectively gauge the capacity of each organisation to implement more aggressive and coordinated programmes, as well as define convergence points for NGOs, POs, consumer groups and other stakeholders in the alternative rice marketing movement.

Small retailers often reject traditional rice varieties.

photo: ILEIA process documentation

Our observations

Current alternative rice production, processing, marketing and distribution activities need to be improved through the re-organisation and further strengthening of the system. There is a need for better cooperation and specialisation among the agencies involved to make it more efficient and cost-effective. A lead agency could be chosen for each stage of the production and marketing chain, from supply inputs (organic fertilisers, quality seeds), quality control, storage and milling to actual marketing and distribution.

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Based on: Miclat-Teves AG, Liangco GD & Teves RG, 1999. **The emerging alternative rice marketing system in Manila and Luzon provinces: A preliminary study. Report to the ILEIA Research Programme**.

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What farmers learned from other farmers

A. Corales, E. Valiente, M. Razon, L. de Guzman, R. Manabat, T. Amurao, R. Gabriel

photo: Ria Midat-Teves

A delegation of KADAMA and KALIKASAN farmers visited five NGO-supported farmer groups to exchange experiences on developments in LEISA rice production. These groups were the Bukidnon Centre for Sustainable Agriculture (BCSA); Technical Assistance Centre for the Development of Rural and Urban Poor (TACDRUP); the Community-based Native Seeds Research Centre (CONSERVE) in Mindanao; Infanta Integrated Community Development Assistance Incorporated (ICDAI) and Philippine Rural Reconstruction Movement-Camarines Sur Branch (PRRM-CamSur) in Luzon. BCSA is involved in the MASIPAG programme. Most of the farmers supported by TACDRUP and ICDAI follow a pesticide free or low-external-input approach while the others practice organic agriculture. The five groups visited included some 300 organic farmers with about 400ha of organic rice yielding an average 3-5t/ha.

Discussions made it clear that farmers are motivated for LEISA rice farming because of it offers environmental and health benefits. It also requires less capital and leads to cost reduction and improved incomes. Farmers also benefit from premium price, household food security and improved soils.

Most farmers involved in these NGO programmes are small farmers who can afford to produce organic rice because they own their land and derive an income from other livelihood activities. Many farmers grow rice mainly for home consumption and devote the largest portion of their land to other cash crops such as coconut, sweet potato, corn and citrus. The area under organic rice is relatively small and the family can easily provide the labour and organic materials required.

Experiences gained so far

Both indigenous traditional rice varieties (ITRV), traditional rice varieties (TRV) and high yielding varieties (HYVs) are used in organic and pesticide-free rice production. BCSA (MASIPAG) and CONSERVE advocate the use of TRVs and ITRVs in organic rice farming. They train farmers in seed selection and breeding to increase yield and lessen dependency.

Some farmers do not spray while others rely on botanical pesticides made from '*makabuhay*', '*sili*', '*madre cacao*', '*lagumbre*', and '*amarillo* claiming that traditional varieties are resistant to black bug, for example, a major rice pest in Mindanao. Other use chemical pesticides.

Many farmers experienced a serious drop in yield during the first 4 to 6 cropping seasons. This was discouraging. Farmers who initially applied a combination of chemical and organic fertilisers had fewer problems. Later yields improved as soils became more fertile. Now, yields come close to those achieved in conventional agriculture but costs are less and farmers are able to avoid debt. Initially only relatively low amounts of organic fertilisers were used. Some farmers only used rice straw as fertiliser. They found this was insufficient to maintain yield during the transition phase. After the soil has been regenerated and yield brought up to an acceptable level some farmers succeeded - at least for a time - in sustaining high yields with zero purchased external inputs.

Rice straw and chicken manure are the main organic fertilisers. In Mindanao, rotary tractors are used to incorporate rice straw into the soil. This hand tractor, called a 'turtle', can cut rice straw more easily than the usual hand tractor used in Luzon, making incorporation faster and easier. There are adequate amounts of water and rice straw is almost completely decomposed by the time transplanting takes place.

In most groups LEISA rice farming works because of the heavy support provided by the NGOs, the academe and the diocese. In the ICDAI programme, where a participatory and relatively broad approach is being followed, conversion to LEISA has been easier and faster even with minimal support.

Still a long way to go

It was observed that there were still many problems in LEISA rice production. Only chicken manure and commercial organic fertilisers are used and this makes farmers dependent on those producing these organic external inputs. A case in point is TACDRUP who import chicken manure pellets from the Netherlands. As chicken manure decompose easily and contains high amounts of nitrogen its application may lead to higher nitrogen losses than from the chemical nitrogen fertilisers used in conventional agriculture. The presence of heavy metals and toxins in poultry feed also makes it non-sustainable in the long term. Biodiversity is still very low on organic farms but a further evolution of organic rice production toward more integrated systems should stimulate biodiversity.

Farmers gave several reasons for the limited adoption of organic rice production. Yields were lower during the transition phase; organic farming is laborious and raw chicken manure has a foul smell; organic fertilisers are in short supply and farmers who do not own their land will not invest in organic farming. Some prefer conventional farming because they think chemical fertilisers and pesticides are more effective or they are put off by the unstable and low prices offered for TRVs. Farmers felt there was a general lack of support for LEISA farming and that organic farmers are sometimes ridiculed.

LEISA rice production in the Philippines still has a long way to go before any large-scale adoption can be envisaged or sustainable integrated systems have been developed. Nevertheless, the members of the KADAMA and KALIKASAN delegation concluded that the farmers visited, although they had only had two to five years' experience with LEISA rice production, were clearly on the right track. ■

Summarised from: A. Corales, E. Valiente, M. Razon, L. de Guzman, R. Manabat, T. Amurao, R. Gabriel, 1999. **Participatory assessment of farmers' experiences on the use of organic farming technology. Internal report of the ILEIA Research Programme**. Published in Philipino language in 'Balong ng Buhay, Tomo I, Bilang I, 1999. PRRM-NE, Bukang Liwayway, Bantug, Muñoz, Nueva Ecija, Central Luzon, The Philippines.

KALIKASAN: aiming at integrated organic agriculture

Kalikasan has received national recognition for its organic rice production.

photo: Bert Lof

In 1992, after a PRRM facilitated training in Low External Input Rice Production (LEIRP = LEISA), seven farmers from Lupao, Munoz and Guimba in Nueva Ecija province started to experiment with organic farming and TRV/ITRV seeds from the MASIPAG programme. The results were satisfactory, the experiments were replicated and more farmers were trained. In 1993, 64 farmers founded KALIKASAN-NE. Their aim was to develop sustainable rice-based organic agriculture. Each cooperator devoted about one hectare of his or her land to organic rice production.

An Alternative Trading and Marketing (ATM) programme was started in a joint business venture with PRRM, a premium price was obtained for organic rice and a crop production loan scheme of P10,000.00 was extended to each farmer.

KALIKASAN's activities include the provision of technical assistance, the training of new members and making inputs such as chicken manure and rice seedlings available to farmers. This has resulted in a considerable reduction in production costs and an increase in the net income of farmer cooperators. Farmers have to pay an annual membership fee of P50.00 and a P1,2000.00 contribution to capital build up.

Toward integrated organic agriculture

In 1997, KALIKASAN-NE had 179 farmer cooperators cultivating some 142 ha of organic rice. During the early years yields dropped. However, after four years of organic rice production farmers succeeded in increasing yield to between 4.5 and 5 ton about the same amount as produced on conventional rice farms. The recommended application of chicken manure on clayey and sandy soils is 40 and 60 bags/ha (1 bag = 50 kg.) respectively in the first season. The application is reduced by 10 bags/ha each season until only 10 bags/ha are required in the fourth season on clayey soil and the sixth season on sandy soil. Some farmers have succeeded in sustaining high yields for a time without applying inputs.

Various ITRVs and TRVs (M-88, Benggawan, Wagwag, Sikades, Milagrosa, Ag-14, Ag-10, Ag-8, Ag-5, Brown Rice, Elonelon and Muguama) are being tested in demonstration farms. Farmers prefer Ag 5 and Ag 8 because of their strong vegetative growth, prolific tilling, grain filling capacity and medium height as well as their resistance to lodging, pests and diseases and palatability. Ag-5, Ag-8, Ag-10 and Benggawan proved resistant to 'tungro' virus in the 1994 rainy season when HYVs suffered serious attack.

Although there are generally fewer pest problems in organic rice, farmers do use biological pesticides. Some farmers successfully experiment with both traditional and new methods of pest management.

> *Box 1* **Pest management: the example of the Golden Snail**
>
> Mario Imperio from Triala, Guimba, experimented with the pest control techniques used by his ancestors. One technique involved placing pounded '*makabuhay*' vines in the waterways of rice field so that the bitter sap would be washed out by the water and carried to the Golden Snails' breeding ground. Another method was to lure snails to *'gabi'*, papaya and banana leaves that had been scattered in the rice field in the early morning. The leaves were collected before noon when the snails had moved onto them. The third experiment involved water management. Small canals filled with rice bran were built along the banks of the rice field. All three experiments were successful.

KALIKASAN-NE farmers are well known throughout the Philippines for their success in developing organic rice farming and marketing. Their partnership with the ILEIA Research Programme helped KALIKASAN to obtain quantitative proof of the economic viability of their organic practices. It also strengthened their skill in carrying out experiments designed to develop farming systems that were well adapted to their conditions, needs and objectives. This further consolidated their position in relation to conventional farmers, scientists and policy makers. Membership has increased rapidly and by 1998 there were 259 members in 18 communities.

Farmers recently started experimenting with organic vegetable production. They aim to gradually evolve their rice farming systems into diverse integrated farming systems. Farmers intend to experiment with soil fertility management, plant breeding, conservation of genetic resources, and diversification.

■

Summarized from: Maria Lina, Danilio Gatchalian, Florencio Galapon Jr., 1998. **KALIKASAN-NE: a documentation and evaluation of experiences in sustainable agriculture**. Internal report of the ILEIA Research Programme. Published in Filipino in 'Balong ng Buhay, Tomo I, Bilang I, 1999. KALIKASAN-NE / PRRM-NE, Bukang Liwayway, Bantug, Muñoz, Nueva Ecija, Central Luzon, The Philippines.

photo: Bert Lof

The continuing discussion on LEISA and Masipag organic rice production.

KADAMA: recreating lost biodiversity

KADAMA farmers' organisation was founded in 1991 as a confederation of five farmer organisations: DIWA, UGNAYAN, LIKHA, PMK and KADAMA. It has about 1500 members. Cooperation between farmers dates from 1981-1984 when the Agency for Community Education Services (ACES Foundation), a rural development NGO, facilitated participatory assessment of Green Revolution technologies on small farmers in four communities.

A consensus was created on the need to unite with other farmer groups in the interests of change and the development of alternative technologies. Similar assessments were organised in other communities and, in 1985, four 'BIGAS' follow-up conferences were organised, three at regional level and one national conference. Here farmers described their negative experiences with HYVs and related technologies and programmes and were able to recommend alternatives (Modina and Ridao, 1987).

In 1986 the 'MASIPAG' Centre (*Mga Magsasaka at Siyentipiko para sa Pagpapaunlad ng Pang-agrikulturang Agham* = Farmers and Scientists for Agricultural Science Development) was set up in Jaen, Nueva Ecija. Facilitated by ACES Foundation, it started to cooperate with farmers in eight communities where DIWA was active. This Centre was the first of thirteen envisioned for the various provinces and aimed at stimulating grassroot change. Its programme was intended to enhance direct cooperation between farmers, scientists and development workers. MASIPAG focused on collecting and evaluating traditional rice varieties (TRVs); breeding improved traditional varieties (ITRVs) appropriate to local soils and climates; alternative pest management using locally produced pest traps; biological pesticides; resistant varieties and diversified farming techniques; organic farming using organic fertilisers; and training farmers in rice breeding and documentation.

The farmers established community seed banks in farms managed by each federation and at the same time maintained at least five varieties on their own farms. Varieties were not only characterised and multiplied but were also subjected to variety adaptability trials. Interested farmers chose parent materials for breeding from the pool of locally adapted varieties and, after some training, they made their own crosses (Basilio, Razon and Estrella, forthcoming).

KADAMA's involvement in the MASIPAG programme and the support of ACES Foundation ended in 1994. MASIPAG now focuses on Mindanao and Negros where it has become very successful.

A new impulse

Twelve members started to test the MASIPAG package. It consisted of traditional and improved traditional varieties, chicken manure (at a rate of 90 sacks i.e. 4,500 kg/ha.) straight planting (40x40) facing an east-west direction and 2-3 seedlings per pocket. After a few seasons about 200 farmers were involved in testing.

The KADAMA federation aimed to enhance farmer cooperation, spread the use of MASIPAG technology and organise the marketing of MASIPAG rice. Marketing was unsuccessful, however. Farmers where forced to sell their rice to local traders who paid them lower prices for TRVs and ITRVs. This problem and because there was no crop assurance for farmers using the MASIPAG package, made many KADAMA members lose interest even though their production costs were lower and there had been no negative effects on the environment or community. Some of the more motivated farmers, however, continued to use organic fertilisers and ITRVs.

In 1996 the ILEIA Research Programme gave a new impulse to experimenting with alternative/ LEISA rice production. PTD experiments provided strong evidence that soil fertility management with chicken manure produced results equivalent to local practices based on chemical fertilisers at reduced cost (see Abon p 29). ITRVs also proved as productive as the commonly used HYVs.

KADAMA is giving high priority to recreating the biodiversity lost through rice production and has launched a new ITRV selection and breeding initiative. It plans to continue PTD experiments on soil fertility management and on such new approaches as the rice intensification system (SRI) developed in Madagascar (see ILEIA Newsletter Vol 15 No 3 & 4, Dec. 99).

■

Summarised from: Melencio F. Razon, Domingo S. Ramos, Victoriano Bautista, Aurelio P. Estrella, 1999. **The evolution of sustainable agriculture in the KADAMA organisation. Internal report of the ILEIA Research Programme.**

KADAMA, 30 Bernardo District, Cabanatuan City, Nueva Ecija, Central Luzon, The Philippines.

References:
- Basilio CS, Razon MF. and Estrella A, 1999 (forthcoming). **Searching for seeds of freedom: plant genetic resource utilisation and conservation by KADAMA farmers' confederation**.
- Modina RB and Ridao AR, 1987. **IRRI rice: the miracle that never was.** ACES Foundation Inc. Quezon City, 140 pp.

Looking back for the future

There has been a marked change in rice farming in Nueva Ecija in recent decades. The ILEIA Research Programme made an exploratory study of development trends and their impact on the sustainability of agriculture in the province. With a better understanding of this process farmers may learn from their history and be better equipped to choose appropriate options for the future.

Danilo S. Vargas, Marilou G. Abon, Cynthia C. Divina and Lolita D. Bibal

Three important periods in the recent agricultural history in the Philippines' lowlands were studied. (Vargas et al, 1999). However, lack of time and difficulties in accessing information means further study is still needed to get a full insight into current trends and opportunities for developing sustainable rice farming.

Pre-Green Revolution

Prior to the Green revolution in 1972, the hacienda system was prominent in Nueva Ecija reflecting the influence of Spanish colonisation. The landlord had a direct interest in rice as a cash crop and the farmers were sharecroppers required to turn over 50 to 75% of their rice harvest to him. The development of transport, and the Cabanatuan-Manila rail link in particular, opened up a market for surplus rice. By the 1880s, Nueva Ecija had become a major rice exporter, shipping out 500,000 'cavans' (1 cavan = 50 kg) of paddy annually. By the mid-1930s surplus production had increased to 8 or 9 million cavans/year as natural forest and grasslands were brought under cultivation. Farmers produced vegetables such as maize, string beans, squash, *upo* (*Lagenara siceraria Mol.*) and *patola* (*Luffa cylindrica L.*) and raised carabaos, cows, ducks and chickens for subsistence. Natural animals and plants such as frogs, fishes, crabs, trees and herbs were important sources of food, fodder, medicine and construction material.

One rice crop was produced annually and the largest paddy yield was 2.5t/ha. Farms were rain fed with supplementary irrigation from small tanks and rivers. Traditional rice varieties were planted and took 5-6 months to mature. Soil fertility management was minimal and involved nutrient harvesting, fallow vegetation and manuring. Farmers recall that the soil was fertile, black and loose, and able to retain water for 2-4 weeks. Earthworms were abundant.

In those days, Filipino rice farmers were essentially organic farmers using

photo: Bert Lof

The traditional rice system was an integrated system and included trees, vegetables, small livestock, fish and poultry.

Development trends in the Philippines rice bowl

indigenous production methods well adapted to local conditions. Endemic plants such as *madre de cacao* (*Gliricidia sepium*) and cogon grass warded off pests and diseases and the farmers' belief in God was reflected in farming activities. Prayers or '*oracion*', for example, were offered to prevent insects infesting rice seedlings and strong cultural traditions such as '*bayanihan*' (labour sharing), harvest thanksgiving and respect for nature permeated farming. This system remained intact until 1972 when the government launched the 'Masagana 99' development programme.

Masagana 99

Radical changes took place in Philippine agriculture during President Marcos' rule (1965-1986). Structural changes in the agricultural system were effected through the implementation of major agrarian policies, programmes and legislation. Objectives included the implementation of land reform in tenanted rice and maize production areas; self-sufficiency in food production, especially as far as rice was concerned; the expansion of export crop production; and the promotion of import substitution. These changes were accompanied by Green Revolution technology and agribusiness development.

The Agrarian Reform changed the land tenure system from share to leasehold and introduced a government controlled fixed rent. In 1982 this was between 9-15 cavans of rice per farmer. Rice and maize land above a landlord's entitlement was redistributed and farmers became leaseholders and amortising landowners with holdings of between 1.2 and 3 irrigated or rain fed hectares. However not all farmers benefited from the redistribution.

The *Masagana 99* programme introduced in the early 1970s persuaded farmers to adopt the 'Green Revolution' technology package developed by the IRRI. It offered farmers collateral-free loans at relatively low interest (12%), a subsidised package of HYV seeds, and chemical fertilisers and pesticides. Land preparation was mechanised, and hand tractors, rotovators and threshers replaced carabaos. The construction of the Pantabangan Dam and the development of the National Irrigation Agency (NIA) gave many farmers access to cheap irrigation.

The Central Luzon Loop Survey, conducted by IRRI in 1980, reported that between 1966 and 1975 there had been a 95% increase in the adoption of modern varieties. This, together with chemical fertilisers, pesticides and improved irrigation made double cropping possible. Productivity increased from about 2 t/ha per cropping season in the early 1970s to 4 t/ha in 1985. By 1977, the Philippines was self-sufficient in rice and exported it as well. Between 1966 and 1979, the average Central Luzon farmer increased rice output by 80% and his or her annual rice equivalent income by 39%. However, if income from rice production is adjusted against increased input and consumer prices, the real average farmer income in 1979 was only 60% of their 1974 earnings. Thus, despite producing more, small farmers lost out in terms of their power to purchasing other goods.

A study by the Chamber of Agriculture and Natural Resources showed that between 1976 and 1981 wage rates increased 207%, fuel prices 260%, fertiliser and pesticide 126% and the consumer price index 74%. Prices for rice and corn, however, increased by a mere 44% in the same period.

At the same time, socioeconomic conditions improved at village level. Villagers had better access to health services and education, they were able to upgrade their houses and the transport and retail system began to function better, facilitating access to food and goods. In addition, agricultural extension services were intensified and it became easier to farmers to get up to date agricultural information and technology.

Deregulation

From 1982-1983 there was a dramatic decline in agricultural production and in rice in particular. This was precipitated by serious drought caused by *El Niño* and by the general economic situation. Many farmers found themselves heavily in debt and scarcely able to afford the *Masagana 99* technology package. The decline in production forced the Philippines to start importing rice again and prompted the government to advocate a new approach to agricultural development.

Deregulation, with the emphasis on free enterprise and greater private sector investments in agriculture, became the official policy. In 1985, lifting price controls on milled rice, liberalising fertiliser imports and removing fertiliser subsidies signalled the end of *Masagana 99*. The Aquino and Ramos' administrations followed similar deregulation policies and opened up the country to the world market with a shift to high-value export production and the importation of cheap rice. Since 1996, average rice imports have returned to 1960's levels. In Nueva Ecija the yield from irrigated rice has stagnated at about 5 or 6 tons in a good season. Some farmers claim yield has decreased. With a population growth of 2.3% (1994), this scenario will surely lead to a further decline in rice self-sufficiency.

The new rice production programme requires farmers to form organisations before they can get loans. Only 15% of the farmers targeted by the government's Grain Production Enhancement Programme (renamed *Gintong Ani* in 1996) have borrowed from the programme's accredited sources. The big landowners benefit most from the programme and can easily get loan privileges because they control production and have strong political and business connections. Most small farmers continued to depend on usurers for their loans and have to pay up to 30% interest per season for this service.

▶

Between 1988 and 1992, the price index for rice only increased 44.1% against increases in the general price index of 65.6%. Farmers' claim profits from rice production continues to fall because chemical fertilisers are becoming less effective and inputs and labour costs increase faster than the price of paddy at the farm gate. The cost and shortage of labour has forced a shift from transplanting rice to direct seeding during the dry season and has meant greater dependence on herbicides and further decreases in farmers real income. Many of them have taken up off-farm activities, others migrate to the urban areas or seek employment abroad. Farmers have increased their efforts to raise chickens, ducks and pigs, cultivate fruit trees such as the mango and grow vegetables like onion, garlic, pepper, and cucumber. These 'side-lines' are becoming increasingly important elements in farmers' cash incomes. However, such products are mainly grown on a contract basis, thus increasing farmers' dependence on agribusiness.

Because agriculture does not seem to have a promising future, farmers are strongly motivated to invest in the education of their children so that the new generation can build its future outside agriculture. In the early 1990s there was favorable economic development in the Philippines. Many new jobs outside agriculture were created allowing the process of economic transformation to proceed quickly. Unfortunately, the general economic crisis in the South-east Asia and a growing negative balance of trade (US$ 5,383 million in 1997) increased unemployment from 10.9% in 1996 to 13.3% in 1998 and cut off the supply of jobs outside agriculture.

Sustainability at Stake

Not only is the economic sustainability of rice farming in Nueva Ecija under constant pressure but farmers also face serious ecological problems (see Kabir p 14). Soil quality is deteriorating probably because of imbalances caused by chemical fertilisers, pesticides, herbicides and continuous irrigation. Problems identified by farmers include hard pans, soil acidification and increasingly ineffective nitrogen fertilisers (see Hipolito p 24). Scientists from PhilRice, BSWM and IRRI are concerned about P, K and Zn deficiencies and the low level of organic matter in the soil.

Many farmers not served by the National Irrigation Agency (NIA) installed shallow wells, as irrigation water is one of the most critical inputs in intensive rice production. However, the water table began to fall and farmers had less irrigation water particularly during periods with low recharge such as the 1998 drought. As more wells are drilled and upland watersheds are denuded, there is a growing threat that ground water in Central Luzon will soon be depleted.

Prior to the Green Revolution, the Nueva Ecija farmers used a wide range of traditional rice varieties including *Tjeremas, Intan, Binato, Raminad, Wagwag* and *Milagrosa*. These were late maturing and long stemmed varieties and were superior to modern varieties in eating quality. Today, traditional varieties are rarely planted in Nueva Ecija.

Farm organisms such as frogs, snails, crabs, mole crickets, shrimps, fish and other insect predators vital to maintaining a balanced ecosystem have nearly all disappeared. Many of these species were important and inexpensive sources of food. Health problems have also increased and farmers attribute these to the continuous and intensive use of chemical fertilisers, pesticides and herbicides.

Not all Nueva Ecija farmers were prepared to remain the passive victims of the problems accompanying development. By 1980, KADAMA and KALIKASAN farmers were already experimenting with alternatives to the Green Revolution package. Traditional rice varieties, biological pesticides and organic fertilisers were reintroduced and improved (see pp 19 & 20). Farmers started to rebuild cooperative ties with each other recognising that these had grown weak.

KADAMA and KALIKASAN are sensitive and responsive to the needs of their communities. Looking back at the past they assessed their experiences and made sustainable rice agriculture their choice for the future. In this they are pioneers. ■

From:Vargas DS, Abon MG, Divina CC. and Bibal LD. 1998. **Agricultural development in Nueva Ecija: the case of Rajal Centro and Triala. Report for the ILEIA Research Programme.**

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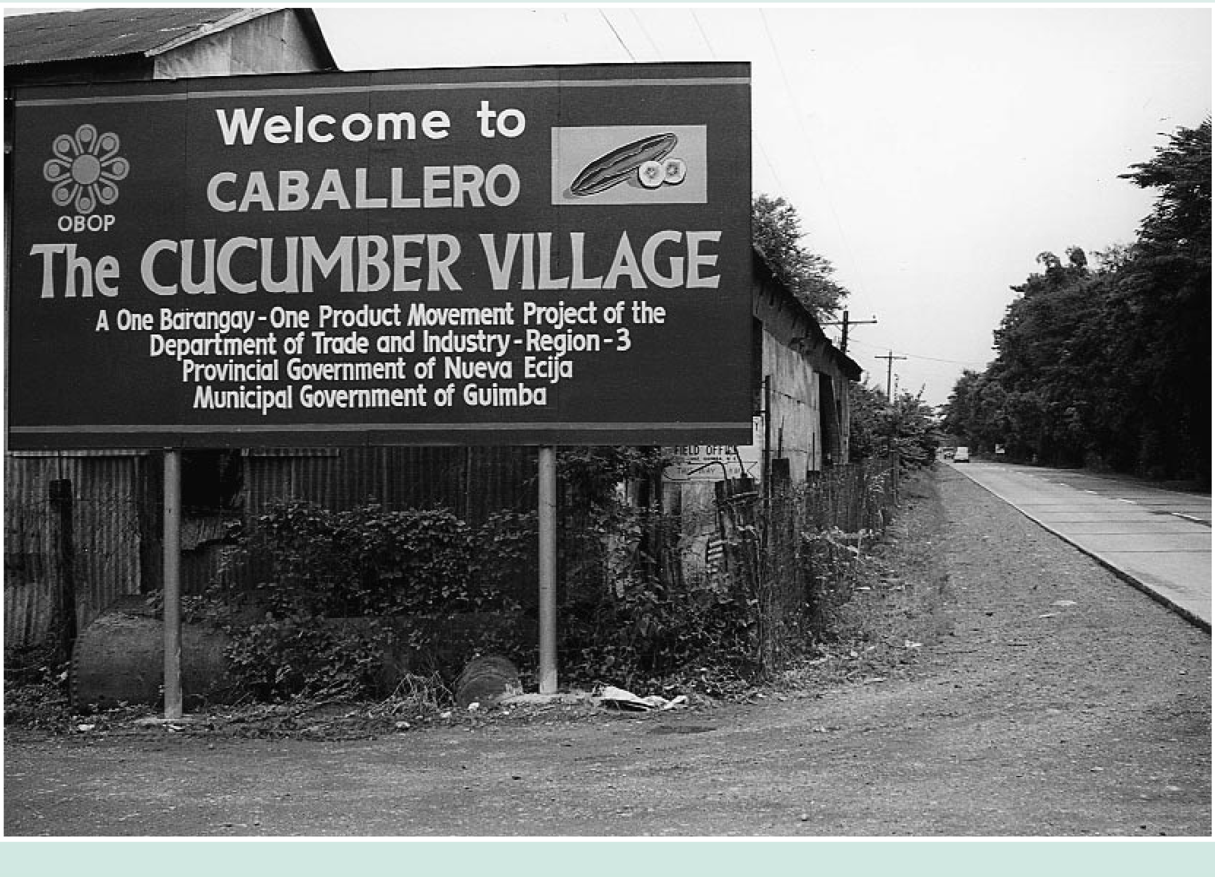

The rice economy today is dominated by monocultures.

photo: Bert Lof

Sustainability of intensive rice production threatened

Use of agro-chemicals, continuous irrigation and intensive mechanisation leads to soil degradation.

photo: Bert Lof

Humayun Kabir

The sustainability of intensive rice production is under threat and the problem is attracting increasing attention. An exploratory study was carried out for the ILEIA Research Programme to establish an overview of the ecological and economic impact of development trends in rice production (Kabir, 1999). The study was based on a literature survey and was subsequently reviewed by rice specialists from PhilRice, PCARRD and UPLB. This article summarises the main findings.

The intensification of rice production on the humid lowlands has meant that relatively extensive systems based on one annual rain-fed or irrigated rice crop and drought resistant crops or fallow vegetation have been turned into an intensive rice monoculture of two or three crops of rice. This has brought about several important changes in the production system.

- Year round production with a limited number of rice varieties.
- Rice paddies flooded most of the year without adequate drying period.
- Heavy dependence on inorganic fertilisers and pesticides;
- Greater uniformity in the varieties cultivated.

These production system changes have lead to long-term biophysical changes in the natural resource base. This threatens the ecological sustainability of rice farming (Pingali et al, 1997). At research station and farm level, these trends are reflected in declining factor productivity and falling profitability and input efficiencies. All have serious implications for economic sustainability.

Yield decline has been recorded in long-term, on-station experiments in several countries and at IRRI's in-house research station. However, yield decline at farm level has yet to be confirmed by scientific assessment. Rice production and yield growth rates are slowing down and, in the major rice growing countries, fall well short of population growth. The processes and trends discussed below threaten the ecological and economic sustainability of intensive lowland rice production.

Soil management

The chemical fertilisers used in rice production have a low and declining efficiency. Nutrients are lost through volatilisation, de-nitrification, percolation and run-off. Forty to seventy percent of the chemical nitrogen applied to the soil is lost to the environment leading to air pollution and pollution of ground and surface waters. At the same time, increased methane emissions contribute to climate change - the greenhouse effect.

Declines in the partial factor productivity of nitrogen fertiliser have frequently been observed. Recent work at IRRI suggests that continuously irrigated wetland soils have a reduced capacity to supply nitrogen. Flooded soil mineralises organic matter very slowly. Huge amounts of nutrients are lost through the removal and burning of rice straw. When rice straw, for example, is removed from a one hectare plot of HYV rice, 66kg N, 6kg P and 160kg K are lost as well. This loss, together with imbalances in the use of fertilisers, has increased the incidence of phosphorus, potassium and micro nutrient deficiencies in many rice soils.

Seasonal cycles of mechanised ploughing and puddling over a longer period result in the formation of hard pans and water logging in paddy soils. While favourable for rice production, these hard pans create problems for subsequent non-rice crops and this limits diversification within intensive rice systems.

Water management

Since 1979, the expansion of irrigated land has lagged behind population growth. This is mainly because of increasing irrigation costs, inadequate government investment, and policies that favour privatisation. Due to insufficient drainage and low water quality, 25% of irrigated rice suffers from some degree of salinity. Severe upland erosion causes siltation that in turn affects the storage capacity of reservoirs and reduces the amount of irrigation water available. Because of over-pumping and increased run-off there has been a steady and widespread decline in ground water reserves. At the same time, the rapid pace of industrialisation and urbanisation has resulted in growing competition for scarce land and water resources

The amount of irrigated land is shrinking rapidly due to population growth, urbanisation and industrialisation. In China, for example, where land is in short supply, nearly 4 million hectares of cropland - most of it in irrigated areas - has been lost. In addition, large tracts of irrigated land are no longer in production because existing irrigation infrastructures are poorly maintained.

Pest management

Continuous rice cultivation, uniformity in the varieties cultivated and the injudicious use of pesticides has lead to the build up of pests in irrigated rice systems and to further increases in pesticide application. Many pests become resistant to pesticides, fungicides and herbicides. Pesticide is used because it is believed that rice production is not possible without high levels of chemical pest control. A recent study by IRRI has shown that 80% of the pesticide applied by rice farmers were unnecessary. Pesticides cause ecological and health problems for humans and animals. They also contaminate surface water and this is one of the main reasons why the natural predators of pests and diseases as well as edible fish, frogs, snails, crabs and shrimps have disappeared from natural and farm environments.

Integrated Pest Management (IPM) has proved effective in reversing these trends. In countries where it has been encouraged there have been significant decreases in the amount of insecticide used. However, alarming amounts of herbicide are still being used to offset increasing labour costs and to facilitate direct sowing.

Crop improvement

Intensive rice monoculture is dominated by modern varieties with a very narrow genetic base. Traditional rice varieties are becoming increasingly rare and are only used by a few farmers. There has been little increase in the yield potential of modern varieties since the 1960s. Only hybrid rice varieties have a higher potential but these are more expensive and need well-controlled irrigated conditions. Poor and marginal farmers often cannot afford them. In regions with favourable production conditions the yield levels of many farmers come close to the assumed yield potentials of the modern varieties.

Researchers, using genetic engineering, are now trying to develop new, super rice with a yield potential of 13-15t/ha. Although it is still too early to assess the economic, social and ecological impact of the super rice, it is doubtful whether it will be able to improve the economic position of the small farmer. The full risks of genetically engineering a major food staple are also not yet fully understood.

Because doubts are being raised about the ability of plant breeders to increase the yield potential of rice. The necessary increase in food production must, therefore, come from an increase in average yield. This will be difficult in places where crop production has already been greatly intensified. When yield levels come close to 75% of their potential maximum, the incidence of disease will increase, the number of pests will intensify and it is difficult to keep soil in good condition. This means that it will be increasingly important to improve rice yield in less favourable conditions.

New insights into rice ecology indicate that the yield potential of available rice varieties is much higher than has been assumed (see article on the 'System of Rice Intensification in Madagascar. ILEIA Newsletter Vol 15. 3 & 4, December 1999). Considerable yield increases may be possible without the use of genetic engineering and may also be within the reach of poorer farmers working in marginal conditions.

Farmers are leaving the land

Higher wages in urban areas and rural poverty cause labour migration from the countryside to the towns. This creates a labour crisis on the land particularly during seasons when farm work is heaviest. When labour becomes scarce and more expensive, farmers are forced to use labour saving technologies including herbicides and mechanisation. In the long term this may lead to an increase in the size of rice farms.

The declining efficiency of chemical fertilisers, pesticides and irrigation water induced by the above mentioned ecological problems together with the increasing costs of labour and inputs relative to the price of paddy have contributed to making rice farming less profitable. Liberalisation and the globalisation of the rice market have put further pressure on rice prices. The general decline in the terms of trade between agricultural and industrial products and services has also helped to marginalise rice farming economically and farmers are being forced to look for other sources of income. Young people are being driven to seek employment outside agriculture and, in the long-term, this may mean that the number of farmers will decline.

Rice farming towards sustainability

Such developments will affect the future of rice farming and the choice of technologies and policies will heavily influence the sustainability of the rice economy. The available technology options developed by scientists and innovative, traditional and ecological farmers should be carefully analysed and their economic, social and ecological impacts described. Results can be used to support the decisions made by farmers, researchers and policy makers in their efforts to secure sustainable rice production.

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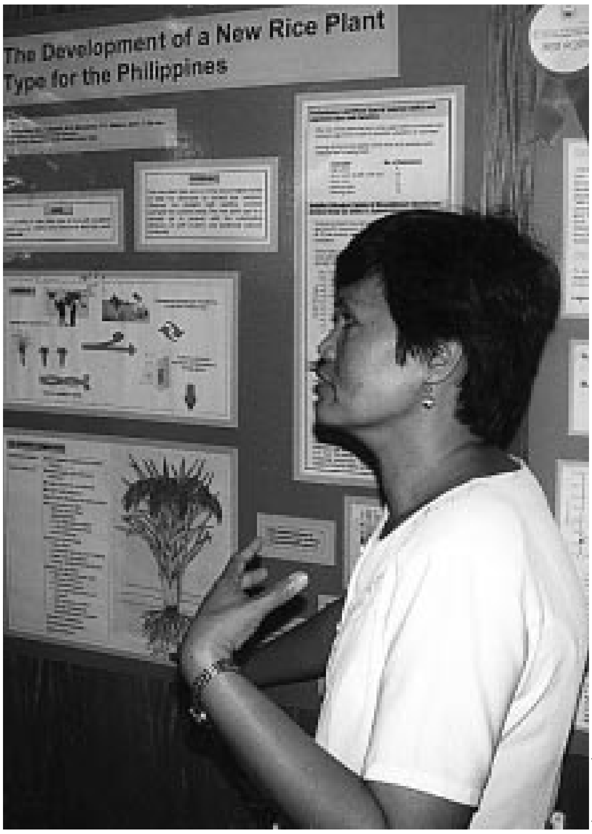

photo: Bert Lof

New super rice has high yield potential but the risks for small farmers are yet unknown.

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Humayun Kabir is a rice specialist at the International Institute of Rural Reconstruction in the Philippines. This article is a summary of Kabir H, **Sustainability issues in lowland rice production. Report for the ILEIA Research Programme.**

Philippines Programme

A working group made up of members of the KALIKASAN and KADAMA farmers' organisations together with a task-force from Central Luzon State University co-ordinated by the Centre for Central Luzon Studies (CCLS), and the Nueva Ecija branch of the Philippine Rural Reconstruction

Marilou Abon

Movement (PRRM-NE) was responsible for the LEISA research programme in the Philippines (Box 1). Staff from the Bureau of Soils and Water Management (BSWM), the International Soil Reference and Information Centre (ISRIC), the Philippine Rice Research Institute (PhilRice), the International Institute for Rural Reconstruction (IIRR) and the Philippine Development Institute (PDI) were involved in specific research activities.

The research programme set out to validate the capacity of LEISA technologies to sustain intensive lowland rice production in the specific development context and conditions of Nueva Ecija. The programme was guided by Stakeholder Concerted Action (SCA). SCA involved planning, monitoring, evaluation, capacity building, networking, process documentation and information sharing among partners. Farmer-led Participatory Technology Development was supported by farmer-led case studies and researcher-led context and technical studies. Process documentation and training were an essential part of the programme.

Sustainability at stake

One of the main reasons why farmers, NGO staff and academics became interested in the Research Programme was that they felt conventional lowland rice production was not economically and ecologically sustainable and they wanted to investigate the viability of the alternative technologies being practised by some farmers. Two context studies were carried out: an examination of intensive lowland rice production in general (Kabir, p 14) and a more specific investigation of lowland rice production in Nueva Ecija (Vargas et al, p 16). These studies provided a framework for the PTD experiments and the case and technical studies.

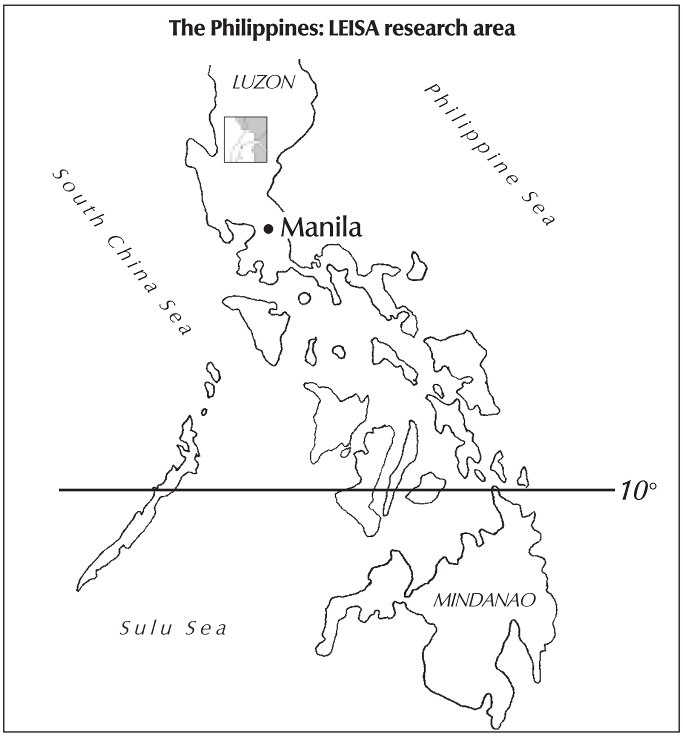
Participatory Technology Development

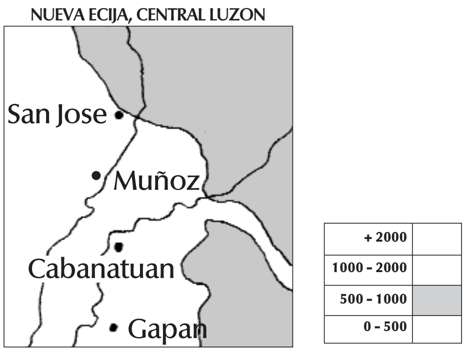
Farmers used Agro Ecological Mapping to analyse the evolution of their resource base. Research priorities were set drawing on the results of this problem analysis. Farmers considered soil fertility to be the bases of ecological and economic sustainability and soil fertility management became the focus of the research programme. To monitor the performance of their PTD experiments, farmers selected indicators appropriate to their production systems, objectives and social and ecological environment (Box 1, p 28).

BSWM and ISRIC made soil classifications at two representative sites and established information about the natural resource base. Scientific and indigenous soil and land use classifications were also compared (Kauffman, p 9).

Comparative PTD experiments on soil fertility management (pure chicken manure versus pure chemical fertiliser and a fifty-fifty mixture of both) and rice varieties (improved traditional varieties versus conventional high yielding varieties) were undertaken by some 120 farmers all of whom belonged to the KADAMA and KALIKASAN federations. Experiments extended over three cropping seasons: wet season 1997 and dry and wet seasons 1998. At the end of each cropping season assessment workshops were held and results were compared to farmer objectives. Where necessary, indicators and monitoring and assessment procedures were reviewed and modified. Scientists from CLSU subjected the results of these experiments to statistical and economic analysis. Farmers made a final assessment at the end of the third season (Basilio, p 32).

In 1997, during the first season of experiments, climate conditions were favourable. However, in the dry and wet seasons of 1998, drought (El Niño) and typhoons (La Niña) caused serious crop damage and only a few farmers could take part in dry season experiments because irrigation water was scarce. The 1998 results are, therefore, unreliable. Conclusions presented here are based mainly on the results of the 1997 wet season. The PTD process used in this research and the results of the PTD experiments are described by Abon (pp 27 & 29).





Nueva Ecija, one of the largest provinces in Central Luzon, provides 20% of the nation's rice and is known as the 'Rice Bowl'. It has an aggregated area of 528,430 ha. Half the province is alluvial plain. The Caraballo Mountains rise in the north and the Sierra Madre ranges, running north to south, dominate the east. About 230,000 ha or 95% of the province's agricultural land is under rice - 54% irrigated and 46% rain fed. The soil in Nueva Ecija is generally fertile and well drained with moisture-retentive clay and silt loams. Between 1951 and 1985 annual rainfall was 1874mm with 121 rainy days per year. The wet season extends from July to October and the rest of the year is dry. August has the most rainy days and February the least. Rain often coincides with typhoons which can cause heavy yield losses. El Niño and El Niña bring serious droughts and floods once a decade.

Case and technical studies

Case studies were carried out to support the PTD process and to help identify possible experiments. The development of organic farming amongst KALIKASAN-NE farmer cooperators (p 20) and the experience of KADAMA with LEISA rice production were studied and documented (p 19). A field trip was also made to five, NGO-supported, LEISA organic and integrated rice production programmes in Mindenao and Central Luzon and the viability of organic farming in these programmes was evaluated in farmer to farmer discussion (Corales et al. p 21).

Technical studies were based on the analysis of secondary data and focused discussion groups, a process directed by scientists. Experiences with marketing alternative and organic rice in Central Luzon (Teves & Liangco, p 22) were studied and an attempt was made to come to a better understanding of the soil fertility related problems identified by farmers as 'soil acidification' (Hipolito p 24). The soil fertility study was complemented by a literature survey that analysed options for LEISA soil fertility management (Peñaloza et al. p 25).

Sharing the results

Research programme results were discussed at a national workshop organised by the International Institute of Rural Reconstruction (IIRR) in the Philippines attended by representatives of farmer organisations, NGOs and national and international research institutions. Participants shared experiences of developing sustainable lowland rice production. A detailed account of the workshop will be published in a special IIRR ILEIA publication.

The LEISA research programme was reported several times on Philippine national television. Two videos have been made: a general video on the PTD process (in English) and a training video (in Tagalog). The Country Research Report together with reports of most of the studies (Box 2) and the videos can be ordered against costs from Dr. M.G. Abon, CCLS, CLSU, Muñoz, Nueva Ecija. ■

References are not included in the articles.
A full list of references can be obtained on request.

Box 1 **Organisations in the Philippine LEISA Working Group**

KALIKASAN-NE Peasant Federation for Sustainable Farming in Nueva Ecija has members who come from people's organisations and farmer groups as well as individual farmers from Carranglan, Lupao, San Jose City, Muñoz, Talavera, Sto. Domingo, and Guimba. The federation aims to develop organic, integrated, sustainable farming to improve the livelihood of its members.

KALIKASAN has grown from seven demonstration farms totalling 1.75 ha in 1992 to 274 farms and 171 ha in 1998. KALIKASAN receives support from the Philippine Rural Reconstruction Movement - Nueva Ecija Branch. For more information see p 20.

KADAMA Confederation of Nationalist Peasants is a confederation of five farmers' federations in Nueva Ecija. Member federations are DIWA, KADAMA, UGNAYAN, LIKHA, and PMK from the towns of Sta. Rosa; Jaen, Zaragosa and Cabiao; Carranglan; and Cabanatuan City. The confederation began more than five years ago. Some of its member federations have more than a decade experience in organic agriculture, community organisation, cooperative development and advocating policy. For more information see p 19.

Central Luzon State University (CLSU) was established as an agricultural school in 1907 and subsequently developed into a regional university. It is located in Muñoz, Nueva Ecija. The university's academic programme involves the training of the researchers, farm managers, extension agents, farm technicians, entrepreneurs, home economists, fishery graduates and teachers who make up the country's agro-technical manpower. The university carries out its research, extension and training mission by supporting sustainable agro-industrialisation and encouraging balanced socio economic growth. Technology, information generation, commercialisation; integrated capacity building; communication, advocacy, market-driven innovation and partnerships with key sectors of development are important elements in this process.

Philippine Rural Reconstruction Movement (PRRM) is a non-governmental organisation made up of committed professionals, industrialists, and other volunteers who work together to liberate the peasants and the rural poor from structures of oppression. Dr. James Yen, a Chinese scholar and founder of the International Mass Education Movement, set up PRRM in 1952. PRRM has a fourfold programme that focuses on livelihood development, education, health and self-government. In addition, it conducts policy studies and is concerned with rural planning in the interests of comprehensive rural development.

The services provided by PRRM through its Nueva Ecija branch include supporting local community development and cooperation, business development, environmental resource management, and basic social support systems. PRRM- NE supported KALIKASAN-NE and later it became one of PRRM-NE main partners in implementing sustainable agriculture development projects in the area.

Box 2 **Reports and video's produced for the ILEIA Research Programme**

- Abon MG. and Divina CC, 1999. **The Filipino LEISA experience. Country Report.**
- Abon MG, 1999. **Statisitical analysis of the PTD experiments**.
- Basilio C, San Buenaventura TB, Hibionada RS. and Bugayong FA, 1999. **Farmers forum on participatory technology development.**
- Conception RN. and Batjes NH, 1997. **A farmer-guided soil classification system for the Philipines: a case study for Barangays Triala and Santa Rosa, Nueva Ecija, Central Luzon.** ISRIC Report 97/03. Bureau of Soils and Water Management, Manila, and International Soil Reference and Information Centre, Wageningen. ISRIC, PO Box 353, 6700 AJ Wageningen, The Netherlands.
- Corales at al. 1999. **Participatory assessment of farmers' experiences on the use of organic farming technology.** Published in Philipino language in 'Balong ng Buhay, Tomo I, Bilang I, 1999. PRRM-NE, Bukang Liwayway, Bantug, Muñoz, Nueva Ecija, Central Luzon, The Philippines.
- Hipolito MC, Mescallado H. and Peñaloza DP Jr, 1998. **Alternative soil fertility options**.
- Hipolito MC, Sigua L, Hipolito RR, Leon R de and Lopez R, 1999. **Soil acidification: problem assessment and control**.
- Kabir H, 1999. **Sustainability issues in lowland rice production.** IIRR, Silang , Cavite, The Philippines.
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- Lina et al, 1998. **KALIKASAN-NE: a documentation and evaluation of experiences in sustainable agriculture.** Published in Philipino language in 'Balong ng Buhay, Tomo I, Bilang I, 1999. PRRM-NE, Bukang Liwayway, Bantug, Muñoz, Nueva Ecija, Central Luzon, The Philippines.
- Miclat-Teves AG, Liangco GD and RG Teves, 1999. **The emerging alternative rice marketing system in Manila and Luzon provinces: A preliminary study.** PDI, 3-B Mayumi Street, UP Village, Diliman, Quezon City, The Philippines.
- Mondoza-Mescallado HC, 1999. **Economic analysis of PTD experiments in Nueva Ecija, Philippines**.
- Vargas DS, Abon MG, Divina CC. and Bibal LD. 1998. **Agricultural development in Nueva Ecija: the case of Rajal Centro and Triala.**

- CCLS, **Participatory Technology Development**, training video.
- CCLS, **A bridge to tomorrow**. Video documentary on the ILEIA Research Programme in the Philippines.

If not mentioned otherwise these publications and videos can be ordered from CCLS, CLSU, Muñoz, Nueva Ecija, The Philippines.

THE PHILIPPINES

RESEARCH PARTNERS

- KADAMA farmers federation
- KALIKASAN farmers federation
- Central Luzon State University
- Philippine Rural Reconstruction Movement

In the humid lowlands of Central Luzon, The Philippines, the research programme focused on irrigated rice. Members of the farmers' federations KADAMA and KALIKASAN chose to experiment with soil fertility and improved traditional rice varieties. They compared the performance of chicken manure and chemical fertilisers, improved traditional and high yielding varieties and different amounts of chicken manure. Scientists from Central Luzon State University carried out the statistical and economic analysis. Beside making studies on the sustainability and history of rice production in Central Luzon, scientists looked at farmers' problems with soil degradation and the options for organic and integrated soil fertility management. The experiences of KADAMA and KALIKASAN and other groups of farmers in Central Luzon and Mindanao with alternative rice production and marketing were also documented and analysed. Provisionally, farmers reconfirmed their earlier conclusion that, for them, compared to current conventional practices, LEISA and organic practices were viable options. Identical yields could be obtained and costs were lower after several seasons. However, although a necessity given the ecological unsustainability of intensive rice production, much has still to be done to make LEISA rice production a viable option for all farmers in the region.

Towards Integrated Soil Management

Sjef Kauffman*

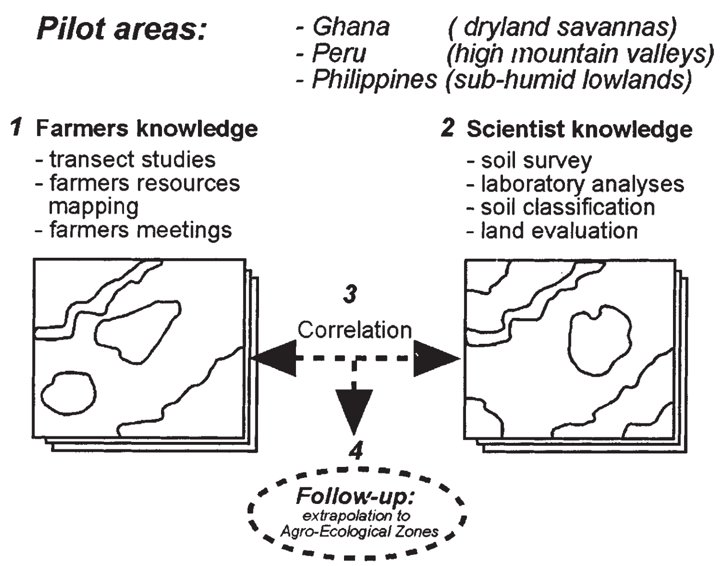
One of the first activities of the ILEIA collaborated research programme in the Philippines, Ghana, and Peru was the characterisation and evaluation of soils in six research sites by farmers and soil scientists. ISRIC sub-contracted three national soil institutions in Ghana, Philippines and Peru (see below), to work in close cooperation with farmers and NGOs in the pilot areas on this task. The comparison and integration of views held by farmers and scientists about the soils was a major part of the project. The objective was to contribute to a participatory process aimed at solving soil-related production constraints in farming. The soil study proceeded from the following questions:

- Is it possible to correlate farmers (indigenous) soil knowledge with formal soil science?
- How do farmers manage their various soils to produce crops?
- How are farmers dealing with soil-related production constraints/ limitations?
- Is there a LEISA solution for land threatened by the degradation caused by present-day land uses?

Methodology

A schematic presentation of main activities is given in Figure 1. In the six research sites the national soil scientists first executed a classical field soil survey complemented by an analytical characterisation of soil samples. The research sites were selected by ILEIA staff, farmers and soil scientists. The farmers' and scientists' soil knowledge was correlated through joint field observations. For this purpose different approaches were used. In Ghana and Peru, farmers and scientists followed closely the traverses and soil pits used in conventional soil mapping. In the Philippines joint walk-throughs were made to observe different land uses and different soils. Farmers indicated soil changes and named the soils according to local custom and language. Scientists asked farmers a series of standard questions. These questions focused on recognition of different soil types, indicators for soil characterisation, local soil names, present and potential land uses and soil management operations. Land suitability questions focused on the dominant soil-related constraints to agricultural production and the management of soil-related constraints to productivity, a question that included a consideration of the ecological threats of present land use. These farmer-scientist dialogues had a different character in the three countries. In Ghana, a series of standard questions were used (Asiamah and Spaargaren, 1997). In the Philippines the farmers were asked to make soil and land use observations by categorising their observations by using the basic human senses - sight, hearing, smell and sound (Conception and Batjes, 1997). In Peru, besides the use of standard soil characterisation questions, the dialogue had a rather free character, especially when production constraints were discussed (Kauffman and Valencia, 1998). In addition to the fieldwork, plenary sessions were held, in which the farmers and scientists discussed the results of the fieldwork. Farmers frequently mentioned non-soil related constraints to production, which were discussed and included in the reports.

Figure 1 – A schematic presentation of four major project activities



Results

The research sites in North Ghana are located in a nearly level to weak undulating plain with long slopes towards valley bottoms with slope gradients between 1 to 5 %. A large number of soil types is distinguished by both farmers and soil scientists (see Figure 2: Farmer and scientists soil maps).

In the Philippines the pilot areas are located in the broad alluvial plain of Central Luzon. Soils are pre dominantly poorly drained, dark grey coloured clays. In Peru the research sites are situated in the north and the centre of the Andean mountains. Both areas have a strongly dissected mountainous landform and are situated between 2700 and 4500 m above sea level. Variation in soil types is largely determined by geological parent material, slope and altitude zone.

More information on the environmental conditions of the pilot areas is given in the country sections in this Newsletter. For detailed information reference is made to the project reports (Asiamah and Spaargaren, 1997; Conception and Batjes, 1997; Kauffman and Valencia, 1998).

Knowledge compared

To a certain extent it is possible to correlate farmers soil knowledge with formal soil science. However, correlation of local soil names cannot always be made in a consistent way, because of the different criteria and rules used by farmers and scientists. Farmers have a pragmatic way of characterising and classifying soils based on their strong practical focus. For example, they will mainly consider topsoil properties when weighing up agricultural soil use. When looking at soil as a building material, generally only subsoil properties are taken into account. Soil science views soil properties over a standardised control soil depth for multi-purpose assessments. An additional difficulty is the variation in local soil names, which can be very large depending on the variation in idioms and languages in a region. Nonetheless, it is recommended that the potential use of indigenous soil names should be maximally explored for strengthened communication between the stakeholders at local level.

Agreement about problems

From the results in the research sites, it follows that farmers and scientists were ►

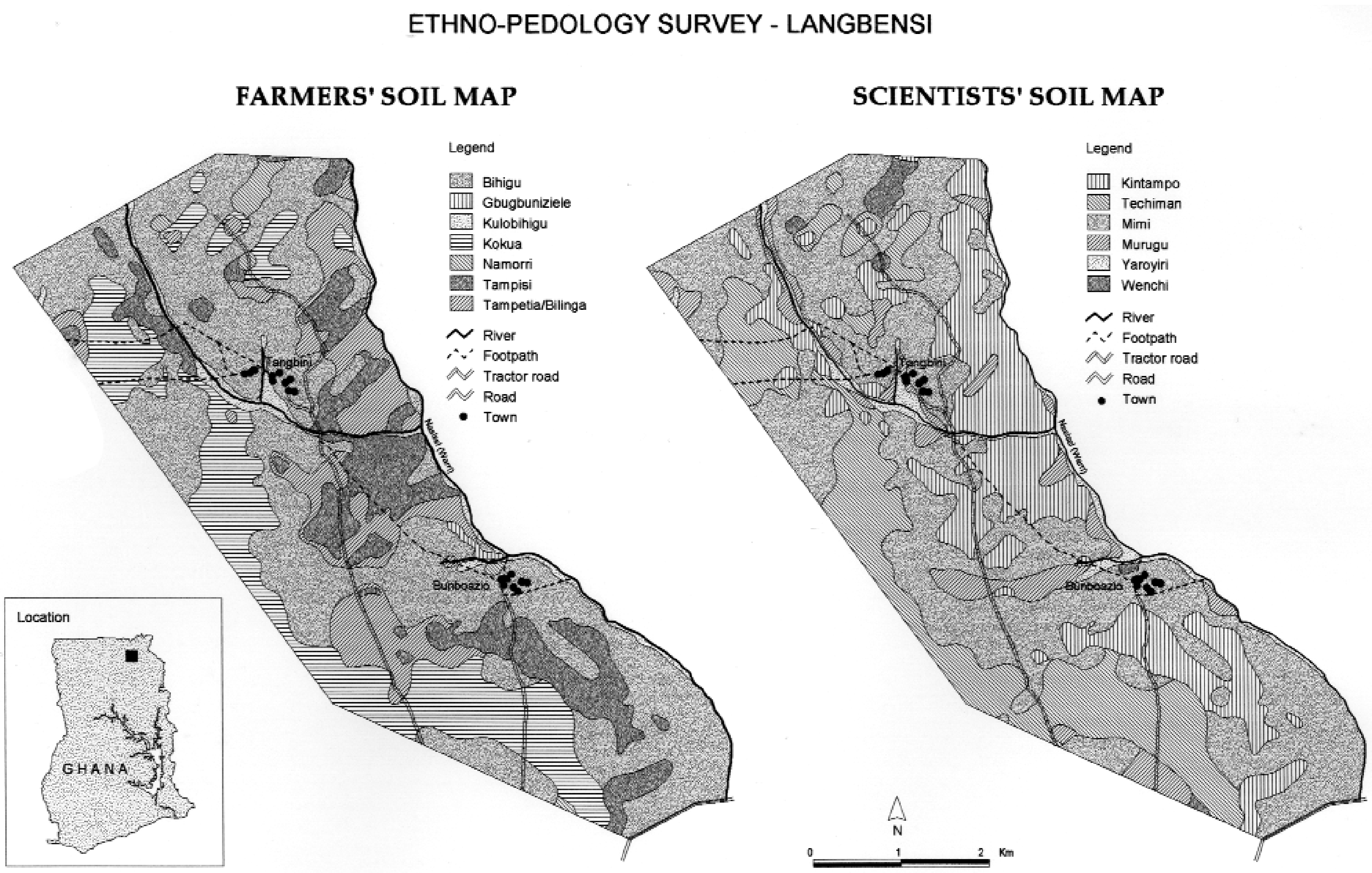


Figure 2 – Farmer and scientists soil maps

able to discuss soil-related production constraints, the local soil management techniques and potential solutions for how to overcome these constraints. The three main soil-related production constraints, indicated by both farmers and scientists in the research sites are related to water availability, plant nutrients (soil fertility), and soil degradation. The participatory process of farmers and scientists on how to solve these three constraints in a joint effort should result in the development of an Integrated Soil Management (ISM) approach.

Towards Integrated Soil Management

ISM will help to realise the agronomic potential of existing soil types, and prevent the reduction of this potential by further soil degradation. ISM will require the simultaneous application of water and soil conservation measures and organic and inorganic soil fertility measures (the latter including amendments such as local by-products and rock phosphate). ISM will contribute strongly to efficient water-use in rain-fed agriculture in the semi-arid and seasonally dry (sub-)tropics, a major challenge given anticipated population growth and accompanying food needs, especially in sub-Sahara Africa. A cornerstone of the ISM approach is the recognition of the importance of soil organic matter to preserve soil fertility and soil physical properties. Therefore one of the goals is to look for those land uses and soil management practices, which will maintain or increase soil organic matter content. Such considerations are also important in the context of enhancing terrestrial C-sinks with a view to mitigating atmospheric CO^2 levels as emphasised in the Kyoto protocol on climate change. The synergism of the various elements of such an ISM approach is especially important (Breman, 1997; Kauffman 1996). However, an ISM approach involves considerable investment. For soil and water conservation and organic fertility measures, these consist mainly of labour time; for inorganic soil amendments, mainly of money. ISM should have a sound economic basis, because the full benefits of these investments will only appear after several years. This is partly caused by learning effects: farmers may need considerable time to become acquainted with the new technologies involved in ISM, and to adapt them to local circumstances. Moreover, there are considerable time lags in the bio-physical process of soil improvement itself (Koning et al. 1997).

A recommended follow-up activity for these studies is the extrapolation of results from the research sites to the respective major ecological zones (see Figure 1 Stage 4). Such an activity will provide a tool for transferring results to policy levels responsible for policy measures for the proposed ISM approach.

■

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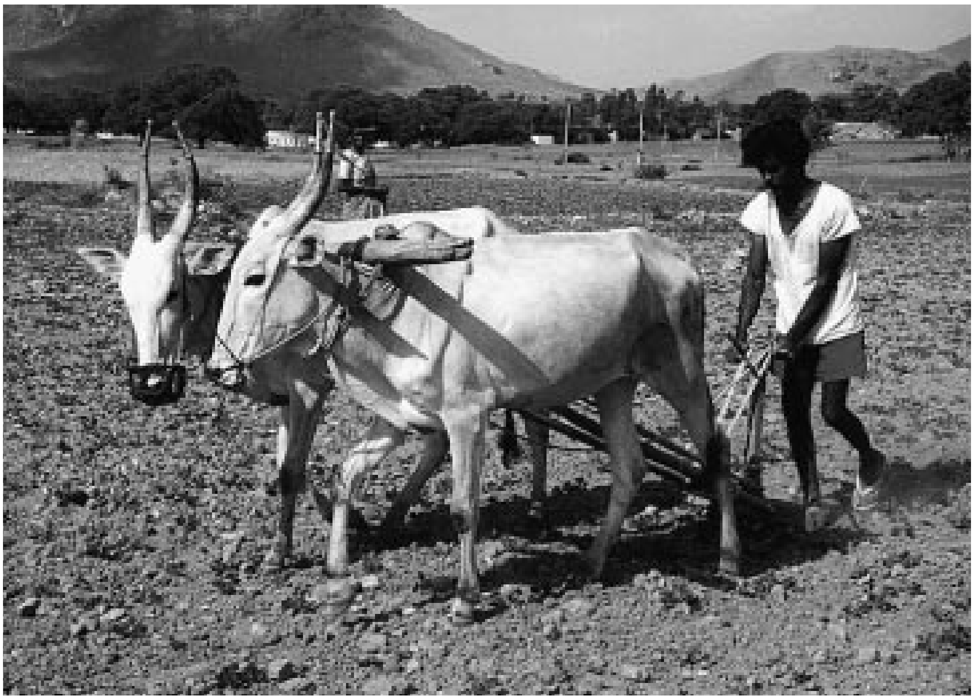


ILEIA Collaborative Research Programme

From 1984, ILEIA has been concerned with collecting, analysing and exchanging experiences on the participatory development of Low-External-Input and Sustainable Agriculture (LEISA). LEISA is sustainable agriculture based on ecological principles. It makes optimal use of combinations of locally available internal and external inputs and indigenous and scientific knowledge adapted to local conditions and needs. LEISA sets out to provide alternatives to unsustainable 'conventional', 'modern' or 'High-External-Input' Agriculture (HEIA) and to unsustainable 'traditional' or 'Low-External-Input' Agriculture practices (LEIA) (see also box 1).

Box 1 **What is LEISA?**

LEISA is an approach to sustainable agriculture that builds on:

- Agroecology: a scientific knowledge base from which ecological concepts and principals can be applied to the design and management of sustainable agroecosystems;
- Indigenous knowledge: knowledge farmers have of their locality generated from their own and their ancestors' experiences. It includes knowledge originating from outside the region that has been internalised. Indigenous knowledge is holistic and encompasses all aspects of rural life;
- Scientific knowledge: knowledge base developed by scientists;
- Participatory learning, planning and action: participation of development supporters in local development processes to strengthen farmers' and own capacity to adapt to changing needs and conditions and towards sustainability;
- Economic viability, ecological soundness, social justice and cultural integrity: sustainable development is important but should not be pursued at the expense of the cultural and social values of those segments of the population who have little influence over economic and political decision making.

ILEIA sees LEISA as dealing with the technical and social options open to farmers wanting to improve their productivity and income in an ecologically sustainable way. LEISA builds on the optimal use of local resources and natural processes and, if necessary, acceptable, and feasible, on the safe and efficient use of modest amounts of modern external inputs. LEISA systems, which are highly situation specific, build on indigenous and scientific agroecological knowledge. In its social and political dimensions LEISA is concerned with empowering men and women to use their knowledge, skills, values, cultures and institutions to build up their farming future.

LEISA involves participatory methodologies to strengthen the capacity of farmers and other actors to adapt to changing needs and conditions and make agriculture sustainable. Creating an environment conducive to sustainable agricultural development means making LEISA effective at the policy-making level. As a concept and knowledge base LEISA provides direction, practical options and methodologies for development and achieving sustainable agriculture. LEISA is not, however, a blueprint for this, it is a development approach with a strong political message.
(see **LEISA in perspective; 15 years ILEIA.** *ILEIA Newsletter* Vol. 14 2&3, 1998.)

In the cases reported in ILEIA's Newsletter and other publications the reasons for the successes and failures of LEISA experiences were often unclear because many factors involved in their development remained unexplored. In order to come to a better understanding of the necessity and opportunities for developing LEISA, those evaluating Phase III of the ILEIA programme recommended adding a research component to the project's core activities.

In 1994, the Dutch Ministry for Development Cooperation (DGIS) asked ILEIA to initiate and facilitate a research programme mandated to make:

> *A participatory assessment of the viability of LEISA technologies in different environmental and socio-economic settings and substantiate this as far as possible by quantitative data. This participatory assessment should include an attempt to understand the processes that lead to changes in farmers' livelihood and land-use strategies.*

Objectives

This mandate involved implementing three regional research programmes in contrasting economic and ecological conditions. It was intended to provide farmers, researchers, policy makers and funding agencies with convincing insights into the necessity and viability of developing LEISA. It would also show what specific LEISA practices were appropriate for given conditions. Viability in this context meant that when specific LEISA practices were compared to conventional farmer practices they would be both more effective in satisfying farmers' needs and in meeting the economic, ecological and social criteria for sustainability. However, adopting LEISA practices had to be feasible for local farmers.

The second objective was to demonstrate the effectiveness of participatory approaches to technology development by strengthening and supporting farmer experimentation. In this way the knowledge of farmers and scientists would be combined in the interests of developing sustainable agriculture.

The collection of scientifically valid data was imperative. Policy makers had to be convinced of the importance of supporting the development of LEISA and conventional research agendas had to be moved in the direction of the real needs and priorities of farmers, LEISA and sustainability issues.

The research questions

There were two main research questions. First, when compared with other forms of agriculture is LEISA a viable option in the research sites and in situations with comparable farming conditions? Second, how can development/transition processes towards LEISA be supported in the research sites and comparable farming conditions?

Five specific questions followed. To what extent is the type of LEISA envisaged for a particular research site a more viable and sustainable development option than the agricultural practices generally used in the area? Can LEISA technologies satisfy farmers' objectives and to what extent are the preconditions for adopting LEISA technologies? How far are national objectives satisfied by LEISA technologies? And finally to what extent is the policy environment conducive to making a transition towards LEISA?

The vision behind the research approach

To implement this research mandate ILEIA developed an innovative research approach built on the following assumptions:

- Farmers and researchers (and other outsiders) see agriculture in different ways because they have different world visions, values, experiences, needs and objectives. They also use different languages, expressions and categories to describe agriculture.
- LEISA is a holistic approach to land use and can be examined either from the perspective of the interests of the individual farmer or those of society as a whole. Farmers and governments may have conflicting visions and interests.
- Research is too often determined by researchers' individual or institutional agenda's and takes little account of farmers' priorities and knowledge.
- Sustainability is an objective. Farmers' (and other stakeholders') innovative ability to adapt agriculture to often complex processes of change is an essential element in developing sustainable agriculture. The involvement of farmers, development workers and researchers (and at a later stage traders, bankers and policy makers) in processes of 'participatory' development can enhance the effectiveness of learning, farmer experimentation and scientific research in the development of sustainable agriculture.
- Knowledge of the dynamics of the farm-household system and its wider socioeconomic context is necessary in order to understand what conceptual, technical, institutional and policy changes are needed to make the transition towards LEISA feasible.
- As the context, needs and objectives of agriculture are constantly changing, assessment should cover a sufficiently long period of time and include the present and future situation. It should also focus on actual (unsustainable) and alternative (more sustainable) techniques.
- Such an assessment should be convincing both for farmers and researchers.
- Active and sustainable collaboration with local partners is only possible if the research fits the agenda's of farmers, development workers and researchers. It must also have a development perspective, satisfy a felt need for assessment and create a capacity to institutionalise the assessment and monitoring of sustainability at farmer' and other levels.

It was concluded that an assessment of the viability of LEISA should:

- Take farmers' priorities as a starting point and focus on concrete problems;
- Include the visions and categories of farmers and scientists;
- Include farmers' assessment (criteria and indicators) and scientific validation;
- Assess agriculture from a micro and macro perspective;
- Compare technologies and analyse contexts and trends;
- Include relatively large groups of farmers and build on quantitative data as much as possible;
- Run for a sufficiently long period;
- Be firmly rooted in PTD (see box 2) and SCA (see box 3) in working groups of farmers, development workers and scientists;
- Create local capacities in LEISA, PTD, SCA, participatory assessment, the monitoring of sustainability and emphasise a process of long-term concerted learning and action.

Finding research partners

In 1995, three contrasting regions in Ghana, Peru and the Philippines were selected for ILEIA research. Three criteria were used in the selection of partners: their region was representative of specific, contrasting agroecological and socioeconomic conditions; they had long-term working relations, and they had experience with the participatory development of LEISA. Research sites were located in the following zones:

- the sub-humid zone of northern Ghana;
- the high Andean valleys of Central and Northern Peru;
- the humid lowlands of Central Luzon in the Philippines;

In 1997, a fourth region - the dry zone of India's Deccan Plateau - was added when AME in south India (ILEIA's sister programme) became involved. In India, however, research followed its own internal dynamics.

In northern Ghana farmers are mainly subsistence oriented and entirely dependent on locally available resources. In the Andean valleys and on the Deccan Plateau agriculture is partly subsistence and partly market oriented. Production is dominated by one cash crop that uses external inputs. In the lowlands of Luzon irrigated rice is grown for market with high amounts of external inputs.

Box 2 Participatory Technology Development

PTD is essentially a process of purposeful and creative interaction between rural people and outside facilitators. Through this interaction, the partners try to increase their understanding of the main features and dynamics of local farming systems and define problems and opportunities. They also learn how to experiment with a selection of 'best-bet' options for improvement. These options are based on ideas and experiences derived from indigenous knowledge and formal science. This process of technology development does not only attempt to find solutions to current problems. It also tries to develop sustainable agricultural practices that conserve and enhance natural resources for future generations. Most important of all PTD aims to strengthen the capacity of farmers and rural communities and enable them to analyse ongoing processes and develop relevant, feasible and useful innovations.

There are six main steps in PTD:

❶ *Getting started*: building relationships for cooperation; preliminary situation analysis; awareness mobilisation.
❷ *Looking for things to try*: identifying priorities; identifying 'best-bet' options from indigenous knowledge and scientific sources; screening options.
❸ *Designing experiments*: reviewing existing experimental practice; planning and designing experiments; designing, monitoring and evaluating protocols.
❹ *Trying things out*: implementing experiments, monitoring and evaluation.
❺ *Sharing the results*: communicating basic ideas, principles, results, and the PTD process; training in skills, proven technologies, use of experimental methods and farmer to farmer extension.
❻ *Keeping up the process*: creating favourable conditions for continuing experimentation and agricultural development (Veldhuizen et al 1997; Reijntjes et al 1992).

This process of technology development is closely linked with social change and encourages local innovation, self-confidence, and self respect through self-organised planning, implementation and the evaluation of systematic experiments. The process also fosters a cultural awareness as planning and assessment obliges participants to take account of their own situation and the responsibilities and needs of others in the community.

photo: Bert Lof

Box 4 FARMS

FARMS is a computerised farm management data system based on the FoxPro database management software programme. The package was developed by Aavishkar Software Consultancies, Madras, in close collaboration with AME, Bangalore, India and allows quick data entry and cross-checks. It has the potential to rapidly analyse the various aspects of farm management including the results of financial performance, agricultural production, labour requirements and nutrient, energy and groundwater balances. It also provides sustainability indicators at plot, crop, crop group, enterprise and farm level.

Box 3 Stakeholder Concerted Action

SCA aims to strengthening local participatory development processes by creating stakeholder working groups or platforms. In agricultural development such stakeholder groups involve farmers and other land users, development workers, researchers, policy makers, banks and agribusiness. Stakeholders have a clear interest in working together to achieve a common goal while at the same time ensuring that each others interests are taken into account. Concerted actions provide SCA with a focus. These actions imply analysis, developing an action plan, conflict resolution, monitoring and evaluation, information exchange and lobbying. In the ILEIA research programme PTD gave an initial focus to SCA.

LEISA Working Groups consisting of representatives of farmer organisations, NGOs, agricultural research institutes, universities and/or government extension services were set up in each region. These stakeholder groups were the main research partners in the ILEIA Collaborative Research Programme. Other independently operating organisations and consultants were also involved in the programme from time to time.

In each region, one or two research sites were identified. These played a central role in the research. The working groups in each country are described in the country sections later in this Newsletter. ILEIA played an important role in conceptual guidance, backstopping, funding, inter-region coordination and final management. AME played the same role in India with some conceptual and funding support from ILEIA.

Setting the research framework

The research framework was designed as an action-oriented R&D programme by ILEIA staff working directly with research partners and external advisors. It grew out of a common interest in ‘assessing the viability of their experiences with developing LEISA’ in a participatory way and the need to strengthen regional capacities in PTD.

In a general research workshop held in the Netherlands in June 1997, an overall research framework was finalised, adopted and accepted by delegates from the different working groups, country programme officers and the external advisors.

The ILEIA Collaborative Research Programme was designed to accommodate three interactive lines of activity:

➊ **Stakeholder Concerted Action**: the formation of working groups of farmers, development workers and researchers; setting the research agenda; defining sustainability; selecting key indicators and measuring methods; planning; negotiation; sharing and monitoring programme activities; process documentation; library and information management; programme evaluation; training and networking.

➋ **Participatory Technology Development**: farmer analysis of land-use problems, setting objectives and priorities for research, identifying experiment options, selection of farmer indicators, experimentation, monitoring, evaluating results, dissemination, farmer-to farmer visits and scaling-up.

➌ **Assessment Research**: scientific monitoring and validation of farmer practices; experiments and farm-household systems (FARMS); exploratory studies on history, trends and the sustainability of agriculture in the region; case studies on successful LEISA practices in the region and technical studies on the specific technical problems facing farmers at micro and macro level.

PTD was supported and complemented in the research process by scientific validation. Scientific studies proceeded from the problems and priorities identified by farmers in the research sites and were implemented as much as possible in a participatory way. The working groups provided platforms for SCA to direct, coordinate and evaluate the programme (see also Box 5).

Table 1: Criteria for LEISA

Ecological criteria	Economic criteria	Social criteria
· Balanced use of nutrients and organic matter · Efficient use of water resources · Diversity of genetic resources · Efficient use of energy sources · Minimal negative environmental effects · Minimal use of external inputs	· Sustained farmer livelihood systems · Competitiveness · Efficient use of production factors · Low relative value of external inputs	· Widespread and equitable adoption potential especially among small farmers · Reduced dependency on external institutions · Enhanced food security at the family and national level · Respect and build on indigenous knowledge, beliefs and value systems · Contribute to employment generation

Source: ILEIA Research Workshop, June 1997

Setting the reference base

A reference base was needed to assess the development of agriculture in the context of sustainability and to assess the comparative viability of LEISA. Such a reference base can be created by criteria for defining sustainable agriculture. This process has to be repeated regularly as insights into sustainable agriculture and the skills needed to measure indicators evolve. The partners in the ILEIA Research Programme proposed and formulated such criteria. These proposals were discussed and combined into a common set of criteria for LEISA during the general research workshop and were subsequently finalised at regional-level meetings (see Table 1). Indicators and norms for each criterion had to be developed further in the ecological and socioeconomic environment specific to each local level.

In assessing the viability of LEISA at the household level, emphasis was placed on farmers' objectives and the preconditions that determine how motivated farmers are when it comes to adopting LEISA production systems. Important at the societal level were national objectives and the premise that sustainable agriculture must be "economically viable, socioculturally just and ecologically sound" (Brundtland 1987).

Answering research questions

The viability of LEISA systems depends on the comparative performance of the technologies involved and the technology development process. Conclusions should be derived from the results of assessment research, PTD and SCA. Figure 1 shows the strategic footsteps taken in order to validate LEISA. At the end of the research programme farmers, scientist and the stakeholders should try to reach a conclusion together.

Agricultural conditions change constantly and the viability of LEISA technologies change with them. Conclusions about the viability of specific LEISA technologies are therefore only valid for a specific time and for specific local conditions. To get answers to research questions that cover longer periods, a system of sustainability monitoring is required. Such a monitoring system should build on farmer experimentation and scientific monitoring and evaluation.

Expected outputs

- Initial analysis of sustainability of current agricultural practices.
- First analysis of viability of LEISA practices in the research areas.
- Collection of scientific information on specific problem issues.
- Strengthening capacity of all stakeholders to implement SCA.
- Strengthen capacity of stakeholder to carry out PTD experimentation.
- Further development of methodologies.

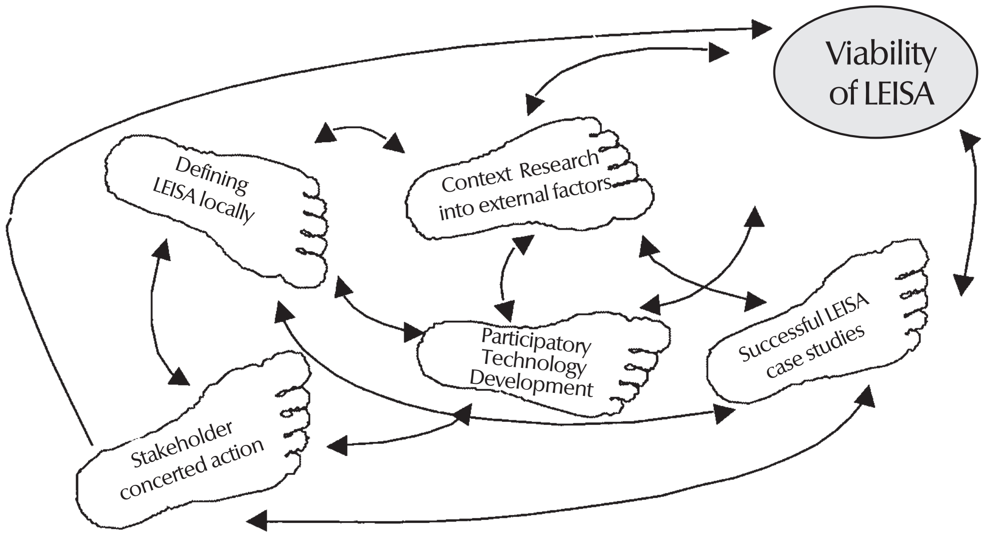
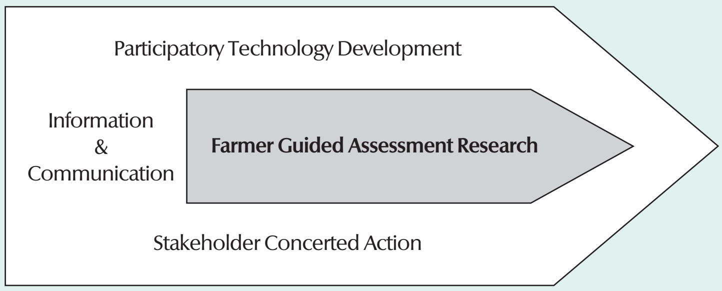


Figure 1. Strategic footsteps: iterative steps in the development – research process

Box 5 **Big and small boats of LEISA development**

Research programme objectives had to be in line with the development agenda and processes of NGOs and other development organisations working with farmers on sustainable land use and poverty alle viation. In the research framework workshop this broader development process was conceptualised as the 'Big Boat' within which LEISA development would take place. In this process farmers' innovate and their land-use practices have an own dynamic with or without external support from interested stakeholders. ILEIA contributed to these processes by providing information, facilitating communication (library support, documentation, Newsletter and other publications) and by supporting PTD and SCA. Development objectives were therefore high on ILEIA's research agenda.

PROCESSES FOR THE DEVELOPMENT OF LEISA



In ILEIA's research programme, the Small Boat of assessment research - carried within the Big Boat' of the development process - had a pilot role. It drew inspiration from and guided and sharpened PTD and SCA activities. Assessment research involved context and case studies, farmer experiments and the scientific monitoring and analysis of farm production systems (FARMS). It focused on specific problems and practices identified and prioritised by farmers at field and macro level. PTD activities associated with farmer experimentation formed an integral part of Small Boat research activities. This was important because ILEIA considers farmer assessment essential to the outcome of the ILEIA research programme. Small Boat research gave direction to the overall PTD process. The PTD and SCA process within the larger development process provided the social mechanisms through which problems and priorities were tackled. Thus, PTD activities occurred both inside and outside the Small Boat.

Assessment was part of ILEIA's research mandate and therefore ILEIA focussed on the Small Boat. Collecting verifiable data was imperative because policy makers had to be convinced it was necessary to support the development of LEISA. Conventional research agendas also need to be better orientated to needs and priorities of farmers.

Although PTD and SCA were not the direct subjects of assessment they were supposed to generate interesting methodological results for the overall research programme. Moreover, they were important in obtaining valid research results from participatory, jointly-implemented research. Therefore, there was close interaction between the activities of the two 'boats'. Both were part and parcel of ILEIA's overall research effort and contributed to the development processes of the 'Big Boat' pursued by ILEIA's partners in the research

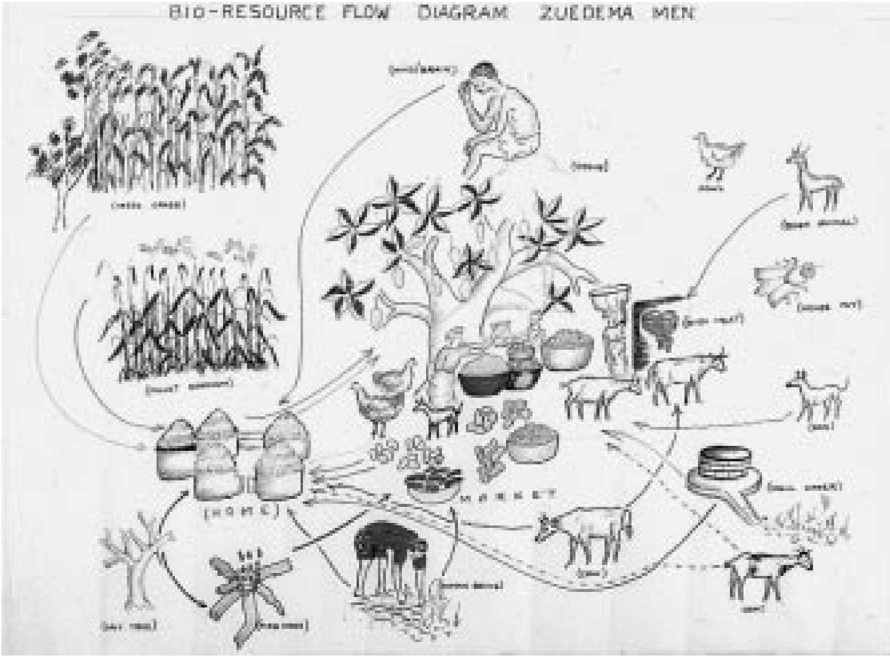


illustration: Ghana Research Archive

Implementation

The working groups were responsible for the day-to-day planning, coordination and monitoring of the programme. Biannual workshops with staff from ILEIA Netherlands were held to formulate general plans. Contracts with terms of reference and budgets were drawn up for each activity. ILEIA (NL) and country programme officers were responsible for budgets, administration, programme monitoring, reporting to the funding agency, quality control, trouble shooting and general support. ILEIA (NL) was closely involved in programme conceptualisation but not in direct implementation. Visits two or three times a year and long distance communication enabled ILEIA (NL) to meet general monitoring, management and support obligations.

The conditions, focus and dynamics of research in Ghana, the Philippines, India and Peru were very different and this was reflected in the process and the results obtained in each country. Serious conflicts within the initial ILEIA research team (1996) caused delays. The research programme outlined here started in early 1997 and it was summer before PTD experiments and studies began. The time available for experimentation was therefore short: two seasons in Ghana and Peru and three in the Philippines. In India the situation was different because AME had initiated the PTD process in 1994.

Given the limited amount of time available assessment research focused on the first three specific research questions. A start had been made with the FARMS programme but due to software problems this activity had to be stopped. Most of the planned context, technical and case studies were implemented before the end of 1998. Considerable attention was given to capacity building in SCA and PTD at the beginning of the research process. In this way conditions were created for a research effort that could be sustained beyond the planned withdrawal of ILEIA in 1999. Bad weather brought about by El Niño strongly influenced the results of PTD experiments during two seasons in the Philippines and one in Peru.


photo: Bert Lof

Newsletter reports results

This issue of the ILEIA Newsletter presents the research programmes in the four countries. In each country section articles are included on the overall country programme, sustainability problems, the main trends in agricultural development in the region, the case and technical studies carried out, the SCA and PTD process and the PTD results. An introductory article by Kauffman outlines the results of a study in Peru, Philippines and Ghana to compare farmers' and scientists' land use categories. Each country section carries articles on the overall country programme, sustainability problems, main trends in regional agricultural development, case and technical studies, SCA and the PTD process and its results. A concluding article written by the ILEIA team, attempts to synthesis the main results of the programme.

If you would like to know more about the ILEIA research programme and the wide diversity of information and insights gained you might like to consult our Web site for reports, country documents, and other source material. A series of local publications (see country sections for references) will become available during the year 2000.

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Photo: Bert Lof

Low-cost solutions are being used to increase yield and income in groundnut cultivation.

Groundnuts: from subsistence runner to bunchy cash crop

AME, operational in Southern India, is a partner of the ILEIA research programme. Its research focuses on farming systems where groundnuts constitute about 70% of the area farmed. Twenty to thirty years ago bunch type groundnuts were introduced in the area as a cash crop. Before that runner type groundnuts were grown in rotation with finger millet, in mixed crop systems with cowpea, pigeon pea and castor. Marginal farmers on poor quality soils still use this system but the runner type has been replaced with the bunch type.

Declining yields turn profits into losses Farmers claim that in the last ten years yields have declined and fungal diseases such as leaf-spot (early and late), root collar rot and stem rot are on the increase. Pests like red-hairy caterpillar, white grub, leaf-miner and tobacco army worm are creating increasing problems. Thus whilst yields are declining, the costs of production show the increasing costs of controlling these pests and diseases. Some farmers are forced to grow groundnuts, as money lenders are only willing to provide loans guaranteed by groundnuts. Consequently, farmers have to sell their produce through the same money lender. The compound interest can be as high as 120% a year. Crop failures are certain to occur once in three years, either due to inadequate or excessive rain, or unfavourable rainfall distribution.

Many groundnut farmers are heavily in debt. The culprits are soil degradation and mono-culture. We hypothesise that, on the basis of three cycles of PTD experiments, the problems are caused by the following factors. First, soils up-hill have been eroded and soil depth has declined, hence water holding capacity has come down and dry-spells lead to more severe drought stress.

Second, decline in organic matter content of the soil leads to relative shortage of micro-nutrients and to deterioration of soil physical characteristics: infiltration rate, aeration and water holding capacity of the soil decline. Third, relative micro-nutrient deficiencies (of Mg, Zn) caused by the removal of the residual foliage for cattle feeding, lead to susceptibility to fungal diseases. Four, inter-crops were useful in controlling pests and mono-cropping of groundnut increased pest incidence. Finally, the increase in the area under groundnuts and the decline in the practice of rotating groundnuts with cereals has led to higher levels of pest and disease incidence.

Our strategy was to restore soil fertility and physical characteristics at low cost. Together with 300 farmers and using the PTD approach we experimented to increase the yield. We found cheaper sources of nitrogen: rhizobium bacteria; phosphorus: mussooriephos plus phospho-bacteria. We applied gypsum at flowering stage. We found that the yields increased compared with the control plots in which fertilisers (DAP or other compound fertilisers) were applied but that yields were similar or lower when compared with plots in which substantial quantities of farmyard manure had been applied. This focused our attention on farmyard manure. We found that when some 5 to 7.5 metric tons were applied per acre the monetary returns were twice as high as the costs involved. Our main problem was to generate the required quantities of farmyard manure as the average farmer has two heads of cattle generating no more than 4 metric tons per year. This is insufficient for one acre. The yield increase of groundnuts grown with farmyard manure is such that the area under groundnuts can be reduced without income being affected. The area freed can be used for green leaf manure production. One of our partners has started green manure production plots to evaluate the feasibility of this approach.

Pests and diseases are controlled in eco-friendly ways. Leaf-spot is controlled by application of magnesium fertiliser, leaf extract of Lantana and Agave or commercial fungicide. The latter are applied on an early warning system that measures leaf wetness. Preliminary results suggest that applications of magnesium might be the most cost-effective solution. Together with the Indian Council of Agricultural Research (ICAR), ICRISAT and the Australian Council for International Agricultural Research (ACIAR) we are now developing ways to control white grub jassids, white flies and leaf miner with a systemic insecticide. More eco-friendly methods will also be tried. Congregation pheromone isolation for white grub adults to attract them to one spot and kill them before they can lay eggs is also being tried. Neem-cake applied to the soil is being tried to control white grub, jassids and possibly leaf-miner. Inter-cropping with trap crops like soybean and cowpea to manage leaf-miner population, sunflower for tobacco army worm, castor for red hairy caterpillar will be tested further. Village-based experiments with the control of red hairy caterpillar will be undertaken next year in endemic areas.

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LETSystems to strengthen local economies

Camilo Ramada

The money system as we know it, is an accumulation system where wealth, resources and energy tend to flow towards the center of economic power. One of the main mechanisms behind this tendency is interest. Because of interest, money and capital goods are only used for those activities that hold the greatest promise of economic profit to those who own them. This makes the economic system a competitive one rather than one of co-operation. Its 'growth compulsion' forces everybody to exploit labour and plunder nature.

Another typical feature of our economic system is that the creation of money is in the hands of a few private institutions - banks. These banks are only controlled by governments to a limited extent. This means money can be manipulated and separates the creation and flow of money from real production. Financial trade (making money with money) is nowadays ten times the size of real trade in commodities. These three elements - interest, money in the hands of a few and money separated from production - are the main characteristics of an accumulative money system.

LETSystems

Local Exchange and Trading Systems (LETSystems) can prevent the benefits of local activities leaking away to external economic players. In a LETS-economy, people trade with each other on the basis of a self-created means of exchange. Somewhere, whether in a computer or on the back of a piece of paper, accounts are kept of the economic activities of LETS-members. Every LETS-member starts with an account on zero. When someone makes a transaction, he or she goes into debit and the receiver gets a credit. This means that money is no longer scarce: when you need it, you create it. It also means that money is only created when a transaction is completed. In other words the moment of valuation (production) and money-creation are on the same level. Because all the credits in a system are exactly as large as all the debits, the system always comes to zero. This is an economy of reciprocity.

Computerized LETSystems

LETS is relatively new in most European countries but the system has been in use elsewhere in the world for over ten years. Other similar systems for exchange of goods and services at local level are much older. The first computerized LETSsystem started in 1983 in the Comox Valley near Vancouver in Canada. The local economy had been based on timber, tourism and a military base but had gone into freefall when logging was restricted, the tourist industry declined because of the strength of the Canadian dollar and the military base closed. Many people lost their jobs and had their houses repossessed. Several local service sector businesses went bankrupt. A local resident decided to try to stimulate the local exchange of goods and services by enabling people to trade with each other without having to use national currency. He organized a central computerized bookkeeping system to keep a record of trade as in a LETSystem.

The first European LETSystem was set up in Great Britain in 1988 and the concept was quickly taken up elsewhere. Britain now has about three hundred systems in operation, partly due to the existence of the very active umbrella organisation LETSLINK UK. From Britain LETS spread to The Netherlands, and from there to Belgium, Germany, France and Denmark. In The Netherlands the LETS-movement now consists of about 85 systems with an average of about hundred members each. The biggest is the Noppes-system in Amsterdam with a thousand members. By trading in the LETSystem, the members combat their economic (and social) exclusion and frustration.

Local money systems

Another interesting example of LETS is the Red Global del Trueque in Argentina. What started as a simple LETSystem in the neighbourhood of Bernal, a suburb of Buenos Aires, acquired a totally unexpected dimension. The existing structure of neigbourhood and community based organisations proved fertile ground for the economic self-help a system such as LETS can provide. After receiving some media coverage, the idea spread so fast that it proved very difficult to keep accounts. When different communities wanted to trade with each other a new solution was found: the issuing of alternative money or 'Creditos'. These are notes equivalent to a dollar, but they have their own characteristics. They are distributed in an egalitarian manner. Each new member receives fifty Creditos, which he or she can spend freely. This created a very active economy where people proved able to provide a large array of goods and services for themselves and each other. The Trueque idea has now spread all over Argentina (and has grown to 100,000 members within three years). It can now be found in Uruguay, Brazil, Bolivia and other countries.

There are also some experiments in Africa, Senegal and Ivory Coast for example, and Asia. In Africa traditional saving systems have always been organized in ways that fortify the local community. Nowadays, various trading systems are being introduced, according to the LETSystem or variants of local money systems like the Trueque system.

Socially sound and environmentally friendly

The economic activities a LETSystem generates are labour rather than resource intensive. In many cases LETS-activities involves maintenance and repair work or work that makes it possible to reuse things. Frequently ecologically sustainable methods of agriculture are involved. LETSystems increase trade at the local level and therefore strengthen the local economy and know-how. This tends to reduce the need for the (inter)-national transport of goods. Hence, LETSystems alleviate poverty and reduce environmental damage.

Should such systems become successful on a large-scale, then we could speak of a global movement towards strengthening local economies. LETSystems may result in stable, inclusive and sustainable local economies, giving ample space for human values.

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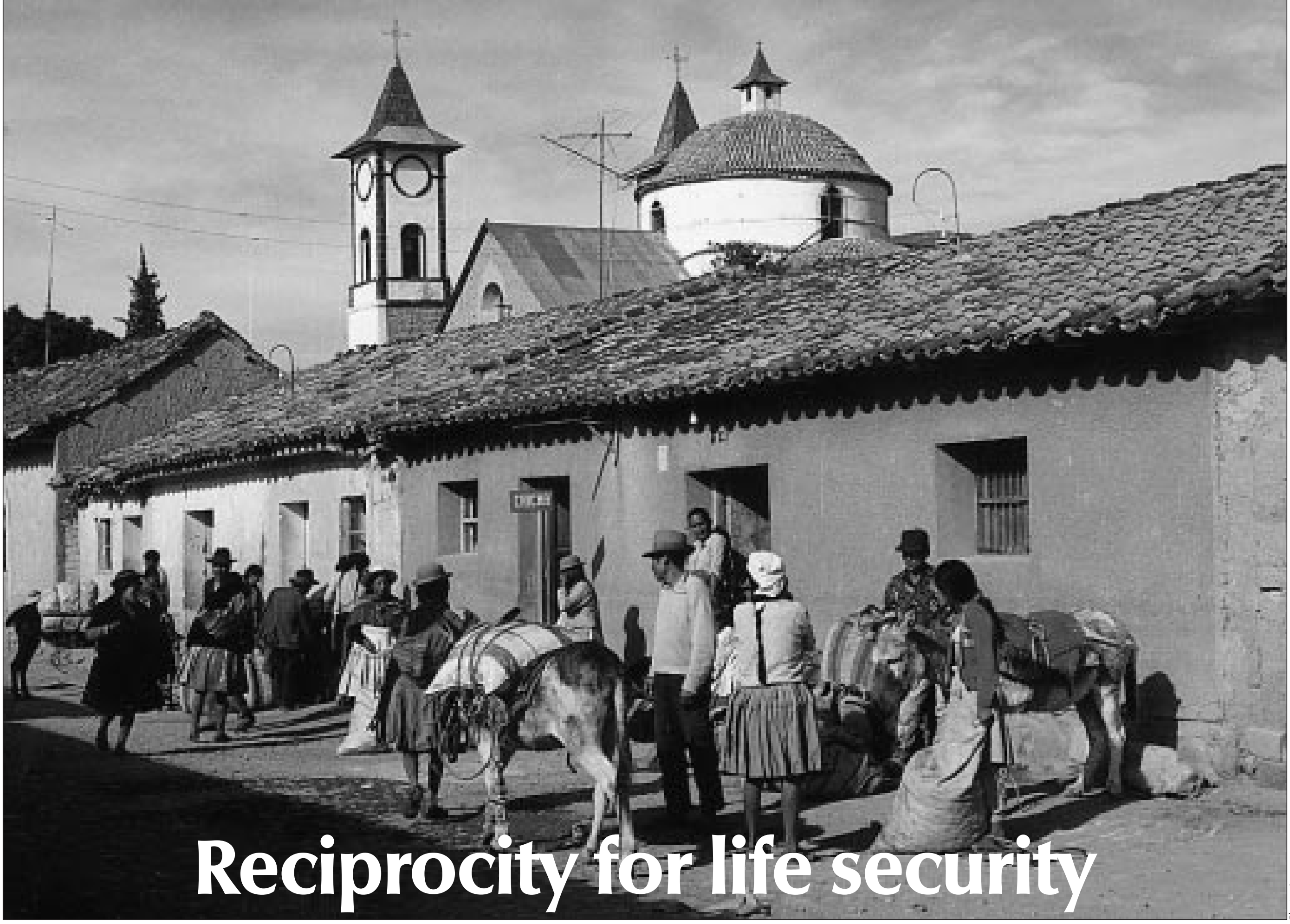

Photo: Agruco

Reciprocity for life security

When we say that there are few ways Southern countries can counteract the negative effects of the market economy we often overlook the alternatives offered by economies of reciprocity. Today, these potentials are being rediscovered. From the sixteenth century farmers throughout the Andean region have actively participated in the commercialisation process but they have not forgotten the cultural legacy or principles of 'El Don'.

Freddy Delgado, Juan San Martin and Domingo Torrico

El Don refers to the moral reciprocity between people, nature and the spiritual world. For the farming communities of Bolivia and other Andean countries, these forms of exchange are based on traditional survival strategies. Traditional Andean life moves between three spheres: the material, the social and the spiritual. Economic logic is also reflected in these spheres: *commercial transactions* for the material life, the *trueque* for social life, and the *cambiacuy* for spiritual life.

The 'Seventh Friday Fair' and the 'inter-ecological journeys' discussed in this article are clear examples of Andean reciprocity. Traditionally, they provide Andean farmers with access to products from different ecological zones that secures and broadens their subsistence base. The case studies presented are based on research carried out over a nine years period by a group of researchers attached to the Agroecology programme of the Universidad Estatal de San Simón, Cochabamba, Bolivia.

The Seventh Friday Fair

Sipe-Sipe is a small town of approximately 2000 inhabitants and is the capital of the second municipal section of Quillacollo province. It lies 28 kilometers south-east of Cochabamba at an altitude of 2500 meters. It is a typical Latin American town with a Catholic church and roofed market clustered around a central 'plaza'. At half-past-five in the morning on the seventh Friday after Easter, several hundred farmers from over 35 villages travel some 15 km to take part in a vivid fair.

The fair is very important for farmers in the region because it contributes to food security through non-monetary and monetary exchange, re-creates and strengthens social relationships between relatives, friends and 'compadres' from different communities in the valleys and highlands, and is an occasion when religious feelings can be expressed. The timing of the fair is important because it coincides with the harvesting of the last tubers in the highlands and maize in the valleys. It is the festival of seeds and takes place at the same time as Taurus Pleiades and the sun come into alignment. Farmers from the highlands arrive at Sipe-Sipe on Thursday or very early on Friday morning with a variety of recently harvested agricultural products. Throughout the day and into the night exchanges take place guided by the concepts of *cambiacuy*, *trueque* and *purchase-sale* each complementing the other in objective, time and importance.

The *cambiacuy* is the most important form of exchange and begins early in the morning. It has a strong spiritual and emotional dimension strengthening relationships between individuals and signaling a new friendship. Exchange is based on affinity rather than interest in gain and this eliminates the mere quantitative aspect of exchange. Relationships are recreated through sharing family and community news which strengthens feelings of solidarity. The produce is handed over as a gift to satisfy and please the receiving family and in the confidence that a gift will be given in return.

Farmers come from the highlands and valleys and offer the products of their different agricultural ecosystems. Farmers from the highlands bring potatoes and other local tubers (*oca* and *papalisa*) while farmers from the valleys bring varieties of local maize. Local biodiversity is clearly reflected in these transactions.

The *trueque* (barter) is another form of exchange. It is less spiritual and emotional than *cambiacuy*. However, the *trueque* does not lose the sense of the spiritual altogether. The *trueque* can take place between farmers or between 'sales people' and the individuals concerned do not necessarily know each other. For instance, a clay plate produced by a farmer may be exchanged for the *oca* content of two similar plates, or for the full *oca* content of a plate of maize. Farmers can obtain ceramics, weavings, baskets and other agricultural products through *trueque* which they could not have accessed through *cambiacuy*.

Purchase-sale is the third form of exchange used by farmers. In it they adopt 'market logic' although there are still indigenous Andean characteristics involved such as 'liking each other' and 'bargaining'.

Money from purchase-sale enables farmers to complement their diets with food items such as sugar, rice, cooking oil, radio batteries and candles difficult to get through exchange. Purchase-sale also makes it possible for them to pay for transport and *chicha* (local beer made from maize).

Flexible exchange

In both *cambiacuy* and *trueque* there is wide flexibility in the exchange parameter. For instance, in the exchange of maize for tubers, bags woven from sheep or llama wool (or even synthetic fibers) are used. These have a mark to indicate a level or amount. This mark is not based on either the metric system or Imperial system. In Quechua the mark is called *chimpu*. This mark is the parameter that allows bargaining to take place about the quantities of tubers or maize to be exchanged. Here factors such as individual needs, the productivity of the harvest and 'liking each other' play a role.

Before the exchange takes places both parties come to an agreement on the content needed to fill the chimpu. A bag might only contain potatoes which are then exchanged for a bag of good quality maize. Another bag might contain a mixture of potatoes, *oca* and *papalisa* to be exchanged for a similar bag of yellow or white maize.

About half the *oca* and *papalisa* harvest of highland farmers is exchanged in Sipe-Sipe. The rest is either consumed at home or sold at other markets and festivities. According to the farmers, the products received in Sipe-Sipe through *cambiacuy*, *trueque* and purchase-sale have a special spiritual or vital energy.

Thanksgiving

The Seventh Friday Fair provides an opportunity for meeting with distant relatives, friends and compadres, for making new friendships, and exchanging the latest news. At the end of the afternoon, when the exchange is over, the farmers begin a celebration to give thanks to Nature, to the 'Little God' (Diosito) of food, and to the Urkupiña Virgin by pouring a small amount of *chicha* on the soil. In song and dance they express their appreciation to *Pachamama* or Mother Earth. The celebration takes place in the only church in the village. Masses are held around noon followed by a procession around the plaza.

It is not known how the 'Seventh Friday Fair' originated. According to farmers themselves and older people of the villages, it may date back to the time before the Incas.

The fair in Sipe-Sipe provides farmers with an opportunity to recreate their 'economic' logic as part of a worldview in which spiritual, social and material aspects of life interact and where the security sought goes beyond ensuring physical and economic access to food.

Inter-ecological journeys

The farmers form Japo, a village on the highlands of Tapacarí, practice reciprocity with several communities in the valleys of Morochata in neighbouring Ayopaya province. Exchange in the form of *cambiacuy* or *trueque* can take place through inter-ecological journeys. These journeys are marked and accompanied by rituals and festivities during the months of July and August when the harvest is over.

The women farmers from the highlands produce a cheese called 'Valle Tika' intended for *cambiacuy* or *trueque*. The women prepare this dried cheese from sheep milk during the rainy season (January and February) and it is stored until July and August.

Fifteen years ago this journey was made on foot with a herd of llamas (beasts of burden used in the Andes) and took three to four days. Today, the women travel by truck and the journey to Japo takes about five hours. Once they arrive at a valley community, the large group separates into smaller groups. Visits are then made to different farming villages where their relatives, compadres or friends live. Each small family group will lodge for 4 to 10 days at the home of friends until their cheese supplies are gone. In some cases they will stay longer if they have arranged to carry out construction work for the valley farmers or to help with farm work. Sometimes there is a kind of 'agreement' between a puna community and valley community. For instance, it has been noticed that farmers bring clay and tools to make hand-crafted pots and plates which are exchanged for maize with the valley community.

Sharing the benefits

From the moment they arrive in the community, there is mutual flattery and friendly treatment and presents are exchanged. The highland farmers take *kañahua* (Andean grain similar to quinua), or *chuño* (dehydrated potato) to give to the valley farmers because these are highly valued products and not available at local fairs and markets. Valley farmers offer the visitors a large plate of cooked maize, called *mote* accompanied by egg and some spicy salad which is enough to support them for the day. This means they do not need to prepare food and so they can spend their time visiting homes to exchange cheese for maize. Normally, the highlanders bring with them between 40 and 150 cheeses, 2 to 5 *arrobas* (25 pounds) of *chuño*, sheep skins, and sometimes *charque* (dried meat) for sale or barter. In years when the maize harvest is good, the valley farmers feel committed to give more; in bad years they are able to give less. Two medium sized 'Valle Tika' cheeses or three small ones are exchanged for one *chimpu*, the exact amount depends on how good the seasons yield has been. Sometimes highland farmers will take *chuño* to sell or exchange for maize or exchange sheep skins for hens.

Farmers return to the highlands by truck and generally they carry a larger load than when they arrived. The maize they have obtained is distributed in small quantities to those relatives who for some reason were unable to travel. This helps them to secure a balanced diet for the coming year and ensures material, social and cultural reproduction.

Conclusion

According to macro-economic indicators, Tapacarí, Ayopaya and Quillacollo are poor provinces. The use of money is limited and complementary. However, as we have seen, reciprocity is the basic economic principle among Andean farmers. The market economy only complements the indigenous economic principles to improve quality of life.

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Photo: Agruco

'Cambiacuy' between relatives, tubers for maize.

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Photo: R Prakash

Marketing produce through self help groups

R. Prakash and S. Motilal Nehru

Kerala, the southern most state of India has a wide variety of plantation and food crops. In order to develop the horticultural sector, the Kerala Horticulture Development Programme (KHDP) was set up in 1993. It is a co-operation between the European Union and the Government of Kerala. The programme aims at enhancing and sustaining the income of participating farmers through organic farming practices and appropriate marketing of vegetables, banana, pineapple and mango.

The essence of the programme is building up self help groups. Local communities will be strengthened through the self help groups, which will facilitate the development of group organisational and management skills. The programme adopts an integrated approach involving activities encompassing all phases of horticultural production, produce handling and marketing and it operates in selected geographic locations in the State of Kerala.

Self help groups

All programme activities are converged into voluntary neighbourhood self help groups of about 20 participating farmers. Each self help group selects Master Farmers who will be trained and will take up a lead role and will act as facilitators. This system aims at providing sustainability to the development process and ensures greater farmer participation. The farmers are selected and inducted to the programme-based self help group system on clearly set criteria.

The programmes have introduced a unique concept of promoting master farmers to take up functional leadership in production, marketing and credit related activities in each self help group. Farmers are provided with training in crop production technology, produce handling and enterprise management. Training programmes are organised based on need identification and using relevant training modules. The programmes have introduced a new methodology of appropriate technology through Participatory Technology Development. Farmer experimenters conduct on-farm experiments for developing better technologies and for adapting existing technologies which will combine latest scientific knowledge in the field with the practical wisdom of the farming community.

The programme promotes pest and disease surveillance in the project areas to provide timely warning and forecasting of possible out breaks of pest and diseases in the fields with the objective of reducing the indiscriminate and over-use of pesticides by farmers.

Credit linked production system

KHDP has introduced a unique credit system for lease land farmers who formerly had no access to credit. The credit support to the farmers is designed to provide money in time and in adequate amounts in a fast, easy and cost effective way. The credit delivery arrangement has been formalised through a memorandum of understanding with four selected public sector bans with details of specific responsibilities. The credit delivery process has been streamlined, with the master farmer in each self help group. acting as a key person and with close co-operation between extension staff and bank officers. Credit planning is at the self help group level. The scale of finance is based on realistic estimates on cost of production. A new credit culture is being evolved through the self help group structure where repayment rates are above 90%. A credit linked crop insurance scheme has been introduced by KHDP for all banana growing farmers. Their crops are automatically insured against damage or losses caused by pest and diseases. This scheme is farmer friendly.

Focus on marketing

The major problem facing farmers is the marketing of their produce. The programme is extending not only horticultural crop production but also the processing and marketing of their products through a well-planned and better-managed horticulture enterprise. The shift is from ‘what it is possible to produce: to producing what is marketable’. This change demands better understanding of the markets and the changing consumer needs. Through group marketing, farmers are able to fetch fair and reasonable price.

Procedure

Marketing infrastructures at site level have been set up. This includes establishing field centres for bulking the produce from 10 to 15 self help groups. The concept of field centres is to create farmers’ markets where commission agents and wholesalers come together to buy produce. Farmers receive the latest market information from the programme, which improves their marketing power. Field centres are developed through a bottom-up approach. The group marketing efforts of self help groups will be combined through a field centre when the volume of bulking justifies the establishing of such a centre. The field centre operations are managed by a committee of master farmers from the participating self-help groups.

The self help groups proved to be very effective and boosted the confidence of the farmers who are able to fetch a fair price for their produce.

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Explore local potential to begin marketing

G.K. Upawansa

A country such as Sri Lanka, with several agroclimatic or ecological zones, is able to produce a rich assortment of agricultural products. It has a mountainous centre and seasonal monsoons that govern rainfall rhythm and soil characteristics. Each season starts with a little rain at the beginning in the form of the rainfall pattern of inter monsoonal rain and reaches a peak before it fades off into a small drought. The crops grown and cropping patterns are determined by the rainfall pattern and sometimes the windfall pattern of an ecological zone. In the mountainous areas exotic crops such as pears, apples, potatoes, beet, carrot, and cabbages, are grown. At lower elevations all tropical crops, and spices are cultivated.

Capitalising on demand

Such conditions allow a wide variety of crops to be grown at different times of the year. At times markets are flooded with particular commodities and prices are below the cost of production. There are no cold storage facilities or processing to even out gluts and shortages. Poor packaging causes heavy post harvest loss, transport costs remain constant and, of course, wholesalers keep their normal profit margin even when prices for the farmer are low. Marketing and transport has evolved to complement existing production and consumption patterns.

Studies carried out in Sri Lanka show that over 90% of vegetables and grains contain poisonous agro-chemical residues and are unsuitable for consumption. In fact, some traders pay extra to get products sprayed to improve their keeping quality. Many consumers, particularly in big cities, are concerned about this and there is a demand for organic and ecological products.

Capitalising on this demand, unscrupulous traders offer insect-damaged commodities as organic or ecological products as there is no certifying system. But even if a certifying system is in place, abuses cannot be ruled out. Further certifying is costly and difficult because of very small farm size and certified products would become too expensive for ordinary consumers. However, there are also organisations promoting organic and ecological farming and producing and selling for almost the same price as conventionally produced commodities. Eco conservation (ECO) is one such organisation.

Preconditions not yet fulfilled

There is a demand for ecological products in cities. However, producers in rural areas cannot get a reasonable price for ecologically grown commodities. This is mainly because of transport costs and the scattered nature of production. In order to run an eco-shop continuously in a city, the following three conditions have to be fulfilled.There must be a regular supply irrespective of climatic rhythm; there must be a variety of products and the quantity must be sufficient to meet demand.

Presently none of these conditions can be realised. But ecological farming is indispensable for several reasons, namely, to rehabilitate devastated farm land, reduce the cost of production, improve ecosystem and environment, sustain sufficiently high yields and to produce poison-free food items. Unless marketing is assured it is difficult to promote ecological farming. Hence organisations individually and collectively attempt to find solutions and ways of marketing.

Current experiences

Palm foundation, a Dutch NGO, implements an organic farming programme in rural villages. It collects produce once a week and brings them to the eco-shop in Nuwara-eliya, the hill city. If there is a surplus, they send this to Colombo. Transport is provided by Palm. Prices paid to producers are higher than for conventionally produced items. Gami Seva Sevana, another NGO with farmers in neighbouring villages, produces vegetables organically. It collects produce once a week and prepares parcels containing a mixture of seasonal vegetables. These parcels are deliver to their regular customers and some are sold in their shop. Transport is provided by Gami Seva Sevana but costs are recovered.

Local demand explored

ECO observed that even in vegetable growing area, the conventional producers avoid agro-chemicals on products for home consumption. Some tended to buy vegetables from eco-farmers. Therefore, ECO began a programme of educating consumers to help them identify eco products using their senses and to let them see for themselves that the colour, smell, and touch of fresh and cooked Eco products are different from conventionally produced vegetables and fruits. Eco producers also started selling their products at their own farms.

What eco-farmers in Kurunagala cannot dispose of at the farm gate they send once a week to the village fair. They nominate one or more willing farmers to collect excess produce and pay them for transporting it. At the village fair, fruits and vegetables are sold at the same price as other products and they sell quickly. Demand has increased over time and a reliable clientele has gradually been built up.

In all cases what is produced is sold and supply often falls short of demand. This is particularly important during gluts. As there is direct contact between producers and consumers no profit is taken by middle men and transporters. Producers get a reasonably high price and consumer get better quality.

In this way, after organic agriculture has been developed in different ecological zones on the basis of an assessment of local demand, it will become easier to fulfil the preconditions for marketing at national level. Lanka Organic Agriculture Movement (LOAM) are working towards introducing a certifying system to support this process.

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Photo: GK Upawansa

Farmers started selling their eco-products from their own farms.

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Marketing organic vegetables
a balancing act

photo: Coen Reijntjes

Mans Lanting

and Dilip Chinnakonda

AME's foray into organic methods of vegetable cultivation was triggered off by discussions on recycling organic waste in the city of Bangalore in south India. We came in contact with ACTS Ministries, an NGO composting biodegradable refuse with farm land at their disposal. Consumers' Collective (CoCo), a micro level collective marketing organic produce, had already approached AME to see if it was possible to get a supply of organic vegetables for its member-consumers. The situation seemed almost 'ideal'. There were partners interested in and with the capacity to produce and purchase organic vegetables.

Statistics for farming in these areas show that 50% of all pesticides used went into 5% of the area under cotton cultivation and another 30% of pesticide usage was accounted for by vegetables grown on 10% of the area. Hence, it was an attractive proposition for AME to explore the possibility of organic vegetable cultivation and marketing.

AME's objectives
AME objectives were to systematically develop technical knowledge on organic vegetable cultivation through field experimentation, to demonstrate a 'model' of recycling organic waste from a particular zone in the city, and to develop viable producer and consumer linkages in one part of the city. Our effort started from the demand side. A consumer survey of members of CoCo conducted in 1996 provided the basis for a production plan. It indicated that consumers required small quantities of about 12 vegetables throughout the year. These were needed on a regular and rotational basis, which meant staggered production on very small plots.

ACTS was expected to assume the following roles: production, marketing and extension. Production was to take place on their farm. Marketing would be done with their own transport, and involved the same families who provided organic waste. Extension of the project to farmers in the neighbouring villages would be the task of their staff. AME had agreed to provide technical guidance.

Unexpected turns!
Management problems at ACTS Farm, complicated by our inexperience in projecting yields and envisaging crop losses, resulted in irregular supplies of vegetables and financial losses to ACTS. Eventually, ACTS backed out as losses mounted. Initially CoCo had agreed to take the produce but due to irregular production and lack of transport, a number of other problems emerged. AME had to provide transport; CoCo could not absorb the imbalanced (extra) supplies and AME had to market the excess produce and foot the bill for the leftovers. Finally, extension also caused problems as staff from ACTS were unavailable because they had other committments. This meant that AME had to guide the farmers.

While the pilot experiments were underway in ACTS Farm, the process of dialogue to motivate farmers from the nearby villages began. Though sceptical initially, the notion of small plots and staggered planting of a variety of vegetables for a continuous and steady yields of vegetables gained acceptance after a series of meetings and exposure visits. Group size increased to ten and supplies grew.

AME encouraged a link between a school and CoCo for bulk sales. But the vacation periods of the school tended to coincide with peak production periods and upset the supply-demand equilibrium. The inclusion of ICRA, another NGO marketing organic products, as a bulk purchaser and more individual customers created a better demand.

Supplies

Difficulties were also experienced in ensuring farmers kept up a regular supply of quality vegetables. Imbalances in production occurred due to the tendency of farmers to alter production schedules by replacing long duration crops with quick return short duration crops. Production was also affected by such factors as adverse weather conditions. Today, each plot is cultivated three times a year and each harvest yields an average of 1.75 kg/m^2 (of any vegetable). About 5.25 kg/m^2 of vegetables can be harvested annually. It has been estimated that one family in Bangalore requires approximately 5 kg of assorted vegetables every week. Annual demand per family is 260 kg. This means that 50 m^2 is needed to meet one families annual vegetable requirements.

The average price for any vegetable is Rs.10 per kg. This allows a margin of 10% for the retailer, of which about 5% is absorbed by weighing and other losses. The actual profit margin is therefore about 5% or Rs.0.50 per kg. Rentals and other overheads for a store could easily be about Rs.1500 per month. So, a retailer has to sell at least 3000 kg of vegetables per month (660 kg/week) to 130 customers to break even on fixed cost. Transport has not been taken into account. The weekly harvesting should be 660 kg giving 1.75 kg/m^2 and an area of approximately 350 m^2 under production. In real terms though, a retailer should be able to service at least 260 customers with 1200 kg of vegetables every week, to run an outlet profitably. If transport has to be optimised and then a minimum of 2500 kg is necessary for the smallest lorry load. For the sake of freshness, 5000 kg have to be supplied twice a week. So weekly, a 1000 customers will be required for the shop to be economically viable.

Planning production according to season is at the heart of maintaining a year round supply of vegetables this includes crop rotation schedules, irrigation requirement and labour availability. Practically, this entails the creation and management of blocks containing small plots, to accommodate both staggered planting and crop rotation. Initially, each farmer offered 0.25 acres, which was divided into four blocks with twelve plots in each. The current cultivation practices emphasise low external inputs, soil fertility management through the application of compost/FYM, efficient methods of irrigation, trap cropping, companion planting, crop diversity and appropriate land preparation i.e. raised beds and Trichoderma mixed with the soil, for effective pest and disease management.

photo: Coen Reijntjes

Harvesting of organic vegetables

See-sawing supply and demand can be explained by drops in vegetable supplies due to uncertainties of weather, pests, and seasonality, or because only a few farmers cultivate vegetables. Consumer interest may be affected and decline leaving very few clients, a problem if supplies then increase. When the area is small, the slightest change can trigger off problems of over- or under-production. The balancing act is a delicate one since vegetables are perishable. AME spent Rs.1,00,000/- (US$ 2500) for a year to support marketing. This was mainly absorbed by subsidising unsold produce.

Marketing issues

By May 1998, the production level had reached 1200 kg per week, requiring around 260 clients. It was at this juncture that marketing operations received another jolt with the closure of CoCo. We realised then that organisations such as CoCo and ICRA had virtually no risk bearing capacity. Besides, modest numbers of consumers put a limit to the quantity of vegetables these alternative outlets could absorb. This was the factor that had constrained CoCo from being able to generate enough money for its staff. So, even though AME had supported the shop manager's salary for a year, CoCo could not enhance its turnover during this period and it became unviable. ICRA, meanwhile, continues to attract consumers and AME is handling the major aspects of the marketing.

Consumers have expectations; they insist on high quality produce and variety. If the quality dips even marginally, they are unwilling to pay market prices. The 'bag system' was not very appealing, since clients want the content to change every week. In effect, our initial notion that high income earners would be inclined to buy '-healthy' vegetables at marked up prices went bust!

The quality demands of the consumers compelled AME to apply fairly stringent monitoring of quality and variety at farmer level. Any produce not meeting the required minimum standards were being sent back. We noticed that small-scale farmers backed out because they had difficulty in maintaining quality standards.The decline in the number of farmers from 10 to six hampered formation of a self help group, a credit management organisation of the farmers which is necessary if collective marketing is to becomes a reality.

From our experiences we have learned that small farmers cannot easily absorb novelties and uncertainties. We have to turn to medium farmers who have adequate financial resources, water and enough household labour to sustain intensive organic vegetable cultivation. The project now faces a dilemma! Those farmers still involved are keen to expand the acreage under vegetable cultivation since this makes management easier. But AME is hesitant, because creating an expanded market has its own dynamics - it means a phenomenal effort to identify and motivate about 400 additional clients. We hope to rope in commercial retailers with risk-taking capacity to take over marketing.

The project is poised for a 'quantum leap'. It implies that AME is likely to have less control over quality aspects and variety. But market realities mean some modifications are necessary. We now realise that it is necessary to go a step further and explore avenues for formal certification and we intend to initiate this with an accredited certifying agency and the conveners of CoCo and ICRA

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Creating a green market

Experiences from Green Net–Thailand

Vitoon Panyakul

During the last few years the organic market in Thailand has been booming and the number of green shops has increased from zero in 1992 to around 40 shops in 1997. In the long-term the national market looks quite promising. There is an increased awareness of the health and environmental issues involved in organic food consumption. Due to the macro-economic recession, consumers have had to cut down on 'luxury products' which has affected some categories of organic food and environmental products. However, increasing number of people have become health conscious and are spending more on health food. Because of the economic slump many are tending to cook and eat more at home. This has increased the amount they spend on basic food items, such as rice, vegetables, fruits.

The organic market in Thailand is a new market and there are still only a few operators in the business. A much larger market is waiting to be tapped. At the moment there is little competition among the operators and most of them can co-operate at some level. Present competition centres on product availability, assortment, and product information. In the future this may shift towards product quality and services.

Most sales take place through green shops and green corners in conventional shops. In green shops there is a personal relationship between customers and sale staffs and this is an advantage particularly when it comes to promoting new products. In conventional stores there is little communication with consumers but this type of store is better located and more accessible. A smaller volume of sales passes through regular lunch-time stalls in office buildings and through membership/home-delivery systems. These services make it possible to keep in touch with consumers and their reactions can be passed on to producers thus helping improve product quality.

Outside the domestic market, the Thai-European Fair Trade partnership on jasmine rice has shifting its focus to organic rice. Around 10-20% of a total 150 tons of rice is now inspected by Swiss-based inspectors and certified according to EC regulation. Apart from jasmine rice, the European groups have also become interested in indigenous rice varieties, non-GMO-organic soya oil, and dried fruits.

Improvements are needed

It is clear that to unlock the potential market, we need to improve product quality and quantity. First, most products are only available seasonally: at certain period there is too much and at others not enough to satisfy demand. Continuity must be guaranteed so that marketing can be planned and some degree of reliability is necessary. Second, many products are of low quality and are rejected by the A class consumers who are the largest group purchasing organic product at the moment. Third, product quality is not consistent. In one delivery the product will be good but in the next it will be unacceptable. Fourth, product assortment is limited. There is considerable scope for new product development, especially for processed food items.

Labelling to avoid confusion

Some mainstream traders have launched 'hygienic products' (conventional products contaminated with agro-chemicals at a level which is considered safe) with the support of the Ministry of Agriculture. Many consumers are misled into believing that these products are genuine organic products only to realise later that this is not the case. This confusion may have negative implications for organic trade. The Alternative Agriculture Network together with consumer organisations and concerned groups have initiated a national certification programme known as Organic Agriculture Certification Thailand (ACT). Operating as an independent inspection and certification agency, ACT could provide organic labels for organic food produced according to ACT Basic Standard. More than 100 farmers have been certified by ACT since 1997. The organic ACT-certified products label will become available at the end of 1998. However, due to lack of international recognition, the ACT label cannot yet be offered to organic exports. ACT is, in the process of building up competency with the aim of applying for IFOAM accreditation in the near future.

Fresh products

Most organic producers focus on rice production. There are also a small number of vegetable and fruit growers. Field crops are also expanding quite fast. However, there are very few organic chicken farms and there is no organic livestock production.

Following the collapse of the bubble economy, it seems that there is a growing interest among some farmers and the urban middle class to return to the land. Both Green Net and ACT as well as other NGOs in the Alternative Agriculture Network have received many enquires regarding organic farming techniques and marketing prospects. Green Net, in co-operation with Technology for Rural Ecology and Enrichment (TREE), has organised some workshop. However, due to lack of technical capacity, only basic courses can be offered. The Thai organic movement would find it very useful if there was an international exchange of technical knowledge and training curricula as well as more published materials. These could form the basis for a more comprehensive training programme and provide practical information for those interested in knowing more about organic farming.

Processed products

Food processing is strategically important for the development of organic agriculture and alternative marketing. Organic food processing adds value to raw materials, prolongs their shelf life, leads to an increase in product assortment, provides additional income for women producers and builds

Organic Market Survey

In October 1997, Green Net conducted a consumer survey in Bangkok which showed that of the green consumers currently visiting organic shops. 84% were women and 66% of them were between 21 and 40 years of age. 60% were single and 53% had had tertiary education. Their occupations varied from civil servants, to private company employees and academics. 37% has a monthly income of between 10,000 and 20,000 baht while 34% has less than 10,000 baht. 29% has more than 20,000 baht to spend each month. The average middle-class income would be around 10,000-30,000 baht per month. 43% of the respondents had been consuming organic food for more than 3 years and 27% for 1-2 years. Most of the green consumers were quite conscious of health and environmental issues.

Enquires into green consumers' interest in organic products showed that 97% claimed to be most interested in information about the product itself, while 94% wanted to know about product hygienic and 82% felt it was important to know the address of producers or distributors.

With regard to prices, 58% of consumers felt that present price levels for organic food were too high while 55% found them appropriate. Those respondents who said they were not regular consumers of organic food said this was because only a very few varieties of organic vegetables were available, they often did not cook at home, prices were too high, or Green Net shops were not within easy reach.

up grassroots community enterprises. It can also lead to developing new ways of processing perishable fresh products thus increasing the profitability of marketing operation and can create opportunities for foreign-exchange earnings

At present, local producers only use simple processing technologies such as sun drying, heating, jamming and pickling. There seems to be a large market for processed products but quality must be improved. The Alternative Marketing Network, a network of NGOs working on fair-trade of organic products, decided to focus its development efforts on 13 selected assortments with good market prospects. These products are strawberry jam, dried logan, sesame oil, soya sauce, sesame snacks, palm sugar, shrimp paste, canned water chestnut, local herb tea, dried chilli, wild honey and rice.

Food-Processing by Communities

Many factors have to be considered in setting up a processing unit. These include the issue of the quantity of the raw materials. Quality must be suitable for processing and the price of the raw material must not be so high that it endangers the competitiveness of the end product. Community enterprise needs to be based on sound financial and business plans. Financial investment has always been a stumble block in community enterprise. Local producers often have little capital to invest in such projects. At the same time, very few financial organisations are willing to lend money to local initiatives without some physical quarantees. Given the recent financial crisis, it is highly unlikely that local communities would be able to obtain a loan from private commercial firms or government agencies. Communities, therefore, depend on ethical or green finance from both local and international sources. It may, therefore, be wise simply to contract processing out to local factories.

The technical problems of food-processing and packing can be a little complicated. However, there are several universities and research institutes willing to support a community-based food processing programme. Management is also a critical factor in the success or failure of a project. Major areas to be considered are processing, personnel, finance and marketing. Processing management refers to controlling processing and ensuring that it takes place in accordance with defined objectives and standards. This means technical knowledge and skills, something that local staff and producers often lack. Also personnel, financial and marketing management need to be strengthened as they are often not part of the common culture of local communities.

Consumer campaign

Despite growing consumer awareness, many consumers continue to insist on a 'consumerist' approach to food consumption. They often demand that organic fruits and vegetables should look nice, be as cheap as conventional products (if not cheaper), and even that they be available the whole year round. Such demands are not compatible with the natural way of organic farming which emphasises diversity and seasonality.

Organic products must be traded fairly so that farmers can earn a decent income from a financially viable operation. Consumer education and life-style change are therefore crucial to the success of organic agriculture. Recently, Green Net has launched a 'green consumer' campaign to encourage health-conscious consumers to act in a more socially responsible manner.

Conclusion

Unlike other markets, an organic market is not born naturally. It is not advisable to wait for conventional market forces to organise the organic market. From Thai experiences, an organic market requires conscious actions and comprehensive efforts to foster its development. Wholesale distributor, retail outlets, production extension, food-processing community enterprises, certification, and consumer education are among the principal pillars of the organic market. These must be developed simultaneously so that each reinforces the other and no element becomes a bottle-neck. National co-operation is certainly required to synergise efforts and avoid duplication and competition. This means that all those concerned whether consumer groups, NGOs, or farmer organisation must develop a strong political will.

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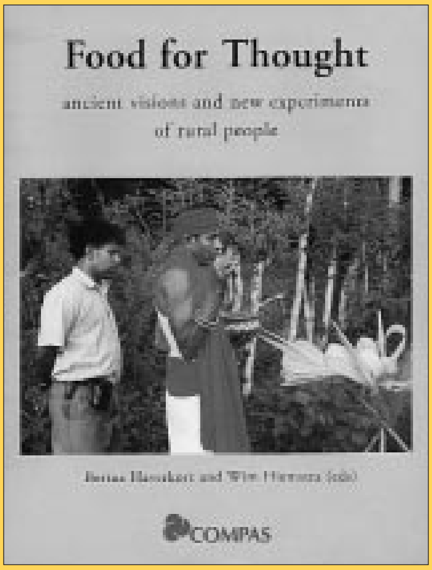

Food for Thought presents new insights into the knowledge of rural people. In many societies, good harvests and good health can only be obtained if the laws of nature, community regulations and rules set by the spiritual beings are properly followed. This book hopes to stimulate development agencies to take indigenous knowledge seriously. Based on the experiences and insights of some 15 organizations in ten countries, it goes beyond the technical knowledge embodied in traditional farming, land use and health practices. The book deals with ancient worldviews or cosmovisions and the role of traditional leaders. It draws conclusions about the holistic nature, strengths and also limitations of this knowledge and describes how in various countries in Asia, Africa, Latin America and Europe some development agencies are supporting rural people in carrying out practical experiments based on local concepts. A framework for such on-farm experiments and ideas for a methodology for supporting endogenous development are presented.

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Regional typical food production is a promising option for marginal rural areas. Experiences from Italy show that where production per hectare is low, prices per kilogram can be high. Value is added to these products primarily during processing and marketing. However, there are obstacles to introducing regional-typical food production and these problems are often organisational not technical.

photo: H. van der Meulen

Regional typical food production

the value-added scenario

Hielke S. van der Meulen

Umbria is known as the *The Green Heart* of Central Italy. Predominantly rural, with a low average population density, its farmers produce a large number of typical food products. These include *Lenticchie di Castelluccio* (lentils), *Casciotta di Norcia* (cheese), *Patate Rosse di Colfiorito* (potatoes), *Olio di Spoleto* (olive oil), *Sedano di Trevi* (celery), *Tartuffo Nero della Valnerina* and *Tartuffo Biancho di Umbertide* (black and white truffles), *Miele di Gubbio* (honey), *Farro di Monteleone di Spoleto* (spelt), *Sagrantino di Montefalco* and *Orvieto Classico* (wines). This article discusses the marketing of two of these products: lentils and spelt.

Castelluccio lentils

Castelluccio di Norcia is a small town high in the Apennine mountains. The surrounding plain (1300 meters) is surprisingly barren and is generally used as sheep pasture. Rye, fodder and lentils are cultivated on the low-lying peaty land where acid soils yield small quantities of tiny, but tasty lentils (*Lens culinaris*). The volcanic soil of Monte Vettore could produce three times the volume of lentils per hectare, but these do not cook well and have a 'muddy' taste. In recent years the *Piano Grande di Castelluccio*, has become a major summer tourist attraction. At the end of August the lentil crop is harvested and threshed. Old wooden combines stand scattered over the fields and people travel great distances to buy lentils directly from the farmers. They prefer to buy uncleaned lentils mixed with small stones and straw to avoid being cheated. Genuine Castelluccio lentils sold in shops carry a hall mark as a guarantee.

Castelluccio lentils cost about US$8 per kilo off-farm and US$10 in the food store, more than twice the price of ordinary lentils. Tourism has stimulated price and helped spread their reputation throughout Italy. Farmers of the Colfiorito Plain (800 meters) are trying to copy the Castelluccio's success but have run into problems. Their product is less palatable, tourism is less, and Colfiorito is traditionally well-known for red potatoes and chick peas (*Cicer arietinum*) not lentils. Images are hard to change!

Monteleone farro

Farro di Monteleone di Spoleto is similar to *Lenticchie di Castelluccio* in product type, scale of production and image. But processing techniques, packaging and marketing strategy have played an important role in its success. It is, however, not a village product. It is a region-typical product launched by one family.

Farro (*Triticum dicoccum*) is an ancient cereal and has been a staple food for 2000 years. It is still grown in mountain regions throughout the Mediterranean. It is highly resistant to pests, drought, cold and poor soils and is therefore an excellent crop for organic farming. Chemical fertilisers and rich soils have an adverse effect on productivity. This is particularly true for *Triticum Dicoccum Durum*, a variety cultivated on the high plain of Monteleone di Spoleto. After ploughing and sowing in October, no further weeding or care is needed until it is harvested in August. Only sheep manure is added to the crop and sheep breeders receive straw in exchange for mature sheep dung. Yields average 1500 kilogram per hectare. In Monteleone di Spoleto the classical rotation is one year farro, one year barley and three years lucerne/grass meadow. According to local farmers the most appropriate soil has 'iron in it'. It gets as hard as steel and red as rust when dry.

Farro is used as sheep fodder but in difficult times farmers eat it as well. Traditionally, broken grains were added to a vegetable soup or *minestra*. Its special quality is that it does not get too soft when cooked. Threshing farro is a laborious process because there is a double chaff and it is difficult to break the grain. Most of the women in Monteleone abandoned *farro da minestra* after the Second World War. However, Giuliana Cicchetti began to trade her farro to families in the village in order to pay her children's school fees. When work became too heavy, she asked her husband to invent something to help her. During the 1980s Renato Cicchetti built an eight-stage processing plant from various machine parts. Today this home-industry provides a living for three families.

The Cicchetti's have four grades for their products: whole grains, 'minestra', flour and popped farro. The products are all packed in air-tight packets weighing 500 gram. The pack carries information about the origin and special qualities of Monteleone farro and suggests recipes for soups and pastry. Ciccetti's two sons deal with marketing. They visit every shop in the area and present their products at food fairs. Cicchetti's *Farro d'Oro* (golden farro) is now sold in food stores and delicatessen shops throughout Central Italy. The Ciccetti family control each link in the production chain. They add the value and they keep it.

As demand for Monteleone farro grew, the Cicchetti's began to borrow land from families who had left the village for Rome and from retired farmers. Other farmers in the neighbourhood tried to profit from

Lentil straw is turned using traditional wooden machinery.

growing, processing and selling farro but they have not been able to reach the same standard of processing and marketing. If the farmers of Monteleone were able to agree on common production regulations and a definition of their farro products, instead of competing over price and product innovation, an entire economy and culture could be constructed. Such an economy would make it possible to preserve the liveability and landscape of this beautiful area.

Tradition: a unique selling point

Lenticchie di Castelluccio and *Farro di Monteleone di Spoleto* are successful because they draw upon relatively exclusive traditions. These relate to two aspects of local culture: agri-culture and eating culture. Monteleone farro is processed according to traditional techniques which are difficult to imitate and account for a large proportion of the added value. In the case of Castelluccio lentils, soil and micro-climate are important elements that provide extra value.

It can be argued that in Castelluccio even the soil is the result of tradition. Years of cultivation has turned the swampy valley bottom into arable land with unique properties.

Tradition has value on the market. Industries gladly abuse it and farmers often ignore it. This does not mean that new products cannot establish a name as regional specialities. Every tradition must start somewhere and tradition is practically the only selling point that cannot be reproduced. It is unique.

Marketing

However rich the tradition and unique and difficult to reproduce the product, the success of a regional typical food product ultimately depends on the marketing efforts of producers and traders. It is important to market a regional typical food in the context of the area of origin and retain the association with local and unique culture and landscape. The product should not come from one entrepreneur but from several farmers. This makes the product more authentic and credible to the consumer. The harvesting of Castelluccio lentils during the August tourist season is a perfect example of how a region can be successfully sold. Producers in an area with clear-cut boundaries, with characteristics that can be easily visualised and with a name of their own, have a strong marketing advantage.

Another important factor in promoting a product is the package. The commercial success of the Monteleone farro produced by the Cicchetti family is largely the result of the delicatessen image of the packaging and the clear written text that informs the consumer about its origin, characteristics and how it should be prepared. Farro is sealed in a solid vacuum pack. This reduces the risk of decay and makes food store owners more willing to experiment. The Cicchetti's wanted to sell their farro products at a relatively high price and give the retailers a fair margin. In Italy, the delicatessen approach to food marketing attracts better prices than approaches that centres on the rustic, organic or environment-friendly. Italian farmers are very capable of 'radiating' high-quality images and convincing buyers by demonstrations of passion and good taste. Another critical factor, at least in the initial phase of entering the market, is direct contact between producers, consumers and retailers. This enables producers to get the extra price they need to cover higher production costs. It also provides them with feed-back and helps them improve their product or presentation. Personal contacts with buyers must be seen as an investment in future sale.

A final important factor in the marketing of regional typical food products is certification. The first step is for local producers to agree on common regulations. The resulting label will usually be based on self-certification. The next step will be the application for the national Italian DOC-label or its European equivalent the PDO (Protected Designation of Origin). The growing use of hall-marks shows that regional typical food production is becoming a social construction that needs to be protected against the quick flows of information and investment capital in modern society. It is far from being a 'natural' product of geo-physical conditions and local tradition. Farmers and processors often feel pressed to adopt technological innovation. In general, the more courage producers show in restricting themselves, the greater the success of their regional typical product.

Low external input agriculture?

Though regional typical food production is low-external-input in nature, it is characterised not so much by the reduction of costs, inputs or energy but by the value added to each unit of product. This goes far beyond the adjustments involved in simple commodity production. Since it involves processing, packing and marketing, the benefits of regional typical food production filter from the farming community into the wider economy.

The creation of added value linked to a particular region tends to make the sale of food products more sustainable. Without sustainable sale, sustainable agriculture seems impossible as low prices and an insecure market easily leads to the exploitation of the soil.

Third World countries certainly have considerable potential when it comes to developing regional typical food production. Gradually some of the products have found their way through the same trading networks used for durable consumer goods. The major problems will arise from the 'social construction of quality'. This means the organisation of production and processing according to a set of more or less strict common rules and the limitation of production volume in order to maintain scarcity on the market.

The personal primary needs of poor peasants should be fulfilled. However, we should bear in mind that in Europe, many high-priced regional typical foodstuffs were part of a poor man's diet until very recently. Regionally typical food production strategy is, by definition, restricted to specific regions and specific groups of producers who can distinguish themselves from the 'rest'. It is not an alternative to political measures to tackle the structural problems of poor and 'backward' areas.

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photo: H. van der Meulen

Sale of lentils to tourists.

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Sustainable agriculture needs sustainable markets

'I like your talk about saving the environment... But what is in it for me? (a realistic Kenyan smallholder farmer)'

Jos van Oostrum

Many farmers in situations of radical change and uncertainty trying to conform to 'best practice for sustainability' are asking the same question. How to combine making a living with conserving their resource base. Kenyan smallholders got together with the Association for Better Land Husbandry (ABLH) in 1993 to develop a conservation for business' approach in which farmers' groups committed themselves to developing a business plan.

Since then remarkable progress has been made in promoting conservation farming practices. In 1992, few would have thought it possible that small farmers could increase their self-sufficiency in maize from 22% to 48% or that they could decrease the incidence of hunger in their communities by 33%. Sales of vegetables produced by farmers who have adopted the conservation for business approach have increased dramatically and their dependence on the market for their own vegetable supplies have declined equally significantly (Hamilton, 1997).

Working as a team, farmers and facilitators in four ABLH target areas in the districts of Busia, Kakamega, Kirinyaga and Vihiga managed to ensured a continuous supply of 24 fresh and 12 processed Conservation Supreme certified products to 14 different market outlets in Nairobi and Kisumu, over a period of 14 weeks.

Impact of conservation farming

ABLH and partner agencies aim to help rural people to overcome poverty by increasing their food production and generating income on the farm. The project follows a participatory approach. Farmers are helped to develop their skills, organise their activities and become credit worthy. They test the suitability of new practices and set-up farmer-to-farmer advisory and training services. A basic principal is that farmers can make economic progress without having to make large cash investments and practices requiring little or no cash inputs - a very important feature when dealing with poor farmers - have been introduced. Double digging of vegetable beds (a system of deep digging and incorporating compost into the soil) in home gardens, for example, has had a significant effect on small farmers' livelihoods. Combining water harvesting, recycling organic matter and introducing different types of vegetables has also proved successful and has been extended beyond the kitchen garden to the maize fields.

Linking farmers with markets

As conservation farming becomes more widely adopted, smallholder farmers have to sell their surplus farther away from home. Increasing demand from urban centres and international markets offer attractive opportunities but at present many farmers are exploited by traders and middlemen. In response, ABLH has set up the Smallholder Marketing and Certification Project (SMCP) which aims to promote fair trade, fair and stable prices and the opportunity for small farmers to trade directly with big buyers by marketing Conservation Supreme (CS) and organically certified products.

CS is similar to the Integrated Arable Farming (IAF) system that replaces chemical inputs of pesticides and minerals with mechanical and biological products and processes. It does not ban them entirely. IAF requires a considerable change in farming practices and the adoption of different environmentally friendly technologies. Farmers are advised to manage their farm as an ecosystem and they must observe, interpret and anticipate. The CS pilot project has been undertaken by SMCP and marked the start of a joint learning process, that formed the basis for certification procedures and standards to be developed on a larger scale. It also created consumer awareness.

Project aims

First, the project aimed to develop CS products in selected stores and extend the CS concept and standards for certifying and regulating crop production. Second, it aimed to show the potential of collective marketing of fresh and processed smallholder crops in accessing and maintaining stable and profitable market opportunities. Finally, it was concerned with developing low cost strategies for conservation-based food businesses capable of reducing poverty, improving rural people's livelihoods and boosting rural economies.

Conservation Supreme and organic standards offer quality assurance to the customer. Once an awareness about conservation products has been created, consumer demand can be establish and smallholder livelihoods and the environments in which products are produced can be improved. As farmers often find themselves in an uncertain and unfamiliar market situation, the aim of the CS project was involve them in marketing their products and increase their knowledge and confidence. The project guides farmers from producer organisation, to handling organisation to farmers' own marketing and distribution agencies. It facilitates group networking, bringing farmers together to share experiences and market collectively. Model food processing factories were set up and farmers were actively involved in production and training.

Maintaining a constant and sufficient supply of CS quality produce is a major challenge. The farmers involved in the first pilot project were rainfed. Farmers with access to irrigation water were later identified to ensure continuity of supply through the dry season. The integration of irrigation and rainfed farmers will require training, careful planning and a clear division of roles.

Transport is a determining factor in the profitability of any CS food business and transport costs must be reduced to the minimum. Smallholder groups should be spatial concentrated. In the project the groups decided to pay the farmer driver (vehicle was supplied by ABLH), and to contribute to networking costs (a 10% levy on fresh sales was agreed and paid by the farmers). This was re-invested in the project and farmers agreed to put aside 5% of revenue as group savings.

Product identity

CS produce acquired a distinct identity in the stores because farmers labeled and packaged them. The public reacted positively to the CS concept. However, price premiums could not be expected in the first trials and active lobbying will be necessary to explore opportunities in niche markets.

Farmers were able to trade directly with market outlets and avoid exploitation by brokers and middlemen at farm-gate level. They were exposed to real market situations, including timely deliveries, different modes of payment, and the negotiation of orders. They could also explore opportunities. The transfer of information between market outlets and the groups has been critical.

Group and business capacity building

The development of organisational and management capacity at farmer and facilitator level is as important as new technology in the conservation for business approach. Farmers in the project formalised their relations through networking by establishing Farmer Action Associations. Amongst other things they were training in production scheduling, grading, recording, and accounting and this greatly improved their knowledge, skills and self-confidence. Exchange visits were used to enhanced farmer to farmer learning and interaction, creating a 'develop ourselves attitude' as a first step towards empowerment.

The complexity of human interaction in practical approaches to rural development demands a balanced, step-by-step development of skills, capacity and confidence. Any scaling up of the CS programme next year must include a proper staff development programme and a significant increase in staff numbers.

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The concept of added value

Value adding is a concept that has been adopted by development agencies world-wide. However, this strategy sometimes involves setting-up sophisticated production processes in places where electricity supply is unstable and facilities for repairs are non-existent. The effect on consumer confidence of factors that disrupt supply is often disastrous. In this article the concept of value adding is explained in the context of developing countries. Several examples are given of the pitfalls of value adding strategies and some case studies are discussed.

The lessons to be drawn from examples of failure have a wide application as the following case studies show.

Senegal: A group of Senegalese women used to do very well selling dry fruit on Dakar's local, informal market. They decided to venture into the local tourist and supermarkets trade and their co-operative acquired an expensive sizing and packaging machine. However, the drying was of poor quality and did not appeal to the targeted middle class and tourist consumer. Meanwhile, the product had become too expensive for the traditional customers.

Kenya: in Kenya, a German NGO invested heavily in fruit drying projects involving hundreds of producers. However, no marketing plans were made. The NGO was obliged to buy the products itself and found it could not sell them.

Philipinnes: three coir (coconut fibre) processor co-operatives in Samar, the Philippines were supplied with processing plants by a Netherlands donor. However, because the co-operative members considered themselves workers, any attempts to involve them in improving the plant failed. They had no sense of ownership or responsibility for the new materials and infrastructures.

The basic idea

Such experiences are not uncommon. Many producers' groups, entrepreneurs, and NGOs attempt to add value to the product but instead of the expected profits, they make losses. As a product moves from raw material to end product, its value can increase. It is legitimate that small producers should strive to maximise the return on their product by processing it further. Without market surveys, appropriate technology and skills, however, there is a very real danger of failure. Market oriented value adding is directly related to what the customer is willing to pay. Market oriented solutions involve making the product as attractive as possible to customers by adjusting the appearance, quality, quantity, and the emotional value of a product and providing the right service or promoting the product in such a way that it reaches the target group. First, the potential consumer has to be defined and then producers can focus on what the customer wants. Knowing the market is to understand the potential value of the product. Without knowing the potential value of the product, it is difficult to use the right value adding strategies. Such strategies include adding emotional value (for example, the attractions of organic products to the customer); packaging and giving more attention to the promotion.

There is an overlap between production oriented and market oriented value adding. Production oriented value adding involves offering good quality products and thus lowering production costs as much as possible. Once a definition has been made of what can be expected from a product, a list of value adding extras can be defined. The clearest and easiest method of determining whether value can be added to a product is to go through the production cycle (see Box). Before reaching the customer the production cycle goes through the following stages: crop selection, planting, weeding, fertilising, pest control, harvesting, transport, storage, post harvest activities, and processing. At each stage choices can be made that may lower production costs and give additional value. Some choices can be implemented by the producer others require knowledge, labour, machines and money from outside sources.

Standardisation and preventing loss

Standardisation of the production process increases efficiency and leads to cost reduction and therefore profit maximisation. The lack of standardised production procedures, proper production process lay-out, clearly defined tasks and operation procedures for workers often result in low product quality, accidents and disastrous losses. The losses, wastes and financial costs resulting from low and variable quality of products in developing countries are high. Proper harvesting and processing techniques, together with adequate storage facilities can, for example, protect small holders from the rodents, insects and humidity that can destroy up to 25% of their stored product. (J.W.Clay, 1996).

Efforts to add value to a product should be carried out with caution. Interventions that seem an obvious way of increasing profits can easily lead to the opposite result. Marketing, the various stages in the production cycle, and the best way to structure production must all be carefully analysed in the context of costs and benefits. This is particularly important when working with small-scale producers who are extremely vulnerable to the consequences of poorly developed ideas.

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A feasibility study was conducted for the organic production of sunflower oil in the Bungoma district in Western Kenya at the request of the HOPE Community Development Programme. An analysis of HOPE's production cycle involved the following questions:

- Is using a different seed variety as profitable as it seems?
- How much more does it cost (work, money, time etc.) and what are the profits?
- Is it viable to offer cold pressed sunflower oil which has a better price on the market?
- How much extra would it cost and what are the extra returns?

This research resulted in a action plan for the next four years

The weakest go to the wall

Plans for an expensive and unreasonable control mechanism to monitor small farmers' co-operatives are in the pipe-line threatening the livelihoods of thousands.

Petra Heid

Organic produce is increasingly popular in Europe and a wide variety of products are available. All products are subject to inspection according to the guidelines of the current European regulation 2092/91. Under this system organic produce is deemed to comply with these standards if it can be proven that it has been subject to comparable guidelines and monitoring procedures. This makes it possible to monitor products originating in a wide variety of climatic conditions and agrarian structures. Monitoring small farmers (normally co-operatives) in Latin America, Africa and Asia, who are the main producers of organic coffee, for example, has proven to be an extremely arduous task. We are now trying to develop a practical and sophisticated monitoring procedure that is applicable to different farming structures and that meets stringent EU requirements for a 100% inspection rate and spot checks.

EU procedures

Over the years the various international certification organisations have each managed to develop such modified monitoring systems. These have been incorporated within the requirements of the IFOAM accreditation programme and have been accepted by the EU.

Several European member states are now questioning the reliability of these control mechanisms. France in particular is demanding a stricter spot check regime of small farmers' organisations. This would inevitably lead to higher inspection fees for these organisations. An even less acceptable consequence would be, however, that the improvement in quality envisaged by this measure might lead to exactly the opposite!

Ever increasing numbers of small farmers' co-operatives, especially in Latin America, have converted their production to conform with organic agriculture guidelines. A more sustainable approach to farming diminishing agricultural areas has brought farmers a more dependable and, in some cases, even richer harvests, which they can sell at higher prices on the international organic market. This has made a major contribution to improving the living standards of hitherto economically disadvantaged small farmers, and to strengthening their self-governing organisations.

Small farmers' groups wishing to sell their organic produce to European member states have to agree to be inspected at least once a year according to European regulation 2092/91. This involves experienced inspectors from monitoring organisations recognised by the EU making on-site inspections, interviewing the farmers and checking their records. On the basis of this information they decide whether the production, processing and marketing of the organically cultivated produce meets requirements. It is extremely difficult to inspect all the small farming units that make up a group. In large organisations, comprising hundreds or even thousands of small farmers from several villages scattered over an area of up to 10,000 square kilometres, it is absolutely impossible for an inspector to perform this task in a reasonable time and at reasonable expense.

Complementary control

Years ago, with the primary objective of solving this difficult problem, Naturland and other international certifiers guided by the IFOAM accreditation programme, IOAS, introduced a 'quality control system' (see Box) that would be a major component in the inspection procedures applied to small farmers' groups. The idea was to establish a framework for these organisations enabling them to establish and develop internal control mechanisms. Selected employees were trained in special courses and became qualified inspectors capable of assisting EU inspectors. This meant that the local inspectors were entrusted with the inspection of each small farmer's plot according to European regulation 2092/91, enabling EU recognised inspectors, on their annual visit, to concentrate on the processing and marketing of the organic produce and to determine whether the internal quality control system was operating satisfactorily.

A precondition for the establishment of such quality control systems is an enormous transfer of know-how from the certification organisation responsible to the small farmers' groups. This is the only way small farmers' groups can be educated step by step towards assuming some of the demanding tasks involved under EU requirements. This means, for example, developing standards within the small farmers' organisation which are equivalent in stringency to EU regulation but are worded in such a way that members can understand them. Furthermore reference is made to local conditions and to the organic cultivation of indigenous crops. A team of advisors must ensure that these internal standards are communicated to all small farmers wanting to join the organic programme. Locally trained inspectors will then check whether each of the organic units is complying with these standards. Local inspectors have an exact knowledge of their region, its inhabitants and farming methods practised, and can also take part more intensively in inspection procedures. They can work with more insight and more cheaply than an official from a EU recognised inspection organisation.

The internal quality control system is examined by the external European inspector on the basis of the data produced by the small farmers' organisation concerned. Its quality and veracity are tested in spot checks in the form of on-site inspections and interviews with randomly selected small farmers. If inspectors discover flaws in the internal inspection system, the spot checks and on-site inspections are increased. If, on the other hand, all is satisfactory, the number of spot checks may be reduced. This flexible method of proceeding motivates small farmer groups because, if internal quality control is done well, the work load of the external inspector can be reduced and money can be saved.

In introducing internal inspection systems, Naturland and other international-

Photo: Petra Heid

Inspection of small farmers' groups is a severe challenge to any certifying organisation.

ly operating certifiers first invested much effort in convincing and guiding small farmers and in restructuring procedures. However, this effort was rewarded. Production co-operatives managed to establish economically viable quality control systems and data became available for statistical purposes and for correcting any weakness identified.

Threats

The plans now in the pipe-line will mean that most of this effort was a waste of energy. Brussels is debating a procedure whereby EU organic control of small farmers' groups will be put on a different footing. The percentage of small farmers who are to be subject to spot checks by the external inspector will be set,and no matter how good the internal inspection system is, at least 10% - 30% of all small farmers in an organisation will have to be inspected annually by an external inspector who will visit their farms. Presently, it is the external inspector who determines the percentage of inspections after consultation with the certifying organisations. In the case of large, well-organised small farmers' groups, this was significantly below the envisaged percentage (about 2% - 5%), whilst smaller organisations were subject to a considerably higher percentage (20% - 50%).

Fixing spot-check ratios will diminish the flexibility and adaptability of the system and may result in a rigid, over-expensive and unrealistic construction. Even if the level of spot-checks decided upon is only 10% it will still mean increased inspection charges, especially in the case of small farmers' groups with a large number of members (500 or more). Here a rapid deterioration in the quality control system can be expected, since the time available cannot be expanded at will to accommodate the disproportionate increase in the number of spot-checks required and a drastic inflation in the inspection charges cannot be avoided.

Let us take the example of a coffee co-operative in Mexico with 2,100 members that cultivates organic coffee over about 4,200 hectares. At an inspection rate requirement of 10%, this would mean the external inspector visiting 210 farms even though each of the 2,100 members had already been subject to internal inspection. An inspector who is expected to verify the documentation provided has to allow enough time to visit the farms and to conduct interviews with the farmers. The inspector can only visit four to eight producers at the most per day and there are also the more remote farms that can only be reached on foot.

This means that an inspector would need at least thirty days or more only to spot checks the small farmers and even if local specialists were asked to assist, this inspection procedure would cost the small farmers' associations a fortune (between US$ 5,000 and US$ 12,000). Organic production would no longer be economically viable.

What will happen if the amendment planned in Brussels is passed? 'Time is money' is the motto. In order to save time, interviews with farmers will be kept short, probing conversations and skilled questioning to reveal less obvious but important details, enabling the situation to be judged more realistically, will become a luxury and be scrapped. Only those plots that are easily accessible by foot and car will be checked regularly. These 'show-case farms' may well be managed in an exemplary way since they will be expecting external inspectors to visit them regularly. In order to cope with visiting the large number of farmers to be inspected in a few days, the temptation will be great to enrol cheap assistants. It is quite conceivable that recourse will be taken to inadequately prepared and poorly instructed assistants in order to be able to achieve the inspection target. In short, the 'practical' side of the external inspection may be so adversely affected that it makes no sense at all.

A percentage which may be too high for the larger small farmers' organisations may be too low for a very small organisation. In the case of small farmers' groups with just twenty members, for example, the inspector would, in theory, only have to check two farms. This is far too few to enable a judgement to be made as to how well internal inspection systems are working.

These examples make it clear that strict regimentation of the inspection procedure as in the current concept will do nothing to produce the intended results. Naturland, is making a case for the percentage of spot checks to be graded in a reasonable way, bearing in mind the number of members in a small farmers' group, with the aim of maintaining expenses and quality at an acceptable level and enabling the small farmers' groups to take an active part in the running of their organisation as partners in organic agriculture, whilst not denying the European Union or the consumer their perfect right to be supplied with organic produce of guaranteed quality.

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Criteria for the quality control of small farmers' organisations

The performance of tours of inspection of small farmers' groups which can comprise several thousand members with widely scattered plots of less than two hectares on average in poorly accessible regions is a severe challenge to any certifying organisation. The aim is to follow a practical procedure which will meet the requirements for a 100% inspection under the EU regulation 2092/91 and keep inspection charges at a level acceptable to all the parties concerned. Naturland, as one such certifying organisation, has devised special criteria for quality assurance, in co-operation with the inspection organisation IMO (Institute for Market-Ecology) and in accordance with IFOAM's accreditation programme. These criteria are the basis for Naturland's certification of small farmers' groups.

Development of internal standards
Every organisation is obliged to develop internal standards for organic agriculture applicable to the crops cultivated and in compliance with EU regulation 2092/91 and to pass these on to all its members farming organically.

Proof of a well-managed advisory system
Proper advisory services are indispensable for the successful application and development of any method of organic agriculture. It can be realised either by an external advisory service or an internal advisor, whereby agricultural engineers experienced in organic agriculture form the core of a team of advisors who, in turn, instruct experienced farmers who have contact with every member of the organisation. In this way they ensure that every farmer is familiar with the internal standards determined by the organisation and applies them correctly.

Performance of qualified inspection
In order to comply fully with EU Regulation 2092/91, every small farmer must be inspected at least once a year. This inspection is performed by specially trained and qualified staff of the small farmers' organisation, who visit every plot and document the results in exhaustive survey files. Particular attention is paid to ensuring that the inspectors do not visit their own locality.

Documentation of all procedures and organisation structures
A contract has to be drawn up between each small farmer and the organisation to which he or she belongs. In this contract the small farmer pledges to maintain internal standards determined and specific penalties are agreed upon for every infringement. The organisation is obliged to provide comprehensive proof of the results of each inspection before the harvest begins and to maintain lists of the producers. Purchasing lists and all records documenting the flow of goods to the point of export are an equally important component of the organisation's internal quality assurance system.

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Sustainable chocolate
a practical business example

Craig Sams

In 1991 we launched Green & Black's organic dark chocolate made with cacao grown in Togo, West Africa. The chocolate was a high quality product, the first 70% cocoa solids organic product to be sold in the UK. It was a success at the very top end of the chocolate market. In 1993, we needed an alternative source of cacao and started a new project in Belize that embodied organic and fair trade principles.

There had been a cacoa planting project in Belize since 1983 run first by the Overseas Development Agency (ODA) and from 1986 by USAID in co-operation with the food giant Hershey's. These schemes were funded by bank loans secured against the collateral of Indian Reservation land. Farmers were encourage to buy hybrid seeds and agri-chemicals, clear forests and plant trees close together. This left little room for shade trees and fertilisers and fungicides became essential. The economics of the programme were carefully worked out, but were based on a selling price of US$1.80 per lb. The programme finished in 1992.

In October 1993, I spoke to Justino Peck, the Chairman of the Toledo Cacao Growers Association (TCGA), the co-operative that represents the Maya Indian cacao growers of the Toledo District of southern Belize. They were facing serious problems. The selling price for cacao had fallen from US$1.80 to 55c and loans could not be repaid. The bank threatened repossession and plantations were becoming overgrown as cacao farmers migrated north to work as orange pickers and sugar cane cutters to earn enough to service their debts and feed their families.

Co-operating with TCGA

Together with TCGA, Green & Black's worked out a new deal for a new product - MAYA GOLD. The co-operative signed a five year rolling contract to be our exclusive supplier of organically grown cacao for use in Maya Gold chocolate at a starting price of $1.25 per pound. We assured them that if we used cacao from other organic sources in Maya Gold we would pay the TCGA US$200 per tonne of such cacao used. We also agreed to assist them to obtain organic and fair trade certification and provision was made for training. A US$20,000 cash advance was made so farmer members could be paid in cash for their cacao.
A 5 cent per lb forestry premium was offered to encouraged growers to thin out their trees and plant more shade trees. We also offered an additional 5 cent per lb to any grower who planted one mahogany, one cedar, one mamey fruit and one cohune nut tree per acre of cacao. This was to encourage long-term investment because after twenty years one mahogany tree could easily be worth more than a year's cacao harvest. It was also to protect wildlife and biodiversity, an essential but difficult to measure aspect of organic farming. Trees would attract migratory birds, insects, and mammals and help maintain the balance of life that ensures no single species gets out of control. A habitat would also be preserved for game, an important source of protein in the Maya diet. Two members of the TCGA set up tree nurseries to provide the baby mahogany and cedar to plant out on the cacao. The TCGA took responsibility for implementing these provisions and the Soil Association inspected and approved the area for organic production. Slowly the project got off the ground as farmers adjust their agricultural pattern and, after a good start, the TCGA has kept going.

What made it a success?

The quantity and value of the cacao increased. In 1993, the gross area income from cacao was US$10,000. In 1997 it was over US$100,000. Organic certification allowed the TCGA to tap into the fastest growing sector of the European and North American food industry. Next year the TCGA anticipate total income from Green & Black's of nearly US$200,000.

Securing the market in advance played an important role in this success. Before Green & Black approach TCGA, we discussed the Maya Gold concept with Sainsbury's, a leading UK supermarket chain. They agreed to stock the product for six months when it was ready. We also sought and gained Fairtrade Foundation certification and Maya Gold was the first product to bear their mark.

Maya Gold was launched at a press conference at the Oxfam stand at the BBC Good Food Show in London. The same day BBC Newsround sent a film crew to Belize and came back with footage of Maya villagers harvesting cacao which was shown on the afternoon and evening television news. Other press coverage was extensive and supermarkets were soon sending in orders. Sales have now levelled out but are still moving upwards.

Problems

Despite the commercial success, problems emerged at the interface between the Maya deal with Green & Black's, and the ODA's master plan for the region, which was based on selling logging concessions to Asian companies to gain foreign exchange and on extensive rice growing. The ODA representatives in the South were cautious about us, probably rightly so, as there are plenty of people who come to the Toledo District, make all kinds of promises, and then disappear without trace. The ODA team warned the Maya of the risks of taking the organic route, advising caution.

Our 5 cent per lb tree planting scheme also met with resistance. The ODA's forestry advisor notified the growers that any mature hardwood trees would belong to the Forestry Department and would not be the property of the grower. This was deeply discouraging to the growers and the new tree nurseries were closed down.

In addition, WHO's malaria control programme in the area had a policy of spraying houses and areas where malaria had been notified with DDT. This nearly led to contamination of some organic cacao. Because there was no telephone communication, villagers had no advanced notice of spraying. The authorities have now agreed to give two weeks' notice when they intend to spray so that villagers can get their cocoa sacks, as well as their children and animals out of the way before the sprayers arrive.

The future

Growers are switching back to the local variety of cacao. It tastes better and although yields are lower the quality is superb. As well as increasing cacao production, the TCGA wants to diversify and, with organic status, they find they have an advantage. This season the TCGA grew a trial crop of 5 tonnes of red kidney beans and 5 tonnes of black beans which Green & Black agreed to purchase at EU organic market prices. A considerable increase is planned for 1999 because quality is excellent and prices are good.

Ginger is also being planted around the edges of the cacao trees and produces a good crop. This increases earnings from the same area of land enabling farmers to look after two crops at the same time. The ginger does not compete for fertility with the cacao. Annatto has also been grown widely and is processed in the villages to produce a yellow colouring paste which can be used in organic margarine and butter.

Social gains

First, cacao production has strengthened the position of women. Unlike rice, post harvest processing is an important part of cacao production and women play a key role. Beans are fermented in boxes next to houses for five days. Once they are fermented, they are dried in the sun, turned, and protected from rain. Women control these operations and as a result they can benefit directly from the income generated by cacao.

Second, secondary education in Belize is free, but the nearest high school is in Punta Gorda, 20 miles from the villages in the Maya Mountains. With no daily bus service, students have to board with families in Punta Gorda, a significant cost. As a result of increased cacao income, more students go to high school and a bus service has been set up on a daily basis. There is even talk of building a high school in one of the central villages.

Third, the TCGA has become a unifying force in a community where there are two distinct cultural and language groups: the Kekchi Maya and their neighbours the Mopan Maya. Mistrust and suspicion between the communities had been exacerbated when aid workers, missionaries and government officials were suspected of favouring one group over the other. Within the TCGA there is one shared goal - to sell Green & Black's as much good quality cacao as possible.

Challenges ahead

The leaders of the TCGA are respected figures in their local communities, consulting to ensure that the Maya speak with one voice on matters where their community has hitherto been weak and divided. This is important as there are challenges ahead.

Traditional landholding patterns based on use have been weakened by Government policy and land the Maya considered to be their reservation land has passed to Malaysian and Chinese logging concessions. Loggers damage watercourses and take out all the valuable trees leaving only an impoverished landscape. This land could be reclaimed for organic cacao with the replanting of mahogany and other hardwoods but government policy discourages this. Government is also reluctant to recognise the historic right of the Maya to occupy and harvest their homeland.

To support their claims the Toledo Maya Cultural Council, in conjunction with the Indian Law Resource Centre and the National Geographic Society, recently produced a 150 page Maya Atlas that details Maya land use and occupation patterns in the Toledo District. The Council stakes a claim to land that has been used by the Maya for hundreds, indeed thousands of years.

Plans by the Interamerican Development Bank (IDB) have also threatened Mayan land security. The IDB has agreed to pave the Southern Highway, the road to the South, and this will open up the area to more economic activity. Originally IDB funding was conditional on the recognition of Maya rights, but these conditions have not been satisfied and, despite Maya protests, the construction of the highway is now open to tender. The Toledo Maya Cultural Council have taken their appeal to the Belize Supreme Court of Justice and it may well end up in the Privy Council in London if their legally legitimate claims are not satisfied.

Despite these problems we hope that Maya Gold will continue to serve as a model for larger projects and that our trading and marketing venture with the Maya of Belize will become typical of the way ethical trade can be conducted globally.

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In 1967, Craig Sams founded Whole Earth Foods expanding from an organic macrobiotic restaurant into retail and then into wholesaling and manufacturing.

Organic agriculture *lessons from the field*

Studies have shown that organic agriculture is economically viable, that farmers can achieve more income as a result of premiums and that they need fewer inputs to maintain returns. Organic systems are based on the optimum use of local resources and technologies and can give farmers greater independence and more control over their means of production. However, more comprehensive monitoring is needed to analyse their sustainability and impact.

Many farmers enter organic production because they want to farm in a more holistic way. Other major stimuli for developing organic agriculture include environmental and social concerns, economic necessity, a lack of chemical inputs, and market demands. Small farmers are also encouraged to take up and stay in organic farming by the prospect of being able to produce more food at the subsistence level, having a larger surplus for local sale, or being able to cultivate a product of significant export value. Farmers are most responsive to organic agriculture when they have not been exposed to the 'chemical message' and their farming systems involve traditional or nil inputs. When production is relatively labour intensive and if farmers have the chance of developing the organic concept themselves they are also more inclined to convert to organic agriculture.

Farmers are less likely to take up organic farming in situations of high labour cost and labour scarcity and where there has been an over-exposure to the chemical message . Farmers with relatively mechanised farms and a commitment to high input, high output strategies are also less likely to convert. Insecure land tenure means small farmers will be reluctant to plant permanent crops.

Local and foreign NGOs, local and foreign buyers, government agencies and large private farmers are generally the main initiators of developments in organic agriculture. Development often occurs at one focal point and spreads outwards to link a widening range of organisations. In Egypt, the Dominican Republic and India, pioneering work by individuals has lead to the development of local organisations capable of representing the organic sector and to government recognition programme provides access to premium prices if certain practices are followed. It functions as an effective extension method with the capacity to support sustainability.

The challenge of going organic

Organic agriculture relies on natural predators and an understanding of local soil and environment. It is knowledge intensive and, from the beginning, requires more design and management. When farmers only known chemical solutions, implementing control of pests and diseases through measures such as rotation, composting and time of planting represents a major change. Organic agriculture requires time and well-trained extension workers. Active organic management is required for a least twelve months before organic status is conferred. Benefits will not be immediate and small farmers will require considerable support in the first years. High input farmers will require financial support such as capital grants or annual area payments to offset the financial problems associated with conversion. Studies show that, in Western Europe, farmer's enthusiasm for organic agriculture correlates closely with the size of the conversion grants available.

It is probably no accident that coffee, cacao and tea are so prominent among the organic products supplied by developing countries. Conversion often does not involve radical change. These crops are often planted with shade trees even in conventional systems and, as such, they support a diversity similar to that encouraged in organic systems. Organic cocoa, for example, in contrast to conventionally cultivated plantation crops such as citrus, supports biodiversity and because the ground is not disturbed or cleared during planting and the root structures of other trees remain intact, soil and water resources are also conserved. However, an annual cropping system on bare, semi-arid land where there is little diversity and where few farmers can afford livestock will require much more time before it becomes a viable organic system. These factors represent a significant challenge to the small farmers' motivation to converting to organic production.

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Strategies to commercialise agroforestry products

The Northern Bolivian Amazon region has an abundant vegetation cover of humid tropical forests with a high diversity of timber and non-timber species. Rubber and Brazil nut have been important for the livelihoods of indigenous groups and peasants. Rubber has not been exploited for about twenty years but there is increasing exploitation of palm heart. Shifting cultivation is practiced and a hectare of forest is cut each year to grow food, a process that can be sustained for two years. To counter this and increase incomes, Instituto para el Hombre, Agricultura y Ecologia (IPHAE) has a project which uses agroforestry systems to improve land use sustainability and generate higher incomes for farmer families.

Rik Overmars, Nelson Mariaca and Armelinda Zonta

Development of agroforestry cannot be achieved by only producing for home consumption. Species with commercial potential such as fruit species, palms, timber producing species and leguminous cover crops are used and provide farmers with an income in the short-, medium- and long-term and therefore they cut less forest each year. Large-scale plantations are unfeasible because farm families lack labour and conditions are unsuitable for mechanisation. Marketing is, however, critical.

Rapid production

To get early returns and stimulate farmer interest, IPHAE uses a species with rapid production. Urucú or Anatto is a resistant variety that is productive 18 months after planting. When the project started in 1995, Urucu was selling for US $ 1.7 per kg. Subsequently, in 1997, the price dropped US $ 0.5 per kg in 1997 which did not justify harvesting the crop. This clearly demonstrated the importance of market research, small-scale plantations and diversification.

Urucú *(Bixa orellana)* or Annatto is a medium, tall shrub that produces seeds rapidly. The seeds are covered by Bixina, a substance that is a natural red/orange colourant that is widely used in the dairy industry, and in tomato pastes and ketchup. Principal producers are Peru, Ecuador and Brazil. It is exported to the United States, Japan and Europe.

Together with the municipal government and a private company, IPHAE is looking into the possibility of installing an anatto paste processing plant in the region. It should bring added value and better prices.

Market creation

Copoazu is a cacao-related species. It is not well known in Bolivia but shows great potential. For this reason IPHAE generated a local and regional demand by introducing imported pulp from Brazil. Today, IPHAE sells 10 tons of pulp annually. This can be supplied by the first group of farmers to plant copoazu in their agroforestry systems. We have to actively promote the consumption of Copoazu in other parts of Bolivia for new agroforestry systems.

Copoazu *(Theobroma grandiflorum)* is endemic in the Amazon and produces a fruit similar to cacao. The pulp is used as a basis for juices, marmalades, jellies, and nectar (see photo) and can be added to yogurt and ice-creams. 'Cupulate' is processed from the seeds and is similar to chocolate.

In order to reduce transportation costs for national and international markets, IPHAE is investigating conservation and processing of Copoazu pulp (pasteurisation and marmalades) and, with the help of fair trade organisations, is exploring European markets.

Substitution of raw material

The region has a palm-heart industry (13 processing plants) using natural *Asaí (Euterpe precatoria)* as raw material. Unlike the Brazilian Asaí, this species does not return after cutting and takes about 60 years to produce palmito. It is estimated that 60,000 palm-hearts are being cut daily in the region. This means that the natural resource base of palm-heart will be economically depleted within 5 years.

Pupuña, Pejibaye or Peach-Palm *(Bactris gasipaes)*: Once the mother stem has been cut, suckers sprout from its base and produce palm heart within one year and yield a regular and sustainable production provided soils are not depleted and are fertilised. When mature, the species also produces edible fruits rich in protein and vitamin A.

Peach-palm was introduced by IPHAE as an alternative to natural palm heart. IPHAE's agro-industry desk has been successfully in processing palm hearts from Peach-palm using the same technology as was used for Asaí. Taste tests, market acceptability and cost benefit analysis of the agroforestry systems have been made.

Increasing densities

Brazil nut is an important economic resource and farmers migrate to the barracas, large forest properties owned by a patron, to harvest them. Collectors have to walk long distances carrying heavy loads and incomes are low, living conditions provided are minimal and the patronage system keeps many indebted and dependent.

Brazil nut *(Bertholletia excelsa)* occurs naturally in the Amazon forest with a natural density of between 0 and 9 trees per hectare. Production can be increased by augmenting densities in poorly stocked forest areas and by management in fallow and agroforestry systems.

By planting Brazil nuts in their fallow, or stimulating the natural re-growth and regeneration of the tree, natural densities can be increased. In agroforestry systems, trees start producing at 12 years and, with grafting, much earlier. Many farmers sell Brazil nuts from their own land to the Farmers Cooperative (CAIC). This has a processing plant and exports under fair trade schemes to solidarity markets in Europe and the United States.

Agroforestry systems play a major role in raising farmers' incomes in the Amazon and help counter the deforestation caused by shifting cultivation. The combination of farmers' extension and the promotion, processing and commercialisation of agroforestry products helps overcome a major bottleneck experienced by many development projects: lack of markets.

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Copoazu fruits suitable for making marmalades and other products.

Photo: Rik Overmars

Unlocking trade opportunities

Nick Robins and Sarah Roberts

In today's globalising world, export success is one of the major routes to economic progress for developing countries. But the conditions for success are changing as producers face rising environmental expectations in key export markets, resulting from tightening regulations, new corporate practices and changes in consumer values and lifestyles. These new expectations reflect the growing recognition that current patterns of consumption, particularly in the richer, industrialised world, are not environmentally sustainable. Profound changes in the ways in which goods and services are produced, traded and consumed will be required, both to reduce the burden on the global environment and to ensure that a growing population has resources to meet its needs.

For those who can adapt to these requirements and start moving to anticipate trends, there are new opportunities to be found in sustainable trade that can generate financial, environmental and social benefits. Already growing numbers of farmers in the South are receiving higher prices and more long-term security by selling their products into environmentally friendly or fair trade markets in the North. Consumer demand for organic products is gradually increasing in responding to concerns about the environmental and health implications of industrial agriculture.

New opportunities in a growing market

Latin American producers have been quick to tap into these markets. The organic sector in Mexico, for example, is now estimated to be worth US$ 500 million and Argentina is making serious efforts to develop its organic sector with sales rising from US$ 1.5 million to US$ 20 million in the last six years. This rapid development has been supported by efforts to overcome the bureaucracy surrounding EU recognition of imported organic goods. By requesting equivalency status for its certification system, Argentina became the first developing country to obtain a place in the EU provisional list, thereby gaining market advantages.

Partnerships are needed

Organic certification can be a slow, laborious and relatively costly process and a particular challenge to smaller producers. A common solution is to form co-operatives to share the load. In Uganda, for example, the Lango Co-operatives Union has made the transition to organic cotton production with the support of the Swedish International Development Agency (SIDA). SIDA provided technical assistance, organised crop finance, and ensured organic certification. It also supported the training of local certifiers thus reducing the cost of third-party inspection. The way prices were set was another innovative feature of this project. Before conducting business, all partners in the chain list their costs and claim a fixed margin based on open books. A fair trade organisation then looks for the best possible price on the market. Any excess funds are paid out to the producers, either as extra premiums or as development fund contributions. For the 5,500 farmers involved in organic cotton production in Lango, this has meant a 20% average increase on farm gate prices.

Links between members of the supply chain has meant that Lango solved one of the major problems facing Ugandan exporters: banks that refuse to pay crop finance. With the help of the Dutch government, the project received a loan, at commercial rates, and SIDA arranged that risks were covered by the Dutch HIVOS/Triodos Fund that provides funding for environmental and social projects in developing countries.

Another organic cotton partnership that has paid dividends is that between the Swiss cotton trading company Remei, and Maikaal Fibers, a spinning mill in Madhya Pradesh, India. Eighty-five villages produce cotton for Maikaal, which is certified by a Swiss company. The project guarantees to buy cotton and provides extension services, interest-free credit and a price premium of around 20% An estimated three-quarters of the cotton is sold through the Swiss Co-op, which launched a new range of clothes - Natura Line - in 1995 and aims to be entirely organic by the year 2000. It should be noted that the Co-op has kept the price of Natura-Line products at the same level as conventional brands, despite the premium price paid to cotton growers.

Action for Fair Trade

Fair trade organisations have been working with Southern producer organisations for decades to try and ensure that they receive a decent income for their work. Only recently, however, have fair trade products begun to reach mainstream Northern markets.

Coffee is probably the most successful fair trade product. It is also the most important traded commodity after oil and the main export for many Southern countries. Most comes from family-owned farms in developing countries. Fair trade organisations work with the producer organisations, promote the sale of fair trade coffee, monitor buyers and roasters and guarantee that labeled products meet fair trade criteria. The ethical trading organisations bear the costs of inspecting producers.

The fair trade market was boosted by the development of recognisable fair trade marks awarded for products that met clear criteria. However, it was the development of a clearly recognisable brand, Cafedirect, that brought fair trade coffee into mainstream retail outlets and within easy reach of consumers. Cafedirect was developed by a partnership of four fair trade organisations that bought coffee from 14 producer organisations in Africa and Latin America. Sales have increased dramatically over the last five years and Cafedirect controls 3% of the roast and ground market and 2% of the instant market in the United Kingdom despite being 10% more expensive than most conventional brands.

As well as higher income and greater security, fair trade can also lead to environmental benefits. Fair trade organisations often work with producers to improve the ecological sustainability of production.

Serious barriers

Small- and medium-sized exporters often face serious capacity constraints in responding to the challenges presented by sustainable trade. Conventional trade barriers in the industrialised world, such as restrictive trade policies in the agricultural and textile sectors, perverse subsidies and bureaucratic regulations are also serious barriers to Southern producers. Partnership along the product chain is essential in overcoming these problems. NGOs, government agencies and buyers in the North can all play an important role by providing technical or financial assistance, long-term security or in helping to develop producer organisations. Positive policy choices also help expand sustainable trade opportunities.

Governments in industrialised countries should ensure that policy making processes are transparent to exporting countries and that new regulations are phased in such a way that producers have time to make the necessary changes. Whilst Northern governments could play a much more proactive role in developing the market and improving access for sustainably produced goods, governments in developing countries can do much to promote sustainable trade by integrating environmental factors into their export promotion strategies.

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Robins, N and Roberts, S **Unlocking Trade Opportunities** IIED 1997 (Contains ten case studies of developing country producers who are benefiting from sustainable consumption)

The author, former director of the Max Havelaar Foundation, the first fair trade organisation to be set up in the Netherlands, draws on his experience of the fair trade movement to examine its development and to discuss its strengths and weaknesses. He argues that the continued development of the fair trade movement will depend on a closer and possibly more institutionalised relationship between trade and industry, development organisations, and ethical and conventional financial institutions.

Photo: Bert Beekman

Fair trade and trade development

Bert Beekman

'Fair trade' covers a wide range of ideas. The Fair Trade Commission in the UK monitors fair competition between market operators and companies. Those who follow its Code of Conduct and comply with local labour laws are, by definition, engaged in fair trade. In this article, however, fair trade is seen as a conscious decision to help small producers in the Third World become viable exporters of their own produce and to support their learning process. Fair Trade does not mean, however, that other forms of trade are unfair.

Fair trade, of course, is not limited to agricultural commodities and agricultural producers. All disadvantaged producers of any marketable product fall within the definition of the fair trade movement. In practice the fair trade labelling movement and organisations such as Equal Exchange in the USA and ATJ in Japan are mainly concerned with coffee, cocoa, tea, bananas, honey and sugar. The older alternative trading organisations work on a smaller scale and deal with thousands of food and non-food products. In this article we focus on small, co-operatively organised, agricultural commodity producers.

Small farmers disadvantaged

Major international agricultural commodities are frequently produced by small farmers who have no secure title to land. Their land holdings are small and they are unable to assert their civil and economic rights even when these are protected by law. Their access to market often depends on long and exploitative chains of intermediaries. Not only do they lack bargaining power, they have no access to information on world market prices. It is difficult for small farmers to acquire the technology and technical skills and the cost of financial services are frequently beyond their reach. As many farm in fragile, near subsistence economies, their choice of survival strategies are not necessarily rational from the economic and ecological point of view. Due to imperfections in the market, lack of transparency and politically inspired distortion, small farmers tend to receive lower prices for their produce.

Addressing the dilemma

There are many reasons why the problems of small farmers should be addressed. First, maintaining and boosting the economic viability of smallholdings puts a brake on migration to overcrowded cities incapable of offering employment alternatives. Second, creating an effective economic and institutional environment makes it possible for people to exploit the market potential of their area. Finally, supporting farmers initiatives by encouraging co-operatives and associations enables them, collectively, to gain fair access to the (world) market: trade is better than aid. In recent years, fair trade labelling has increased the effectiveness of such interventions.

Aims of fair trade labelling

Fair trade labelling aims to develop market niches where newcomers to the world market can learn the ins and outs of this type of trade in a relatively protected environment. In doing so, it tries to provide small farmers' organisations with fair access to the (world) market, under conditions appropriate to their needs. The movement also supports farmers' organisations in their attempt to secure working capital and long-term loans for investments, market information, communications, management support and technical assistance.

Promoters of Fair Trade

Over the years, alternative trading organisations have promoted fair trade through specialised chains of (Third) World shops. The movement began about 30 years ago in the Netherlands and the *Fair Trade Organisation* is still one of the most dynamic organisations in the field. Today, trading organisations are found in almost all industrialised countries and most of them share suppliers' databases.

In the eighties, the movement stagnated. World Shops could not cope with the demand for markets coming from Third World suppliers. Mainstream distribution networks had to be accessed and pressure built up to professionalise the network of World Shops. This lead to the development of fair trade certification and labelling. The model was first developed and tested in the Netherlands under the name Max Havelaar. Later it spread within and outside the European Union until today certification

Small-scale ecological coffee farmer in Jalapa, Guatemala.

and labelling is carried out in some 15 countries. Some use the name 'Max Havelaar', others have chosen names and labels that reflect their own national and cultural identity. However, all are members of Fair Trade Labelling International.

Coming up to standard

National fair trade labelling organisations own their label and defined the conditions under which producers, traders and industry acquire the right to use the fair trade label in their commercial promotion. Royalties have to be paid to the labelling organisation when labels are used and these are used to cover operating costs. Fair trade regulations vary from organisation to organisation. In principal, however, there are a number of fundamental conditions. Third World producers and exporters have to be democratically organised and exert effective democratic control over their management. Their products must be up to international standards in terms of quality and quantity and they must be accountable to the labelling organisations.

Buyers and importers using Fair Trade labels have to comply with certain conditions. These include giving their suppliers secure market access; enabling them to build effective and sustainable commercial relationship; paying them a premium over current market prices and guaranteeing a floor price that effectively covers both direct and indirect production. In addition they must ensure that their suppliers have access to credit facilities so they can finance their commercial operations.

For its part the labelling organisation must define and adapt the fair trade criteria, enforce and supervise the rules of the game, maintain a register of authorised producer organisations and buyers, and maintain an environment that allows the system to work effectively. It is also responsible for profiling and defending the public authority and credibility of the label and promoting labelled products. Most importantly, the labelling organisation remains accountable to the consumer public and must retain their confidence. Fair trade rules exist for many major Third World agricultural commodities including coffee, cocoa, tea, bananas honey and sugar. Regulations for orange juice and nuts are being drawn up.

Ten years fair trade

Fair trade certification has helped bring fair trade products into mainstream European distribution networks. Sales of coffee and bananas have increased tenfold. Today, small farmers are able to sell 14,000 tons of coffee with a trade value of some US$ 40 million in this way. In the Netherlands the market share of fair trade coffee has risen from 0.2% to 2% and in Switzerland to 5%. Mechanisms and alliances have been created to make substantial amounts of short- and medium-term ethical bank loans available. While the impact of fair trade labelling appears to be unquestioned, its global impact should not be overestimated. In a global perspective fair trade is no more that a tiny niche market.

Although its impact is growing, results have been reached under very special market conditions and at a time when world market prices were persistently below subsistence level. Under these circumstances, fair trade offered a valuable alternative to those who had their name on the Fair Trade Labelling Producers' Register and who had secured an outlet for their product. However, not all organisations used (were able to use) this opportunity to effectively develop the capacity to survive under 'normal' market conditions. In 1994, coffee prices on the world market started to return to 'normal' levels, i.e. above the floor price established by the fair trade labelling organisations. For many farmers' organisations, the price premium of US$ 0.05 per pound above the market price was insufficient, while the inflexibilities inherent in the fair trade model eroded a substantial part of the price premium. A growing number of farmers' organisations who had been operating within the fair trade market ran into serious trouble despite higher-than-market prices, while others managed to survive and went on to develop into strong and respected co-operative organisations, addressing the economic needs and rights of many thousands of small farmers and their families.

Photo: Bert Beekman

To operate on the world market, small farmers need to co-operate. Co-operative of small coffee farmers Marcala, Honduras.

Critical factors

It would seem that in some cases fair trade procedures have not been adapted to the operational needs of farmers' organisations, especially under present unstable market conditions. In addition, the fair trade labelling organisations have not paid sufficient attention to the development and organisation of the necessary management support services. Management is also a critical factor at farmer level. The minimum scale of operations needed to run an export business is far beyond the scope of small and often isolated farmers. Lacking the management skills needed to operate the business, they have to hire in managers over whom they may have little control. If there is no effective control and accountability is not enforced, the temptation to address private interests above co-operative interests can be irresistible and leads to serious problems. In this way a vicious circle develops and the co-operative is excluded from credit and loans because it has become uncreditworthy and its commercial liability has been further compromised by inadequate quality control.

Many co-operative organisations, however, have successfully exploited the opportunities of the fair trade market and built up and diversified their businesses to the benefit of their members. Critical success factors seem to be the availability of highly competent and reliable management, sustained management support, and market diversification into conventional, fair trade and organic markets.

Challenges

There are several major challenges facing the fair trade and organic market. A strategy must be developed to facilitate the merger of ecological and fair trade criteria incorporating social fairness and ecological responsibility as preconditions for sustainable production. Criteria must be adapted to the operational needs and limitations of Third World realities and international markets. At the same time the management and information gap must be closed and a solution found to the recurrent problem of credit. It is clear that the certifying organisations cannot solve these huge problems on their own. Strong global alliances with trade and industry, development organisations, ethical (and conventional) financial institutions, universities and consultants are needed in order to build a system that works and hence challenges 'business as usual'.

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The organic market
opportunities and challenges

Photo: Bernward Geier

Bio-café stand at IFOAM café conference, Chiapas, Mexico.

Bernward Geier

The trade in organic products is growing rapidly and becoming a reality throughout the world. Growth rates in the sector show organic products, that a few years ago supplied niche markets, have now entered mainstream marketing channels. Already 30,000 organic farmers are certified in Italy. In Scandinavian countries like Sweden and Finland and in Switzerland some 8 % of farming is (certified) organic. Austria leads the world with 10 % organic farming and in some Austrian provinces such as Salzburg and Tirol, the proportion is almost 50%. Although some in the organic movement might question whether we are straying from the path of 'healthy natural' growth, it cannot be denied that we are heading for a boom.

Respected organic market analysts, such as Professor Ulrich Hamm in Germany, have forecast an annual growth rate of between 20 to 30%. In some countries this might be as high as 50 percent. The largest organic trader in the UK predicts that the organic market world wide will increase from US$ 11 billion to US$ 100 billion over the next ten years with the USA, Europe and Japan leading the way. In this context, Denmark's plans to make organic products account for 20% of the total domestic food market by the turn of the century seems far from being a green dream.

Farmers in North and South are asking how they can take advantage of this growth. The export opportunities offered by the so-called developed world have clearly been a major stimulus in getting organic farming established in many countries. It is unlikely that organic agriculture would have developed so successfully in the northern hemisphere if there had been no demand pressure. Supplying a market in which demand outstrips supply is a producer's dream. This has been the case with organic farming for a long time and figures show that this trend is set to continue. Yet, the sector has shown it is also vulnerable and that prices can collapse if there are sudden and exceptional increases in the supply of particular products. Therefore, marketing with a clearly targeted strategy is a must for organic products. The organic market is a special one, partly because premium prices are involved. It requires a special effort. Attention should be given to meeting the requirements of a guarantee system that will ensure organic quality and allow consumers to develop their preferences for organic products with a feeling of trust.

Setting up a guarantee system

The first pillars of this guarantee system are the organic standards, rules and (governmental) regulations that clearly define the practice of organic farming. From the beginning, the organic farming movement has been more than a set of ideas. It is firmly rooted in a normative description of farming in harmony with nature.

Standards, whether international, regional or linked to a specific philosophy, are not intended to be a handbook for farmers working in the field. Indeed they make rather 'dry' reading. What they do provide is a guide to organic production and the means to develop a truly ecologically sound farming system. They define our systems and technologies and give us a huge advantage as we face the urgent need to distinguish organic farming from 'half-way approaches' such as integrated pest-crop management. Standards are not simply a collection of prohibitions describing what is not allowed in organic farming. Standards reflect clearly the positive approach and definitions of organic farming by emphasising what ought to be done in order to farm organically and stressing the avoidance of synthetic chemical substitutes that have lead conventional agriculture to its present 'dead end'.

Implementing organic standards requires inspection. A body that is independent of standard setting and control should evaluate facts and findings and where farmers and products are shown to have complied with organic standards, it should be able to issue a certificate confirming a product 'certified organic'. A logo or seal that functions as a trademark is used to translate this into a statement of quality that the consumer can understand.

It is still a fact of organic life that a lot of product inspection and certification carried out in the southern hemisphere are done by institutions based in the North. However, efforts are being made in many parts of the world to develop regional and national organic product guarantee systems. Such systems not only reduce costs but also give organic producers in the 'developing' world more independence and self-control. IFOAM (see page 16) and many of its member organisations actively support this decentralisation strategy.

However, even if regional and national guarantee systems are established, there will still be a need for producers to work in close co-operation with certification programmes in the North if products are to be exported to these markets. I estimate that, world wide, there are about 300 organic trade marks on the market. Few consumers have an overview of this 'seal jungle'. There is an obvious need to establish international 'control' and supervision of organic certification. Therefore, IFOAM has established an accreditation system for certifying institutions where, on the bases of mutual recognition, it is possible, for example, to allow licensing agreements.

Co-operation with partners

Knowing the rules and working with them is not sufficient to bring an organic product successfully onto the export market. Partners are needed to take care of such matters as shipping, processing, and ensuring trade is well organised. Besides the usual information on transport logistics, custom regulations, tariffs and price mechanisms necessary in exporting any product, trading within the organic sector requires a particular type of knowledge. Most of this cannot readily be found in the literature on economics and marketing. Perhaps one of the most effective ways of developing an understanding of how the organic market works is to attend one of the several international organic fairs. The most international, prominent and by far the strictest of these 'organic' fairs is the Biofach which takes place in Germany every year (p 16).

A number of donor organisations including SIDA and GTZ and development agencies in the North have established promotion and training programmes to foster export opportunities for organic products. These projects have already helped to encourage producers in developing countries to enter the rapidly growing market for organic products.

Challenges and traps

The global market in organic products was foreshadowed by the export of grain and soya from the US to Europe in the 1960s. Over the last ten years organic products have been marketed in increasingly larger quantities outside the area in which they are grown. Whilst seasonal production and regional markets remain an important objective in organic farming, there is nevertheless plenty of export opportunities for such products from the South as coffee, tea, cacao, bananas, spices, herbs and other subtropical and tropical products.

'Ecological dumping' is becoming more common and is a practice strongly resisted by the organic movement. There is a very real difference between production in keeping with the holistic principals of the organic movement and the purely commercial production of 'natural', 'biological', or 'organic' products such as organic cash-crops in monoculture. It is not enough to exclude what is known as 'ecological dumping' from the organic sector. Given the holistic nature of our movement, we also care about social aspects. In joining forces with the Fair Trade movement we also hope to be able to seriously challenge the 'social dumping' that involves the exploitation of cheap labour and child labour.

The danger of bio-colonialism

'Bio-colonialism' is one of the major challenges facing the organic movement. Given the much greater economic wealth and 'buying power' of the North, many products of organic quality find their way into these premium markets and so become unavailable to local and regional populations. Much more effort and creativity is needed if organic food is to become accessible to more people throughout the world. The SEKEM initiative (p 5) is a good example of how this can be achieved. Community supported agriculture with direct links between producer and consumer, in Japan and Asia known as TEKEI (see ILEIA Newsletter Vol 10 No 1 1994), offer a way of getting out of the bio-colonialism trap. Today, there are organic shops in India and Malaysia, farmer markets in Brazil, and organic produce in supermarkets in Argentina. Box schemes and home delivery of organic products are also being set up in several southern countries.

Very often organic farming systems begin with the production of 'cash crops' and gradually, with the knowledge gained in producing for export, the whole farming unit is converted to organic systems. Thus, planting shadow trees in coffee plantations and using compost is often followed by introducing organic methods into the cultivation of staple foods such as corn and beans.

About prices and fairness

Fair trade is always associated with production in the developing world. However, we need fair and real cost covering prices for farmers all over the world. And here the organic market has something to offer all farmers. Organic production often requires more effort and may result in lower ('optimum rather than maximum') yields. Also, as millions of consumers all over the world have come to realise - 'nature has its price'. Therefore, growing numbers of consumers are prepared to pay premium prices because they know they are getting premium quality products in return. In calculating the price of organic products more factors are involved than in the pricing of conventional products. Demand, for example, plays a much bigger role. The complex of aspects involved makes it difficult for us to discuss price finding and setting mechanisms in the organic sector here. However, we can say that premium prices ranging from 20% to 30% seem to be normal and, when combined with often higher fair trade premiums, they make it possible for small farmers to continue to work their land, feed their families and enjoy real development.

Beginning a new lifestyle

As we have seen, the booming development taking place in organic farming and marketing offers many opportunities. But there are challenges as well and these have to be faced. However, if we do not give up our holistic principles, we will be able to go on contributing to the establishment of organic production systems. And this could lead to changes in life style and consumption patterns that will reach far beyond food and nutrition.

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Photo: Bernward Geier

Corner with Terra Pura biological products in conventional supermarket in Germany.

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Agricultural trade, opportunity or trap?

Editorial

There has always been agricultural trade. Trade remains a necessity whether it is barter between neighbours or long-distance trade facilitated by money. Trade makes it possible for households to supplement their own production and satisfy their need for food and money whilst exploiting comparative advantages. In this century, there has been an enormous expansion in trade supported by cheap fossil energy, agro-chemicals, refrigeration and increasingly sophisticated forms of transport. At the same time, the buying power of urban populations in both the North and South have combined with trade liberalisation and globalisation to give a powerful stimulus to markets everywhere.

This trade expansion has brought benefits to many agricultural producers and consumers. However, it has also been responsible for an uncontrolled concentration of power and wealth in the hands of a few countries, companies and persons, most of whom can be found in the industrial West. Control over capital and knowledge-intensive technologies, unfair trade practices including the dumping of cheap subsidised food and the manipulation of small farmers whose market choices are already limited have seriously effected small farmers everywhere. At the same time the capacity of industrialised countries to protect their own agricultural markets and the worsening terms of trade between agricultural and industrial products have also contributed to the decline and poverty of many agricultural communities. As small, market-oriented farmers lose out to larger farmers and the non-farming professions, and trans-national companies gain control over international commercial flows and agricultural production, many leave their land to search for jobs elsewhere. (Coote 1996; Reijntjes et.al., 1998).

This not only leads to an increasing gap between rich and poor but also to the loss of food security, ecological degradation, pollution and the decline of indigenous knowledge and cultural diversity. Market-oriented agriculture and agricultural trade can lead to a serious depletion of soil fertility, soil erosion and a loss of biodiversity. Agriculture under such circumstances is not ecologically sustainable.

However, agricultural trade and market-oriented agriculture do not have to be a trap for the small farmer! Fair and green trade offers important economic and ecological opportunities for sustainable development (Panayotou 1993).

Fair Trade

Alternative approaches are being developed in reaction to the free trade model. Since the 1970s, the Fair Trade movement has been developing fast (Beekman, p 8). Import organisations buy direct from Southern producer partners, pay a fair price and establish long-term working relationship. Initially, health food and Fair Trade shops were important alternative trade outlets. Today, however, Fair Trade products can be found in most supermarkets. Trade organisations that respect the principals of Fair Trade and accept external monitoring by labelling organisations, are awarded a seal (label) of approval. The fundamental principal of Fair Trade is equal partnership between Southern producers, Northern importers, labelling organisations, Fair Trade shops and consumers (EFTA 1998).

Organic agriculture

The demand for organic products from the tropics and within the tropics is growing fast (Geier p6; Robins and Roberts p10; Panyakul p22). This not only provides hundreds of thousands of farmers in the tropics with an opportunity to get a premium for their products, it also makes it possible for them to cultivate in an ecologically sound way. The International Federation of Organic Agricultural Movements (IFOAM) has formulated basic standards to define organic production. At the moment national market, trading and certification systems for organic products are being developed in many tropical countries (Geier p6; Beekman p8). Certification, whether from the Fair Trade or the Organic Agriculture Movement, is necessary to create confidence and trust. Not only does certification protect consumers from fraud, it enhances ecologically sound production and fair trade Sams p12).

High value products

Also the production and marketing of high-value, non-conventional, indigenous and local agricultural products such as medicinal herbs and traditional agricultural and non-timber tree products with specific qualities may offer small farmers and indigenous people, particularly those working in marginal areas, ways of increasing their income in an ecologically sound way. Overmars (p11) reports on the new production processes and markets being created in Brazil for non-timber tree products and Van der Meulen (p20) describes the potential of niche markets for local, traditional products.

Critical factors

However, to unlock the opportunities of international trade in green, fair and high value products it is very important for producers to find reliable partners who can take care of certification, financing, shipping, processing, marketing and distribution (Geier p6; Robins and Roberts p10). To be successful, the scale of trade operations has to be sufficiently large. This makes co-operation between farmers a necessity. However, a larger scale also

Photo: GK Upawansa

Local marketing of eco-products in Sri Lanka.

means that management becomes more complex and often the necessary skills are missing (Panyakul p22). According to Beekman (p8) the availability of highly competent and reliable management and sustained management support are critical success factors.

Toward a new protectionism?

Unless alternative approaches to trade become mainstream, the inequity and environmental damage inherent in conventional trading practices will remain unchallenged. Lang and Hines (1993) argue the need for a more appropriate economic framework to redirect the world economy towards sustainability. This is not a feasible option in the short-term. A more immediate approach would be a new type of protectionism in which governments formulate trade regulations based on socially fair and ecologically sound standards capable of creating enabling conditions for green and Fair Trade and for LEISA and sustainable agriculture in general.

Priority to local economies

Even if such legislation were to be adopted, it would not be possible to eliminate completely the negative social and environmental effects of international trade. There will always be an important group of farmers who are unable to compete on the (inter)national market and whose farms fall in the margins of the globalising economy. International trade is wholly dependent on fossil energy, itself an important source of pollution and, in this sense, (inter)national trade is inherently unsustainable. To avoid the environmentally unsound transport of agricultural products over long-distances and a risky dependence on distant consumers, sustainable development should focus on the development and protection of the local economy. Particular attention should be paid to marginalised peoples and guaranteeing ecological and cultural appropriateness.

Strengthening the local economy fosters a community's sense of social and environmental accountability, self-reliance, food security, cultural and biological diversity and the commitment to conserving its natural resource base. Delgado et al (p28) show how indigenous people in the Andes protect the cultural, ecological and economic integrity of their communities by sustaining barter - which as a system is probably more widely spread than officially recognised - as an important element of their economic and cultural system.

Strengthening local economies

In many communities economic activities function at an unnecessarily low level as money and local natural resources leak away into the wider market economy. Local exchanges of goods and services can be greatly enhanced by the development of local money systems. Ramada (p30) describes how a local money system has successfully stimulated the local economy in Argentina. Many local groups and communities in the North and in the South are currently experimenting with these Local Exchange and Trade Systems (LETS) (Douthwaite, 1996).

Although income from (inter)national green and fair trade can play an important role in strengthening local economies (Beekman p8), Upawansa (p26) rightly points out that the priorities of poor countries such as Sri Lanka should be to ensure that enough healthy food is produced for the local market rather than to struggle to access national and international organic trade. Lanting et al (p24) and Prakash and Nehru (p27) describe examples of successful initiatives to organise organic production and trade at the local level. Finding the right balance between local and (inter)national green and Fair Trade is crucial in the development of sustainable agriculture.

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Coen Reijntjes (ILEIA).

SEKEM in Egypt: bio-dynamic production and a way of life

The SEKEM farm in Egypt is situated in the desert near the south tip of the Nile delta, not far from Cairo. It was established in 1977. The total farm area is 55 ha, of which about 30 ha are under cultivation. Additional farms which supply products on a contract basis to the main farm cover about 500 ha. And this area is steadily expanding. The products are certified in accordance with the Demeter standards for biodynamic agriculture. The main crops grown can be divided into three categories: fruit trees, herbs and spices, and vegetables. A wide range of vegetables are grown for the Egyptian home market as well as for off-season fresh vegetable consumption in Western Europe. Spices and herbs are designed for both domestic consumption and exports. The farm also includes animal production.

From the very beginning SEKEM aimed at supplying local people with high quality organic food. SEKEM has contributed to getting organic production onto its feet in Egypt. It has established several organic shops in Cairo and delivers its products to about 7,000 pharmacies and 2,000 shops. In a tea-drinking country like Egpyt it is significant that certified organic herb teas from SEKEM are amongst the most popular in the country. Because of the success of the SEKEM products on the West European market, exports have now risen to 40 percent of the total turnover instead of the 10-20 percent planned initially.

There is little doubt that the SEKEM initiative is a show case of holism within the organic movement. Well-rooted in anthroposophic and bio-dynamic philosophy, all SEKEM's projects and enterprises have developed very rapidly. Today, SEKEM has more than 120 people in full-time employment and co-operation with over a hundred bio-dynamic farms marketing their products through SEKEM provides another 250 employment places for Egyptian men and women. SEKEM has also played a pioneer role in developing organic cotton production.

What began as a farm on sandy desert soil on the outskirts of Cairo, has now become a centre of cultural and social development. The SEKEM kindergarten and school provides education for 350 children some of who are handicapped. A health clinic provides medical care and a mobile ambulance station reaches those who are unable to get to the clinic. Art and culture within the SEKEM community are expressions of SEKEM's approach to life and the design of its building and the conditions and environment reflect these principals.

Helmy Abouleish, SEKEM, Egypt
Source: **The future agenda for organic trade**. Proceedings of the IFOAM conference on organic trade. London, 1998.

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ILEIA research

Highlights Ghana

Photo: Huub Ruijgrok, Small World

Women farmers began trials to control the incidence of pests in stored cowpeas.

The Northern Ghana LEISA Working Group (NGLWG), a network of NGOs, research institutes and university and government employees concerned with agricultural development have committed themselves to a research and advocacy programme that will investigate the feasibility, sustainability and conditions for the further expansion of low-external-input agriculture in Ghana.

In 1997, PTD research began in two areas, Langbinsi and Sandema. Two villages were chosen in each area and, in each village, with the assistance of Working Group members, the NGO took the lead in organising a problem analysis, identifying possible actions and in implementing experiments. The majority of those farmers who participated recognised the need to maintain soil fertility and were willing to look for new options. Women identified storage pests - especially in cowpeas - as an important food security constraint.

About 50 farmers were selected by the village to participate in the soil fertility management experiments. These were designed to improve soil nutrient content by incorporating organic manure from local sources including cattle manure, household refuse and crop residues. Treatment with a phosphorus fertiliser was also included in the trial design because research at the Savannah Agricultural Research Institute and soil analyses at the Soil Research Institute had concluded that soils at the sites were deficient in P. At the end of the season farmers found that organic manure had lead to yield increases but consensus was not reached on the benefits of adding phosphorus. Farmers agreed that organic manure had been of benefit during the drought conditions that had prevailed during the growing season (with or without P). Farmers observed that P was an external input and, although relatively cheap compared to other inorganic fertilisers, it had to be bought. It was also difficult to get locally. Men and women farmers considered organic manure the best option and new ideas emerged about using compost in further experimentation (see Box)

After the harvest, women farmers began trials to control the incidence of pests in stored cowpeas. The treatments applied were all based on locally available substances one of which was an extract from the neem tree. Results of these trials will be assessed in May.

Apart from the PTD process other ILEIA research activities focus on understanding the agroecological, socioeconomic, cultural and policy environment of northern Ghana. A recent study commissioned by the NGLWG examined the development and transitions of farming systems from an historical perspective and concluded that "villages were getting poorer" because the natural resource base was becoming exhausted, there was soil erosion, a decreasing diversity of trees and grasses, tree and shrub cover was disappearing and grazing land was getting scarcer. It argued one explanation for this was not population pressure and decreasing rainfall as often suggested but the annual practice of bush burning. Another reason put forward was concentrating cultivation on fields near the homestead. This had lead to shorter fallows and more intensive land use.

A study was also commissioned to investigate how farmers tackle this 'man-led' depletion of natural resources. Individual farmers and, in some cases, entire villages came to the same conclusion: bush burning. Now, by restricting burning, many farmers have increased their yields, have made themselves more resilient to drought and are benefiting from the re-establishment of trees and grasses. They are also trying to find ways of using organic manure and of preventing run-off by building stone bunds. Many villages report that increasing numbers of farmers are adopting these practices.

In Langbinsi and Sandema collective participatory action by farmers, NGOs and researchers has provided useful lessons in collaborative participatory research. The assessments made of PTD experiments and the studies carried out by farmers and researchers will set the agricultural agenda in the coming months.

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Farmers' visit Burkina Faso

In October 1997, fourteen farmers from the pilot sites of Langbinsi and Sandema visited their Burkina counterparts in areas less endowed with natural resources. The farmers visited north–eastern Burkina where mulching, integrated crop and livestock farming and composting have been adopted by many farmers.

When they returned they reported the innovations they had seen to a village meeting. Villagers were particularly interested in the practice of making compost from crop residues mixed with household refuse, animal dung and chaff. Some villagers have already started making compost pits. The awareness that organic matter is the key to improved soil fertility maintenance made them anxious to try out compost making. As one woman farmer said "It used to be easy to collect dung from my neighbours, but now everyone wants to use it for their own compost pit."

Photo: Abraha Lemlem

Improved forages benefits Ethiopian farmers

Cattle, sheep and goats are vital for Ethiopian agriculture. They feed mainly on crop residues and harvested fields but this forage cannot satisfy their needs. They do not produce as much milk and meat as they could, and the oxen are sometimes so poorly fed that they have little strength. In order to improve animal performance, high-quality forage is needed. The Ministry of Agriculture's Fourth Livestock Development Project (FLDP, 1987-94) focused on forage improvement strategies suitable for smallholders. The strategies reported here come from Bihar Dar District, in West Gojjam Zone, which lies close to Lake Tana. Lying at an altitude of 1700 to 2300 metre. It has an annual rainfall of 800-1200 mm most of which falls between June and September. Average farm size is 1.5-2 ha. About 95 % of farm households keep about 3 head of cattle as well as some sheep and goats. In terms of better animal nutrition, higher livestock yields, enhanced soil fertility and erosion control, results of forage strategies are promising. Multiplication of forage legume seed has played a large role in this success.

Abraha Lemlem

Thousands of farmers in Bahir Dar District have established hedges of tall forage plants such as Sesbania sesban, *Leucaena leucocephela*, *Cajanus cajan* (pigeon pea) and *Pennisetum purpureum* (elephant grass) inside their farm compounds. These plants provide forage, shelter and fuelwood and are sown around the edges of the garden so they do not compete with garden crops.

A few farmers have also established mixed plots (50-100 m^2) of perennial herbaceous legumes in their backyards. Where space is very limited, they sometimes plant climbing legumes. Measurements made in farmers' backyards throughout Ethiopia showed a forage yield of 195 kg of dry matter (DM) per year from 50 m of hedge and 100 m^2 of herbaceous legumes (Alemaheyu et al 1987), with large variations between sites. In Bahir Dar, farmers' yields were 53-84 kg DM from a 50 m sesbania hedge and around 200 kg DM from a 50 m row of elephant grass, with one cut per year.

Change is gradual, but now 200 farmers in West Gojjam fatten their animals on improved legumes. They sell cull oxen at high prices using the cash, for example, to buy replacement stock. One farmer with dairy cattle fed on home-grown forage legumes gets up to 8 litres of milk per cow per day without supplementing the animals' diet with industrial by-products.

Undersowing

Forage legumes are sown under another established crop. The legume is usually sown after the final weeding of the main crop, but may be sown earlier if weeding is light or weeds are cut. The legumes are grown in crops such as maize, sorghum, barley, wheat or plantation crops such as coffee, and are grazed with the crop residues or cut-and-carried away with crop remains. In our district, the main food crop is maize, and the main undersown legume is vetch (*Vicia dasy carpal*). Under this programme, about 120 farmers now sow 60 ha.

Neither we nor the farmers have measured the effect of undersowing forage legumes on the yield of the main crop. According to researchers elsewhere in Ethiopia, yield is reduced by 5-15 %. At the Adet Agricultural Research Station, local *Trifolium* species were undersown in wheat. This gave slightly higher grain and straw yields than on the control plot, probably because of the increased soil fertility. In addition, these treatment plots also yielded legume forage.

Many farmers in the district say that undersowing helps to keep the soil *sibam* (fertile in Amharic) as well as boosting milk production. Ato Muluken Lakew, a farmer in Sebatamit Peasants Association, reported that his maize plants were yellow in previous years but had turned green because of undersowing. Some farmers make hay from the vetch.

Forage strips

These are narrow lines of forage established between arable crops and provide cut-and-carry feed, fuelwood, help reduce soil erosion and improve soil fertility. Forage is planted in bunds or on contour strips without bunds. Tree and shrub legumes are used for alley farming and shelter belts.

Some 170 smallholders have planted about 17 km of *sesbania* tree legumes around food crops. These trees are cut back during the cropping season to provide feed and reduce shade. Initial measurements showed annual yields of 75-100 kg DM per

100 m of forage strip (Alemayehu et al 1987). My own farm-level studies in Bahir Dar suggest that 200 m of sesbania shelter-belt around a 0.25 ha plot provides 200 kg DM with one cut per year.

Farmers prefer to plant forage as shelter-belts (*imballelie*). Formerly they grew eucalyptus and the oil crop noug (*Guizitea abysinnica*) around their food crops and to protect cash crops from livestock and wind. Shelter-belts provides forage, do not compete for land and, unlike other ways of planting strip forage, do not disturb normal cropping patterns.

Oversowing

A mixture of legume seed is broadcast on grazing areas without cultivation or fertiliser. This is a simple, low-cost strategy to increase natural pasture quality and productivity. Sowing roadsides from a moving vehicle is one way of covering a large area. In Bahir Dar, 200 farmers have oversown 25 ha and good results have been reported from degraded grazing lands. Farmers prefer *Desmodium intortum*, *Macroptilium atropurpureum* (Siratro), *Desmodium uncinatum*, *Stylosanthes scabra* (Seca), *Stylosanthes hamata* (Verano) and *Macrotyloma axillare* (Axillaris) for oversowing.

Farmers see little point in oversowing communal grazing land. They prefer to oversow the degraded natural pastures under their own control. Real benefits take two years to appear and some farmers do not have the patience to wait. They prefer oversowing herbaceous legumes rather than grasses, possibly because they see this improves soil fertility.

Seedling survival

Free-ranging livestock and drought are the biggest threats to seedlings. Fences and thorny branches are used as protection until plants are well established. By the end of the rainy season, they are strong enough to survive browsing and the long, dry season until they are harvested during the second rainy season.

Seedlings transplanted from the farmers' own backyard nurseries have a higher chance of survival than those obtained from MoA. The farmers can chose when they transplant their own seedlings and take greater care with preparing the site and watering.

Farmers' preferences and practices

Some farmers complained their animals did not like the new forages. However, MoA held farmer field-days and farmers experienced in the cut-and-carry feeding of stall-kept animals showed how this was done. As a result of these field days, many farmers began to get their animals used to eating these forages.

Farmers prefer the fast growing sesbania for hedging. It can survive in a wide range of soils and climates and provides a better shelter-belt in forage strips. It is particularly popular as a dual-purpose plant in coffee cultivation.

Another dual-purpose legume is pigeon pea. It is harvested as a family food and what remains after the harvest becomes animal forage. Elephant grass is also popular for hedges and, in fertile soils, it is ready for forage use at the same time as sesbania. However, it is more palatable and animals get used to it more quickly. Once elephant grass has been established, farmers can readily propagate it from cuttings.

Farmers prefer tree legumes to herbaceous legumes because trees provide more feed in times of drought. Farmers who produce seed for sale prefer stylo to vetch because it is more productive, disease resistant and fetches higher prices.

Some of the farmers are now experimenting with mixing cereal straws and green forages such as vetch, Desmodium and Rhodes grass (*Chloris gayana*), to get better forage use out of the straw.

Farmers' preferences among forage plants

Criteria	Preferred species in order of ranking
Early feed	Elephant grass, sesbania
Survival rate	Elephant grass, sesbania, leucaena
Fuelwood	Sesbania
Palatability (acceptability to animals)	Elephant grass, leucaena, sesbania, vetch
Ease to expand	Elephant grass, sesbania
Forage strips	Sesbania
Food + forage	Pigeon pea
Shade for coffee	Sesbania
Long lifetime	Leucaena, sesbania, elephant grass
Seed production	Stylo (Verano, Seca), vetch
Oversowing on severely degraded areas	Stylo species, Siratro, Desmodium
Resistance to grazing	Stylo species, Desmodium

Seed production

It is not feasible to meet the seed requirements of these various forage-improvement strategies by importing seed. The success of the forage programme depends on building up local capacity to supply seed. FLDP introduced a seed contract system to encourage farmers to produce high-quality forage seed at low cost and in large quantities. Growers are paid contract rates for clean seed.

In one year (1992/93) when the MoA provided herbicide (Triflan) free of charge, farmers produced stylo seed during the first rainy season. But now no herbicide is provided, they produce stylo seed in the second season. Some seed producers have started to sow stylo between rows of maize, so that they can harvest maize in the first rainy season and stylo in the second. The African bollworm, aphids and thrips were problems for farmers producing vetch. MoA offered them the opportunity to try insecticides (Malatione, Seven, Basodinek), initially free of charge. Farmers now pay for these inputs.

Toward local seed marketing

Farmer-to-farmer exchange of forage seed, seedlings and cuttings is developing. Farmers who have started to collect seed from their own forage trees or legume plots no longer ask the MoA for seed. There are signs of self-sustainable seed production. Development agents encourage this by telling farmers that MoA will only provide free seed once. We hope that this strategy will gradually lead to the creation of a local market for seed and planting material.

Women grasp the opportunities

Many women heads of household have also started to grow sesbania for shelter and fuelwood. The Ministry of Social Affairs recently started a programme in our area to provide women with local, female goats. The programme also encourages women to grow tree legumes to feed them. In Bahir Dar this approach is just beginning but it has been very successful in other parts of Ethiopia.

Both women and men are finding seed production provides an interesting income. In our district 22 women produce stylo (Verano) which gives them an income of between 300 to 1000 birr. Women appear to be especially skilled in collecting and multiplying forage seed, and their earnings contribute significantly to the total cash income of their households. We now have three women development agents in our forage programme: one in forage husbandry and two in seed production. It is recognised that forage production and seed multiplication offer particular opportunities for women. ■

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Experimenting within farmers' worldviews

Photo: Bertus Haverkort

Rukman Wagachchi of the Network for Agri-cultural revival in Sri Lanka (on the left) is taking part in a 'kem' with the shaman (on the right).

In recent years, much work has been put into understanding the products of indigenous knowledge. Many traditional, indigenous soil and water conservation techniques, ethnoveterinary practices, natural pesticides and intercropping have been documented, assessed and improved. ILEIA is one of the organisations following these developments. However, in documentation and assessment as well as participatory technology development (PTD) there has been a Western bias. Indigenous knowledge is being approached with concepts derived from contemporary Western science. Our comprehension of the concepts of life (or cosmovision) and the internal logic of indigenous knowledge and our understanding of the processes of indigenous learning, experimentation and the roles of the indigenous institutions is very undeveloped.

Bertus Haverkort and Wim Hiemstra

COMPAS (Comparing and Supporting Indigenous Agricultural Systems) supports the process of endogenous development. Compas consists of 13 NGOs and 2 universities in 10 countries in Asia, Africa, Latin America and Europe. COMPAS wants to be able to function as an open platform with members and activities at the regional, national and global level.

COMPAS has observed the sophistication with which indigenous people explain their reality. Farming, for example, is more than the bio-physical elements of seeds, soil and water and the economics of the market. It is placed in the context of a larger worldview in which the natural, social and spiritual are inextricable. Thus, farming involves the application of rules that reflect notions of a sacred nature, a spiritual world and a natural environment. For many traditional farmers, a good harvest and good health depend on a farming practised in harmony with the laws of nature, the regulations of the community and prescriptions of the gods and other spiritual beings.

Indigenous reality

Rural people often feel their indigenous knowledge and traditional institutions are neither understood nor appreciated. Outsiders are ready to disdain the non-material elements of their culture. Indigenous communities have learnt not to express their worldviews too openly. Indigenous knowledge is gradually disappearing. In many cases indigenous institutions have gone underground and indigenous knowledge is maintained, transferred and modified without being noticed by outsiders.

A peoples' understanding and description of their spiritual world is rich, diverse and structured. It is experiential and may be based on the teachings of visionaries (spirit mediums or shamans); it can be expressed in classical texts such as the Veda's (India), or in linguistic and artistic symbols. The spiritual world is seen as containing a creating force, there may be a polarity between good and evil and it is peopled with gods, spirits and ancestors. These spiritual beings may express themselves in nature and through living creatures.

There is no reason to romanticise traditional cosmovisions. It cannot be concluded that indigenous cosmovisions and traditional practices have always been effective in preventing overexploitation of soils, overgrazing, deforestation, water pollution, erosion and environmental disaster. Nor have they always been able to maintain social stability and equity.

Joining endogenous development

For (non)governmental development organisations to be effective, there is a need to take part in endogenous development. This is development from within the local culture, based on changing local conditions, resources, cosmovisions, knowledge, objectives and values. This implies a good understanding of the evolution of local culture and the characteristics and dynamics of the local knowledge system and cosmovision. There should be respectful cooperation with local (traditional) leaders and communities and an appreciation of the potentials and limitations of the resources for agriculture, health and nature management available locally.

From in-depth case studies and intercultural dialogues, COMPAS partners concluded that a focus on rural people's cosmovisions can help re-connect the work of development agencies with rural people's indigenous knowledge. Farmers interpret (agricultural) development within their cosmovision. This cosmovison is the context within which they define their relationship with outside agencies and make decisions about the technologies to be used and production strategies to be followed.

Development organisations are being challenged to go beyond validating indigenous technical knowledge. Farmers' concepts of life - and the agricultural practices derived from them - are dimensions of reality they must relate to even though they may not fully understand them. Developing a climate of mutual trust requires learning, South-South exchange and an objective approach to Western knowledge.

Second Phase of COMPAS

The second phase of COMPAS (1997-2002) will take the documentation of indigenous cosmovisions a step further. Fifteen partners will seek to:

- strengthen the cultural identity of local populations by a joint assessment of cosmovisions, indigenous institutions and farmer to farmer exchange;
- develop approaches for strengthening endogenous development;
- conduct local experiments with farming methods that are based on local concepts and traditional institutions;
- network with other organisations at national and regional level and train field staff in approaches of endogenous development.

Exchanges will also take place at the international level through workshops, newsletters and visits. COMPAS seeks to find the best combination of knowledge and practices from (non) western sources appropriate for specific ecological, cultural and knowledge contexts. This means taking into account cultural and spiritual sources of knowledge still present or which can be reconstructed.

During a workshop in February 1998, the partners elaborated a framework for their approach. Considerable attention was given to the issue of local experiments carried out within farmers' worldviews. It was concluded that such experiments were important to test the effectiveness and relevance of local practices, to improve local experimental practices and skills and to develop a theory which could explain the effectiveness of indigenous technologies.

Cultural and spiritual dimensions

Most of the steps used in PTD were considered relevant in designing the framework. However, a further step was taken. The cultural and spiritual dimension was integrated into the experimental design and it was decided to seek the cooperation of spirit mediums, traditional religious leaders, local healers and elders.

Examples of parameters for experimentation include the use of time-frames that respect ritual and astrological calenders; show respect for sacred places and animals; incorporate sociocultural issues such as taboos, totems, class and caste and draw on spiritual elements indicated by spiritual leaders showing respect for ancestors, dreams and visions. These parameters involve both qualitative and quantitative data. In this process, the field worker must have an open attitude and be ready to learn from indigenous' epistemologies.

Work of partners

Partners in Sri Lanka described traditional worldviews where the power of sound (mantras), symbols (yantras), auspicious times (astrology) were presented by traditional leaders. These powers play an important role in agriculture and are 'managed' by traditional spiritual leaders who perform '*kems*' (rituals) at farm levels (see Box 2 *Agnihotra*). In India, unlike Africa and Latin America, classical knowledge has been preserved in a literary tradition. Veda's are centuries old texts, some written in Sanskrit, dealing with religion, health, agriculture and other matters (see Box 1). The *Ayurvedic* approach to health is practised in hospitals and universities but in agriculture, this stock of knowledge has systematically been neglected. Some COMPAS partners (FRLHT, KPP, CIKS, GREEN) are collecting and studying these classical texts and using them to design farm-level experiments. In Zimbabwe, a COMPAS partner (AZTREC) works together with the traditional spirit mediums and village chiefs to include their knowledge and spiritual practices in nature conservation. In Bolivia, AGRUCO has reconstructed the cosmovision of the Andean people and is working together with the ancestral institutions to improve farming activities.

Farmers very enthusiastic

Kalyani Palasinghe shared her experiences on organising a farmers exchange meeting on spiritual agricultural practices in Galle, Sri Lanka.

"With the help of farmer leaders, I identified key people: those who have a spiritual function, knowledgeable farmers and Ayurvedic doctors. Also those who were simply interested in the subject were invited. The objective of the meeting was to discuss with resource people, to present to farmers the spiritual practices used in their own tradition and how spiritual leaders go about their work. In Sri Lanka, shamans carry out rituals to influence good crop growth using the enhancing powers of sound (mantras) and symbols (yantras). These rituals have to be performed at times considered auspicious by astrologers. The shamans has undergone an extensive apprenticeship, is inaugurated and lives a pious life. Shamans were asked to talk about the mantras they use, show some of the yantras and demonstrate a particular ritual. Other shamans were asked to make drawings of the rituals they usually performed so they could be presented to the meeting. My role was to prepare and facilitate the meeting.

We used traditional symbols and ceremonies to introduce the meeting. An oil lamp was lit, mantras were intoned, and

VRIKSHAYURVEDA or the science of plant life, by Surapala, tenth century. *Translated into English by Nalini Sadhale. 1996. Asian Agri-History Foundation, 47 ICRISAT Colony-I, Brig. Sayeed Road, Secundarabad 500 009 India. Order code: AHB 001.*
The original Sanskrit text of Surapala's Vrikshayurveda contains 325 verses about the importance of trees and agriculture. The part on agriculture deals with topics such as propagation and planting, soil and 'nourishment', 'ailments' and treatments. Further, three scientists comment on the texts. They reveal the broad agricultural knowledge base that existed in India centuries ago.
KPP in Southern India, one of the COMPAS partners, will design farm level experiments to test ancient knowledge and adjust it to present day conditions.

a ritual was performed. First, however, we asked participants if they would like to share. It is very important to search for the right resource persons. We also made a kind of healthy curative oil, a small demonstration whose applicability was immediately clear.

The farmers were enthusiastic. They sensed that in this way their knowledge, their culture and their spirituality was respected. The meeting lasted longer than usual. Farmers continued their discussions long after it had ended. Most of the participants wrote down the mantras and, in some cases, they recognised them from their parents day.

During the meeting drawings of spiritual practices were shown. They provoked so much reaction that we only needed to ask: What do you see on this poster, and do you think it is useful, to start a lively discussion. At the end of the meeting we asked farmers whether they would be interested in experimenting with some of these traditional practices. We got more than twenty volunteers and I promised I would help them experiment. I now need to define the methods for field experiments. My colleagues at the Ministry of Agriculture are surprised at the level of participation and the self-respect shown by the leaders. Nobody said it was nonsense. The idea was apparently well received and the idea of testing these traditional practices appealed to farmers and professional scientists alike."

■

Further information

We feel that the COMPAS approach is challenging and relevant. There is a great need to learn together, to inform each other and to have an intercultural dialogue on the different sources of knowledge present in cultures all over the world. A report of the February workshop and the names of COMPAS partners are available from the ILEIA Newsletter on request. Readers who want to share their experiences of indigenous knowledge or are interested in the COMPAS newsletter should contact:

- **Rukman Wagachchi**, Network for Agri-Cultural Revival, Hewaheta Road 71/77, Talwatte, Sri Lanka. Fax: +94 8 232343, email: pasasa@eureka.lk;
- **David Millar**, CECIK, PO Box 42, Tamale NR, Ghana. Fax: 233 71 23478;
- **AGRUCO**, Universidad Cochabamba, Casilla 3392, Fax: +591 42 52601, e-mail: agruco@pino.cbb.entelnet.bo;
- **Bertus Haverkort** and **Wim Hiemstra**, International Coordination, ETC, P.O. Box 64, 3830 AB Leusden, The Netherlands. e-mail: compas@etcnl.nl

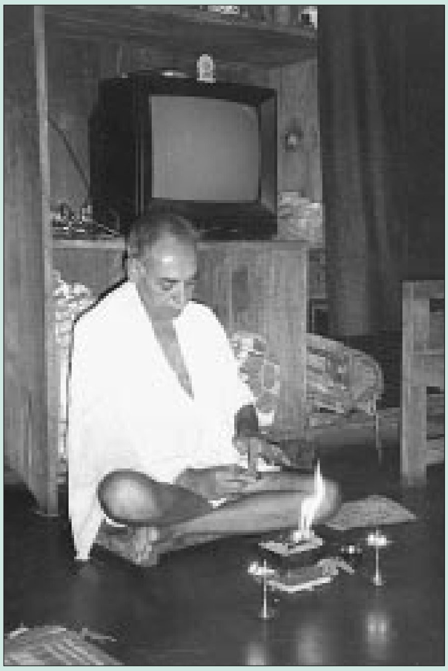

Photo: Bertus Haverkort

Mr Purushottama Roa, an organic farmer in Thirthahalli, Karnataka, is preparing Agnihorta a traditional anti–pollution ritual. He has been performing this ritual on his farm for the last six years.

Agnihotra, an ancient fire ritual

Agnihotra is one of the rituals of the ancient Hindu religion and is used today in traditional farming and health care where it is known as 'Homa therapy'. *Agnihotra* brings and keeps life in balance. In Sanskrit agni means fire and hotra the offering of sacrifices. Agnihotra has a scientific as well as a spiritual dimension.

Fire in the Hindu tradition is a symbol of purity and is believed to improve the mind. *Agnihotra* must be performed daily by an elderly member of the household and involves burning, mantras and timing.

The ritual is performed in time to the natural rhythm of sunrise and sunset. A cow dung cake is burned in a pyramid-shaped copper pot. Then at sunset and sunrise a few grains of rice covered with ghee (butter) are burned as an offering whilst mantras are intoned. At sunset the evening mantra "I offer to Agni, this belongs to Agni, this is not mine" *Prajapataye svaha, prajapataye idam na mama* (I offer to Almighty Father, this belongs to him, this is not mine) is chanted. In the morning, the mantras *"Suryaya svaha, suryaya idam, na mama"* (I offer to the Sun, this belongs to the Sun, this is not mine) is used.

Those attending the ritual sit near the fire-pot until the sacrifice is burnt. Sacrifices are offered at the critical moments of sunset and sunrise to the cosmic energy and the life force (sun) and to their earthly representative fire. *Agnihotra* expresses man's gratitude to divine energy. Intoning *idam na mama* (this is not mine) at sensitive moments reflects a total submission to mother nature and generates a feeling of detachment from the idea of wealth. The cumulative effects of the mantra's vibrations and the vapours released during burning have a multi-dimensional impact on human, animal and plant life. Inhaling these energised gases helps restore metabolic equilibrium. Scientists observe that ozone (O^3) is created during the burning ritual which makes *Agnihotra* an anti-pollution ritual.

Comparative experiments have been carried out to test the impact of *Agnihotra*. These experiments have been reported in Madan and Manohar (1990). Dr. B.G. Bhujbal of Pune's M.J.P. Agricultural University has conducted experiments in germinating grape seed and rooting grape cuttings treated with *Agnihotra*. He reported that seeds germinate in 21 days whilst the control sample took 6 months to germinate. Cuttings treated with *Agnihotra* developed better roots than the control sample. Dr Ramashraya Mishra experimented with the germination and development of wheat plants. He compared the growth of plants treated with hotra, those grown in the traditional way, and those in a control sample.

Dr A.G. Mondkar, a microbiologist from Bombay, observed the therapeutic effects of *Agnihotra* ash when he successfully cured scabies in rabbits by applying ash for three days. This method is much safer than the Benzyl benzoate or Salicylic acid usually used.

Farmers' reports are also positive. Mr Bharamagoudra, an organic farmer from Dharwad District in Karnataka, India, uses *Agnihotra* ash to protect seeds from seed-borne fungal and bacterial pathogens. He treats his wheat, sorghum and chilli seed with *Agnihotra* ash before sowing and reports better germination, minimal disease attack and better crop quality. Mr M.N. Varkar started practising *Agnihotra* on his organic farm 11 years ago. He cured psoriasis and now uses *Agnihotra* ash as manure and to revitalise the soil.

A.S. Ananda and **Aruna Kumara**, Krishi Prayoga Pariwara (Agri-experimenters), Chitrakoota No. 14, I Cross, II Block, I Stage, Vinobha Nagara, Shimoga - 577 204, Karnataka, India.

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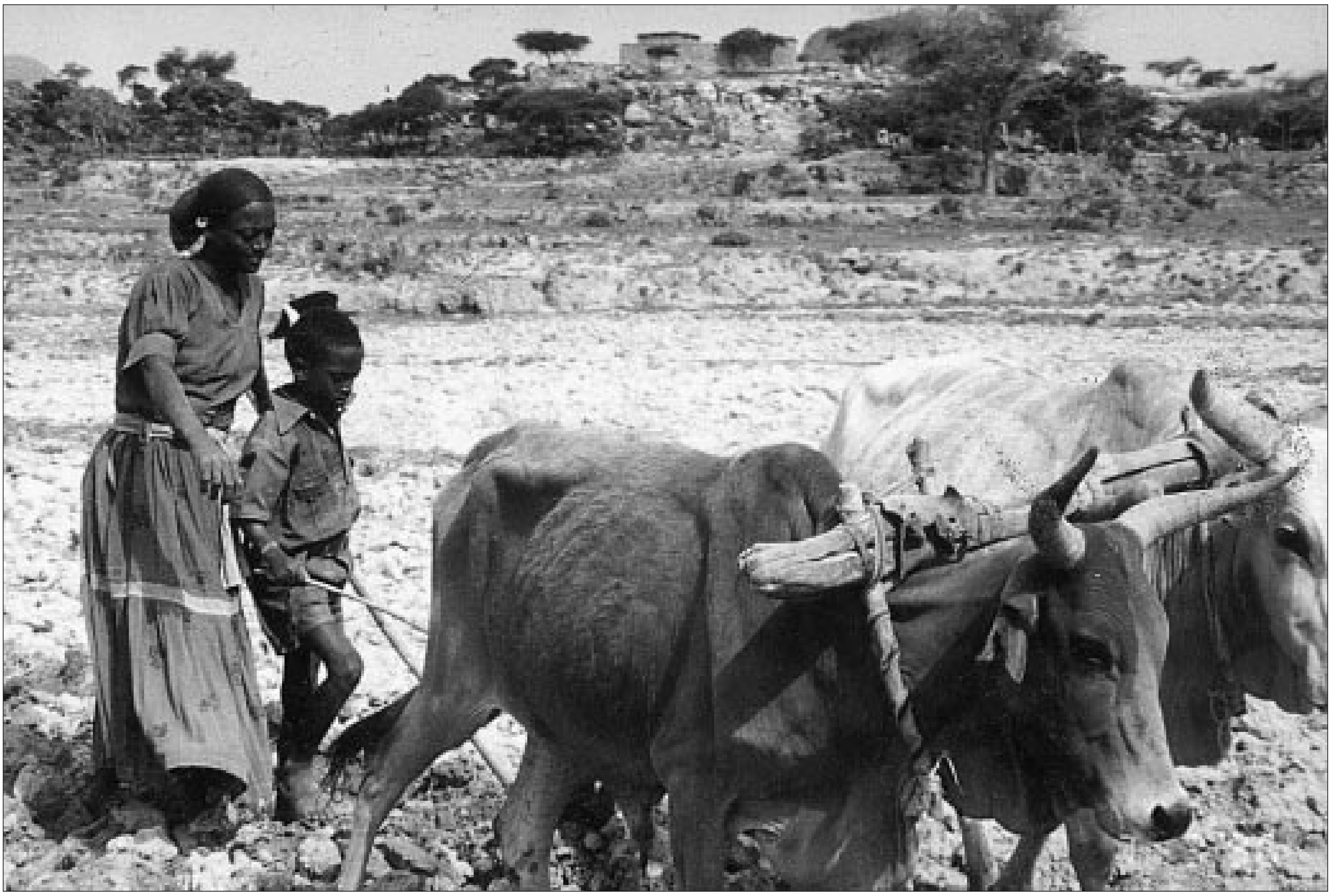

Photo: Fetien Abay

Farmers' innovations in land and water management

In the semi-arid highlands of Tigray in Northern Ethiopia, generations of farmers have developed land-husbandry systems that allowed them to live under harsh conditions. Their systems involve physical and biological techniques of soil and water conservation (SWC) and integrate aspects of agronomy, livestock husbandry and forestry. Farmers continue to innovate and refine their practices. Local innovation can be a source of inspiration for more widespread development.

Mekelle University College (MUC), the Bureau of Agriculture and Natural Resources (BoANR) and other governmental and nongovernmental organisations in Tigray are looking for indigenous land husbandry innovations and see this as an entry point into Participatory Technology Development (PTD), in the second phase of a Dutch-supported programme 'Indigenous Soil and Water Conservation' (ISWC). The aim is to promote existing processes of improvement by recognising local initiatives, by linking innovative farmers with each other and with formal research and extension, by validating and disseminating successful technologies, and by supporting farmers and rural communities in their own experiments. This article deals with some of these farmers' innovations and the above programme.

Fetien Abay, Mitiku Haile and Ann Waters-Bayer

Tigray is an area of extreme land forms, with flat plateaux and lowlands separated by steep slopes and escarpments. ISWC works in the semi-arid highlands at 2000-2500 metres. Average annual rainfall is usually between 450-900 mm. The rainy season is June to September. Smallholder farms are between 0.2 and 1.5 ha. The soils are shallow, stony and of low fertility. Barley, wheat, teff, finger millet, field peas, maize and sorghum are the main crops and the land is worked with oxen and the *maresha* plough.

Seeking local innovation

Our inventory of indigenous innovations in SWC was carried out in Tigray's western, central, eastern and southern zones. Extension agents, university teaching and research staff and university students completing their 5 month practical period were involved. They observed local differences in practices and asked local people about individuals and groups who had discovered new ideas and experimented with innovations without the support of formal extension services. Attempts were made to identify both male and female innovators.

Integrated management of hill and farm

One example of a very creative innovator is Ato Haile Gebrehiwot, a 50–year old farmer in Western Tigray. Over the past 13 years, he has developed an integrated farm system that combines various innovations: revegetation with diverse indigenous species, moisture conservation and soil-fertility management, apiculture and improved farm implements. His farm has an average annual rainfall of 860 mm. He and the nine members of his family farm 1.25 ha of land. His main crops are maize, teff and fruit and he keeps 5 head of cattle, 3 donkeys, 5 goats, numerous poultry and an increasing number of bees. In Western Tigray, where farm sizes are larger than elsewhere in the region, he is seen a moderately well–off farmer.

Slope revegetation to reduce floods

Like most other farmers in his area, Ato Haile's land is frequently flooded and covered with silt and stones from a steep, treeless hillside above his home. In 1984, without external assistance and using only family labour, he started to build stone terraces on the hillside to control run-off. He collected seeds and the vegetative parts of various local tree, shrub and grass species and established them on the slope. The hillside is now a forest dominated by indigenous species and some more recently introduced fruit trees. Altogether there are 43 tree and shrub species, 5 fruit and beverage species, and 6 grass species.

The physical structures and soil cover have solved the problem of flooding, and from the vegetation he gets firewood for home use and sale. Moreover, the organic matter has allowed much water to infiltrate and this ensures moisture over a longer period which benefits his farm and homestead garden. He has deliberately planted bee-forage species amongst the vegetation because he wanted to expand his production of honey and bees.

The sale of bees is very lucrative so he developed a system to increase swarming frequency. First, he keeps the bees in a narrow hive fixed on an elevated pole or beam. He then exposes them to alternating cold and warm conditions, and does not harvest the honey produced. The bee population increases and in their discomfort the bees form new colonies in the small gourd hives he provides. These bees are sold at the local market.

New animal-drawn implements

To make it easier to transport heavy stones for SWC, Ato Haile designed and manufactured the *menkorkor* (Fig. 1) which is drawn by two oxen. It is a kind of wheelbarrow with a wooden frame supported on a wheel made by fitting together two spent bombshells. This is an example of using resources available locally and left over from Ethiopia's long war. A wooden shaft connects the frame to the oxen yoke.

He decided to plough with one ox to solve the problem of an unbalanced team of oxen. He thought that a plough drawn by a single animal would be useful for neighbours who only have one ox. He himself has two oxen and now he can prepare land for sowing more quickly because his family can plough two plots at the same time. He made a single-ox yoke to pull the *maresha*.

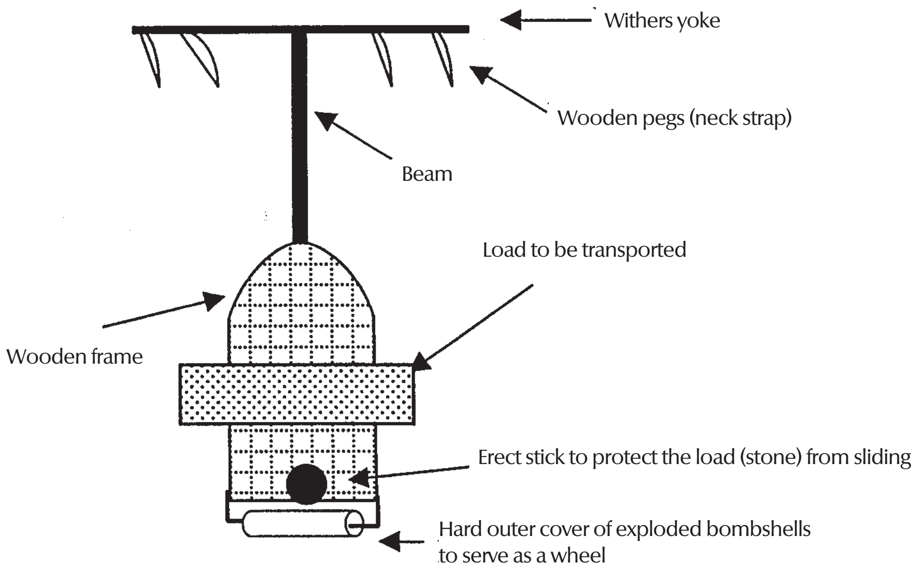

Figure 1. Menkorkor used to transport heavy loads

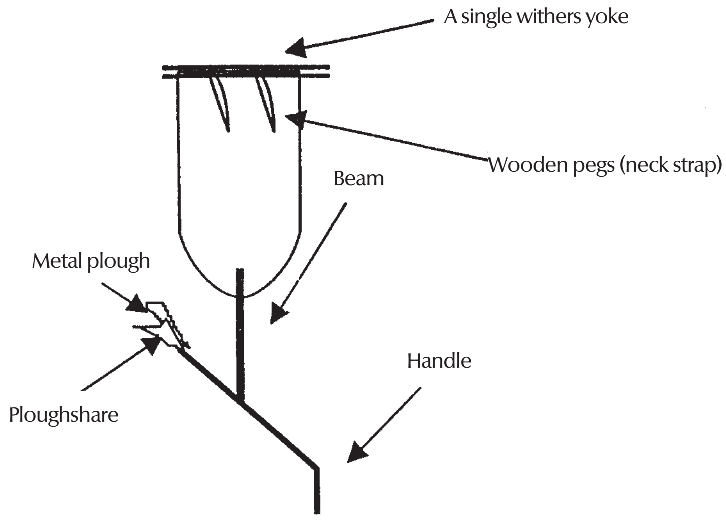

Figure 2. Single-ox plough

Generous dissemination

Ato Haile wants to promote his innovations. Hundreds of extension agents and farmers have come to learn from him about revegetation using indigenous species, bee-keeping and manufacturing improved implements. These visits have been organised by the BoANR and the Tigray Development Association. Ato Haile takes the lead in demonstrating and explaining his innovations. He lends his implements to other farmers, so that they can try them out for themselves. He also supplies the seeds of various tree species to interested farmers and gives them technical advice - free of charge - on raising and transplanting seedlings and establishing the trees.

He says that 13 years of experience proves his system is well-adapted to the environment and is effective. He has integrated SWC measures, crops, trees and livestock, including guinea fowl which he has domesticated from the wild. According to Ato Haile, his system will be sustainable if no deliberate man-made interventions disturb it.

Seeking new ideas

Ato Haile is keen to talk to scientists and other farmers about new ideas. For example, before he reforested the slope above his home, a gully had formed on his farm. Indeed, the gully formation ultimately motivated him to plant trees above it and on its edges. The gully is not getting worse, but now he would like to re-establish his field there, and would like to exchange ideas with other farmers who have successfully reclaimed gullies. He is also interested in trying out new plant species suitable for terrace stabilisation and animal feed, including tree fodder.

Innovative women

During the inventory, examples were found of women farmers who had observed and analysed the unintended effects of actions that were either a 'mistake' or originally meant for another purpose. They recognised the useful effects of these practices and developed them further.

W/ro Leteyesus Gobena is a 26-year-old woman who farms in Central Tigray, where annual rainfall is about 600 mm. Three years ago, after her husband died, she started ploughing on her own. In the Tigrian culture, where men traditionally plough, this is an innovation in itself. Leteyesus applied various traditional practices she had learned from her husband, such as sowing presoaked seed of maize and sorghum to accelerate germination, using the hoof action of small ruminants to work teff seed into the soil, and cultivating teff by ox plough between uncultivated strips (*terwah*).

During her first attempt at *terwah*, Leteyesus formed, unintentionally, some furrows on each side of the grass strips. She observed that the teff growing in the field with these furrows had a higher yield than the teff in her neighbour's adjacent, uniformly ploughed field. She recognised the utility of the furrows and prepared them intentionally during the next season's ploughing.

In order to gain even more benefits from *terwah*, she dug up sods of the grasses livestock preferred and moved them to the grass strips. She explained that the shade from the grass stops water from disappearing so quickly in the sun. In addition, she deliberately collects seed of grasses she finds useful for different purposes, including broom-making, to plant on the strips. In the second year, she cultivated where the enriched grass strips had been, and made grass strips lined with furrows where she had previously grown teff. She thus seems to have developed a system of simultaneous enriched fallow on her very small landholding (0.2 ha). In this high-population area of Tigray, the practice of fallowing has long been abandoned.

Infiltration pits

W/ro Azmera Atseba is a 38-year-old woman farming in an area of Eastern Tigray that receives about 450 mm rainfall per year. She sows teff, wheat, barley, sorghum and tomato in irrigable fields with a total area of 1 ha. In 1996 she followed instructions given by the Home Agent to dig a shallow pit in her backyard for garbage disposal. However, in the early wet season, the pit filled up with run-off water. Later in the season, there was not enough rain for the crops and most farmers in the area failed to harvest anything.

W/ro Azmera observed that the wheat she had sown near the pit in her backyard grew well, and she harvested more grain and straw from this area than from the other parts of her backyard farm, even more than in other years with better rain. She concluded that the plants grown near the pit benefited from the water stored there which had infiltrated the soil. The next year, she deliberately dug infiltration pits in her backyard and even in the fields outside. She harvested over 3 quintals from 0.25 ha. Before her innovation she would have expected no more than 1 quintal.

Difficulties in spreading innovations

It seems to be difficult for other farmers to accept women's innovations. Indeed, the very sight of a woman behind a plough raises the comments from some men that it will bring misfortune to the village. An additional problem is that many women farmers (household heads without husbands) are quite poor and cannot spare time from their work to discuss their ideas with others. Some farmers were impressed by the results of Leteyesus' infiltration furrows, and the local council asked her would she teach this to others. She replied that she must farm and think of new ways to get the most out of the little she has for her family's survival. She cannot leave her work without some kind of compensation.

More and more examples

This is only a small sample of the still growing number of innovations being discovered by researchers, students and fieldworkers in Tigray. Other innovations include:

- trapping silt and water in ephemeral water courses to create new land (see also Hagos & Asfaha 1997);
- reclaiming farmland from a river by constructing walls in the river bed and diverting the water flow
- distributing manure through water diverted into fields at points where silt traps were built into gullies
- changing the shape of unploughed strips designed to retain more water in a traditional community-managed irrigation system.

Men and women in Tigray experiment with using every conceivable resource available to them to improve their land-husbandry systems. They integrate physical and biological methods of water control, crop husbandry, soil-fertility management, livestock and manure management, plant introduction and selection, crop-residue management and agroforestry. Indeed, the innovations go beyond agriculture and include the use of wildlife. One farmer in Central Tigray, for example, uses manure of the wild *ghyhe* (hyrax) on his cropland. The *ghyhe* has the convenient habit of depositing its manure repeatedly on the same site; it is therefore easy to collect. Ato Abreha claims that it improves the fertility and moisture-holding capacity of the soil for up to 4 years and greatly increases his crop yield.

Promoting small-scale farmers' ideas

Data are still too few to be able to analyse differences in innovation behaviour, types of innovation attempted and spread of innovations according to gender, age and relative wealth. However, the initial data suggest that some women develop innovations that can be useful for both farm and household chores, and that communicating women's ideas more widely is a more difficult task than communicating those of men.

Extremely poor farmers, whether male or female, are finding new ways of making intensive use of local resources. Such innovations are of particular interest to very small-scale farmers. Other innovations discovered were developed by better-off farmers and need more resources than poorer farmers can invest. The richer farmers also have more time to teach others and can lend implements or donate planting materials. Ways must be found to compensate very poor farmers and help them share their ideas with others.

Generating enthusiasm

We publish information on farmer innovations in a Tigrigna language newsletter and distribute this to interested field staff, supervisors and farmers. T-shirts are distributed to workshop participants and as prizes for discovering farmer innovation: the picture on the T-shirt is of W/ro Leteyesus ploughing her fields.

We encourage researchers to make detailed investigations of the various innovations discovered by field workers, to assess their positive and negative impacts together with farmers and to work with farmers to improve their land-husbandry systems. In workshops in the field, the men and women farmers explain their innovations to governmental and nongovernmental researchers, field agents and programme managers. Joint on-farm experiments under the control of farmers, and in watersheds under the control of local resource users are being designed in the framework of PTD training workshops.

Farmers experiments will be complemented by studies and, where necessary, on-station research which will help explain or show how farmers' practices can be improved, and generate the information innovative farmers and communities need to continue development activities. As a result of these activities enthusiasm for local innovation and experimentation to improved land husbandry in Tigray is growing.

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(email: wb.waters@link-goe.de)

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Vetiver, the super grass for water conservation

In the 1988 December issue of the ILEIA Newsletter John C. Greenfield reported on the use of Vetiver grass for moisture conservation in rainfed agriculture. This was at the beginning of a very successful worldwide effort to reintroduce the use of Vetiver grass (Vetiveria zizanioides) for soil and water conservation. Today it is an important grass used in stabilising engineered earthworks, land rehabilitation, and pollution mitigation. It is used in at least 60 countries and is promoted by governments, NGOs, and the private sector. In 1996, positive experiences with Vetiver grass resulted in the Vetiver Network being awarded the John Franz Sustainability Award for the best judged environmental technology. Nevertheless, there may be farmers, development workers or researchers who do not agree with this evaluation. ILEIA would like to invite them to write about their experiences with Vetiver grass.

Richard G. Grimshaw

There is overwhelming evidence that properly established Vetiver hedgerows will reduce soil loss to acceptable levels (< 3 tons/ha) and rainfall runoff by as much as 70% depending on slope and soil type. Soil moisture content is improved, and crop yields, particularly on shallow soils in dry years, have increased by as much as 30%. There is a clear correlation between Vetiver hedgerows and improved groundwater recharge. Where Vetiver leaves have been used as mulch on adjacent orchard crops (Jiangxi Province, China) there has been dramatic increases in soil organic matter (from 0.04% to 1.8% in two years, plus significant increases in N, P, K and other minor elements).

Evaluation results from El Salvador, Tanzania, and the Philippines show that about 80% of farmers who began using Vetiver technology continued to do so after three years. In Tanzania (HIMA/DANIDA project) 1600 farmers tried four different conservation systems (Vetiver, Napier and Guatemala grass hedgerows, and Fanya Juu terraces). 85% of farmers preferred Vetiver hedgerows because they were simple to make, are not labour intensive (in Madagascar farmers can plant 200 meters of Vetiver hedgerow in one day as against digging only 15 meters of Fanya Juu terrace), remain good for many years, and effectively reduce soil erosion. Farmers also see Vetiver hedgerows as improving runoff infiltration, and reducing runoff velocity. On well conserved farms production per unit area increased. Farmers indicated that Vetiver grows upright and causes very little disturbance to the adjacent crops; terraces are easily formed behind the hedgerows (30 - 40 cm in 2 or 3 seasons). Vetiver grows well under drought conditions, is rarely browsed by livestock, and can be used as thatch.

Few downsides

There are a few downsides to this technology. Because it is sterile, the grass can only be propagated vegetatively, this can be a problem initially, but after a few years a plentiful supply of new plant material can be obtained from dividing existing hedgerows. The question of its fodder value is also problematic. Farmers and researchers have provided evidence that if Vetiver is cut every three weeks most livestock find it palatable. If left to mature it is generally unpalatable.

Vetiver grass technology can be used by those small communities who want to take initiatives themselves without having to wait for a 'big plan'. Vetiner can be used without risk and without depending on 'officials' and formal institutional for support. The technology is simple and easy to disseminate and learn and cannot fail if applied correctly. User training is, therefore, essential.

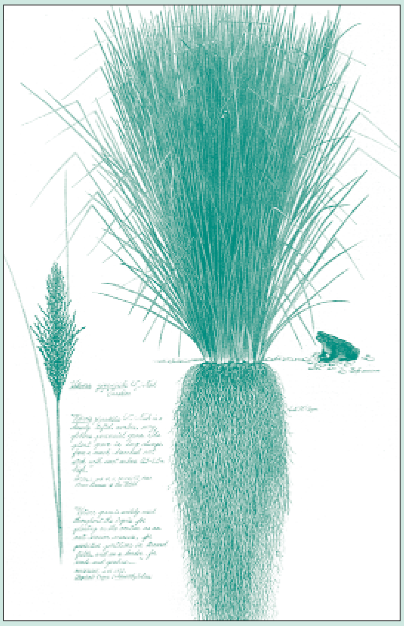
Availability and multiplication

Vetiver grass is found in almost every tropical and subtropical country. If you want to find sources of Vetiver get in touch with the local Ministry of Agriculture research station, or the national herbarium. As it is used for medicinal purposes, the local medicine seller will perhaps know about it. You can also contact the Vetiver Network Once a source has been located the grass has to be multiplied in simple nurseries. One hectare from an average quality nursery will produce enough planting material annually to establish 100 - 150 km of Vetiver hedgerow.

The Vetiver Network

Since 1996, the Vetiver Network has helped establish and support five regional (Latin America, Southern Africa, West Africa, European and Mediterranean, and Pacific Rim) and four national networks (China, Thailand, Philippines, and Madagascar); and has supported some fifteen NGO's in Asia, Africa, and Latin America. The programme seems to be very successful and use of the technology is accelerating. ■

More information is available about Vetiver technology and associated programmes from: **The Vetiver Network**, 15 Wirt Street NW, Leesburg, Virginia, 20176, USA. Email: vetiver@vetiver.org. Homepage: www.vetiver.org.



Vetiver grass for soil and water conservation, land rehabilitation, and embankment stabilisation: a collection of papers and newsletters compiled by the Vetiver Network
by RG Grimshaw, L Helfer (eds). 1995.
The International Bank for Reconstruction and Development / The World Bank, 1818th H Street, N.W. Washington, DC 20433, USA.
281 p. ISBN 0 8213 3144 2.
World Bank technical paper, ISSN 0253 7494; 273.

This technical paper is the result of seven years of research and development on the use of vetiver grass as a promising - and proven - agricultural technology to prevent soil erosion and conserve precious rainfall moisture. This technical paper includes a monograph on 'The role of Vetiver grass in sustaining agricultural productivity', issues 3 - 12 (March 1990 till July 1994) of the **Vetiver Newsletter** and the full text of the practical handbook **Vetiver grass: The hedge against erosion** which provides step-by-step instructions as to the use of the technology. A list with selected readings is included as well.

The Vetiver Newsletter and the practical handbook can also be ordered separately from the Vetiver Information Network. 15 Wirt Street NW, Leesburg, Virginia 20176, USA, Fax: +1 703 771 8260, E-mail: vetiver@vetiver.org.
The Vetiver homepage on the internet *www.vetiver.org* provides the latest current info. (CR)

Transferred technology in a basket of options

In the Communal areas of Zimbabwe, the attitude towards soil and water conservation (SWC) is slowly changing. This article analyses experiences from a partnership programme for natural resources management, particularly SWC, in Zaka Communal Area. One important lesson learnt has been that technologies transferred from other parts of the world work surprisingly well. But adoption has only taken place after participatory awareness raising workshops, where farmers have identified their problems and have been encouraged to experiment with and adapt the technical options provided by the extension staff.

Søren Dreyer

Zaka District, in southeastern Zimbabwe, consists almost entirely of communal land. Subsistence farming is the main economic activity and the crops grown are maize, groundnuts, cotton, sorghum, millets, and sunflower. Soils are generally poor and sandy and population densities are more than 65 persons/km^2, which is very high for a mountainous, steeply sloping area with many rock outcrops.

Five years ago, the Danish NGO MS-Zimbabwe and Zaka Rural District Council went into partnership. With the objective of working with communal farmers to conserve natural resources. The idea was to introduce a range of options for SWC very different from the blanket contour ridging of the past. The programme has now been largely implemented by government extension agencies who felt strongly that a more participatory-oriented approach to extension was necessary.

Workshops for problem identification

Participatory workshops for both local communities and extension staff were organised to identify natural resource management problems. Villagers considered drought, soil erosion, deforestation, and reduced soil fertility as their main problems. Extension staff saw convincing farmers about the usefulness of contour ridges, avoiding cultivation on steep mountain slopes and providing solutions to the problems of reduced soil fertility as their main concerns.

Based on the results of these workshops, plans were made for a three-year programme. Options included Vetiver grass contour strips; Fanya Juu contours; infiltration/composting pits in existing contour drains; establishing woodlots with eucalyptus *ssp*. or indigenous species; planting orchards; the sustainable management of existing woodlands; intercropping and improved crop rotation.

Look and Learn Tours

The most efficient tool in introducing these technologies proved to be Look and Learn Tours. After the first demonstrations, we decided to let the transfer of technology take place not from technocrat to farmer, but from farmer to farmer.

Between 1993-95 quite a number of farmers participated in Look & Learn Tours to the nearby Makoholi Research Station where they were given some idea of the technologies available. These visits proved very valuable later when pilot activities were initiated in the district. Today, farmers visit pilot areas within the district in an environment similar to their own and where projects have been initiated by farmers like themselves. During the visits, farmers from the pilot areas explain in their own words what they have done, show how they have done it, and prove what they have achieved. After the tour, the visitors are usually very keen to start their own activities. Since most of the technologies are cheap and easy to use, they can get to work immediately. Supported by their local extension staff, they can, for example, start by establishing small forestry or Vetiver nurseries on their homesteads and at schools or by borrowing tools for digging mechanical conservation works.

Popular technologies

The programme is now in its fifth year and its success is clearly visible. One remarkable technology very popular with farmers is

Mr. P. Jacobs, at the far left, is converting his conventional standard contour bunds into vetiver contour hedges. Following his own ideas, he has planted the vetiver hedge just above the drainage channel (left), so that when the hedge is well established, he will destroy the drain and ridge which will release land for cultivation.

photo: Søren Dreyer

Vetiver grass (*Vetiveria zizanioides*), which the World Bank has been promoting for many years as conservation's 'miracle grass'. It is in great demand in Zaka. The grass is popular because of its low labour requirements and, when it is used properly, the speed at which results can be achieved. Women household heads are particularly appreciative of its low labour requirements, for labour in this area is a scarce resource.

Farmers have had surprisingly few problems in getting used to the concept of biological contouring (Vetiver grass strips). Mechanical contouring is still unpopular and considered to be very hard work. The Kenyan Fanya Juu system, another mechanical system, is also becoming more widespread because it demands less labour than conventional contouring.

A further success is infiltration pits, which are an improvement on existing contour ridges. Good compost can also be made in these pits during the rainy season. Thus, like many other SWC technologies, infiltration pits or *chibatamvura* have more than one function.

Many farmers have tried several of these options at the same time. For example, agroforestry plots protected by Fanya Juu contours with Vetiver strips to control rill erosion inside the plot or using Vetiver strips to control erosion in existing woodlands in order to provide a better environment for natural regrowth. Farmers themselves are deciding how to implement and combine these different technologies and in doing so take full responsible for the results.

Rain water harvesting costly

Rain water can be collected below a rock outcrop and stored in a tank to water vegetable gardens and fruit trees in the dry season. But not ever farmer can afford this expensive technology. The price of a simple rain water harvesting project with a 70-80 m^3 tank is approximately US$ 300. The programme has supported water harvesting amongst some farmers who have shown genuine interest in conserving their land. A few better-off farmers have started water harvesting projects without any programme support. It is hoped that villages or groups may later adopt water harvesting projects collectively.

Conclusion

A conventional and 'packaged-based' extension system does not seem to be able to mobilise farmers. In Zimbabwe with its long history of blanket recommendations and enforcement-oriented extension, the concept of participatory methods and the provision of options has much potential even if the technologies being transfered are not wholly indigenous.

■

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A crazy family's model for land regeneration

When Gopalakrishnan and Vijayalakshmi bought their 16 acres farm, Sarang, in 1982, it was abandoned land, situated at about 800 m on the slopes of three hillocks. Agriculture was impossible: the land was denuded and eroded. The only source of water was drying up. Sarang is in the Attapaddy region in Kerala, India and is a man-made desert although it used to be full of dense rain forests. The government has invested millions of rupees in the construction of contour bunds for soil and water conservation here, but planted no trees.

The two teachers wanted to start an alternative school to prepare youngsters for farming. Subsistence farming would be an important part of the curriculum.

Photo: 'Shree' Padre

Sarang's forest regeneration after one and half decade. An oasis in the desert of Attappady. Mulching is an important method in natural farming.

They needed to regenerate their land. They reasoned "If deforestation caused water sources to dry up, wouldn't the reverse rectify the damage"? They sunk several percolation tanks and asked neighbours not to allow livestock to graze on their land. The question was how long would it take for the spring to be reborn?

'Mother nature' did her work! First grass like lantana became more abundant. Later grass gave way to small shrubs and trees. Gopala and Vijaya did not plant more than half a dozen trees on their farm and once there was no human or animal interference, forests started growing naturally. Birds and wind must have helped spread the trees. Six years later the spring was reborn! Several checkdams were built across the valley to hold back the spring water.

Today, thick deciduous forest covers much of Sarang. Dry leaves form a thick forest floor and prevent erosion and enhance percolation. Below this mulch, soft fertile soil is being rebuilt. Weeds like lantana and eupatorium, abundant in neighbouring farms, have vanished. When deciduous trees reached a certain height, evergreen trees like rosewood appeared.

Gopalakrishnan believes tilling, a method widely used, is unsuitable for these sloppy areas. Mulching is the technique they use. It retains moisture, controls soil erosion and facilitates growth of microorganisms. Green gram (a legume) is grown to enrich the soil. Today, Sarang has a good top soil which can reach depths of 30 cm. External inputa are zero.

Sarang contrasts sharply with the rest of Attappady. All the crops are rainfed. They grow millet, banana, elephant yam, pumpkin and sorghum. There is a variety of wild bitter gourd and tomato that is self seeding and grows with zero attention. Gopala and Vijaya are convinced that "Farmers have to adjust their taste-buds to what can be grown in the soil". Their farm is almost self-sufficient in food and vegetables, a rare achievement in Kerala where farmers aim to produce irrigated cash crops and end up growing deserts.

'Shree' Padre, P.O. Vaninagar, via: Perla, Kerala, India-671 552.

In Enugu State, southeast Nigeria, present day population densities of up to 400 persons per square kilometre and the limited availability of land for agriculture have encouraged intensified land-use practices such as dry season gardening. Parastatal controlled formal irrigation schemes, concentrating mainly on rice production, currently operate at only 20% of their capacity. Given the present economic crisis, government funding to rehabilitate these schemes is unlikely. Informal vegetable irrigation by smallholder farmers, however, is on the increase with many men cultivating these traditionally women's crops. This article focuses on the response of farmers to the problems of water and labour scarcity, and potential low-cost improvements that can be made to current water management practices.

Photo: Anne Gobin

Bridging gaps in water and labour supply

Anne Gobin, Paul Campling and Jan Feyen

In Enugu State, annual rainfall is between 800 and 2000 mm with a distinct dry season that lasts from November to March. Smallholder farming systems are predominantly rainfed with a focus on tuber-based crop mixtures and oil palm. Additional income is derived from small ruminants and poultry. Crop densities and the level of farm inputs decrease with distance from the homestead and are affected by land tenure status. Home gardens in the immediate vicinity of the house are individually owned and comprise multipurpose trees and shrubs, and a large range of annual crops and vegetables. The family/clan owned 'near fields' are located close to the settlements in an intensive fallow system associated with oil palm dominated forest. The 'distant fields' are located on communal farmland where tuber crops are produced in an extensive bush-fallow system.

Micro-scale irrigation is a minor but increasingly widespread activity in the region where 65 to 70 % of farmers have practised irrigation for 10 to 15 years. Farmers give preference to pepper, tomato, amaranthus, telfeiria and eggplant. Depending on the water source used, field sizes range from about 200 m^2 to 1000 m^2. Though practised on a micro-scale, the sale of irrigated vegetables, and particularly yellow hot pepper, provide an important additional source of income and can fetch high prices. The major production constraints for micro-scale irrigated farming are insufficient water supply for irrigation (91 % of farmers), labour and lack of money to pay for handwatering (72% of farmers). These expenses are often given as reasons for not starting irrigation.

Indigenous management practices for dry season agriculture try to tackle the problem of water scarcity and reduce the labour needed for watering. Depending on the location of the farmer's field in relation to a reliable dry season water resource, a distinction can be made between:

- Irrigated home gardens and nurseries located next to the homestead
- Irrigated fields located near perennial water sources such as springs and rivers

Home garden vegetable cultivation

Home garden irrigation involves the production of seedlings and the cultivation of small vegetable plots. Depending on the quantity of water available at the homestead, villagers will transplant some of the seedlings to a small homestead plot. Vegetable cash crops and/or seedlings are watered twice a day with rainwater stocks built up during the wet season and water purchased from tankers or carried home from often distant perennial sources. Household waste water is used to a limited degree but only in watering plots. The most popular system is to fill up an oil drum at the water source and water the plots either by sprinkling water by hand or pouring it over a broom.

A common strategy to reduce labour and water costs in pepper and tomato cultivation is to keep young plants in a fenced nursery covered with palm leaves for as long as possible. Seedlings are kept in well-manured baskets lined with plastic. Plants are regularly transplanted during the vegetative period until about 20 stands per basket are maintained. Planting to the home garden or family owned near-fields is delayed till just before the full flowering stage, which farmers hope will coincide with the start of the rainy season. Supplementary irrigation is still required since rainfall is often erratic during this period. Many farmers maintain both a nursery and a small plot to get two cropping periods and minimise the risk of failure.

Micro-scale irrigation

Fields near perennial water sources are increasingly being irrigated during the dry season. The most widespread crop is yellow hot pepper cultivated in a mono-cropping system. Some farmers plant a few stands of

Women manufacturing clay pipes and pitchers for micro-scale irrigation

telfeiria along the beds. Women are hired to carry water from the river, spring or stream and pour it into storage vessels located at regular intervals in the fields and water pepper stands in the morning and evening. A mixture of chicken manure and grass is carefully placed around each plant to provide manure and conserve moisture. Fear of snakes prevents farmers from mulching the entire field.

Two farming systems can be distinguished depending on the location of the irrigated plot. Plots are started in November on river or stream floodplains, and are harvested before flooding in June. After the first floods, rice is transplanted on the same plots. Since full irrigation is required throughout the dry season, plot sizes depend on a farmer's ability to pay for handwatering. In more upland areas, pepper is planted from early February; the period of full irrigation is shorter and use is made of the rainy season. Around June cassava is interplanted and allowed to overgrow the pepper stands.

Potential technological improvements

There are two approaches to improving the existing micro-scale irrigation systems: increasing water supply to the field and improving water application effectiveness and efficiency within the field.

Since the 1980s, government support for small-scale informal irrigation has concentrated on increasing water supply to the field by setting up loan schemes for farmers to purchase relatively low-cost, low-head petrol pumps for lifting surface water from rivers, streams and lakes or tapping the high-yielding shallow aquifers of the Anambra Plains. However, these schemes have faltered with the devaluation of the local currency and 'low-cost' is no longer an appropriate term. In addition, spare parts are difficult to get and there are no maintenance support programmes. Furthermore, low-head pumps are only suitable where water supplies are readily available and an infrastructure of ditches exists to convey the water within the plot or to the fields by gravity. This might be possible in floodplain areas (precluding upland areas), but would require levels of investment beyond the means of local farmers in an essentially peripheral farming activity. In addition, risk aversion is the predominant strategy adopted by farmers to minimise crop failure so fields are kept small and intensive when irrigation is needed. Thus a technology which is expensive, not village-maintained and needs large quantities of water is unlikely to be adopted by farmers. The practice of carrying water to storage vessels on individual fields, often at a substantial distance from the water source, is likely to continue. A different approach to improving irrigation practices is therefore needed.

Effective and efficient water use

Modern concepts of irrigation management have introduced the Soil-Plant-Atmosphere Continuum (SPAC) as a unified system where moisture availability is a function of a conjuction of these components. The advent of permanently installed irrigation systems has established that optimal moisture levels in the SPAC are best maintained by high-frequency, low-volume (i.e. small daily) water applications (Hillel 1990). The consequences for water-use effectiveness are illustrated by high yields of daily watered fields on coarse sandy soils hitherto classified as unsuitable for irrigation.

Micro-scale irrigation techniques, highly efficient in water use and labour-saving when compared to handwatering, can offer simple, low-cost solutions to problems of water and labour scarcity. Three methods that have shown promise in Africa are pitcher irrigation, subsurface pipe irrigation and low head drip irrigation. All three are classified as localised irrigation systems since only the soil at the base of the plant, i.e. the plant root zone, is wetted. Methods, technical adjustments, conclusions from our own experiments and discussions with farmers in the region are reported below.

Pitcher irrigation is an efficient and economic way of providing localised subsurface irrigation by using unglazed porous clay pots (Mandol, 1974; Dupriez and De Leener, 1989). The pots are buried neck-deep in the soil next to the plants or between plant rows and water is poured into the pitcher. When full, water oozes out at a rate controlled by the porosity of the pitcher wall, the waterhead in the pitcher and the water potential of the surrounding soil. Pitcher irrigation proved particularly useful for creepers such as telfeiria and melon since their roots are concentrated and can easily be traced. Technical adjustments were made by piercing holes near the neck of the pitchers thus allowing immediate soil-water replenishment at the time of irrigation and making the technique more useful for less drought tolerant crops.

Photo: Anne Gobin

Low-head drip irrigation.

Subsurface pipe irrigation is achieved by means of shallow-buried small-diameter clay tile drains or slotted PVC, bamboo or metal pipes (Batchelor et al 1994). The total length of pipe or clay tile is equal to about 10 m. At one end of the pipe, either an elbow piece or basin is formed to allow filling; the other end is blocked. If PVC, bamboo or metal pipes are used, slots are cut in the surface of the pipe to allow water to seep through. Clay tile drains of about 30 cm are abutted to each other and water exits via the joints as a result of the imperfect fit between the ends of the pipe sections. The pipes are buried so that they cross the root zone allowing for a terrain roughness within a range of 30 cm. Undulating fields must be levelled during land preparation to ensure optimal efficiency. Improper installation and high inside pipe roughness leads to unequal water distribution and might lead to plants being cut off from irrigation. Farmers complained about the skills required to install the pipes. Slotted continuous pipes proved easier to install and manufacture and are much smoother than clay tiles.

Low-head drip systems operate under pressures of 0.5 to 2 metres water head compared to 10 to 15 metres water head needed for standard drip irrigation (Miller 1990). Small reservoirs such as oil drums can be used as header water tanks which are mounted on block supports so that water pressures fall within the required range. Perforated flexible plastic piping conveys water to the plants. Low-head drip irrigation was found suitable notably for stands with a 100% ground cover, such as closely spaced amaranthus, since humidity is well retained under the canopy after a water application. ■

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Photo: Mohamed Mechergui

Three-layer cropping system around Tunisian oases

Improved irrigation efficiencies in Tunesian oases

The experience reported in this paper underlines the importance of actual field knowledge when agencies plan to improve water use efficiencies in an irrigation system. A strictly technical solution is inadequate. Knowledge of the field situation provides insights into the real functioning of the system, actual water distribution and the importance of socioeconomic factors.

Mohamed Mechergui and Gerrit Van Vuren

Kebili, in the Tunisian Sahara, has a mean maximum temperature of 40ºC and minimum 5ºC. Annual rainfall is below 100 mm and wind speed is sometimes high and charged with dust. Formerly, irrigated agriculture was only practised near the natural water springs and the cropping system consisted of three layer, namely date palms, fruit trees and a ground crop. Today, irrigation has increased considerably and now covers an area of around 7,660 hectares spread around 68 oases.

Two distinct groundwater layers are in use: the so-called terminal complex and the continental intercalair aquifer. The former, which is most used is over-exploited in the Kebili region because there are a large number of illegal wells. In 1986, 680 of these illegal wells were pumping 2,700 l/s, over 40% of the total 6,200 l/s being extracted. A sustainable flow rate should not have exceed 4,500 l/s. The second aquifer is less intensively used: the rate in Kebili being 980 l/s and 650 l/s in Tozeur. This is because extraction requires a high technological input where wells are installed. Apart from these two aquifers, water can also be drawn from the shallow water table. Theoretically, the capacity of this shallow water table should be 4.8 million m^3/year but only 1.6 million m^3 is used because some of this water is saline.

Piezometer readings clearly show the degradation of the water sources with a drop in piezometric head of about one meter per year in both aquifers. The degradation of shallow ground water through salinisation is the result of high ground water levels. Observations show, for example, that the water table in Faouar oasis was 47 meter below soil surface in 1956; today it is at surface level. The rapid degradation of the different water sources show that the present agricultural oasis system is far from sustainable. In this article we will describe suggestions for improvement, with special emphasis on the oasis of Rahmat, which is fairly representative of the majority of traditional oases in the region.

The oasis of Rahmat

When it was created in 1932, Rahmat supplied a total irrigated area of 32 ha from two artesian wells. These were sufficient to irrigate a crop system of date palm, fruit trees and alfalfa. The area was subdivided in 0.25 ha individually owned plots.

Over the years the oasis has been extended to 92 ha and is equipped with two pumped wells operating 20 hours a day. The total discharge is 86 l/s and this water is collected in a concrete distribution box from which it is divided into three equal parts and lead through pipes to three sectors. Here there are a number of outlets each serving a block of about 3 ha. Water is brought to the surface into open canals that further distribute it to the farms. In each sector, the water delivery rotates over the blocks to create an irrigation interval of 14 days, with an irrigation length of 8 hours per ha and a discharge of about 30 l/s. Within the sector the irrigation is organised so that water delivery starts from the outlet at the top of each canal. On these sandy soils, surface irrigation is the only technique used.

The Association of Collective Interest (AIC), a farmers organisation, plays an important role in all but daily management. It fixes the water price with district authorities, gives directives on how water distribution should be organised and settles conflicts between farmers.

The day-to-day distribution of water is handled by an operator, who is responsible for opening and closing the outlets. The only guidance herefore is the time required per hectare (which is 8 hours) and the sequence of opening, normally from head to tail. Farmers know when they will get water, so they open the canal bund in the basin nearest the canal in advance.

An office-based solution

In the present irrigation approach, the depletion of water resources is clearly a major problem. Part of the water is pumped from non-renewable fossil water, the rest comes from an over-extraction of renewable ground water. At the same time, heavy leakage from the earth canals causes high groundwater levels in the oasis and leads to land salinisation. As a solution to this problem, engineers suggested replacing the open canals with 200 mm PVC pipes. Each farmer would get a riser pipe from which water can be taken. It was believed that this would prevent farmers using more water than they needed, depletion of the groundwater reserve would be reduced and ground water levels would be lowered.

Actual water management

Field observations revealed that water management is actually organised very differently. It became clear that the operators role is more important than is formally recognised. In practise he decides on the irrigation time for each owner depending on his estimation of plot size, his relation to the farmer and his social position.

It was observed that the three sectors, although equal in size, did not receive the same discharge. In one sector actual discharge was 25% higher than in the other two sectors under the pretext that its irrigated area was larger.

Inconsistencies also occurred at the outlets. Farmers take water from different outlets giving different excuses for doing so. Although irrigation timings appear to be respected, water is sometimes transferred to another farmer.

Another problem in the management of water was observed inside the irrigated area of one outlet. Contrary to the specifications of the project, which defines a standard plot as being 0.25 ha, actual areas vary from one palm tree to 2 ha. Each farm managed the water in its own way in the absence of a specific recommended method. Some farmers do not do any levelling inside the parcel which leads to considerable water loss. Whilst the required dose was 50 mm, we observed actual irrigation gifts varying from 100 to 300 mm and more. This was partly because farmers have no method of control. In one case we observed that the profile was wetted beyond a depth of two meters although the palm tree's active root-zone does not go below 120 cm.

Another observation is that the irrigation system is just supply based, in the sense that the quantity of pumped water does not depend on the quantity needed in the system. In summer this fixed supply is in good equilibrium with crop water requirements. In the winter season, however, the supply is several times higher than demand and causes a steep increase in groundwater level.

Water losses in the unlined, very sandy canals is high. We measured canal losses of 30 to 60 % over a length of 400 to 1000 meters.

Both cropping system and type of farmer was not what we expected. Instead of the three layer cropping system, we observed that date palm was the main crop. Only occasionally was there a second layer crop of apricots, fig or olives. There was generally no third layer crop except in those places where alfalfa, an important crop for those farmers raising goats, was cultivated. Many plots were owned by absentee farmers who lived in Kebili or even Tunis and who hired labour to cultivate their plots. There was also share cropping. Many of these 0.25 ha plots were not, in fact, being cultivated by farmer families.

A different strategy

On the basis of this field research it became clear that the problems surrounding water management in these oases were more complex than assumed. Apart from the problem of diminishing water resources, we found an extensive type of agriculture being practised in which only palm tree cultivation is important. Water management at farm level is poor and water distribution to farms is unequal. In this situation, the construction of a buried pipeline system up to field level would be insufficient to solve the problems of irrigation inefficiencies at field level, especially during the winter season; discrepancies between the designed and actual irrigated area; and inequity in water distribution.

To improve water use efficiencies, it is important that farmers should first be willing to re-establish the three layer crop system on which the irrigation system was first established. It is suggested that improvements that require little external input, improve the knowledge base of farmers and, which are oriented towards improving organisation, be introduced. The construction of a buried pipeline system would only then be possible. The advantage of this system would be that payment per unit of land could be changed into payment per volume of water supplied, an approach that certainly helps to increase water use efficiency. It might facilitate a demand-based irrigation system, where farmers have to apply for water in advance and create options for changing from present surface irrigation towards low pressure sprinkler or even drip system techniques.

This case of the oases in Tunisia touches on a common problem in irrigation development. Although irrigation agencies are generally well informed about regional water resources, they tend to work with a generalised (idealised) picture of the field situation in mind. Detailed field observations would provide them with a much better insight into how farmers handle water, and contribute to the development of more appropriate solutions. Often such an approach will focus more closely on the farmers' organisational structure and knowledge base. Sometimes, a bottom-up and participative approach can reduce the level of investments required for construction work and safeguard the use and management of the scheme because farmers feel involved in the analysis of the problems.

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Traditional water harvesting systems need to be improved

In the dry regions of south and centre Tunisia, with a long-term average rainfall of around 200 mm, water harvesting is the only way to secure crop production. The landscape consists of undulating hills and mountains denuded of natural vegetation. Soils are poor and extremely shallow and rocky. Most land is being used as marginal rangeland except for those places where runoff water and soil are being harvested which permits cultivation of olives and barley and sometimes even apples, apricots, chickpea, faba bean, lentiles or watermelons. Different traditional water harvesting systems can be found of which the *Jessour* systems is best known. This system consists of a series of stone and earth walls, called tabias, built across the stream beds of narrow valleys. The *tabias* collect and retain soil washed down hillsides by torrential rains, forming terraces in a stair-step fashion down the slope of the valley. This has worked for centuries, but recently the *jessours* have not been well maintained because of outmigration, shortage of labour and loss of skills and traditional knowledge. This is destroying the systems and is causing serious erosion.

The Institut des Regions Arides (IRA) in cooperation with the International Centre on Agricultural Research in Dryland Agriculture (ICARDA) are now trying to adapt these traditional systems to existing economic conditions. Farmers as well as scientist have made some innovations. For example farmers are using plastic bottles to irrigate young olive trees. The bottles (without bottom) are filled with pebbles and placed top down with the opening near the roots of the trees. In this way irrigation water is stored and gradually made available to the plants.

Scientists have designed new techniques to store and guide the precious water directly to the roots of the trees or crops to increase water efficiency. In a process of participatory technology development these techniques are now being adapted to the conditions in which the farmers work.

This programme is also part of the documentation of farmer innovations in soil and water conservation exercise referred to on page 21 of this issue.

Information on the programme: **Dr. B. Chahbani,** ARI, 4119 Medenine, Tunisia, Fax: +216 5640435.
Information on the *Jessour* system can be found in: **Les Tabias**. by Khlifa Alaya, Werner Viertmann and Thorsten Waibel. 1993. 192 pp. ISBN 9973-9735-0-X. GTZ, PO Box 5180, 2636 Eschborn 1, Germany.

Photo: Aloysius P. Fernandez

Meeting of the Ramanath Sangha, a self-help group in Kamalapur

Self-help groups in watershed management

MYRADA's involvement with watershed management began in Gulbarga 10 years ago. The PIDOW-MYRADA project was a partnership between Government, the Swiss Development Cooperation and MYRADA. Its objective was to enable the farmers involved to emerge as a fourth partner and progressively control watershed resources. MYRADA's role was to ensure that the process of planning and implementation would help people acquire the skills, confidence and organisational expertise to control and manage the resources within their watershed. This should increase productivity and sustainably and make it possible for vulnerable groups to derive benefits from these investments. Initiatives taken in Gulbarga spread rapidly to other MYRADA watershed projects. Recently MYRADA's experiences have been evaluated. This article discusses what has been learned about the function and role of Self-help Credit Management Groups (SHGs) as basic social groupings responsible for watershed management.

Aloysius P. Fernandez

From MYRADA's experiences it became clear that the strategy accepted by many research and government institutions that each watershed should have one association - the Sangha - was not viable. The social configuration of the 'Sangha' does not necessarily coincide with the geographical unit of a watershed. Even in micro-watersheds several groups emerge when people are free to decide for themselves. Large associations accommodate different interest groups as well as socially distinct configurations like caste, family, occupation, lifestyle or origin. If they are to stay together, these large groups need the intervention of outsiders like NGOs. It was found that intervenors spent more time and energy keeping large groups together than in actually helping them acquire the skills necessary to manage resources. It became clear that the basic social grouping even within a micro-watershed must be a 'socially functional group' or a group that does not require outside intervention to stay together. Such groups will usually be small with less than 20 members, have common interests and be largely homogeneous in terms of cast, class and livelihood.

Self-Help Credit Management Groups

MYRADA, therefore, focused activities on small, homogeneous watershed management groups that had started as Self-help Credit Management Groups (SHGs). MYRADA used credit management as an entry point and training tool. Credit is an appropriate training tool because it is familiar and meets a felt need. Being able to successfully managing their common fund gives a group the confidence that they can achieve their objectives provided they are willing to observe certain rules and create a culture that motivates people to support each other. Self-help Credit Management Group members acquire considerable management experience while conducting the affairs of their organisation. They learn to set priorities, to take decisions and risks, to draw up rules of behaviour, to resolve conflicts and to apply sanctions effectively for non-compliance. They acquire the skills required to institutionalise and administrate cooperation. These skills are necessary in managing watershed resources. They cannot be easily acquired during a watershed programme since the process of watershed development is still heavily influenced by intervenors who insists on technical specifications and guidelines. This transfer of technology approach within a delivery system leaves little room for the development of local people's institutions.

Apex Societies

In several micro-watersheds throughout the Gulbarga project more than one homogeneous group emerged. There were also large farmers who did not join any of these groups but wanted to be represented when watershed activities were discussed. To cope with this situation Apex Societies or Watershed Management Committees were formed by representatives from the small homogeneous groups, large farmers, and representatives of farmers with land in the watershed who did not live in it. Apex Societies coordinated the implementation of the treatment plan and dealt with outside intervenors. They supervised the work done on farmers fields and later assessed it before sanctioning payments. In some cases the funds for treatment works were given to the Apex Societies, in others funds passed directly to individual farmers after the Apex Society confirmed that work had been satisfactorily completed. Apex Societies also played a key role in resolving disputes that arose during implementation.

Maintenance secured

The issue of maintaining treatment measures is crucial for sustainable watershed management. People suspected that there were many areas where outside contractors had been the major beneficiaries. This weakened their commitment to maintaining these measures. It was possible to solve this problem by establishing a transparent procedure which involved SHG members and the Apex Societies in assessing work, handling cash and maintaining records.

Initially the intervenors expected the Apex Societies to play a central role in maintaining treatment measures. In practice the small homogeneous SHGs have emerged as the most appropriate institutions to maintain the resources that benefit group members. It was, for example, the SHGs who entered into agreements with other farmers to regenerate and maintain fallow lands. In Gulbarga over 35 such agreements have been negotiated. This strategy has transformed previously neglected land into regenerated parks, increased biomass production and been effective in managing soil erosion and water run-off.

The common fund

Farmers need to have a stake in watershed investment. It is the SHG that has the financial resources - the common fund - from which an individual farmer can borrow to undertake improvement and maintenance work after the project ends. Commercial Banks do not advance credit for such measures. The Land Development Banks, where they exist and have resources, do have provision but conservation measures on dryland are not considered viable investments. Further, the official specifications for treatment measures in terms of size, structure and location usually conflict with farmers requirements and with what they can manage. This makes the approval of such credits difficult and raises transaction costs. One of the main reasons why farmers do not invest in maintenance work is that most credit involves high transaction costs. Farmers need credit because, to construct the treatment measures, they either have to give up alternative wage employment to do it themselves or they have to hire bullocks, carts and labour.

Photo: Aloysius P. Fernandez

AK Doddi watershed showing stone bunding and bund strengthening with vegetative measures

Some SHGs decided to convert all the grants given by the Government for agricultural inputs into loans returnable to the common fund. Farmers were motivated to contribute both in cash and kind. The contribution from each farmer varied depending on the value he placed on each measure. For example, farmers tend to contribute much more to activities from which they expect immediate returns like silt traps, while measures involving cement and concrete get lower priority and hence lower contributions.

Reasons for disinterest

There are of course other reasons why farmers have not come forward to take up conservation measures. The perception that the increased productivity will not be large enough to warrant investment is a major reason. There is evidence that farmers, even on drylands, are willing to borrow up to 20% of costs from SHGs to construct treatment measures if good soils and better moisture retention capacity assures them of a crop. After investing in such structures, however, there have been instances where farmers have not cooperated in efforts to prevent erosion from higher slopes because they anticipated a lower harvest of silt lower down. Their strategy was to concentrate soil rather than to conserve it.

There are other factors that dissuade investment. The pull of the city, the increasing demand for cash and the rising price of land which is viewed as a scarce resource even without treatment measures, the shift to irrigation and the problems of unstable markets which favour those with staying power.

Initiatives by SHGs

The role played by SHGs so far depend on the resource to be maintained. If it is a common resource like revenue, waste land, and private fallows which were protected and from which all members derived regular benefits, the SHGs have taken the initiative to organise, develop, manage and maintain it. The cost of efforts to acquire this common resource have been shared by the SHG and the intervenors. The SHG usually contacts the owner of the private fallow land and negotiates an agreement. The NGO played an important role in lobbying with the Government for the release of revenue lands. The activities involved in developing this resource have been funded by the intervenors with the SHG organising the work and contributing labour at generally lower rates. Management of this resource are taken on by the SHG where members are confident that they have access to and control of the produce and adequate protection from cattle. It must be noted, however, that the initiative to manage a common resource where titles and user rights are not clear is normally not taken up by the SHG. As far as the management of revenue lands is concerned it is only after some years, when they have gained confidence, that the SHGs take the initiative. Access to these lands has been open but in some cases traditional grazing rights have been exercised. The potential for conflict in these areas is high.

If the measure is a substantial one such as a weir being constructed with cement, the SHGs do not agree to maintain them. Their position is that they do not have the resources and skills required to maintain such structures. MYRADA staff, however, believe that if people place a cash value on water collection in weirs which is used by domestic animals for drinking and wallowing and for washing clothes, adequate revenue can be mobilised to pay for maintenance. In practice, however, as water for animals and domestic purposes are considered basic needs, it is difficult to levy a charge. Sub-soil water is seen as a common resource. It is, therefore, difficult to charge farmers whose wells have been recharged significantly due to water conservation measures.

A broader approach needed

MYRADA's interventions have motivated people to cooperate and to build institutions which they find relevant to their needs and which they can manage. As farmers become convinced that watershed management is paying there is a growing hope that these institutions will be sustainable. But it is not only productivity and institutions that need to be sustained, equity should also be ensured. This has proved more difficult to achieve, especially in areas where resources are scarce. The landless and marginal farmers tend to be marginalised in watershed programmes. During the implementation period they get work and income, but this has to be sustained. In some watersheds this has been achieved by giving the landless a stake in the increased biomass, by increasing their capacity to earn through training and by helping them to start small businesses and cottage industries. They also have become members of the credit groups and have access to credit. For this, however, watershed management programmes need to have a broader approach than they do at the moment.

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Social differences in water resource management

Water security goes hand in hand with food security and is crucial for economic and social well-being. With consumption levels spiralling, water management strategies are necessary to meet national and communal needs. No clear consensus exists and debates on water management are polarised. Two views dominate; both approaches are technocentric and pay insufficient attention to social differences. What alternative approaches could be followed?

Lyla Mehta

At country and regional level, the 'Big is Beautiful' view dominates. Large dams are seen as a panacea for water-scarce areas. International dam-builders assert that the social and environmental costs of these schemes are marginal when compared to the benefits of hydropower and irrigation (Biswas and El-Habr, 1993). They advocate top-down, centrally-organised hydroelectric and irrigation systems based on extra-basin transfer of water. The controversial Narmada dam in western India is a good example of such a project.

Small watershed projects

At community and village level, the 'Small is Beautiful' view plays an important role in highlighting the socio-environmental problems of large dams, including the unequal benefits of canal irrigation (McCully, 1996). It highlights the advantages of small-scale projects based on the principles of water harvesting and watershed management, which are seen as more ecofriendly. However, there is a tendency to gloss over location-specific discrepancies arising from social difference.

Both technocentric

In some ways both views have flaws. Both tend to be technocentric and, until very recently, supply dominated. Both also maintain an aggregated view of the community involved. Whilst the advocates of large projects focus on superlatives and inflate the actual number of beneficiaries, the advocates of small projects espouse the principles of democracy, equity and participation, forgetting that existing power relations within a community are based on different axioms. There is often a rather naive assumption that just because a project is small, it is bound to be successful and egalitarian.

In reality, both macro and micro projects often fail on social grounds because they neglect the fact that any kind of water or ecological intervention will build on and feed into existing social and power relations. Social differences, including such variables as class, gender, caste, ethnicity, historical legacies, power, occupation and political rivalries, can hinder the smooth functioning of any water scheme.

Weaker groups disadvantaged

Clearly, a village is rarely the homogenous and happy place it is often made out to be. There are poor and rich; weak and powerful. In order to gain legitimacy the implementing agency nearly always operates through traditional power-brokers. These are often men and from the higher castes. Only occasionally do the concerns of women, key water users, and those from lower castes come to the fore. Economically weaker groups such as the landless and pastoralists are also largely excluded from benefits.

In many small-scale schemes, targets such as technicality and environmental regeneration seem more important than issues of equity and social justice. They opt for homogenous communities or to focus on just one articulate (powerful) group. Thus, despite often lofty intensions to secure participation and equality, such projects build on skewed power and social relations.

The twenty-first century will possibly see many micro-level watershed projects. Despite the surge of ideas on watershed development, there is a danger that the problems of social differences will be ignored.

Alternative approaches

How can this problem be avoided? Clearly, the social feasibility of a project is just as important as its technical feasibility and perhaps socioeconomic appraisals should precede technical ones. One should ensure that marginalised groups participate by according them more power in the context of intervention and by establishing solidarity with them at the very outset. This entails being aggressively partisan. Through aggressive partisanship, groups which would otherwise be excluded could be explicitly targeted (Mehta 1997). An alternative would be to opt for the more subtle but protracted process of negotiating between social actors within and outside communities. Through this negotiating process, points of conflict could be exposed and systematically worked through (Leach, Mearns and Scoones, 1997).

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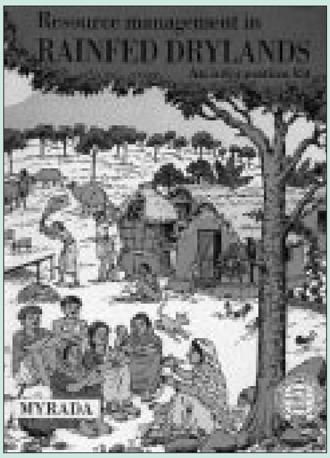

Resource management in rainfed drylands: an information kit.
1997. Bangalore : MYRADA; Silang : IIRR, 1997. 356 p. ISBN 0 942717 71 6. MYRADA, 2 Service Road, Domlur Layout, Bangalore 560071, India; International Institute of Rural Reconstruction (IIRR), Y.C. James Yen Center, Silang, Cavite 4118, Philippines.

The International Institute of Rural Reconstruction (IIRR) conducted in the past decade about 20 workshops on different topics, all resulting very attractive, practical information kits. This last one in this series was produced at a workshop jointly organised by IIRR and MYRADA, a South India based NGO. It describes successful agricultural strategies for drylands, areas with less than 800 mm per year rainfall. In India, the largest part of the country consists of rainfed dry areas, and hence it is not surprising that a lot of research and successful field action in dryland agriculture originates from there. This manual compiles these Indian experiences with farmer-tested, dryland technologies. They involve traditional approaches to natural resource management, gender issues, soil and water conservation, crop management, soil management techniques, alternative land use systems, post-harvest practices and agricultural implements and a concluding chapter on innovative approaches in participation, extension and institutional partnerships. Very accessible, practical information, richly illustrated with excellent drawings. (IHG)

Photo: 'Shree' Padre

Mass marriage provides SLM volunteers with an opportunity to explain the open well recharging method and its importance to people.

Saurashtra's water insurer

'Shree' Padre

The Saurashtra region of Gujarath, India, resembles an inverted saucer, surrounded on three sides by the sea. Saurashtra has about 4700 villages and a population of some one million people. In a normal year the monsoon brings between 300 and 500 mm of rain. If the monsoon smiles, there is plenty of water and good crops of groundnuts, cotton and millet: the money tinkles in. Every 2 to 3 years, however, there is a drought and between 1985 and 1987 there was one of unprecedented severity. Most of the open wells that normally contain between 350,000 to 400,000 litres of water and provide the main source of irrigation water in the district, dried up.

1988 brought hope. There were good rains and Ramjibhal Manjibhai, a farmer in the small town of Dhoraji had an idea. He diverted run-off water into his open well. Although his neighbours warned him this would silt up the well, he was adamant. The next summer, though some silt had got into his well, Ramjil had water while his neighbours had none.

Shamjibhal Antala also lives in Dhoraji and he watched these developments with interest. He was impressed by this way of increasing the water table and wanted to pass on the idea to others in Saurashtra.

After many discussions with friends he improved upon the method. A 6 x 6 foot filter tank was dug close to the well and filled with 2-3 layers of pebbles of different sizes. Just above the bottom of the tank, a cement pipe - 9 inches in diameter - was installed to guide the water into the well. Rainwater came into the filter tank through open channels and gushed into the well through a pipe. This installation cost the farmer between Rs.500 and Rs.1000.

If there were streams or rivers in the vicinity, cement pipelines were laid between them to the filter tank. All Saurashtra's rivers flood at least 4 times during the monsoon. When their water is diverted, it is enough to recharge nearby wells.

Spreading the message

Antala and his friends approached the farmers in the evenings. Many of them rejected the idea, others asked for subsidy. There were no takers for the recharging plan. Shamjibhai did not want to give up the idea. He and his friends set up the 'Saurashtra Lok Manch' (SLM) with water conservation as its main objective.

SLM did not wait for government programmes or finance. It plunged into action determined to convince people that there was a way of solving the water crises. First, the SLM approached the dharmic leaders - the Mahanths, Priests and Swamis. Heed the SLM's advice, they warned, otherwise disaster will strike.

Meanwhile, social reforms were underway. Mass marriages were becoming popular because people were fed up with the lavish marriage ceremonies that turned many parents into paupers. The SLM saw this as a way to spread its message. Volunteers displayed a model of the recharging method at mass marriage ceremonies and explain how it worked. Between 1994 and 1995, 42 mass marriages were held in Saurashtra and 2000 couples entered wedlock. Each ceremony was witnessed by some 25,000 people. Thus, thanks to mass marriage, the well recharge concept reached 800,000 people.

Demonstration was not the only strategy used by SLM. It also held hundreds of meetings at village level. Many articles were published in Gujarathi and, in 1994, the SLM organised a 'Jala Sanchayan Abhiyan' (Water Conservation Movement) that involved 750 villages in the Rajkot district.

Slowly but steadily the campaigns began to bear fruit. Between 1992 and 1993, 3,000 wells were recharged. The following year SLM raised its target to 10,000 wells. The successes of individual farmers got around quickly. Total number of recharged wells rose to 25,000 in 1995, far beyond SLM's expectation. Today there are more than 30,000 recharged wells.

Simple and cheap

The recharging method is particularly suitable for irrigation wells. In Saurashtra if water remains in the irrigation wells for the winter and summer, farmers can be sure of two more crops. Gundasara village has 277 wells, 210 have water thanks to the recharging method. According to estimates, farming is possible when wells are recharged on 30,000 ha.This has led to increasing income by Rs 150,000,000. The popularity of the method is that it is low cost and does not require external inputs or external knowledge.

SLM has identified 99 drought prone districts. Many wells can still can be recharged. Wherever Antala goes, he has one simple message: *"Forget about the government for the moment. Don't ask what it can do for you. Be independent. Water is your problem and here is a solution which you can keep entirely in your own hands*".

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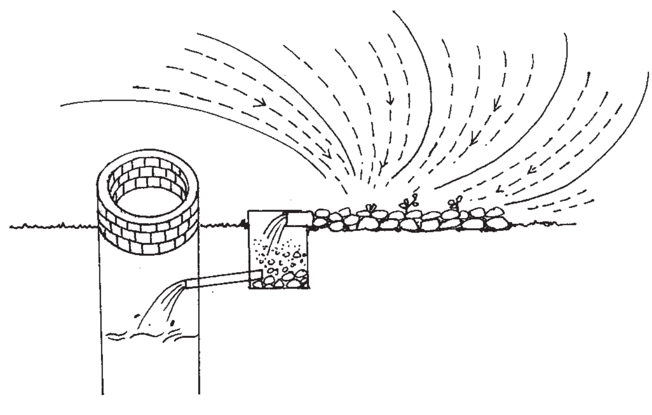
'Shree' Padre, PO Vaninagar, via: Perla, Kerala - 671 552, India.



Percolating the rainwater where it falls.

Photo: Alex Bolding

A proud farmer with his lined irrigation furrow

Challenges of organising catchment councils

This article discusses key issues in the operationalisation of (sub-)catchment water-user organisations. In the Nyanyadzi river catchment in Chimanimani district, Zimbabwe (see map) there are many indigenous, farmer-initiated irrigation furrows but few have legal water rights. Water scarcity in recent years has lead to a struggle between downstream irrigators in the government-run Nyanyadzi irrigation scheme and the various groups of upstream irrigators in the Shinja resettlement scheme and the Mutambara and Muusha communal areas (see Bolding et al 1996). The Zimbabwean Ministry of Water and Rural Resources has initiated a process of decentralisation. Responsibility for water management has been devolved to (sub-)catchment councils consisting of water users themselves. This system has considerable potential but legal and practical problems have created difficulties.

Alex Bolding and Lawrence Nyagwande

From its source in the eastern highlands of Chimanimani district, the Nyanyadzi flows west into the Odzi river. The Nyanyadzi runs through all of Zimbabwe's five agroecological zones. Its source is at 1200-1500 metres in a region of high annual rainfall (circa 1200 mm) and fertile soils. On its way west it flows through an area of large-scale commercial farming and subsequently through resettlement and communal areas. It enters the Odzi in the dry, low veld where, at an altitude of 550 meters, soils are marginal and annual rainfall less than 400 mm. Just before it enters the Odzi, a small-holder irrigation scheme taps away water by means of a permanent weir. The Nyanyadzi irrigation scheme as it is known, was established by the government in 1934 and has been government managed ever since. A thousand de facto plot holders occupy a 414 hectare site.

Most farming households in the 800km^2 Nyanyadzi catchment area depend on dryland agriculture. They harvest one rain-fed crop of per annum: maize in the better rainfall zones and millet/sorghum elsewhere. Two harvests in five fail. The catchment is dissected by more than one hundred small furrows that tap water from the river and its tributaries. Most of these furrows water between 0.1 and 25 hectares and have been constructed by the indigenous irrigators who manage them. Most of these furrows are simple in infrastructure. Temporary stone weirs divert water from the river and earthen furrows carry it to the fields. The main crops in summer are maize, cotton and paprika and in winter wheat, tomatoes and sugar beans.

From 1983, plot holders from the Nyanyadzi irrigation scheme together with the national extension and irrigation service (Agritex) have organised regular raids upstream along Nyanyadzi river to destroy '-informal' irrigation furrows and get water for their intake.

Water entitlements

Those using the water are not over concerned with legal entitlements as defined in the Water Act. Basically most Nyanyadzi catchment irrigators feel that water belongs to God or is a public good which should be shared with others. Few accept that the Government owns the water. Practically speaking entitlement is confined to those who own or use land along the river. However, formal irrigators like those in the Nyanyadzi project claim the water from the Nyanyadzi river belongs to their scheme. They have entitlements to all the water. Upstream furrow irrigators with water rights tend to put forward the same claim. However, they do not deny others 'a chance'. It is impossible to divert the river's entire flow.

Within the Ruwedza valley entitlements are related to type of land holding. Most downstream furrow irrigators will agree that the white and black commercial farmers upstream have a right to extract water since they own title deeds to the land. During the severe water scarcity of 1992-95, the headman at the downstream end of Ruwedza valley claimed that his furrow was the oldest in the area. Upstream furrow irrigators generally seem to claim entitlement on the basis of their top position. In most cases downstreamers are ignored in the matter of entitlements.

Some claim more rights than others

Some successful furrow irrigators claim they make better use of the water than the wasteful Nyanyadzi plot holders whose main canal loses some 70% of its water through its sandy, unlined canal embankment. Other furrow irrigators, those who have made heavy investments in canal infrastructure, feel their investment gives them the right to deny Nyanyadzi plot holders access to water because the latter have been provided with canals free of charge.

Springs are generally considered to be the private property of those working the surrounding land. There is consensus among communal and resettlement farmers that households with no direct access to land near the river should only be entitled to use water for domestic purposes. Usually unoccupied river banks are not included in this rule.

All these local perceptions of entitlements should be considered in setting up catchment users organisation, since government definitions of who owns water seems to mean little to those involved.

Boundaries

In the Nyanyadzi catchment water users differ in their awareness and understanding of hydraulic interdependence. The issue of hydrological boundaries strongly ties in with local conceptions of entitlements to water. Hydrological units, however, do not correspond with social units. In organising catchment users, what should be the criteria for sub-division: the number of inhabitants/water users; administrative units; available water flow; distinct features in the landscape or social communities? There has been little debate on the exact criteria involved in setting the boundaries for catchments and sub-catchments. It has been assumed that these boundaries can be determined in Harare on the bases of watershed maps, righted water users, and hydrological zones. In practice this is impossible.

Ground and surface water

Most surface water originates from sub-soil sources (springs, aquifers). This implies that any regulations with regard to river water abstraction must include ground water use.

In places like the Ruwedza valley the intricate interplay between ground and surface water is fully appreciated by local water users. Furrows are spread geographically to optimise the benefits from recharge of the river by sub-soil aquifers. Springs are carefully exploited and riverine vegetation is promoted especially in the upper reaches of the Ruwedza river. Thus sponges in the river bed are allowed to continue. When a spring surfaces relatively far from the river bed, land users near that site may use the water for their own benefit. This has implications for the membership of future Catchment Authorities and means that membership of catchment councils should not be confined to furrow irrigators alone.

Uses and users

Farmer-initiated furrows are used for a variety of purposes. Each user has a particular need. Gardening and the use of spring water, for example, is nearly always women's work whilst commercial crop production in furrow irrigation is done by men. Discussions on water distribution and allocation are usually initiated and led by men. However, a catchment council that involves only male dominated channels of communication and decision making will be ineffective.

Historical roots

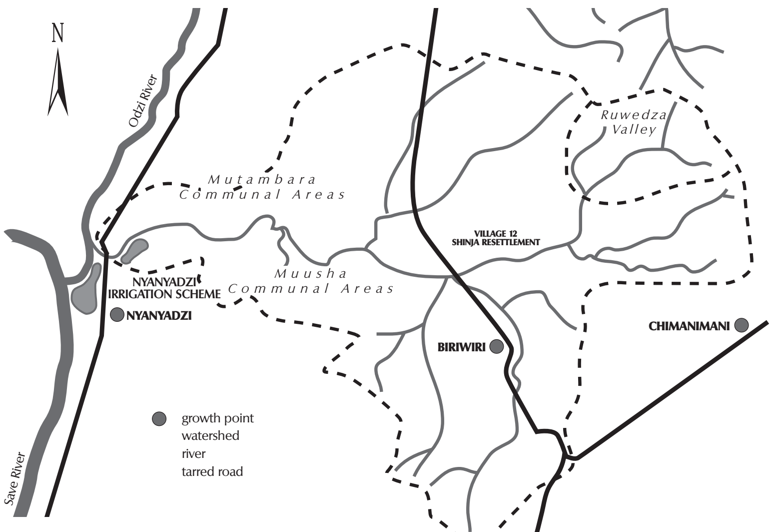
Some water users have worked out their own strategies for dealing with water scarcities because conflicts had to be settled or because of mutual dependence. In the Ruwedza valley, downstream furrow users share the available water during periods of water scarcities. The weekly rotation of turns used does not include upstream commercial and resettlement farmers. Downstream furrow users would never challenge the (white) commercial farmer's right to water, despite the fact that he has no water rights and they do, because he helps with road maintenance (to enable trucks to come and collect produce from the irrigation furrows) and supported the downstream water users in their struggle to retain some autonomy and not be incorporated in the resettlement scheme. These relationships are varied and complex. By highlighting one aspect of the interdependence and interfering with it, other aspects may be jeopardised.

During the upstream raids in 1987 and again in 1991 some furrow irrigators in Village Twelve struck a water sharing agreement with the Nyanyadzi plot holders through the mediation of the District Administrator. It was agreed that water from upstream would be released every other week by furrow irrigators in Village Twelve. These water sharing arrangements and the complex relationships between groups in a catchment demand careful appraisal in future water user organisations.

Representation and leadership

Zimbabwe has a large variety of social institutions, each with their own, sometimes overlapping, allegiances. Many proposals originating from policy makers' desks pay little more than lip service to the diversity of present day Zimbabwe. Village Twelve in the Shinja resettlement scheme is a good example of this diversity. Who should represent this village on the catchment council? The traditional leaders, recognised by the new comers ('illegal land squatters'), but despised by some official settlers? The members of the Village Development Committee who seem mainly to represent the official settlers? The Zimbabwe Farmers Union representative who runs a small, informal furrow, but has hardly any following in the village? Or should it be the one officially in charge, the government resettlement officer, who hardly ever visits the village?

It is clear that representation and leadership issues demand careful study. Each locality is different. Simplified or reified models of how people should be represented have little relevance here.



The Nyanyadzi Catchment, Zimbabwe

Not everybody gains

The main stumbling block in setting up a catchment council in Nyanyadzi has been that few were interested in joining such an organisation. During times of water scarcity downstream users are interested in striking a deal with upstream users . However, the problem will always be that top-enders are unlikely to gain much from such arrangements.

This has serious implications for the setting up of successful catchment authorities. Somehow top enders must be provided with incentives to take part. Subsidies for good land husbandry practices (perhaps extended to sustainable forms of stream bank cultivation) are one option but unlikely to be very effective. More substantial benefits in the shape of infrastructural improvements (dams) are likely to make a deeper impression. Penalties could also be imposed by recognised authorities. However, for these to be effective and well administered, the catchment council must first be allowed to mature. Hydrological units do not coincide with social units and the council is more likely to succeed in becoming accepted as a social entity if it is not immediately associated with punishment. Win-win options should first be exploited.

Win-win options

This is why in Nyanyadzi two experimental centres in water and soil conservation were established in the upper parts of the catchment. This *kuturaya* (try out in Shona) approach - takes up farmers' suggestions and tests them in the local trial centres. It promised almost immediate gains for local upstream farmers who would benefit from increased yields. Down stream users would also benefit in the longer term because sedimentation would be reduced and base flow would be increased. The basic challenge in setting up catchment authorities lies in the identification and exploitation of such win-win options.

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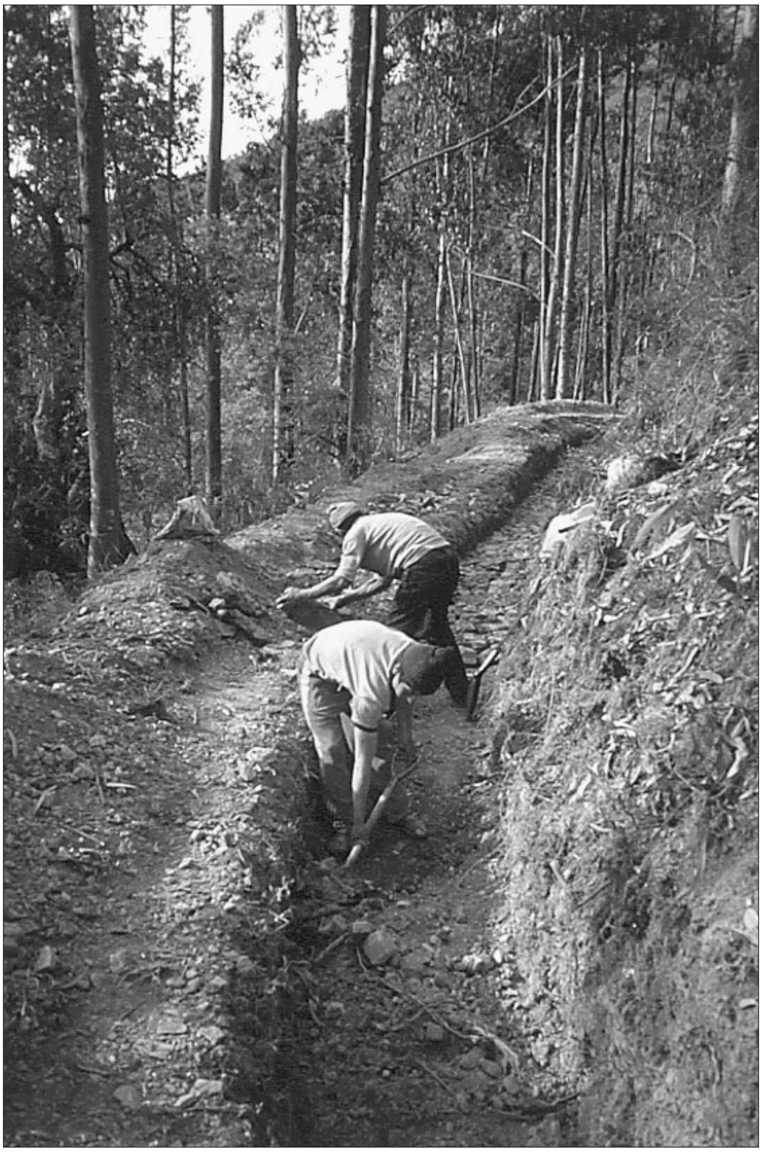

Photo: Willem Kastelein

Irrigation development in the Peruvian Andes

SNV Netherlands Development Organisation has over 15 years experience in providing technical assistance to partner organisations working to improve irrigation management in the northern and southern Peruvian Andes. Willem Kastelein co-ordinates these activities and, in this article, discusses some of the lessons and experiences gathered over the years.

Willem Kastelein

The Peruvian Andes are located between the arid desert of the Pacific Coast and the humid tropical rainforests of the Amazon. The highest peaks are almost 7000 m above sea level. Between the mountain ridges are highland plains or punas and steep valleys.

The main agricultural areas are concentrated in the valleys. These lie at between 2000 and 3500 m and tend to have a semi-arid climate with a relatively short rainy season and irregular, unreliable precipitation. In these conditions the use of irrigation is generally advantageous. The availability of irrigation reduces drought risk and can help extend the growing season, sometimes even making it possible to grow a second crop. Irrigation is widely practised and considered important for development. Irrigation was also important in Pre-Hispanic Andes cultures and was reflected in their religion and temples. Quite a number of these ancient irrigation systems, some of which are more than 2000 years old, are still functioning today.

Spanish colonisation resulted in the decimation of the indigenous population. In its social organisation, post-Hispanic rural society consists of indigenous comunidades - generally 30-200 families with common territorial property rights, mestizo (smallholders) and haciendas (large estates) owned by European immigrants. In the agrarian reform of the late 1960s haciendas were subdivided into smallholdings. The comunidades have also been reorganised into individual farms, though formal communal property rights remained intact and communal organisation has generally been maintained as far as common interests and the common use of resources are concerned.

Smallholders generally produce for their own consumption, selling only some of their crops to cover cash needs. Irrigation is used to produce potatoes, maize, beans, peas and several local cereals for the market. Pasture land is also irrigated, particularly to overcome the dry season in areas where dairy cattle are kept.

There are various ecological zones in the Sierra and most irrigation systems are small-scale with between 5 and 200 water users. Larger schemes with more than 1000 smallholder water users are not uncommon. Irrigation is practised both on the valley floors and on the (generally steep) slopes.

Intervention in irrigation by both governmental and non-governmental development organisations has aimed at improving existing irrigation and the construction of new systems. Generally speaking, these interventions have not produced the expected economic results and their sustainability is questionable.

Irrigation interventions

The introduction of improved irrigation may create new possibilities for production and development projects. But it must be understood that a change in irrigation alone is not enough in most cases. To be successful, change must respond to the needs and priorities of the interest groups concerned. In many situations, more inputs, including access to extension, additional labour, investments and a market infrastructure are needed. These inputs should be available at a reasonable price and give sufficiently high returns. In many cases these conditions are often not met and as a result irrigation interventions fail to secure improvements in production.

An analysis of six cases in the Cusco area has shown that more water had become available as a result of these improved irrigation systems. However, the amount of labour required to manage the systems was such that the productivity per unit of labour remained unchanged, even with higher production per unit of land. Meanwhile, soil erosion had increased significantly. As labour can be considered the most precious input in these LEISA systems, these results cannot be considered satisfactory.

Women and water

In recent decades the role of Andean women in decision making at household level has increased. Many men have fled because of political violence or because economic opportunities elsewhere are more attractive. However, formal irrigation organisations usually only include women who are household heads, this despite the important role played by women in agriculture and irrigation. Women are major water users and need water for livestock and domestic purposes. Therefore, it is important that they are included when decisions are made on water management and irrigation. Projects have failed in the Peruvian Andes because insufficient account has been taken of women in project planning and implementation. Experience has shown that women can be closely drawn into the process of decision making and the establishment of water rights if the importance and logic of their participation is explained and discussed. Experience has shown that this type of approach has led to more sustainable results.

Establishment of rights

In irrigation systems that function without external intervention, water rights and the right to use the irrigation system are generally related to an individual's involvement in the construction and improvement of irrigation infrastructure. This can either be a cash or a labour involvement. Rights are consolidated through participation in operation, maintenance and repair work. These rights will normally be inherited by children and, in most cases, they can be sold. Normally the irrigation organisation would have to give permission for such sale, however. New users may obtain rights by making a contribution which is considered equivalent to the efforts already invested by present water users.

Irrigation interventions by most development organisations tend to focus on the construction of physical infrastructure and do not take existing rights and the mechanism that establish new rights into account. Development organisations increasingly recognise the importance of adequate water-user organisation and seek to include this in their intervention strategies. Only a few however, seem to realise that the development of rights through participation in construction is an essential and fundamental starting point. This seriously limits the effectiveness of development interventions aimed at strengthening sustainable irrigation organisation.

Where existing rights are not taken sufficiently into account, water users will be reluctant to participate in projects. If the creation of new rights and obligations is not sufficiently clear, people will be less inclined to invest in new developments. If all investment costs (sometimes including labour) are paid from external sources, people do not feel that rights have been legitimately established for the beneficiaries. Consequently, water users are not likely to see such schemes as their own property and responsibility.

Appropriate technical design

Designing irrigation in the Andes is technically complex because of steep topography, irregular geology and the variety of soil types. The use in the Sierra of irrigation design criteria developed for conditions on the Peruvian Coast has had serious negative consequences. In some cases the construction of irrigation canals has destabilised the slope of the land causing landslides through overtopping of canal banks. This has lead to serious erosion damage both to canals and environment whilst construction of canals over unstable calcareous and gypsum rocks has resulted in collapses.

In some parts of the Andes farmers have developed sprinkler irrigation appropriate to their own conditions and needs. Around the village of Paucartambo, for example, water originates in small springs with discharges often well below 2 litres per second. This is difficult to handle efficiently in surface irrigation. Constructing appropriate storage reservoirs to enable more efficient surface irrigation would require considerable investments. As the relatively steep topography easily provides the required pressure, simple but effective irrigation is achieved using relatively low-cost polyethylene tubes (50 to 100 m long) connected to locally made or imported sprinklers. Although the application of sprinkler irrigation has considerable potential in the Andes, many development organisations are now promoting it without adequately assessing local conditions.

There are examples of cases where sprinkler irrigation, introduced to replace current surface irrigation systems, has given rise to disturbing effects and where serious conflicts have arisen because of its consequences for water distribution and the rights and obligations of water users. Further it has been observed that on heavy soils, water from sprinklers infiltrates very slowly causing it to flow into depressions. This results in low water use efficiencies. The advantages of sprinkler irrigation are often not realised in practice because plots are small and irregular which leads to high fringe losses.

In the Andes, as elsewhere in the world, transplanting technical options from one place to another can have adverse effects. Irrigation infrastructure must be designed to respond to the social and organisational requirements particular to each irrigation system and to the complex physical condition of specific locations. Irrigation alone cannot ensure sustainable development. ■

Photo: Willem Kastelein

Sprinkler irrigation in Paucartambo.

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Challenging water scarcity

Photo: Coen Reijntjes

Water, lifeline in farming. Low cost and biophysically and socially adapted technologies are needed. A treadle pump used by smallholders near Gorakhpur, Uttar Pradesh, India.

Editorial

Whether it comes from rainfall or irrigation, water means life in agriculture. When there is a water shortage plants become stunted, yields drop, animals become weak and men and women have to struggle to find the water they need. Most farmers have to deal with the problem of uncertain and variable rainfall and the effect it has on agricultural production. Rainfall is a serious risk factor in farming and farmers are always vulnerable to yield losses caused by extreme climate fluctuations. Besides recurrent natural phenomena such as El Niño with its devastating droughts and floods there are also the droughts and floods that are man-made and are the result of local deforestation and erosion, global warming and modern agricultural practices. To feed a growing world population, agricultural production must be increased and secured. One of the ways this can be done is by improving water management in rainfed agriculture or by irrigation which is one of the main ways of increasing yield and reducing the risk associated with drought.

However, irrigation often gives rise to its own problems. Competition for water between agriculture and industry is becoming increasingly acute. Untapped water reserves are becoming more difficult to find and over-consumption of water leads to such problems as the disturbance of natural flow patterns in river systems, ground water depletion and salt water intrusion in coastal zones. Due to insufficient drainage, a considerable amount of irrigated land has been degraded by water logging and salinisation. In some places, pesticide pollution and industrial waste has made water unsafe.

The amount of rainfall infiltrating the soil is decreasing because deforestation, soil erosion, monocropping and urbanisation is hampering groundwater replenishment. Access to water is becoming a critical issue, conflicts over water rights between farmers, between traditional and modern water laws, and between countries increase. At the same time, much irrigation water is being used inefficiently. Many new and promising schemes have been unsuccessful because the technology chosen has proved inappropriate for local economic, social and biophysical conditions or inadequate attention was paid to the importance of water rights, social organisation and gender.

Although irrigation is an important technique in food production it can still be improved. It also has its limitations and should not be seen as the only way in which water can be secured for agricultural production. In fact, there is a wide diversity of strategies that can be employed to conserve scarce water resources. Where irrigation development has reached its limits or is not possible, other types of strategies become important. In this issue of the ILEIA Newsletter we have combined different approaches to water management: irrigation, water harvesting, watershed management and water conservation. Several articles, from Peru (p6), Zimbabwe (p8) and India (p11 and p12) focus on the social organisation of water management. Others, from India (p10), Tunisia (p14), Nigeria (p16), Ethiopia (p21) and Kenya (p29) examine low-cost technology adapted to local conditions.

Water management is complex

Water is not only managed by individual farmers but also by groups of farmers in irrigation schemes and watersheds. Entitlement to land and water, social cooperation and legislation are important aspects of water management. Initiatives to improve water management can be taken by individual farmers as well as by communities, governments or projects. At the community level and above, processes of participatory planning are essential.

There are many traditional water management techniques. Some irrigation and water harvesting systems are very old and at field level these traditional strategies and techniques are still being used to make optimal use of available rainfall. Watershed management, however, is a relatively new approach and has become increasingly necessary as population pressure, modern agriculture and deforestation continues to disturb the ecosystems of natural watersheds. As water becomes more and more scarce, there is a need for an integrated approach to water management that encompasses all water users, types of water use and sources of water. Water conservation is also becoming increasingly important in planning and development. Water management, however, can never be an aim in itself, it is an integral part of farm and land husbandry and its objective should always be to protect and improve the farmers' situation.

Social organisation

The design, implementation and management of irrigation and watershed schemes depends to a large extent on the way farmers and the other actors involved relate and work together, and organise access to resources. The rural population is far from homogeneous (Mehta p11). Differences in wealth, gender, caste, ethnical background and political preferences, for example, mean that people have different access to resources, have their own rights and obligations, adopt livelihood strategies appropriate to them, have their own patterns of cooperation and thus have different and sometimes conflicting interests and perceptions of the local situation. This can make collaboration in irrigation and watershed schemes difficult (Bolding p.8). Many irrigation and watershed projects have failed because their design was based on physical and economic criteria alone with little consideration being given to social factors and issues such as entitlements to land and water (Kastelein p6; Diemer & Huibers, 1996). However, getting all groups of users involved and organised is often far from easy (Bolding p8). Self-help credit management groups (Fernandez p12) and farmer experimentation (Bolding p8) can increase the level of interest in water management and strengthen social cooperation.

Technology

High-external-input techniques may be too expensive for smallholders or are inappropriate to local biophysical and social conditions (Somashekhara Reddy and Sharathchandra p5; Kastelein p6; Mechergui & Van Vuren p14; Gobin et al p16). Many farmers would benefit from low-cost techniques more suited to their conditions and needs and which also ensure an increase in water use efficiency and conservation. Examples of such techniques include locally made sprinklers (Kastelein p6), low-pressure drip irrigation (Gobin et al p16; Chapin p29), water harvesting techniques (Padre p10; Fetien et al p21; Muhia p29) and the use of Vetiver grass (Dreyer p18; Grimshaw p20). Mulching (Padre p21) and the use of organic fertilisers are basic soil management techniques that increase water infiltration, water-holding capacity and help prevent water losses. Multiple cropping systems, like mixed cropping and inter-cropping, can help farmers to get the most out of the water available to them during particular seasons and from different layers of the soil. They can also help protect the farmer against the risk of complete crop failure.

Farmer innovation

Farmers, men as well as women, have developed many low-cost water saving techniques but often these innovations remain unrecognised. A programme on Indigenous Soil and Water Conservation in Africa is cooperating with technical services, universities and NGO's in Zimbabwe, Tanzania, Cameroon, Ethiopia, Burkina Faso and Tunisia in making an inventory of farmer innovations in soil and water conservation. Fetien et al (p.21) report on several of these innovations. Also Padre (p.10) reports on an interesting farmer innovation in India. Better insight is needed into why some of these innovations are being adopted by farmers and others not. Fetien (p.21) and Padre (p.19) describe two initiatives undertaken by farmers in Ethiopia and India to reforest their land. These experiences clearly show the impact of man-made drought and the positive effects of water conservation and reforestation on the availability of water and the productivity of land.

Many of these low-cost measures are within the reach of farmers. Water scarcity, therefore, can be challenged!

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Mud Katta, still appropriate

The coastal region of Karnataka, India receives an average annual rainfall of 3800 mm between April and October. Little water flows down the streams to the Western Ghats after October. There is hardly any rainfall between February and April and the demand for irrigation is heavy. The perennial crops in the uplands are areca nut, coconut and coffee and in the valleys and coastal zone, paddy and vegetables are grown. Holdings are very small, normally not more than 0.5 ha. There are no major dams and ground water yields from wells are low. Irrigation, therefore, depends on tapping and conserving lean stream flow.

Mud Katta, the solution

Farmers build temporary bunds in the streams to harvest and store irrigation water. This water is guided through canals into smaller ponds or *kere* dug out and located on individually owned fields. Irrigation water is lifted manually from the *kere*. The bund, constructed from wood and earth, allows enough seepage to fill downstream bunds. Heavy floods are prevented from entering the fields by bunds constructed in such a way that they are easily washed away by heavy, early rainy season flows. They are rebuilt after every rainy season.

A farmer-elected committee is responsible for constructing and managing the system. Older people, experienced in estimating stream flow, are responsible for timing bund construction. The farmers receiving water from the main pond contribute a fixed amount of poles, leafy material and labour and help construct the bund at an agreed time. The farmers also desilt the canals. There is no lack of trees; 40% of the upland is forested and farmers in the coastal zone grow trees on their land.

This irrigation system is known as *Mud Katta* and can be found in every stream in Dakshina and Uttara Kannada. In the taluk of Mangalore, for example, some 3550 ha are irrigated in this way.

Conserving water

Farmers lessen evaporation by growing aquatic weeds in the *kere*. These cover the whole pond and are harvested regularly. They provide bedding for the animals and afterwards good manure for the fields. Drinking water is also tapped from the *Mud Katta* and stored in separate wells. These are only used when there is not enough ground water.

All structures are kept well filled in the dry season. As the soil is sandy, this enhances the recharging of ground water, another function of *Mud Katta*. This is important because salt water intrusion is increasing along India's coast due to heavy deforestation and overpumping of ground water for urban and industrial needs.

Mud Katta fits local needs and conditions

The arrival of pump sets and bore wells has not affected *Mud Katta*. Smallholders find it uneconomic to maintain individual wells and install pump sets. *Mud Katta* is cheaper, it uses local materials and no large investment is needed. Attempts to replace *Mud Katta* by concrete structures has failed because they tend to collapse.

The construction and management of *Mud Katta* does not seem to be affected by the break-down of social cohesion among rural communities. The benefits and limitations of pumping water from wells has forced farmers to cooperate. *Mud Katta* is well adapted to local conditions and continues to satisfy the need for irrigation water. At the same time this traditional system plays an important role in checking the intrusion of salt water.

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Two cases from the field

Caterpillars and ducks

Integrated rice-duck cultivation in Vietnam

M.A. Qaium

The Red Hairy Caterpillar, or *Amsacta albistriga* is a voracious polyphagous pest attacking many rainfed crops in low-rainfall areas of Andra Pradesh, Tamil Nadu, Karnataka, Madhya Pradesh, Maharashtra and Rajasthan in India. The caterpillars devour sprouting seedlings and cause damage rates that vary from 25-100 percent. Farmers try to avoid the pest by postponing resowing until late in the season but losses are still heavy. Deep ploughing to expose pupae to the sun, destruction of egg masses and digging trenches to prevent the migration of catepillars are also ineffective.

Pesticide applications are not an option for smallholder subsistence farmers because egg hatching occurs in many different batches and requires adequate and immediate control. Women, children and the elderly catch caterpillars but cannot keep up with the speed at which they emerge. Sanghi and Qaium developed a Natural Pest Management (NPM) strategy that draws on communal resources and promises to reduce the work load that catching caterpillars currently imposes on women.

This NPM approach is based on the observation that only collective action can ensure the effective implementation of non-pesticide control. Taking the behaviour patterns of the parent moth as their starting point, Sanghi and Qaium, supported by regular meetings with scientists and NGOs, set about motivating farmers and training them to recognise patterns in the moths life cycle and behaviour. Light traps, each of which proved effective for an area of 7 - 8 hectares were set up at night - the time when moths are most active. Rainfall predictions were monitored by farmers enabling them to anticipate when moths were likely to emerge and the eggs deposited by female moths around light sources were collected and destroyed. Migratory caterpillars were locked into traps baited with their favourite food, such as cowpea or cucumbers in intercropped fields or the leaves of *Calotropis* or *Jatropha* at field boundaries.

Whilst this strategy was successful and pesticides were avoided, it was labour intensive and made heavy demands on the capacity of farmers to cooperate together. It did, however, help free women from the week-long work of catching caterpillars because night monitoring was generally carried out by men. The results of this strategy have been such that the Andra Pradesh State Department of Agriculture, working in close cooperation with NGOs, has adopted it in a number of areas and it is being recommended as a control strategy by the Andra Pradesh Agricultural University.

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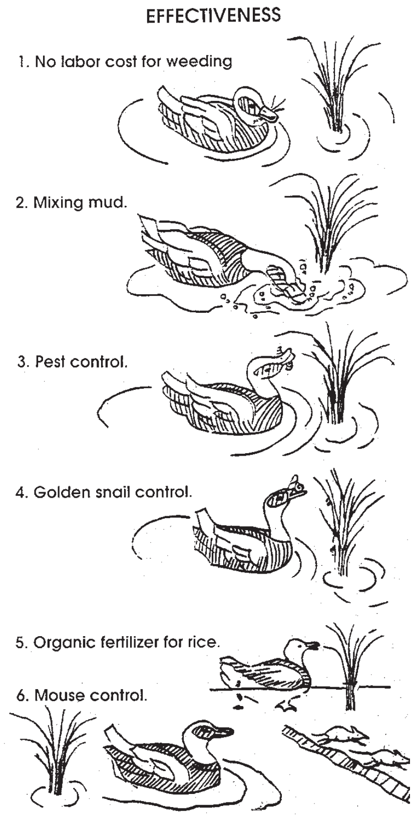
(More detailed version of this articles is available on request (eds.)



source: VAC VINA, Haiphong, Vietnam

Integrated rice-duck cultivation in Vietnam

Pham Cong Phin

Duck raising has a long history in Vietnam. Duck owners are constantly trying to reduce feeding cost and use paddy grains dropped around rice fields to feed their ducks during the harvest period. When the young rice plants are well established, ducklings are got ready. The birds must be big enough to feed themselves when they are allowed into the rice fields after the crop has been harvested.

An integrated rice-duck cultivation method developed in Japan offers another approach to integrating duck-rice production. Ten day-old ducklings are released into recently transplanted rice fields at a density of about 190 ducks per hectare. As they feed they help control insects, weeds, snails and even mice. In doing so, they considerably reduce the amount of human labour needed in cultivation. The ducks are taken out of the fields before the rice ears appear. They are then big enough eat.

In 1994, the rice-duck system was tested for the first time in Vietnam. Trials took place in the Sustainable Agriculture Promotion Centre, Haiphong and were guided by VAC VINA (Garden Association of Haiphong). Farmers' interest was immediately aroused and the method is now being used by several hundred families in the locality. More data is necessary, however, before it can be introduced into extension programmes.

This method of chemical-free rice cultivation has aroused much interest in Japan, where some 10,000 families have adopted the system, and in Korea, China and Taiwan. Recently, Tanzania also began experimented with this organic alternative.

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(More detailed version of this articles is available on request (eds.)

ILEIA research

Highlights Peru

photo: Marielle Dubbeling

The Peruvian Andes are characterised by several different altitude zones and this has given rise to considerable agricultural diversity. Farmers in the region have had long experience in growing potatoes. They are the staple crop of the region and are cultivated on valley floors and hillsides during the rainy season (September-April) and, under irrigation, during the dry season (May-August).

However, despite their long history and their prominence in the local diet, the potato yields of small Andean farmers are generally low. This is largely due to pest and disease related losses. Intensified potato production, less reliance on local species and varieties, and the indiscriminate use of pesticides has resulted in a high incidence of pests and diseases.

Early in 1997, the ILEIA programme in Peru initiated a PTD process amongst farmer groups in Huancayo (Central Peru) and Cajamarca (Northern Peru). The majority of these groups identified potato pests as a major constraint in agricultural production. It was decided to carry out a series of experiments on controlling late blight (*Phytophthora infestans* - one of the main problems in potato cultivation all over the world), and in the control of the potato moth (*Phthorimaea operculella*), a pest which generally attacks the crop during storage. Farmers have allied with local NGOs and research institutes such as INIA (National Institute for Agricultural Research) to design and evaluate these experiments.

Two different trials on ways of controlling the potato moth, and thus reducing the damage it inflicts on stored potatoes, have already been finalised and evaluated. One trial, conducted by a farmer group in Cajamarca and supported by INIA, involved four different methods of storage:
a) storage in sand,
b) storage in barley straw,
c) storage in quinua chaff, and
d) plain storage, the traditional method of storage that served as a control.

The moth inflicted most damage in the control method, with the result that there was a considerable loss and a low percentage of sprouting. There was virtually no incidence of pest found in the other categories of storage. However, the number and quality of sprouts varied considerably. Straw treatments resulted in a large number of short sprouts with seemingly burned ends whilst potatoes stored in sand had a small number of long sprouts that were easily damaged during planting.

In Huancayo, a farmer group supported by *Grupo Yanapai* and INIA tested three different storage methods: a) plain storage, the traditional method serving as a control, b) use of herbal ashes, and c) use of petrol traps. Generally speaking, farmers considered treatment with ash to be the best. The problem with petrol traps was that petrol often spilled from the traps and damaged the potatoes.

New trial designs for 1998 have been formulated on the basis of these results. The exchange of results between the two different farmers' groups and the support of research institutes such as INIA (for example, in terms of training on the life cycle of the moth, plus monitoring and evaluation of results) has been an important stimulus.

However, the question of what strategy farmers will adopt towards controlling pests in the near future remains an open one. The government has eliminated the tax on pesticides making them more easily available to farmers. PTD as it is being implemented at present concentrates on one specific agricultural problem and technique. The challenge to ILEIA and its partners is to extend beyond this technique to sustainable development of the farming system as a whole. To this end, ILEIA is monitoring and analysing the economic and ecological performance of a limited number of ecological and conventional farming systems within Peru. This research will not only broaden our understanding of these farming systems and their management strategies, but will also provide information on the economic and ecological costs and benefits involved. Hopefully, this will give us more insight into the bottlenecks and opportunities for sustainable agricultural development - our ultimate objective!

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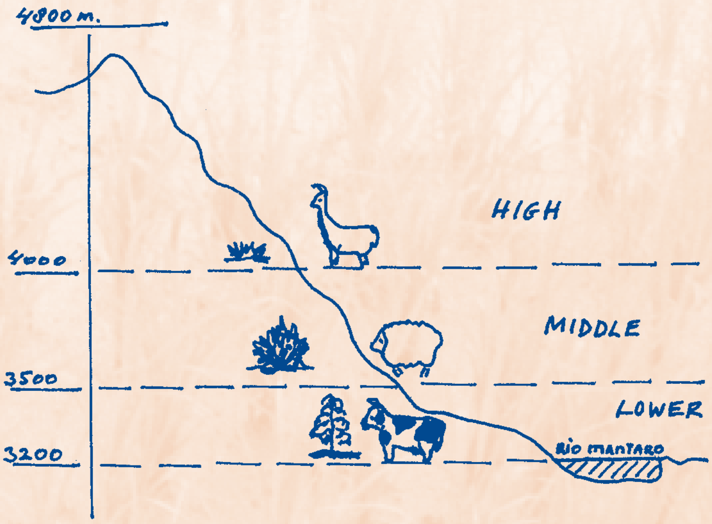

Agro-ecological zones of the Valle del Mantaro

drawing: Grupo Yanapai/Steenhuis

The potato is of fundamental importance in the diet and economy of the farmer in the Bolivian Andes. Usually this crop is either grown in rain-fed conditions above 4000 meters or under irrigation in the valleys where the altitude varies from 2500m to 800m. The Andean potato weevil - various species of the genus Premnotrypes - is the main pest at higher altitudes. The adult female lays her eggs at the base of the potato plant. The hatching larvae move through the soil and feed on the tubers formed underground.
At harvesting time, the larvae leave the tubers and enter the soil forming pupae and later as adults they invade recently planted potato fields. The weevil produces one generation each year a process well synchronised with the potato crop.

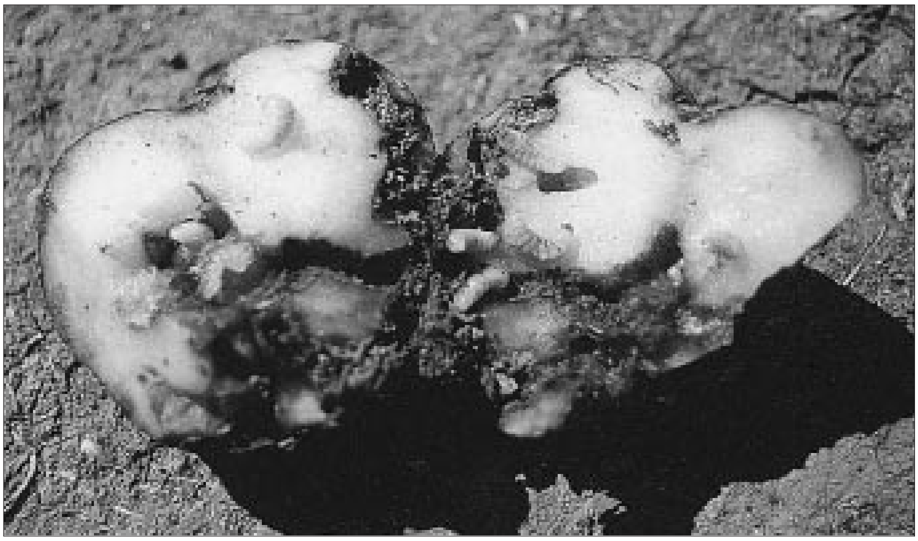
photo: Bentley

Training Bolivian farmers in IPM

Rayne Calderón, Raúl Esprella and Luis Crespo

The larvae cause most damage making deep, irregular tunnels in the potato tubers. Farmers report that often over 50 percent of tubers are damaged in this way and that in some cases damage runs to between 78 and 100 percent have been found. Highly toxic insecticide, often used in a dangerous and inefficient manner, is the main way these pests are controled. Farmers have no knowledge of alternative control methods.

IPM of the Andean Potato Weevil

Building on earlier work by the International Potato Centre (CIP) in Peru (Cisneros and Gregory, 1994), the Bolivian Potato Research Programme (PROINPA) began working with IPM in Kollana, a community in the Altiplano or central highlands of Bolivia. Here, at an altitude of 3900m, the most prevalent potato pests were weevils and tuber moths. The PROINPA programme looked at existing control methods and compared them to IPM technologies so that farmers could see the advantages of the latter for themselves.

Training farmers

Farmers must understand the enemy if they are to fight it. Lack of knowledge makes control methods ineffective. The project began by providing farmers with information about the weevil. Its habits are such that many farmers are unaware of its life cycle (it walks not flys, but only walks and its habits are nocturnal) and do not know that the larva and the adult pest are different stages in the weevils development. Farmers need information on its behaviour, the length of each stage of its life cycle and the periods when the insect is most vulnerable to the various IPM strategies possible.

Training activities such as courses and field days were organised for a variety of groups including farmers, school children and extensionists from NGOs. Children were quick to learn: they were inquisitive, had a good memory and plenty of time to practice IPM components, such as manual collection. A variety of materials were used during these training sessions. PROINPA and CIP produced handouts, pamphlets, posters, slides, videos and flip charts according to local needs.

Implementing measures

Various control methods were discussed during the course of training and the farmers analysed them before deciding which were the most appropriate. IPM strategies included: **Harvesting potatoes on woollen bags** Directly after harvesting potatoes are heaped onto the bags normally used for transport. This allows the larvae that leave tubers to be caught so they cannot return to the soil and complete their cycle.
Stirring up soil in areas of concentrated infestation where potatoes were mounded in the field or where seed was selected. This left larvae and pupae exposed to light and predators. **Covering ditches with plastic in the vicinity of stores and fields.** The weevils, who are unable to fly, could not negotiate their way over the slippery plastic into the potato fields. **Ditches around the fields covered with straw** The ditch is filled with straw which creates a perfect environment for the weevils during the day making it possible to catch them easily.
Adults collected manually This is a night job because the weevils are nocturnal.
Elimination of volunteer plants
Volunteer plants may be a source of infestation. **Use of chickens** Chickens are important predators and find the weevil palatable at all stages of its development. **Directed application of insecticides and chemical barriers**. Such spot application involves the proper use of insecticides with a low toxicity. Insecticide is sprayed around the base of the plant where the adults weevils rest during the day. Chemical barriers can also be sprayed around the fields to keep weevils at bay.

Amongst the most promising components of IPM adopted by farmers in Kollana were the use of bags during harvesting; the timely and well-directed use of insecticides; covering ditches around the fields with plastic and using chickens as predators.

PROINPA and other institutions have organised weevil collection competitions to sensitise farmers to the weevil problem. Farmers who handed in the most adult weevils were given small prizes. So far eight “collection competitions” have been organised in various parts of Bolivia so far. Four have been held in La Paz and a total of 470,000 adult weevils have been collected, a figure that represents a potential population of 118,000,000 larvae. These collection competitions are most useful when run immediately prior to the time when the female weevil start to lay their eggs.

Institutional follow-up

The weevil project has stimulated interest amongst many NGOs in the central Altiplano. NGO staff have been trained in weevil control by PROINPA and this information is now being spread through several communities in other provinces.

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(Thanks to Graham Thiele for translating this article).

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Gender and Integrated Pest Management

In 1995, a PAN Asia and the Pacific study of women and pesticides, through interviews with more than 2,500 farmers and workers most of whom were women showed that most farmers and workers spray pesticides or come in direct contact with pesticides .

Sarojeni V. Rengam

Most are unaware of the adverse effects of pesticides and many of those who apply pesticides often cannot read labels or do not follow instructions. Users often do not use protective clothing because it is unsuitable for the climate, is unavailable or too expensive; farmers and agricultural workers in the region use highly toxic pesticides listed as World Health Organization's Class 1 pesticides, extremely hazardous pesticides. Most of those surveyed stated that they have been poisoned, citing acute effects like dizziness, muscular pain, sneezing, itching, skin burns, blisters, difficulty breathing, nausea, nail changing colour and sore eyes.

The development of IPM, which has centred on food crops like rice and vegetables will be able to benefit women farmers and workers - the main contributors to food production. But unless women are specifically identified and included in project planning, implementation, and encouraged to assume leadership roles they are likely to remain invisible. It is essential that IPM training, information and extension reaches these women. IPM programmes, training methodologies and technologies need to take women's time committments into consideration.

Sungai Buaya Case Study

In 1994 a series of meetings were held with farmers of Sungai Buaya, Seberang Perak, in the Malaysian peninsular. The farmers of Sungai Buaya were heavy users of agrochemicals and the degree of mechanisation in the region is considerable. After initial high yields, farmers needed ever increasing inputs of pesticides and fertilisers, with ensuing health hazards and environmental damage. The farmers approached the Education and Research Association for Consumers (ERA) who then contacted PAN AP for support to tackle the problems involved in pesticide use .

The village consisted of about 100 families, most of whom live below the official poverty line. The average size of a family was about 8 members. Average monthly income from rice was below US$ 100. Most of the farmers borrowed heavily at the beginning of the rice season.

After initial discussions with key people in the 'kampung' (village), we started an intensive one-day orientation programme on IPM, and shared achievements in other Asian countries. More than 150 farmers participated, expressing concerns about the health hazards of pesticides, increasing operating costs, and notable decreases in yields. Significantly the women farmers, although present, sat at a distance and did not participate. After the meeting, we had informal discussions with these women for their feedback on the IPM discussions. They had many questions about IPM and its success in other countries. They had not raised these questions earlier because they were 'shy', and "after all, the men were there to raise these questions" - we encouraged them to speak out. Regular meetings with the Steering Group (or Jawatan Kuasa Kelompok) in the kampung followed, but no women was involved.

We had to make sure that we continued to meet with women after the discussions had taken place. In developing the IPM curriculum for the first rice season, the Government Agriculture Training Centre helped to identify and bring together key IPM trainers and extension officers (from the Department of Agriculture (DOA) in the Northern Region of West Malaysia), and ERA and PAN AP. In discussing the participation of women and how to encourage it, all DOA personnel felt that it was a bad idea - since the families in Sungai Buaya were Muslims, it would be difficult to conduct the training of a mixed group. However, we agreed that after the first season we could try to reintroduce the topic.

The IPM training schedule, and the issue of women's participation, was put to the village steering group who discussed it with the village. They suggested changes in the training schedule, and the head of the village volunteered his field for training and as a 'demonstration plot'. But the unexpected suggestion was that women farmers were to be involved in the training.

These training sessions covered two full rice-growing seasons with 25 field-training sessions. 50 farmers were trained, with one-fifth of the participants being women. In the beginning, the women were silent and kept to themselves. But as the training involved weekly observations and identification of pests and predators in the rice fields, as well as experiments with fertiliser use, the women began to share their observations in the group.

Also, the women initiated follow-up discussions after the training sessions. While the men rarely got together afterwards, the women made time to get together to discuss the training, the difficulties they faced and generally shared their ideas and thoughts. They often sought clarification from the organisers of ERA or PAN AP, who were women, since they felt more comfortable with us. Their group discussions often included others not involved in the training - they were sharing their knowledge.

In addition, at the end of the first season, a training session on gender issues was organised with the village women (including the 10 women participants of the IPM training). ERA and Tenaganita, a local women's organisation, conducted the highly successful training which discussed the many problems and issues they faced as women and farmers.

In the second season, there was a marked difference in the women's responses during training sessions. A few became actively involved during the mixed group discussions. The sitting arrangements during discussions had also slowly changed. While at first the women sat at the back; they were now in a separate row but side by side with the men. Although 50 farmers formed the core of the training programme, others from the village were also dropping in at the training sessions. The IPM training had become more of a village activity and others benefited from the experience.

During the training evaluation, the trainers and the participants acknowledged that the women were collectively the best participants. In addition, the women have organised saving schemes, and income generating projects including making snacks for sale. The IPM participants are also rearing fish for consumption and sale, with the women being fully involved in this successful enterprise. . For about a year, the women have also been hired by the farmers in adjacent villages to check fields for pests and predators, and advise them about their pest problems. These women farmers have also taken on leadership roles in their village especially if matters relating to IPM issues. They have been invited to speak about their experiences, and their needs as rice farmers, in several seminars. In fact, they have been asked to represent their village in these activities.

New Directions

Given the inequalities within society and within the household, it is essential that women are part of planning and implementation, in order to reach the goal of sustainable pest management and food security. It is only when women have access to, and control of, resources that they can be equal participants in food production. Women must also have more access to information - only then will they be empowered to take decisions regarding sustainable farming practices and manage finances. This will also enhance their status in their families and communities.

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Developing an African model for effective IPM training

There is growing concern in Africa about the dramatic rise in the use of pesticides by small-scale farmers. Cases of acute poisoning and problems with pesticide residues in local and export produce attract growing attention. Smallholders in the East African highlands grow cash crops such as coffee in a mixed cropping system that includes vegetables. Pesticides are increasingly being used on a calendar basis. The cost of agrochemicals is a heavy drain on the farmers' income, and sometimes pesticides destined for coffee are used for vegetables and other food crops. This puts human health at risk. Although alternative pest and disease control options exist, there is very little information on IPM and integrated crop management (ICM) available to this group of farmers. NGOs promoting organic farming often focus on kitchen gardens and subsistence crops.

Brigitte Nyambo, Martin Kimani and Stephanie Williamson

To address these issues, a small pilot project was started in Kenya in late 1995. Its aim was to develop and disseminate appropriate crop management options. The Farmer Field School (FFS) approach to implementing IPM has been used with great success in many Asian countries in rice and vegetable cropping systems. This approach combines training with field-based, location-specific research to give farmers the skills, knowledge and confidence to make ecologically sound and cost-effective decisions on crop health.

The Kenya pilot project set out to discover whether FFS training methods developed mainly in the paddy rice monoculture and small-scale, commercial vegetable production from the Asian farming context would work in Africa. The project team therefore adapted existing FFS curricula to develop a training programme tailored to the specific agro-ecological and socio-cultural needs of Kenyan smallholders who grow a variable mixture of annual and perennial crops for domestic consumption and for sale. In particular, the project team needed to develop learning exercises to help farmers explore integrated crop management options for long-established coffee gardens.

Running the project

Many IPM projects have failed to bring farmers, researchers and extensionists together, and poor linkages amongst these groups have been one of the major obstacles facing farmers when they try to implement IPM techniques. To avoid such pitfalls, this project aimed at developing inter-institutional collaboration between research, extension and an NGO, in order to build bridges between key players and better support farmers ready to experiment with IPM. The International Institute of Biological Control (IIBC) Kenya station, the Coffee Research Foundation, the Kenyan Agricultural Research Institute, the Extension Division of the Kenyan Ministry of Agriculture, Livestock Development and Marketing, and the Kenya Institute of Organic Farming (KIOF), an NGO, cooperated in running this project.

The project team ran a Participatory Rural Appraisal amongst farmers in the Kiambu area to identify immediate pest and disease problems in their coffee and vegetable production, and to discuss the wider implications of their farming systems. Many small-scale farmers in this area have virtually abandoned their coffee bushes, because of the low price of coffee and the rising cost of pesticides. Those growing tomatoes for the local market find that insecticide and pesticide form an increasingly large proportion of production expenses. Farmers tend to apply these pesticides as an insurance measure against pests and diseases, with little regard to need or timing, and as a result do not achieve higher yields or better quality produce.

The Farmer Field Schools project decided to focus on developing options that were cheap, sustainable and based on ecological principles. Farmers should be able to see the benefit of these options within one growing season.

Setting up Farmer Field Schools

The project team then put together a draft training and research curriculum for a Training of Trainers (TOT) course and for Farmer Field Schools, that combined discovery-learning exercises on pests, weeds, natural enemies and disease transmission with experimentation on organic methods, including liquid manures and botanical pest repellents. Eleven Ministry and KIOF extension staff were trained to become FFS facilitators and they set up FFS groups in four agro-ecological zones. About 65 farmers were involved in the project. The crops they grew included coffee, kale, cabbage and tomato.

Two of the groups had already been trained by KIOF and had no wish to use agrochemicals. However, they were having problems with vegetable diseases and were troubled by low coffee yields. The other groups were committed to treating their tomato crop with pesticides.

The FFS sessions were held for half a day once or twice a week in the fields of one of the farmers. The sessions were conducted over a period of six months. Each group carried out weekly observations on small plots in this field, in order to compare their usual cultivation practices with the pest control practices using IPM/ICM options developed by the project. They also conducted experiments on alternative crop management methods, including traditional non-chemical methods. The groups visited each other to discuss their experiments and findings.

Preliminary results

The Farmer Field Schools generated a great deal of enthusiasm amongst all the farmers who attended them. One of the contributing factors was that sessions were carried out in local languages. English, Kiswahili and the use of scientific names were kept to a minimum. There were no local names for some diseases or insects, so farmers invented their own on the basis of a careful observation of these organisms. For example, they observed that hoverfly larvae were common predators of aphids on vegetables and dubbed these new-found friends 'helicopter insects' because of the flight patterns of the adult insect. These activities helped give farmers a sense that they were in control of the learning process, and this gave them the confidence they needed to tackle experimentation.

Both the organic and non-organic farmers were able to learn useful new methods for improving the health and profitability of their crops. The interaction between the KIOF and the Ministry extension staff during the TOT gave rise to much discussion on integrated crop management, and highlighted the need for taking a critical look at all recommendations - whether these were for synthetic or organic compounds. The tomato growers in particular discovered the benefit of preparing compost and using liquid manures and plant tonics to produce more robust plants.

All the groups came to appreciate the value of predators and parasites in controlling pests, and developed an understanding of the consequences of pesticide application and other management practices on these natural enemies. For example, the organic coffee farmers were able to observe higher numbers of parasitised *Antestia* bugs (a pest that sucks and damages developing coffee berries) in well-pruned IPM plots. They could compare this to conditions in the plots where coffee bushes were currently left unpruned. All the groups learned the value of making management decisions based on a regular monitoring of crop ecology, input costs and labour effort.

The FFS process clearly demonstrated the need for farmers to experiment with options in order to find the best solutions for their particular situation and problem. Mulching vegetable crops is commonly recommended as a means of conserving moisture and reducing the diseases spread by rain splash. During their weekly observations, the groups discovered that many crickets and cutworms were found hiding under the straw mulch and that these were destroying young seedlings. Farmers concluded that it was better not to apply mulch until the transplants were well established.

The farmers chose to test a variety of local methods for controlling soil pests and diseases in nursery beds. These were methods which they had heard of, but never used. Many farmers simply sow in topsoil enriched with compost, and disease incidence among seedlings is high. In the FFS, comparison plots were set up to investigate the effects of different treatments. Three of the groups found that burning plant trash on the top soil before sowing was most effective when measured in terms of percentage germination, seedling vigour, and the reduction achieved in the incidence of rootknot nematodes.


photo: Nyambo

Preparing a coffee agro-ecosystem analysis poster

After producing immediate, visible results in vegetable plots, the FFS persuaded participants that it would be worthwhile to invest more time and effort in their coffee bushes and to try out IPM and ICM options. In the groups where coffee bushes had been neglected, farmers were able to see a marked difference after a few weeks. Plant health and potential yield improved as a result of pruning, mulching and the application of organic matter. Where farmers were using pesticides, IPM experiments showed that good coffee husbandry and decisions taken on the basis of agro-ecosystem analysis could halve the number of fungicide applications needed, without causing any reduction in potential yield.

The season-long interaction in the FFS also allowed coffee researchers to discuss the question of coffee management. The informal setting made it possible to address some issues that were difficult to tackle through official channels, such as the extent to which current research was relevant to smallholder systems.

Of major concern to smallholders is the lack of guidance on which food crops can be intercropped without negatively affecting coffee yields. Preliminary research from the Coffee Research Foundation showed that maize, sweet potato and cassava compete heavily with coffee, but potato and legumes can be grown so long as they are not planted directly under the coffee canopy. The project team was able to discuss these findings in the FFS, and relate them practically to learning activities showing the position of coffee feeder roots and where mulch and manure should be applied for maximum benefit. The interaction generated informative responses to farmers' and extensionists' questions. The information provided was immediate, and more direct that the communications that emerge from the formal recommendations handed down from research to extension.

The FFS provided a forum in which farmers and researchers could study topics that were not on the formal research agenda, and they were able to complement each other's experimentation. For example, an interesting disease management method suggested by one farmer - and later tested by several groups - involved diluting skimmed milk in water and spraying this onto tomato plants to delay the onset of blight. By using milk, one group was able to halve the usual number of applications of the expensive *Ridomil* (metalaxyl) fungicide. Another group found that the protective effect was not sufficient to prevent blight in cool, wet weather. As a result, researchers are now studying the usefulness of milk solutions and other non-chemical pest and disease controls that showed promise in the FFS plots.

The next stage

This FFS project provided many interesting and encouraging results. It was a first attempt to develop an African model of IPM training in smallholder cash crops. Most farmers were extremely keen to continue FFS sessions and many were already sharing their new experiences with family members and neighbours. Other groups asked for FFS to be organised in their area. Both farmers and extension staff gained not only skills and knowledge, but also the confidence to take decisions and set up small experiments. Researchers involved in the project were generally positive about this new form of collaboration and felt they had learned a great deal about non-chemical crop management practices, and gained an insight into the way farmers view production problems. The FFS pilot project succeeded in stimulating farmers to set up experiments in their communities. In this they were supported by a set of guided learning activities that were flexible enough to accommodate the different ideas and particular interests of the groups concerned.

This approach has much to offer in cropping system situations where pesticide misuse is not a major issue, as the experience of organic farmers and those with badly neglected coffee bushes confirmed. This small pilot, even though it was short and had limited resources, nevertheless raised several questions. IIBC and collaborating organisations are planning a full impact assessment of the FFS pilot project, in order to assess the lessons that can be drawn from it for farmer participatory integrated pest and crop management research and training in perennial cash crop systems. The assessment will analyse the technical output and the results of FFS experiments, as well as the cost/benefit of IPM/ICM options and whether ecological principles learned in the annual crop context can be readily transferred to perennials. It will also focus on indicators in the process, such as the sustainability of FFS impact at farm and community level and the likelihood of continued collaboration between project partners. Decision-making in coffee cultivation was an area where important gender differences emerged in the FFS groups and this needs to be considered in future programmes. Other issues to be explored include the best way to build farmer participatory methods into the state extension system, and the relevance of the experiences of this FFS project to other smallholders operating in mixed cropping systems.

The Kenya FFS pilot project generated a great deal of enthusiasm among the farmers, extension staff and researchers involved, and created a demand for further FFS training. As one of the FFS participants said during the evaluation session, "We are researchers too and we are proud of our findings". ■

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Courses transfer more than information. They provide examples of how information can be communicated in the learning situation. Participants on an international IPM refreshing course were introduced to Non-Formal Education (NFE) in the hope that they would use this method to train IPM extension workers in their own countries.

photo: H. Stoetzer

The philosophy of IPM learning

Huub A.I. Stoetzer

It is now accepted that IPM is a knowledge-intensive and location-specific process involving direct field observations, data gathering and decision making by farmers in their own fields. The inappropriateness of extension methods based on conventional methods of transferring technical knowledge in IPM programmes has been highlighted by the success of Farmer Field Schools (FFSs). In emphasising a participatory approach FFS uses discovery to achieve active learning. Field ecology emerges as a holistic system involving the whole cropping cycle and not simply specific production components and farmers experiment rather than watch demonstrations carried out by extension workers or researchers. After critical testing they select from a '-basket' of options rather than adopt fixed recommendations and in this way farmers enhance their decision-making skills.

Although the FFS approach is spreading rapidly and many NGOs work with participatory extension methods, traditional learning methods are still characteristic of extension systems particularly those within national extension services. Here, in a top-down approach, the extension worker acts as an intermediary between researchers and farmers in transferring the 'new' technology generated by researchers.

For staff involved in the IPM knowledge system, working in a participatory system represents an important shift in attitude and thinking. The question is how can staff involved in the traditional, top-down knowledge system be reassured that participatory approaches are not life threatening! The answer seems to be through training courses and workshops. However, experience has shown that despite innumerable workshops and articles, many misconceptions still exist about the participatory extension approach. To overcome these problems the IAC extension refresher adopted the Non-Formal Learning approach and, as we explain below, it was a success.

International IPM training

The International Agricultural Centre (IAC), Wageningen, the Netherlands has been running a three-month, international course on IPM in the early 1970s. Using a variety of training methodologies, the course deals with practical, technical and scientific aspects of IPM and includes an IPM Extension module. It addresses a target audience of higher and mid-level officers concerned with crop protection and working within governmental organisations and NGOs. Most course participants come from the South.

Over the years experience has shown how difficult it is to introduce in-depth participatory extension approaches effectively into the IAC-IPM extension course. Technical crop protection specialists and extension workers tend to be more familiar with the traditional transfer of technology type of extension system. Therefore, a short, regionally-based refresher course in extension was designed as a followed up to the international IPM training course held in the Netherlands.

Regional IPM extension courses

These regional two-week **Extension Development for IPM** courses held in cooperation with such organisations as the International Centre of Insect Physiology and Ecology (ICIPE), Kenya and BAIF, Development Research Foundation, Pune, India.

Training trainers

The course anticipates that when participants return to their home countries they will use their new experience to train others. The course is based on ideas developed and tested in IPM extension and training in recent years and makes an attempt to extrapolate the IPM experience to sustainable agriculture in general. IPM seems an appropriate methodological starting point when introducing sustainable practices and improving farmers' and extension workers' capacity to think in ecological terms because many of the ecological processes involved in IPM are easy for farmers and extensionists to observe.

Extension Development for IPM is based on the principles of NFE and adult education: learning through experience, experimentation, and self-discovery and building on existing knowledge and experience.

Field problem are translated into learning experiences and group dynamic exercises are an important part of this process. It is known that people tend to imitate the teaching methods used on them in the past. It is important, therefore, that course participants' experience NFE for themselves. All methods and activities used on the course are consistent with those to be used later in the participants work situation and the course itself is structured according to NFE principles.

Participants' experiences

Some participants on the refresher course showed an initial resistance to this learning-by-doing and learning-by-discovering method. They still expected lectures and more technical subjects and the fact that neither facilitator(s) nor participants were supposed to lecture was rather difficult for some course members. This problem was most evident in discussions with the farmers. Once in a while facilitators had to intervene by breaking into the lectures that developed when participants addressed farmers. In general, however, participants showed interest in discussing opportunities and constraints with farmers and in using the participatory rural appraisal techniques when visiting their fields. It was interesting to see that participants involved with organic farmers in Kenya tried to get as much technical information as possible about growing crops according to organic principles.

Although the course was held in English, communication with farmers was in the local language. The number of participants speaking the local language on each refresher course was usually a little less than 50 percent.

In discussion sessions with farmers, translation was required but this did not appear to be present a problem. If full use had been made of PRA techniques translation would have been less necessary as visualisation strongly assists the mutual understanding of the topics introduced. In analysing the many problems confronting farmers, it was found that facilitators were needed to guide both the selection of key issues and the choice of how these issues should be approached by the extension session. An initial proposal for the extension session put forward by the course participants themselves, for example, was a series of lectures on technical subjects. The facilitators had to probe for new ideas and alternatives and then encouraged the participants to formulate these into improved proposals.

Farmers were supposed to participate as much as possible in all activities, demonstrations, explanations, and group interactions. The techniques necessary to ensure this degree of farmer involvement were used during the course. Whilst some still found it difficult to use these methods, in their final evaluation participants showed that, in general, they were convinced of the effectiveness of the participatory extension approach and the learning methodologies it involved.

Experiences during the extension day

These extension sessions generated considerable interest although often there was some tension at the beginning. The farmers did not quite know what to expect from the group which contained several foreign faces. Course members, on the other hand, saw it as a ‘day of truth’, a kind of practical examination. In addition farmers were not used to the agro-ecosystem analysis. However, drawing attention to the differences between beneficials (the farmers’ friends) and pests (the farmers’ enemies) and the positive and negative factors that influenced crop health provided plenty of opportunity for the group to warm up. Discussions were particularly interesting when the groups presented their conclusions on the status of their crop and suggested ways in which problems could be prevented or controlled. During the extension day the field was the training material and the farmers’ own observations the groups’ source of knowledge. This was clearly a new learning experience for both farmers and course participants.

Visual aids were used as much as possible and farmers reacted positively to the exercises in group dynamic exercises. They were excited to discover that their fields did not only contain ‘farmers’ enemies’ but ‘farmers friends’ as well and that using pesticides might endanger these beneficial insects. Such issues led to long discussions. In their evaluation farmers made it clear that they had enjoyed the way the sessions were organised and appreciated the approach. They were positive (and sometimes very kind) in their evaluations of the course participants and made a number of striking remarks. I conclude this article by letting the farmers’ comments speak for themselves. “Today we are not told what we have to do in our crops”. ”For the first time in contacts with extension workers or researchers we feel that they (participants) treat us as equals”. ”These participants sit together with us on the ground at the same level”. ”We learned a lot of new things about growing our crops and trying to prevent or control the pests”.

”We did not know that we have friends (parasitoids and predators) in our crops, helping us to control the pests.” (This remark was also made by a group of organic farmers in Kenya!); ”When can we have a next field day. We want to go and try to implement new ideas”.

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photo: H. Stoetzer

Rope game, a group dynamic exercise

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A more detailed version of this paper is available from ILEIA on request. Please contact the author directly for details of the ‘Extension Development for IPM course.

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Using *Tithonia* concoctions for termite control in Busia District, Kenya

As part of the Kenya Woodfuel and Agroforestry Programme (KWAP) farmers in Western Kenya are taking part in an on-farm experiment in pest control. In keeping with the participatory approach, farmers identified the major insect pests in their area. A number of local, wild shrubs were selected and used to prepare insecticides. Tithonia turned out to be a very effective multi-purpose shrub.

Floice Adoyo, John Bwire Mukalama and Musa Enyola

Busia is a district in Western Kenya that lies close to the Ugandan border. Altitudes in the region vary from 1128 to 1500 metres above sea level. The district falls within the Lake Victoria Basin and receives a mean annual rainfall of between 600 and 2030 mm. Mean annual maximum temperatures range from 26° C to 37° C and mean annual minimum temperatures fall between 14° C and 22° C. Evapotranspiration rates range from 1800 mm to 2200 mm. Busia covers some 1776 km² and 137 km² of this is permanent water. Crop cultivation, animal husbandry and fishing are the main economic activities.

KWAP has been active in Busia since 1984. It uses Participatory Rural Appraisal techniques (PRA) to analyse the factors that constrain tree growing in the district. Farmers have identified the scarcity of firewood, a lack of building materials and fodder trees, the absence of fruit trees, shallow soils, and the heavy incidence of such pests as termites, moles, monkeys, weevils, stalk borers, ticks, liver-fluke and worms as major problems. Pests threaten food supply at the household level, and the main cereal crops of this drought-prone area - maize, sorghum and finger millet - are especially vulnerable. Termites are particularly destructive and attack planted trees as well as dried materials being used in building. Chemical pesticides are not used very much in Busia because they are too expensive for most smallholders and are not thought to be very effective.

Since 1986, KWAP has been actively developing an operational approach designed to help farmers in Western Kenya achieve more effective farming practices. Small-scale, on-farm experiments have been part of this initiative. Working together with research institutes and government extensionists, farmers have adapted and modified technologies in an attempt to find concrete solutions to their farming problems.

Busia's wonder shrubs

A number of remarkable shrubs can be found along the roadsides of Western Kenya. In Busia, the botanical pesticide potential of these shrubs had not yet been fully recognised by development workers. Local shrubs that may provide a solution to the widespread problem of termite infestation include *Tithonia diversifolia* which has proved useful in improving soil fertility (see ILEIA Newsletter 13.3). *Tithonia* decomposes fast, releases plant nutrients readily, and is particularly rich in phosphorus.

During on-farm bio-mass transfer trials, it was noted that plots treated with *Tithonia diversifolia* or with a mixture of Tithonia and *Melia azedarach* hardly suffered from termite attack, irrespective of the stage of crop development. This motivated many farmers to experiment with Tithonia and to combine it with other herbs and shrubs in an attempt to control termites on their farms. This article draws on the farm records kept by one of the farmers who took part in these trials.

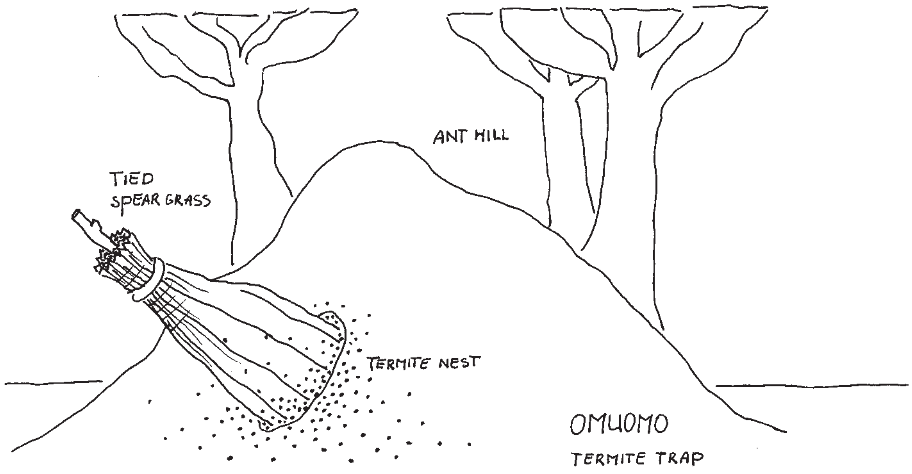

Figure 1: Trapping termites

Experiments in termite control

Mr Egesa took part in the experiments designed to test the effectiveness of various termite control substances. He lives on a 7-acre farm which he shares with his three brothers. Egesa has one wife and their marriage has been blessed with five children. Farm activities include dairy farming under zero grazing and Egesa has one animal and one heifer. He cultivates fodder crops, napier grass and calliandra trees, and observes soil and water conservation measures. The family's horticultural crops consist mainly of tomatoes and pigeon peas which are grown on two acres of land. Maize, beans and cassava are the main subsistence crops. To earn extra income, Egesa has taken up selling tree seed to his neighbours, and often travels from market to market in search of customers. He has been experimenting with various technologies in order to increased his production. In his farm records he notes how he experimented with a solution of Tithonia and Cassia spp. in an attempt to control termites and increase his production.

"I mixed the leaves of two kilograms of *Tithonia diversifolia* with two kilograms of *Cassia spectabilis* and *Cassia siamea*. I left it for three days before I stirred it. After 15 days, on 23 October 1994, it was ready for use. I applied the solution to my trees. It stopped the termites for two weeks. I filled a 100 gram tin with the mixture and used this to treat each tree. I forgot to mention that I used 16 litres of water to make the solution. I prepared another batch of the solution the same day using the same amount of leaves and water. This was ready for use on 17 December. I used the same 100 gram tin but this time added a half measure extra. I sprinkled this mixture on my trees and it kept the termites away for about 18 days. The mixture has a bad smell. You really have to be devoted to your work to use it! In the meantime I prepared another 'tea'. This time I sprinkled twice as much solution on my trees as I had done the very first time. I am still waiting for the results".

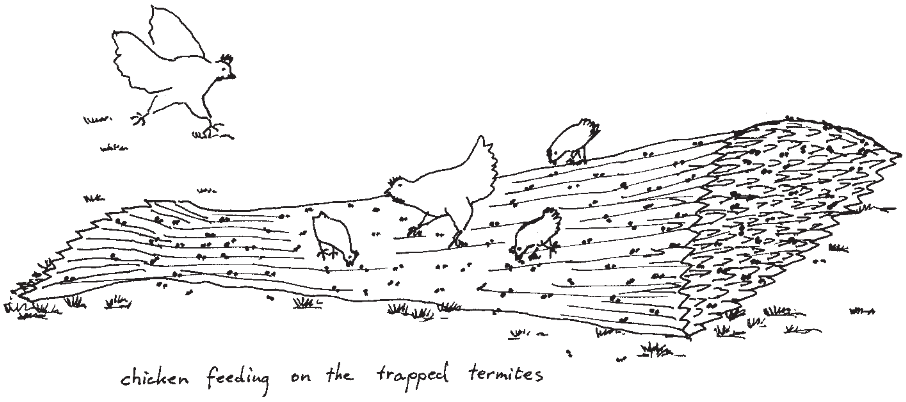

Figure 2: Excellent chicken food

Egesa also reports experimenting with a mixture of tithonia and cassia spp ash. Here he had less success. "On 10 January 1994 I picked 6.5 kilograms of *Tithonia diversifolia* and six kilograms of *Cassia spectabilis* and *Cassia siamea*. After I had dried them I was left with 8.5 kilograms of dry matter. I burned this and applied the ash to the trees using a 100 gram container as a measure. I applied 100 grams of ash to each tree. After five days I found the termites were already destroying my trees".

A third experiment was considerably more successful. On 24 November 1994 Egesa prepared a solution from these ashes rather than applying the ash directly. The solution controlled the termite attack for about a month. A week later he reported that he had made yet another solution, using 8.5 kilograms of dried leaves. This time, however, he made it stronger.

"I added 14 litres of water to the leaves in my third experiment so the solution would be stronger. On 12 December it was ready for use. Because it was stronger it controlled the termites for 40 days, and between 16 December and 24 January I had no problem with these pests. On 24 January I made another solution using the same amount of leaves and water. I wanted to repeat the experiment because last time it had worked well. The new solution was ready on 8 February 1995. I poured it around my trees and it helped control the termites for 45 days.

Next, Egesa prepared a treatment using 2 kilograms of *Tithonia diversifolia* leaves and a mixture of two kilograms of *Cassia spectabilis* and *Cassia siamea*. This time he used ten litres of water and was curious to find out how strong the result would be. When it was ready he poured it around his trees. It worked for 20 days. He assumed that this was because much of the solution was washed away by the rains.

Two farmers were involved in the *Tithonia diversifolia, Cassia siamea* and *Cassia spectabilis* experiments. Other farmers carried out similar experiments using a mixture of *Tithonia diversifolia* and *Agave sisalana*. There were also farmers who used pepper mixed with the sisal leaves and leaves of *Vernonia amygdalina* and tobacco. After boiling this mixture for about 30 minutes they sprayed it on fruit trees in particular. These solutions and the ash mixture were applied to crops as well as trees. Some farmers poured the solution directly into the termite nest in an attempt to kill these pests. As farmer Isako Ramondo explained, organic concoctions were quite effective in destroying termite mounds.

"I had eight ant hills on my farm and the underground termites destroyed my crops and trees. I pounded together 4 kilograms of fresh *Tithonia diversifolia* leaves and 4 kilograms of fresh *Melia azedarach* leaves. I immersed this mixture in 20 litres of water and left it to ferment for four days. I then poured the fermented mixture into the opening of each of the eight termite nests. The solution was very effective and controlled most types of underground termites. The good thing is that this mixture is cheap. I do not have to repeat the treatment until new termites move onto my farm. When they do they'll get the same treatment. However, this method only works on underground termites".

Trapping termites

The termite trap, or *Omuomo* as it is called in the Luhya language, is made from spear grass. A bundle of grass is tied at one end and left open at the other. A peg is pushed into the bundle and is anchored to a hole dug in the termite mound. The fresh grass attracts the termites and they come out to feed on it. Once the termites have completely infested the grass, the bundle is carefully pulled out (see Figure 1). The termites are then fed to poultry and to quails, which are a local delicacy (Figure 2). This technique helps reduce the termite population to some extent.

Farmers were involved in a variety of trials. In this way, results could be compared and it was possible to see which technique was the most effective. This created a sense of ownership, farmers felt the research process was theirs and it had a favourable effect on participation. After two years of research, all the on-farm trials were analysed. The farmers were closely involved in this process. When the data had been compiled, it was found that the solution made from Tithonia/Vernonia and sisal leaves had an advantage over the other solutions. In addition to controlling termites, it contributed to soil fertility. Crops and trees sprinkled with this solution were healthier and grew faster.

Farmers also concluded that the pepper/ sisal/Vernonia/tobacco solution could be used very effectively to remove scales from fruit trees. Scales could easily be brushed off after trees had been sprayed with this solution.

After the results had been analysed, farmer-managed field days were organised to explain the research findings to other farmers in the area. Now many farmers are using either the ash or one of the solutions to control termites and other pests. As Jenipher, a farmer from one of the project areas explained, "We use Tithonia solution on our fruit trees. It is very effective. The insecticide from the shops is too expensive for us. Tithonia has really helped us save our crops and trees". The Tithonia solution works well when poured into the termite nest, although it is sometimes difficult to identify nests because some of the termites are migratory and do not build nests.

Apart from its pesticidal qualities, *Tithonia diversifolia* is considered to be a medicinal shrub and people use it to deworm young children. It is used to prevent malaria and to cure fevers and stomach upsets. It is also given as fodder to goats, sheep and cattle in the dry season.

Farmers noted that there were some negative aspects to using Tithonia. It has a bitter taste, and after gathering and processing it farmers find it difficult to remove the stains it makes from their hands. Despite these problems farmers were enthusiastic about the shrub because it was so effective. It improves soil fertility, gives an increased yield, and saves farmers from having to spend money on chemical pesticides. It can also keep termite damage to acceptable levels. Using Tithonia has made it possible for farmers to increase theirfood production and tree planting activities, and the survival rate amongst newly planted tree seedlings has increased by sixty percent.

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__Pyrethrins are a group of economically very important natural plant insecticides. These compounds are derived from the dried flowers of the pyrethrum daisy, Chrysanthemum cinerariaefolium (Fam. Compositae). Pyrethrum powder and extract, containing various pyrethrins, have been used as insecticides for more than a century. After the Second World War, the demonstration of the powerful insecticidal working of the pyrethrins came at a time when there was growing concern about the use of environmental unfriendly chemicals such as DDT.__

drawing: source: J.W.Purseglove: Tropical crops-Dicotyledons

Natural insecticide pyrethrum

Rik Thijssen

The natural pyrethrins have some of the qualities of an ideal pest-control agent. They are very effective against a broad range of insects and up to now there have been no reports of the development of resistant strains. Pyrethrins paralyse insects very rapidly on contact, a much valued characteristic. One of the major advantages of the pyrethrins is their low toxicity to all warm-blooded animals including human beings.

Pyrethrins processed from pyrethrum plants are not stable making the insecticide not so useful for crop protection. The pyrethrins are an effective pesticide only when exposed to light and when air is limited. This means they can be used effectively in domestic sprays but are not efficient or economic when used to control pests in agricultural crops and in forest areas. However, industrial imitations of pyrethrins called pyrethroids can be used for general crop spraying.

The plant

Pyrethrum plants grow wild on the Dalmatian coast of Yugoslavia. In 1929, Captain Gilbert Walker, who was the first planter to grow pyrethrum commercially in Kenya, imported some seed from Yugoslavia and planted it on his farm in the highlands near Nakuru town. With the outbreak of the Second World War, Kenya became the leading producer of pyrethrum, a position it still retains, and Nakuru remains the centre of production.

Pyrethrum is a perennial herb with white-yellow flowers that grows to a height of about 60cm. In Kenya it is grown by more than 100,000 small-scale farmers at altitudes between 1500m and 3000m. Pyrethrins are concentrated in the flowers to a level of 1 to 2 percent of dry weight. Pyrethrin content is larger at higher altitudes. The pyrethrum plant is propagated by seeds or vegetatively by splitting parent plants. The first flower picking takes place about 4 months after planting seedlings or splits, and thereafter at intervals of 2-3 weeks during flowering, a period which, in Kenya, extends over 9-10 months of the year. The flowers are picked by hand, usually by women and children, and a skilful picker can harvest up to 25kg of fresh flowers per day. The harvesting of flowers is labour intensive, and this has resulted in a decrease in cultivation in some parts of the world.

Production and market possibilities

A special assessment study by the Biotechnology Programme of the Dutch Ministry of Foreign Affairs (Jovetic, 1994) concludes that despite high global market demands for natural pyrethrins, it is very unlikely that production of pyrethrum materials ‘in vitro’ in greenhouses will be commercialised in the near future as productivity is low when compared to farm production. In addition, the market price of pyrethrins is not very high and the natural source is a relatively high-yielding and fast-growing plant, with not very strict climatic requirements.

The yield of fresh flowers and the content of pyrethrins depend on the variety used, and on factors such as soil, climate, picking interval, and drying methods. On average, 3 to 4kg of fresh flowers yield 1kg of dried flowers. About 250kg per hectare of dried flowers are produced during the first year, increasing to 1000-1200kg per hectare for the second and third year. The price of dried pyrethrum flowers depends, of course, on the quality, but with an average pyrethrins content of 1.5 percent farmers in Kenya get US$1 per kilo. After the third year yields decline.

In the early days pyrethrum was exported from Kenya as baled dried flowers and contained a minimum of 1.3 percent pyrethrins. Pyrethrum flowers are now processed by the Pyrethrum Board of Kenya and marketed as an extract containing 25-50 percent pyrethrins. Present production in Kenya is about 10,000 tons of dried flowers per annum, roughly 50 percent of the world production. The largest importers of pyrethrins are the USA and Europe.

New uses of pyrethrum

In the past, growing pyrethrum was seen as the way small-scale Kenyan farmers raised a little cash for their farm family. All the produce was sold to the processing industry and few farmers were really aware of the potentials of pyrethrum. Extension agents from the Pyrethrum Board gave pyrethrum growers advice on the technical aspects of production and the best drying techniques for the harvested flowers. In return farmers were able to generate a regular and reasonable amount of money.

Recent developments, however, have opened up new and interesting options for the use of pyrethrum in pest management on smallholdings. A combination of pyrethrum and non-toxic piperonyl butoxide results in a powder that is highly effective in preventing insect damage to stored grain, particularly wheat, maize, barley and oats. This powder, mixed with grain immediately after harvest, controls weevils, beetles, grain borers and meal worms for up to two years. Both large- and small-scale users can apply it easily and safely. A similar formula was designed by researchers from the Kenya Agricultural Research Institute (KARI) to protect stored tobacco from the cigarette beetle and the tobacco moth.

Other very interesting new developments are related to the initial problem of what to do with the 'waste materials' of the pyrethrin industry. Out of every 10 lorries delivering the dried pyrethrum flowers to the factory, 9 lorries can be filled with the powder that remains after pyrethrins have been extracted. It was found that this powder, the pyrethrum marc, was a healthy feed supplement for dairy cattle, sheep, goats, pigs and horses and is comparable to other common feeds such as hay, Napier grass and bran (Table 1). Pyrethrum marc is sold to farmers at Ksh300 (about US$5) per 50 kg bag.

It has been reported that livestock fed on pyrethrum marc have a reduced load of intestinal parasites and have ticks less often. Regular feeding with pyrethrum marc also results in an improved general appearance and has meant that farmers presenting livestock for display in agricultural shows now put their animals on a pyrethrum marc diet. The output of the factory in Nakuru sustains about 10,000 cows every year at the recommended feeding level of 3 kg per day per adult animal.

Farming Systems Kenya, an NGO, and farmers have been experimenting over the last six years with the use of pyrethrum marc to control maize stem-borers, one of the most important pests of Kenya's staple food. Female moths deposit their eggs on the leaves of the maize plant and the larvae eat out extensive tunnels in the stem. This sometimes results in complete crop failure. A small handful of pyrethrum marc with a slightly higher level of pyrethrins (about 0.3 percent), placed in the heart of the plants at the critical time when the stem-borers' eggs hatch, can almost completely control this hazard. With a grant from the UNDP Global Environment Facility (GEF), Farming Systems Kenya will now begin an awareness and training campaign to share these findings with more farmers and to develop better ways of fitting the on-farm production and use of Pyrethrum into existing farming systems.

The Kenya Institute of Organic Farming (KIOF), an NGO that has been promoting organic agriculture since 1986, describes the preparation and use of pyrethrum to control insects such as aphids, white fly, spidermite, mealy bug, on crops in its **Field Notes on Organic Farming** in the following way. Boil 500 g of fresh pyrethrum flowers in four litres of water to make a 'strong tea'. Let the infusion cool before straining or filtering. Dilute this mixture with an equal amount of water made soapy with a 30 gram bar of soap. Soap enhances the effect of pyrethrum by making it stick better to the plants. The mixture should then be applied to or sprayed on the affected crop.

Meanwhile, some farmers have been experimenting with pyrethrum on their own. Hellen Chirchir, a retired teacher with a farm in the termite- and tick-infested drier areas of Kericho district, is a good example. She was given about half a kilogramme of dried pyrethrum flowers by a friend in Molo, one of the major pyrethrum growing areas in Kenya, 40 km from Nakuru. She pounded the leaves into a powder and because she had read somewhere that mixing pyrethrum with sesame oil would increase its effectiveness against insects she mixed the pyrethrum powder with half a litre of sesame oil and 3 litres of used deep-frying oil. After making a small opening in two termite mounds on her farm she poured a little of this mixture into the mounds every day for about a week. Much to her surprise the termites disappeared completely after a week.

Later Mrs. Chirchir found that mixing a little pyrethrum powder with milking salve and smearing this mixture under the tail, the legs, and behind the ears of her dairy cows protected them from tick attack. Her only regret is that she cannot grow pyrethrum on her farm.

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photo: Rik Thijssen

Gathering pyrethrum flowers

Table 1. Nutritive value of Pyrethrum marc.

Proteins	Carbohydrates	Fibre	Minerals	Oils	Pyrethrins
13%	56%	23%	7%	1%	‹ 0.1%

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This article discusses the role of women in agriculture in Vietnam and focuses on the participation of women farmers in IPM Farmer Field Schools (FFS). The article is based on the findings of a study 'Women and IPM in Vietnam' carried out in 1994 by the Hanoi- based Centre for Family and Women Studies on behalf of the FAO.

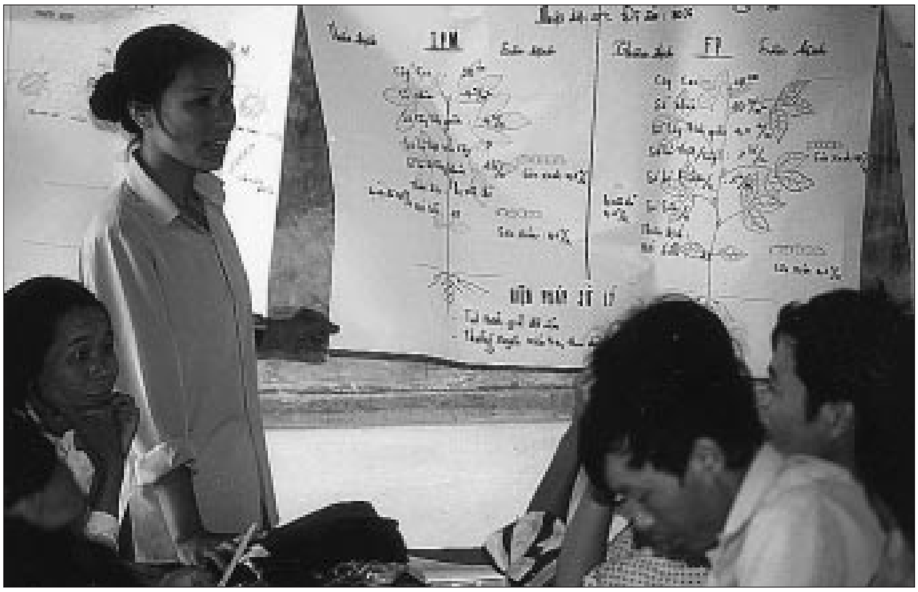

photo: National Programme IPM, Vietnam

Women farmers and IPM Farmer Field Schools in Vietnam*

Nguyen Nhat Tuyen

Since the early 1990s, the Vietnam government has participated in FAO's Inter-country Programme on Integrated Pest Management in rice in South and Southeast Asia. After the agrarian reforms of the late 1980s, the Vietnam government became increasingly interested in renewing the role of its plant protection and extension agencies, and in handing over more responsibility to farmers. It also wished to cut subsidies on such agricultural inputs as pesticides and fertilisers. Farmer Field Schools (FFS) - where farmers re-discover the agro-ecosystem of their fields - were introduced in Vietnam on a national scale in 1992.

Agriculture and gender

The major food crop in Vietnam is rice. Rice production is practised in almost all Vietnam. The deltas of the Red River in the north and the Mekong in the south account for more than 50 percent of all cultivated land. Eighty percent of Vietnam's 75 million population live in the rural areas and 70 percent make a livelihood from agriculture. While there are roughly the same number of men as women in the total labour force, the largest proportion of female labour (72 percent) is to be found in the agricultural sector. Although traditionally women are supposed to perform only 'light' agricultural work and men the 'heavier' jobs, in practice this is little more than a stereotype. Women actually perform almost all the work done in agriculture. Nearly twenty years of war has only served to exacerbate this situation.

In the post-war period, the collectivisation model was introduced into Vietnam, and men and women became members of cooperatives. During this period, women were pushed back into their traditional roles and the work done by women was valued much less than the jobs carried out by men. Various studies show that the payment for a day's ploughing (done by men) was twice as much as that paid for a day of transplanting, watering and weeding (done by women) (Hong Hai, 1988). By the end of the 1980s, the collective model had been succeeded by an individual household-based form of production, and families had been given title to their land for 25 years.

A survey carried out in southern Vietnam in 1993 (CFWS, 1994) showed that women do a larger proportion of the farm work than men. Also, many women work as day labourers and as such have to carry out tasks that include harmful activities like spraying pesticides. Another study by Cantho Agricultural University confirms that women form the largest part of the labour force and are involved in transplanting, weeding, harvesting and drying rice. In households where male members are absent, women also undertake most of the winnowing, watering and pesticide spraying. Finally, we should note that in the country as a whole there are 12 million households, 3 million of which are headed by women.

In general, studies of the division of labour between men and women in the rural areas show clearly that labour is not divided simply according to sex on the basis of health conditions or physiological characteristics. Rather, the division of labour between genders is social in nature and depends on long-standing habits, customs and superstitions.

Women's access to knowledge

Despite the fact that women take part directly in many stages of the agricultural production process, women are neglected in the field of agricultural training. This is largely due to the widespread bias that training supposedly deals with 'technical' knowledge and technology is supposed to be a male domain. Women learn about agriculture from their neighbours, husbands, parents, the radio or the newspapers and to a very small extent (3.5 percent) from extension staff. (Thai, 1994).

When IPM Farmer Field Schools were introduced into Vietnam, the bias favouring male farmer participation was still prevalent. It was present in the selection criteria used to determine who to admit into FFSs. Criteria included the completion of lower secondary school, farming experience, and the ability to communicate knowledge to others. Although useful in themselves - especially as far as ensuring the dissemination of knowledge was concerned - these criteria, if formally and rigidly applied, restrict women's access to FFSs.

In Vietnam there are not enough extension workers at grass roots level. Extension workers are usually male, and 100 percent of the senior positions are occupied by men. In countries where high input Green Revolution agriculture has become the dominant agricultural practice, the use of pesticides, including highly toxic products, is common. Extension and plant protection agencies have become the major vehicle promoting the use of these inputs, and generally there is very little discussion about their impact on health and the environment. Prior to the introduction of IPM Farmer Field Schools in Vietnam, pesticides were widely used and were stored in the farmers' houses - even in their kitchens. Women did not use any protective clothing when they sprayed their crops, and even lactating women handled and sprayed pesticides.

The introduction of IPM Farmer Field Schools a few years after the agrarian reform laws came into force was at just the right time. Men and women farmers were eager to know more about how to cultivate their crops in a sound and economic way. Women farmers, however, did not automatically benefit from the Field Schools and were under-represented from the start, as the following data shows. Up to the autumn of 1995 only 13 percent of the 37,000 farmers who attended FFS were women. Women were better represented in the training of trainers programme for IPM: by the autumn of 1995, some 1,250 trainers/facilitators had completed a Training of Trainers course and 422 of these were women. However, as 50 percent of all farmers are women, there is clearly still room for improvement.

What are the factors that prevent women from participating in IPM FFS? The greatest constraint experienced by women is time. Women have to divide their time between tasks in the home and in agriculture. A woman farmer: "In the evening, before going to the Field School, I have to prepare the feed for the pigs for the next day. Although my children can help me, I don't want them to work while I am out studying". Time is also more 'costly' for the poor, for widows, and for women with small children. Besides their farm activities and housework, these women often work to earn the extra income they need by doing off-farm activities such as trading or wage labour. If this time spent on earning additional income could be compensated, then the lowest income groups would be better represented in the Farmer Field Schools.

Family backing

Men usually take part in training activities because they decided to do so. Women often have to seek their husband's or family's approval first. In a discussion with women in Thang Binh, one woman said: "Whether or not a woman comes to this training depends on the attitude of her husband. I am lucky. My husband understands me and my desire for 'improvements' and when I go to the course my mother and sister help me with the household work. If they didn't I would not be able to go each time".

Local leadership

Village leadership, including village administration and cooperative management, plays an important - if not essential - role in organising IPM training courses. They are the ones who interpret and apply the selection criteria. If men dominate village leadership, as is often the case, this can easily lead to male bias in selection. Although there is a set quota for women's participation, the number of female trainees has always been smaller than required. The main reason for this is that there has not been enough detailed discussion with women. Insufficient information is given about what goes on in Farmer Field Schools, or about how important they are for women.

Trainers

Trainers have a major role to play in organising a training event such that it meet the requirements of both male and female farmers. When introducing a training course to local leaders, trainers often lack information or knowledge about the way gender operates in the division of labour in the locality concerned. Because of this, they do not have the negotiating capacity to ensure a fair representation of women in the FFS, and often trainers themselves are not convinced that such equality of representation is important. The degree to which women have participated in FFS up to now has depended on the perception and initiative of individual staff and trainers.

However, there is also a positive side to the story. The fact that there are a reasonable number of female trainers in Vietnam (of course there is always room for improvement) has influenced the way local leaders perceive women's capabilities. Also, women farmers tend to take female trainers as their example, and become more self-confident as a result. They find it easier to communicate and talk openly with trainers who are also women.

Training curriculum

The 1994 study by the Centre for Family and Women Studies revealed that, generally speaking, trainers lacked the practical skills to integrate gender awareness in the concrete activities of the training programme. The FFS takes up one growing season. Is it possible to cover the gender inequalities that women experience in the household, the community and their agricultural labour in one short growing season of 12-14 weeks? The answer is, of course, no. A quota for female representation in the FFS is not sufficient to address - let alone to redress - gender biases and the problems confronting women in their households and agricultural work.

Although women play an essential and important role in agriculture in Vietnam, they rarely have a chance to participate in any formal or informal agricultural learning programmes. The IPM Farmer Field Schools have certainly enabled some women to participate more fully, but in future FFSs should focus more strongly on redressing inequality by critically evaluating those selection criteria that have so far hindered the admittance of women. A closer look should also be taken at the stereotypes involved in the gender division of labour, and special attention should be paid to local traditions and customs that constrain women's equality in agriculture. A gender quota for field school training is not an adequate long-term solution. It is more important to raise gender awareness among social organisations, government agencies, extension and other agricultural departments, the local community and its institutions - and amongst women themselves. This should be done in a culturally sensitive way, building on women's own achievements in their own society and locality.

Since 1995, the national IPM programme has done much to address the issues raised in the Women in IPM study discussed here. The Women's Union has become more involved, especially at a local level. More effort has been put into encouraging local leaders to facilitate women's participation. In addition, there have been several initiatives to draw public attention to the problem of women and pesticide use. A national contest was organised and broadcast on TV, and a selection was made of those farmers' groups whose songs and poems most eloquently expressed the importance of preserving natural conditions in the rice fields.

General concern about the importance of women in agriculture at a national level (Ministry of Agriculture, Women's Union) and at international level (FAO) is still not fully reflected in the specific activities of the IPM programme. This is because of the way FFS are linked institutionally to plant protection agencies, and, to some degree, to the extension service. As a result, they tend to be more technical than holistic in their approach to agriculture.

With the introduction of FFS, the Vietnamese government has made an important step forward, and has enabled farmers, both men and women, to gain access to the most recent scientific insights into agro-ecosystem analyses and to more information on how to care for their health and their fields. At the same time, however, the FAO and the Ministry of Agriculture should try to develop a vision of more sustainable and healthy agriculture which will secure a lasting livelihood for future generations of farmers.

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Food security and local production of biopesticides in Cuba

photo: P.Rosset

Artisanal biopesticide production

Until recently, Cuban agricultural production was based almost entirely on the conventional industrialised model characterised by a strong dependence on synthetic pesticides and fertilisers, fossil fuels and other Green Revolution inputs. With the collapse of the socialist trading bloc in 1989, however, the country's access to pesticides and other inputs it had relied on vanished almost overnight.

Peter Rosset and Monica Moore

The simultaneous loss of most of the country's imported agricultural and industrial inputs, direct food imports, international markets and sources of foreign exchange resulted in a profound and continuing crisis for the Cuban people and government, a crisis amplified by escalation of the US government's long-standing economic and political blockade of the island nation. Most critically, agricultural production and food access plummeted to record lows, resulting in acute food shortages in a country that for decades had guaranteed an ample, low-cost food supply as a right of citizenship.

In 1990, the Cuban President Fidel Castro declared the start of an indefinite 'Special Period in Peacetime' as the framework for the dramatic policy reforms necessary to meet the basic food requirements of the island's population. It was to be a period in which Cuba's agricultural and economic productivity would be rebuilt. As a direct result of the Special Period, Cuba has embarked on an unprecedented national transition from high-external input to low-input and organic agriculture, including the implementation of biological, control-based, integrated pest management (IPM) approaches throughout the country.

Drawing on experience and investments in human resources that predate the Special Period by many years, policy makers, producers and researchers began adapting and reconstructing Cuba's agricultural infrastructures to facilitate low external input production, including the breakup of state farms into smaller units under more direct management by producers; the creation of a national network of small laboratories producing an increasing variety of biological control agents, botanical pesticides and biofertilisers; legalisation and promotion of private sector farmers' markets; widespread development of urban agriculture; and a new emphasis on farmer-to-farmer and farmer-to-extensionist exchanges, on-farm research and agro-ecological training for producers and scientists alike.

Cuba's agricultural conversion not only challenges the common belief that feeding a nation's population depends on pesticides, but also highlights the strengths and limitations of two different versions of IPM: the 'input substitution' approach as opposed to using IPM as a component of an ecological agricultural system.

Local Production of Biological Agents

Coping with a more than 80 percent drop in the availability of pesticides and fertilisers was among the more desperate challenges at the start of the Special Period. Cuba's decades of experience with biological control proved crucial in meeting this challenge. Historically, much of this experience was with mass-reared parasitoids. Since 1968, the parasitic fly *Lixophaga diatraeae* had been used against the sugar cane borer in almost 100 percent of the areas planted with sugar cane. Parasitic wasps (*Trichogramma* spp.) have been widely used since the early 1980s against Lepidopteran pests in pasture management, and later in tobacco, tomato and cassava. Also in the early 1980s, the sweet potato weevil *Cylas formicarius* began to be controlled in sweet potato using predatory ants (*Pheidole megacephala*). Reservoir populations of these ants were established where they were naturally abundant, and colonies moved into sweet potato fields from these areas, achieving up to 99 percent control.

Despite such successes and the adoption of a national policy favouring IPM in 1982, pesticides remained the main form of pest control in Cuba until the onset of the Special Period. At that point, researchers working on biological control and other aspects of ecologically-based agricultural production systems were mobilised from within different universities, ministries and research institutions to respond to the crisis. In effect, this instantly mainstreamed the ideas of a number of younger scientists whose exposure to the environmental movement and ecological principles had led them to develop a critique of Cuba's dependent modernised agriculture, but whose ideas were marginalised within the infrastructure supporting that system.

Based on the work of such researchers and using existing technologies, the Ministry of Agriculture significantly accelerated and expanded existing plans to increase the production of natural enemies in order to replace the lost pesticide imports. By 1994 some 222 decentralised 'artisanal' laboratories were in operation and provided insects, nematodes and entomopathogens (bacteria, fungi and viruses that cause insect diseases) throughout Cuba's 15 provinces. These labs, which are called Centres for the Production of Entomophages and Entomopathogens (CREEs), facilitated the rapid adoption of IPM systems in crops previously managed under pesticide-based systems.

A typical CREE we visited in Pinar del Rio province employed 4 technicians with college degrees, 4 mid-level technicians, and 7 high school graduates. All were children of members of the cooperative where it was located. The cooperative received a ten-year loan from the bank to construct and equip the centre - a medium-sized house filled with sterile microbiology-type lab rooms and about a dozen autoclaves. According to the director, the CREE provided their products free of charge to the cooperative, at the same time selling them to neighbouring farmers, state farms and other co-ops. He said that sales were sufficient for them to break even, covering the cost of their salaries, loan payments, and the pest control needs of the entire cooperative.

While many CREEs are on cooperatives, others can be found in agricultural high schools, universities, and mixed agro-industrial enterprises. Some are smaller than the one described above, whilst others are much larger. Cuban technicians have even helped set up CREEs in other countries, among them Mexico and Nicaragua.

With the creation of the CREE network, applications of biological control-based IPM systems quickly expanded into new crops and crop/pest combinations. CREE personnel are in close contact with the producers they supply, and interact regularly with them to improve the efficacy of biological control in their regions. The production and use of entomopathogens has expanded particularly dramatically, and Cuba has developed unique capacities in this area. Many improved techniques of production, harvesting, formulation, application and quality control have been elaborated for numerous bacteria and fungi. *Bacillus thuringiensis* (B.t.), is a bacterial insecticide widely used to control a great variety of Lepidopteran pests in many crops and is used for mosquito control in public health programmes. In addition to the CREE's production of B.t., three 'semi-industrial' plants also produce a more uniform B.t. biopesticide, which is seen as a potentially important export product. Fungi-based biopesticides produced by the CREEs and in widespread use include: *Beauveria bassiana*, used extensively to control Coleopteran pests - including weevils that attack sweet potato and plantain; *Verticillium lecanii*, to control whitefly; (*Bemisia tabaci*), a vector of viral diseases in tobacco, tomato, beans and numerous other crops; *Metarhizium anisopliae*, for various insect pests; and *Trichoderma* spp., used as an antagonist of the soil-borne pathogens of tobacco seedlings (see Table 1). Other biopesticides now being developed for scaled-up production include *Nomuraea rileyi* and *Hirsutella thomsonii*.

Table 1. National production figures for biopesticides in Cuba (metric tons).

For insect control 1994	
Bacillus thuringiensis	1,312
Beauveria bassiana	781
Verticillium lecanii	196
Metarhizium anisopliae	142
For plant disease control	
Trichoderma spp.	2,842
For nematode control	
Paecilomyces lilacinus	173

Source: Díaz, 1995.

Given the importance of tobacco in the Cuban economy and culture, the success of biological control in this crop is extremely interesting. Tobacco production in most countries is heavily reliant on methyl bromide, a highly hazardous and ozone-depleting fumigant pesticide listed for worldwide phase-out under the Montreal Protocol. Based on the success of Trichoderma spp. as an alternative, Cuba now plans to prohibit all use of methyl bromide in 1998.

No panacea

We do not mean to suggest that biological pesticides have been a panacea for Cuba. First, it is hard to obtain accurate estimates of efficacy in Cuba. Second, many other factors have gone into stimulating increased food production, not the least of which are the higher prices paid to farmers, land distribution and new marketing mechanisms. Furthermore, artisanal production of biological control agents has not been without problems.

CREE staff readily admit they cannot ensure quality control standards or production goals in their artisanal laboratories, given unpredictable supply shortages and power cuts that are still common features of the Special Period. The resulting uneven quality and availability of biopesticides are significant obstacles to the efficacy of the pest management systems that depend on them. Producers' unfamiliarity with biological control is, more generally, another obstacle. Most extension personnel are new to biocontrol themselves, and training capacity is not yet sufficient to ensure that the biopesticides are always used to greatest effect. As chemical pesticides are either unavailable and/or unaffordable, however, producer experience with and enthusiasm for biological pest control continues to grow. According to the Director of an award-winning CREE in the Province of La Habana, the country's most important food-producing province, demand for biopesticides outstrips supply at most CREEs during peak seasons, suggesting that limited production capacity may also constrain IPM efficacy.

In a larger sense, pesticides - whether biological or chemical - cannot substitute for prevention. In that light it is interesting that there has been a virtual explosion of intercropping across Cuba's previously monocultural landscape, as farmers have raced ahead of agronomic research to use traditional methods where modern ones have disappeared. Many farmers argue that the intercrops reduce pest attack and produce more per unit area. A now ubiquitous cropping system is the maize/sweet potato intercrop, which is said to greatly reduce both sweet potato weevil and armyworm infestations, enabling high productivity without pesticides. In the absence of precise data, it is difficult to measure the relative contributions of new technologies like biopesticides versus traditional and suddenly back-in-style practices like intercropping.

The Cuban case is a crucial one in that it extends what have been local experiences to the level of national self-reliance and food security. That is important in the 1990s, an era in which concrete proof is more important that idealistic rhetoric.
It cannot be denied that locally produced biopesticides have played a key role in allowing Cuba to overcome a food crisis, although the actual efficacy of these products and their importance in relation to other changes in contemporary Cuba have proven hard to quantify.

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Pemba is characterised by two rainy seasons. Cassava is the staple food, although rice, grown twice a year under irrigation, is preferred. In the 1980s, to reduce dependence on imported rice, the Ministry of Agriculture introduced irrigation schemes for resource-poor farmers. Local rice variety yields were low under rain-fed conditions, but showed tolerance to prevailing pests and diseases. Irrigated rice yields were not much better, however, because of low soil fertility, water management problems, and such pests and diseases as Hispa (Trichispa sericea), Rice Yellow Mottle Virus (RYMV) and stem borers.

photo: Alida Laurense

IPM in irrigated rice for smallholders on Pemba, Zanzibar

Asha Omar Fakih, Shariff Maalim Hamad and Christine Wipfler

During the 1970s and the 1980s, clove prices were good and there was enough money for the Plant Protection Service (PPS) to offer farmers a variety of chemical pesticides and spraying services almost free of charge. Little consideration was given to environmental effects.

In the early 1990s, clove prices fell and a cheaper IPM approach was adopted. Research into harmful organisms and crop protection practices had provided insights into pest and disease management. Chemical pesticides not only presented a health hazard, they also killed off natural enemies, and pests had become resistant to them.

Farmers proved reluctant to adopt these extension messages. Changing from a conventional research and extension approach to IPM proved difficult. Technicians have to learn when and how to cooperate with farmers, and farmers have to rely more on themselves. Participation did increase during the course of the PPS-IPM programme, although mistakes were made because farmers had not participated enough in the early stages of programme development.

The history of the IPM programme

The IPM irrigated rice programme was developed in three stages. First, on-farm research into Hispa and Rice Yellow Mottle Virus. Second, the results of the trials were used to train farmers, and third, participative training and a research programme were designed.

Stage one: on-farm research

The problems with Hispa (*Trichispa sericea*) and RYMV came to the attention of the PPS in 1990. Farmers were not involved in initial on-farm research trials, where synthetic and botanical *Tephrosia vogelii*) pesticides were used against Hispa. Common rice varieties were screened, and RYMV tolerant varieties were recommended. The rice technology package presented to farmers suggested early planting to reduce Hispa and RYMV incidence; simultaneous planting by all the farmers in the valley to diminish the risk of Hispa infestation and minimise RYMV problems; keeping the bonds clean to reduce multiplication of Hispa on alternative host plants around the rice fields; controlling water levels in the fields as the Hispa beetle readily attacked tender plants too deeply immersed in water; the continual monitoring of fields to enable the farmers to detect and solve field problems as early as possible; and the use of *Tephrosia vogelii* to control Hispa.

Stage two: conventional training

In 1996, this new package seemed effective and a training curriculum was designed which aimed at overcoming farmers' reluctance to introduce new cultivation techniques. In March 1997, the first group of farmers was selected, and seven women and eight men met every two weeks. Training on crop husbandry was given in the farmers' own fields, and field tours were organised to the irrigated rice valleys.

The training programme involved very limited farmer participation and demonstrations were the main teaching tool. However, farmers were more interested in solving their soil fertility and irrigation management problems. Training programme evaluations also showed that farmers had not understood some of the topics and, therefore, rejected some of the recommendations.

Stage three: Farmer Field Schools

The training approach was changed. The Southeast Asian Farmer Field School approach was adopted and agro-ecosystem analysis (AESA) was introduced. Farmers were encouraged to make a detailed analysis of their crop, looking at the numbers of insects per plant, water, weeds, number of tillers and general crop health. They learned to formulate research proposals themselves and, on the basis of group analysis, came to decisions on crop, disease and pest management.

As a result of farmer initiatives, a new rice variety gained increasing popularity. In 1994, farmers received rice from Pakistan as food aid. The farmers who sowed some of this as seed found that one variety showed promise. They asked Ali Badru, a technician from the Irrigated Rice Department, to verify their findings. He compared the variety to recommended hybrids and local varieties. Highly productive, it yielded only a little less than the hybrids. It also required less fertiliser than hybrid varieties, and farmers could produce their own seeds. The variety proved tolerant to Rice Yellow Mottle Virus, had a good taste and was easy to harvest because of its height. The new variety took Ali Badru's name and is extremely popular today.

More participatory research focusing on alternatives to chemical fertilisers is planned. Trials will be conducted with green manure, and farmers will use the AESA method to assess their crops. ■

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Chinese rice farmers

The new IPM experts

The farmer training approach discussed here is FFS. The field schools run in the Chinese case study examined here involved some 25 farmers who met each week. Training took place in the farmers' own rice fields. In this supportive learning environment, local ecology and practices were discussed and the farmers' perceptions of their farm agro-ecosystems were developed further. This process of observation is known as agro-ecosystem analysis. The outcome of the farmers' weekly agro-ecosystem analysis became the basis of such decision-making as whether or not to continue relying on spiders and parasitic wasps to control rice pests.

Margaret S. Mangan

The FAO-IPM programme is based on a new understanding of rice field ecology. Experience in many countries has shown that insecticides actually cause more pests, and there is now a better understanding of the importance of beneficial insects and spiders in the rice ecosystem. Research has shown that the use of insecticides early in the season destroys the detritivore and plankton feeding insect populations which are the first food source for generalist predators such as spiders. A lack of generalist predators leaves the crop more vulnerable to pest population increases later in the season.

Four Principles of IPM

There are four principles central to IPM. First, to encourage the growth of healthy crops and to stimulate farmers to use the best possible agricultural practices. Second, FFSs should emphasise the importance of conserving beneficials: pesticides should only be used as a last resort. Third, crops should be observed every week and farmers should be guided in this during training sessions designed to improve their skills. Finally, farmers should become experts, their training empowering them to make crop protection decisions responsive to the needs of their crops.

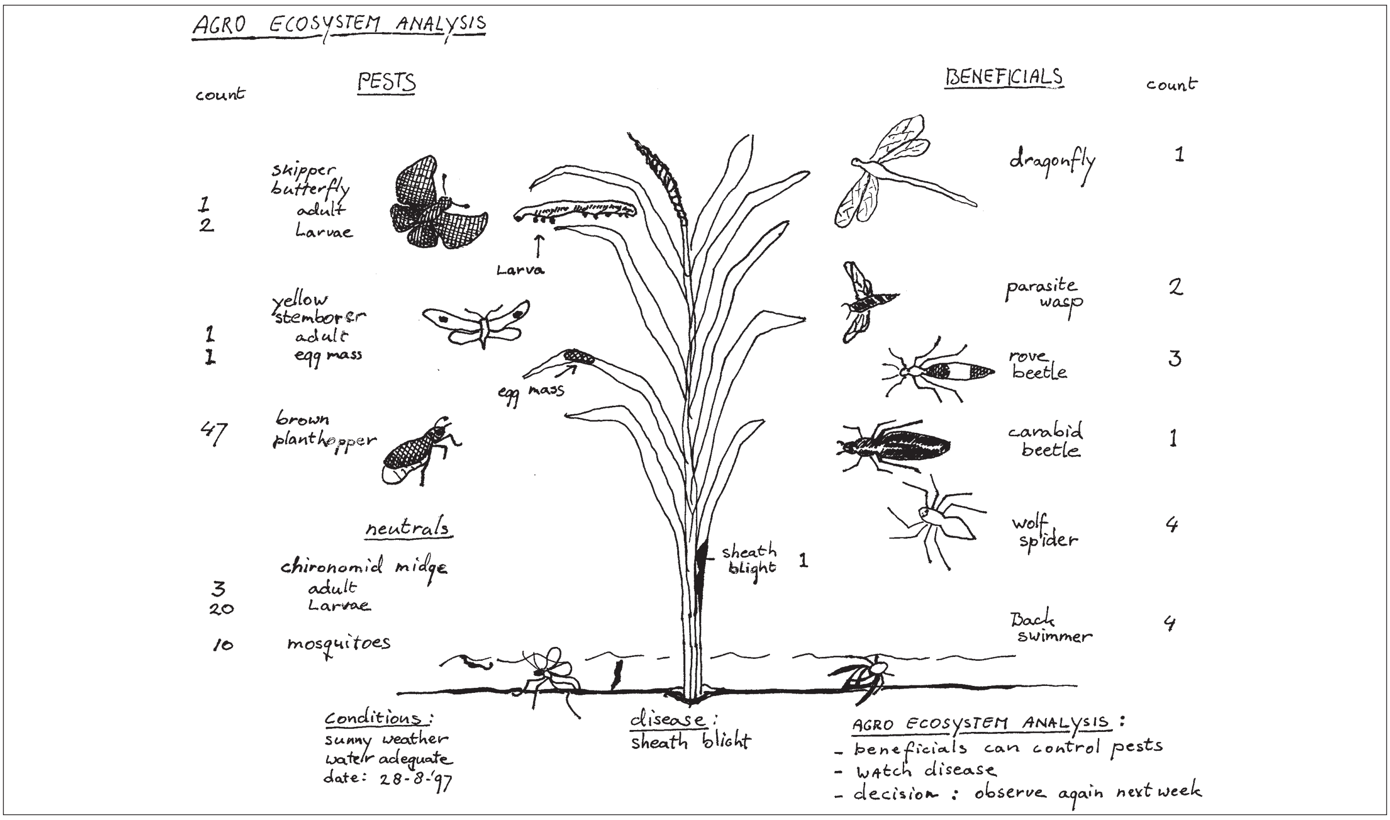
Farmers need to know which pests, diseases and animals are beneficial. In rice fields, beneficial species tend to outnumber pest species by about two or three to one. Farmers should also be able to identify neutrals - insects that are neither pests nor beneficials. Above all, they must be able to identify all these agro-ecosystem elements in their fields - not only on a classroom chart.

The agro-ecosystem of all crops changes in the course of the cropping season. In Sichuan, for example, very few stemborers are found early in the rice season, whereas thrips abound at this time. The proportion of these two pests changes as the rice grows. Parasitic wasps (beneficials killing leaf-eating caterpillars) are scarce early in the season, but become numerous in the second half. In the FFS, farmers acquire the skills needed to observe these changes as they occur from week to week.

This model was first used to train farmers in China in 1994. Twenty-five farmers who took part in the FFS in Wan Po Village, Sichuan, China, in 1995 were interviewed both before and after training and were observed during the weekly training sessions (Mangan, 1997).

Wan Po is situated in Meishan County, in the Red Basin of Sichuan, about two hours' drive south of Chengdu, the provincial capital. It has mild winters and very occasional snowfall. Summer temperatures rarely exceed 40°C. A single hybrid rice crop is grown in the summer, and canola or other crops are planted during the winter.

The Wan Po FFS farmers were organised into small groups of four or five people. Each group was named after some beneficial, for example, 'dragonfly', 'spider', 'parasitic wasp', or 'ladybird'. Every week, each group would complete an agro-ecosystem analysis of their FFS rice field. This consisted of examining approximately ten hills (clumps) of rice in a transect across the field. Observations included recording the types and numbers of insects, spiders and other animals, and collecting information



Drawing: Mangan/Steenhuis

on disease, weather, general plant health, and water level. This information was then transferred to paper. Each group made a drawing of a rice plant on a large sheet of paper using crayons or coloured pens. The farmers drew in all the pests on one side of the plant and all the predators on the other. Neutrals were grouped together in one corner, and weather and water conditions were clearly indicated. Using this method, farmers were easily able to track the ratio of various pests to selected beneficials from week to week (Mangan 1997).

Group presentations

After entering the observations made in the rice field on their drawings, each group presented its analysis to the other farmers in the FFS. Observations, conclusions and the decisions they had made during the week were discussed. Every week a different member of the group was encouraged to be the presenter. The other group members contributed by answering questions. Initial shyness and reluctance soon gave way to confidence and self-assurance as the training progressed.

FFSs covered other activities besides agro-ecosystem analysis, the 'insect zoo' being an example. A potted rice plant was placed in a simple cage built by the farmers, and a specific number of a particular kind of pest - such as 100 brown planthoppers - were introduced into the cage. The pest's predators - five wolf spiders, for example - were also released into the cage. Each group of farmers was able to vary the pest/predator ratio. At the end of the week, the group opened up its insect zoo, and pests and predators were counted. The results, which usually demonstrate how effective beneficials can be in destroying pests, were then discussed with the members of the FFS. One of the results of the insect zoo demonstration was that farmers often started to experiment on their own and brought these informal results back to the group (Mangan 1997). Other games were designed to strengthen group cooperation and to helped farmers identify pests and recognise their habits.

Because the farmers applied what they were learning from the very first activity undertaken in the FFS, learning was functional. Farmers developed a deeper understanding of how the different components of the rice ecosystem interact, and this enabled them to make more informed decisions about their own field management.

Results of interviews

Twenty-five farmers in Wan Po were interviewed before and after FFS training. Questions were asked about beneficials, pests, neutrals, pest-predator relationships, the ecosystem in general, and the effects of pesticides used in the field.

Before the FFS, only 11 farmers knew the names of those insects that were pests, while 15 farmers, 60 percent of the total sample, could not give a specific example of any beneficial in the field. In pre-FFS interviews, 4 farmers said 'All insects are pests'. Before FFS training, of the 25 farmers interviewed, only spiders (7 farmers), dragonflies (4 farmers) and ladybirds (1 farmer) were known to be beneficial. In addition, before the FFS farmers could name very few insects individually. The total number of insects/spiders farmers referred to by name ranged from one (both times stemborers) to a maximum of nine. The average number of insects mentioned was four.

After training, all 25 farmers mentioned spiders, 23 farmers mentioned dragonflies, and 6 farmers mentioned ladybirds. Seven more beneficial insects were also named. Most importantly, farmers could identify these in the field. There was a 233 percent increase in the total number of beneficials named by the farmers after training. There was a 22 percent increase in pest species named. The lower percentage was due to the fact that farmers were already familiar with pest species, but had not known very much about beneficial species.

Before FFS training, 4 of the 25 farmers had said they had seen some predatory spider/insect attack another insect. After training, 14 farmers had seen some predatory spider or insect attack another insect, and 12 farmers described in detail what they had seen. The FFS had successfully focused farmers' attention on understanding how beneficials actively controlled pests.

Before training, 15 of the 25 farmers said it was beneficial to spray pesticides on their rice. After training, only 5 farmers continued to claim pesticides were beneficial, and 19 of the farmers explained pesticides were not good because beneficial insects/spiders were also killed in the process.

Before training, only one farmer was able to give an answer that showed no misunderstandings about the way pesticides worked. After training, 8 farmers provided answers that indicated they understood how pesticides killed insects, and another 9 farmers gave a correct explanation although they added a few facts that were not correct. A fundamental change in the understanding of the function of pesticides had taken place.

Only 5 farmers could give examples of neutral insects - those that are neither pests nor beneficials - before the FFS. The mosquito was the insect most named. After the FFS, 23 farmers were able to give correct examples, and most often these were mosquito larvae and ants. However, even after training, farmers still did not understand very clearly how neutrals functioned as a major food source for beneficials during the first third of the rice season, before populations of plant-eating pests began to increase. This was a concept that was not obvious to farmers.

Before FFS training, farmers were asked what would happen if all the spiders were removed from their fields. Only 6 farmers said that pest populations would increase. After training, all farmers said pests would increase if spiders were removed from their rice fields. After FFS training, only 7 of the 25 farmers thought it would not be beneficial to have insects in the field, but none of these 7 farmers said they would kill the insects they found there, even if this were possible. They recognised that there were predator and neutral insects as well as pests in their fields, and that a balance between them was necessary to maintain a healthy ecosystem and protect the crop. After training, only one farmer was unable to name more beneficials. No farmer said that all insects were pests. The number of insects/spiders named by the farmers in their post-FFS interviews ranged from 5 to 14. On average, ten kinds of insects were named.

These answers show the influence of the FFS on developing a concept of the pest-predator relationships in the field, and on extending farmers' understanding of how generalist predators protect crops. During the course of the FFS, the farmers' concept of the rice ecosystem, and their understanding of the function of beneficial insects in that ecosystem deepened considerably.

In the FFS, understanding and skills are developed through direct participation in specially designed situations. The careful arrangement of FFS activities in this educational experience strongly contributed to the formation of more scientific concepts. The FFS was effective because learning activities took place in a rice field - a familiar and learner-friendly environment.

The use of small groups of farmer trainees to make observations, and the role played by the FFS in challenging their conclusions, proved effective in bringing about change in farmer practices. Interviews conducted one year after the FFS had been held showed that the basic objective - to secure a reduction in pesticide use - had been achieved.

The application of these new IPM methods taught through Farmer Field Schools is environmentally sound and sustainable. The Farmer Field School is an efficient model for empowering farmers to reduce the use of pesticides. Wider application of this training approach benefits farmers economically - they save money because they buy less pesticides - and benefits the planet's environment. Everyone wins.

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photo: S. Page

Natural pest management in Zimbabwe

The Zimbabwean Eco-lab has an innovative way of tackling farmer participatory training in pest management. ZIP Research operates from the ECO-lab and is concerned with training the Farmer Field Workers (FFWs) selected by farmers' groups.

Sam L.J. Page

Since independence in 1980, communal farmers in Zimbabwe have been persuaded to use increasing amounts of fertiliser and pesticides on crops such as maize and cotton and on their horticultural produce. As a result, pests are becoming resistant and soils are growing more acidic and infertile. The use of toxic and expensive inputs has brought health and money problems to many farmers and their families.

In order to counter this trend, a small NGO known as ZIP Research has recently been set up to offer safe and sustainable alternatives to synthetic fertilisers and pesticides. ZIP Research operates from the Eco-lab, a purpose-built, fully equipped laboratory built from NORAD funds (Norwegian development aid). It is situated in the Fambidzanai Permaculture Centre, 20 kilometers west of Harare. One section of the Eco-lab is devoted to research into the indigenous natural enemies of common pests, while the other is dedicated to training Farmer Field Workers (FFW) in Natural Pest Management (NPM) and organic farming methods. NPM is concerned with developing farming systems that manage pests naturally, that is without synthetic pesticides. NPM strategies rely on farmers' knowledge and try to minimise the need for interventions.

Farmer Participatory Training in NPM

Training provided by ZIP Research has borrowed the 'learning through experimentation' approach of FAO Farmer Field Schools. However, ZIP Research training is less 'top-down', in that training is given mainly to farmers rather than extension workers. There are three reasons for this. First, farmers are highly motivated because they depend on farming for their survival. Second, farmers are mainly women whereas extension workers are generally men. Third, training farmers directly ensures that the knowledge stays within the community. If an extension worker received specialised training, he or she might be tempted to look for a more lucrative job elsewhere. ZIP Research trains in NPM and its approach is holistic and agro-ecosystem oriented. This means that the farmers who participate can eliminate all synthetic pesticides from their farming system and are then able to apply for organic certification in order to receive a premium for their produce.

Each training programme is 'tailor-made' for a particular group of participants and proceeds from the demands of their agro-ecological zones and cropping systems. Training is only offered to farmers who are actively seeking help to reduce their pesticide use. It forms part of a project which is designed to eliminate all pesticides from the farming system, promote environmental awareness, and lead to improved incomes through the sale of organic produce either on the local or overseas market. In some cases, local extension officers are also trained in NPM and organic farming methods, so they can help provide follow-up support to Farmer Field Workers (FFWs) and act as a buffer between farmers and over-zealous pesticide sales representatives.

Training at the Eco-lab

Farmers select FFWs from their own communities. The FFWs spend four weeks at the Eco-lab, where they learn relevant facts about soil science, insect life cycles, pest-predator relations, disease transmission and development, and the way natural and synthetic pesticides work, through a series of in-field and 'jam-jar' experiments.

These FFWs also learn about the value of indigenous seed, exchange ideas on traditional grain storage techniques, discuss ways of designing simple experiments, and learn the importance of maintaining diversity and soil fertility through mixed cropping, composting, green manuring and crop rotation. For the purposes of organic certification, the FFWs are introduced to mapping, record keeping and the regulations laid down by the International Federation of Organic Agriculture

Movements (IFOAM). Farmer exchange visits and market survey opportunities are also arranged, and games and songs are used to consolidate the learning process.

This training is carried out in a spirit of 'sharing ideas' and the FFWs learn techniques which enable them to become keen observers and innovators in both a scientific and creative way. The extended training period also allows time for friendships to develop between the FFWs. This ensures that the participants work as a team and skills are shared.

ZIP Research decides whether trainees will make suitable FFWs. This final assessment is not based on academic achievements, but on a candidate's motivation, outgoing nature, and his or her ability to empathise with other farmers in their community. Ideal FFWs are married, and therefore have access to their own land. The composition of the group reflects the age, gender and level of poverty of the farmers in their community.

FFW-led Farmer Field Schools

On returning to their communities, the FFWs share their new knowledge and ways of learning with the ten farmers who originally selected them. At the same time they continue to receive support from ZIP Research and from trained extension officers. The FFWs conduct regular Farmer Field Schools, ensure that individual farmers adhere to the agreed guidelines for organic production and certification, and write monthly reports.

During the Farmer Field Schools, the farmers' groups scout for pests and predators, discuss control strategies and carry out simple experiments on insect life cycles. They also examine the efficacy of local natural pesticides, grain storage treatments and the comparative susceptibility of crop varieties to pests. ZIP Research's role during these Farmer Field Schools is to support the FFWs in their job as facilitators and to offer advice when asked to do so.

Donor support

The FFWs receive a small salary. This is provided initially by DANIDA, the donor, although in the long term these salaries will be paid for by the organic premium, which should be at least 20 percent above normal farm-gate prices. Expenses associated with training and providing follow-up support for the first two or three years must also be met by donors. These costs, however, appear well justified because results so far have been impressive.

At the moment ZIP Research has two projects. The first is being funded by DANIDA, and involves a collective of 60 farmers and 6 FFWs in Chinamhora. This group has just started to supply Harare with its first fresh organic vegetables. The collective grows tomatoes, peas and carrots in rotation with brassicas such as cabbage and alliums such as onion, in order to control root-knot nematodes and satisfy local consumer demand for these vegetables. They have discovered two native plant extracts, Mucherekesi (*Swartzia madagascariensis*), an effective fungicide, and Chowa (*Datura stramonium*), a good insecticide.


photo: S. Page

Experimenting in organic production

The farmers have also composed a number of songs, and these help illiterate members of the group to retain facts about such organic farming practices as composting, intercropping and rotation. The songs also seem to strengthen a dying tradition, the practice of singing together while tilling the land.

One FFW working in the cotton growing area of Mtoko has discovered a small ant which is predacious on stem-borers and bollworms but which is only active when there is an intercrop of indigenous cowpea to provide shade and nectar. The FFW also discovered a 'zebra' caterpillar that, astonishingly, seems to relish aphids!

The second project, supported by the SIDA EPOPA programme, is based in the Zambezi Valley in northwest Zimbabwe. Here, resettled farmers have cleared land that was once home to thousands of elephants, and now grow cotton and other crops. Many farmers are concerned about the environmental degradation triggered by this land clearance and the consequences of heavy pesticide use. They have started to experiment and grow cotton without pesticides.

ZIP Research has recently trained 30 FFWs to ensure that 330 farmers will be able to produce organic cotton in the coming season. A minimum of 15 tons of lint is required before spinning can begin. So far the new FFWs have greeted their training with enthusiasm, and have been spurred on by the achievements of the organic farmers in Chinamhora (they are planning to hold a singing competition next year!) However, opposition from the many multinational chemical companies which operate in the valley is anticipated.

Farmer-Participatory Research

Research conducted at the Eco-lab is designed to support on-going projects. Research topics are often initiated and carried out by FFWs and their farmers' groups, and results are shared amongst project members. This coming season farmers will be reporting on the incidence of predatory ants on intercropped and monocropped fields, and will be finding out which varieties of tomato perform best during the rainy season. Organic cotton growers will be observing the impact of strip-cropping sweet sorghum as a trap crop for the American bollworm, and assessing the suitability of different live fencing materials for encouraging insect predators.

Meanwhile, scientists at ZIP Research will explore the efficacy of the 'zebra' caterpillar and various other indigenous natural enemies such as parasitoid wasps, insect viruses and entomopathogenic nematodes. They also intend to come up with standards that can be used to measure the effectiveness and selectivity of the many plant-based insecticidal sprays used in farmers' experiments. In this way scientists and farmers can share the excitement of applied research.

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*ZIP Research is an independent scientific unit operating under the auspices of the Zimbabwe Institute of Permaculture.

Crop protection in the 1990s

During the 1990s, there have been new awarenesses and developments in crop protection. There have been improvements in user, consumer and environmental protection at the product development level and in the approaches adopted. When we analyse the relevance of these improvements for small farmers in developing countries, however, it becomes clear that there is still a lack of progress in making the new crop protection practices available to them.

Gaby Stoll

Product development during the period under consideration is characterised by the intensive and aggressive development of products using biotechnology and genetic engineering. This can be seen from the following figures:

Table 1: Predicted US Market for biopesticides, 1992-2002 (in millions of US$)

	1992	1997	2002	AGR in %
Pyrethroids	410	487	560	3.2
Bacterial	68	137	275	15.0
Pheromones	42	56	75	6.0
Viral & fungal	26	44 69	10.3	
Others	13	16	23	5.9
TOTAL	559	740	1002	6.0

AGR = Annual growth rate

*Source: **Pesticide Outlook**, February 1994*

The US government is actively supporting this trend. Between 1991 and 1994, 50-70 % of all new pesticide registrations were issued for biotechnologically and genetically engineered products. In addition to developing products using these advanced technologies, another trend can be observed. The agrochemical industry is putting considerable effort into stimulating the market for conventional pesticides in Latin America and Asia, as these offer the greatest growth rates. Countries such as Brazil, China and India have become important producers of conventional pesticides in recent years, and in a number of developing countries these products are sold very cheaply at local markets. One consequence is that it is easier for farmers to buy these products so they are able to make more frequent applications, a practice that we know is harmful for users, consumers and the environment (Table 2). This table shows that resource-poor farmers have little access to the new developments being made in pesticide products. Resource-rich farmers, however, can afford the newer and safer pesticides. Poor smallholders are only able to afford the older generation of pesticides. These show widespread resistance and contain the most toxic substances. However, as we shall see in this article, small farmers can benefit from an integrated approach to crop protection.

Approach to development

During the 1990s, important integrated approaches to user, consumer and environment friendly crop protection have been developed. These include integrated cultivation systems for organic cotton involving elements of preventive crop protection; Farmer Field Schools; Farmer First Research; Participatory Technical Development(PTD); and Local Knowledge.

With experience and confidence in these approaches growing, it became obvious that it is possible to secure yields using far less pesticides than had previously been suggested. Cotton provides an excellent example of this. With the development of integrated cultivation systems for organic cotton that contain elements of preventive/natural crop protection, it can be demonstrated that a crop that consumed 25% of the world's insecticides could be grown successfully without any insecticide at all. Tadeo Caldas (1997) has reported on the major crop protection strategies in cotton (Table 3). Interestingly, neither the Consultative Group on International Agricultural Research (CGIAR) nor the agrochemical industry contributed in any way to the development of organic cotton cultivation systems. Instead, its success was due to the concerted effort of private companies, advisers and farmers.

The following comparison of crop protection strategies adopted in conventional and organic cotton shows that yields are lower in organic cotton. However, the reduced costs involved in crop protection measures and the price premium offer compensation (Table 4).

The cotton example shows that belief in the indispensability of pesticides arises from a scientific bias, and that this is maintained by particular interests. It also shows that the development of a viable alternative crop protection concept requires a holistic approach incorporating elements of the natural, social and economic sciences. Finally, we see that non-traditional researchers can further develop results from basic research, through such strategies as adaptive research and PTD for example, and achieve acceptance in the field. Similar conclusions can be drawn from studies of rice production.

Table 2: Access to pesticides, productivity, income and danger of pesticide poisoning for farmers with different resource endowment

FARMER		Pesticide	
		cheap Toxicity class I & II non-selective high resistance	expensive less toxic selective low resistance
Very resource-poor farmers	access to capital	-	-
	access to products	-	-
	productivity	-	-
	income	-	-
	user-safety	-	-
Resource-poor farmers	access to capital	+	-
	access to products	+/-	+/-
	productivity	+/-	-
	income	+/-	-
	user-safety	-	+
Resource-rich farmers	access to capital	+	+
	access to products	+	+
	productivity	+	+
	income	+	+
	user-safety	-	-

Table 3: Crop Protection strategies in organic cotton cultivation in India, Senegal and Zambia

	India		Senegal		Zambia
	Site 1	Site 2	Site 1	Site 2	Site 1
Pheromones, lures, traps	Y, loc	Y, loc	Y, imp	Y, imp	no
Mating disruption	N	N	Y	N	N
Trichogramma	Y	Y	N	N	N
Chrysoperla carnea	Y	Y	N	N	N
Ladybird beetle	Y	Y	N	N	N
Bacillus thuringiensis	Y	Y	Y, imp	Y, imp	N
Nuclear Polyhedrosis Virus	Y	Y	N	N	N
Neem	Y	Y	Y	N	Y
Other botanicals	Y	Y	Y	N	Y
Cow urine	Y	Y	Y	N	N
Trap cropping	Y	Y	Y	Y	Y
Border crops	Y	Y	Y	Y	Y

Farmer Field Schools (FFS)

The concept of FFS was originally developed as an extension methodology for IPM in rice. This methodology is based on a structured learning process. The concept allows farmers to explore areas of research that are of particular interest and importance to them. This training concept is not only limited to IPM in the strict sense. In Asia, many NGOs and farmers' organisations have adapted and interpreted it to suit their own specific situations and interest. Some of these organisations apply the FFS concept not to IPM as such, but to agricultural system development in general. The flexibility of the concept and the experiential learning on which it is based have made it a widely used and valuable extension tool.

These approaches start with a participatory problem analysis and local knowledge. The experimental site is usually the farmer's field or a special experimental site identified by the farmers' group. The key to this approach is to teach farmers to experiment with their local knowledge or new/external information in order to make it effective and suitable to their specific situation. Farmers and extension workers gain methodological skills to develop their own solutions. This challenges conventional research paradigms and calls for a new relationship and respect between the various actors involved. Examples of this approach are the development of neem extracts in Thailand, the MASIPAG programme in the Philippines where farmers select and breed rice varieties according to their own criteria, and coffee farmer cooperatives that rear their own beneficial insects.

Smallholder options

Now we have to answer the question we posed earlier: what access do resource-poor farmers have to natural crop protection practices? Let me quote the participant from a workshop on natural crop protection held in Tanzania in December 1996 who said, "There exists a significant amount of knowledge on natural crop protection, but we believe it is not well organised and developed. It is still largely undervalued, not well experimented and there has been little diffusion. There is, therefore, a need for us to share the various experiences and methodologies used here and there and to develop this field further".

This participant acknowledges that access to information on natural crop protection practices in the widest sense has improved. But this does not mean that the information is getting to the right place. Information only becomes relevant when it is enlivened, that is when it has been transformed in such a way that it can be incorporated into people's daily life and work. However, this is the 'big gap'. The interplay between the various actors is still not optimal when one looks beyond the small islands of innovations. Research topics are still determined more by who and what receives financing, rather than by what is relevant to small farmers. This means that topics important to this group are largely under-represented.

Final reflections

During the last 10 years, and particularly while working with the people of Southeast Asia on the development of natural crop protection practices, I learned by observation and experience that they are guided more by the concept of *'but-as-well'* than by the Western concept of *'either-or'*. Underlying the 'but-as-well' is the concept of multiple approaches capable of responding to multiple realities, realities which might seem to contradict each other if we take the 'either-or' perspective. If we relate this insight to crop protection, we create room for multiple approaches where the one does not hinder the other.

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Table 4: Comparison of crop protection strategies and yields for conventional and organic cotton

		conventional	organic
India	crop protection strategy	Endosulfan Monocrotophos BHC	Trichogramma
	yield kg/ha sc	2,000	1,500
Turkey	crop protection strategy	ca. 7 applic. contact- and systemic insecticides	predators commercial biosprays
	yield kg/ha sc	3,700 2,700	3,500 2,500
Egypt	crop protection strategy	Malathion Dimethoate Sumicidin	predators pheromones Beauveria
	yield kg/ha sc	2,800	2,600
Peru	crop protection strategy	ca. 5 applications of insecticides	Trichogramma Bacillus thuringiensis
	yield kg/ha sc	1,500	1,200

Generally: * lower costs for crop protection measures (60-70 %)
* price premium of 15-20 %

Source: IFOAM, 1996

A Perspective on IPM

In the past six weeks I visited the future of IPM in two places. One was about 3 hours east of Jakarta, in a rice growing village in Kalensari, District Indramayu, West Java, Indonesia. My hosts included Warsiyah, Madamin, Sobari, H. Yusuf, and about a dozen other farmers who have done research for the last two years on the agro-ecology of their village. My companions included a young Japanese staff member of his Ministry of Agriculture and two FAO field staff who both had visited Kalensari before. Our facilitator was Arief, also with FAO, who moved to Kalensari two years ago and studies agro-ecology with farmers there. While my learning came from participating in meetings, field visits, and interviews, the scientist farmers of Kalensari have recently completed a detailed monograph.

Peter Kenmore

Scientists have been characterised as having three essential tools: clear understanding of currently accepted explanations and concepts, fresh observations from nature, and a profound dissatisfaction with these two, because they do not match. The scientist farmers in Kalensari have all three. When extension agents told farmers to apply insecticides to control rice stemborer (*Scirpophaga spp.*) , and they did, they observed that damage to treated fields was nevertheless often high. When extension told them to plant on a rigid calendar schedule to avoid stemborers, and they did, they observed that stemborers sometimes caused heavy damage, and sometimes not. They were dissatisfied with the current explanations, and they conducted, and continue to conduct, a number of field studies to create better knowledge. Many of these studies examined in detail the behavioural and population consequences of the stemborers' life cycle which has evolved and adapted to the uncertainties of rainfall. The scientist farmers have discovered by asking straight questions in the field how to observe and analyse insect populations during the dry fallow season from August to November. They track quantitatively the survivorship, diapause, emergence and invasion flights of stemborers. This allows them to decide for themselves, based on precise 'readings' of their local agro-ecosystem, when to plant rice so as to minimise the immigration of pests.

They understood from the beginning that their results would bring them into conflict with a centrally managed extension system. They addressed this conflict with confidence and skill. They began the task of convincement with influential villagers, carrying the local extension worker along with them, then proceeded to the sub-district officials, neighbouring sub-districts, and ultimately the district head, in whom they found receptive. In their organisational meetings, and later in educational seminars for officials, they used the power of their science to make their case. At the same time they made clear that they would take full responsibility for the management of insect pests in their communities. This was an important announcement, because when accepted it relieved local officials from central crop protection targets and allowed them to learn about the local agro-ecosystem.

In consequence, the irrigation schedule for the district Indramayu - often Indonesia's highest rice producing district - has been adapted to the scientist farmers' recommendations. Educational seminars have been organised with farmers from all the other sub-districts. All sub-district agricultural officials and many local government staff have been or are in training courses given by farmers. In agro-economic terms, the communities are growing as much or more rice with fewer inputs. While El Nir scientists are confident they know what is happening with stemborer populations in their slightly moistened fallow fields, and they are ready with alternative management strategies.

The second, temporary, home of the future of IPM was 2 hours west of Boston, USA, where a group of Indonesian and Vietnamese IPM trainers and managers are spending six sabbatical months. These are seasoned field experts and organisers. They have each been responsible for a number of Farmers Field Schools and the community IPM linkages after the Farmers Field Schools. A very innovative grant has made it possible not only for them to improve their command of English, but more importantly to interact with community organisers, adult educators, and IPM farmers in a very exotic ecosystem. This allows them time to analyse together and at a distance their Asian IPM experiences, to forge their own linkages as an international IPM management team, and by comparing North Atlantic IPM with Asian IPM, to reflect in an academic setting on the rapidly changing roles of civil society and the state. They have already become participants and teachers at the local university. When they return to Asia they will work as a networked team among Asian countries as well as within each of their own countries.

Scope of IPM

Participatory IPM led by farmers is now practiced in over 50,000 communities found mostly in Indonesia, Vietnam, Philippines, Bangladesh, China, Sri Lanka, India, Cambodia, Lao PDR, Republic of Korea, Ghana, Kenya, Cote d'Ivoire, Burkina Faso, Mali, Egypt, Sudan, Honduras, Nicaragua, Senegal and Zimbabwe. This is over 2 percent of all rural villages in all developing countries. There are over 30,000 competent IPM trainers any of whom can facilitate a Farmers Field School through an entire crop season, and then the resulting farmers' IPM group through the remainder of their year-round production agro-ecosystem. The majority of those trainers are themselves small-scale farmers. Farmers practicing IPM have increased their seasonal profits by as much as 30 percent, increased yields per hectare from 1 percent to over 10 percent, all while reducing pesticide use by 30 percent to over 95 percent (and often eliminating insecticide use) and substantially lowering occupational health risks. Most of the communities practicing IPM grow rice, but IPM is also practiced by farmers of maize, soyabean and other field beans, cabbage, tomato, groundnut, coconut, cacao, coffee, peppers, sweet potato, cotton, mango, and cucumber. Government agencies and NGOs have both initiated IPM programmes, and found that they were transforming their own institutions as farmers demanded better technical information, better service, and a larger role in planning programmes.

History

The history of IPM in and by rice-farming communities falls into three periods. From 1967 to 1977 was the era of the high Green Revolution. Even before the official release of rice variety IR8 more than 50 percent of farmers had already begun using insecticides in the Philippines, up from about 3 percent ten years before. By 1985 more than 90 percent of farmers in Southeast Asia were using insecticides in irrigated rice. The vast majority of those insecticides were subsidised. Farmers were not paying a market price for insecticides, so they could not make an informed financial decision.

Yet nearly from the beginning of the Green Revolution increases in insect populations following insecticide applications were detected. In a survey of farmers' fields in West Java conducted in 1970-71. In 1971 staff members at the IRRI were routinely treating varietal screening trials with insecticides to build up populations of planthoppers. Insecticide-induced increases in populations of plant-sucking insects are among the first reliable symptoms of an intensification syndrome, exemplified by the Green Revolution model, that de-stabilises production.

The ecology of this syndrome had been sketched - but left incomplete due to political economic pressures - in Japan in the early 1960s by Y. Ito and K. Kiritani. In tropical countries it was only re-discovered in the later 1970s after insecticide-induced outbreaks became common. Destruction of predators and parasites of planthoppers by insecticides allowed these insects to multiply. Insecticide resistance did not play a major role in the politically strategic outbreaks of the 1970s and 1980s. The capacity of insects to multiply, and the ferociously local character of population dynamics - where ten square meters could maintain a population one thousand times larger than an adjacent ten square meters - meant that local managers of individual paddies - the rice farmers, could benefit from in depth knowledge of agro-ecology.

From 1977 to 1987 IPM moved from research towards extension. By 1988 Training and Visit extension systems in the Philippines, Indonesia, Sri Lanka, Bangladesh, India, Thailand and Malaysia were attempting to introduce IPM to rice farmers through their systems of 'impact points' or through strategic extension campaigns designed on the principles of social marketing. These centrally driven message delivery systems, no matter how sophisticated, could not respond to fine-grained local ecological variation. Recommendations were inflexibly early, late, or inappropriate. More dangerously, in the area of crop protection these recommendations often collapsed under commercial marketing pressure to chemical product pushing. The logical fears of extension agents that by failing to push (even optional) chemicals they would be culpable for any crop failure, whether pest-associated or not, led to a one dimensional view of their job. To satisfy superiors who communicated by setting targets for inputs distribution extension agents often became chemical dealers themselves.

New sources of local expertise had to be engaged. Those sources are the communities themselves. In most Asian extension systems the crop protection units are semi-autonomous. Their staff are supposed to have special qualifications, and they are required to go into farmers' fields in order to report upwards on threatening pest populations. While their surveillance work often served as a trigger to release more subsidised pesticides, their relative independence and assignments to the field created windows of opportunity for training and education. These field staff, most never having planted and grown a complete rice crop, were put through intensive field Training of Trainers courses for four months, six days per week in the field. As farmers became pest control experts, pest control staff gained credibility as farmers. They also learned and practiced adult non-formal education skills, and welded together in teams that could rely on each other when they were re-inserted into their home office bureaucracies.

From 1988 to the present IPM, while for the most part remaining within national structures of agricultural extension, has moved toward education rather than training, and through education towards community organization, community management, planning and community control of IPM. Full time IPM trainers facilitating and then following up Farmers Field Schools have been succeeded naturally by networks of farmer trainers who can call upon specialists for specific advice. These farmer IPM trainers now carry out the majority of training in Indonesia. In 1993 a Global IPM Field Exchange and Meeting was held in Southeast Asia. Participants from Africa, the Near East, Latin America, and Europe spent ten days in the field learning from Asian IPM farmers, then planning for their own countries. This has led to strong initiatives of participatory IPM in Africa, the Near East, and Latin America.

Impact of IPM

As IPM becomes a doorway for transformation and community empowerment we require new thinking about impact. While agro-economic criteria of impact are necessary they are not sufficient. The quality of scientific process and the social-political momentum of empowerment are equally necessary, and the three dimensions must be accounted for in studies of impact.

The narrowly agro-economic impact of IPM, after taking into consideration the costs of Farmers' Field Schools and Training of Trainers, is considerable. One study of over 1300 villages in Vietnam showed a 4 percent yield increase in rice and over 20 percent increase in profits. Farmers Field Schools organised by trainers in seasons after their own training was completed in Ghana, Cote d'Ivoire, and Burkina Faso have shown savings for rice farmers of over US$90 per hectare, with at least as high yields, and profits increasing by over 25 percent. In Philippines, when cabbages were contaminated by over-use of pesticides, IPM training resulted in farmers reducing from over 20 applications per season to three, including one treatment with an insect pathogen. In Indonesia there were three nationally threatening planthopper outbreaks on rice between 1977 and 1987. In the ten years since, under an IPM national declaration and removal of pesticide subsidies, there have been no national outbreaks. The savings to the government of Indonesia by eliminating the subsidies has exceeded US$1 billion. India eliminated a US$30 million annual subsidy by the central government for insecticides, and instead imposed a 10 percent excise tax on them. This has meant US$60 million annual new income to the government, which spends over US$10 million per year on IPM field training. In China, provincial governments, impressed by farmers' profits increasing by over 15 percent from practising IPM, now pay for more IPM training than the central government. When calculated from field-derived estimates of micro-benefits to farms, the financial rates of return of IPM investment have exceeded World Bank and Asian Development Bank critieria for project approval.

A crucial dimension of IPM impact is empowerment. The Kalensari experience illustrates how communities come to control the IPM research, planning and implementation process by engaging the world around themselves. This is the path forward. My final examples, from Africa, show how the path may be followed in other regions. In Kiambu district, Kenya, a group of women farmers held an IPM Farmers Field School and continue to meet every week, a year later, in the field often with their facilitators and technical advisers,who are also women. They work in coffee-tomato-maize systems. During my visit in July 1997 the Director of CropProtection of the Kenya Agricultural Research Institute delivered to this group of 25 women a diagnostic report on a tomato pathogen that the farmer scientists had recognised was neither a nutritional disorder nor insect damage. The report offered both chemical and cultural management options. The group discussed the report, and seemed likely to choose the cultural management option and not the chemical one. What was remarkable was that this group of farmers had accessed the leading national institution and received service, just as giant plantation operators do, in order to inform their decision making. This is the power of scientist farmers.

The final case is from Mali, where a group of farmers had completed Farmers' Field Schools and were reporting results to our August 1997 visitors group of outsiders and irrigation system officials. When these scientist farmers explained that insect pests were not observed to be a threat in that season, due to effective natural enemies, the most senior of the irrigation officials, with a plant protection background, protested. He accused the farmers of being complacent, that other pests they could not observe might be destroying their crop. In reply, the senior female farmer raised her voice from the end of the room, and accompanied by affirmations from both men and women farmers, engaged the official in discussion. She explained that because they had conducted simulation studies of rice crop damage and observed and measured how the crop had recovered, the scientist farmers were confident that other damage, even if unobserved, would not result in yield loss. She then went on to raise the issue of the "package" of inputs that each farmer was required to take and pay for out of the harvest. She recalled that the package included about US$80 worth of pesticides, which were not needed at all that season. Faced with scientific arguments and with the unanimity of the group of IPM scientist farmers that season, the irrigation official conceded that the package would be re-examined. When the content and process of IPM are linked to community power, even during the first seasons, transformation begins.

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Indigenous and modern approaches to IPM in Latin America

Prevailing economic policies in Latin America encourage the production of export and/or commercial crops, primarily in large-scale monocultures. Pesticide expenditures in the Latin American region increased from US$1.0 billion in 1980 to US$2.7 billion in 1990. The major recipients of pesticides were large-scale production systems producing sugar cane, cotton, maize, soya beans, rice, citrus and tomatoes, especially in Brazil, Colombia, Argentina and Mexico. Predictably, the emphasis of the chemical-intensive agricultural export model has intensified ecologically-based crisis conditions and has led to serious environmental and health consequences (Belloti et al., 1990).

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Despite the above trends, there are several documented cases of alternative pest management approaches scattered throughout the region that have resulted in sustainable crop production. These are both traditional crop protection practices (indigenous IPM systems) developed by indigenous farmers using traditional knowledge and local resources, and modern IPM systems developed by innovative researchers involved in the search for more sustainable methods of food production.

Despite many scientific advances, it is still arguable whether ecological principles have actually had an impact on the practice of modern IPM. In many cases, modern IPM has come to mean Intelligent Pesticide Management, which aims at scouting crops to monitor pest densities in order to take action (usually insecticide application) when they threaten economic viability (the economic threshold (ET)). As long as the simplified structure of monocultures is maintained, pest problems will continue because the process of ecological simplification has been set in motion. The IPM projects described below are, however, a step in the right direction as they em phasise the withdrawal of pesticides, allowing beneficial fauna to recover and a more desirable level of biodiversity to re-establish itself within agro-ecosystems.

Peru

In the mid-1950s, as cotton production reached a peak in the Canete Valley, organochlorinated insecticides were in intensive use. Several pests had already developed resistence to these pesticides, and heavier dosages and more frequent applications became necessary. Six new species of secondary pests made their appearance and cotton yields fell sharply.

A number of changes in pest control practices were introduced in response to this crisis including the banning of synthetic organic pesticide use, the reintroduction of beneficial insects, crop diversification schemes, planting of early maturing varieties and the destruction of cotton crop residue. Pest problems declined dramatically, and pest control costs were substantially reduced (Hansen, 1987).

Nicaragua

In Nicaragua, cotton also exhibited the classic pesticide 'treadmill' pattern observed earlier in Peru. After a successful production phase in which cotton yields peaked in 1964-1965, pesticide-induced ecological disruptions made themselves felt: insecticide-resistant pests, secondary pests and the elimination of natural enemies. Average yields fell by 15-30% because of insect damage, despite 28 insecticide applications per season. In 1971, a programme started by UN-FAO began to yield information on, amongst other things, economic thresholds, the seasons when natural enemies were most abundant, and cotton phenology. This helped researchers to identify the best time for planting cotton and the conditions that gave the best growth environment to the plant, allowing it to escape boll weevil and boll worm attack. Later, a 'trap cropping' system was developed. This consisted of planting small cotton plots at the beginning and end of the growing seasons to attract and concentrate weevils. Once trapped, they were then killed off by selective insecticides (Swezey et al., 1986).

Costa Rica

Another case of insecticide-induced ecological disruption comes from the Pacific coastal plains. In 1954, over 12,000 hectares of United Fruit Company banana plantations were treated with an aerial application of dieldrin granules against banana weevil and rust thrips. This killed off many natural enemies and led to the appearance of other pests which had previously been of minor significance. An outbreak of banana stalk borer, Castiomera humbolti was countered by more pesticide spraying. By 1958, in spite of increasing pesticide use, there was an unprecedented outbreak of pests, with even six major Lepidopteran pests including Ceramidia moth, owleye and the West Indian bag worm that had not previously been a problem. In 1973, the oil crisis prompted United Fruit entomologists to stop all insecticide sprays in the entire Golfito banana division. Insect pests fell to below a level where they were a threat to profitability within one to three generations (a period of several months) with little or no fruit loss. Within two years, virtually all of the former pest species had almost disappeared from the plantations. Indeed, pests like Ceramidia and the owleyes were rarely seen. There were occasional small outbreaks of larvae of the West Indian bag worm, but their numbers did

Table 1. Selected examples of multiple cropping systems that effectively prevent insect-pest outbreaks in Latin America (after Altieri, 1994).

Multiple cropping System	Pest(s) regulated	Factor(s) involved	Country
Cassava intercropped with cowpeas	Whiteflies *Aleurotrachelus socialis* and *Trialeurodes variabilis*	Changes in plant vigour and increased abundance of natural enemies	Colombia
Corn intercropped with beans	Leafhoppers (*Empoasca kraemeri*), leaf beetle (*Diabrotica balteata*) and fall armyworm (*Spodoptera frugiperda*)	Increase in beneficial insects and interference with colonisation	Colombia
Corn intercropped with beans	Corn leafhopper (*Dalbulus maidis*)	Interference with leafhopper movement	Nicaragua
Cucumbers intercropped with maize and broccoli	Flea beetles (*Acalymma vitata*)	?	Costa Rica
Corn-bean-squash	Caterpillar (*Diaphania hyalinata*)	Enhanced parasitisation	Mexico
Corn-beans	Stalk borer (*Diatraea lineolata*)	?	Nicaragua

not threaten the economic threshold. The same was true of the banana weevil. Stopping pesticide sprays allowed natural enemies to move in from the surrounding jungle, colonise the area, become more abundant and thus re-exert a natural control over many of the pest populations (Stephens, 1984).

Brazil

By 1970, total soya bean production had reached 2.278 x 106 tons, especially in the states of Parana and Rio Grande do Sul, covering an area of about 5.5 x 106 has. As soya bean acreage increased, so did the number of insect pests. In 1974, Brazil adopted an IPM programme that relied primarily on monitoring pest damage, establishing economic thresholds and the application of specific insecticides. This IPM programme was so successful that between 1974 and 1982 insecticide applications fell by 80-90%. In the 1980s, the programme was expanded to include the use of Nuclear Polyhedrosis Virus against the velvetbean caterpillar. This virus is host specific and it can be readily mass-produced by farmers themselves. They collect sick larvae that, when macerated and filtered, can be applied in a water solution (Campanhola et al., 1995).

Colombia

During the late 1970s and early 1980s, it would have been considered usual to make some 20 to 30 pesticide applications in a tomato growing area covering about 2,000 hectares. An IPM programme in the Cauca Valley implemented in 1985 succeeded in reducing the number of pesticide applications to two or three. This saved over US$ 650 per hectare. Use of a microbial insecticide derived from *Bacillus thuringiensis* combined with the release of natural enemies such as *Trichogramma* spp., and the encouragement of natural populations of the parasite *Apanteles* spp., were particularly effective in reducing the major pest *Scrobipalpula absoluta*, a leaf miner/fruit borer (Belloti et al., 1990).

Chile

In 1972, populations of two aphid species (*Sitobium avenae* and *Metopolophium dirhodum*) were detected in cereal fields. Despite the presence of resident natural enemies, these aphids reached outbreak proportions. As a result, over 120,000 hectares of wheat were sprayed aerially with insecticides. In 1975, the aphids and the Barley Yellow Dwarf Virus they transmit were responsible for the loss of about 20% of national wheat production. In 1976, the Chilean government's agricultural research centre, in conjunction with the FAO, initiated a pest management programme. As part of the strategy, several aphidophagous insects and parasitoids were introduced against the aphids. Five species of predators were brought in from South Africa, Canada and Israel, and nine species of parasitoids of the families Aphidiidae and Aphelinidae came from Europe, California, Israel and Iran. In 1975, more than 300,000 Coccinellidae were mass-reared and released, and from 1976 to 1981 more than 4x106 parasitoids were distributed throughout the cereal areas of the country. Aphid populations were maintained below the threshold where they could inflict economic damage by the action of biological control agents (Zuñiga, 1986).

Cuba

Since trade relations with the socialist bloc collapsed in 1990, pesticide imports to the island have dropped by more than 60 percent. Because of this, the Cuban government adopted an IPM policy which focused on biological control in its search for techniques that would enable biologically sophisticated management of agro-ecosystems (Rosset and Benjamin, 1994). Key components of their strategy are the Centers for the Production of Entomophagae and Entomopathogens (CREEs), where the centralised, 'artesanal' production of biocontrol agents takes place. By the end of 1992, 218 CREEs had been built throughout Cuba and were providing services to the State, cooperatives, and individual farmers.

CREEs produce a number of entomopathogens (*Bacillus thuringiensis, Beauveria bassiana, Metarhizium anisopliae*, and *Verticillium lecanii*), as well as one or more species of *Trichogramma* wasps. Their production depends on what crops are being grown in the area.

The array of both proven and promising IPM technologies developed by innovative researchers and indigenous farmers offers considerable potential for reducing agrochemical use and improving agricultural sustainability. The challenge now is how to incorporate local knowledge and skills as well as innovative IPM research into the research agenda of national and international organisations. The other challenge is how to mobilise these organisations to help scale up the initiatives described here and make wider eco-regional impact possible. At the political level it is clear that a true reduction and/or elimination of pesticide use in the agro-export sector will require major political reforms that deal with the reasons why farmers turn to chemicals. These include government pesticide subsidies, corporate control of agricultural enterprises, research serving the needs of the private sector, and internationally set, unrealistic, cosmetic standards.

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Table 2. Selected examples of cropping systems in which the presence of weeds enhances the biological control of specific crop pests (after Altieri, 1994).

Cropping systems	Weed species	Pest(s) regulated	Factor(s) involved	Country
Beans	Goosegrass (*Eleusine indica*) and red sprangle-top (*Leptochloa filiformis*)	Leafhoppers (*Empoasca kraemeri*)	Chemical repellence or masking	Colombia
Brussels sprouts	Natural weed complex	Imported cabbage butterfly (*Pieris rapae*) and aphids (*Brevicoryne brassicae*)	Alteration of colonisation background and increase of predators	Chile
Corn	Natural weed complex	*Heliothis zea, Spodoptera frugiperda*	Enhancement of predators	Colombia
Corn	Natural weed complex	*Dalbulus maidis*	Interference with leafhopper movement	Nicaragua
Soybean	Broodleaf weeds and grasses	*Epilachna varivestis*	Enhancement of parasites	Mexico, Colombia
Soybean	*Cassia obtusifolia*	*Nezara viridula, Anticarsia gemmatalis*	Increased abundance of predators	Brazil
Soybean	*Crotalaria usaramoensis*	*Nezara viridula*	Enhancement of Tachinid parasite (*Trichopoda sp.*)	Brazil
Sweet potatoes	Morning glory *Ipomoea asarifolia*	Argus tortoise beetle (*Chelymorpha cassidea*)	Provision of alternate host for the parasite *Emersonella* sp.	Costa Rica
Vineyards	Natural weed complex	Grape mealy bug *Pseudococcus affinis*	Enhance natural enemies	Chile

Integrated Pest Management:

Smallholders fight back with IPM

This issue of the Newsletter is about substituting external inputs for labour, management skills and knowledge. It is about Integrated Pest Management (IPM) and men and women farmers participating in Farmer Field Schools, experiential learning and non-formal education.

from the editors

Although 35 years have passed since Rachel Carson published **Silent Spring** with its devastating account of the effects of the indiscriminate use of agro-chemicals, the one-sided push for increased output continues. Nature is controlled to this end and reliance on pesticide has not diminished. In northern countries, the environmental movement, followed hesitantly by government regulation, has had some impact on stabilising and perhaps curbing agro-chemicals, but in the South the use of pesticides has increased and chemical companies aggressively expand their markets.

Since the 1950s agriculture has been dominated by the vision of modernisation and the potential for using technology to mould nature to this end. This model has dominated the industrial agriculture of the North and the history of Green Revolution agriculture in the South.

Fortunately there have been initiatives within several agencies and governments to implement alternative approaches. FAO's Inter-Country IPM programme, which introduced the participative learning model of Farmer Field Schools, is one such example. First in Asia and later in Africa, many farmers were led to explore the wonderful and complex ecological relations present in their own fields and eco-regions. In this last Newsletter of 1997 we focus on IPM and try to give a picture of the changes that have taken place in recent years.

IPM

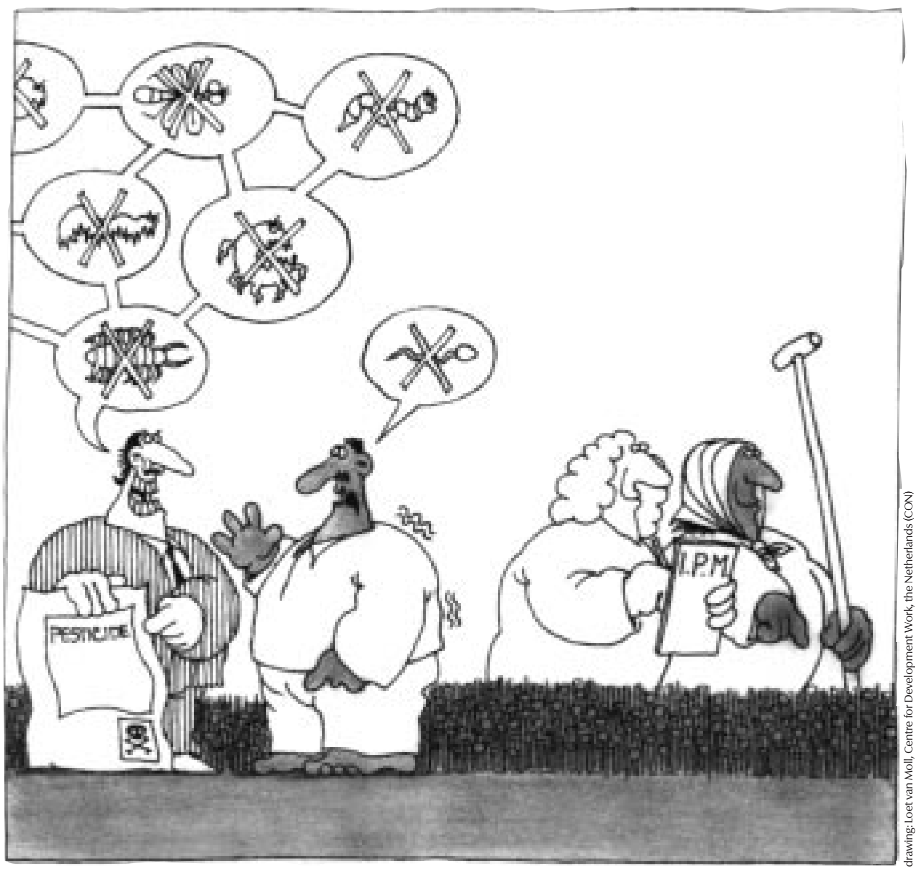
Integrated Pest Management developed in the 1970s as a response to the negative side effects of using pesticides. Pests were becoming resistant to chemical treatments, and the health of farmers, farm workers and consumers was in danger. These hazards were far greater in Third World countries, and today's evidence suggests that the situation has become even more volatile. The latest WHO figures suggest that at least 3 million, and perhaps as many as 25 million, agricultural workers are poisoned each year by pesticides, and some 20,000 deaths can be directly attributed to agro-chemical use. Studies from the Philippines have computed the alarming costs of pesticide to the national economy, showing these negative effects extend far beyond the individual (Pretty 1995).

In its early stages, IPM was a technical approach designed to reduce the number of pesticide applications. It subsequently developed into a methodology in which farmers were encouraged to develop IPM interventions themselves, in the process of coming to a better understanding of their agro-ecosystems. We can distinguish three stages in the development of IPM.

First, **the integration of control methods and target pests**. Technically, IPM consists of a combination of control methods including biological control, host plant resistance, cultural control, and selective chemical control. First generation IPM projects focused on reducing the use of insecticide by introducing the idea of pest population thresholds. Above this threshold, spraying against a particular pest - supervised control - was considered justified. Next, various control methods were combined to combat one or two key insect pests. Second generation technical IPM projects targeted more pests, and by including diseases and weeds, addressed the many crop protection problems experienced by farmers.

Second, **crop protection was integrated with farm and natural resources management**. When it was realised that many agricultural practices influenced pest development, and that crop intensification often leads to increased pest problems, control measures were designed that fitted into overall farm management. Indigenous knowledge and traditional cropping practices were studied, adapted and eventually served as the building blocks in IPM programmes. Natural Resource Management (NRM) became a deliberate objective because of the importance of bio-diversity in biological control and the social value of environmental protection. IPM projects practised Integrated Crop Management to solve the conflicting needs of agricultural production and the environment.

Third, **the integration of the natural and social sciences**. It became clear that fixed prescriptions do not work in tropical agriculture since site-specific agro-ecological and socio-economic conditions determine what is best in any one situation.



drawing: Loet van Moll, Centre for Development Work, the Netherlands (CON)

Farmers must be able to choose from a 'basket' of technologies. Existing extension systems, such as Training and Visit did not provide sufficient flexibility because they were based on the concept of a 'transfer of technology'. IPM projects started to develop around a more dynamic extension model - the Farmer Field School (FFS). This approach combined training with field-based, location-specific research to give farmers the skills, knowledge and confidence to make ecologically sound and cost-effective decisions on crop health. A number of examples of the ways in which FFS has developed in different countries are discussed in this Newsletter (see the articles by Kenmore, Page, Mangan, Nguyen, Nyambo, Fakih and Rengam).

Instead of promoting the transfer of ready-made techniques, FFSs emphasis building on farmers' ability to experiment and draw conclusions, on enhancing the farmer's ability to make good decisions, and on 'empowering them so that they can improve their socio-economic position (Van de Fliert 1993). This new model of IPM extension also generates research questions. The research agenda develops at the point when, in attempting to train farmers, critical gaps in knowledge are identified.

In order to create an environment that encourages farmers to adopt IPM, the problems of research and extension have been addressed and agricultural policies - particularly those that favour pesticide use - have been critically reviewed. The relevance of third generation IPM projects goes beyond crop protection to address Integrated Nutrient Management and Integrated Tillage Management. The involvement and organisation of farmers is essential in maintaining the momentum in this process.

Project design is vital and should be open-ended enough to allow the inclusion of pest problems. Adoyo (see pp 24-25), describes an agro-forestry and woodfuel project in which farmers identified pest control as a priority and began to experiment with botanicals in an attempt to control termites.

Subsistence farming

The existence of indigenous knowledge on pest management cannot be taken for granted. Bentley (1997) reports important misconceptions among Bolivian smallholders about pests and, hence, about ways to combat them. In some situations, this might lead to pesticide abuse. Knowledge and insight are essential if farmers are to invent their own, alternative techniques. Alternative pest and disease control options may exist, but poor communication can prevent this knowledge reaching farmers.

Pesticide is not used much on subsistence crops, and pests and diseases often form only a small part of a farmer's problem. In such situations, an Integrated Crop Management (ICM) approach may be very useful. An interesting example of this is given in the article by Page (pp 13-14). Other acute crop production problems include water availability and soil fertility, issues that call for the intervention of multidisciplinary teams. Such an integrated approach is much more difficult to operationalise and is less easily mobilised for subsistence crops than it is for cash crops.

Participatory approaches

Agricultural development projects that are based on farmers' participation draw on indigenous knowledge. Farmers search for solutions based on their own needs, because farmers understand their own responsibilities and possibilities the best. In Adoyo's article, farmers carry out experiments. As one Kenyan farmer put it at the end of an FFS training session, "We are researchers too and we are proud of our findings".

The participatory approach analyses problems and uses local knowledge. The experimental site is usually the farmer's field or a special experimental site selected by the farmers' group. Farmers are taught to experiment with their local knowledge and this is complemented by new or external information. In the process, farmers and extension workers gain methodological skills which help them develop their own solutions. Such a sequence challenges the conventional research paradigm, and calls for new relationships and respect between the actors.

Trends in product development

Despite the potential of IPM, the use of pesticides continues to grow (Altieri, pp 6-7). The agro-chemical industry is concentrating its efforts on promoting conventional pesticides in Latin America and Asia. In 1996, pesticide use increased by 6 percent in Latin America and countries such as Brazil, China and India have become important producers of conventional pesticides (see Stoll, pp 11-12). In a number of developing countries these can now be obtained very cheaply at the local market, lowering the economic threshold for pesticide use and allowing more frequent application.

In many cases, IPM has been the equivalent of Intelligent Pesticide Management. Crops are scouted to monitor pest densities so action (usually an insecticide application) can be taken when the economic threshold (ET) has been exceeded. As long as the simplified structure of monocultures is maintained, ecological simplification will lead to pest problems. We are convinced that this is not the case in the integrated agro-ecosystem approach.

Working for smallholders

The article by Sam Page (pp 13-14) gives an interesting example of how a small NGO organised itself to meet the needs of smallholders in Zimbabwe. The training given borrowed the 'learning through experimentation approach' from FAO 'Farmer Field Schools'. However, some variations were introduced, in the sense that training was given primarily to farmers directly selected by farmers groups. Those farmers participating in the project abandoned the use of synthetic pesticides and were able to apply for the organic certification that entitled them to a premium for their produce. On returning to their communities, 'Farmer Field Workers'(FFWs) supported by the project, shared their new knowledge and ways of learning with the ten farmers who had originally selected them. The FFWs conduct regular Farmer Field Schools, ensure that individual farmers adhere to the guidelines for organic production and certification, and write monthly reports.

Achievements in IPM amongst small farmers are still modest. Nevertheless, the array of both proven and promising IPM technologies developed by indigenous farmers and researchers described in this Newsletter show the potential that exists for reducing the amounts of agro-chemical used and for improving agricultural sustainability. Farmers cannot simply cut their use of external inputs and still hope to maintain output. External inputs must be substituted by labour, management skills and knowledge. Farmers must, therefore, invest in learning (Pretty 1995). The challenge is how to use local knowledge and skills to motivate national and international organisations to change their research agendas and help fill the gaps in IPM knowledge.

The other challenge is to mobilise organisations such as those described in this Newsletter for a wider eco-regional impact. Care must be taken to avoid the indiscriminate copying of approaches that have been successful in other regions. The Asian FFS, for example, is not necessarily the approach for every African situation. It may well be that the African FFS model will ultimately be very different from the one developed in Asia.

The road to sustainable pest control is not a romantic short cut through the domain of traditional farming. Overcoming the obstacles, detours and deadends will challenge creative farmers and scientists for many years to come (Bentley 1997).

■

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