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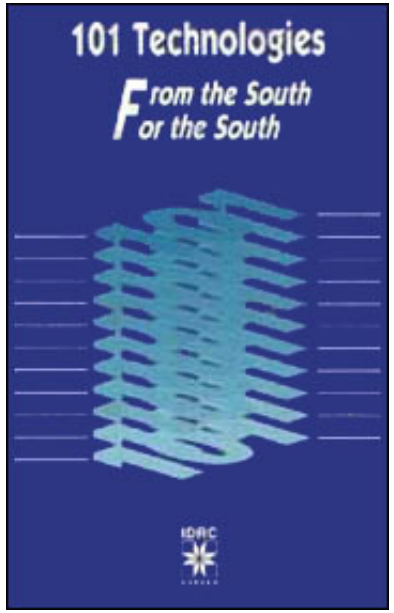

One Hundred and One Technologies - From the South for the South (IDRC, 1992, 231 p.)

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  - 7. Mulbud a computerized calculator for multi-crop farm budgets
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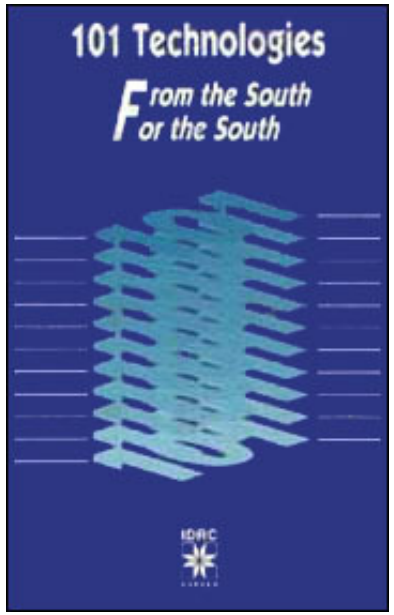

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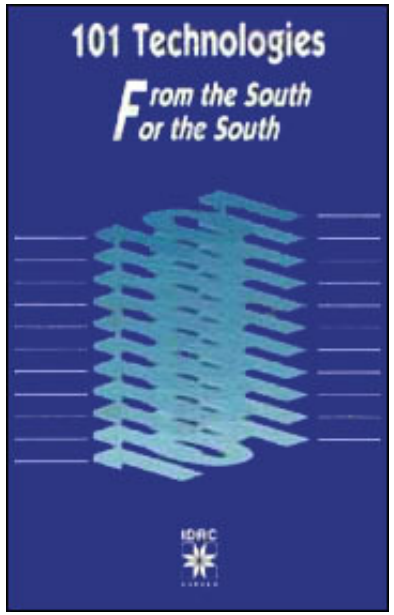

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One Hundred and One Technologies - From the South for the South (IDRC, 1992, 231 p.)

Education

79. Community-run preschool centres in low-income areas

Preschool education and child-care development are rare in poor and marginal areas in Chile; government-funded programs have limited capacity and privately-run programs are out of reach for the "poblaciones" - the people living in poor communities.

The Centro de Estudios y Atencin al Nio y a la Mujer (CEANIM, Centre for studies and care of children and women) has developed and tested a model to enable poor communities to run their own preschool centres. The preschools are seen as one

way to reduce failure and drop-out rates in elementary schools.

The main characteristic of CEANIM's model is the participation of mothers in the development, administration, and organization of the centres, as well as teaching of the children. The mothers receive training in workshops where they learn about socialization, health, hygiene, and nutrition. The centres are a low-cost alternative for these mothers, who need only to give one period of duty per week and bring in cleaning supplies once a month.

Each centre is developed in three stages:

- **During the first year, CEANIM sets up the centre and ensures its basic functioning.**

- **During the second year, mothers and the community as a whole participate in teaching at and running the centre, as preparation for operating the centre themselves, with human and material resources provided by CEANIM.**

- **In the third stage, the centre functions autonomously, with occasional help from CEANIM to solve specific problems.**

The main objective of this initiative is to transfer the project from the hands of the institution (CEANIM) to the hands of the "pobladoras," the women from the poor barrios of Santiago. An evaluation of the program showed that the women's confidence was significantly increased by their participation at these centres, both as administrators and as educators of their children. The quality of the children's education was improved when mothers were involved, and the children's verbal communication and psychomotor skills were also improved. Children from these

centres were better prepared to enter the formal school system.

CEANIM has established some 15 preschool centres in poor areas of Santiago. As well as providing improved social services for the children and mothers, the centres facilitate community participation in deciding on the objectives and the content of their children's education. CEANIM has also developed an evaluation model that can be applied to assess these preschool programs.

Potential users

Government agencies, NGOs, and other organizations involved in preschool education and child-care in poor communities.

Contact

Dr Maria Angelica Kotliarenco
Centro de Estudios y Atencin al Nio y
a la Mujer
Bueras 182
Santiago, Chile
Tel.: 380-043 or 330-514
Fax: 56-2-383-040

Resources and publications

- **La Comunicacin en el Proceso de Aprendizaje - Una Experiencia Preescolar, CEANIM, 1988, 195 pp. (an evaluation of the impact of paraprofessionals and mothers in preschool teaching).**

80. A school-community integrated system for literacy

Under the auspices of the Institute for Teacher Education, Kyambogo (Uganda), a system to promote literacy in the schools and community has been developed and implemented in four primary schools. MINDSACROSS is not a structure or organization, but rather a concept that can be interpreted and put into practice in many different formats and contexts.

MINDSACROSS gets students to compose, write, read, discuss, and publish indigenous literature that can then be shared in small learning networks with classmates, schoolmates, and the community. The purpose is to provide a forum for all participants to be active teachers and learners, cooperating to make literacy a powerful tool for social and intellectual development and change.

Years of political conflict, instability, and economic mismanagement in Uganda have led to the deterioration of social services including education. There is a lack of affordable, available, and culturally relevant material. Literacy is not taught in the schools in the context of the students' daily lives; as a result a majority of graduates with few prospects of further education lose their literacy skills once they leave school. MINDSACROSS seeks to promote literacy as an individual and collective meaningful skill for the acquisition and sharing of knowledge to improve life in the schools and the communities.

MINDSACROSS has two main objectives:

- **To encourage school management, parents, teachers, and pupils to practice and consolidate pupils' developing skills in reading, writing, and drawing;**

- **To build confidence among pupils as innovators and as capable and permanent communicators with themselves, their peers, and other audiences.**

MINDSACROSS consists of four basic activities, designed to broaden the leachers' perception of their roles as literacy teachers, and to get children to practice and consolidate their developing skills. The four basic activities include the following elements:

- **Discussions with teachers to help them to reconceptualize the process of teaching and learning literacy within the core curriculum (English, social studies, math, science, and health);**

- **Professional assistance in implementing creative writing in the classroom;**

- **Development of a forum for pupils to share and discuss their writing with their peers within and outside their classroom, school, and community;**

- **Assistance to compile, duplicate, read, discuss, display, and disseminate the writings and drawings to other children and other audiences. This includes publication of booklets and displaying texts in classrooms and on notice boards.**

Some 70 booklets have been published so far, containing stories, poems, texts, and drawings both entertaining and educational. Examples of titles include: Peoples of Uganda; Mr Bee and His Good Friends; My Small Book About Seeds; AIDS: From 7th to 1st Killer Disease; Water: A Miracle by God; Accidents at School. The texts can be used for children at other levels in school, children in preschool centres, drop-outs doing practical training, and adult literacy learners.

The children's responses suggest that their involvement in the creative writing activities helps them to understand concepts and knowledge relating to themselves and their communities. They are given the power and the opportunity to reflect on what they know and believe, or as one pupil explained: "of telling in my own words on anything I want."

Potential users

The MINDSACROSS concept can be adapted for use in schools and communities anywhere where literacy skills are low or become lost from lack of use. The materials produced by MINDSACROSS have application mainly in Uganda but could be useful in other East African countries.

Contact

Dr Katherine Namuddu
MINDSACROSS
PO Box 6577
Kampala, Uganda
Tel.: 233595 or 257792

Resources and publications

- **MINDSACROSS: A School-Community Integrated System for Living Literacy; Case Study of Uganda Primary School Pupils As Authors, Katherine Namuddu, 1990, 195 pp.**

- **MINDSACROSS: A School-Community Integrated System for Living Literacy; An**

Overview of the Status of the Project, Katherine Namuddu, 1990; a 38-page booklet giving an overview of the project.

- **Some 70 booklets of texts by Ugandan schoolchildren.**

81. Educational games for preschool children

In the Andean countries of Latin America, rural and urban indigenous children suffer various socioeconomic and cultural constraints which result in low educational achievement and high drop-out rates at the primary school level.

The rich cultures of the Andean countries include numerous educational traditions whose potential to increase children's abilities and confidence is now being recognized. Children's games are one of them. Once transmitted from generation to generation, the world of indigenous knowledge is rapidly disappearing under the influence of foreign cultures.

The Centro de Investigacin sobre el Desarrollo Infantil (CIDIE), with IDRC support, has researched and collected traditional Indian games from communities in four Andean countries (Bolivia, Colombia, Ecuador, and Peru), for use as inexpensive, easy-to-use techniques to prepare indigenous children for school. The games have been adapted to develop competence in language, math, abstract thinking, and social learning, and to develop cultural values.

In a second project, CIDIE is developing and testing a complete package of both indigenous and nonindigenous games and materials, with a practical guide to their use for mothers and child-care workers. The package complements the work of an alternative community-based program for preschool education run by the Instituto

Colombiano de Bienestar Familiar in rural communities and in centres for disadvantaged children.

Prerequisites

Manuals and a brief training program.

Potential users

Educational and preschool child-care organizations (governmental or nongovernmental) working with rural and urban indigenous preschool children throughout Latin America.

Cost and availability

Two manuals describing the games are available from CIDIE (see below). As well, a package of 60 games for children 4-6 years old is being assembled for use by mothers and child care workers in rural and marginal communities. The package costs about US $320.

Contact

Dr. Cecilia Bustamante
Carrera 19, No.74-44, Bogot,
Colombia
Tel.: (57-1) 217-6067
Fax: (57-1) 13.92.19 or (57-1) 13.91.81

Resources and publications

- **Una Alternativa de Educacin No Formal, Juegos para Nios Preescolares de Comunidades Indigenas y Campesinas, CIDIE, 1988, 92 pp., US $3.50.**

- **Jugar para Aprender, CIDIE, 1989, 27 pp., US $1.50.**

- **A Spanish-language VHS video describing the application of traditional games in children's centres and a package of games and materials to develop cognitive and language skills.**

82. Spanish-language software for basic education

The Instituto SER de Investigacin (Colombia) has developed and tested a software package to help disadvantaged children at the elementary level to improve their math and Spanish skills, two major stumbling blocks experienced by rural indigenous children. The pilot program resulted in an improvement in creativity, reasoning skills, self-esteem, and achievement among the school children.

The software was developed after an evaluation of the impact of computers in rural Colombian schools undertaken by SER. They concluded that Spanish-language, culturally appropriate software adapted to Colombian needs had to be designed. The software was developed in collaboration with teachers, and is flexible enough for them to adapt it to different grades and individual skill levels. For example, teachers can increase or decrease the level of difficulty of the exercises or even incorporate subjects from their social or cultural environment.

The programs take the form of games which enable students to master the basic

concepts of math and Spanish. For example, one game consists of a series of simple addition, subtraction, division, and multiplication questions. If the player makes three errors, the computer wins the game. The game can be set at different levels of difficulty. Another program provides a short text for reading, then asks a number of questions to assess the child's understanding and encourage word associations and the identification of synonyms.

Two math and two Spanish programs were originally developed, followed by four additional programs.

Students who took part in the pilot program have shown a higher interest in school, remain in school longer, and get higher grades. Their confidence in their learning abilities has increased as they can learn at their own rate.

Currently more than 5000 students in Bogot have access to the programs, through the Ministry of Education. Each program comes with a teacher's manual.

Prerequisites

There are two versions of the program. The first requires an Atari (130 XE or 65 XE) computer. The newer version is used on IBM or DOS compatible computers with graphics cards.

Potential users

Elementary schools with Atari or IBM compatible computers in Spanish-speaking Latin-American countries, particularly those with indigenous or disadvantaged students; ministries of education and others working within the formal education

system.

Contact

Carlos A. Rojas C. Instituto SER de Investigacin Carrera 15A, No 45-65, AA1978 Bogot, Colombia Tel.: (57-1) 288 01 00; Cable: SERIN Fax: (57-1) 245-5248 or (57-1) 226-803

Resources and publications

- **VHS video (15 min.) in Spanish, which shows the program undertaken by the Secretara de Educacin de Bogot to provide computers and software to 40 public schools in Bogot.**

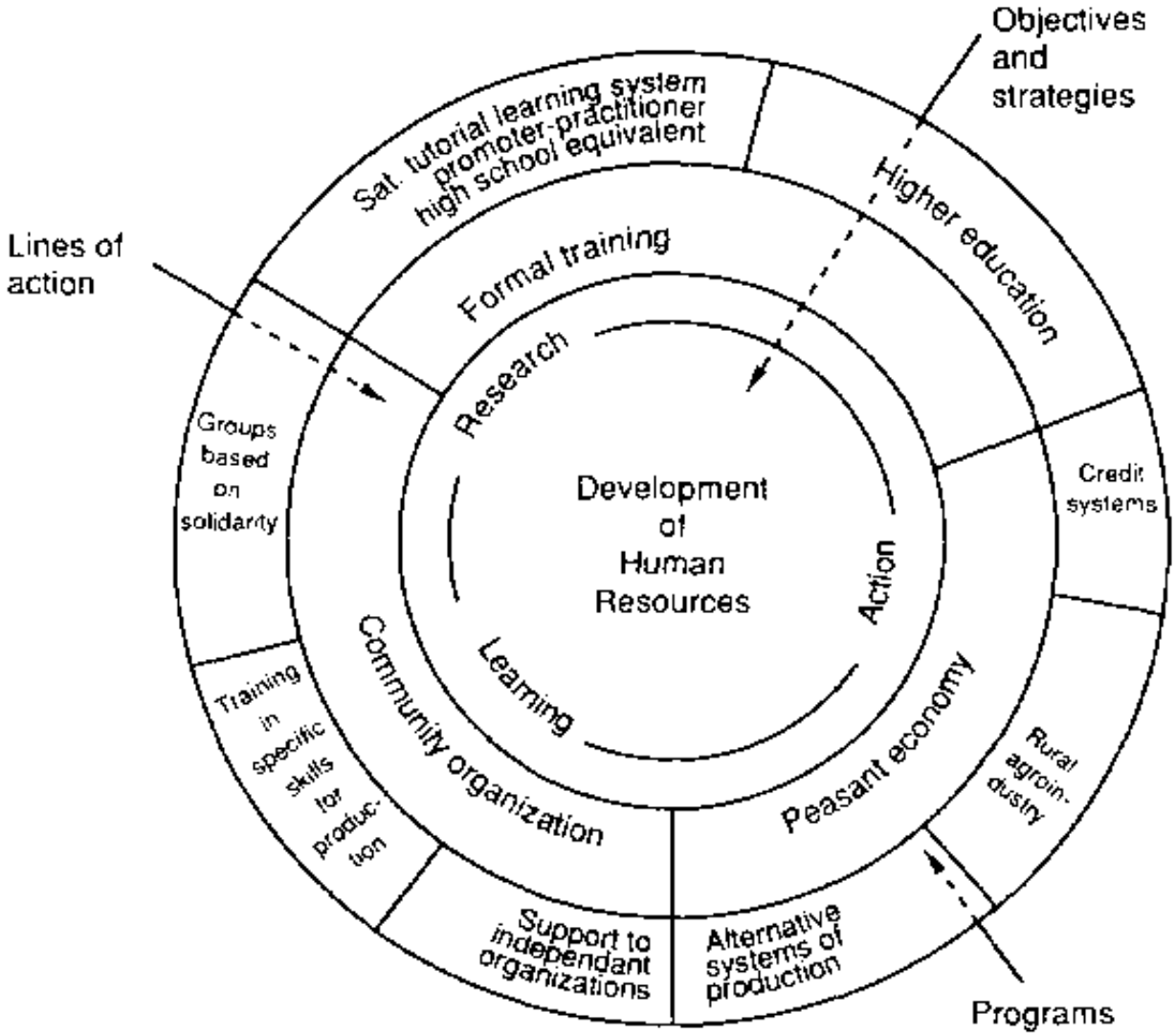
83. Rural community-based system for university-level education

The Fundacin pare la Aplicacin y Enseanza de las Ciencias (FUNDAEC), founder of the Rural University located in Perico Negro near Cali, Colombia, has a philosophy that rural populations should not only benefit from higher education but should actively participate in the creation and generation of knowledge and technologies to improve their quality of life and standard of living. FUNDAEC seeks to dispel the image of the poor farmer whose life must be planned and managed by the more privileged members of society.

The Rural University is a community-based system for the development of human resources. A general strategy of research-action-learning permits scientific knowledge to be directly linked to the application of technology and to channel what has been learned back into the curriculum. The University's strategy includes

strengthening of community structures, application of science and technology to the rural economy, and formal training.

The Rural University's plans and strategies for the development of human resources in the rural areas include the training of rural youth as promoters, technicians, and high-school graduates in rural well-being. This training is realized through the Sistema de Aprendizaje Tutorial (SAT), a tutorial learning system with an innovative educational curriculum recognized by the Colombian Ministry of Education. Students, who live and work in their communities, join the system as they begin to study service to the community, mathematics, language, science, and technology with the tutors that are trained by the Rural University.



Rural University, Colombia, South America

The rural youth who finish high school, be it through the SAT or traditional high-school programs, can continue their university studies in rural education. During their course of study the university students, who are being trained in an innovative program that integrates the educational, productive, and organizational

aspects of rural life, undertake joint research and development ventures with members of their communities. They also participate in the activities of the agroindustrial centre on the university campus which provides training and support to small local agroindustries, such as soy milk, fruit juice, and chocolate production. The centre has developed courses in rural agroindustry for potential entrepreneurs and is intimately involved with the development, support, and dissemination of agroindustry in the region.

Prerequisites

Training and use of educational materials developed by FUNDAEC. Agricultural and animal production techniques are linked to community organizations and initiatives. FUNDAEC provides training by means of seminars and workshops for interested organizations.

Potential users

Ministries of education, institutes for the improvement of agricultural and animal production, NGOs, agricultural or microenterprise policymakers.

Contact

The Director
FUNDAEC
AA 6555
Cali, Colombia
Tel.: (67-23) 536-489
Fax: (57-23) 536-491

Resources and publications

- **Numerous textbooks on math, science, agricultural techniques, etc., produced by FUNDAEC.**

- **Rural University - Learning About Education and Development, Farzam Arbab, IDRC, 1984, 72 pp., $7.95.**

- **To the Heart of the Campesino, VHS video, FUNDAEC.**

- **Footholds, a film showing different innovative educational models in Latin America, including the Rural University. IDRC, 1984, 28 min.**

84. Materials to improve rural primary education and counter school leaving

In Mexico, as in many countries, the educational system has deteriorated with the advent of economic crisis. The problem of academic failure and school leaving is especially acute in the rural areas and among the indigenous population. The rural education system is still not fully relevant to the realities of peasant life. As a result, between 1980 and 1986, only 10% of the children in rural primary schools completed their sixth year.

To address this ongoing problem, researchers from the Centro de Estudios Educativos (CEE) have developed an integrated community-based education program to overcome academic failure among rural children. The methods and materials invite the participation of children, teachers, parents, school authorities, and community leaders. The basic assumption behind the program is that academic failure is rooted in the gap between the educational system and the

ways disadvantaged children communicate, learn, and interact. It is also linked to the generally poor preparation of rural teachers.

Three separate programs have been developed. In the community preschool program, Conociendo a Nuestros Hijos (knowing our children), a model for a preschool curriculum has been developed, based on activities that involve the family and the community. Teaching materials are aimed at preschool teachers, mothers, and community participants, and the goal is one of prevention of school leaving and academic failure. The pilot program proved very popular. A package of materials was prepared for mothers of preschoolers, on health, hygiene, nutrition, parent-child interaction, and on how to create a good home environment for learning. A package for teachers on working with parents' groups to foster good home environments includes manuals on research methods, how to interview mothers on their child's development, how to plan work sessions with mothers, how to systematize models for health, hygiene, nutrition, etc.

Figure

The community primary school program aims to adapt curriculum to make it relevant to rural conditions. An upgrading program for rural teachers has been developed, focusing on strengthening basic reading, writing, and math skills, and encouraging innovation in their teaching methods and curriculum. The program seeks to involve the community in the educational process and link the curriculum to the socioeconomic activities of the community.

The training program lasts two years, at the end of which the teachers become part of the process of developing new primary education methods integrated with rural life. The program has three components: theory, which is presented in 16 independent study manuals; research and learning on the problem of school leaving and academic failure, with research exercises in each manual; encouraging innovation through the integration of theory and practice. This component includes workshops on Spanish language skills and math, where the teachers learn about child development and the learning process; use of research tools to identify problems and make changes; and teacher-led programs for parents, to encourage a better home environment for learning.

Results of the pilot program for teachers showed an increase in leachers' motivation, a greater pride in of their role and their ability to identify and solve problems, a better understanding of rural realities, and a reduction in the turnover rate. Eighty-five percent of the teachers enrolled in the program completed it.

The study guides for teachers are on the following topics: learning theories; academic failure; interests, expectations and images of the teacher; characteristics

of the rural population; rural schools in Mexico; educational planning, authority and discipline in the classroom; personal interactions between education professionals; child development; pedagogical methods; personal history and career development; teaching, the school and the education system; philosophies of education; values and daily life; values and the curriculum; the role of education in society.

A basic education program for primary school drop-outs is aimed at 9 to 14 year-olds, and is based on an alternative curriculum model that is flexible and adapted to the children's situations. The program suffered from a lack of interest in the community and a lack of belief in the value of basic education for drop-outs. A manual was prepared on diagnostic tools and educational strategies for recuperating school drop-outs and reducing absenteeism.

Potential users

Educators, school authorities, community groups in rural areas in Latin America. The materials should be adapted to local conditions.

Contact

Lic. Sylvia Schmelkes
Centro de Estudios Educativos
Av. Revolucin 1291, Mxico 20,
D.F., Mexico
Tel.: 593-5776; 593-5977

85. Teaching building techniques with picture-scripts

The poorest people in India do not have access to either the technical know-how or the financial resources to build effective housing. The Communication Centre of Scientific Knowledge for Self-Reliance has developed a novel approach to teaching low-cost house-building techniques to the urban poor. "Picture scripts" offer a simple way to communicate knowledge directly to those concerned, even if they cannot read; the scripts are easily understood, easy to copy by hand, and adaptable to different skill levels. The scripts represent technical information translated into simple drawings accompanied by short explanations.

The project in India disseminates information on house-building techniques, with special emphasis on the roof, which is the most difficult and crucial part to build. For example, one script shows how to flatten tin cans to turn them into sheet metal. Another shows how to use old bottles to let light into the house. The picture-script booklets, in Hindi and Tamil, address different climatic conditions. They focus on bamboo and aluminum foil, two inexpensive materials that are readily available and provide excellent insulation from heat and humidity, respectively. Local craftspeople can easily prefabricate the bamboo structures.

The manuals will be combined into a Popular Encyclopedia of Survival, which is being used by India's Directorate of Adult Education in its national literacy programs. Besides Hindi, Urdu, and Tamil, they are translated into several local dialects. The manuals are adapted to suit each audience and change form from place to place. They are estimated to have reached some 10 million people.

Potential users Individuals and community-based organizations involved in low-cost housing; literacy programs.

Contact

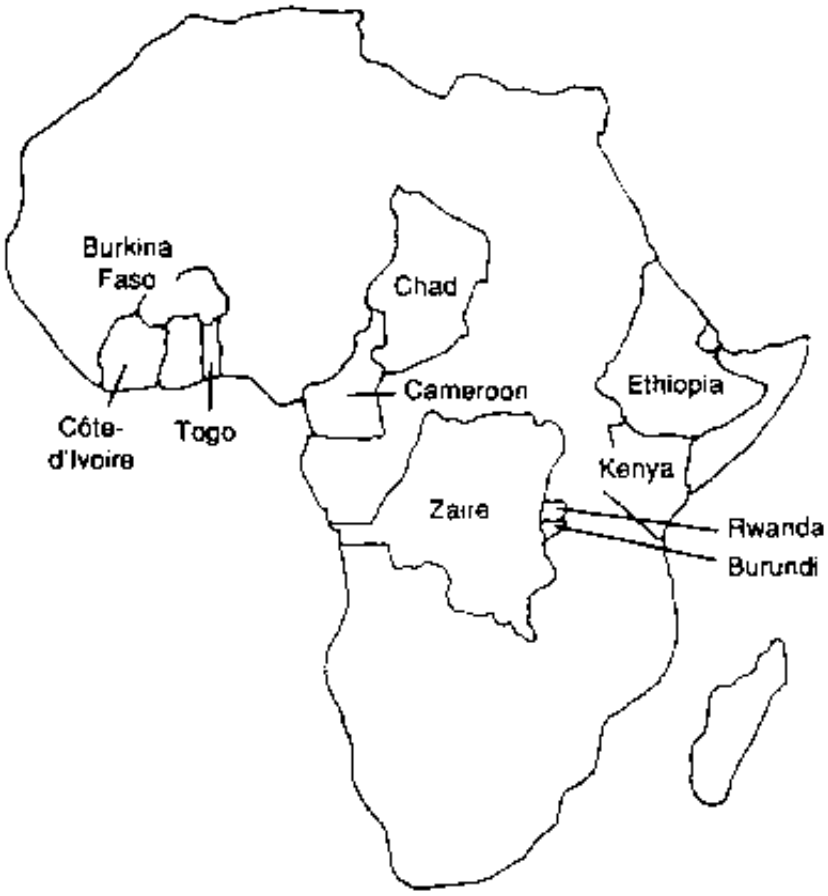
Mr Yona Friedman Communication Centre of Scientific Knowledge for Self-Reliance, 33 Boul. Garibaldi, 75015 Paris, France Tel.: (33-1) 47.83.20.24

86. Rural information and training services

INADES-Formation Cameroon is exploring ways to collect and communicate both traditional knowledge and new technologies to literate and illiterate people in rural areas. The most popular activities in its information and training program are correspondence courses in agriculture, animal husbandry, and health. It also conducts seminars in villages to discuss traditional and new farming techniques and health practices.

INADES-Formation Cameroon publishes a lively, popular English-language magazine, Rural Development Review, written in an informal style that encourages a sense of ownership among its rural readers by speaking directly to them. Rural Development Review is complemented by a variety of question-and-answer booklets in French, English, Fee-fe, and wondo. A popular radio show, Rural Rendez-vous, reaches a large audience in North-West Province.

Disseminating information is made more complex by the close to 200 languages spoken in Cameroon besides the two official languages (English and French). For this reason, INADES-Formation Cameroon uses Pidgin (the lingua franca of the western and coastal areas) as well as English in its radio broadcasts and publishes materials in French, English, and several local languages.



Map of Africa

One of the strengths of INADES-Formation Cameroon is recognition of the essential role women play in agriculture and development. Their publications and seminars acknowledge this by directing specific material to women and seeking information from them. INADES also addresses environmental issues such as the devastating effects of bush fires and the importance of trees.

The close links of INADES-Formation with farmers, the two-way dialogue, the emphasis on disseminating both traditional knowledge and innovative

technologies, have helped to ensure the popularity and success of this process of learning and development in the farming regions of Cameroon.

Potential users

NGOs and community groups working in the area of rural information dissemination could learn from INADES's extensive experience and successful techniques. The materials themselves would need to be adapted to local needs and realities.

Contact

The Director
INADES-Formation Cameroon
BP 11
Yaound, Cameroon
Tel.: (237) 23.16.51

For Rural Development Review and information on the Bamenda program, contact:

INADES-Formation, Bamenda Delegation PO Box 252, Bamenda North-West Province, Cameroon Tel.: 36-11-80

Resources and publications

- **Numerous educational booklets, including a series on farming (how to sell products; how to use credit; animal husbandry; information on different crops; etc.); and a series on development (African history; development and international**

relations; rural development; industrial development; etc.). French only.

- **Textbooks for courses in small project management. French only.**

- **Rural Development Review, a publication of the Bamenda Delegation of INADES-Formation. Contains articles on agriculture, health, and social issues of local concern, as well as practical information and a question-and-answer column for farmers. English only.**

- **IAgripromo, a quarterly inter-African magazine promoting rural life is published by INADES. French only. For information or subscriptions contact: INADESFormation, 08 BP 8 Abidjan 08, Cte d'Ivoire; tel.: 44-31-28; telex: 20 2139 F RCINF (ATTN IF17 INADED FO).**

87. Education materials for the consumer

The Consumer Association of Penang (Malaysia) or CAP, does grassroots work linking consumer issues with environment and development issues. It has produced many educational materials and held workshops, seminars, and rural information programs. For programs in rural areas, CAP produced four-page brochures consisting mostly of sketches and using few words. CAP is helping people to become more responsible consumers and it is also helping to protect them from marketplace malpractice and abuse.

CAP has produced a series of pamphlets with detailed information and analysis for use by teachers, women's groups, university students, youth leaders, and workers. The pamphlets are used in teacher-training courses to help in the teaching of "life skills" - what to buy, spending and saving, health, nutrition, and

safety - and as resources for consumer clubs in schools.

The pamphlets are printed in English, Chinese, Malay, and Tamil. Among the titles and topics included in the series are:

- **Safety at Home, at Work, and on the Road;**
- **Advertising: The Price You Pay;**
- **Protect Your Money;**
- **Sugar Destroys Your Health;**
- **Towards a Non-Smoking Generation;**
- **The Third World Environmental Crisis: A Third World Perspective;**
- **Be Healthy: A CAP Guide for Malaysian Women;**
- **Good Nutrition, Good Health;**
- **Product Safety for Women;**
- **Malaysian Environment: Today and the Future;**
- **Stand Up for Your Rights!**
- **Breast Feeding: The Best Start in Life;**
- **Medicines: Some Do's and Dont's.**

Potential users

NGOs, community groups, government, and schools in Southeast Asia.

Cost and availability

The pamphlets are available from CAP. They range in price from US $1 to $3.

Contact

Martin Khor Kok Peng, Research Director
Consumer Association of Penang
87 Cantonment Road, Penang,
Malaysia
Tel.: (60-4) 37.35.11 or 37.37.13 telex: 40989 CAPPG MA

88. Critical and selective TV viewing

We are becoming ever more aware of the power of television to convey messages to large segments of the population. In many countries, concern is mounting about the content of the programming, the negative impact of TV messages on children, and the lack of mechanisms to educate the TV audience to make more active and critical use of this media. In Chile, the Centro de Indagacin y Expresin Cultural y Artstica (CENECA), has developed a comprehensive program of education for television viewing, to encourage a more democratic and participatory use of TV by parents,.teachers, and children.

CENECA has been working on the theme of education for TV viewing, with IDRC support, since 1982, and has now developed an educational package for schools and community organizations, based on its extensive experience.

The two main objectives of CENECA's educational program are:

- **To provide different social groups with the capacity to create their own interpretations of TV messages. This includes the ability to view TV programs critically, and to define one's own interests and needs and compare them to what**

TV has to offer.

- **To strengthen cultural expression among different social groups so that they can participate in influencing TV programming to better suit their needs.**

The program has the following characteristics:

- **It is flexible, and can be used in different educational settings (schools, families, community groups, etc.).**

- **It is adaptable to different age groups and sociocultural backgrounds.**

- **It is a low-cost program which requires little or no outside financial help.**

- **It is decentralized, and can be incorporated into existing organizations.**

- **Strategies have been developed to incorporate the program into different institutions and groups, such as schools, unions, women's groups, etc.**

The program is composed of the following elements:

Educational materials and activities (simulations, games, etc.). See Resources and publications below for a list of the manuals that have been published. These include manuals for working with children and adults, low-income youth, and low-income women's groups. The manuals have been very much in demand and have been reprinted several times.

- **Training. CENECA has organized workshops, courses, and seminars with**

teachers, parents, community leaders, labour groups, women's groups, and youth. The activities aim to encourage creativity. For example, in the schools, the manuals can be adapted to different ages and grades; they can be added to the regular courses or used in extracurricular activities. Workshops can be organized for parents, out-of-school youth, and other groups.

- **Evaluation and monitoring.**

- **Dissemination of the methodology within local and regional organizations in Latin America. The aim is to decentralize the program, adapt the methodology to different contexts, and set up institutional bases to provide continuity.**

- **Research into the concrete relation of different groups of viewers to TV messages. This provides scientific information and contributes to theoretical knowledge**

about the effects of TV on society. A manual has been produced to help educators (both formal and informal) find out how TV affects the group they wish to work with. The results can help to decide on how to develop an educational program for a particular group or class (see Resources and publications below).

- **A program to enable viewers to demand the kind of programming they want from TV producers. This involves both educating viewers to the possibilities and limitations of TV production, and educating TV producers to the real social needs of their audiences.**

Potential users

Schools, community groups, popular education practitioners, church groups, unions, parents' groups, women's groups, etc., in Latin America. CENECA has organized workshops in Argentina, Colombia, the Dominican Republic, and Uruguay. The materials could also be adapted for use in other regions.

Contact

Valerio Fuenzalida Centro de Indagacin y Expresin Cultural y Artistica Santa Beatriz 160 - Providencia, Santiago, Chile Tel.: 43772; Telex: 346386; Fax: 2233355

Resources and publications

- **Mdulo de Educacin para la TV, Valerio Fuenzalida, Paul Edwards. A manual for teachers and parents on how to teach children and youth to watch TV critically and selectively. Includes nine units, with games and activities that don't require technical infrastructure or special knowledge. CENECA-CENCOSEP, under the auspices of OREALC-Unesco, 1984, 170 pp. In Spanish only.**

- **TV y Recepcin Activa, Valerio Fuenzalida, Paula Edwards. A guide for working with low-income urban youth. CENECA-CENCOSEP, 1985, 136 pp. In Spanish only.**

- **Mujer TV - Guia de Trabajo en Educacin Para la TV con Grupos de Mujeres Pobladoras, Paula Edwarda, Soledad Cortes, Maria Elena Hermosilla. A guide for working with low-income women's groups. CENECA, 1986, 180 pp. In Spanish only.**

- **Explorando la Recepcin Teleuisiva, Maria Elena Hermosilla. A manual containing**

15 simple techniques for discovering the relation between TV and a group of viewers. CENECA-CENCOSEP, 1987, 150 pp. In Spanish only.

- **TV-Padres-Hrijos, Valerio Fuenzalida. A manual aimed at parents and educators, showing how the influence of TV can be managed within the family, in school, and in youth groups through special activities. CENECA-Ediciones Paulinas, 1984, 205 pp.**

- **Educacin para la Comunicacin Teleuisiva, edited by Valerio Fuenzalida. A book on the most significant experiences in education for TV viewing in Latin America, with contributions from seven countries. CENECA, 1986, 230 pp.**

89. A program and materials for street girls

In many Latin American cities, a large portion of poor children live in the streets. They survive through activities such as watching and waxing cars, begging, thieving, drug trafficking, and prostitution. Without family guidance, political consciousness, or education, they are vulnerable to exploitation and are destined to remain marginal and poor.

A number of educational programs and shelters have been set up throughout Latin America, with an emphasis on street boys. However, there are few social and educational programs for girls that take into account their special needs, in spite of the fact that in Bogot (Colombia) alone, there are approximately 15 000 street girls, most of them prostitutes, under 12 years of age.

In Colombia, the Fundacin de Servicio de Orientacin Juvenil (Youth Orientation Service Foundation) has developed and tested an educational model aimed at

enhancing the lives and future educational options of young girls involved in prostitution.

The strategy uses scientific information in such areas as humanistic psychology, health, and the law, to help the girls develop social skills to communicate with others, and enhance their self-respect and personal autonomy.

Called Ambiente de Mutuo Apoyo (Environment for Mutual Support Program) or AMA, the method seeks to provide an atmosphere where the girls can learn to value themselves and others, develop social skills, and increase self-esteem and cooperation through group problem-solving.

The system seeks to build an alternative positive culture for the girls, teaching them the importance of mutual support and responsibility for identifying and solving their problems.

Some of the main strategies used include: providing the girls with an open and trusting environment; creating an atmosphere that promotes change rather than complacency; addressing the girls' problems in the here and now, valuing each person as she is now rather than analyzing or dwelling on the past; using problems as opportunities for learning and change; expecting mature behaviour from all participants (girls, educators, administrators); using values as the basis for establishing rules, with the basic value being that of mutual help and support; using the concept of responsibility as an essential factor for change.

The researchers concluded that the best results were obtained in groups of 9-10 members of the same age. The success of the method depends to a great degree

on the training and motivation of the group leaders, and their ability to develop an alternative environment that is pleasant, participatory, and creative, with a positive moral atmosphere. Their relation to the youth must not be conflictual or complicit, but rather that of a guide helping to rechannel the girls' energy in a positive direction.

Illustrated manuals, written in a popular education style, have been produced for the teachers/facilitators of the program and the "students." They include detailed descriptions of the method as well as numerous exercises and techniques. (See Resources and publications).

As well, a series of short booklets has been published as educational tools that can be distributed directly on the street or used in the program. Focused on women, they deal with topics such as mental health, women's rights and dignity, women in the workplace, and health issues.

Researchers have found that the program has been successful in increasing the girls' serf-esteem, and reducing anxiety and negative attitudes toward themselves and their environment. The strategy was effective in helping the girls to internalize the concept of personal and social responsibility, leading to more constructive behaviour. It promoted reflection on the moral aspects of daily life without using moral "recipes" or abstract concepts. Although the program does not produce overnight transformations, it has been shown to be an educational technique of great usefulness for working with troubled teens.

The basic strategy has been adapted for use by organizations in Argentina, Chile, and Venezuela.

Potential users

Educators, social workers, psychologists, and others working with young girls aged 12-18 years, involved in prostitution, abandoned, or living on the street.

Contact

Carlos Canon Fundacin de Servicio de Orientacin Juvenil Carrera 30 No. 78-12 AA 080470 Bogot, Colombia

Resources and publications

- **Ambiente de Mutuo Apoyo: a general description of the method and its philosophical base.**
- **Acogida: how to create a welcoming environment and get a group started.**
- **Personalizacin: promoting personal development and self-esteem.**
- **Socializacin: training in social skills; the process of socialization; difficulties in adolescence; support techniques; value formation through social relationships.**
- **Interiorizacin de Valores: activities for group discussion; group problem-solving; promoting values of mutual support, responsibility, etc..**
- **Juridico: human rights and responsibilities in judicial terms and in relation to the realities of street children; developing the children's awareness and decision-making capacities concerning rights and obligations in the areas of life and**

personal integrity, personal identity, family, sexual activities, and work.

- **Educacin Sexual: human sexuality, reproductive responsibility, health and human ecology.**

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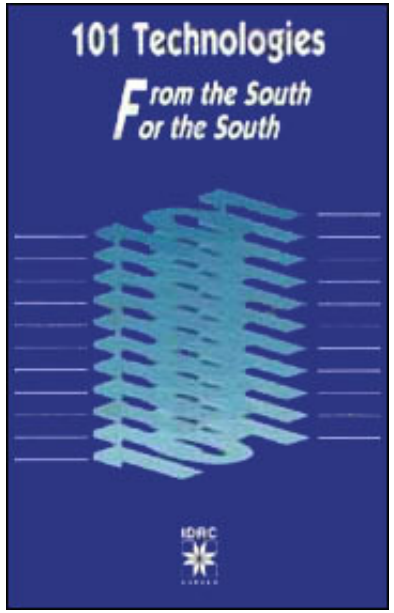


One Hundred and One Technologies - From the South for the South (IDRC, 1992, 231 p.)

Communication and information

- **90. Trilingual training package for video production**
- **91. Using video to introduce new technologies**
- **92. Children as agents of change**
- **93. Policies to limit effects of volcanic disasters in Latin America**
- **94. Procedure to obtain infant mortality rates in marginalized areas**
- **95. An information system for child protection agencies**
- **96. Minisis multilingual software for information management and research**
- **97. Information on human rights**
- **98. Redatam software package to access and use**

- small-area census and other data
- 99. Information system for juvenile courts
- 100. CGNET a network for agricultural research
- 101. Computer model for analyzing third world economies

One Hundred and One Technologies - From the South for the South (IDRC, 1992, 231 p.)

Communication and information

90. Trilingual training package for video production

Video has become a new and important tool used by many Third World groups for popular education, information, and training. With portable video, groups now have an inexpensive and manageable medium with which to create their own material according to their own cultural tradition and needs. Lack of or poor training of users of the medium, however, often makes video ineffective.

Montreal-based Vido Tiers-Monde collaborated with the Instituto pare Amrica Latina on a trilingual training package (English, French, and Spanish) for using portable video. This self-training package includes a 45-minute video on all aspects of production and distribution, supported by three illustrated booklets containing technical information.

The kit can be used in the classroom during training seminars or be a "teacher" to people who are learning to use video on their own.

The training package was developed in Canada and Honduras and has been tested in Chile, Peru, and Zimbabwe. More than 600 copies have been distributed in Algeria, Argentina, Benin, Bolivia, Burkina Faso, Mali, Niger, Senegal, South Africa, Uruguay, and Zaire.

Prerequisites Adequate power supply and access to a video unit and a television screen.

Potential users NGOs and community groups that want to use video as an organizing/development tool.

Cost and availability

The kit is available in English, French, and Spanish. Italian and Swedish versions are in the works. Approximate prices (Can) are as follows: English: $250; French: $120; Spanish: $75. Orders from developing countries for English and French versions are also about $75.

Contact

All languages in NTSC standard:

Alain Ambrosi, Vido Tiers-Monde
3575 Saint-Laurent, Suite 608
Montral, PQ
Canada H2X 2T7
Tel.: (514) 982-0770; Fax: (514) 982-2408

French or Italian kit in PAL standard:

Jean-Paul Guillet
Organisation catholique internationale du cinma et de l'audiovisuel
Pal 220 San Calisto, 00120, Citt del
Vaticano
Rome, Italy
Tel.: (39-6) 698-7255; Telex: (504) 2014 C.I. VA OCIC;
Fax: (39-6) 698-7335

In Spanish for all Latin American countries (NTSC or PAL):

Instituto pare Amrica Latina
AP 270031, Lima 27, Peru
Tel.: (51-14) 61.79.49; Telex: 25202
PE HCSAR;
Cable: IPALC; Fax: (51-14) 46.63.32

91. Using video to introduce new technologies

Community participation and organization are essential to the effective introduction of new technologies. Based on the experience of introducing UNIMADE handpumps in several communities in Costa Rica, the Fundacin Tecnolgica de Costa Rica (FUNDATEC), in collaboration with the villagers who participated in the handpump project, developed a set of dynamic participatory strategies for introducing new technologies (particularly water supply and sanitation technologies) in rural areas. Out of this process they produced a series

of video training modules in Spanish entitled Con Calor de Amigos.

These training modules do not constitute a "how-to" package, but are designed to promote reflection and discussion, to encourage development workers to look critically at their own attitudes and methods, and to help in the development of effective strategies. They stress the importance of building awareness, self-esteem, and confidence as a prerequisite to technical and material development. For FUNDATEC, "appropriate technologies" imply that both technical and social aspects are considered in any technology dissemination project.

Each module comprises a short video in NTSC format, accompanied by printed material - an easy-to-read pamphlet providing a synopsis of each module and a manual for animators to lead discussion. Using TV-style situation dramas, the videos dramatize key human elements in the relations between field workers and communities that can contribute to or prevent the success of community-based interventions. The videos are designed to be presented in a discussion format.

The following eight modules make up the package. Two narrative voices provide the perspectives of the NGO and of the community.

- **Los Expertos: this video looks at the NGO world, the handpump project, and the theme of community participation on a theoretical level. It covers the setting up of a multidisciplinary team, and the problems that arise when people from different career backgrounds work together.**

- **El Arranque: this video looks at the community, its living conditions and health conditions, and the decision by the NGO and the community to undertake a**

common project. It covers the new experiences coming out of the first visit of the project team and the community.

- **Encuentros: this video shows initial contacts and reactions, convocations and meetings, as well as the human and professional reactions of team members from various fields.**

Los Bigotes de la Pulga: this video covers health education, the discovery of the microbial world (using a microscope), and the need for handpumps. Because it is difficult to understand the existence of something you can't see, it is also difficult to correlate some diseases with water. The microscope becomes a tool to open people's minds to a new concept.

Enredados: the community doesn't accept the rules of the game. The local committee matures with experience and takes the project into its own hands. They present their own decision to the community rather than the project team's choice.

- **El Turno: there is a shift in attitudes, an increased emphasis on larger realities. Both the community and the project team have many other concerns in their lives other than the project.**

Mi Bomba: this module shows the appropriation of the technology and training in handpump installation and maintenance. When someone is able to understand how the technology works, can change that technology, and teach others about it, one can speak of true appropriation

- **La Instructora: the final video looks at the training of instructors from the**

community, from both NGO and community perspectives. It demonstrates, through the real process lived by a local woman, that local people are better able to reproduce the project experiences in their own daily language, using their own examples. The "instructora" learns that she is able to go beyond her traditional housewife role.

Local actors took part in the videos as well as professionals. The production provided training to local people in the use of video and became a catalyst for further drama activities in the community.

The project reached the following conclusions regarding the strategies used for introducing the handpumps:

- **It is essential to look at community participation, health and hygiene, and cultural values when introducing any new technology;**

It must be possible to repair and maintain the technology locally to create a real sense of local "ownership";

Community participation must be real and direct in the planning, implementation, and evaluation of the project;

The technology becomes a key element that must be clearly linked to related topics, such as preventive health care, environmental sanitation, reforestation, community organizing and administration;

Training of local instructors returns the capacity for knowledge-sharing to the community, and increases self-esteem and humanitarian values;

- **Community participation is a dynamic process that can't be summarized in a rigid "format."**

Potential users

Community field workers, for use in their organizational and promotion activities; NGO staff and government fieldworkers, to sensitize them to the process of community involvement in the introduction of new technologies, especially water supply technologies.

Contact

Elias Rosales Escalante
Fundacin Tecnolgica de Costa Rica
Apartado 159 - 7050, Cartago, Costa Rica
Tel.: 51-53-33 ext. 2335
Fax: (506) 51-5971; (506) 51-5348; or
(506) 51-1552

Resources and publications

- **As well as the videos and related materials, four manuals in Spanish were developed by the project, on the following topics: health and hygiene; rehabilitating hand-dug wells with ferrocement; handpump installation, repair, and maintenance; work manual for community instructors on how to organize and lead workshops on health issues, community organizing, and administration.**

- **The final report submitted to IDRC on the production of the videos provides**

detailed information on the community participation process.

92. Children as agents of change

During the 1980s, there was a growing recognition among educators and health workers that children can be effective change agents in the areas of health and hygiene. Children often communicate and share more than adults, and in some cases are more literate than their parents. Many children also have responsibility for younger siblings while their parents work.

The "child-to-child" approach was developed and named during the Year of the Child (1979) by a group of health and education professionals. The goal was to improve health and reduce infant mortality by engendering positive health practices among children. Based on activity-oriented learning methods, the approach is now used in programs in over 70 different countries. These range from structured programs in schools to the participation of children in community health programs in urban slums.

There are two main goals in the child-to-child approach:

- **Making children competent through activity-based learning that can be applied in their everyday lives;**

- **Using children as change agents in the environment (through sanitation or tree-planting programs), with other children (by using positive health practices in sibling care), with their families (by sharing their knowledge with parents), and in their communities (through plays, participation in immunization campaigns, etc.).**

Programs in different countries emphasize different aspects. For example some programs emphasize community activities, while others will focus on teaching children effective sibling care. People in each community know best how to adapt the concept to local conditions.

The following are examples of programs using the child-tochild approach in India, where the concept is being widely applied.

- **In Malvani, a health clinic uses local children as outreach workers in community health programs. These "mini-doctors" take younger children to the clinic for examinations and check them for scabies. They apply simple treatments under the supervision of a health worker and explain to their charges the importance of cleanliness. Responsible for some six families each, they encourage mothers to bring in their babies for vaccinations. Other community activities include plays and skits (for example on malaria), storytelling, action songs, puppetry, and the sale of nutritious snacks to replace fried or sweet street snacks. In an IDRC-sponsored evaluation undertaken by the Aga Khan Foundation, it was found that child-volunteers were instrumental in identifying 477 cases of scabies, 233 cases of vitamin deficiency, 979 cases of anemia and 150 cases of tuberculosis. They performed 289 demonstrations of oral rehydration therapy.**

The Mobile Creche program runs some 20 daycare centres on construction sites. They have incorporated activity-based teaching of health and nutrition into their programs. An evaluation of this program showed that parents were accepting their children's messages about oral rehydration therapy, and the negative impact of alcohol and chewing tobacco.

A number of schools in Bombay and New Delhi have begun teaching health topics in science class using child-to-child approaches. In New Delhi, the project began in 32 schools in 1987, and expanded to 108 schools in 1990.

In rural India, various programs including nonformal education given to children before school and in daycare centres, provide training to the older children who bring their younger siblings to the centres. In Rajistan and Gujarat, the Centre for Health and Nutrition Awareness provides training and technical support to local NGOs in teaching children basic health skills and encouraging their dissemination through skits, neighbourhood cleanups, and the recruitment of infants for vaccination.

The programs offer particular opportunities for girls to develop self-confidence and be more visible in the community. They also can be helpful in disseminating important information to out-of-school youth.

In Honduras, IDRC has also been involved in a similar program. In the urban slums of Tegucigalpa, a program using child-to-child techniques is being used to improve health and sanitation. The children observe the relation between sanitation and health through visits to clinics, and "clean" and "unclean" sites. They are taught the importance and methods for handwashing, boiling water, maintaining latrines, etc. They prepare skits and plays for families and school, and draw posters to take home and post in their communities.

Prerequisites

Organizations wishing to incorporate the child-to-child approach in their programs

will require training in activity-based learning methods.

Potential users

Schools, daycare centres, health clinics and community organizations that have access to children and want to have an impact on the health of the community.

Contact

Rajni Khanna, Program Officer Health and Education
Aga Khan Foundation
Sarojini House, 2nd Floor, 6 Bhagwan Dass Road
New Delhi 110001, India
Judith Evans Aga Khan Foundation
Rue Versonnex 7, 1211 Geneva 6
Switzerland
Tel.: (022) 360344
Telex: 27545 AKF CH
Cable: AKFGVA Geneva

In Honduras:

Douglas A. Matamoras c/o Project HOPE/Honduras AP 1587, Tegucigalpa, Honduras Tel.: 22-4806 Telex: 1501 HOPE HO

The Institute of Child Health of London University (UK) collects and shares information on the child-to-child approach around the world. They can be reached at:

Child-to-Child London University Institute of Child Health Institute of Education 20 Bedford Way London, WC1H OAL, United Kingdom

Resources and publications

- **Activity sheets and readers in English, Arabic, French, and Spanish (some titles) are available from: Teaching-Aids at Low Cost, PO Box 49, St Albans, Herts AL1 4AX, United Kingdom. Tel.: (0)727 53869. English materials produced in India are available from the Aga Khan Foundation, India (see address above); French materials available from l'Enfant pour l'enfant, Institut Sant et Dveloppement, 15 rue de l'cole de Mdecine, 75270 Paris - cedex 06, France; Nepali readers available from Centre for Health Learning Materials, TU Institute of Medicine, PO Box 2633, Kathmandu, Nepal; Urdu readers available from Hamdard Foundation, Pakistan, Hamdard Centre, Nazimabad, Karachi 18, Pakistan.**

- **One free set of activity sheets (English; Arabic and Spanish available in 1992) can be requested by overseas groups. Contact the Child-to-Child Trust at the Institute of Child Health, above.**

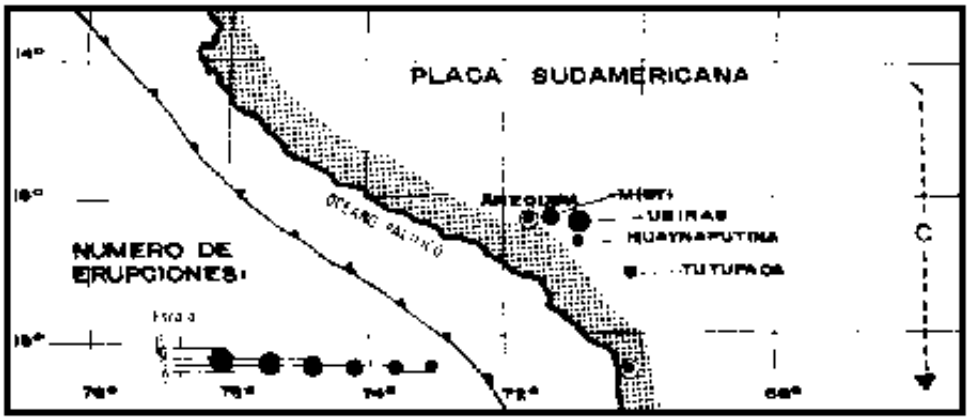
- **Child-to-Child, Another Path to Learning, Hugh Hawes (UIE Monographs 13), 1988, ISBN 92820 1049X. Available through sales agents for Unesco publications and bookshops.**

- **Aga Khan Foundation (India) has produced a video about the child-to-child projects they have sponsored (1988), see address above.**

93. Policies to limit effects of volcanic disasters in Latin America

The 1985 volcanic eruption of Nevado del Ruiz in Colombia left 22 000 people dead and 6000 families homeless. The high losses were not inevitable. They were due to several factors including a lack of systematic volcano monitoring, the absence of public policies for disaster prevention and preparedness, and insufficient coordination among the various bodies responsible for hazard assessment and emergency planning.

Researchers who studied the El Ruiz eruption concluded that while there was sufficient scientific information to point to the likelihood of an eruption, a number of social and institutional factors prevented both effective communication of this information to the communities at risk, and the elaboration of specific emergency plans to deal with a possible disaster.



Vulcanoes en el Peru con actividad eruptiva historica

Researchers in Peru and Colombia have now developed specific policies for volcanic zones in Chile, Colombia, Ecuador, Nicaragua, and Peru based on existing scientific, technical and organizational capacities in each country.

The researchers began by studying the 1985 El Ruiz eruption and the response of local and national governments and international agencies, as well as the inhabitants of the region. They assessed the scientific, technical, and management capabilities needed to limit the effects of volcanic eruptions, as well as the capabilities already existing in each country, and made policy recommendations. They also produced a video aimed at educating communities at risk, organized an international workshop in Bogot, and identified ways to share expertise and resources throughout the region.

Policy recommendations are in the areas of prevention of casualties (through education and use of the media) and reaction to eruptions (using civil defense measures). The researchers have identified specific volcanoes that pose the greatest risk and have evaluated existing volcanic maps.

Specific recommendations deal with, among other things, the need to decentralize administrative responsibility for emergency planning and response; the need to establish better linkages between the scientific community and the mass media; and the importance of ongoing geological and historical analysis of high-risk areas, including, where warranted, the elaboration of detailed volcanic maps.

The recommendations stress the need for equipment as well as political will to implement permanent monitoring of high-risk volcanoes, and encourage international organizations to support this capacity in developing countries.

Potential users

Governments and organizations involved in emergency planning in volcanic zones.

Contact

Dr Alberto Giesecke, Director

CERESIS (Centro Regional de Sismologia pare America del Sur)

Postal address: apartado 14-0363, Lima, Peru

Street address: Av. Arenales 431, Of. 702, Lima, Peru Tel.: 247421; Fax: 51-14 336750

Telex: 20053 PE PB LIMTC Atencin
CERESIS
Cable: CERESIS

Resources and publications

- **Riesgo Volcnico Evaluacin y Mitigacin en America Latina, Aspectos Sociales, Institucionales y Cientfcos, CERESIS, 1989.**

- **El Neuado del Ruiz y el Riesgo Volcnico en America Latina, CERESIS, 1990 (Executive summary).**

- **A la Sombra del Volcn (In the Shadow of the Volcano), Spanish video, 36 minutes.**

94. Procedure to obtain infant mortality rates in marginalized areas

The infant mortality rate provides useful information on levels of development,

child rearing behaviour, sanitation and health, and communities at risk. However, it is often difficult to measure accurately and inexpensively.

Areas where the infant mortality rate is high are often the most difficult to assess, due to the lack of hospitals, records, and health infrastructure, as well as the isolation of communities and low literacy levels. Retrospective surveys are expensive and time-consuming, and mothers often don't remember specifics about pregnancies and deaths. The average time between the collection of the information and its analysis is 2 years.

Three organizations in Argentina, Chile, and the Dominican Republic have tested a new procedure to obtain infant mortality rates in poor areas. The method is simple, fast, and inexpensive.

When a woman delivers a baby at a hospital, a clinic, or at home with the help of a midwife, she is asked three simple questions on the results of her previous pregnancy:

- **Have you had a previous baby born alive?**
- **If yes, is that child now alive or dead?**
- **If the child is dead, did he/she die younger or older than one year of age?**

With this method, health officials can accumulate accurate indirect estimates of the infant mortality rate. The method goes directly to the mother for information and reduces memory errors. It can be incorporated into a permanent system of data collection using hospitals, clinics, and midwives; or it can be used in routine census surveys.

Accurate estimates using this method were obtained in Argentina, Bolivia, the Dominican Republic, and Honduras. The results were comparable to those obtained through traditional survey methods. Further research is being undertaken in Brazil to refine and test the method in different contexts, and look at ways to disseminate it for general use.

Potential users Health and development planners, government ministries, NGOs, local governments, and communities.

Contact

In Argentina:

Eduardo Ramis, German Pollitzer, Jorge Somoza Fundacin Cruzada Patagnica Gines Ponte s/n Neuquen, Argentina Tel.: (0944) 91286/91295

Centro de Estudios de Poblacin Avda. Corrientes 2817 Piso 7 Buenos Aires, Argentina Tel.: (0541) 9610309/9618195

In Chile:

Jos Miguel Gzmn Centro Latinoamericano de Demografia, Casilla 91 Santiago, Chile Tel.: (0562) 485051 up to 485061

In the Dominican Republic:

Bienvenida Rodriguez Consejo Nacional de Poblacin y Familia Avda. San Cristobal esq. Avda. Tiradentes Santo Domingo, Dominican Republic Tel.: (01809) 5665866

95. An information system for child protection agencies

The problem of abandoned street children in the cities of Latin America is becoming more acute. Child protection agencies and other organizations working with children are overburdened. In 1987, the National Children's Institute of Uruguay (INAME) had some 10 000 children (abandoned, orphaned, and young offenders) in its care, and the number keeps growing. Lacking resources and accurate records, the organization can sometimes take days to track down a child in care. As well, there are no inventories of foster homes and available adoptive parents and their characteristics.

With the help of the Inter-American Children's Institute, INAME is now using a computerized information system to keep track of the children and the services available to them. As well, statistics and records generated by the system help to identify trends and problems and to improve services.

The system, called SIPI, is based on Clipper and dBase III+ software. Manuals describe step-by-step procedures for data collection, validation, and correction. The package includes a pilot database with access through telephone lines. Currently some 150 institutions (daycare centres, rehabilitation centres) call INAME at a prearranged time to transmit information on the children's whereabouts. The database includes some 300 variables (name, birth date, height, date of registration, reason for being care, etc.).

The system was developed in consultation with child protection agencies in Argentina, Bolivia, Brazil, Costa Rica, Ecuador, Jamaica and Peru. The information structure developed through this process is therefore more universal and

independent of the administrative structure of different organizations. Negotiations are currently underway to transfer the system to Brazil and Ecuador.

Prerequisites IBM or compatible microcomputer. The system works in a network environment.

Potential users Child protection agencies and other organizations working with large numbers of children.

Contact

Julio Max Rosenblatt, IIN-OAS
Casilla de Correo 16212
Montevideo (11600), Uruguay
Tel.: (5982) 47 - 2150
Fax: (5982) 47 - 3242; Telex: 23119
IIN UY

96. Minisis multilingual software for information management and research

Organizations involved in information management in the South need appropriate tools. This includes having access to software that can produce and manage information in their own language and character set.

MINISIS is a versatile, multilingual, easy-to-learn information management system developed by IDRC for use on the Hewlett Packard 3000 family of minicomputers.

The system is flexible enough to handle many different applications. For example, IDRC uses MINISIS to manage the operations of the library, the Centre's mailing list of some 30 000 names, and a research project data bank, called IDRIS, which contains information on research activities by IDRC and other donor agencies. The system can be used to search for information on thousands of topics, and computer specialists can use it to develop their own specialized information tools.

Other examples of applications supported by MINISIS include: registries of correspondence; directories of consultants and experts; land data banks; press clipping services; record and music libraries; legislative assembly documentation systems; germplasm registries; meteorological information databases; student record systems; chemical toxicology databases.

One of MINISIS's most useful attributes for international organizations is its capacity to operate in and process data stored in a variety of Roman-based languages as well as Arabic, Chinese, Greek, and Thai, through the use of "dialog files" that are independent of the software. IDRC distributes the software in English, French, and Spanish. The Arabic version is distributed in cooperation with the Arab League, which has translated the dialog files into Arabic. A Chinese version has also been produced.

First developed in 1978, the system is now being used by 350 organizations around the world, some two thirds in the South.

The MINISIS Users' Group is a forum for users to share ideas as well as specialized software they may have developed. This international group meets once a year, and several regional groups hold regular meetings. As well, IDRC

manages a library of software tools developed by users, and distributes the software to all MINISIS users. Regional MINISIS Resource Centres provide training and assistance to users in their region (see addresses below).

Organizations can acquire MINISIS by signing a licence agreement. The software is provided with documentation in English, French, Spanish, Chinese, or Arabic, and training in the use of the system is also provided. Each user then receives any new enhanced versions of MINISIS and any repairs that have been made to correct reported problems. Users also receive a newsletter with articles relating to MINISIS activities.

MINISIS version G.01 is the one currently in use. IDRC is developing an improved version (Version H) which will enable MINISIS to be used on low-cost DOS-based microcomputers used by most nongovernmental organizations. It is expected to be available in the spring of 1993.

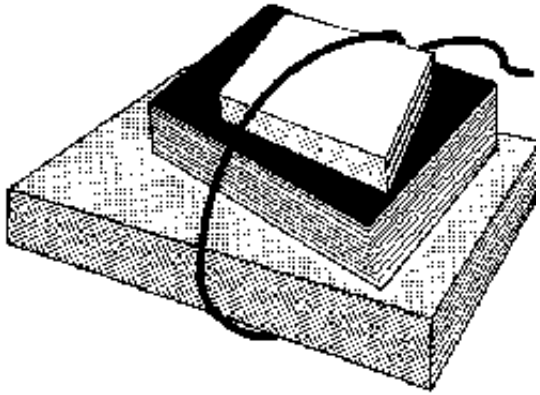
Prerequisites

For Version G.01: Hewlett Packard series 3000 minicomputer, with 256 K of memory, and the following software: Version IV or later of MPE, HP FOS including EDITOR, FCOPY, SORT/MERGE, and KSAM.

Version H, to be available in 1993, will require an IBM or compatible PC/XT/AT microcomputer with 640K RAM and a MS or PC DOS 3.3 or higher operating system.

Potential users

Documentation centres, information centres and departments, universities, research agencies, and any organization involved in information management.



Managing libraries is one of MINISIS' many possible applications.

Cost and availability

The software is available at no cost to organizations in the Third World. Elsewhere, it is licensed through commercial distributors.

Contact

MINISIS Outreach
Information Sciences Division
International Development Research Centre
PO Box 8500, Ottawa, Ontario
Canada K1G 3H9
Tel.: (613) 236-6163; Fax: (613) 238-7230
Telex: 053-3753; Cable: RECENTRE
Regional Resource Centres

Arab speaking countries:

- **M. Mohamed Gasmi, Directeur du dpartement, Technologie de [`information, Arab League Documentation and Information Centre, Tahrir Square, Cairo, Egypt**

Latin America:

- **Ing. Enrique Barreto, Coordinator, Centro de Recursos MINISIS-Amrica Latina, Centro de Informacin Cientfica y Humanstica, Cindad Universitaria, AP 70-392, 04510 Mxico D.F., Mexico**

China:

- **Mr Jiang Xiang-Dong, Computer Centre, Scientech Information Centre, Ministry of Machinery and Electronics Industries, 1 Nanli Baiwanzhuang, Beijing 100037, People's Republic of China**

Francophone West Africa:

- **M. Dieudonn Kameni, Organisation africaine de la proprit intellectuelle, BP 887, Yaound, Cameroon**

97. Information on human rights

Human rights violations affect large numbers of people around the world. Many organizations collect vast amounts of data on these events, to assist imprisoned, ill-treated, and displaced people, or to locate those who have disappeared. Accurate information about rights, laws, processes, and evidence of violations

allows individuals, groups, and organizations to take action. However, when each organization uses a different format, it becomes difficult to make comparisons and cross-check information, a problem which, for example, hindered the processing of cases involving disappearances in post-military Argentina.

The Human Rights Information and Documentation System International, or HURIDOCS, has developed a system of standard formats for recording human rights events and cases that will allow faster and more efficient exchange of information among organizations. This follows on the development, in 1985, of standard formats for the recording and exchange of bibliographic information on human rights, now used by some 50 documentation centres.

The standard formats are designed to:

- **Be a practical aid to documentation for action;**
- **Provide a coherent and compatible system within an organization;**
- **Provide for rapid, effective, and precise retrieval;**
- **Interface with both manual and computerized systems;**
- **Enhance networking;**
- **Be flexible enough to meet the needs of different organizations;**
- **Provide "action material" to the more formal information channels;**
- **Provide a basis for higher-quality statistical research.**

The system can be used manually or by computer. A manual in English has been published, and there are plans to translate it into French and Spanish.

Although the formats can be used for any violations, their emphasis is on torture,

arrests and detentions, deaths and killings, displacements and destruction of property, disappearances, deportations, external exile, and banishments. The following formats are included in the package: information on the event, on the victim, on the source, on the alleged perpetrator, on interventions, and on additional details.

The formats can be used separately or in combination. They are a tool to be integrated into systems by each organization, according to its needs. They are fast and easy to complete, but not simplistic, and aim to facilitate analysis.

Each organization is free to develop its own software for using the formats. For organizations using computers but unable to develop their own software, a HURIDOCS software program called EVSYS will be available in English, French, and Spanish as soon as translations are complete. An earlier version is available in English and Spanish.

EVSYS, like the formats themselves, is a tool that will allow organizations to develop their own systems according to their own needs. The software can be used on microcomputers using the DOS operating system, and will eventually be able to run under other operating systems.

The next step is the development of a training program that can be used worldwide. Already one member of the HURIDOCS Task Force has provided training in the standard formats and the EVSYS software to 17 human rights organizations in Colombia and five in Ecuador.

Potential users

All organizations involved in human rights work can use the formats. Small legal and human rights groups can improve their effectiveness through cooperation and exchange with larger international organizations such as the United Nations High Commission for Refugees and Amnesty International. Human rights include the right to development. This makes the formats potentially useful to other groups involved in a wide range of social issues such as housing, consumer rights, refugee work, and disaster relief.

Contact

HURIDOCS International Torggate 27, 0183 Oslo 1, Norway Tel.: 47-2-20-02-47; Fax: 47-2-11-05-01 Telex: (051) 918023 geonet G (quote on first line: "Box:GEO2:HURIDOCS") E-mail: Geonet: GEO2:HURIDOCS

98. Redatam software package to access and use small-area census and other data

To plan adequate services and development initiatives at a local level, planners, policymakers, and researchers, among others, need access to the wealth of information generated by the census process. However, it can be difficult, time-consuming, and expensive to access specific information on small areas such as townships, city neighbourhoods, or even particular blocks.

In 1985, the United Nations Latin American Demographic Centre (CELADE) in Chile developed a userfriendly interactive software package that helps to introduce disaggregated population and housing information into development planning. It provides organizations with a simple means to store and access large amounts of census or other data on a microcomputer. Called REDATAM (for Retrieval of Data

for Small Areas by Microcomputer), it stores all the original census or other microdata on a hard disk or laser disk in a hierarchical database. Users can obtain tabulations to their own specifications rapidly, at low cost, and without the assistance of a programmer.

A new version, called REDATAM-Plus, has been developed and incorporates the following features:

- **The database structure will be changed into a multidisciplinary database that can include microdata from two or more censuses or surveys as well as aggregate information from sectors other than population and housing, such as rainfall, clinic services, or population projects in specific areas;**

- **The system will be able to interface with the Geographic Information System, or GIS software, which will allow the user to define easily the areas being analyzed, as well as to produce graphs and maps;**

- **The system will be able to operate in a Local Area Network, allowing several people to use it simultaneously;**

- **It will have the capacity to produce camera-ready tabulations for publication.**

REDATAM-Plus allows the user to create self-contained sub-databases that can be moved to regional offices. There are also various facilities for the administration and editing of the databases.

There are certain limitations to the software that users should be aware of. REDATAM-Plus is designed to work with data that is relatively stable (such as

data from a census or survey, or vital statistics) and will not be changed once it is in the REDATAM database. It cannot replace commercial database systems for information that must be updated or corrected frequently, nore does it replace conventional statistical packages such as SPSS, SAS, etc. Its main function is to facilitate the rapid manipulation, selection, and processing of subsets of data on the microcomputer.

The previous REDATAM 3.1 package has been used in over 25 countries in Latin America and the Caribbean, as well as in Egypt, India, Indonesia, and Zimbabwe. A French version of REDATAM 3.1 is being distributed in African countries. During 1991, a number of countries in Latin America and the Caribbean began using test versions of REDATAM-Plus.

Prerequisites

An E;M or compatible microcomputer with 640K RAM memory and a DOS 3.0 or higher operating system. If the area of interest to the user is likely to have hundreds of thousands or millions of cases, or if a GIS will eventually be employed, a 386 running at 20 MHz or faster is recommended along with a coprocessor. The software and tutorial database occupy about 5.2 Mb. A single census with one million records will normally compress into about 20 Mb.

A programmer may be required to convert a large census database into a REDATAM-Plus database, but once it is created, users can work on the system without assistance. The demonstration package includes a tutorial based on a ready-made population and housing database with about 7000 people living in a hypothetical country.

CELADE can provide technical assistance and training on the creation of REDATAM-Plus databases and the use of population-related applications with GIS to Latin American and Caribbean countries, and possibly elsewhere.

Potential users

Development planners, municipal and provincial authorities, researchers, statisticians, housing authorities, health planners, economists, demographers, etc. Some examples of uses of REDATAM include: detection of pockets of poverty at the municipal level and identification of possible social investments (Chile); a study on-the geographical distribution of poor communities (Paraguay); the elaboration of a demographic map (Uruguay); the availability of health workers (Pan American Health Organization); and a database for road maintenance (Costa Rica). The English-speaking Caribbean countries and various Latin American countries have, or are planning to disseminate their 1990 census data using REDATAM-Plus.

Cost and availability

The software and user manuals for REDATAM 3.1 and REDATAM-Plus are available in English and Spanish. REDATAM 3.1 will be discontinued around March 1992, except for the French version A demonstration disquette for REDATAM-Plus in English and Spanish will be available free on request after March 1992. If the requestor decides to use REDATAM-Plus, the software will be provided with a user manual in English or Spanish at a low cost (estimated at US $50 to $70 plus postage and handling) to governmental organizations and NGOs in developing countries. A French version of REDATAM-Plus is planned.

Contact

Dr Arthur Conning Chief, Population Information and Technology Area Mr Ari Silva, Head, Data Processing Section Latin American Demographic Centre United Nations Economic Commission for Latin America and the Caribbean Casilla 91, Santiago, Chile Tel.: 011-56-2-208-5051 or 206-1519 Fax: 011-56-2-208-0252 or 228-1947 Cable: UNATIONS

Resources and publications

- **REDATAM Informa, a newsletter for REDATAM users in Spanish, produced by the Instituto Nacional de Estadsticas, Chile, Casilla 498-3, Santiago, Chile; Fax: (562) 696-1929.**

- **Various papers on REDATAM and REDATAM-Plus have been written by CELADE and published in various periodicals. Contact CELADE for more information.**

99. Information system for juvenile courts

In Colombia, delays in juvenile (or family) courts have created a crisis of confidence in the system. Citizens feel alienated, defenseless and fearful due to the ineffectiveness and delays in the courts. For example women have to wait up to 5 years for a judgement on child support. The inefficiency of the courts can also lead to corruption and prevent timely information from reaching judges, lawyers, social workers, and litigants.

The Instituto SER de Investigacin has developed a software package to address this problem. Designed for civil court cases involving minors (child support,

parental rights, custody, adoption, etc.), it enables the court or judge's office to record daily information on cases and schedules and improve notification processes. It can assist in analyzing bottlenecks and provide statistical information on caseloads for the Ministry of Justice. It can help court staff with scheduling and make information more accessible to the public, which in turn should help to improve the public's perception of the legal system.

The package is currently in use in a family court judge's office in Bogot, and has shown excellent results. It is used for data entry on child support requests, division of assets, etc., and to manage information on court processes and outcomes. Since the system was adopted, the productivity of the judge's office has increased by about 68%. This has had a direct stabilizing effect on what can be a confusing judicial process.

The system not only increases the quantity of work that can be done, but also improves the quality. For example, staff have more time to keep abreast of the latest developments in legislation and jurisprudence, and show increased motivation.

The software and user's manual are available in Spanish. The system is easy to install and use.

Prerequisites

An IBM or compatible microcomputer with 20 M capacity.

Potential users

Juvenile courts and judges' offices in Spanish-speaking countries.

Cost and availability

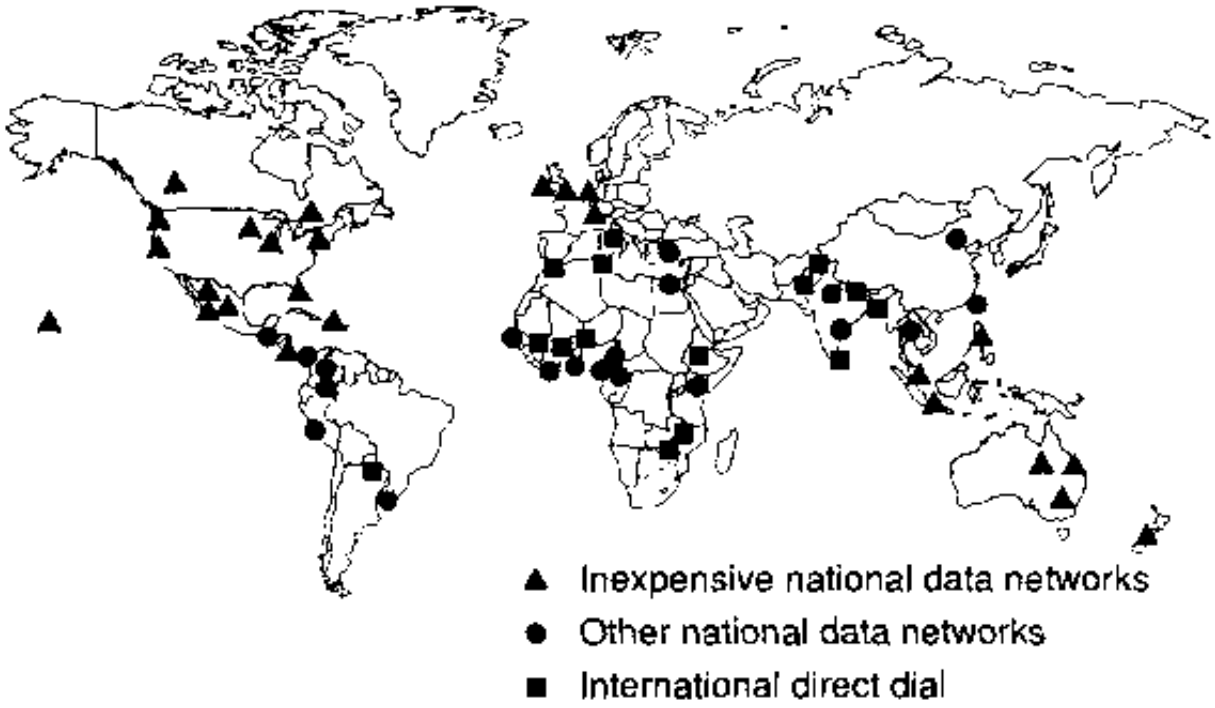
Use of the software is negotiated on case by case basis. Users normally require modifications to the system for it to meet their specific needs.

Contact

Instituto SER de Investigacin Carrera 15A No. 45-65, AA 1978 Bogot, Colombia Tel.: 2880100; Fax: (571) 288-2106

100. CGNET a network for agricultural research

An effective research community can facilitate the search for appropriate solutions to the many problems facing agriculture and food self-sufficiency, especially in the South. The strengthening of crucial research linkages can contribute to this process.



CGNET Locations

The Consultative Group on International Agricultural Research (CGIAR), a grouping of international agricultural research centres in both the North and the South, has pioneered a computerized communication network called CGNET. The network was developed to address the need to improve the quality, quantity, and speed of communications. In light of increasing costs of conventional communication methods (phone, fax, telex, cable), and decreasing or frozen budgets, a lower-cost method was needed to enable CGIAR members to exchange information on research and solutions.

The result, CGNET, is a network that has been in daily use for the past 7 years. It began with a feasibility study on potential users' needs, technical possibilities, and

potential means of implementation. A recommendation was then made on appropriate technology and procedures, and a pilot project designed. Initially, staff at seven centres were trained in the use of an internationally available computer-based messaging system.

CGNET now provides its users with the following possibilities:

- **Computer messaging;**

- **The collection of data from field sites, which can be sent directly to research centres;**

- **Joint authorship of reports and papers;**

- **Easy distribution of surveys and reports (a text can be sent to several locations at once, replacing costly mail, fax, or telex);**

- **The use of news collection services maintained by the major wire services which are linked to the CGNET system; these services can also provide such things as the USDA's monthly statistics on wheat rust or accurate daily reports of world exchange rates;**

- **The ordering and publicizing of publications;**

- **A gateway to the World Bank electronic network;**

- **Gateways to other e-mail networks, such as commercial message services and academic networks;**

- **An alternative means of sending faxes or telexes: messages can be deposited for transmission to telex or fax machines in countries with lower fax and telex rates; CGNET will also try to deliver a telex or fax to a location with unreliable telecommunications systems until the message gets through, saving the sender much time and frustration;**

- **Easy communication with advisory boards;**

- **Easy communication with researchers who are traveling or on leave.**

The network has been very successful. Before its implementation, CGIAR had been spending US $2 million annually on phone, telex, telegram, and postage costs. Savings from using CGNET have been estimated at US $3 million by 1990, and perhaps as much as a further $3.5 million in reduced travel. As well, the network quickly expanded to include users outside CGIAR. By 1991, there were over 300 CGNET mailboxes in 48 countries and nearly all of the CGIAR centres were online. The network also provides a model of what is possible in computer communications.

A consultant who worked on setting up the initial system established a private firm called CGNET Services International, which provides administrative assistance, training, and consultative services to the participating network members in addition to overall network management.

Prerequisites

To join the network: a microcomputer, a modem, and a telephone line. In areas where telephone lines are very noisy, better quality modems are required. The

situation will differ in each country and area. Some countries require special permits to operate a modem and e-mail. The electronic mail installation should include a few days of training for local staff.

Cost and availability

In areas where there are inexpensive data network services (mostly in the North and some Southern capital cities such as Mexico City), users use a local phone call to access the data network, which puts them in touch with CGNET. A low-cost (US $60 to $150) modem can be used. In some countries, the data networks can be expensive, because they charge high rates, or because a long-distance call is needed to reach them. This increases the cost per page, and a more expensive (US $200) modem is recommended to compensate for noisy telephone lines. In countries that do not have national data networks, users must dial a network in another country, which considerably increases costs. High-quality modems (US $600) must be used to ensure error correction.

Approximate costs for using the system have been estimated as follows: for users with access to low-cost data networks, US $30 per month in fees and $0.21 per page sent or received; for users with access to higher-cost data networks, US $85 per month in fees and $0.98 per page sent or received; for users who must dial another country, costs run from US $160 to $360 per month in fees and $0.68 to $2.18 per page sent or received. These costs can vary a great deal according to the quality of local phone systems and the way the system is used.

Potential users

Researchers, scientists, planners, administrators, and others concerned with addressing the problem of food self-sufficiency. As well, donor agencies that fund agricultural research, scientific organizations in related disciplines (resource management, forestry, environmental studies), and national research institutions in developing countries could all benefit from a CGNET connection.

Contact

**Consultative Group on International
Agricultural Research Secretariat
1818 H Street N.W., Washington, DC, USA 20433
Tel.: (202) 4738951; Fax: (202) 3348750
Telex: 82987 WORLDBANK; E-mail: Dialcom
157:CGI001**

**CGNET Services International
1024 Hamilton Court
Menlo Park, California USA 94025
Tel.: (415) 325-3061; Fax: (415) 325-2313
Telex: 490 000 5788 (CGN UI)
E-mail: Internet Postmaster@CGNET.COM;
Dialcom 157:CGI100**

Resources and publications

- **International Computer Networking: The Experience of the CGIAR, Linksey, Novak, Ozgediz, and Balson, to be published 1992, IDRC.**

101. Computer model for analyzing third world economies

Researchers in Colombia have adapted an economic model used in the North for policymakers in the South, taking into account Third World economic conditions, such as high inflation rates and different financial systems.

The research was undertaken by the Fundacin pare la Educacin Superior y el Desarollo (FEDESAROLLO) to confront the economic crises brought on by debt and the deteriorating primary goods markets. The model allows policymakers to plan careful management of savings and investment.

In two previous phases, the project developed separate models of the "real" economy (savings, investment, balance of payments), and the "financial" economy (role of the central bank, the financial system, determination of interest ratea). The third phase integrated the two models into a third that can be used to determine the influence of financial variables (money, credit, and interest rates) on the real economy (production, consumption, investment, and balance of payments), and vice versa.

The model can be used to address issues such as the taxation of primary goods exports, further devaluation of the peso, management of foreign debt, and import controls. It can also simulate the outcomes of monetary policies, interest rate controls, and sectoral credit policies. A number of simulations carried out to replicate the behaviour of the Colombian economy between 1980 and 1985 illustrated the model's ability to capture adequately the reality of the country's finances.

The technology is based on the adaptation of a Northern model - the computable general equilibrium (CGE) model - to meet the needs and requirements of the Colombian economy. Within the CGE model is a social accounting matrix, a tool used to assess the effects of policy changes on different income groups. These models are at the forefront of the development of new techniques for analyzing Third World economies.

Prerequisites

To run such models, reasonably powerful desktop computers are needed (with 640K RAM and a hard disk of at least 10M). Although the use of the model entails some degree of computer knowledge, there are several solution packages available that greatly facilitate the process. In Colombia, the package is used in connection with a program named GAMS (General Algebraic Modeling System), originally developed by the World Bank and presently distributed by GAMS Development Corporation (1520 New Mapshire Ave. N.W., Washington, DC, USA 20036). Researchers at FEDESAROLLO have been approached to provide training in the use of these models to researchers in the Dominican Republic and Uruguay.

Potential users

Policymakers and analysts in the public and private sectors. The Colombian government's planning department is currently using the model to evaluate the effects of macroeconomic policies and to make projections. It has also been used to evaluate the impact of specific agricultural policies, including changes in internal coffee prices negotiated between government and coffee producers. The United Nations Development Programme (UNDP) is using the model to evaluate

the effects of structural adjustment on the poor. Although the program is useful mainly for Colombia and is not sold commercially, the experience acquired by FEDESAROLLO has enabled them to develop similar programs for other uses, such as one for macroeconomic programming in Nicaragua (used by the Central Bank and the Ministry of Economics).

Contact

Mr Eduardo Lora Fundacin pare la Educacin Superior y el Desarollo AA 75074, Bogot, Colombia Fax: 571-212-6073 Cable: FEDESARROLLO Bogot

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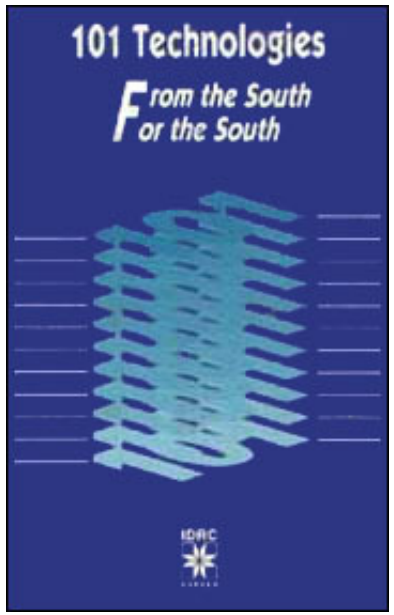

- **Education**
- **Communication and information**

Preface

You are looking at proof that technological innovations originate in developing countries. This book describes over one hundred innovations, new methodologies and original conclusions, produced by many of the South's most brilliant minds.

When a problem occurs in a developing region, the local population and even governments tend, all too often, to turn to Northern "experts". This habit is encouraged by international aid agencies, which are often unaware of Southern achievements and skills. The resulting inappropriate, ephemeral solutions are depressingly familiar.

I hope that this book, with its many examples of tangible, practical results in the fields of agriculture, environment, education, information, health and communications, will contribute to raising the profile of the successes achieved by scientists in developing countries. Although we produced the book for all development officials, it is intended specifically for non-governmental organizations in the North as well as in the South. Sometimes these organizations have few opportunities to learn about the achievements of Southern scientists who can be reached by telephone, fax or a short trip.

I am extremely proud of this book. It shows the extent to which our cooperation has been productive, and presents just a fraction of the work done by the IDRC's scientific partners.

At a time when IDRC is mobilizing all its energies to implement the objectives of the Agenda 21 adopted at the Earth Summit, the tangible results contained in these pages augur well for future successes.

Keith A. Bezanson
President

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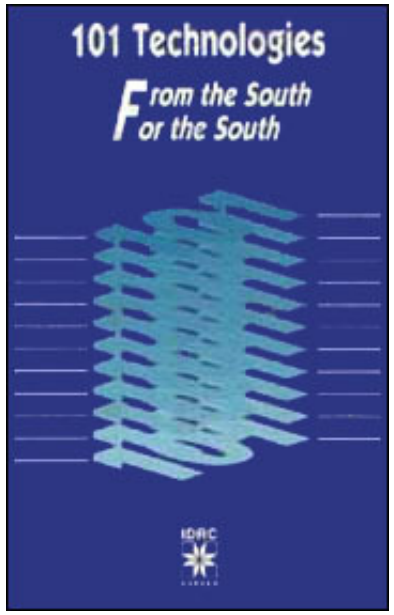


One Hundred and One Technologies - From the South for the South (IDRC, 1992, 231 p.)

Agriculture

1. The jab-seeder a tool for manual seeding

In the Northeast part of Thailand, poor soybean farmers who cannot afford power-driven farm tools spend long, tiring hours seeding their farms by hand. It is done in three steps: making the holes, dropping the seeds in, and covering them up. The task is laborious, time-consuming, unpleasant, and tiring.

The Asian Institute of Technology in Bangkok has developed a new tool called the

jab-seeder, which is a low-cost, simple, easy-to-operate alternative for manual seeding of farms. It increases productivity, reduces planting costs, and reduces the drudgery of the task.

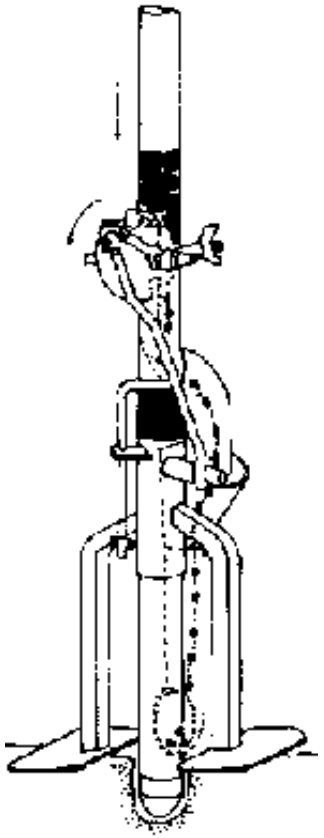
The main advantages of the jab-seeder are that hole-making and seed-dropping are done simultaneously, and there is no bending or squatting. It significantly cuts down on the labour requirements (and therefore the costs) of the planting process. A farmer using the seeder punches it into the ground to make a hole and the seed is dropped into the hole as the seeder is lifted.

The jab-seeder has the following features:

- **It is useful in various types of soil, including untilled (wet) soil, conventionally tilled soil (with or without residues from previous crops), sandy loam, loamy soil, or clay loam soil.**
- **It weighs 2 kilograms and is 1.5 metres long.**
- **It can adjust the amount of seed to be planted per hectare.**
- **It can seed soybean, mungbean, rice, maize, peanuts, and cotton.**
- **Its design can be adapted according to locally available materials.**
- **It has four different types of soil-openers (hole-makers) for various soil conditions.**

The jab-seeder has been disseminated in Thailand through promotion on TV and

through posters and pamphlets; training sessions with farmers and extension workers; and work with manufacturers and sales networks. There is interest in other Asian countries in disseminating the jab-seeder to small farmers.



This cross-sectional view shows how seeds are planted

Potential users

Small soybean, peanut, rice, maize, and cotton farmers who can't afford power-driven farm equipment.

Cost and availability

The jab-seeder costs approximately US $10.00. It is currently made by three Thai manufacturers:

- **Ar-ree Ar-thorn, 253/1-3 Talad Chong-kae, Amphur Takli, Nakornsawan, Thailand.**

- **Kunasin, 107-108 Srisatchanalai Rd, Amphur Sawankalok, Sukhothai, Thailand. Tel.: (055)642119**

- **Anusarn Co. Ltd, 94-120 Chareonmuang Rd, Chiangmai, Thailand.**

Contact

Manual Seeder Project
Division of Agricultural and Food Engineering
Asian Institute of Technology
GPO Box 2754, Bangkok 10501, Thailand
Telex: 84276 TH; Cable: AIT BANGKOK

Resources and publications

The Asian Institute of Technology has published two manuals in Thai and English:

- **Operator’s Manual - AIT Jab-Seeder**
- **Manufacturer’s Manual - AIT Jab-Seeder**

Engineering drawings and technical assistance in the manufacture of the seeder

can be obtained from AIT.

2. Promoting the use of soybeans

The reduction in Nigeria's oil revenues has resulted in l a decrease in imports, including imported high-protein foods. Local production of high-protein foods has also been low, resulting in widespread malnutrition, especially among women and children.

The International Institute of Tropical Agriculture set out in 1986 to promote the growing and eating of soybeans, a high-protein food, to improve the nutrition of rural and urban people. Soybeans need no fertilizer, grow well on poor soil, store well, and can be intercropped with other species. Made up of 40% protein, a higher proportion than cowpeas, powdered milk, or groundnuts, they are less expensive and more nutritious than many traditional foods. While soybeans have the same protein content as dried fish, they are considerably less expensive. The sale of soybean products also provides new income possibilities for women.

The project developed a package of technologies for households and small-scale rural enterprises, including:

- **Identification of appropriate processing equipment, such as an improved oil expeller and an extrusion cooker for developing commercial soybean products that are acceptable to consumers, easy to prepare and store, and economical to produce;**

- **Recipes for soybean-based foods suitable for local consumption and sale; and**

- **A program for introducing soybeans to communities.**

Among the new foods that have been developed are soy vegetable soup and soy milk. Soy flour is also added to customary cowpea, yam and cassava flours in traditional foods such as gari, akara, and ogi. These foods made with soybeans taste similar to the traditional foods but have 10 to 20 times the protein content. They have gained wide acceptance both in rural and urban areas.

New recipes and processing techniques seek to reduce the workload and simplify the production of soybean-based foods. For example, a method was developed for making soy milk from flour at home in 15 minutes, instead of the overnight soaking and grinding required in the traditional method. New, faster methods for manual dehulling of beans at home have also been developed.

A number of booklets on soybeans have been published in English, Hausa, Ibo and Yoruba, using simple language and clear illustrations. These nclude a step-by-step guide to planting, harvesting, storing and processing, and a booklet of recipes (see below).

The program has resulted in a sharp increase in the growing and use of soybeans in Nigeria. In areas where the project activities took place, the percentage of people eating soybeans rose from 0 to 54% since the project started, and 35% of the farmers now grow it. The number of retail outlets selling soy products has also dramatically increased, both in rural and urban areas. Small enterprises now produce soy milk, soy oil, and soybean-based baby foods and animal feeds. Several hospitals and clinics teach mothers how soybean foods can help improve and maintain their children's health. Many women now use soy weaning foods

instead of buying commercial baby foods.

Potential users

Farmers, nongovernmental organizations (NGOs), government, women's groups, co-ops, agriculturalists, small producers, particularly in areas where the diet is protein deficient.

Contact

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Mrs Sidi Osho, Project Coordinator
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International Institute of Tropical Agriculture
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Resources and publications

- **Soybeans for Good Health: How to Grow and Use Soybeans in Nigeria, 22-page booklet, International Institute of Tropical Agriculture.**

- **Soybean as Food in Nigeria, S.M. Osho, 50-page booklet, IITA.**

- **Soybean Recipes, S.M. Osho, 26-page booklet, IITA.**

3. The improvement of chickpea and lentil production

In Jordan, lentils and chickpeas are an important part of the diet. However, production of these legumes declined dramatically in the 1980s. Originally an exporter of lentils and chickpeas, Jordan now imports 40% of local requirements for lentil and 50% of local requirements for chickpea. Farmers stopped producing lentils and chickpeas because of low yields and rising labour costs. Most lentil farmers use manual labour almost exclusively and get caught in a labour crunch at harvest. They are switching to other crops, mostly cereals, to increase profits. Cereal growing is more mechanized.

To increase the production of lentils and chickpeas, to increase farmers" incomes, and to reduce Jordan's protein food deficit, researchers developed improved strains as well as a package of improved technologies and agricultural practices.

The "full package" includes the following:

- **Improved agricultural practices including the use of the chisel plow and sweep to prepare the seedbeds, the grain drill for seeding and fertilizing, and the roller;**
- **Improved varieties of lentils (called Jordan 1, 2 and 3) and chickpeas (called Jubeiha 1, 2 and 3);**
- **Optimum seeding rates for lentils (120 kg/ha for high rainfall areas and 80 kg/ha for low rainfall areas) and chickpeas (100 kg/ha);**
- **Optimum rates for fertilizer application (20 kg of nitrogen and 40 kg of phosphate per hectare);**
- **Early sowing for winter varieties, which significantly increases yields;**

- **Optimum methods for weed control;**

- **Recommendations on equipment adapted to the terrain, for use in mechanical harvesting, including a tractor back-mounted cutter bar (single or double knife), a self-propelled cutter bar, a plant puller, a grain combine and a whole harvester.**

The most promising technique for chickpea so far is a modified conventional grain combine used at a slower speed. For lentils, pulling and swathing techniques are still being investigated to reduce straw loss, which is valuable for animal feed.

Techniques and machinery are adapted to local conditions and socioeconomic factors. The Jordan Cooperative Organization (JCO) rents the required equipment to farmers who request it. They also conduct demonstration trials on seeding and harvesting.

The technology has been demonstrated as a full package to farmers who possess landholdings large enough to introduce mechanization (five hectares or more), and as a minimum input (improved varieties and fertilizers) to smaller, poorer farmers. Seeds of the improved varieties are propagated by the Ministry of Agriculture and distributed to participating farmers. Use of the improved package has doubled the yields of some farmers.

Extension bulletins in Arabic, detailing the recommended practices, have been produced for farmers and extension workers. A 45-minute video in Arabic on mechanical lentil and chickpea production has also been prepared and shown at workshops and field days.

A similar program has been developed in Tunisia at the Institut national de la

recherche agronomique de Tunisie, involving improved strains of lentils and chickpeas, seed production, and recommended agricultural practices. A publication in Arabic will be produced.

Potential users

Lentil and chickpea producers on rainfed farms. The package can be used by farmers with access to machinery, as well as very small farmers or farmers working on stony or hilly soils.

Contact

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UNV JO

In Tunisia:
Mr Habib Halila
Institut national de la recherche
agronomique de Tunisie
Avenue de l'Indpendance, Ariana, Tunisie
Tel.: 231985 or 231 693; Fax: 216 1 711741

Resources and publications

- **Pamphlets in Arabic describing all recommended management practices (University of Jordan).**
- **45-minute video in Arabic describing recommendations (University of Jordan).**
- **Annual reports on the project are available in English.**

4. Beekeeping in rural areas

"Honey hunting," or gathering wild honey in the tropical rainforest, has been a longstanding cultural tradition in Malaysia, from which beekeeping has slowly evolved. Honey and wax are widely used in medicine, as health food, and for traditional crafts such as batik. Malaysia only produces 3% of its local requirements in honey. The rest is imported from Australia, China, and the US. However, local honey at higher cost is preferred to the cheaper, imported honey. Honey hunting is therefore a lucrative business, with expeditions into the jungle bringing in between $300 and $600 a day.

Researchers in Malaysia have now developed technologies and methods to promote beekeeping as a cottage industry with many socioeconomic benefits for rural small farmers and landless peasants. Currently, some 1000 Malaysians maintain about 5000 bee colonies. Most of these beekeepers are small farmers with less than 2 hectares or no land at all.

The technologies that the research team developed include:

- **Methods of hive management using movable frames mounted in wooden boxes to control the production of honey, wax, and pollen;**

- **Methods to control pests and disease;**

- **Methods for the treatment and storage of honey;**

- **Methods for breeding and rearing queen bees;**

- **A technique for the mass rearing of carpenter bees for crop pollination;**

- **An inventory of indigenous plants on which bees feed (in English and Bahasa Malaysia).**

The main system that has been developed is the rearing of bees under coconut trees (called "coconut complex agroecosystem"). However, bees can be kept under coffee, pineapple, star fruit, rubber trees, and in orchards. The pollination activities of the bees increase yields of orchards and other crops.

Beekeeping has been shown to increase a farmer's income by up to 50% under favourable conditions; it requires little capital outlay, no land, and is not labour intensive. It is particularly suited as an income-generating activity for women, young people, and the landless. During the study, it was found that revenue from honey sales reached US $2160 per year; operating costs (labour, feed supplements, pest control, and bottles) cost $837. Net income was therefore $1322.

A major dissemination project has been funded by the Communications Division of IDRC with the following components:

- **Publication of a manual on basic beekeeping, for semiliterate readers, in Bahasa Malaysia. The manual includes modules on hive design, catching wild colonies, hive management, honey collection, pest control, and the economics of**

beekeeping;

- **Two training programs: basic beekeeping (this course is mainly targetted at women from coconut beekeeping areas), and a queen bee rearing course for more advanced beekeepers;**

- **Field days, seminars, etc.**

As a result of the success of this project, an Asia-wide network is being considered to promote and extend beekeeping to other countries.

Prerequisites

Cost of 36 hives and beekeeping equipment (hat and veils, bee blower, gloves, cleaning tool, and bee brush) is approximately US $2488. Pay-back period has been estimated at 2 years. The system works best under coconut trees. The bees themselves can be purchased or colonies caught in the wild (the beekeeping course provides instruction on catching wild colonies).

Potential users

NGOs, co-ops, small farmers, women's groups, and youth groups, particularly in coconut-growing regions of Indonesia, Malaysia, the Philippines, Sri Lanka, and Vietnam.

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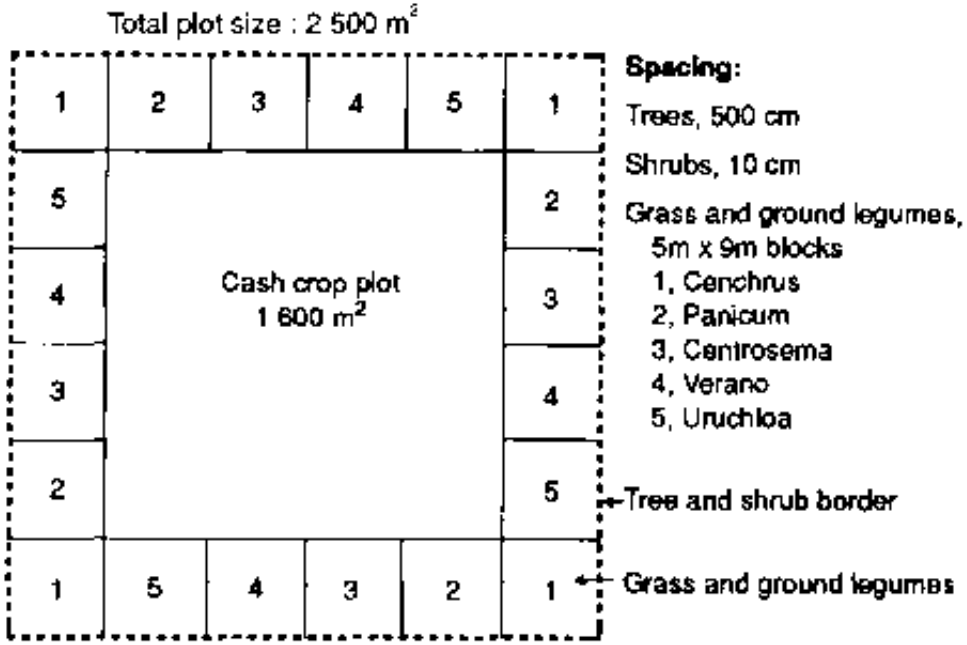
5. Forage system for semi-arid areas

In Bali, Indonesia, it is common for farmers to mix crop land animal systems. In the dry regions cattle are very important, bringing in up to 43% of the total farm income. Native grasses, tree leaves, and cereal straws are used as feed, but the supply is often inadequate.

To increase the availability of animal feed in dry areas, researchers have been working on a new forage production system based on three strata: grasses and native legumes, shrubs, and fodder trees. The system has the potential to reduce erosion and promote a sustainable system for crop and animal production.

The system, as developed by the researchers, uses 0.09 hectares of land on the perimeter of a 0.25-hectare crop field. This land is used to grow grass and legumes (stratum 1), shrubs (stratum 2), and fodder trees (stratum 3). Cattle are kept in stalls and fed exclusively with forage from the plot, unlike traditional systems where the cattle are tethered on grass during the day. Modified versions of the system are operating in India and Southeast Asia. Farmers adapt the system by choosing appropriate forage species and deciding on the amount of land to be allocated to fodder production.



Adapted from Nitis et al (1989), Fig. 3.6; and Nits et al {1990), Fig. 1.

The researchers found that the three-strata system has the potential to:

- **Produce more forage than other systems;**
- **Increase the number of animals that can be sustained on a given farm;**
- **Increase farmers' incomes from animal production;**
- **Reduce soil erosion and increase soil fertility;**
- **Provide up to 64% of a household's needs in firewood.**

Other potential benefits associated with the system are increased poultry and snail production, the possibility of honey production, and protection of the local ecosystem.

Specific grass and tree species were found to be particularly suited to the semi-

arid regions of Indonesia, including Stylosanthes, Acacia, Gliricidia, and Leucaena (trees and shrubs) and Cenchrus, Panicum, Centrosema, Verano, and Urochioa (grasses and legumes). Through the introduction of goats and more complete utilization of the available feeds, the researchers are seeking to improve the economic benefits of the system further in relation to traditional systems.

Prerequisites

Access to seed or seedlings of appropriate species.

Potential users

Small farmers, NGOs, extension services in semi-arid areas where mixed crop-animal systems are used.

Contact

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6. Women and integrated pest management

The widespread use of pesticides in agriculture has resulted in new problems

including poisonings, insect resistance to the chemicals, and the loss of the pests' natural enemies. In the Philippines, it is usually the women who decide on and buy agrochemicals for the farm.

Filipina researchers have been introducing to rural women a new system of integrated pest management (IPM), an environmentally and economically sound way to control agricultural pests.

IPM controls pests using a combination of techniques: the natural enemies of a pest; special cropping practices (such as proper timing and rate of fertilizer application, and synchronized planting, rodent control, and harvesting at the community level); pest-resistant varieties; and minimal use of chemical pesticides based on regular monitoring of the fields to diagnose pest damage.

In the Philippines, IPM was first developed for rice and vegetable plots. Like most technologies, IPM must be fine-tuned and adapted to specific agricultural, ecological, and economic conditions, as well as to the felt needs of the farmers. It has the potential to lower the risks to human health and the environment significantly while providing higher yields and profits.

Because IPM is a people-oriented and knowledge-based technology, a communication strategy is essential to its success. Various methods are used to bring the IPM message to rural communities and specifically to women: radio programs, audio cassettes, and local "resource centres" with exhibits and educational materials, including videos recording local people's experiences with IPM, comic books, leaflets, and posters. Intensive on-farm, hands-on training is needed to acquire the necessary decision-making skills that will make IPM

effective. Education on the health hazards of pesticides is also an important component to convince people of the importance of IPM after they have been repeatedly told that pesticides are essential to their farming practice.

Although educating the women in IPM increases its chances of success, it also provides them with the opportunity to increase their participation in decision-making and their self-esteem. A participatory approach with built-in feedback mechanisms is essential.

When many farmers complained that monitoring the fields took too much time and was difficult for them because of poor eyesight, training in field monitoring was given to young "IPM scouts" who could then be hired by farmers and earn an income.

Prerequisites

IPM must be developed and tested for different locations and crops according to local conditions. Information must be available on local pests, their natural enemies, pest-resistant crop varieties, as well as social, economic, and ecological factors.

Potential users

Farmers everywhere. In Asia, four countries have encouraged IPM as official policy on crop protection: India, Indonesia, Malaysia and the Philippines.

Contact

Dr Candida B. Adalla
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Resources and publications

The Philippines program has produced a number of materials, mostly in Tagalog (the local language) and some in English. These include comic books, pamphlets, leaflets, and other publications on various aspects of big-intensive gardening and agriculture. It also developed a slide-tape show on the project which is available for the cost of reproduction (US $95.50). Mailing costs for the slide show or the set of print materials is US $25.50 airmail or US $1.20 surface mail.

7. Mulbud a computerized calculator for multi-crop farm budgets

Farmers who integrate tree crops into their farms are making a long-term investment that commits them to a course of action for decades rather than one or two seasons. Because of this, it is important for them to be able to do an economic assessment before designing their tree cropping systems.

To facilitate this, a computer package has been developed for the economic analysis of multi-period and multi-crop farm budgets. Called MULBUD (for MULti-crop and MULti-period farm BUDgets), it is an interactive, user-driven simulation tool designed for users with little or no experience with computers and minimal training in economics. It is user friendly and "fail-safe."

The program is used to build farm budgets from data entered by the user. As a simulation tool, its aim is to provide alternatives, rather than fixed solutions. It helps to do rapid calculations of expected future earnings versus current costs, and to decide if the proposed crop combination is advantageous.

The software has the following features:

- **60 possible time periods;**
- **Years and "seasons";**
- **A built-in editor;**
- **Multiple enterprise budgets;**
- **Multiple products per enterprise;**
- **Sensitivity analysis;**
- **Loans/credit scheduling;**
- **15 different displays;**
- **Final report tables and graphics;**
- **Extensive HELP functions;**
- **A detailed user's manual.**

The first system was developed in 1983 for use in Southeast Asia and the Pacific. In 1984, MULBUD version 3 was developed and disseminated in Africa as part of an extension tool kit distributed by the International Council for Research in Agroforestry (ICRAF). A version for use with DOS was subsequently developed, and MULBUD version 5 was released in April 1990.

A detailed user's manual in English accompanies the software, and ICRAF has produced a training manual.

Prerequisites

Version 3 can be used on a 808 chip or Z80 computer with 63K RAM and CP/M 1.4 or higher operating system. The version for PC microcomputers requires an XT with 192K RAM and DOS 2.0 or higher operating system.

Potential users

Agricultural researchers, planners, consultants, and extensionists working with smallholder farmers in the tropics; agricultural economists, foresters, agroforesters, government, universities, credit agencies, large-scale farmers involved in orchards, vineyards or agroforestry.

Some examples of the way MULBUD has already been used include: teaching in forestry and agroforestry courses; an economic analysis of options for intercropping under coconuts; development of credit and subsidy policies for banana farmers; analysis of alley cropping of maize and beans between rows of Leucaena; analysis of intercropping coffee with food crops; silvo-pastoral alternatives in areas suffering overgrazing. The system is in use in about 60 countries.

Cost and availability

The copyright is held by D.M. Etherington and P.J. Matthews in Australia. The package is available from:

- **Anutech Pty Ltd, PO Box 4, Canberra, ACT 2601, Australia. Cost of the package is US $296.**

Contact

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PO Box 30677, Nairobi, Kenya
Tel.: 29867; Telex: 22048 ICRAF;Cable: ICRAF
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Dan Etherington
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8. The rubber-tire groundnut sheller

Groundnuts, or peanuts, are one of the major cash crops in some regions of Thailand and are an important source of protein for rural people. Thousands of Thai farmers work farms of less than 1 hectare, producing groundnuts by manual methods. This is a labour-intensive process which, along with the low productivity of the land and the low quality of the nuts, results in a low income for farmers.

Traditional groundnut cultivation requires substantial time for land and seed preparation, planting, cultivating, and harvesting, as well as drying, dehusking, and cleaning the nuts for selling.

The manual peanut sheller benefits farmers by reducing time and processing costs for both commercial shelling and shelling for seed. Shelling the nuts by hand

produces 7-10 kg of shelled nuts per day, whereas the sheller has a capacity of 30-60 kg per hour. It can potentially increase farmers' incomes as shelled nuts bring in twice as much as unshelled nuts. The initial investment can be recovered quickly, often within the first year of commercial shelling.

The peanut sheller is made of a used rubber tire mounted in a metal housing with a concave wire screen bottom. As the wheel is cranked, the nuts enter the space between the tire and the screen, are dehulled, and drop through the screen into a trough. Winnowing can be done by hand or with a fan. The sheller is 95% efficient and only 3-5% of the nuts are broken. It requires very little maintenance (average cost per year for maintenance is $3 to $5), and spare parts are easily available. During trials, a single machine processed 22 tonnes of nuts in one season without any repairs.

An "economic version" of the sheller has also been designed. It has a simpler and smaller frame and no trough (the nuts fall through the screen directly to the ground below). Its capacity is 25-30 kg per hour, and it has the same efficiency as the larger version.

As well, a motorized rubber-tire sheller with an integrated winnowing fan has been designed for use by large-scale farmers, co-ops, and local traders.

Mechanized equipment developed and designed in Thailand to modernize peanut farming is now being introduced in Africa, Indonesia, and the Philippines.

A dissemination plan for farmers, extension workers, and traders has also been undertaken in the groundnut-producing regions of Thailand. A booklet entitled

Construction Handbook for Groundnut Machinery has been published in Thai and English. It includes instructions on building the manual sheller as well as other groundnut equipment such as a stripper/winnower, a motorized peanut sheller, a grinder, and two types of planters.

Potential users

Small-scale groundnut farmers and traders.

Cost and availability

The sheller costs approximately Can $150 for the manual version and $600 to $700 for the motorized version. Some 160 shellers are in use in Thailand and elsewhere. The sheller is available from the following manufacturer:

Kunasin Manufacturing, 107-108 Sri-Satchanalai Road, Sawankalok, Sukhothai, Thailand, Tel.: (055) 642119

Contact

Dr Winit Chinsuwan
Vice-President, Research Affairs
Khon Kaen University
Khon Kaen 40002, Thailand
Tel.: (66-043) 237604; Telex: 55303
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Resources and publications

- **Construction Handbook for Groundnut Machinery, booklet in Thai and English with engineering drawings.**

- **Machinery for Groundnut, leaflet in Thai and English.**

- **A 20-minute promotional video has been produced by the project, and covers the range of groundnut equipment developed at Khon Kaen University. In English or Thai, PAL standard.**

For all of the above, contact Dr Chinsuwan at Khon Kaen University.

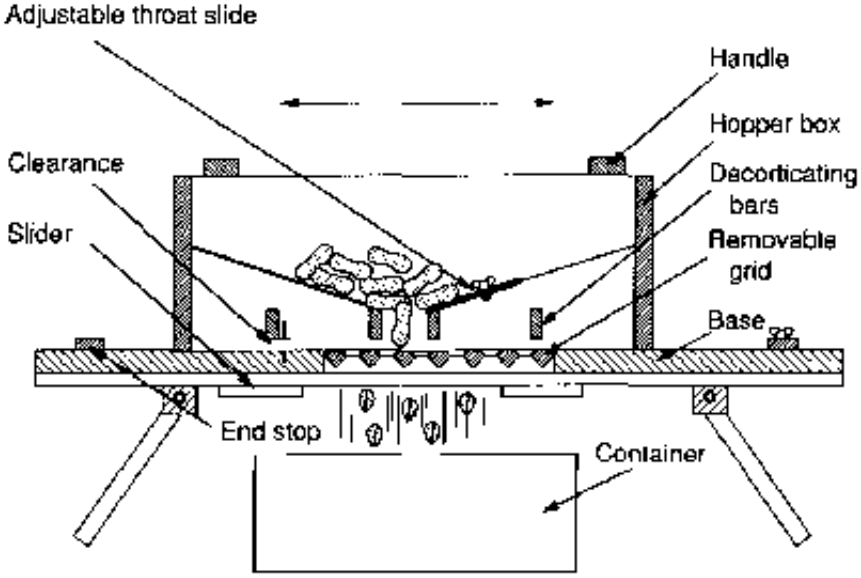
9. Hand-operated wooden groundnut shellers

Groundnuts are one of the most important crops in Malawi. They currently are the fourth largest export crop and provide smallholder farmers with more than a quarter of their annual agricultural cash income, while supplying about half of domestic oil needs. Both confectionery and peanut oil varieties are produced in the country.

Groundnut shelling in Malawi's smallholder sector is predominantly done by hand. While hand shelling keeps the rate of kernel breakage low, it is labour-intensive and leads to "sore thumb syndrome" when large quantities of groundnuts are handled. The low productivity (1-3 kg/ hour) of hand shelling puts enormous pressure on farmers, as they need to shell their groundnuts before the marketing season (June-September) ends. At the same time they are processing and marketing other crops. It was therefore important to search for a simple, efficient, low-cost machine to replace hand shelling.

The Farm Machinery Unit of Malawi, in conjunction with the Tropical Development and Research Institute developed the first model of a hand-operated wooden groundnut sheller. IDRC funded further testing and modification of the sheller, and initial trials were run for a confectionery groundnut variety. Market standards (90% average whole kernel efficiency, WKE, or 10% visible kernel damage) were met.

The sheller was later adapted to work with two other common peanut varieties - one confectionery and one oil. On-site development and testing established optimal factors such as the size of the grid gaps. Depending on the variety, the sheller attained WKEs of 92-96% with shelling rates of 21-42 kg/hour. A larger model of the sheller (twice as wide) more than doubled the shelling rate of the smaller sheller, while achieving similar WKE.



Groundnut Sheller Cross-section of machine

Before shelling is done the groundnuts are pre-graded by size using grading sieves. The sheller is operated by two people, one at each end pushing the sheller back and forth. Groundnuts are placed in a hopper, fall through an opening called the throat, and settle into the gaps in the removable grid, which is placed in a slot in the base. The hopper is pushed against the resistance provided by the nuts, thereby shelling them. The broken shells and kernels fall through the grid gaps into a container placed under the base.

Although the sheller has been designed and adapted for three local varieties, it is possible to use it with other varieties of similar size or to adapt it to new varieties.

The Farm Machinery Unit has demonstrated the sheller at Science and Technology Fairs and agricultural shows for smallholder farmers, and provides information on the construction and use of the sheller. Rural carpenters have been trained in its construction. A construction manual was produced for use primarily by rural-based carpenters. The manual is available in English and Chichewa, Malawi's official language. The manual also describes how the grids are constructed. Distribution is done through agricultural and small-scale industry extension personnel. Extension staff have been trained in proper operation of the sheller with each variety of groundnut.

Potential users

Smallholder farmers of Malawi and other East African countries will benefit from the savings in time and labour obtained with the sheller. Rural craftsmen can manufacture and sell the sheller. The manual's instructions and drawings are meant to enable rural carpenters to build the sheller with a minimum of tools.

Cost and availability

The estimated cost of the original sheller is K52.84 (US $19.90) while that for the larger model is K61.31 (US $23.08). A well-made sheller will last 5 years. Budget analysis indicates that the sheller is worthwhile even for a smallholder farmer.

Contact

Darwin D. Singa and Wells Kumwenda Farm Machinery Research Officers Farm Machinery Unit Chitedze Agricultural Research Station PO Box 158, Lilongwe, Malawi Tel.: (265)767 222/5; Telex: 44648 MINAGRI MI

Resources and Publications

- **Makoko, M.S., and Balaka, H.R. 1991. Instruction Manual for the Construction and Use of a Hand Operated Wooden Groundnut Sheller. Farm Machinery Unit, Ministry of Agriculture, PO Box 158. Lilongwe, Malawi.**

10. The grain mini-dehuller

In Senegal, the Socit industrielle sahlienne de mcaniques, de matriels agricoles et de reprsentations (SISMAR) in collaboration with the Institut sngalais de recherches agricoles (ISRA) has modified and tested several grain dehullers under rigorous laboratory and village conditions. This has led to improvements in one model of the dehuller, making it more durable, simple, inexpensive, and easy to maintain. The mini-CIS dehuller is now being manufactured and commercialized by SISMAR.

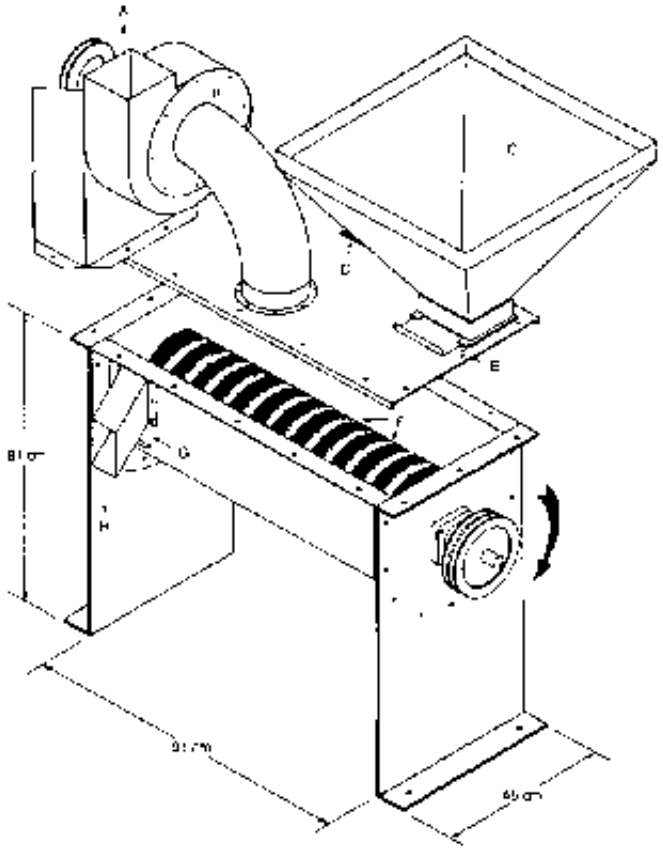
The mini-CIS dehuller was originally designed by the Prairie Research Laboratory of Canada's National Research Council, and modified and adapted in several countries of Africa as well as in India. These dehullers are all based on a metal shaft on which a number of grinding stones, or abrasive disks, are spaced about two centimetres apart. The discs, spinning at 1500 to 2000 revolutions per minute, rub against the freely moving grain and abrade away the outer husks. A winnower separates the grain from the bran by tossing the dehulled grain into the air while a fan blows the bran away.

Sturdy and simple, the mini-dehuller offers many advantages:

- **It frees up women's time, improving their quality of life and providing time for income-generating activities such as gardening, if desired;**

- **It can process several different types of grain, including traditional grains such as sorghum, maize, and millet, and legumes such as cowpeas;**

- **Unlike traditional pounding, no water is used, which means the grain can be stored for longer periods;**



Exploded view of PRL dehuller. A, bran to cyclone; B, fan; C, grain hopper; D, air inlet; E, feed gate; F, resinoid disk; G, adjustable gate; and h, overflow outlet for dehulled graze.

- **It can mill as little as 2-5 kg of grain at a time, about what thousands of African village women manually pound each day, or as much as 10 kg.**

Once dehusked, the grain can be put through hammer mills to produce flour that can compete with the increasingly available imported wheat flour. Removal of the husks makes cooking easier and improves the texture and the taste by removing the bitter elements found in the outer hull of these grains.

The mini-CIS dehuller is now being manufactured for use in villages, with training programs on installation, operation, maintenance, and repair for operators and village committees.

Various models of the dehuller are manufactured in Botswana (which exports dehullers to about 10 other African countries), Canada, the Gambia, Senegal, and Zimbabwe. The dehullers are being disseminated in Burkina Faso, Cape Verde, Egypt, Ethiopia, Ghana, India, Kenya, Malawi, Mali, Niger, Nigeria, Somalia, Sudan, and Uganda.

Prerequisites

An evident demand for the mill; training for ongoing maintenance and repair of the dehuller; availability of parts.

Potential users

Village organizations, women's groups, and others that have traditionally handled sales of local cereals in the villages; commercial millers in urban centres; and cooperatives.

Cost and availability

- **SISMAR, BP 3214, Dakar, Senegal, Tel.: 21.24.30/22.24.85; Fax: 51.10.59; Telex: 77121 SISMAR SG**

Produces the CIS II mini-dehuller for approx. Can $3800 including a diesel motor and $2600 including an electric motor.

- **Rural Industries Innovation Centre, Private Bag 11, Kanye, Botswana, Tel.: 340392/3, 340448/9; Fax: 340642**

Produces the full-size sorghum dehuller for US $2500 (not including diesel or electric power source). Requires a 5.5 kW 3-phase electric motor or a 10 HP engine.

- **International Workshop, Latrikunda Sabije, The Gambia, Tel.: 93649 or contact them c/o Catholic Relief Services, PO Box 568, Banjul, The Gambia, Tel.: 27120/27121; Telex: 7660202 CRS UC; E-mail 141: TCN 1423**

Produces the 1 Mark III mini-dehuller (capacity 6 kg of grain) with pulley for electric drive for US $970; the 1 Mark III dehuller with a clutch and pulley for a diesel engine for US $1190. The first model requires a 3 HP electric motor of 3000 turns per minute; the second runs on a diesel engine of at least 6 HP. Both models need a simple but rigid stand. Drawings can be supplied for suitable stands. The Catholic Relief Services can provide information on their experiences with the dehullers over the last 8 years.

- **Nutana Machine Ltd, 2615 First Avenue North, Saskatoon, SK, S7K 6E9, Canada, Tel.: (306) 242-3822; Fax: (306) 242-2671**

This Canadian company produces the Minihull Dehuller (based on the original National Research Council design) and the Nuhull Dehuller.

The Minihull Dehuller requires a 3 HP electric motor or 5 HP gas engine. It costs Can $2300, including crating; a gas engine drive package costs $1075, and an electric motor drive package costs $725. Quantity pricing is available; contact

Nutana for estimated shipping costs.

The Nuhull Dehuller can process 5-15 kg of grain in the batch mode, and 200-500 kg per hour in the continuous flow mode (rate varies according to grain variety, operator experience, and local operating conditions). It requires a 10 HP electric motor or 24 HP gas or diesel engine. The dehuller costs Can $4900; an electric motor drive package costs $1309; crating for international shipment costs $195.

- **Environment Development Activities (ENDA), PO Box 3492, Harare, Zimbabwe, Tel.: 708568/9; Fax: 729204**

ENDA distributes two mini-dehullers: an 18-kg barrel capacity dehuller with aspiration and a 10-kg barrel capacity batch processor. Both require an electric motor or diesel engine and can process sorghum, millet, and rapoko. The 18-kg model processes 5 tonnes per day and costs US $6000. The 10-kg dehuller processes 900 kg per day.

Contact

Mr Hyacinthe Modou Mbengue ISRA-CNRA, BP 53, Bambey, Senegal Tel.: (221) 23-60-50; Telex: 61117 SG.

Resources and publications

- **Abrasive Disk Dehullers in Africa - From Research to Dissemination, Michael Bassey, O.G. Schmidt, IDRC, 1990.**

- **An End to Pounding, 15-mint film on mechanical dehulling, IDRC, 1980.**

11. Dehulling businesses run by women

In Andhra Pradesh, India, processing sorghum and milllet using the mini-dehuller has enabled the establishment of small-scale food production businesses run by women. The businesses are an important income generator for women's groups associated with the Bharatiya

Grameen Mahila Sangh (National Association for Rural Women) program. These enterprises produce and sell dehulled sorghum in the form of semolina and flour, as well as sorghum-based foods using recipes developed and tested among the local people.

The Indian Council of Agricultural Research and the College of Home Science in Hyderabad, India, have combined their efforts to make sorghum and millet more accessible and acceptable to local people. Sorghum and millet are considered coarse, low-status foods, and are being displaced by imported wheat flour. Sorghum, millet and legumes, once freed of their husks, become more acceptable to consumers. Dehulled sorghum and legume flours were shown to be just as nutritional and as versatile for cooking as rice and wheat flours, and much less expensive.

The technology itself includes:

- **Introduction of the mini-dehullers at the household, village, and periurban level. Initially, mini-dehullers were imported from Canada. The dehullers, now produced in India, have been adapted and modified to suit women users by reducing the height and adding wheels for easy movement.**

- **Development of recipes using sorghum flour and semolina. These were tested and demonstrated in villages and promoted through newspaper columns. Government supplemental feeding programs for vulnerable sectors of the population are using these recipes for infant foods and in porridge, biscuits, and buns. Market research and testing has shown a solid demand for the sorghum products.**

- **The establishment of small sorghum/legume processing businesses run by women. These village bakeries are popular and profitable, producing roti, sooji, flour, semia, snack foods, mixes, infant foods, biscuits, and baked goods.**

The project provided a training program for women in establishing small-scale bakeries. A video, posters, workshops, and exhibits were used to promote the new sorghum products and processing methods.

Prerequisites

Access to a sorghum dehuller. Different food products can be made depending on available resources.

Potential users

Women's groups and cooperatives, government supplemental feeding programs, child-care centres, etc., in sorghum and millet-growing areas.

Contact

Dr P. Geervani

Dean of Home Science
Andhra Pradesh Agricultural University
Rafendranager, Hyderabad, India
Tel.: 245057 ext. 284; Telex: 425-6936 APAU IN

Resources and publications

- **Blueprints and an instructional manual for the modified dehuller. Booklets of recipes using dehulled sorghum. Project profiles for different sorghum enterprises.**

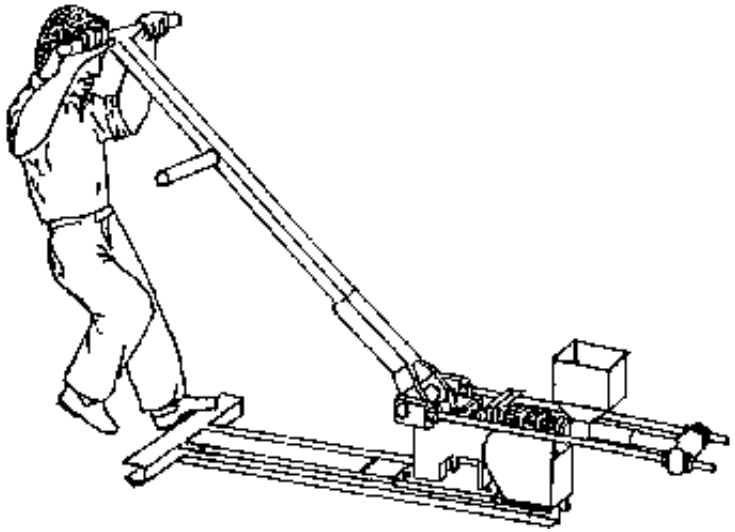
12. Small-scale rural oilseed processing

In Kenya in 1987, 80% of the vegetable oils and fats consumed by the population were imported. The intake of edible oils remains low, affecting the nutrition and health of the people. The production of oilseeds, such as sunflower and sesame, is low, and rural processing of the oils has been virtually nonexistent. The needs of the rural population for oil and animal feed have been met by urban processors at high cost.

The introduction of small-scale processing equipment in the rural areas has the potential to reduce local people's need for cash to buy oil, improve the nutrition levels of both people and livestock, and increase farmers' incomes. It can create additional employment for farmers and oilseed press operators.

Researchers have developed a technological package to introduce small-scale oil

expelling enterprises to rural areas in Kenya. The package includes a ram press for extracting the oil, a filtration device, tools for maintenance, and information on the proper utilization of the oil and cake (the residue of the seeds after the oil has been squeezed out) and on the socioeconomic and nutritional benefits of an oilseed processing enterprise. The ram press, driven manually by a long handle, is composed of a small piston that presses a charge of oilseeds into a metal cage. The basic design was developed by Carl Bielenberg



Body weight is used to activate the oilseed press.

Of AT International, while in Tanzania. The original and improved versions are now widely used there.

The four subcomponents of the package are the following:

- **Training in the preparation of the seeds (drying, cleaning, and warming), the proper use of the press, filtration, and storage of the oil. Filtration is used to**

obtain clean oil by removing particles of cake or dirt in suspension;

- **Information on oil utilization, including the advantages of home-processed oil over commercial oils and fats;**

- **Information on how to mix the residual cake, which is rich in protein, with grain for use as animal feed, especially for milk production;**

- **Information on the socioeconomic benefits of local oilseed processing.**

The package can potentially benefit communities by making ready-to-use oil and seed cake locally available and by providing an important energy source for young children. The presence of the press can stimulate the production of oilseeds, such as sunflower, and create the potential for developing a rural industry, which in turn can create employment and eventually reduce Kenya's edible oil imports.

A technical manual on rural processing of oilseeds using the ram press has been produced. It includes information on the proper methods of preparing the seeds, operating procedures and optimum settings for the press, maintenance of the equipment, oil filtration methods, packaging and storage of the oil and cake, a trouble-shooting section, recipes using the oil, cake utilization, and how to make the enterprise profitable (including accounting charts).

Current field trials are revealing an effective demand for the technology package. The project aims to leave in place a self-sustaining process, with local manufacture and credit arrangements, for the delivery of the technology to rural areas.

Prerequisites

- **Access to oilseed varieties that provide a good yield of oil under small-scale processing conditions, and that are easy to process.**

- **Knowledge of the use of the products (oil and cake) and markets for the surplus.**

Potential users

Farmers, community groups, and NGOs in rural areas, especially semi-arid areas, who do, or could, include oilseeds in the local farming systems. With proper settings, the most recent design of the manual press can be operated by any man or woman of average strength without undue strain.

Cost and availability

The cost of the ram press, including a filtering system, insurance, and transportation, is estimated at about Ksh 30,000 (Can $1500). Annual costs of running the press are estimated at approximately Ksh 11,000 (Can $450). Profit margins for a Kenyan operation, whether the press is privately-owned or run by a cooperative, have been estimated at about Ksh 14,500 (Can $575) per year. This means loans on the equipment could be paid back within about two and a half years.

Contact

Mr John Mugeto Department of Agricultural Engineering Egerton University PO Box 536, Njoro, Kenya Tel.: 61620/61031/61032; Telex: 33075

13. Improved oilseed press

In Pakistan, the domestic production of edible oils is far below the population's requirements, resulting in a high level of imported oils and inadequate diets. Researchers from the Pakistan Council for Scientific and Industrial Research have been adapting and improving village-level oilseed processing equipment to increase the availability of edible oils, increase income and employment, and improve nutrition.

Village-level oilseed extraction exists in the form of animal and motor-driven Kohlus (large mortar and pestle type installations) and small screw expellers, but these are largely inefficient and can only process seeds such as rapeseed and mustard. There are no village-level technologies to process "hard" seeds such as sunflower and safflower, which are increasingly being cultivated in Pakistan. Improved screw expellers will help in the introduction of these new oilseeds, by enabling communities to set up their own processing.

The researchers have improved the design and performance of a small mechanical expeller to increase its oil extraction by 3-4%, its efficiency, and its longevity. The expeller is made of a simple screw composed of a number of segments mounted on a shaft, which can be easily removed and replaced when worn. The screw turns at about 38 rpm within a cage of iron bars with small slits that allow the oil to escape. The pressure and mixing action break the oil cells in the seeds and the heat that is generated makes the oil more fluid.

Technical modifications have increased the expeller's capacity and reduced the amount of residual oil left in the cake from 11-12% to 7.5%. The main

modification is the addition of a reverse worm at the end of the main screw assembly to produce extra frictional heat and greater pressure on the raw material. There are two expeller models with different capacities. The 40-cm expeller can process 60 kg of seed per hour; the 66-cm expeller can process up to 100 kg of seed per hour (the original model processed 35 kg per hour). The energy consumption of the modified expellers is lowered to 75 Wh from 100-120 Wh per kg of seeds. The expeller is driven by a 10 HP electric motor.

The new expeller provides an alternative to both the existing small screw expellers and the large commercial expellers. It can compete with the commercial expellers in terms of capacity, oil recovery, and versatility. It is less expensive (half the price of a large commercial expeller) and more efficient, using only a 10 HP motor as compared to the 30 to 40 HP motor required by the large expellers.

The modified expeller can process rapeseed, linseed, sesame, and copra. Other seeds such as sunflower, safflower, and cottonseed can also be processed either whole or decorticated.

Potential users

Co-ops, village organizations, farmers in Southeast Asian countries where oilseeds are grown and where there is insufficient edible oil available.

Cost and availability

The researchers are collaborating with a manufacturer for the commercial production of the new expeller. The expected price will be approximately Rs 25,000 to Rs 30,000 or Can $1000 to $1300.

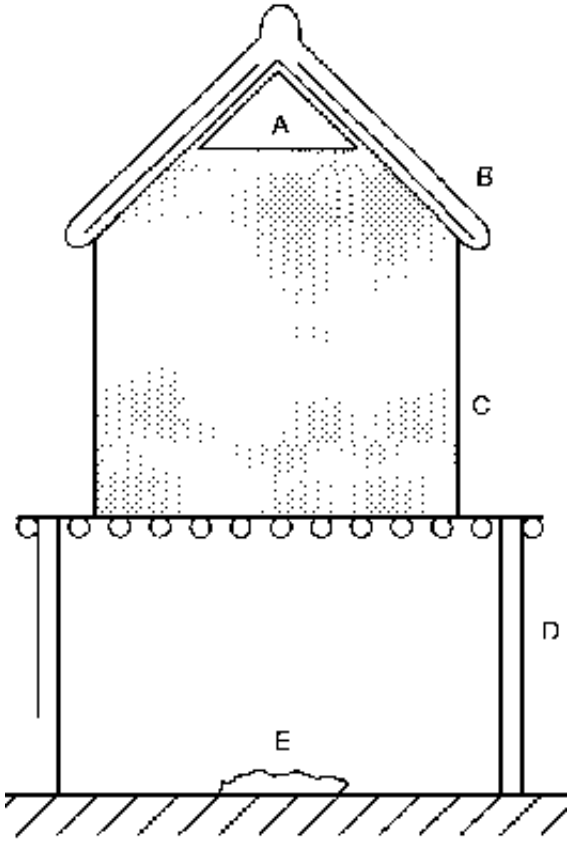
Contact

Dr Shafique Ahmad Khan Pakistan Council for Scientific and Industrial Research Press Centre, Shahrah-E-Kamal Ataturk Karachi 0109, Pakistan Tel.: 212114; Fax: 92-42-227057 Telex: 47115 PCSIR PK; Cable: CONSEARCH

14. Improved methods for storing corn

The main cereal grown in Togo is corn (maize), 95% of which is produced by small farmers who suffer substantial losses because of insects and mildew. Inadequate storage facilities compound the problem.

Researchers at the University of Benin in Togo have developed a series of methods to improve storage, thereby increasing farmers' income by minimizing losses. Improved storage also increases the amount of food available to their families during the year.



Modifications to the granary A, air inlet in the roof; B, plastic lining in the roof; C, removable plastic lines the walls during the rainy season; D, plastic placed around the platform overnight; and E, fire.

The new methods incorporate traditional granaries which are made from harvested cobs and straw. They are used for both storing and drying.

The methods described below are recommended to increase the quality and quantity of the corn.

- Seeding in rows (with generous spacing between) and early harvesting increase

the quantity of corn and limit insect infestation. In very humid regions, a late harvest is recommended because of mildew problems.

- Granaries should be built in sunny areas on cleared land 3 metres away from the nearest building to minimize the presence of rodents. Wire netting can be placed between the posts supporting the granaries to keep rats out.

- In humid areas, it is recommended that granaries be raised off the ground (1.2 to 1.6 metres) and fumigated. Elsewhere or when fumigation is not carried out, granaries should be kept low (35 to 50 cm above ground).

- The recommended size for small granaries is 2-5 metres wide and 1-2 metres high.

- A water-resistant base reduces water reabsorption during the night.

- The walls of corn are reinforced every five or six rows by wrapping them with creepers or rope.

- A conical roof made from plaited straw should cover the corn.

- Sorting before storage will remove any cobs that have already been attacked by insects or mildew. Studies show that sorting the cobs reduces the amount of corn attacked in the granaries by 36%.

- Neem tree leaves, a thin layer of ash on the corn and fumigation create a hostile environment for insects.

- When the corn is sufficiently dry, air circulation is reduced by partially covering the roof with plastic and lining the walls with plastic or clay.

Farmers in Togo have shown great interest in the research findings, which involve no major changes to their usual methods and little extra cost. These simple methods increase the harvest and improve the quality of the corn. Thanks to improved methods, farmers have noted losses of 9%, compared with 15-50% using traditional methods.

A popularization program is currently underway with the assistance of CUSO and the African Institute for Economic and Social Development. An illustrated manual in French has been produced for extension workers and brochures written in local languages are also being prepared for farmers. An information video was produced in French and a local language (Ewe) and will be translated into English.

Potential users

Small corn producers in West Africa.

Contact

Mr K. Kpakote, Director cole suprieure d'agronomie Universit de Bnin, PO Box 1515, Lom, Togo Telex: UNIVERBENIN 5258 UB TO; Telegram: UNIVERBENIN

Resources and publications

A manual in French for extension workers and a videocassette in French and Ewe have been produced. The video is distributed by Canal France International (CFI)

and an English edition is planned.

15. Improved grain storage

Traditionally, in Eastern and Southern Africa, smallscale farmers have stored their year's supply of cereal grain in granaries made of termite-resistant wood, a material that is being rapidly depleted. Given the scarcity of wood it is becoming extremely difficult to repair the traditional granaries or to build new ones. Most traditional structures do not provide adequate protection against rain, insects, and rats. High moisture and poor hygiene make the grain susceptible to mould and allow carry-over of pests. Storage losses are estimated to be in the range of 10-20%. It is therefore essential to develop new types of granaries using alternative materials.

IDRC has supported research by Environment Development Activities-Zimbabwe (ENDA) on the introduction and testing of an affordable improved granary. Initially designed and introduced in maize-growing areas, the improved granaries are now being introduced into sorghum and millet-growing areas. The objective is to develop, test, and distribute improved technologies for postproduction handling and storage of cereals to communal farmers in Zimbabwe's drier areas.

The improved granary retains the traditional cylindrical layout, but is constructed of brick, rather than poles and mud. The only materials that might not be locally available are cement and the large timbers required for the granary floor. The internal dividing walls are about chest high. Four of the resulting compartments are filled with grain, or maize on the cob - fully dried before being put into

storage. The fifth enables a person to enter through the door, stand inside, and fill or empty the compartments. The outside bricks are ordinary burnt bricks - red or reddish-yellow depending on locally available clays.

The new granary can store up to 2.5 tonnes of shelled maize, more than enough for the average maize-eating family. The size of the granary can be scaled down and adapted to various storage requirements.

Cost and availability

The improved structure costs approximately ZWD 600 (about Can $138). Most of the materials are locally available.

ENDA provides information on the construction of the granary and other aspects of cereal postproduction handling and storage technologies. A dissemination package of improved farm-level storage recommendations is available to extension agents, farmers, and researchers.

Potential users

Small-scale farmers of Eastern and Southern Africa. The new postharvest technologies will contribute to the overall strategy of food security for the nine countries of the Southern Africa Development Co-ordination Conference (SADCC).

Contact

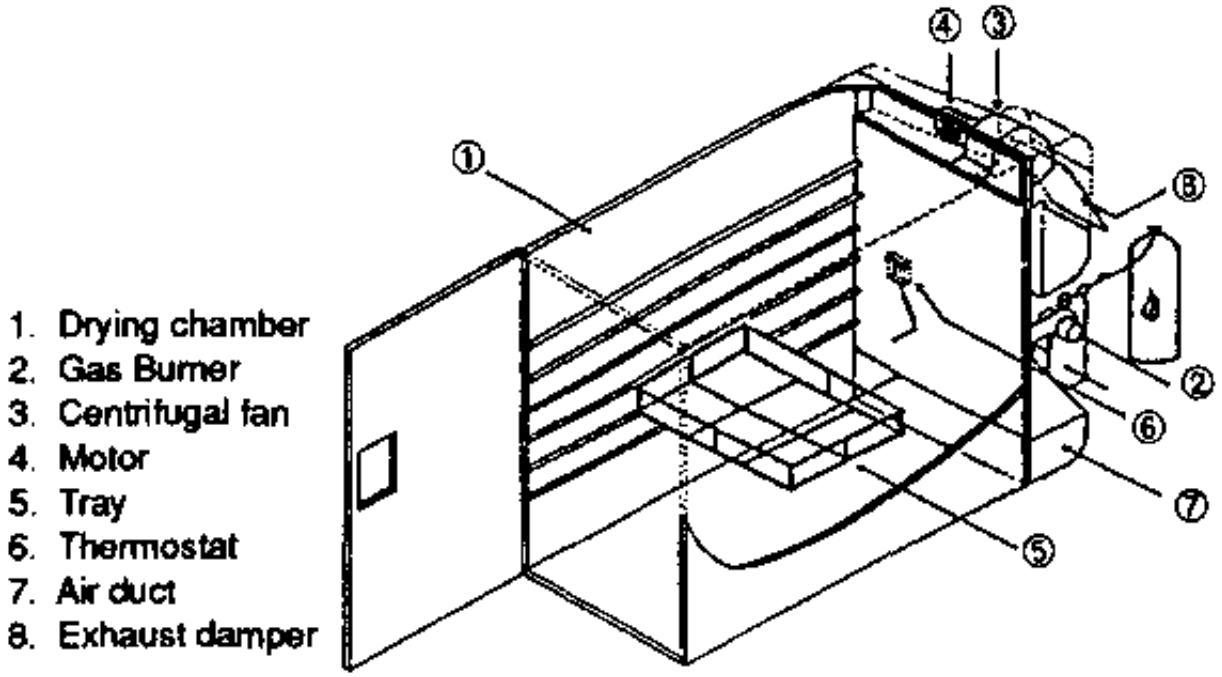
Mr Charles Gore Deputy Executive Director Environment and Development Activities - Zimbabwe 14 Belvedere Rd., PO Box 3492 Mount Pleasant, Harare,

Zimbabwe Tel.: (263) 708-568; Fax: (263) 729-204

16. Multi-crop dryers

Drying is a preservation process that prevents the deterioration of perishable crops and allows for handling, transport, and storage of the products for sale outside the community where they are grown. In Northeastern Thailand, researchers have adapted drying technologies to help expand the markets for fruits and vegetables.

For individual farmers, a cabinet-type tray dryer was designed with a capacity of 100 kg, using a wood fired furnace and the natural thermal draft to move the drying air. This dryer, well accepted by the longan farmers who tried it, is useful if sufficient fuelwood is available. The project has given the design to farmers in Lamphun Province, who are building 50 dryers with government assistance.



Figure

For traders needing a larger capacity, a mechanical dryer with a low-cost fuel oil burner was designed. A mobile mechanical dryer was also designed and was well accepted by users. The mechanical dryers are easy to use, have a fast drying time, and produce uniform products. The investment cost is low and the potential benefits high, as dry products sell for substantially more than fresh fruits and vegetables.

The dryers were field-tested and produce an acceptable quality dry product for the following crops: goundnut, soybean, black mungbean, chili, longan, black mushroom, and Chinese apricot.

The latest prototype mechanical tray dryer, called CMUIDRC II, measures 1.2 x 2.4

x 2.0 metres, and is made of galvanized steel insulated with 25-mm thick fibre glass. It holds 18 trays, which can dry 600 kg of fresh produce. The hot air is produced by a gas burner that uses about 0.5 kg of gas per hour. Drying time is approximately 48 hours. A 1 HP motor is needed to run the dryer.

The dryers have been disseminated through workshops to some 2000 farmers, traders and exporters in Thailand, and have been well received. In 1991, Chiang Mai University received more than 20 orders for the mobile mechanical dryer from longan traders, farmers, and cooperatives.

Prerequisites

Appropriate produce for drying and available markets for dried products. Access to fuel and electricity.

Potential users

Farmers, co-ops, extension programs, traders, and processing factories.

Cost and availability

The dryers have initially been commercialized through the Centre for Engineering Services (CES) of Chiang Mai University. The natural draft dryer costs about 8000 baht or Can $400. The mechanical cabinet type dryer (model CME-IDR II) has an estimated price of 70,000 baht or Can $3500, including installation. Other costs include labour, fuel, electricity, and maintenance.

Contact

Dr Norkun Sitthiphong, Dean
Department of Mechanical Engineering,
Faculty of Engineering
Chiang Mai University, Chiang Mai 50002,
Thailand
Tel.: (053) 221699 ext. 4144; Fax:
66-53-217287

Resources and publications

- **Mechanical Longan Dryers, a training manual produced for a workshop on longan drying. Available from Chiang Mai University.**

17. Potato based food products for low-income consumers

The poor populations living in the urban slums of Lima, Peru, suffer from chronic malnutrition and limited access to low-cost, nutritious food. In the rural areas, potatoes are a major crop, especially for small farmers, and the tubers have traditionally been an important source of calories and protein. However, seasonal price fluctuations put the potato out of reach of the urban poor at certain times of the year.

Researchers at the Centro Internacional de la Papa (CIP) have been looking at ways to support potato farming while providing low-income city people with low-cost, nutritious food products based on the potato.

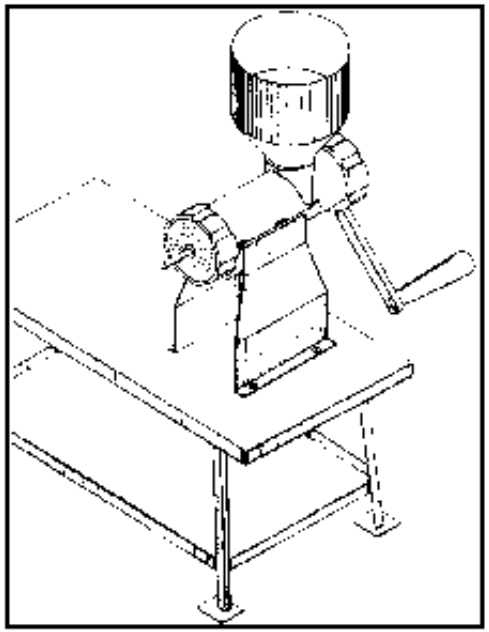
Combining dried potato with cereal and legume flours, the researchers developed a food product they called M-6, which is cheaper than potatoes, nutritious,

versatile, stable, and well accepted in the community. The technology, which has the potential to benefit both poor urban consumers and potato farming communities, has not been widely adopted. The reasons include the complexity of the process, demands on management to effectively run a processing operation on very tight margins, and the high price/irregular supply of potatoes. A small plant in the central highlands of Peru produces a modified version of M-6 to supply CARITAS (a local catholic NGO) with several tonnes of the product each month.

The potato mix M-6 is made of 30% dried potato and the flours of rice, broadbeans, oat, barley, and maize. This was based on local agricultural products; in other areas different ingredients and combinations should be used, based on their availability and low cost. The mix is reconstituted with water and boiled for 25 minutes till it makes a thick soup. Because of its bland taste, it can be used in savoury or sweet dishes.

The potato mix can be used for a wide variety of recipes including breakfast foods, main dishes, and desserts. M-6 provides one third of the nutrients needed by children, and has been shown to improve their health and nutrition when eaten regularly.

CIP developed equipment and processes to produce M-6 both at the family and community levels (100 kg per week), and at the factory level (one tonne per week).



This potato-masher, which can also serve as a grinder, is one of several small-scale machines adapted by CIP for use in family-based processing enterprises.

The factory level process involves the following steps: weighing the potatoes; washing and peeling them using a peeling machine; "rectification", which involves a visual inspection and the removal of eyes, green areas, spots, and sprouts with a knife; cooking the potatoes in water; mashing them, using either a manual meat grinder or more sophisticated mechanical or motorized mashers; using a mixing machine to mix the mashed potato with the right proportions of cereal and legume flours that have been milled beforehand; using a shredder to homogenize the size of the granules; and finally, drying the mix in a solar or electric dryer.

The pilot plant was able to produce 600 kg of wet mix per day, which produced 250 kg of M-6 after 48 hours of drying.

The researchers also developed a process for family or community level production. It was estimated that 100 kg of m-6, used three times a day, could feed a family of six for 9 months. Household equipment (hand grinder, pots, knives, peelers, hand masher, tubs, spatulas) are all that's needed to produce the mix, with the exception of the wooden drying tray which has to be built.

Cooking is done using traditional stoves, and the potatoes are peeled manually after cooking. As mashing with a hand grinder can be very tiring, CIP developed a grinder/ masher for home use. Mixing is done manually in a large tub with flours that have been milled beforehand. The mix is then dried in the sun or in an oven. CIP also developed prototype equipment for families for milling and mixing.

CIP's work on low-cost potato-based foods has wound down, but the results of this experience are being used by CIP in Cameroon, India, and Peru. CIP continues to receive requests for information about processing, for which the M-6 experience has proven very useful.

Potential users

Farming communities, community organizations, small enterprises, NGOs, government, relief agencies and community kitchens in potato-growing areas.

Contact

Centro Internacional de la Papa
Postharvest Management and Marketing
AP 5969, Lima, Peru
Tel.: (61-14) 350266/350842; Telex:

(394) 25672 PE
Cable: CIPAPA- Lima; Fax: (51-14) 35 15 70;
E-mail: 57: CG1801

Resources and publications

Appropriate Techniques for Development and Manufacture of Low-Cost Potato-Based Food Products in Developing Countries, Peter J. Keane, Robert H. Booth, Nilda Beltrn, CIP, 1986. Describes in detail the process used to develop M-6.

A manual on product development for root and tuber crops will be published by CIP, CIAT and IITA, and will include CIP's experience with village level processing.

18. Diffused light storage for seed potatoes

Potatoes are a staple crop in some 130 countries world-wide, and rank fourth in production after wheat, maize, and rice. In Peru, potatoes are an important food source, and the main crop in the Andean highlands. Traditionally, small farmers store their potatoes at home in a dark room to prevent them from greening. These are used as seed potatoes for the next planting, as well as for sale and home consumption. Dark storage can be a problem, however, in the warmer lowland and coastal areas, as it can cause excessive sprouting (the potatoes need to be de-sprouted before planting) and increased losses to insects.

The Centro Internacional de la Papa (CIP) in Peru, in the course of a larger research program on postproduction technologies for the potato, developed a low-

cost, simple method to improve the storage of seed potatoes. The method, called diffused light storage (DLS) involves storing the potatoes in thin layers on shelves or trays in natural diffused (indirect) light with good ventilation.

This simple technique can reduce the weight loss of the tubers during storage, increase their resistance to pests, allow the farmer to store the crop for longer periods, increase yields (by 15 to 30%), and reduce sprouting. Farmers can use their own seed potatoes for planting, avoiding the high costs of commercial seed at planting time. They have more flexibility in choosing their planting time and do not have to de-sprout the tubers (which can require up to five person-days per hectare). The major constraint of the method for small farmers is that diffused light will "green" the potatoes, making them unsuitable for eating. The method can therefore only be used for storing seed potatoes.

Farmers adapted the diffused light concept according to their own needs and accumulated knowledge. They often used corridors, verandahs, attics, terraces, sheds, etc., experimenting with different options and only rarely reproducing the models of extension agents. The technology varied from placing potatoes in front of windows to the building of a 100-tonne diffused light store by a cooperative of producers.

By 1984, 4000 farmers in 16 countries, including Colombia, Guatemala, Peru, the Philippines, and Sri Lanka, had adopted diffused light storage for seed potatoes. A wide array of diffused light storage designs was developed by the farmers, who almost all continued to use the technique on an ongoing basis. Continued research is being done by national potato programs in various countries.

Potential users

Small- and large-scale potato farmers.

Contact

Centro Internacional de la Papa (CIP) Postharvest Management and Marketing AP 5969, Lima, Peru Tel.: 366920/354354; Telex: 25672 PE Cable: CIPAPA- Lima; Fax: (61-14) 351-570

Resources and publications

- **A chapter on diffused light storage is included in Planned Change in Farming Systems: Progress in On-Farm Research, edited by R. Tripp, John Wiley and Sons, 1991.**

19. Cooling technologies for the preservation of fruits and vegetables

In the highlands of Northern Thailand, farmers who grow fruits and vegetables suffer high postharvest losses due both to the conditions in the fields and to poor storage techniques.

Researchers from Chiang Mai University have investigated various storage and cooling technologies, to increase the potential market for the farmers' produce. In a first phase, they designed and tested a passive cooler for storing fruit. While this storage facility required no outside energy, and was inexpensive and simple, it was suitable for only a few kinds of fruit.

The researchers then developed several prototype precooling systems using water spray. They found that precooling and refrigerated transport reduced losses by 8 to 17%. The effects of this system can be increased with careful management including harvesting at the most appropriate time, proper trimming and grading, a good marketing strategy, care in handling, and appropriate pre-treatment and packaging.

Precooling involves reducing the product's temperature before storage and transport, and requires that a large amount of heat be removed in a short period of time, making it more expensive than cold storage. Conventional precooling uses large-capacity refrigerators that require a considerable amount of energy. Forced-air cooling, the method chosen by the researchers, is the most versatile and the most widely used form of precooling.

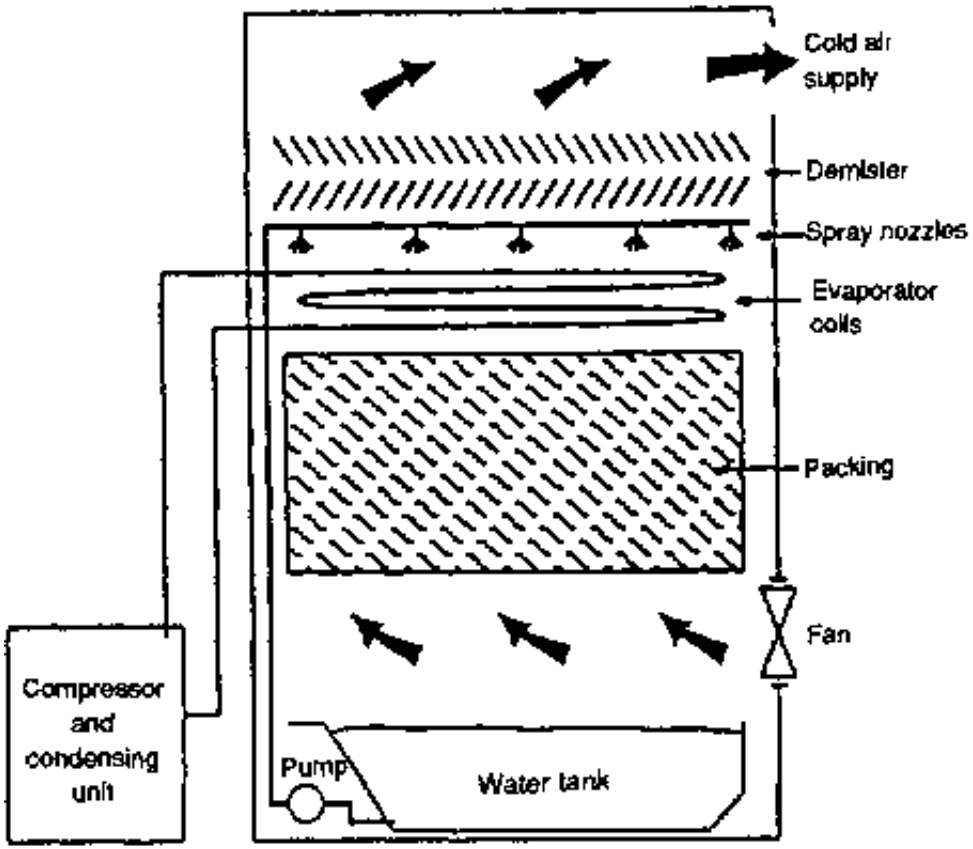
Because there is a high risk of drying out the produce using this technique, the air humidity must be kept high, around 90-95% relative humidity. The prototype precooler consists of an insulated room and an air-cooling unit. Air is drawn from the room into the unit and forced upward through a large surface heat exchanger called "packing." Cold water is sprayed from nozzles above and absorbs heat from the air through direct contact. The air comes out of the packing colder and more humid. It passes through a demister to remove water droplets, then is circulated back into the insulated room where the produce is stored. The water falls to a receiving tank below and is recirculated.

The water can be cooled using a variety of techniques, including:

- **A roof-pond system which passively cools the water during the night;**

- **Ice used as a supplementary cooling source;**
- **Mechanical refrigeration as a supplementary cooling source; or**
- **Mechanical refrigeration alone (called active cooling).**

The prototypes were the first high-humidity precoolers that were locally designed using locally available materials. They cost about one third of comparable imported coolers, and cost can be further reduced by combining them with a passive-cooling system to produce the cooled water.



A high-humidity precoler

The passive-cooling system consists of a shallow pond on the roof of a building A movable insulation panel is placed over the pond during the day and removed at night. This water-cooling method requires no energy and is simple to build and maintain. It is dependent however on an appropriate climate, ideally dry, cool nights, clear skies, and relatively little wind. It can be used in tropical climates with careful evaluation beforehand and an awareness of its limitations.

Commercial-scale precoolers (1000 to 1300 kg) are currently in use in Thailand and are well accepted.

Prerequisites

The precoolers can be built using locally available materials. The packing can be made of corrugated galvanized-steel sheets, PVC tubing, or layers of wire mesh. The cooler requires pumps and a fan, an evaporator coil made of bare copper tubing, PVC nozzles, and wooden slats for the demister. A typical roof pond system uses a 40-squaremetre roof with a 4 cubic-metre water tank.

Potential users

Communities growing fruits and vegetables in highland areas.

The precoolers are currently being manufactured by the Centre for Engineering Services (CES), of Chiang Mai University, at the address below.

Contact

Dr Piyawat Boon-Long

Department of Mechanical Engineering
Chiang Mai University
Chiang Mai 50002, Thailand
Tel.: (66-53) 210320; Fax: (66-53) 221670

20. Act-ais agricultural marketing information system

Foreign exchange is being used in most Caribbean countries to buy food that could be grown locally and traded regionally. Information on regionally grown crops, however, is not easily accessible. A result of this poor flow of information is that few foods are exported, other than the traditional exports of sugar and bananas.

The Association for Caribbean Transformation (ACT) is supporting domestic food production and promoting regional trade in Trinidad and Tobago, Dominica, and Antigua by providing farmers with better market information.

The ACT Agricultural Information System (ACT-AIS) is a computerized database designed by ACT to monitor national data on the agricultural sector in five categories: commodity prices in the wholesale and retail market, the prices of agricultural inputs, estimates of costs of production of various crops, recorded data on total production and supply, and agricultural trade data. Each of these modules can be used alone to facilitate a quick retrieval of data.

ACT-AIS helps with three basic tasks:

- **Storage, retrieval and generation of relevant data;**

- **Processing of the data into useful information using standard analytical methods;**

- **Using the data to formulate strategies for low-income farmers and traders to establish themselves in the market.**

For example, the Commodity Price Module can provide, among other things, a time series on any crop for any specified time period, and a comparative analysis of crop prices for a specified month, the previous month, and the same period 1 year earlier.

The information produced by this module can be printed in a spreadsheet format to generate seasonal indexes of price changes, trends, and forecasts. The information is used to evaluate proposals for investing in certain crops; to plan production; to develop marketing strategies for specific crops; and to formulate realistic expectations of the market at any given time.

Most importantly, ACT uses the information technology to help small-scale producers with little overt market power to estimate what the market wants and to be ready to supply it at the opportune time.

Information is disseminated in the form of bulletins, status reports, and personalized services. To reach directly small-scale farmers - who generally get their information through institutions, traders, and large-scale farm operators - ACT is developing strategies such as providing speakers on local farm radio shows in Antigua and Dominica and producing fact sheets with large print and many illustrations.

ACT is currently developing two new software packages. The first is to maintain an

ongoing database on suppliers and buyers of agricultural produce, so as to easily facilitate market operations from a central information point. The second is to identify agricultural trade opportunities, and provide initial background data for developing agricultural trade.

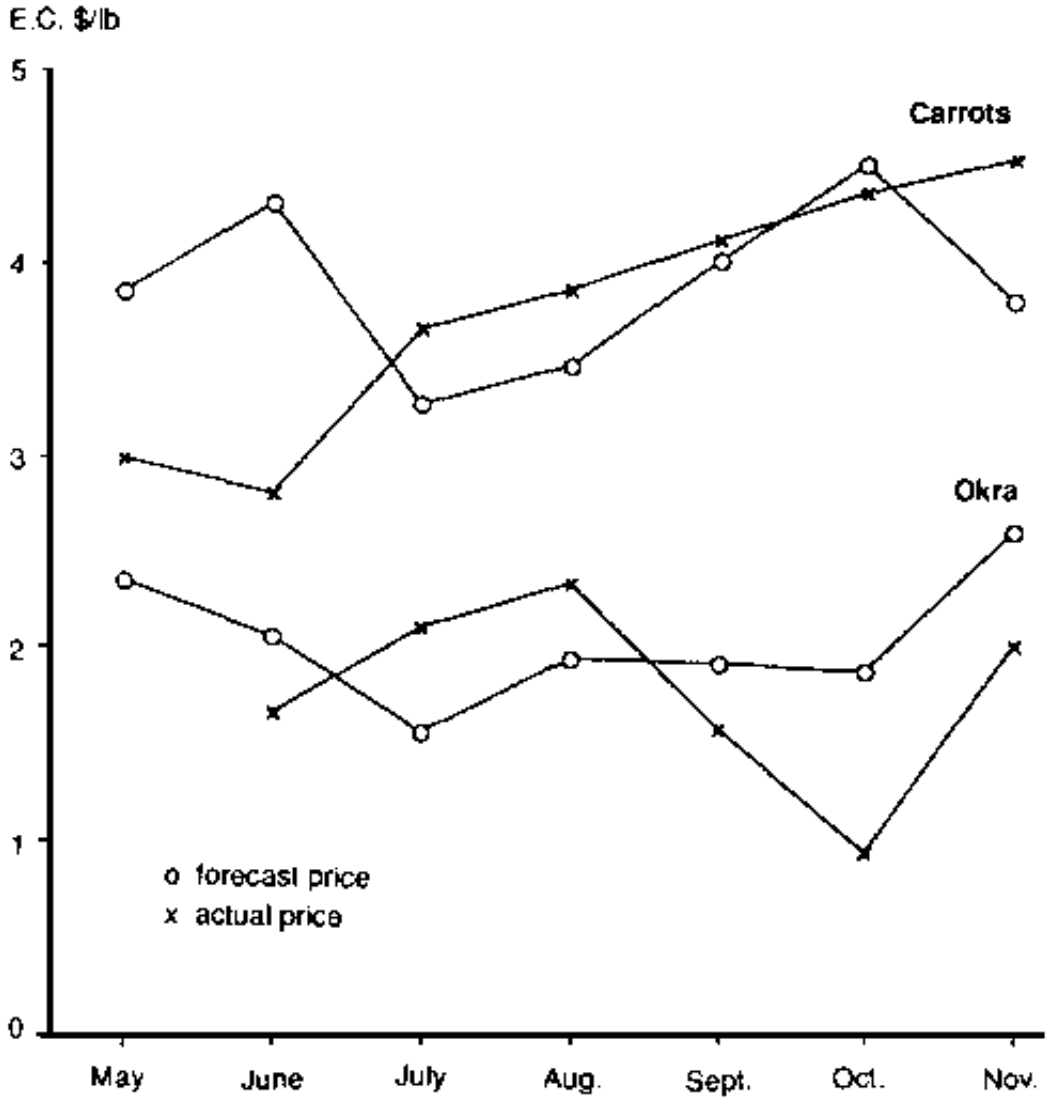
Prerequisites

An IBM-compatible computer with 640K RAM. The program is currently written in dBase III Plus and is being adapted for dBase IV. ACT can compile the program so the dBase program is not necessary to run it. A working knowledge of DOS and a spreadsheet program is needed.

Application of ACT-AIS to agricultural development requires knowledge of small-scale production, marketing, and the development of a network for accessing agricultural data and information from the public domain (such as from government ministries and institutions that publish such information regularly).

Potential users

NGOs that support productive activities by low-income groups; secondary cooperatives, especially marketing cooperatives; and groups of small-scale agricultural producers with a common production or marketing objective



Monitoring the market with the software.

Cost and availability

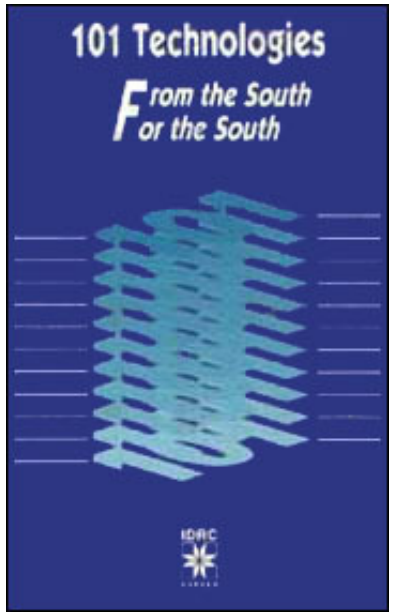
The basic programs for the ACT databases are available on request. Contact ACT for information on costs including postage. ACT has provided training activities for

NGOs from Africa, which included not only the database structure, but also how it supports the credit, marketing, and technical assistance programs of ACT. Copies of the supporting training material are available upon request for the cost of duplication and postage. ACT's preference is to conduct a series of informal discussions, in which ACT can get an understanding of the objectives of the organization, then suggest how ACT-AIS can be modified to serve those objectives better.

Contact

Mr Allan Williams, Project Leader, ACT Ltd, 3 Pelham Street, Belmont Port of Spain, Trinidad and Tobago Tel.: (809) 624-2142; Fax: (809) 627-6032; Cable: ACTRANS PORTOFSPAIN

Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw



26. Live fences for protecting crops and plants
27. A windbreak for protecting crops

One Hundred and One Technologies - From the South for the South (IDRC, 1992, 231 p.)

Forestry

21. Alley farming

Alley farming is a sustainable farming system that could replace shifting cultivation systems in tropical Africa, reducing deforestation and land degradation. It exploits the potential of trees, primarily for maintaining the fertility of the soil, as well as for improving crop and livestock production.

Multipurpose trees (usually leguminous) are established in rows 4-6 metres apart with crops cultivated in the "alleys" between the tree rows. Trees are pruned at the end of the first year and subsequently managed through periodic pruning of

the regrowth so that interplanted food crops get enough light.

Under this system:

- **The trees and shrubs protect the soil against water runoff and erosion, particularly on sloping land;**

Tree prunings may be applied to the soil surface as mulch or incorporated as green manure;

- **A significant amount of nitrogen, mineral nutrients, and organic matter is made available to the topsoil improving soil fertility and reducing the need for inorganic commercial fertilizer;**

- **The mulch also acts as a weed-suppressor and helps earthworms to multiply;**

- **The pruned branches can be used as a protein-rich livestock feed leading to improved productivity of sheep and goats;**

- **The system can also produce fuelwood or poles if desired.**

The system increases the length of cropping periods, so the land can produce more, and soil fertility is rapidly regenerated and maintained. Alley farming can be used on farms of any size.

Prerequisites

Availability of seeds of multipurpose tree species appropriate to local climate and

conditions; training of farmers and community groups interested in trying out the new techniques.

Potential users

Farmers, extension workers, NGOs, and development workers in the agriculture sector. Techniques are useful in areas with erosion problems (such as hill-side farming) and where population pressure and land degradation increasingly limit the availability of fertile land for farming. Alley farming is flexible enough to be used by small farmers as well as by large mechanized farms, and is close to current farming methods. It is also in use in Southeast Asia.

Established in February 1989, the Alley Farming Network for Tropical Africa (AFNETA) promotes and supports alley farming research, on-farm testing, and extension of the concept across diverse environments in tropical Africa. Technical studies are complemented by studies of some of the constraints to alley farming, such as systems of land ownership, labour requirements, gender issues, religious beliefs, ancestral traditions, and socioeconomic pressures.

AFNETA's activities include: information dissemination, and exchange of alley farming techniques; training; and collaborative research with national and international agricultural research centres. A major priority for the network is collaboration between research institutions and development organizations. For example AFNETA co-hosted a training workshop on "Research Institution NGO Linkages" in 1991; an international conference on alley farming held in Ibadan, Nigeria, in September 1992 featured presentations from both research institutions and NGOs.

AFNETA works in Benin, Burkina Faso, Burundi, Cameroon, Cte d'Ivoire, Ethiopia, Ghana, Kenya, Liberia, Malawi, Mali, Nigeria, Rwanda, Senegal, Sierra Leone, Tanzania, Togo, Uganda, Zaire, Zambia and Zimbabwe.

Contact

Kwesi (A.N.) Atta-Krah, Coordinator, AFNETA International Institute of Tropical Agriculture Oyo Road, PMB 5320, Ibadan, Nigeria Tel.: (234-22) 400300/400314 Telex: TDS IBA NG 20311 (Box 015) or TROPIB NG 31417/ 31159; Cable: TROPFOUND IKEJA

Resources and publications

- **Alley Farming: the Development of Alley Cropping as a Promising Agroforestry Technique, B.T. Lang and G.F. Wilson, IITA Reprints, International Institute of Tropical Agriculture, 1987.**

AFNETAN, the official newsletter of the Alley Farming Network for Tropical Africa (see address above).

- **Alley Farming with Livestock - Guidelines, International Livestock Centre for Africa, 1988. ILCA, Addis Ababa, Ethiopia, PO Box 5689; Fax: (251-1) 613218; Telex: Ilca Addis 21207.**

- **Alley Farming in the Humid and Subhumid Tropics, Proceedings of the 1986 International Workshop, Ibadan, Nigeria, available from IDRC.**

- **Alley Farming, a review by B.T. Kang, L. Reynolds and A.N. Atta-Krah, in**

Advances in Agronomy, 43: 315-359, 1990.

- **Alley Farming Training Manual, resource materials and methodological guides for use in alley farming training programs, AFNETA, IITA, 1991.**

- **Trees of Plenty, 19-mint film on the use of leguminous trees in farming systems around the world, 1987, IDRC.**

22. Using paulownia trees for intercropping

In many Third World countries, the depletion of native forests coupled with the increased demand for timber and fuel is creating serious environmental, economic and social problems. One strategy to deal with this situation is to encourage rural people to integrate trees within existing farming systems.

In China, the Paulownia tree has been used with great success in agroforestry programs, on nearly two million hectares of farmland. This planting has helped alleviate the chronic shortage of timber, fuelwood, and animal fodder, and at the same time has served to increase agricultural production and improve soil conservation. The successful development and use of Paulownia in China can benefit many other countries that face similar problems of competing priorities between agriculture and wood production.

Scientists at the Research Institute of Forestry, Chinese Academy of Forestry, have been studying Paulownia and have developed and distributed several improved varieties to farmers and organizations in China and other countries.

The benefits of Paulownia trees include:

- **They are adaptable. They grow on flat or mountainous land, in various types of soil, including: rich humous soil in temperate areas, dry poor soil, rich forest soil, and clay soil in the subtropics, laterite soil in the tropics, and dry steppes.**

- **Paulownia also adapts to a variety of climates, even temperatures as low as -20°C (different species vary in their resistance to the cold). The optimum mean daily temperature for Paulownia is 24-29°C. Precipitation needs also vary greatly, from as low as 500 mm to a maximum of 2000 or 3000 mm annually.**

- **They grow extremely quickly (average growth 2 metres per year).**

- **They have a deep root system that does not compete with the roots of crops.**

- **Their branches and leaves are sparse, allowing plenty of light to come through.**

- **Intercropping with Paulownia can improve the microclimate by reducing the effects of drying winds (wind speed can be reduced by 20-50% on average) and increasing air moisture, which considerably increases yields of crops such as winter wheat, millet, and maize.**

- **Paulownia produces a light yet strong timber useful for furniture, plywood and musical instruments; its sale can considerably increase the income of rural people.**

- **Its branches can be used for fuelwood (a 10-year-old tree produces 400 kg of branches per year).**

- **The branches, leaves, and flowers are rich in protein, carbohydrates, and minerals, making them ideal for animal feed and green fertilizer (a 10-year-old**

tree produces 30 kg of dry leaves per year).

- **The leaves, flowers, and wood have medicinal properties.**

If the trees are used primarily to improve agricultural production, 40-67 trees are planted per hectare. This will increase yields of wheat, millet, and maize. Crops such as sesame and sweet potato are not suitable for intercropping with Paulownia and their yields may actually decrease. If 50 trees are planted per hectare, they will produce 20-25 cubic metres of timber per tree over 10 years, an important extra income to farmers.

Paulownia trees can also be planted primarily for timber production, with the crops as a secondary activity. In this case 200-400 trees are planted per hectare. The crop yield is reduced after 4-10 years, but can still amount to some 37.5 tonnes per hectare over 10 years. From 80 to 140 cubic metres of timber per hectare can be produced after 10 years.

Prerequisites

Access to seedlings or root cuttings of appropriate Paulownia species for local conditions; training in planting and management of the trees and intercropping techniques. The Chinese Academy of Forestry has provided training courses for farmers, technicians, and extension workers.

Potential users

Farmers around the world could benefit from intercropping with Paulownia, especially in areas with poor soils, climate problems such as sandstorms, high

winds, and droughts, and timber, fuelwood, and fodder shortages. Paulownia seeds have been introduced in more than 30 countries in Africa, America, Asia, Australia, Europe, Latin America, and with considerable success in Australia, India, and Pakistan.

Cost and availability

Seeds of different Paulownia species are available from the Paulownia Research Group (see below). Cost is approximately US $10 per 100 g plus US $15 to $20 to cover mailing, quarantine, etc.

Contact

Paulownia Research Group Forest Research Institute Chinese Academy of Forestry Wan Shou Shan, Beijing 100091 People's Republic of China Tel.: 2582211 ext 672; Fax: 2582317

Resources and publications

- **A 27-minute film in English titled Paulownia in China has been produced by the Chinese Agricultural Studio.**

- **Paulownia in China: Cultivation and Utilization, by the Chinese Academy of Forestry Staff, Asian Network for Biological Sciences and IDRC, 1986, 65 pp.**

- **Agroforestry Systems in China, Chinese Academy of Forestry and IDRC, 1991, 216 pp. Models, development, research, and experiences of agroforestry in tropical, subtropical, temperate, and semi-arid regions in China.**

- **Available from the National Paulownia Centre in the United States: Paulownia Information Packet; Kiri Newsletter (Kiri is a subspecies of Paulownia); and Kiri seed. Contact: Dr Peter R. Beckford, 4303 Kenny St, Beltsville, MD 20705, USA.**

23. Agroforestry seed information clearinghouse

Agroforestry is quickly becoming an important component of agricultural development in many countries. Expansion of agroforestry systems, however, are hampered by lack of seed. When seeds are available they are too often expensive and of low quality. This situation is aggravated by limited knowledge of seed production, handling, and testing for quality.

The Agroforestry Seed Information Clearinghouse (AFSICH) in the Philippines was established to serve the information needs of NGOs and government. The project collects information on seed sources and technologies for promising agroforestry species and distributes the information to NGOs and government agencies through brochures, newsletters, and training sessions.

Activities of the clearinghouse include:

- **A database of seed resources for major agroforestry species in the Philippines, as well as organizations, resource persons, and seed production technologies;**

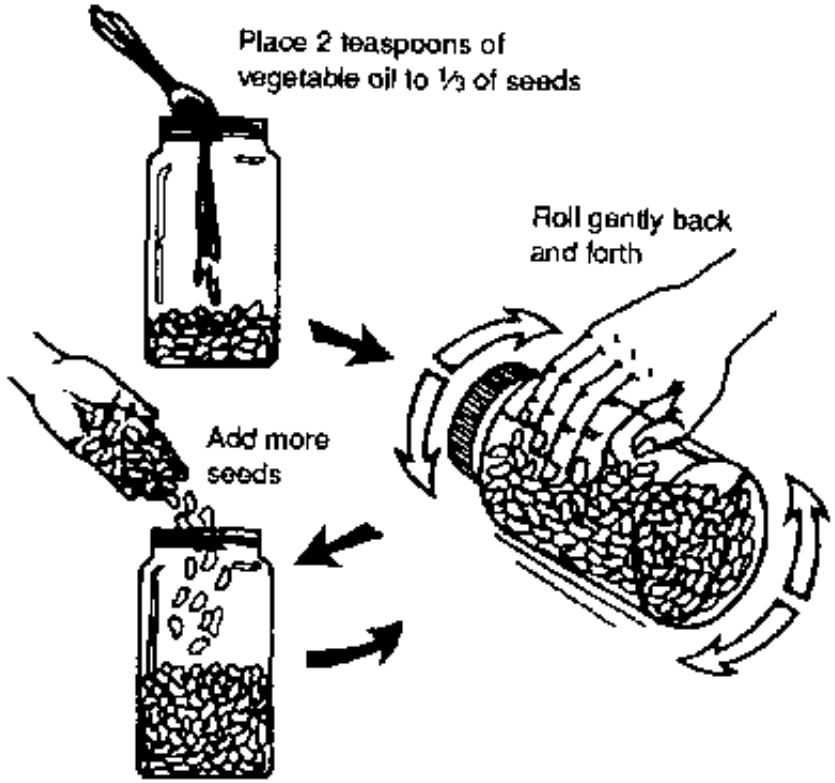
- **Training in seed production and handling for planners, NGOs, trainers, and farmers;**

- **Research;**

- **Coordination of a network linking NGOs and government agencies involved in uplands development in the Philippines;**

- **Production and distribution of extension materials.**

The following types of information on seeds are being generated by the clearinghouse: information sources, uses of different species, taxonomy, growth habits, adaptation, areas under cultivation, flowering requirements and characteristics, seed setting requirements and characteristics, seed handling, and requirements for establishment of the plants.



Oil application to protect seeds

Information from the project has been used to produce the Agroforestry Technology Information Kit and was highlighted in a special issue of the Sustainable Agriculture Newsletter on agroforestry seeds. Fifteen hundred copies of the newsletter were distributed in 75 countries. The newsletter contains information on seed technology (guidelines for production, seed collection and preparation, seed drying, seed storage and protection, seed quality testing, and pregermination treatments), as well as worldwide lists of seed sources, resource people, agencies, organizations, and projects involved in seed production.

The project works closely with NGOs through the network, and its research agenda is based on farmers" problems as identified by NGOs and extension workers, not by the researchers. It is a model of a successful seed exchange network.

Potential users

Farmers, NGOs, and government agencies who do not have access to information on seeds through usual channels.

Contact

Dr Pamela G. Fernandez Agroforestry Seed Information Clearinghouse Department of Agronomy University of the Philippines at Los Baos Laguna, The Philippines 4031 Fax: 63-2-818-2087, c/o Paul Tengirri

Resources and publications

- **Agroforestry Technology Information Kit, available from: Dr. Julian Gonsalves,**

Director, Appropriate Technology Unit, International Institute of Rural Reconstruction, Room 38, Elena Apartments, 512 R. Salas St., Ermita, Manila, The Philippines.

- **Sustainable Agriculture Newsletter, Vol. 2, No. 3, Sept. 1990; available from: SAN, c/o Scott A. Killough, IIRR, Km. 39, Silang, Cavite 4118, The Philippines.**

24. Agroforestry seed centre for southern Africa

As deforestation becomes an increasingly serious problem in southern Africa, agroforestry programs and community woodlots are in need of reliable sources of good-quality tree seed. There is a need for a wider selection of tree species to meet a variety of uses: improvement of soil fertility, protection of crops, provision of shelter, shade, and forage for domestic animals, provision of wood for fuel and construction, and mitigation of environmental damage.

Current problems facing forestry and agroforestry programs include a lack of available seed (and the need to import seed), inadequate testing and storage of seed, a lack of trained personnel, and inadequate information. For the programs to work, obtaining the best possible seed at the right time is crucial. To address this situation and to promote self-sufficiency in seed supply of multipurpose trees, a regional seed centre has been established in Zimbabwe.

The regional seed centre includes offices, workshop and conference facilities, a seed lab, and cold storage. It aims to provide the Southern Africa region with access to certified and improved seed for research and development programs; to develop standardized techniques for collecting, processing, storing, and testing

seed for distribution; to provide training to seed workers in the region; to identify and record existing seed sources and tree stands in the region; to establish resource conservation tree stands for seed production; and to disseminate information (including information on problems of seed importation).

For the first time in Africa, seed stands of major dry-zone species have been established. A system of seed stands has been set up in Kenya, Malawi, Zambia, and Zimbabwe. The regional seed centre has organized various training activities, including a workshop for scientists on taxonomy, seed handling and testing, and a course on indigenous tree seed collection attended by seed workers from Botswana, Burkina Faso, Ethiopia, Kenya, Malawi, Zambia, and Zimbabwe. A computerized list of commercial seedlots has been drawn up, and information on seeds is provided to individuals and organizations both inside and outside the region. As well, the seed centre is identifying seed sources in other countries and on other continents for promising species that can be used in the Southern Africa region.

Potential users

Forestry and agroforestry programs throughout Africa.

Cost and availability

Seed for research is available free or on an exchange basis. A price list in US dollars for different categories of seeds is available. Seeds can be sent to any country by air freight or air mail. An import permit is required for commercial seed orders, but not for seed for research purposes.

Seed species available include:

- **Exotic species: various eucalypt and pine species, and small quantities of other species;**
- **Indigenous species: a range of Zimbabwe acacias and other species.**

Contact

Forestry Commission
PO Box 8111
Causeway, Zimbabwe
Tel.: (263) (4) 706216; Fax: (263) (4) 795557
Telex: 22446 FORCOM ZW
General Manager
Forest Research Centre
PO Box HG 595
Harare, Zimbabwe
Tel.: 4687819; Telex: 2446 FORCOM ZW

Resources and publications

- **FORMAT, a free newsletter published in English by The Seed Centre.**

25. Agroforestry in semi-arid areas

Kenya’s semi-arid areas are under increasing ecological pressure due to growing

population and a lack of arable land. Grazing lands are under threat in the Kakuyuni catchment area (Machakos district), where the number of cattle, goats, and sheep is now more than twice the recommended maximum for the type of land. Rainfall is low, the land produces little, and there are shortages of fodder.

The Kenya Forestry Research Institute is developing agroforestry technologies to counteract the soil erosion and poor conditions. The technologies include:

- **Identification of the most promising species for intercropping (planting trees with crops) and for hedges;**
- **Establishment of fodder banks;**
- **Technologies for the rehabilitation and management of grazing lands;**
- **Identification of appropriate fruit tree species to improve nutrition and provide a small cash crop to local farmers;**
- **Improved tree-planting techniques;**
- **Techniques for community participation and dissemination of the new technologies.**

The growing of hedgerows of trees among crops can increase productivity and improve and protect the soil. The most promising material includes species of Leucaena, Gliricidia, Cassia, and Sesbania which provide fodder, mulch, and fuelwood while preventing soil erosion and surface water runoff.

Wooden fences in the area are constantly attacked by termites and need to be replaced frequently, using scarce trees to provide the wood. Live fences provide a solution to this problem. Three species are recommended to farmers (Caesalpinia spinosa, Parkinsonia aculeata, and Zizyphus mauritania). The trees are planted less than 50 cm apart and are pollarded at 30 to 50 cm above ground to stimulate the growth of side branches.

Natural vegetation in the grazing lands is prevented from maturing by lack of moisture and constant browsing by animals. A package of treatments has been devised for eroded grazing land, to protect both natural vegetation and newly planted trees and shrubs. This includes: digging a 2-metre-long V-shaped trench upslope of the tree to improve water retention; pruning the tree to one main branch to promote upward growth; surrounding the tree with thorny bush to protect it from animals while the main branch is growing; constructing ditches for erosion control; introducing appropriate tree, shrub, and grass species to enrich the land.

Four species of fruit trees were introduced to increase available food and income: mango, pawpaw, rough lemon, and guava.

Researchers are working with farmers to develop tree-planting and management techniques for particular species and locations. These include: pruning the roots of seedlings and the stems if necessary; digging larger planting holes to encourage rapid root development; and planting promptly at the beginning of the rainy season to take advantage of all available moisture.

Self-help groups of farmers, predominantly women, participated in the trials and

were the first to plant the most promising species on their farms. School children and self-help groups are taught the importance and the methods of rehabilitating grazing lands, and given seedlings to start tree nurseries. Information is disseminated mainly through radio programs, newspaper articles, women's groups, and schools.

Prerequisites

Access to seeds or seedlings of appropriate species; training in intercropping, building and maintaining live fences, and rehabilitating grazing lands. The technologies need to be adapted to local conditions, including socioeconomic factors and current farming practices.

Potential users

Farmers, co-ops, community groups, NGOs, extension workers, and agriculturalists working in semi-arid areas.

Contact

Dr Jeff A. Odera
Director, Kenya Forestry Research Institute
PO Box 20412, Nairobi, Kenya
Tel.: Karuri 32173 or 32220; Cable:
KEFRI Nairobi

26. Live fences for protecting crops and plants

In Burkina Faso, deforestation and soil erosion are having a disastrous impact on the environment. Programs for reforestation and smallholding protection have been introduced to reverse the damage. Much of the reforestation, carried out annually at great cost in terms of financial and local manpower resources, is usually destroyed in its first year by village cattle. It is estimated that the plant survival rate is less than 30%. To reduce losses in the reforestation program, researchers from the Ministry of Environment and Tourism have developed agroforestry methods using live fences.

To protect their vegetable crops and young plants, farmers usually use wire fencing, which is expensive, or enclosures made from branches or other material that rots quickly. In contrast, live fences are cheap and quickly form permanent barriers that cattle find difficult to penetrate.

Researchers have identified the best species and methods suited to local environmental conditions. The species were chosen according to the following criteria:

- **The plant's recovery rate after planting;**
- **The plant's annual growth rate in height and diameter;**
- **Ramification, which must be low and full to produce an impenetrable fence; and**
- **The cover, or interpenetration of the branches.**

The following species were selected: Acacia senegal, Acacia nilotica, Acacia seyal, Bauhinia rufescens, Ziziphus mauritiana and Prosopis juliflora.

The following instructions should be followed closely to ensure a healthy fence:

- **Planting the fence. A system of trenches improves water infiltration and increases root growth. The trenches, which aid plant recovery while minimizing the farmers' work, should measure 50 cm (for single rows) to 80 cm (for double rows) wide and 60 cm deep. The trees are planted in staggered, double rows with 40 cm between the rows and 30 to 50 cm between trees in the same row.**

- **Upkeep. The fences must be weeded two or three times during the first year after planting, to reduce competition from weeds. During the dry season each plant needs at least 1.5 litres of water per week.**

- **Pruning. The plants must be pruned once or twice a year, depending on their height, at the end of the dry season or during winter. At first, pruning should be kept low (50 to 80 cm from the ground) to encourage branches to form at the base of the trees. Subsequent pruning depends on the height to be protected, generally around 1.2 metres.**

Two major drawbacks to this method became apparent during the research stage: namely, the amount of work required to dig the trenches and the availability of plants in sufficient quantities at the right time. To overcome these problems, the researchers identified species and methods suitable for creating live fences using direct seeding rather than plants.

Producing live fences using direct seeding is an easy, cost-effective method that does not require growing trees in nurseries and eliminates the planting process. The success of direct seeding depends on regular, frequent watering. The species producing best results using direct seeding are: Acacia nilotica, Acacia seyal and Bauhinia rufescens. The seeds must be planted in early winter (June and July) in

trenches that have been dug and refilled before seeding.

The live-fence method has proved popular with farmers, especially those growing vegetables. This method is a significant step forward and will improve reforestation and vegetable farming conditions in the country.

Prerequisites

Seedlings, potted plants, or cuttings of the appropriate species. In Burkina Faso, the seeds of the forest species used are available from the Centre national des semences forestires (CNSF), PO Box 2682, Ouagadougou, Burkina Faso (Tel.: 30-08-57/30-12-33).

Plants and cuttings are available from the nurseries of the Ministre de l'Environnement et du Tourisme (see above address).

Potential users

Reforestation groups, farming and vegetable programs in dry regions where cattle are causing damage and efforts are being made to halt soil erosion.

Contact

Zigani Goudouma Direction de la production Ministre de l'Environnement et du Tourisme PO Box 7044 Ouagadougou, Burkina Faso Tel.: 33-12-13/33-63-11

27. A windbreak for protecting crops

Most of Tunisia is exposed to strong winds that blow in from the sea. These winds cause numerous problems, including soil erosion, increased rainfall, a reduction in the foliation area of plants, flattening of standing grain, drying out flowers, and blowing down fruit. A windbreak that reduces the wind by 40% provides effective protection for crops.

Although windbreaks have been used in Tunisia for some time, the majority of them are incorrectly planted (trees are too close together), poorly maintained, or made up of tree species that are not suitable for the purpose.

Tunisian researchers have shown that, with appropriate species and methods, windbreaks can increase the yield of vegetable and fodder crops by 17 to 100%, depending on the crop and local conditions. Windbreaks can also produce additional income from firewood and poles.

Although the best windbreaks are designed to suit local conditions, they all have some common characteristics:

- **It is important to use several tree species (eg, Eucalyptus, Acacia, Cypress) to avoid the entire windbreak being destroyed by harmful insects; trees of varying heights also offer fuller protection.**

- **Young plants should be protected by plastic-wrapped mulch to minimize humidity loss and to protect them against harmful insects and weeds. They should be watered regularly.**

- **The windbreak should be permeable to allow a certain amount of wind to get through. An impermeable windbreak raises the temperature in the fields, thereby**

damaging the crops. The porosity of the windbreak varies according to the farmer's needs.

- **Since the windbreak occupies about a tenth of the productive land area, it is important that it produces additional income to compensate for the loss in crops. The species selected should be viable for lumber, firewood, and poles. Small fodder or medicinal plants can also be planted at the foot of the trees to create another source of income.**

- **Hedges that are not irrigated will compete with the crops; a space or laneway must therefore be left between the windbreak and the crops. Fruit trees should be planted at least 6 metres from the hedge to avoid competition.**

- **The windbreak should be maintained and pruned regularly.**

- **Costs can be minimized by planting trees 1 to 1.5 metres apart and hedges 80 to 100 metres apart without reducing the windbreak's effectiveness (trees are traditionally planted 60 cm apart and hedges 50-60 metres apart). The trees also benefit from the irrigation provided for the crops.**

In the dry regions of Southern Tunisia, which receive only 100 to 200 mm of rain per year, researchers have studied the optimum methods for protecting crops and structures against the wind and blowing sand. They have tested fences erected perpendicular to the direction of the prevailing winds. The fences that produce the best results are made from either plaited palm-tree leaves or fibre-cement sheets.

Prerequisites

Availability of seeds or seedlings of species suitable for local conditions.

Potential users

Farmers growing crops in regions exposed to frequent, strong winds.

Distribution

A 20-minute videocassette is available, as well as illustrated brochures in Arabic, written in a simple and lucid style. Radio programs have also been produced and extension workshops organized.

Contact

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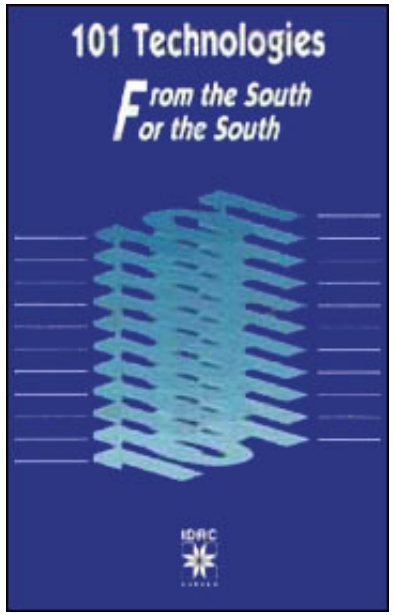
Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw

One Hundred and One Technologies - From the South for the South (IDRC, 1992, 231 p.)
Fishery
28. Non-toxic aquarium fish-catching



- **29. Remote sensing for artisanal fisheries**
- **30. Chinese methods for integrating fish culture with crop and livestock farming**
- **31. Fish spawning kit**
- **32. Rice-fish culture**
- **33. Acadja fish rearing in lagoons**
- **34. Artisanal oyster farming**
- **35. Swimtop a natural piscicide to protect shellfish culture**
- **36. Fish attractors to increase tuna catches by small-scale fishermen**
- **37. Improved technologies for artisanal fishing**

One Hundred and One Technologies - From the South for the South (IDRC, 1992, 231 p.)

Fishery

28. Non-toxic aquarium fish-catching

Coral reefs around the Philippines are the source of 70% of the world's colourful, tropical marine fish. Cyanide is used to catch about 80% of them. It stuns them and makes the fish easier to catch. But it also kills many fish and shellfish along with their eggs and larvae, and creates a health hazard for the fishermen and their families. Repeated doses also kill the coral that provides food and shelter for

numerous fish species, shrimp, lobster, shell fish, and other marine life. Over two-thirds of the coral in the Philippines is damaged. Despite being illegal, cyanide is still used widely by Filipino fishermen each of whom spends more than US $500 a year (about half his gross monthly income) on this poison.

The coral reef ecosystem is a major source of protein for Filipinos. Healthy reefs produce 35 tonnes of fish per square kilometre each year; deteriorated reefs produce only 7 tonnes. Fish account for more than half the animal protein in the rice-based diet of Filipinos. Reduced food supplies and growing unemployment are direct results of the use of cyanide and damaged coral. The coral reefs also used to be a major tourist attraction.

The Haribon Foundation for the Conservation of Natural Resources (the Philippines) and Ocean Voice International (formerly International Marinelife Alliance Canada) have trained Filipino coral reef fishermen to use fine-mesh nets as an alternative to cyanide. Once banned, hand-held nets are now allowed as long as the mesh is large enough to allow fish fry to pass through. The nets do not damage the coral reef, are non-toxic, cheaper than cyanide and more effective.

A thin pleated net made of transparent mesh is draped over the coral. Divers bang bamboo sticks against the coral to get the fish to swim into the invisible net. They then use small dip nets to pick out the fish they want.

A 2-week course that the entire community (women and children included) is encouraged to attend deals with proper use of nets, fish habits, reef ecology, diving skills, and handling of captured fish. Fishermen are paid US $70 to attend.

So far some 300 people have been trained in net fishing and management of the coral reef, and the training team is now 100% Filipino.

Potential users

Communities that engage in aquarium fish catching in Indonesia, Malaysia, the Philippines, and other regions where there are coral reefs.

Cost and availability

The nets cost about US $25 each. For information on suppliers contact Ocean Voice International at the address below.

Contact

Dr Don McAllister Ocean Voice International 2883 Otterson Drive Ottawa, Ontario, Canada K1V 7B2 Tel.: (613) 990-8819 (day) and 731-1755 Fax: (613) 521-4205

Resources and publications

Save Our Coral Reefs is an illustrated educational manual that covers coral reef biology, causes of reef destruction, and what can be done to save the reefs. It is aimed at coastal communities whose livelihood comes from the sea, as well as inland peoples who receive their food from the sea. It is currently produced in English and Indonesian, with a Filipino version on the way. It is hoped the manual will be adapted for use in various countries and languages, substituting local examples and illustrations for those already in the text.

29. Remote sensing for artisanal fisheries

Tuna and swordfish are an important source of revenue for many artisanal fishermen along the coast of Chile. Albacore or white tuna (Thunnus alalunga) and swordfish (Xiphias gladius) are affected by climatic conditions, and are found seasonally in areas where the sea surface temperature varies by a few degrees along persistent (5-10 days) thermal fronts. The fishermen use thermo meters and check the water colour for signs of phytoplankton on which the fish feed. Traditionally, the fishing boats can spend 2 or 3 days prospecting the sea, using up scarce gas and time to find the elusive fish. Prospecting the sea accounts for up to 40% of operating costs on artisanal fishing boats.

Researchers have now developed a method to produce timely maps of sea conditions to assist artisanal tuna and swordfish fishermen. The maps are based on images from the US NOAA-M remote sensing satellite, from which sea surface temperatures and the likeliest fishing grounds can be determined. The Chilean Centre for Space Research (CEE) has a NOAA receiving station and acquires daily images. The project, called SATAL and located at the Universidad Catlica de Valparaiso, uses the data to prepare maps of probable fish locations. Satellite images received by 3:00 pm can generally be consulted the same evening in the communities located close to Valparaiso.

Use of the maps has contributed to an increase in the catch for tuna and swordfish, and has extended the fishing season for these species. While the maps contribute to an increase in revenue and significantly reduce the fishermen's prospecting expenses, they are costly to produce. Mechanisms for making the service self-sustaining are therefore essential.

**Training in the use of the maps has been provided to area fishermen. To increase the independence of the fishermen and lessen the need for time-consuming training, simpler
maps have been devised and a monthly newsletter produced.**

The newsletter, called SATAL Bulletin, provides diverse information of interest to tuna and swordfish fishermen, including articles on equipment, legislation concerning offshore fishing, statistics on catches, the satellite maps, and instructions on their use.

In a second phase, the researchers will develop an information package on the technology for worldwide distribution. They will also investigate the potential application of the technology for small pelagic species.

Prerequisites

To produce the maps: access to satellite images of the desired coastal area and training in their interpretation.

To use the maps: training in the reading of the maps and in basic navigation techniques to find the potential fishing grounds.

Potential users

Artisanal tuna and swordfish fishermen; fishing associations.

Contact

Dra Maria Angela Barbieri, Jefe, proyecto SATAL Escuela de Ciencias del Mar Universidad Catlica de Valparaiso Avda. Altamirano 1480, Casilla 1020 Valparaiso, Chile Tel.: (56-32) 281868/9; Fax: 66-32-28.18.70 Telex: 230389 UCVAL CL

Resources and publications

- **SATAL Bulletin, a monthly newsletter in Spanish produced by the SATAL project and distributed free to fishing associations.**

- **Elementos Bsicos de Navegacin Costera. A publication to assist fishermen in using the remote sensing maps. Includes basic navigation techniques and case studies of problems encountered while using the maps.**

30. Chinese methods for integrating fish culture with crop and livestock farming

The integration of fish, livestock and crop production is an age-old practice in China that has been developed to a fine art. The Chinese system has developed its own characteristics and has attracted world attention. Advantages of this system include:

- **It produces an artificial recycling ecosystem with no waste, reducing organic pollution. For example, livestock and poultry manure are good organic fertilizers for fish farming; combining fish farming with mulberry cultivation on which silkworms can be raised allows the pupae to be used as fish feed and the worm feces and wastewater from silk processing to be used as pond fertilizers. Pond silt can be used as fertilizer for fodder crops, which can be used to feed livestock, poultry, or the fish.**

- **It increases the food supply. By using manure instead of pelleted grain and animal protein fish feeds, the system increases the food available for human consumption. Integrated fish farming can fully use the water, land, and pond silt to increase the food supply. For example, geese and ducks may be raised on the pond, pond dikes may be used for fruit tree and mulberry cultivation or for raising pigs, and dike slopes may be used for fodder crops.**

- **The diverse activities on an integrated farm increase employment opportunities.**

- **There is increased production and income. Currently, pelleted feeds for cultured fish are very expensive. The integrated fish farm produces its own feeds and fertilizers, thereby reducing costs.**

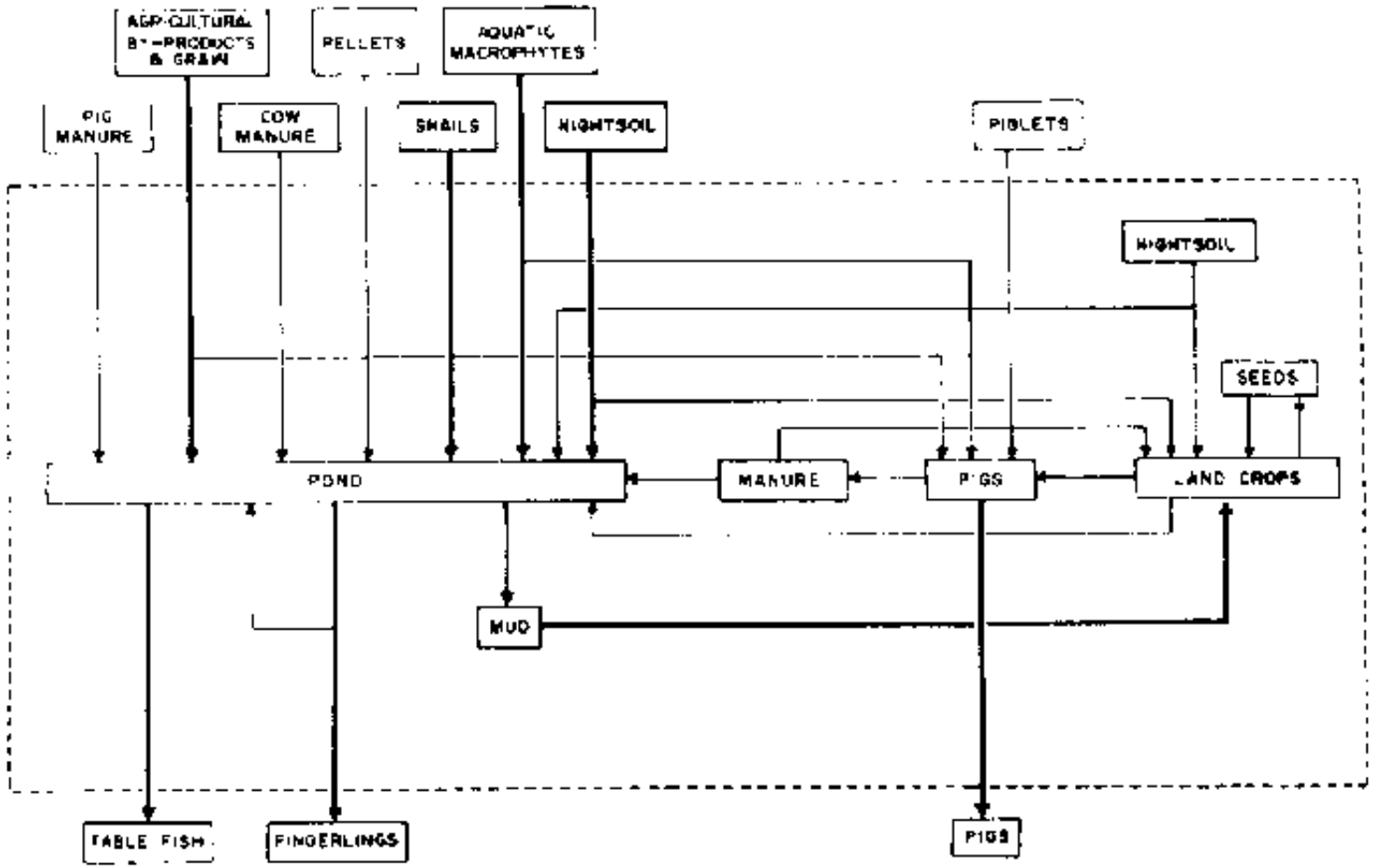
While this practice has been very successful, the reasons for its success have not been systematically identified and vary from region to region.

The Asian Pacific Regional Research and Training Centre for Integrated Fish Farming in Wuxi, China, has been doing aquaculture research for 10 years, and has provided annual training courses for students from Africa, the Asia-Pacific region, Europe, Latin America, and the Middle East. The Centre is devoted to the collection, review, and scientific understanding of the traditional Chinese practice of integrated fish farming and the transfer of the technologies to other parts of the world. They have produced a manual entitled Integrated Fish Farming in China, which introduces the Chinese system and acts as a guide for adapting it to suit local conditions.

Various Chinese integrated fish farming models have evolved according to

different geographical and climate conditions, local agricultural characteristics, socioeconomic conditions and traditional practices. Most fish farms have established complex integrated farming and management systems. For example, the Huzhou sheep provide manure for growing mulberry on which silkworms live; the silkworm dregs are used to feed the fish, the autumn leaves of the mulberry serve as feed for the sheep in winter. Complementary species of fish in the same pond are also used. For example grass carp eat green fodder and their excrete fertilize the water or are eaten by the silver carp.

The Wuxi centre has focused its research on identifying the essential elements that would allow for transfer of the technology to other regions, including: key factors influencing economic returns from the fish farms; the interrelation of economic, energy, and material factors in each system; the optimal species, stocking ratio, and input of feed and fertilizer to meet different local conditions.



Wuxi Fish Farm, Li Yuan People's Commune.

The manual reflects the understanding and experience gained by the workers in the centre, as a result of studies in China and technical cooperation with people from other countries. Because the Chinese system of carp culture is the base level from which integration with other crops, plant and livestock, has evolved, a good portion of the book begins with the biology of the major carp species and the introductory aspects of pond culture. Someone from another country who is new to the Chinese practice of integrated farming needs to understand the basic

biology, reproduction, and culture of Chinese carps. The book then goes on to introduce Chinese and other models of integrated fish farming; management issues; animal raising and plant cultivation on an integrated fish farm; and the design and construction of an integrated fish farm.

The Wuxi centre will be focusing the next phase of its research in three main areas:

- **An analysis of socioeconomic, biological, financial, and management inputs on fish farms;**
- **How to implement research findings to increase income on rural farms;**
- **Development of an interdisciplinary method for analyzing integrated fish farming in China and elsewhere in the world.**

The centre also provides an annual 4-month training course in integrated fish farming for aquaculturalists from developing countries.

Potential users

Aquaculture farmers, co-ops, extension workers, researchers, and scientists interested in maximizing use of available resources and land on fish farms.

Contact

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People's Republic of China Tel.: 667424 or 667892; Telex: 362002 WXHBCN Cable: 3225 WUXI CHINA

Resources and publications

- **Integrated Fish Farming in China, NACA Technical Manual 7, Network of Aquaculture Centres in Asia and the Pacific, Bangkok, Thailand, 1989.**

31. Fish spawning kit

Aquaculture has been practiced in China for thousands of years. An old problem that continues today is the reluctance of fish to breed in captivity, due to their high density in the ponds. It is essential to induce spawning of cultured fish to produce fry for stocking the ponds, because the lack of fish fry limits production.

Canadian and Chinese researchers have now developed a fish breeding kit that will reduce the costs of aquaculture and increase efficiency in fish production.

The technique - called the Linpe method - induces ovulation in female fish by injecting them with a combination of a synthetic hormone and the drug domperidone. The hormone stimulates the sex organs of the fish while the drug inhibits the action of dopamine, a substance produced by the fish that inhibits ovulation.

In traditional fish spawning methods, carp are raised and killed to produce a pituitary extract used to induce spawning. Many fish are sacrificed in the process and the extract has a poor shelf life. This technique also requires that the fish be injected at two separate intervals to induce ovulation.

The new method reduces the cost of production, increases the supply of seed fish, and is more convenient. The rates of spawning, fertilization, hatching, and survival were significantly higher in the trials than could be achieved with pituitary injections. The hormone and the drug can be given together in a single injection, which means that the brood fish stock are handled only once, reducing the risk of disease or damage to the fish. The new method does not alter the reproductive cycle of the fish, and the fertility and viability of the offspring are normal. The solution does not require refrigeration and has a long shelf life. It has been tested on a wide range of fresh, salt, and brackish water species, including carp, bream, salmon, catfish, loach, and others.

The kit consists of a vial of the synthetic hormone, a vial of the drug domperidone, saline solution, and a syringe.

The kit has been distributed in the People's Republic of China through commercial outlets as well as through extension services by Zhongshan University, Guangzhou. Workshops have been held in fish hatcheries and with Chinese farmers to promote acceptance and proper use of the new method.

Potential users

Fish farmers, breeders, and hatcheries around the world. The kit has been introduced in a number of developing countries, including Bangladesh, India, and Pakistan, as well as countries in South America.

Cost and availability

The kit has been commercialized by Syndel Laboratories under the name Ovaprim.

The company has distributors in several countries and the cost of the kit varies depending on volume, import duties, distribution costs, etc. Syndel will refer enquiries to the local distributors. Ovaprim is available in 10 mL and 100 mL vials.

Contact

Syndel Laboratories Ltd 9211 Shaughnessy St. Vancouver, BC, Canada V6P 6R5 Tel.: (604) 321-7131; toll-free line: (800) 663-2282 Telex: 0636700394 MBX CA; Fax: (604) 321-3900

Dr Lin Hao Ren Department of Biology Zhongshan University Guangzhou, People's Republic of China

Dr R.E. Peter Department of Zoology University of Alberta Edmonton, Alberta, Canada T6G 2E9

32. Rice-fish culture

Cultivating rice and fish together has been a 2000-yearold tradition in some parts of Southeast Asia. However, this beneficial cultivation system was gradually abandoned due to population pressures, decreasing stocks of wild fish, and the "Green Revolution" which emphasized high input, monoculture using high-yield rice varieties, pesticides, and herbicides (which are toxic to the fish). The practice, however, has been spontaneously returning, for example, in Northeastern Thailand, where poor farmers cultivate under difficult conditions and use pesticides sparingly.

Rice-fish culture can actually increase the yields of rice (up to 25 or 30% in some

cases) while providing farmers with an important source of protein and extra income. It is a low-cash-input, low-risk technique.

To incorporate fish in a rice paddy, farmers must do the following:

- **They begin by digging a small pond or trench 0.5 to 1 metre deep in a low-lying area of the rice field. This trench becomes a refuge for the fish during planting and harvesting, or when there is little or no water. This also allows the farmer to keep the fish alive well after the growing season.**

- **The excavated soil is used to raise banks around the field for better water control. These banks provide some land above water level, which can be used to grow other crops such as vegetables or fruit trees.**

- **After flooding, the rice is planted.**

- **Fingerlings of carp, tilapia, catfish, or other species are introduced into the trenches.**

- **After 3 weeks, once the rice is well established, the fish are let into the rice fields.**

- **Supplemental feeding varies from none at all to frequent feedings, depending on the farmer and the local conditions.**

- **At harvest, or if chemicals are used, the water is drained and the fish collected from the trenches.**

Benefits of the system include:

- **The recycling of nutrients by the fish through feeding and depositing feces in the soil; this increases the uptake of nutrients such as phosphorus and nitrogen by the rice;**

- **An increase in rice yields;**

- **An increase in income both from the rice and the fish;**

- **A reliable source of protein food for the farmers, countering the decrease in available wild fish in many countries;**

A reduction in insect pests (such as leaf-hoppers, stem-borers and aphids) and weeds, which the fish eat;

- **A reduction in the use of fertilizers.**

Some constraints to the system include:

- **The uncertainty of rainfall and limited irrigation water;**

- **The possibility of water contamination by pesticides, herbicides, and chemical fertilizers, which are toxic to the fish and the organisms on which they feed;**

- **Fish predators such as snakes can lower the fish yield.**

There are many different methods of rice-fish culture, which vary in terms of the types of trenches used, the stocking rates, the fish species used, and the

supplemental feeding. It is important to base rice-fish culture on local farmers' current cultivation methods.

Advantages, drawbacks, and stocking rates for various species of fish can be found in the Sustainable Agriculture Newsletter (see Resources and Publications, below).

Prerequisites

Availability of good water (uncontaminated by pesticides and chemicals). Availability of fish fingerlings of the right size and at the right time, as the timing of the introduction of the fish is critical to the success of the system. This means that rice-fish culture will be more successful in areas where there are local fish hatcheries. However, some farmers allow nature to stock their fields with wild fish, or use various types of traps. If supplemental feeding is necessary, it usually consists of locally available rice bran, termites, vegetables, leaves, etc.

Potential users

Rice-fish farming is a low-cost, low-risk option for poor rice farmers in rice-farming countries, including Bangladesh, China, India, Indonesia, Korea, Laos, Madagascar, Malaysia, the Philippines, Thailand, and Vietnam.

Contact

Dr Achmad Fagi, Director Sukamandi Research Institute for Food Crops JI Kaya 9, Sukamandi, Subang West Java, Indonesia

Mr Niran Tongpan Farming Systems Research Institute Department of Agriculture Bangkhen, Bangkok 10900, Thailand Tel.: 579-5595, 579-0053; Telex: 8447B INTERAG H

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Resources and publications

- **The Sustainable Agriculture Newsletter, Volume 2, March 1990. Contains detailed information on implementing rice-fish culture. Write to: Managing Editor, Sustainable Agriculture Newsletter, CUSO, 17 Phahonoyothin Golf Village, Phahonoyothin Road, Bangkhen, Bangkok, Thailand.**

33. Acadja fish rearing in lagoons

Fish consumption in Cte d'Ivoire is increasing. How-ever, most of the fish is imported since existing stocks can no longer meet demand. Researchers at Cte d'Ivoire's Centre de recherches ocanographiques discovered fish-rearing techniques in Benin that had been adapted to the country's ecosystem, especially the 1200 km² of lagoons suitable for fish rearing. They were looking for a cost-

effective system designed around local materials that would enable the villagers to engage in fish rearing on their own, without outside help.

Acadja fishing is traditionally practiced in Benin. The acadja or "fish pen" is an artificial reef made from branches in about 1 metre of water.

The system has been adapted in Cte d'Ivoire for more modern, intensive rearing with the following modifications:

- **The branches were replaced with bamboo, which is more durable (it lasts for approximately 4 years, whereas one-third of the branches have to be replaced each year). In addition, algae and other organisms can easily cling to the bamboo, providing natural food in sufficient quantities for the fish and eliminating the need to feed them. The yield using bamboo is double that using branches (8-10 tonnes per hectare compared with 5-6 tonnes when using the traditional enclosure). Bamboo grows naturally along the lagoons, where it can also be planted in large quantities.**

- **The enclosures are surrounded by a net that prevents the fish from entering or leaving. The net also stops other fish from being trapped in the acadjas. The system avoids possible conflict between the owner of the acadjas and the traditional fishermen who depend on the other fish.**

- **The lagoon Tilapia is ideal for rearing in acadjas. It can live solely on the algae growing on the bamboo; this reduces the system's demands on the villagers. The rearing of other species, such as Arius gambensis, requires additional food input, which can account for up to half the production costs.**

The first stage in building the enclosures is setting up the nets. After this, the bamboo is spaced every 50 cm around the net, but a small section is left free of bamboo poles. This section gives the owners access to the pen for net fishing. Then the enclosure is stocked. A 2500 m² enclosure may be stocked with 25 000 fry (10 fry per square metre). The enclosure can be stocked artificially or left in a natural state. The fish can be harvested in one of two ways: a single harvest at the end of the year or selective fishing throughout the year using nets that let small fish slip through. According to research results, the preferred method is selective fishing, without moving the bamboo. Acadja fish-rearing generates work in the construction of the enclosure (this requires a lot of manpower for collecting and staking the bamboo) and in fishing - about a dozen people are needed for 5-10 days. At Adiapot in Cte d'Ivoire, the villagers paid about 60% of the costs, excluding the net.

Prerequisites

Lagoon water about 1 metre deep, bamboo, and nets. The construction of the enclosures is highly labour-intensive (approximately 700 person-days per hectare of acadja) and requires some capital expenditure. Some sort of collective organization (cooperative or other) is necessary, given the amount of construction work, capital, and manpower required. A system to protect against poaching is also useful.

Potential users

Governments, NGOs, and groups of fishermen in countries where the necessary conditions exist. The enclosure method is already in use in Southeast Asia, Benin,

Brazil, and Egypt.

Cost and availability

A one-quarter hectare enclosure costs about Can $3700. It is estimated that this sum could be recouped in 1 or 2 years. Maintenance costs are minimal.

Research on simplifying the techniques involved and enhancing the system's profitability is ongoing in Cte d'Ivoire.

Contact

Mr Hem Saurin Centre de recherches ocanographiques BP V18, Abidjan, Cte d'Ivoire Tel.: 35-50-14 or 35-58-80 Telex: Mr SAURIN CRO 22563 ORMSTOM CI Telegram: OCEANO-ABIDJAN Fax: (255) 35-11-55

34. Artisanal oyster farming

Jamaican researchers have adapted and improved oyster farming methods to provide the rural population with an alternative income and employment and to help solve the problem of depletion of natural oyster stocks due to overfishing. Local materials (used car tires, bamboo) and local marine skills can be used for the artisanal farming of mangrove oysters (Crassostrea rhizophorae), which grow naturally in coastal waters on the roots of the red mangrove tree (Rhizophorae mangle).

Oyster farming has the potential to create new or supplementary employment, balance the local economy's dependence on tourism, and provide an alternative

source of protein in the local diet. As well, oyster racks attract more fish closer to shore.

To provide oyster seed, hatcheries were initially determined to be too costly. The technique is to collect oyster spat (young oysters) in the wild by hanging strings of "cultch" (usually 15 x 10 cm pieces of cut rubber tire), separated by 2.5-cm hose spacers, from mangrove and bamboo racks in the intertidal zone. As the tide moves, the spat are caught on the strings and left to feed there and grow to a size of about 2.5 cm after 6-8 weeks.

The young oysters are then sold to the oyster farmer, who suspends them from racks to "grow out" or "fatten." The large oysters are harvested after 3 months, and the others left to grow for 2 more months. They are sold to restaurants and to local vendors.

The mangrove and bamboo racks are built in areas where the water depth is 2-3 metres. Nylon strings are hung from the racks with cultch separated by 15-cm spacers along the string. Bamboo spacers were originally used, but were replaced with old drip irrigation tubing which is available in large quantities, can be reused, and is durable and inexpensive. Racks can accommodate some 200 to 400 strings, with eight cultch pieces on each.

To control the fouling of the spat by other organisms, such as barnacles, colonial ascidinas, and encrusting algae, the oysters must be "exposed" to the air every 2 weeks for 4-6 hours. This kills the organisms that have attached themselves to the cultch and are competing with the oysters for food. This is essential to produce a good yield of quality oysters. The strings are hung over a single upper beam,

which causes less damage than the previous method of laying out the strings on rafts.

Present production is approximately 400 dozen oysters per rack, with a ratio of small to large oysters of 4:1. Market prices in 1990 were J$5 (Can $0.30) per dozen (small oysters) and J$10 (Can $0.60) per dozen (large oysters). Damaged oysters represent between 5 and 15% of the total harvest. Although these were once discarded, they are now processed to make a delicious oyster "punch" blending oyster, boiled roots, alcohol, eggs, and milk products. The drink is becoming very popular among Jamaicans.

Because these oyster farming techniques produce mainly small oysters, several marketing strategies are being implemented to increase farmers" profits from small oysters. These include offering catering services for various events, which use all sizes of oysters and encourage organization and cooperation among farmers; and various processing options, including oyster punch.

Research into oyster farming in Jamaica is ongoing, in an effort to further increase incomes and yields.

Prerequisites

- **Access to sufficient, good-quality oyster seed.**
- **An adequate market demand for the oysters. Tourist areas often provide higher prices and a higher demand for oysters.**
- **The water quality must conform to official standards of safety (maximum of 14**

fecal coliforms per 100 mL of water).

- **Oyster farming requires appropriate sites, protected from rough seas.**

- **Materials needed are mangrove or other hardwood poles and bamboo for the racks, used irrigation hose to make spacers for the strings, monofilament fishing lines, and used car tires to cut cultch and to make floats. Cultch pieces can be cleaned and reused, and even recovered from the sea floor by divers.**

Potential users Fishermen living in coastal areas appropriate to oyster farming.

Cost and availability

It is estimated that an oyster farmer needs 10 racks per season to earn a living, and must hire one extra person for the growing-out period and two people for the harvest. As a supplement to other income, about four racks are needed. A four-rack oyster farm cost J$3000 to J$4000 (Can $180 to $250) in 1985.

Contact

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Resources and publications

- **Oyster Culture in the Caribbean, Proceedings of the Oyster Culture in the Caribbean Workshop, Kingston, Jamaica, November, 1990. Published by the Mollusc Culture Network.**

35. Swimtop a natural piscicide to protect shellfish culture

Shellfish farming, such as shrimp and prawn culture, is an important industry in Thailand, both for the provision of protein in the local diet and for export. However, up to 40% of the crop can be lost to predatory and competing fish such as eels, mullet, sea bass, and tilapia that invade the growing ponds on the coast. A natural fish poison called teaseed cake is used to clear the ponds of fish, but it gives unreliable results and must be imported from China.

Researchers have now developed an alternative natural piscicide from a local plant. Given the trade name SWIMTOP, it is inexpensive, nontoxic to humans and most other nontarget organisms and is effective in killing the invading fish in the pond.

The product is made from the dried crushed leaves of a local small tree which can

be cultivated. It is easy to grow and use and readily available to local fishermen. The active ingredients are called saponins, which are harmless to mammals, do not irritate the skin and do not render the fish inedible.

The commercialized poison comes in the form of a fine powder. A calculated amount of 15 grams per tonne of pond water must be soaked in water for 2 hours. The mixture is then spread into the pond. The poison is absorbed by the fish through the gills. It destroys the gill surface, disrupting the exchange of oxygen. It does not affect the shrimp because of differences in physiology. SWIMTOP is a natural fish poison that breaks down quickly, leaving no toxic residues in the fish or the water. The dead fish are safe for eating. It has the same effectiveness as teaseed cake but is more reliable.

SWIMTOP can be used in both freshwater and brackish water ponds. At a sublethal concentration, it will slow down the fish, which can then be easily harvested from the ponds.

Potential users

Shellfish and fish farmers.

Cost and availability

SWIMTOP has been patented in Thailand and Canada. A company is being established to handle its production, and it is expected to be commercially available in 1993.

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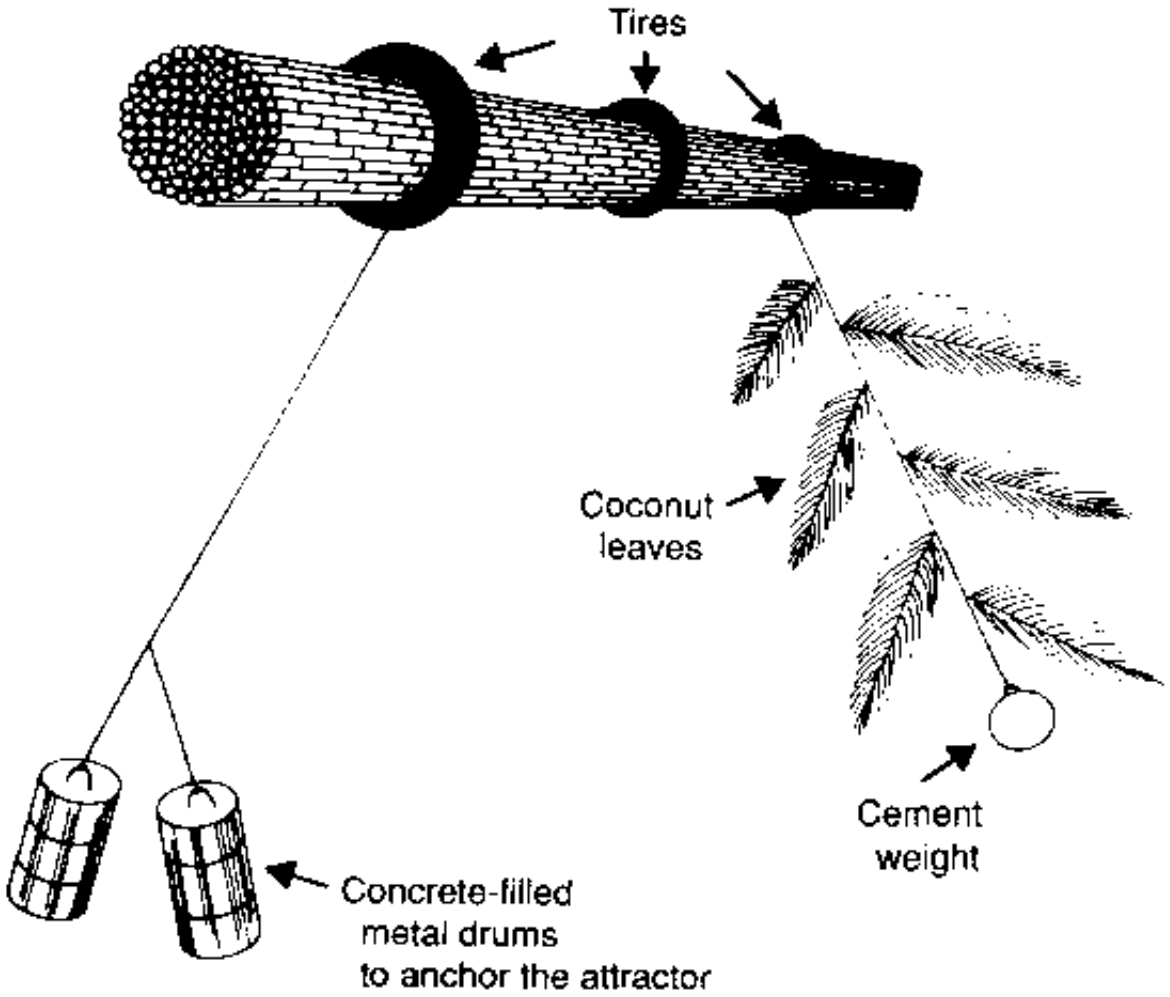
36. Fish attractors to increase tuna catches by small-scale fishermen

Artisanal fisheries account for almost 50% of Brazil's fish catch. In terms of value, tuna is an important resource for these fishermen, who are responsible for an important proportion of Brazil's total tuna catch.

Researchers are helping to increase tuna catches by small-scale fisheries along Brazil's Northeastern coast through a better knowledge of tuna distribution and abundance, and through the use of improved technologies such as artificial fish attractors.



Bamboo payaws (fish attractor)

Fish attractors have been used successfully in Asia by artisanal fisheries to catch live bait and tuna. The principle is simple: a structure is placed under the water and as algae begins to grow on it, it attracts small fish which in turn attract larger fish. Fish attractors are extensively used by commercial tuna fisheries. Simple, inexpensive structures are now being used by small-scale hook and line fishermen.

The fish attractors built in Brazil are floating rafts made of bamboo sticks in a cylindrical form 3 metres long and 1 metre in diameter. From this construction hangs a comb-like array of dried coconut leaves and pieces of discarded fishing nets. The fishing nets provide more surface area for drifting organisms on which small fish feed. A 200-litre drum, filled with concrete, acts as an anchor for an individual attractor or group, and is tied with steel and polypropylene ropes. The attractor is installed at a depth of 100 to 300 metres.

Once a concentration of tuna and tuna-like species occurs, fishermen can harvest as much as 100 to 200 kg per day using hooks and lines. Larger-scale fishermen use a boat with a light at night to keep the fish concentrated under the attractor. At dawn, the "light boat" detaches the line of coconut leaves and lets them drift away from the attractor. Another boat with purse nets surrounds the "light boat" with nets and pulls in the catch. The line of coconut leaves is returned to the attractor to produce another concentration of fish.

Fish attractors can also be made in different shapes and with different materials, such as steel rafts or marker buoys.

They can be used in fresh water lakes and rivers to catch species such as catfish, mudfish, and carp.

In Brazil, data is being collected on tuna distribution, abundance and seasonality, and training is being provided to local fishermen's cooperatives in implementing a tuna fishing program using the fish attractors.

Prerequisites

Fish attractors can be made from local materials such as bamboo, coconut branches, steel drums and concrete. A good knowledge of local tuna distribution and abundance is needed, as well as training in the use of the attractors.

Potential users

Small-scale fishermen, particularly of tuna and other pelagic species.

Contact

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37. Improved technologies for artisanal fishing

Lake Victoria, the world's second largest fresh water lake, is shared by three East African countries: Kenya, Tanzania and Uganda. The lake is surrounded by lake-shore savannah, which is characterized by low and unreliable rainfall. There is little arable land and agriculture is at the subsistence level. Fishing, and the processing and marketing of fish are therefore important economic activities for the people living around the lake. The fishery is a primary source of food and employment in the area.

The fisheries in Kenya's portion of the lake have changed in the last 10-15 years, due to changes in species and the discovery of export markets for frozen Nile perch filets. The resulting increase in commercial fishing has transformed the

fisheries. For example, women, who represent 75% of those engaged in artisanal processing/trading of fish, are increasingly being marginalized. Production, processing, and marketing have become more and more technology-dependent, making it difficult for women to stay in the industry. The fish species of interest to both commercial and artisanal fisheries are Nile perch (Lates niloticus) and omena (Engraulicypris).

The export of local fish has also reduced the supply of locally available, relatively inexpensive protein.

IDRC is supporting research by the University of Nairobi to determine the condition of artisanal fishing in the region. The researchers are looking at ways of improving the earnings of rural women fish processors and traders, through improved processing methods. The research also focuses on the socioeconomic status of fishermen and fish traders, why they succeed or fail, their linkages to other parts of the economy, and marketing channels.

The small-scale processors and traders must acquire new skills and tools to compete effectively with larger, export-oriented fisheries. Improved processing techniques will increase both the shelf life and the value of the various fish products. Longer shelf life in turn allows for market expansion and increases the economic value of the fish as well as nutrition levels in the population.

At the level of improved technologies, efforts are being made to identify new strategies for the participation of women's groups in Nile perch processing and marketing, and to develop improved techniques for fish handling, smoking, and marketing. More efficient Nile perch smoking kilns appropriate and acceptable to

the fish processors are being field-tested and adapted to local conditions. Improved drying and smoking kilns that use only one third as much fuelwood as traditional practices were developed in a previous project.

Omena is preserved by sun drying. Several constraints to effective and hygienic drying indicated a need for improved drying racks. Substantial reduction in post harvest fish losses can be obtained from the improved omena drying technology currently being tested.

At the training level, an effort is being made to train fish processors in special skills, such as business management, that are relevant to development in fishing communities. Components of the training are improved market distribution, accounting and bookkeeping, better organization and stability in women's groups, cooperatives, and bank loans.

Artisanal processing is not proposed as a replacement for large commercial-scale processing. What is needed is to establish the conditions for both to coexist.

Potential users

Artisanal fishermen and fish traders/processors, mostly women, along the coast of Lake Victoria. The results will be applicable to the Tanzanian and Ugandan shores of Lake Victoria. Improvements can be transferred to fishing communities on other lake fishing areas in East and Southern Africa.

This project will forge links with personnel in Tanzania where work on artisanal fish processing is being supported through the UK-based Natural Resources Institute (NRI). Links with similar activities in West Africa are being pursued.

Contact

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Resources and Publications

Artisanal Fisheries of Lake Victoria, Kenya. Options for Management, Production and Marketing. Proceedings of a Workshop held in Kisumu, Kenya, 24-26 November 1988, 158 pp. Gilbert E.M. Ogutu (ed.), 1991. Shirikon Publishers, Nairobi, Kenya.

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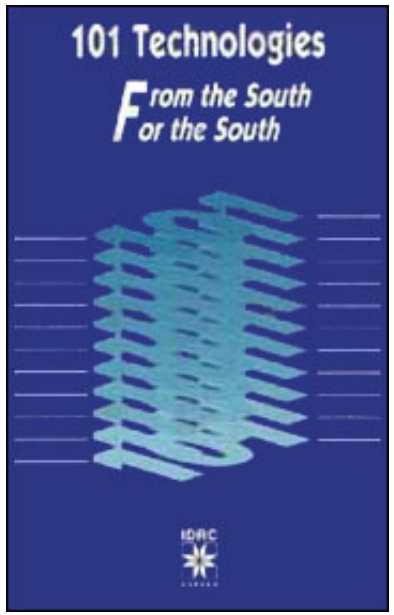


One Hundred and One Technologies - From the South for the South (IDRC, 1992, 231 p.)

- **Energy**
  - **38. Micro-hydroelectricity potential in rural areas**
  - **39. The partial carbonization of peat to make domestic fuel**
  - **40. The ceramic jiko stove**
  - **41. Integrated wood-based energy system**

One Hundred and One Technologies - From the South for the South (IDRC, 1992, 231 p.)

Energy

38. Micro-hydroelectricity potential in rural areas

In the remote and poor Northeastern province of Misiones in Argentina, the Instituto de Economia Energtica has developed a method for identifying micro-hydroelectricity potential over large areas of remote countryside and matching it with the electricity required by rural households.

The method was developed to identify the lowest cost option for providing electricity to rural areas, as well as to provide economic information and policy recommendations for policymakers.

Although the importance of energy to rural communities is recognized, the provision of electricity has been hampered by low population densities and the limited purchasing power of rural people. The research undertaken by the Rural Energy Technology Assessment and Innovation Network (RETAIN) in Misiones showed that decentralized micro-hydro plants can be an attractive alternative to trying to integrate rural areas into a "central grid" system.

Three alternative micro-systems were studied:

- **Micro-hydro systems, consisting of easily built dams on small rivers and streams (using earthfill and rocks), connected to a micro-turbine and generators. The capacity ranges from 4 to 50 kilowatts (enough for one family or a few**

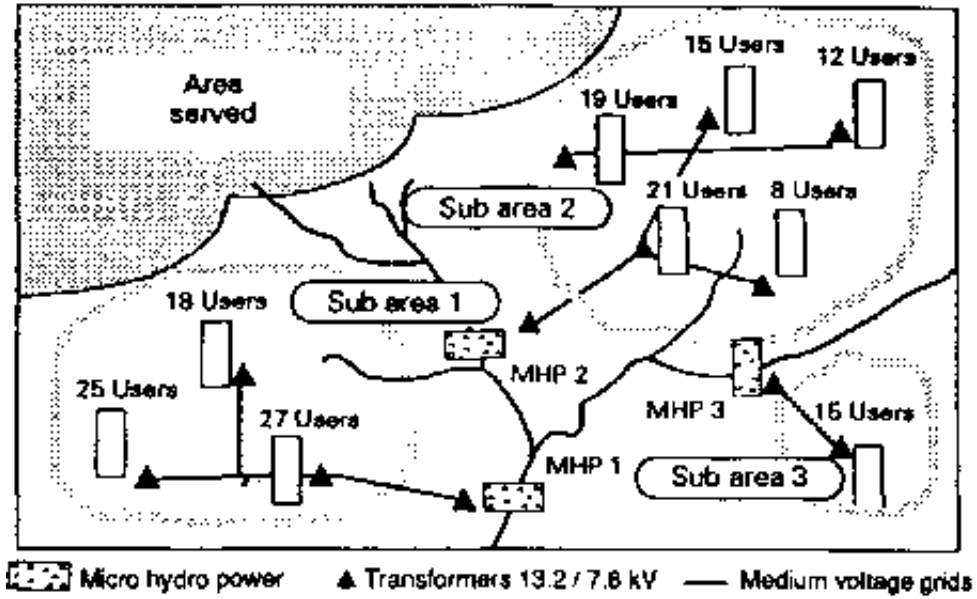
households).

- **Thermal systems, fueled by diesel or gasifiers using charcoal (capacity 4 to 50 kilowatts).**

- **Wind systems, using a three-blade design, direct current generators and storage batteries.**

The method for identifying the potential of these small energy sources consists of six modules:

- **A "diagnosis" of the region's socioeconomic and energy situation, including the underlying processes of wealth creation and their effect on energy consumption;**



Figure

- **A survey of energy requirements, based on an analysis of people's energy needs as distinct from their ability to pay (up to 70% of electricity needs can't be paid for by rural users);**

An assessment of the potential of the area to supply energy from different sources;

- **A map of electricity needs overlaid with the locations of potential micro-plants, as well as existing power stations and distribution lines;**

- **An evaluation of alternative packages, i.e., central grid electricity, decentralized micro-plants (thermal, hydro, or wind), or combinations of the above, with cost comparisons;**

- **Development of preliminary policy recommendations, including the impact of different options on elements of the macroeconomy, such as employment, the development of local industry, and the use of foreign exchange.**

The project has gone on to a second phase to look at the legal, institutional, and financial mechanisms for using decentralized micro-hydro plants, as well as potential markets and the necessary planning for organizing and managing decentralized systems. This includes looking at the availability of credit from financial institutions, the availability of local suppliers and the ability of people to install and maintain the equipment.

As well, research is being done on how small-scale microhydro plants can be replicated over larger areas, and how they can be integrated with a central electricity system (for example, by transfering subsidies from the central system

to users of micro-hydro plants). They are looking at how to overcome opposition to decentralized provision of electricity and have already had an impact on policy-makers and energy companies in the country.

Potential users

Rural people would be the main beneficiaries of a small-scale electricity supply system. The method for assessing its potential can be used by governments, utility companies, NGOs, and policymakers wishing to expand microhydro projects to a full-scale rural system of electricity supply, and to overcome resistance to integrating small-scale systems within the central grid. Some interest has already been shown by policymakers and utility company officials in Argentina.

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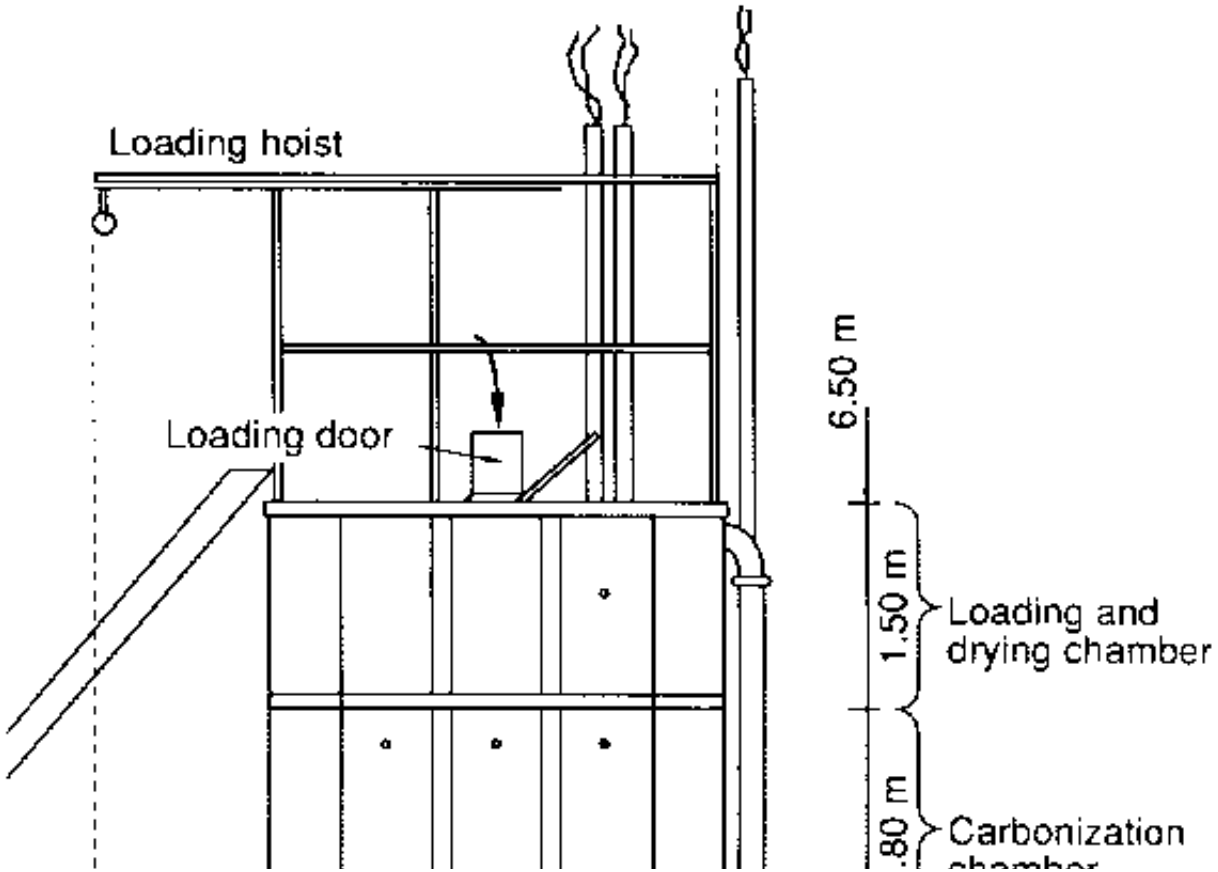
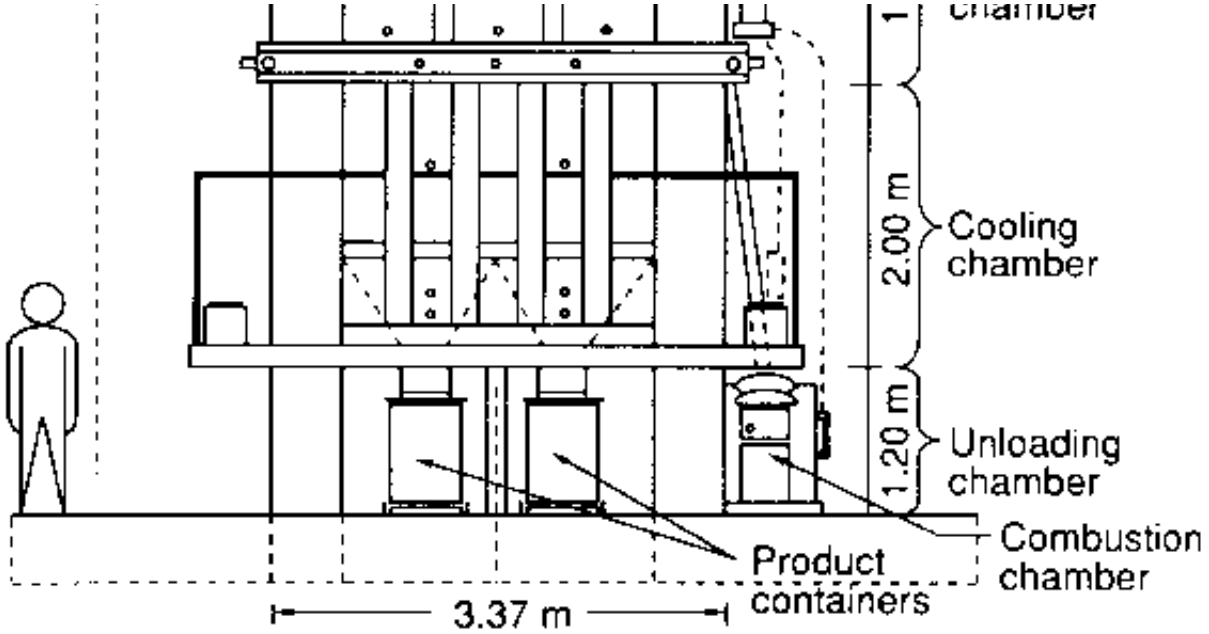
39. The partial carbonization of peat to make domestic fuel

Like many other African countries, Burundi suffers from a shortage of firewood, which accounts for 90-95% of the energy used in the country. The price of charcoal is rising steadily and deforestation is a serious problem. However, Burundi has peat reserves of up to 1 billion tonnes. Peat is already extracted in small quantities for use as fuel in some institutions, including the armed forces and small factories. However, untreated peat is not readily accepted as domestic fuel because of the thick smoke and unpleasant smell it produces.

With the assistance of the Socit d'ingnierie Cartier (Canada), Burundi's national peat marketing agency, the Office national de la tourbe du Burundi (ONATOUR), has developed a small-scale procedure to transform untreated peat into an acceptable fuel for small industries and household use. Peat coking (total carbonization) is a costly process that requires sophisticated equipment, whereas partial carbonization is considerably less expensive and can produce acceptable fuel. This method, which can by used both by small and large industries, consists of the following stages:

- **The peat is cut, macerated and dried in the sun.**





Experimental kiln

- **It is put into an oven and pyrolyzed until partial carbonization occurs.**

- **This procedure produces biomass charcoal that is then cooled, sifted to remove any particles that are too large, mixed with water and a binder (such as molasses), formed into briquets using a press, and dried. The biomass charcoal produced using this method contains 40-45% peat.**

The combustion of the bricks was greatly improved by mixing the peat with agricultural byproducts, such as rice husks, coffee hulls, and wood shavings. The briquets now consist of at least 50% vegetable products and are accepted by customers.

The pilot factory in Burundi can produce up to 4 tonnes of biomass charcoal per

hour. Biomass charcoal is clean and efficient. Given the poor reputation of untreated peat as a fuel, an education program is required to convince users that the briquets do not have the same drawbacks as untreated peat.

This new technology might help reduce deforestation in the country. The pilot factory created 75 new jobs as well as work in the peat bogs.

Prerequisites

Peat reserves; binder (such as molasses or manioc flour). The pyrolysis oven can be made using local methods and materials. The pilot oven, made from fire brick and cement, covers approximately 18 square metres and costs about Can $25 000 to build. The press for forming the briquets is imported and costs about Can $60 000. An improved version, made in Niger, has a completely sealed metal outer layer and an interior made from fire cement.

Potential users

Small rural industries in countries that are experiencing energy problems and have peat reserves (including Bangladesh, China, Rwanda, Senegal, Sri Lanka, and Zaire).

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40. The ceramic jiko stove

In Kenya, 80% of urban and 10% of rural families use the traditional metal "jiko" charcoal stove for cooking. The remaining rural households use firewood on a three-stone fireplace. Wood is the main energy source for cooking, light, and heat in many East African countries (80% in Kenya, 96% in Tanzania, 90% in Uganda). To help address the deepening deforestation crisis, researchers at KENGO (Kenya Energy and Environment Organisations) have developed a more energy efficient jiko.

The new stove uses up to 50% less fuel and is light (3-6 kg) and portable. Ideal for low-income families, it reduces the cost of fuel while decreasing cooking time. For example, water can be brought to a boil faster and for a longer period using the improved jiko. Because of its shape, the stove's heat is directed only to the

desired location, right under the cooking pot.

The ceramic jiko lasts approximately 30 months with intensive use, longer than the traditional jiko. The outside casing is made of metal and produced by local crafts-people. The ceramic inner lining is produced by large and small enterprises, including several women's groups.

Since the new stove costs slightly more than the traditional version, there is a need for educating people on the savings in fuel costs. The cost of the jiko can be recovered in fuel savings in 2-3 months. Savings to the country's forests have been estimated at 206 000 tonnes of wood or 570.000 hectares of trees per year, with some 70 000 improved jikos in active use.

Aside from KENGO, several NGOs, including CARE (Kenya), have worked with women's and community groups on the production, demonstration and dissemination of the stoves.

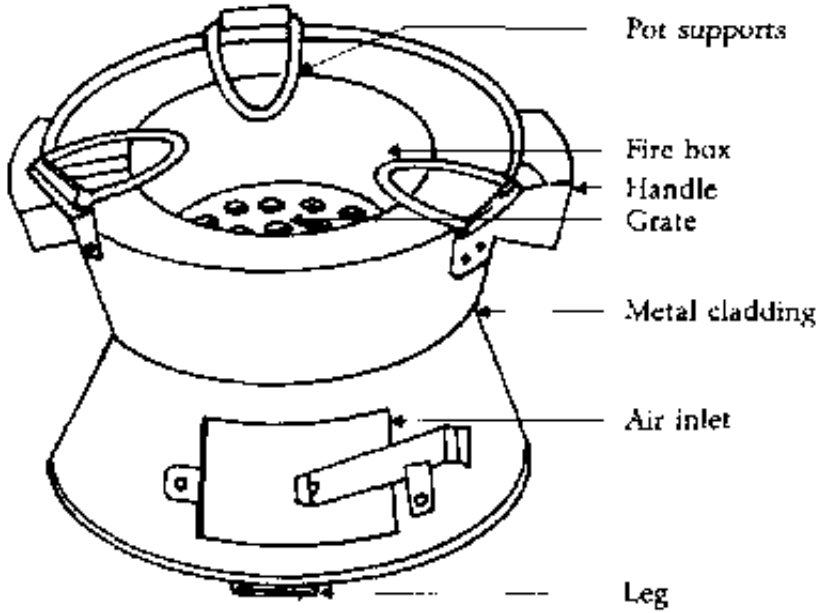
With the success of the domestic ceramic jiko, researchers have developed an improved institutional stove for rural hospitals, clinics, schools, and prisons. These institutions traditionally use fuelwood and charcoal as their main energy sources, and thus contribute to the country's fuelwood crisis. Increased costs of fuel put a major strain on their resources.

The institutional ceramic jiko is based on the same model as the domestic jiko, with a metal outer shell and a ceramic or vermiculite inner lining. It measures 30 to 50 cm in diameter and can last for up to 5 years. Fuelwood savings can reach 50%. Cooking time is reduced and there is less gas emission than with other types

of institutional stoves. As well, a water jacket can be added to the stove to warm water and prevent heat loss from the metal sides of the stove, allowing it to be handled even while in use.

Prerequisites

The use of the stove requires access to fuelwood or charcoal. Production of the stoves requires ceramic material and scrap metal. Training has been provided by KENGO to other regional NGOs in the manufacture of the new jiko. Quality control is an important factor in maintaining the improved efficiency of the stove.



Stoves requires ceramic material and scrap metal

Potential users

Domestic ceramic jiko: rural and urban low-income families.

Institutional ceramic jiko: hospitals, schools, prisons, and any institutions that use fuelwood or charcoal as their main energy source.

Cost and availability

The trade name of the new domestic jiko is Kimathi Jiko, and it sells for 55 to 75 Kenyan shillings, or Can $2 to $3. The institutional stove sells for 25 000 to 30 000 Kenyan shillings, or close to Can $1000. The institutional stove is designed to cook for at least 100 people, using 50-litre or larger cooking pans.

Suppliers of the stoves include:

Domestic jiko:

- **Program Officer, Wambugu (Central Highlands), PO Box 5069, Nyere, Kenya**
- **Mr Richard Kimani, Jerri International, PO Box 52747, Nairobi, Kenya**

Institutional stoves:

- **Mr C.J. Davey, Bellerive Foundation, Ngong Road, PO Box 42994, Nairobi, Kenya Tel.: 254.2.720 274; Fax: 254.2.726 547**

- **Charles Gitundu, Rural Technology Enterprises, PO Box 28201, Nairobi, Kenya, Tel.: 796352**

Contact Kenya Energy and Environment Organisations PO Box 48197, Nairobi, Kenya

Resources and publications

- **Wood Energy in Kenyan Institutions, A Summary of Research Findings, KENGO Wood Energy Series, 1988, 14 pp.**

41. Integrated wood-based energy system

In remote areas where electricity is unavailable and where other fuels are too costly, people meet their energy needs by using wood for fuel or to make charcoal, both of which are environmentally damaging. Charcoal kilns can cause serious air pollution. In response to this situation, the government of the Philippines is seeking to reduce deforestation by establishing tree farms using fast-growing Leucaena species.

The Forest Products Research and Development Institute in the Philippines is using the potential of the tree farms to develop a small-scale biomass energy system that provides rural areas with small decentralized electricity plants. The technology centres on a charcoal-producing kiln and is appropriate for areas where fuelwood is abundant and lump charcoal production is already an industry. Combustible waste gases emitted by the kiln during carbonization, which otherwise pollute the air, are captured, cleaned, and used with about 50% diesel fuel to run a power generator.

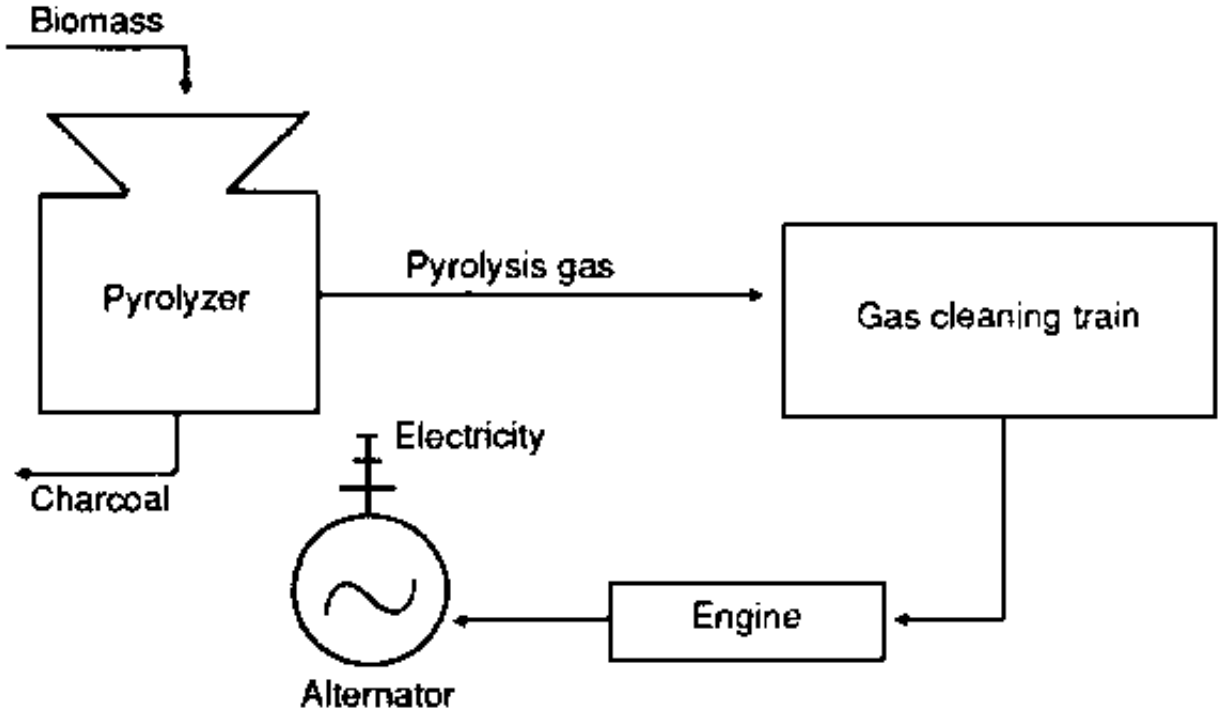
In a first system, four sets of charcoal kilns are used to generate the combustible gases and heat energy. The simplified second system adopts a biomass pyrolyzer that produces charcoal and combustible gases using agricultural wastes such as sawdust, rice hulls, coffee bean hulls, cocoshells, and wood chips. Both systems

are backed up with a gas cleaning and cooling train and an electric generator run off a diesel engine.

The setup also generates byproducts such as better-quality charcoal, wood tar, and heat energy to operate a dryer. Ashes from the kilns are used as fertilizer. The system can also be adapted to run small buses, fishing boats, rice threshers, irrigation pumps, and small ice plants.

Prerequisites

An established source of agricultural and forestry wastes to supply the system and available technical support to operate the system. The annual fuel requirement to sustain the first system (charcoal production) is 2700 cubic metres of wood. It produces 200 tonnnes of charcoal per year, and can run a 12.5 kW electrical plant. The second system (biomass pyrolyzer) uses 20 kg per hour of agricultural wastes. It produces an estimated 9.6 tonnes of charcoal per year and can run a 12.5 kW power plant. The initial capital cost of setting up the plants is approximately Can $1600 for the charcoal kiln system, and Can $1400 for the pyrolyzer system. It is estimated that these costs can be paid back within 2-4 years.



Charcoal production

Potential users

Communities in remote regions without electric power, particularly where there is abundant wood from tree farms and where charcoal production industries already exist; small businesses or government services, such as rural hospitals and clinics; and villages requiring a reliable, low-cost energy system.

Contact

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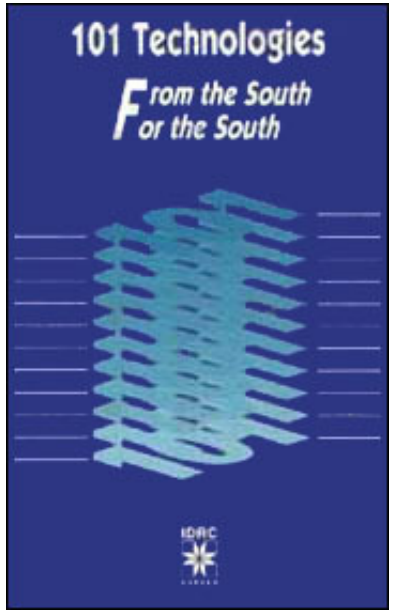

One Hundred and One Technologies - From the South for the South (IDRC, 1992, 231 p.)

Environment

42. Iguana farming for food and tropical forest preservation

The green iguana (Iguana iguana), indigenous throughout Central America, has

been traditionally used as a source of food by Latin American farmers who refer to the tasty reptile as "chicken of the tree" (gallina de palo). Unfortunately, over hunting of their eggs and meat and the destruction of their tropical forest habitat has caused a sharp decrease in the iguana population. They are classified as endangered in some countries and are extinct in others.

Iguana image

The Fundacin Pro Iguana Verde (FPIV) in Costa Rica is implementing a program for the conservation of green iguanas by successfully breeding and raising them in captivity for reintroduction into natural areas. Iguana farming offers an alternative source of food for local consumption and can increase the income of farmers with secondary production activities using skins and other products, such as fat and eggs for medicinal purposes.

The green iguana is the only iguana that lives and feeds on trees. Iguana farming offers an economic alternative to cattle ranching while protecting the natural habitat of the iguana - the tropical forest. Iguana management is designed to be one component of other productive activities in Latin American farming systems. It provides incentives for reforestation, which in turn counteracts erosion, conserves water resources, and enhances soil fertility.

The key elements of iguana farming are reproduction in captivity, controlled incubation, and raising hatchlings in captivity. Once the hatchlings are 7 months old they are released into forested areas on farms, where they grow to harvestable size in two additional years. It is estimated that iguanas can yield as much protein per unit area as cattle. Essential components of iguana farming are the restoration and protection of the tropical forests for food and habitat.

To create the farms, enclosures are constructed with sheet-metal walls sunk 30 cm into the ground. Inside, the animals sleep in shelters made of bamboo and vegetation. Each shelter has an adjustable entrance slit through which young lizards can slither, but predators, which are usually larger, cannot. Most are set on stilts and food is served in the shade underneath. With this system, 20 to 60 young iguanas are kept in an area of 10 ma (0.5-0.17 m² per individual). In

another "high density" design, 30 hatchlings are kept in cages 1 m² (only 0.05 m² per animal). The iguana farms also include an artificial nest consisting of a "tunnel" leading to a sand-filled egg-laying chamber. Both tunnel and chamber are made of predator-safe material and are easily accessible by the farmer.

Artificial nests increase the number of hatched eggs and their survival rate to 90%, versus 50% in the wild. Using food supplements (iguana chow) it is estimated that the population can be maintained at 6 to 10 times the level possible in a rainforest, or around 50 adult iguanas per hectare. Iguana chow is a mixture of broken rice meal, meat meal, bone meal, fish meal, papayas, mangos, bananas, avocados, and a variety of leaves and flowers. Smallholders can erect simple feeding stations and keep them stocked with table scraps or weedy vegetation. This makes for very low-cost production before the iguanas reach harvesting size.

Presently work is being carried out to study existing legislation, land use, natural resource management policies, and socioeconomic settings in target areas in Costa Rica, Panama, and Guatemala. The goal is to establish optimal conditions for sustainable production and marketing of the green iguana to benefit the small farmer.

Cost and availability

The main investment is the cost of the enclosures. The cost of raising the iguanas to usable size entirely in captivity is too high to be profitable. Releasing the iguanas at 6-10 months into forests, farmland with scattered trees, or into village backyards considerably reduces costs. The economic feasibility of iguana management will vary according to social and environmental circumstances.

FPIV will establish collaborative projects for the transfer of technology providing that environmentally beneficial conditions are met. A farming manual will be made available to collaborators .

Farmers living

Potential users

Farmers living close to tropical forest areas from Mexico to northern Brazil and Peru, including a number of Caribbean islands. Small patches of remnant forest encountered on farms and buffer zones surrounding protected parks provide adequate habitat.

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Resources and Publications

- **Stoney, C. The day of the Iguana. VITA NEWS, October 1987, p. 3-8. (a short description of the Iguana Management Project in Panama, sponsored by the Smithsonian Tropical Research Institute).**

- **Microlivestock. Little-Known Small Animals with a Promising Economic Future. BOSTID and NRC, Chapter 33, p. 347-353. National Academic Press, Washington, DC, 1991.**

- **Werner, D.I., and Rey, D.I., El Manejo de la Iguana Verde; Tomo I: Biologa. Fundacin Pro Iguana Verde and Instituto de Investigaciones Tropicales Smithsonian, Panama. 42 pp.**

43. Industrial waste exchange system

In the Philippines, pollution problems are compounded by the fact that most pollution control equipment and methods are too costly for the Philippine economy. Disposal of industrial wastes is becoming a major concern. As an alternative to costly and environmentally unsound disposal schemes, the Environmental Management Bureau of the Department of Environment and Natural Resources, with assistance from the Geotechnical Research Centre of McGill University in Canada, has developed an industrial waste recycling system, based on reusing the wastes in-house or transfering them to another industry. The idea is to use production residues that are in fact raw materials in the wrong place.

The project, called Industrial Waste Exchange - Philippines (IWEP), provides a contact point between industries that want to exchange materials. It is also an information centre providing lists of companies, as well as technical information and assistance on waste management. Project staff will also collect and analyze waste samples when a company is unable to do so in-house.

The system works through a directory of available and wanted materials, that is published twice a year. The entries are coded for confidentiality, and classified into the following categories: acids, alkalis, solvents, plastics and rubber, metals and metal sludges, wood and paper, other inorganic chemicals, other organic chemicals, oils and waxes, textiles and leather, and miscellaneous. Each material listed has a location code, a company code, and technical specifications such as its physical state, pH, colour, contaminants, etc.

Companies can fill out a listing form, free of charge, to be included in the

directory. Although IWEP will put two companies in touch with each other, all agreements are negotiated directly between the generator and the potential user of the waste. In 1989, some 40 negotiations were underway in the Philippines.

Some examples of exchanges include:

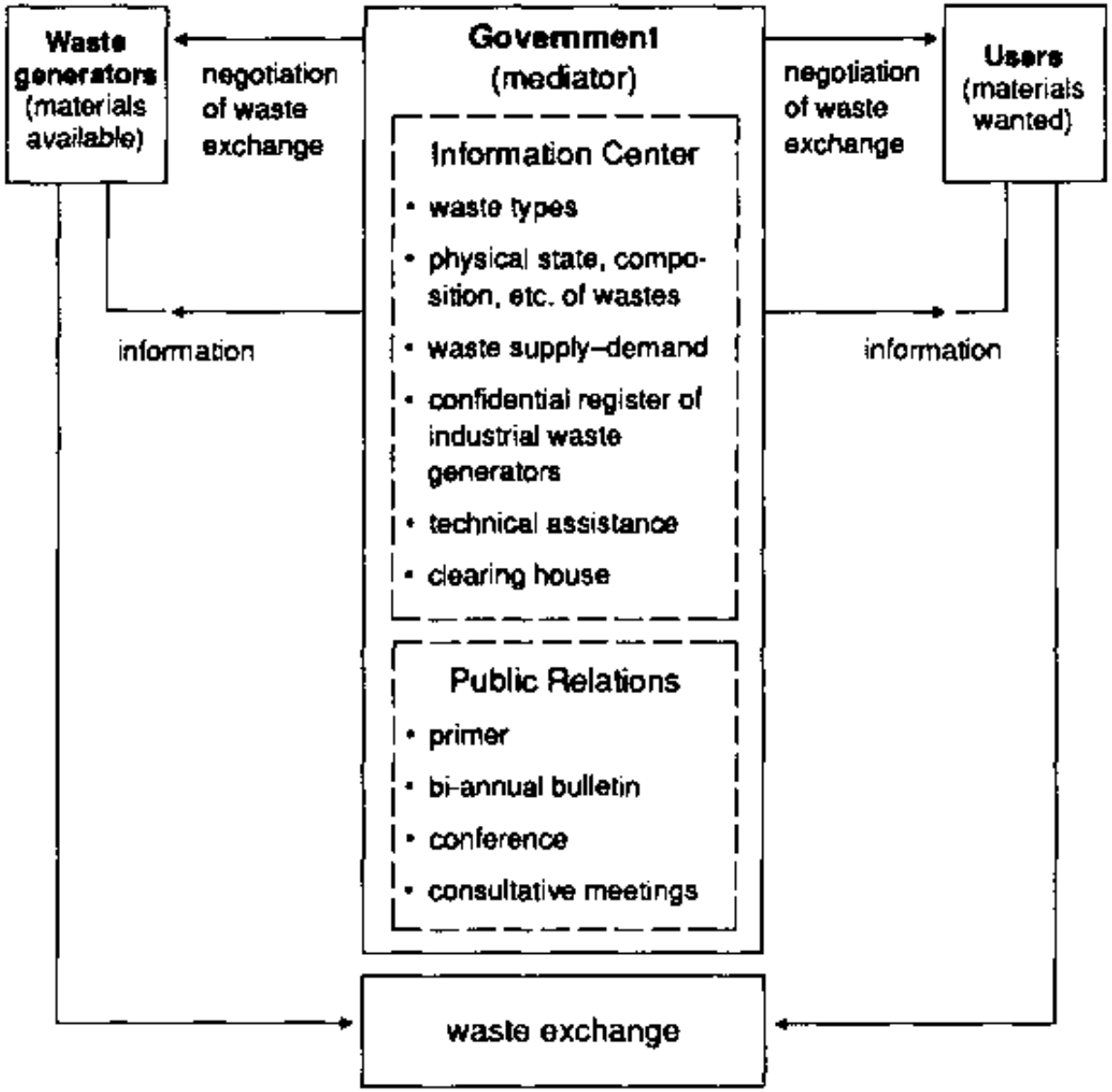
- **Using calcium carbide sludge as a neutralizing agent in wastewater treatment plants;**
- **Using pineapple pulp waste for cattle fattening;**
- **Using waste shrimp heads as an animal feed component;**
- **Using gypsum waste for wall boards and for cement production.**

Two conferences on waste exchange were organized in 1988 and 1989, bringing together government and industry. The purpose was to explain the system, introduce new technologies in waste recycling, provide information on waste exchange and utilization, and encourage participation. The conferences were seen as essential elements in the success of the system.

The system has the potential to reduce environmental pollution, improve the economy through the recovery of usable resources, and reduce disposal costs as well as the costs of raw materials.

Potential users

Environmental ministries and organizations. Industries of all kinds can benefit from the system.



Industries of all kinds can benefit from the system

Contact

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44. Recycled plastic sheets for greenhouses

In the past two decades, the use of polyethylene (plastic) films for greenhouses and for mulch has increased dramatically in the Third World. Between 1967 and 1987 in Jordan, for example, the use of plastics for greenhouses doubled every 2 years, then doubled every 3 or 4 years. Jordan began producing its own plastic films, but this entails importing plastic pellets to make the sheets. As well, the sheets are now causing a major environmental problem regarding their disposal: lasting only 1-1.5 years, they are then either discarded in neighbouring land or burned. Discarded plastic has been responsible for the deaths of cattle who have ingested it while grazing.

Researchers in Jordan have now developed a process to recycle used plastic sheets in the production of comparable quality, less expensive films for mulch and greenhouses. The new process will lower costs for farmers, decrease pollution from plastics, and reduce imports. As well, it has the potential to increase employment, both in production plants and in the collection of the waste plastic.

The process used is called coextrusion, which allows for the combining of layers of different materials to create a stronger and more resistant plastic. The new recycled plastic film is made up of two layers: a highly stable upper layer made from virgin plastic, and a bottom layer made from recycled plastic. In Jordan, used plastic sheets are readily available for recycling, reducing the need for imported plastic. It is estimated that a reduction of 20 to 50% in material costs occurs when using recycled plastic. The new sheets contain up to 50% recycled plastic, and have properties similar or better than virgin plastic films.

Prerequisites

Access to used greenhouse plastic films. The production plant requires a coextrusion machine, a fairly expensive item (US $240 000 to $400 000), 620 Kwh of electrical power, and 25 m of water to clean each tonne of used plastic. To save on water costs a closed system is recommended with a water recycling plant. The plant employs 10 people: two operators, two assistants and six labourers.

Potential users

There are plans to disseminate the technology to small and medium-sized plastic film producers in Jordan, Syria, Iraq, Turkey and Egypt. Currently the technology

is being used in Jordan and Egypt, where it is being adapted to local materials and conditions. Researchers in Egypt are investigating as well the potential for using polyvinyl chloride (PVC) instead of polyethylene, which could reduce costs by as much as 45%.

Cost and availability

Raw materials (used films) cost about US $57 per tonne in Jordan. Total production costs for making regenerated plastic pellets from the used sheets is US $215 per tonne. Actual production of the two-layered recycled sheets runs from US $960 to $1150 per tonne for materials (depending on the thickness of the different layers), with production costs (covering salaries, water and electricity) at $500 per tonne. The coextrusion machine is the most expensive item, ranging from US $240 000 to $400 000.

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45. Electronic networking for african environmental ngos

Many obstacles exist in Africa which hamper the effective inter-communication of nongovernmental organizations (NGOs). This in turn prevents African NGOs from providing effective input as a group to international consultations such as the United Nations Conference on Environment and Development that was held in Brazil in 1992.

Electronic communications have the potential to strengthen NGO networking by increasing their capacity to exchange mail, discuss issues, and share information rapidly and at lower cost than through mail, fax, telex, and phone calls. The poor quality of voice telephone lines, the slow implementation of phone systems with packet switching, and fluctuations in the availability of electricity have all caused Africa to lag behind Asia and Latin America in electronic communication. As well, governments may not be supportive, seeing computers and modems as a security problem or as a source of revenue through high import duties and fees.

The Environment Liaison Centre International (ELCI), in Nairobi, has become a

focal point of a networking project that will build on initiatives to develop a resilient, expandable, and directly interconnected NGO network in Africa. Through the use of microcomputers, modems, and common communications software, the network has, among other things, strengthened NGO capacity for information-sharing and advocacy work, and given NGOs access to new information, including documents and inputs of the preparatory meetings leading up to the UNCED Brazil 92 conference.

Participating institutions share responsibility for the risks and investments of the network. The aim is to develop self-sustaining networking nodes at the national level in several countries, which are linked to regional as well as international networks.

The African network was begun by creating or strengthening electronic links among organizations in Dakar, Harare, Nairobi, and Tunis, which can then be linked through the UK-based network GreenNet to NGOs around the world. In each of these cities, independent but interconnected low-cost DOS-based bulletin boards can be accessed by the NGO "end-users" participating in the network. These bulletin boards need only a small user base to be cost-effective, and they run on regular telephone voice lines.

Modems and software have been provided to some 40 users, along with training and online support. The network hopes to expand by building the capacity in end-users and operators to train new users. A short course and installation manual for the bulletin boards have been developed in English; French and Arabic versions are planned. Half-day workshops and users' manuals have also been developed for the end-users of the network. Each user is expected to pay their telephone costs.

Prerequisites

To participate in this or similar networks, an organization needs a microcomputer, a modem, a telephone line that works at least part of the time, and appropriate communications software. The small bulletin boards require an IBM-compatible computer with the DOS operating system, 40 to 100 Mbytes of hard disk space, and one telephone line, as well as the services of a part-time systems operator.

Potential users

African NGOs, particularly those involved in environmental work. The network could serve as a model for establishing other networks in Africa or elsewhere.

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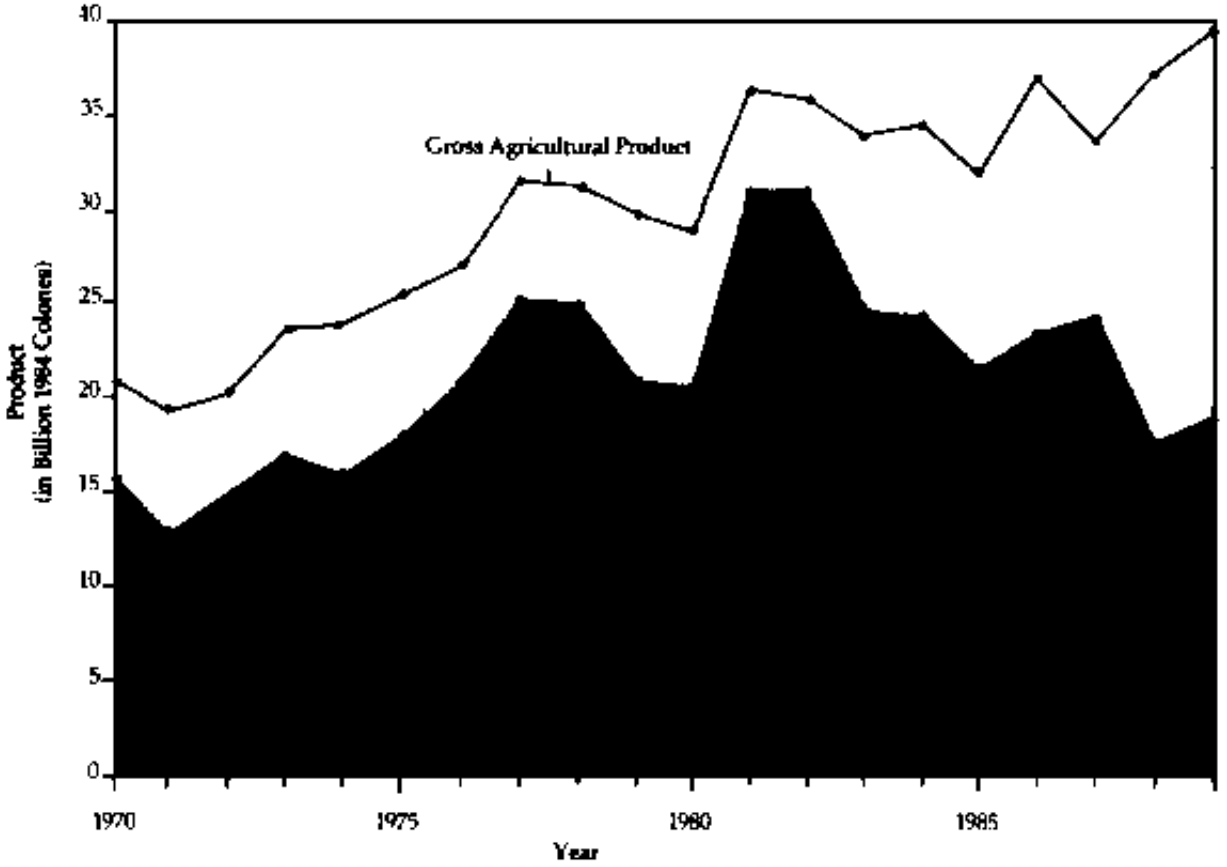
46. Costa rica's new national account system for the environment

The current increase in environmental awareness is highlighting the deficiencies in the United Nations System of National Accounting (SNA), which overemphasizes consumption in national output and fails to account for the environment in income estimation. Conventional national income figures record only the consumption value of natural resources and do not account for losses of natural capital such as standing timber or fish stocks.

The ongoing destruction of forest, soils, and water - basic resources of the country's economy is a loss in the productive value of the economy which is not reflected in national accounts. For instance, when a forest is cut down and sold, the country appears to grow richer, even though the depreciation of the natural capital - both in regard to the forest and the increased erosion of farmland - may create future losses several times greater than the present gain. The result is that, in the existing system, those responsible for economic policies make decisions based on inadequate information. It is therefore urgent that current national accounting procedures be revised.



Costa Rica's agricultural product before and after natural resource depletion.

An IDRC-supported study by the Tropical Science Center of Costa Rica and the World Resources Institute of the United States, had as its main objectives to:

- **Analyze a number of Costa Rica's natural resources in physical terms and assign them an economic value;**

- **Treat natural resource assets consistently with other tangible capital so that resource depletion is treated as capital consumption.**

The first step in the study was to develop physical resource accounts for each sector based on available data. These accounts were designed to record and identify the sources of either an increase in or depletion of the stock. The second step was to assign economic values to the resources using appropriate economic evaluation principles which allowed for the availability or unavailability of data. The physical accounts and economic values were then combined and aggregated to the national level. Finally, the completed natural resource accounts were used to adjust the conventional national income aggregates to arrive at a net, rather than a gross, national product. For example, the results of the study estimate that, when resource depletion is taken into account, the net national product in the fisheries sector between 1982 and 1987 was on average 51% of gross national product. In 1987, it was only 37%.

The Costa Rican natural resource accounting study represents a substantial advance over previous efforts. New techniques, such as remote sensing and satellite imaging, were used to estimate changes in forest cover, mangrove area,

and other land uses. Both the data and analysis of the physical accounts were detailed and systematic. The economic analysis also represents a significant methodological advance, in that it used new bioeconomic models for fisheries accounts and assigned consumptive versus nonconsumptive use values for mangrove accounts.

The results confirmed that the national accounting system in Costa Rica is inadequate in its treatment of natural resources. The lack of knowledge within both the private and public sectors of the many secondary values of natural resources results in the wasteful destruction of important environmental assets. The methodology developed in this study can be used to confront economic development issues realistically.

These studies can be performed at the national or regional level, provided that basic information on economic parameters is available. As well, sectoral studies can be carried out to integrate environmental and economic policies.

Cost and availability

The developed methods to incorporate the depreciation and appreciation of natural resources in national accounts can be transferred and applied in other countries. Both the Tropical Science Center of Costa Rica and the World Resources Institute will provide technical support to interested groups. The collaboration of relevant government agencies is essential.

Potential users

Direct beneficiaries are planners, economists, and policy-makers in all sectors of

government and industry. In addition, this demonstration, along with WRI's earlier case study for Indonesia, will help build support among other governments in the region, international agencies, and other official bodies for a much-needed reform of the SNA.

Contact

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Resources and Publications

- **Solrzano, R., de Camino, R., Woodward, R., Tosi, J., Watson, V., Vsquez, A., Villalobos, C., Jimnez, J., Repetto, R. and Cruz, W. 1991. Accounts Overdue: Natural Resource Depreciation in Costa Rica. Tropical Science Centre, San Jos, Costa Rica and World Resources Institute, Washington, DC, USA.**

- **Repetto, R., Magrath, W., Wells, M., Beer, C., and Rossini, F. 1989. Wasting Assets: National Resources in the National Income Accounts. World Resources Institute, Washington, DC.**

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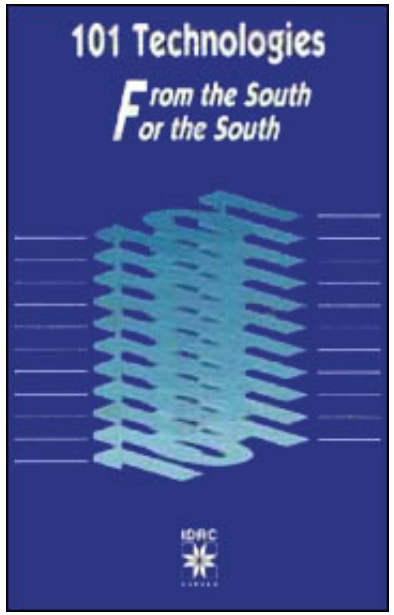
One Hundred and One Technologies - From the South for



the South (IDRC, 1992, 231 p.)

- **Engineering**
  - **47. Tannin produced from pine bark**
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One Hundred and One Technologies - From the South for the South (IDRC, 1992, 231 p.)

Engineering

47. Tannin produced from pine bark

Tannin powder is an essential ingredient in the leather industry. Used to treat or "tan" hides, tannin preserves the leather's flexibility and makes it resistant to rot. Chile imports up to $1 million of natural plant tannin yearly, mostly from Argentina.

Being a coastal nation, Chile is subject to serious corrosion problems from sea water. It imports rust transformers and inhibitors for steel at considerable cost. Researchers have now demonstrated that tannin solutions can be used as anticorrosives at much less cost.

Chile's radiata pine plantations are providing a new source of natural tannin for both the leather industry and for producing anti-corrosives. Large volumes of pine bark are available as a waste product of the timber industry. The bark contains 15% tannin, and can be used to produce a tannin mixture suitable for commercial use. The bark is crushed and heated with water at 80°C, then cooled and decanted. An evaporator removes the excess liquid. Tannin can be produced in liquid or powder form.

The DITECO tannin plant in Chile is now producing tannin from pine bark provided by local sawmills. Local tanneries are mixing the tannin with imported tannin for use in treating leather. The plant employs approximately 40 people, with an additional 20 people gathering bark.

Two anticorrosive products manufactured from tannin have now been developed

and patented in Chile and Brazil. The first is a rust converter for metal. It can be used as a primer before painting steel, and will convert existing rust into a smooth, sealed surface. Tests demonstrated that the pine tannin rust converter works better than commercial converters and as well as sandblasting, the most common but expensive method for cleaning steel surfaces before painting. When applied to buried pipes, bridges, and docks, the rust converter eliminates the need for sandblasting, reducing the cost of surface preparation and cleaning by 30 to 40%.

The second product is a mineral oil-tannin compound used as a rust inhibitor for cold-rolled steel. Cold-rolled steel exposed to the elements during transport and storage is generally protected from corrosion by being immersed in mineral oil after lamination. Protection from rust lasts up to four times longer when tannin is added to the mineral oil. This reduces the cost of cleaning rusted steel before use.

Solutions of another tannin-based product can also be used to prevent corrosion of boilers and other equipment used to produce steam.

Potential users

Small and medium-scale industries with access to natural plant tannin.

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48. Low-cost extraction techniques for essential oils

The Programa Agroqumico of the Faculty of Sciences l and Technology of the Universidad Mayor de San Simn (UMSS) in Cochabamba, Bolivia, has applied steam-extraction technology to make Bolivia self-sufficient in the production of several essential oils such as menthol, citral, and eucalyptol. Oil extraction using steam is a comparatively simple and inexpensive process that is readily adaptable to rural areas. The primary steam-extraction techniques can be learned easily by the rural population in a matter of weeks and do not involve sophisticated industrial technologies.

This technology has the potential to create jobs and generate incomes in rural areas. Within 5 years, the project has almost eliminated Bolivia's annual Can $800 000 of imports of menthol, citral, and eucalyptol oils needed for the production of detergents, soaps, ointments, and other domestic products that have a combined Bolivian market value of $3.5 million. Since 1990, Bolivian manufacturers have obtained almost all the oils they need from the Programa Agroquimico. In the long term, the project could make Bolivia an exporter of the oils (some exports to Brazil, France, and the US have already begun).

The use of the simplified extraction techniques is creating jobs and generating incomes for many disadvantaged farming families in Cochabamba province, one of the poorest in Bolivia. Ten cooperatives are at work gathering the leaves and grass for extracting oils and processing the natural extracts. Each co-op has obtained a steam distillation unit from the program. Each unit is associated with a community of 80-130 families. The crude oils they produce are sold to the university, which in turn refines them into higher grade oils. The purified oils are sold to Bolivian manufacturers of candles, soaps, and other products.

The program is successful enough that an additional 36 communities have approached the researchers to start the processing of eucalyptus and lemon grass. At current prices, average profits from each distillation unit are estimated at $30 000 per year.

Each co-op has control over how their profits are distributed. A women's co-op has been the most successful so far. A detailed study is currently underway to assemble all the necessary information to transfer the technology to other regions and countries.

Production of eucalyptus oil can also contribute to mitigating erosion and environmental damage by maintaining the natural tree cover, since the process only involves cutting the tree branches, which regenerate quickly.

Prerequisites

Availability of oil-bearing renewable resources, such as eucalyptus trees, lemon grass, and mint, and the conditions for growing them.

Each distillation unit comprises a 5-cubic metre extractor, a steam-boiler, a condenser, and a separator. Constructed from local materials, the equipment costs about $10 000. The pay-back period is estimated at 3 to 4 years.

Potential users

Rural or small-town communities with available supplies of oil-bearing plants or trees, such as eucalyptus or lemon grass, and the right conditions for growing them. Eucalyptus, lemon grass, and mint can all grow in poor agricultural

conditions, on land that might otherwise remain unused.

Contact

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49. Carmine dye extraction process for rural enterprises

Peru is the major supplier of carmine dye, a natural, red colouring agent derived from the cochineal insect that is used in foods, drugs, and cosmetics. Global restrictions on artificial colorants in food and other consumer items is giving Peru a considerable advantage in the world market. By 1991, many synthetic red dyes were prohibited in the United States, which put Peru in a unique position. Currently, Peru furnishes 80% of the world's cochineal supply - about 40% as a dye and 60% in insect form.

The Peruvian government wants to increase the processing of the carmine dye in Peru, given that cochineal are plentiful, rural people are experienced in harvesting the insects and drying them, and extraction techniques are comparatively simple. By locating processing plants close to cochineal production areas, rural industry and local employment will increase. Currently cochineal "farmers" earn an estimated 10% of the revenue generated by cochineal. An estimated 50 000 people harvest the insects by hand, dry them in the sun, and sell them through intermediaries to carmine processors in Lima.

The extraction process is available to small-scale enterprises and NGOs including

information on how to improve management of the cochineal insects during infestation, harvesting, and drying. Extraction of carmine powder from the insects involves boiling the insects in water, followed by filtration, precipitation, and washing and drying of the final product.

The Instituto de Investigacin Tecnolgica Industrial y de Normas Tcnicas (ITINTEC), in collaboration with Simon Fraser University, has improved the carmine dye extraction process to give a 24% yield of 72% pure carmine. Other commercial processes give 20-23% yields of 52% pure carmine. A new phase is exploring improved infestation, harvesting, and drying processes. A pilot production plant with a capacity to produce 5 kg of carmine per day has been successful. The technology is now being made available to the private sector, with the following criteria:

- **Production units should be in rural locations close to cochineal producers;**
- **A system such as producer co-ops should be used to share benefits with the cochineal "farmers";**
- **Plants must be owned and run by Peruvians; and**
- **Owners should have the ability to sell the carmine dye abroad.**

Prerequisites

Access to cochineal and markets for the red dye. Cochineal grow on prickly pear cacti in the Andean region. The processing plant requires a fairly substantial capital investment, around US $400 000, suitable for medium-scale enterprises, but high for small-scale companies.

Potential users

Cochineal exporters and producers as well as current producers of carmine who are interested in improving yield.

Cost and availability

ITINTEC can provide a cost analysis for implementation of the technology. The process is available by competitive bid to ITINTEC.

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50. Usable lumber made from waste wood

A technique originally developed and patented in Canada in the 1970s is now being adapted to help address China's current lumber shortage and use residual wood from mills and logging which would otherwise be wasted.

The technique developed in Canada involves "finger-jointing,' mature green lumber using specially-formulated adhesives. This technique can be used on short, small, and crooked thinned-out logs that are currently thought to be useless. The bent wood is cut into sections, the wood ends are profiled into finger shapes and bonded together with adhesives to form a piece of straight and useful lumber.

The Canadian patent holder has waived the patent in China, and Chinese researchers have developed a similar method using immature green lumber as well as dried lumber and locally-made chemicals to produce the glue. Advantages of this technique are that it is relatively inexpensive, easy to adapt and use in small factories, and the products can be handled immediately for manufacturing operations. Although green lumber must be redried after joining to be useful to industry, this process can result in some deformation, depending on the type of wood used. Therefore, whether the finger-joints should be made of green wood or dried wood depends on wood species, uses of the end products, and local production and technical conditions.

The glue developed by the project is weatherproof, durable, stores well, and

works especially well for bonding coniferous trees. The major species tested with the glue are poplar, Chinese fir, masson pine, and larch. Tests continue on other tropical wood species.

The technique could add 15 million cubic metres of wood annually to China's production of lumber, while using waste material and providing part-time income to rural people supplying wood thinnings from their farms and community woodlots. They can make up to 45% more selling the small-diameter wood for finger-jointing than selling it as firewood. This increases the economic value of the wood and stimulates farmers' interest in planting trees.

In 1990, local Chinese factories produced Can $1 million worth of finger-jointed products. Several pilot plants were established for testing the finger-jointed technology and glue production; two commercial plants were set up to build components for truck loading beds; and a factory using the new technology produced laminated beams used in the construction of the 1990 Asian Olympic Games building.

By using waste wood to meet needs for lumber, the technology can contribute to reducing deforestation.

Prerequisites

Supplies of otherwise unusable lumber and appropriate resin adhesives. The lumber can come from thinnings, fast-growing wood stands, crooked logs, used timber, and large branch wood, so long as there are no dead knots, decay, insect holes, or bark pockets on the ends to be finger-jointed.

To set up a finger-jointed lumber mill with an annual output of 3000 square metres, approximately US $4000 in capital outlay is required, as well as a US $2000 circulating fund and 80 to 100 employees.

Potential users

NGOs, government, and the private sector interested in promoting small-scale rural industry. The technology could be useful in countries of the Asia Pacific region where there are shortages of timber.

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51. Bamboo mat board - a replacement for plywood

Bamboo mat weaving is a popular tradition in India and other parts of Asia. Rural dwellers, particularly women and tribal people, weave millions of square metres of mats. Although some of the mats are for household use, most are sold in the market to supplement family income. Over the last decade however, some of the largest consumers - commercial packers and house builders - began switching to plywood and synthetic materials causing a decline in the mat cottage industry and affecting the livelihood of the mat weaving community.

The production of boards from bamboo mats glued together constitutes a sound alternative to plywood made mostly from imported timber. The use of bamboo

also conserves natural forest, which is being depleted at an alarming rate in India. The fast growth and maturation of bamboos and their easy propagation make them an important and inexpensive local substitute for plywood.

The Indian Plywood Industries Research Institute has developed a low-cost low-input technology using local raw materials (bamboo) and adhesives from industrial waste (black liquor) for the production of commercial bamboo mat boards. This technology produces a better product at a more affordable price for the consumer and stable prices for the mats will ensure better wages and living standards for the mat weavers.

This technology can be easily adapted by small-scale rural industries employing local labour with minimum skills. Bamboo mat board will supplement plywood, which is presently made mostly from logs and veneer imported at high cost.

The black liquor from pulpmill waste is being used to produce lower-cost adhesives for the bamboo mat board. This approach will decrease the amount of phenol needed to make the resin adhesive, thereby reducing the cost.

Testing of manufactured items, such as packing cases for horticultural products, especially apples, showed that up to 75% of the plywood could be replaced with the new bamboo mat boards. The cases are estimated to cost 15-20% less than the equivalent wooden packing cases. Bamboo mat boards will be used for low-cost housing, for crates, and for building grain storage rooms and bins presently made out of wood and plywood.

Cost and availability

Initial estimates indicate that the cost of resin for bamboo mat board is reduced by about 75% by using modified phenolic resin. Further reduction in cost is foreseen when black liquor-phenol-formaldehyde resin, which is being developed in the project, is standardized.

The Indian Plywood Industries Research Institute (IPIRI) provides technical assistance in establishing small bamboo mat board production units in rural areas. Negotiations for technology transfer to the Philippines and other interested countries are underway.

Potential users

The rural housing industry and many cottage industries such as construction of packing cases will be the primary beneficiaries of this inexpensive alternative to plywood. The production of bamboo mat board will create employment for rural women and will generate additional income by reviving and expanding the bamboo mat weaving cottage industry.

Farmers will be encouraged to grow bamboo on their land, community property, and home gardens, benefiting from the short rotation of bamboo cropping (3-5 crops per year) and better prices.

Because of the increase in quality and the reduction in costs in bamboo mat production, entrepreneurs can now establish small-scale bamboo mat board factories. The production of bamboo mat boards is a labour-intensive process compared to plywood production and will therefore generate more employment.

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Resources and publications

Copies of the following technical reports are available from the institute on request:

- **IPIRI. 1992. Techno economic feasibility of bamboo mat board manufacture. Indian Plywood Industries Research Institute, Bangalore, India (in press).**

- **Aswathanarayana, B.S. et al. 1990. A study on test methods for evaluating bond strength of bamboo mat board. (Doe. 4).**

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52. Synapse a system for microcomputer-based instrumentation

The National University of Singapore, together with l Total Recovery Systems International in Toronto (formerly SCADA), have developed a user-friendly, flexible hardware-software system for monitoring and controlling industrial

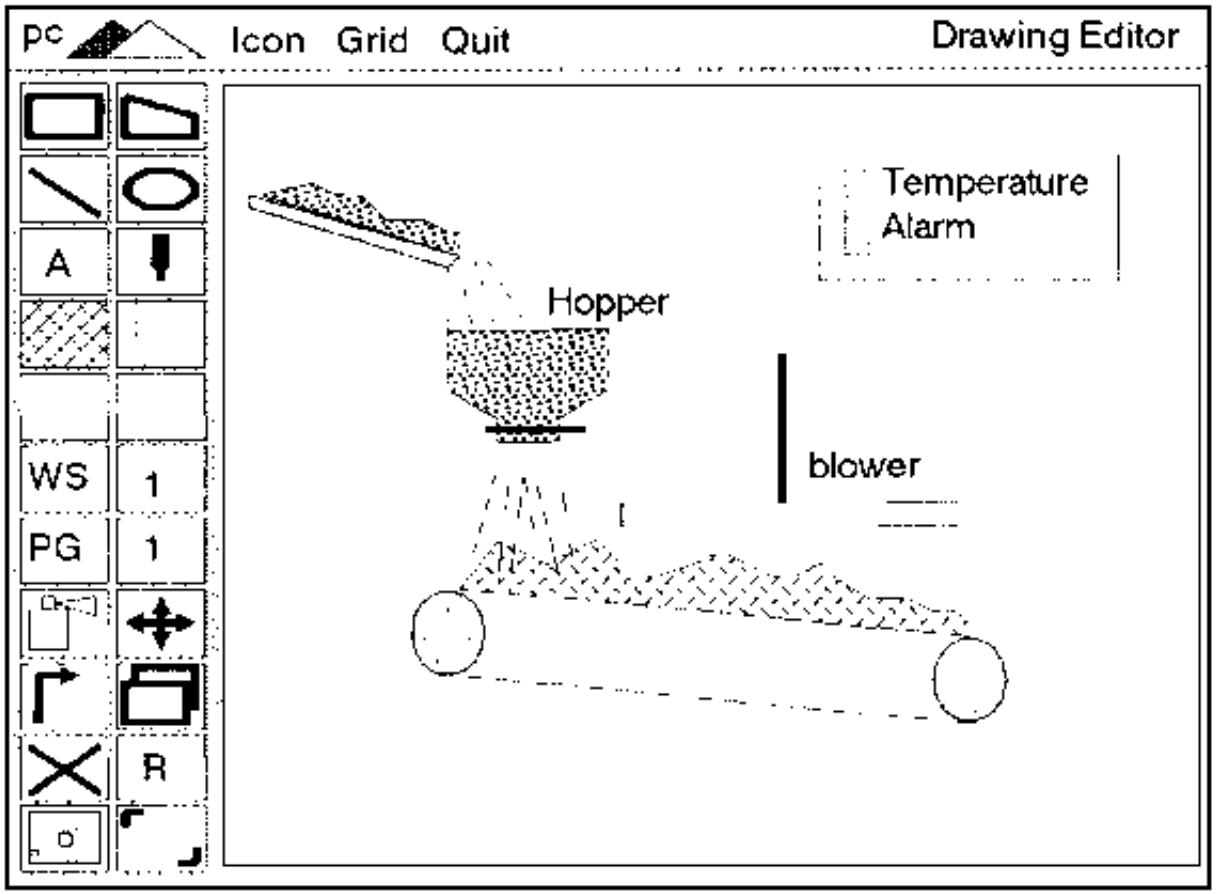
processes using inexpensive personal computers. The system, called Synapse, provides accurate, online measurement for quality control in small industries such as soap manufacture, cheese production, and other chemical processes. It is also useful for teaching and research.

The software package and an interface module allow the computer to be linked to instruments - such as data loggers, spectrometers, and pH meters - that monitor and control a wide range of processes such as adding ingredients, regulating temperature, and checking for colour and consistency. The system has many potential applications including such things as accurately measuring heavy metals in the environment, pH in fish ponds, and soil nutrients.

With Synapse the user can use analytical instruments by computer without any previous expertise or training in computer programming or electronics. The system is also easy to maintain, which makes it particularly applicable in developing countries. It reduces costs for small industry, where each measuring and control instrument has to be bought as a separate package at anywhere from US $1000 to US $5000 each. The Synapse package links all these instruments to a basic IBM for about US $1000.

Several important technological advances were made in the development of the system, including the integration of artificial intelligence techniques, object-oriented programming methods, and natural language processing. The operator uses a mouse to work out the basic structure of the process he or she wants to control. From a menu of icons, the operator can pull down pictures of valves, pumps, meters, liquid levels, etc. Each is automatically linked to a hardware interface. The operator then supplies the conditions that must be fulfilled for the

equipment to operate. For example, someone might tell the program to open a valve when the temperature reaches a certain range. Once this information has been input, the system's extensive database allows the computer to decide what to do, when, and how.



Figure

The system is not rigid or frozen into specific sequences of action. In this way, the computer can decide what to do, while leaving room for the user to incorporate rule of thumb and shortcuts into the operating characteristics.

Prerequisites

An IBM personal computer or clone. Most users are able to use the Synapse system without previous training. A detailed manual is provided to guide the user in mastering the system.

Potential users

A wide range of industries including metal finishing, aquaculture, environmental control and monitoring, and factory automation. Because of the low cost of the software, the system is applicable to small- and medium-scale industries. Universities, colleges and research institutions can use the package for teaching, research and improving their experiments; hospitals can use it as a teaching and diagnostic tool. The system is currently being used in a pilot scheme for improved tea-drying in some of Sri Lanka's tea factories.

Cost and availability

The Synapse hardware and software is commercialized worldwide through Eutech Cybernetics. Total cost is approximately US $1000, excluding the computer, for selected institutions in developing countries (the commercial list price is higher). This includes the software and any required hardware interface cards that link electronic gauges, valves, and other devices to the computer.

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53. Low-cost dobby to improve small-scale commercial weaving

Family weaving enterprises own 85% of the looms currently in use in India and Pakistan. These cottage industries are competing for a domestic and export market where consumers are demanding more and more sophisticated cloth. There is a need to increase self-sufficiency in fabric production for the national textile industry, as well as to modernize the equipment of textile producers.

Small weaving enterprises can now earn 20 to 26% more by producing designed (geometric or floral) patterns rather than plain cloth. These designs are produced on the loom using a mechanical selection device called a dobby. Currently two types of dobbies are used: modern dobbies which are efficient, high speed (200 picks per minute) and expensive; and older, less efficient, cheaper dobbies used throughout the Third World. These local low-cost dobbies, copied from imports, are cumbersome, difficult to maintain and slow (100 picks per minute).

Pakistani and Canadian researchers have now developed a new dobby that is fast and efficient, while still relatively inexpensive and easy to make locally. Called PAKCAN, the dobby can reach speeds of 130 to 160 picks per minute and can be used on 82% of the shuttle looms in use today. Its advantages over dobbies in

current use include:

- **Superior stability;**
- **Perfect alignment of knives and hooks;**
- **Fewer components;**
- **Vibration-free;**
- **Lighter and consumes less energy;**
- **Streamlined appearance and easy to manufacture, maintain, and operate.**

The PAKCAN dobby provides a superior performance with low cost and low maintenance, and has the potential to increase incomes and productivity for the cottage weaving industry.

Prerequisites

The PAKCAN can be used on shuttle looms with speeds up to 160 picks per minute.

Potential users

Small and medium-scale weaving enterprises. There is already a demand for the dobby identified in Brazil, China, Egypt, Indonesia, Malaysia, Peru, the Philippines, Thailand, and Turkey.

Cost and availability

The dobby is expected to sell for as little as Can $800 (based on 30% profit margin and production of 100 units per month). Although this is still higher than current local dobbies (which sell for Can $250), the low maintenance costs and

higher quality fabrics made possible with the PAKCAN dobby make it attractive to small weaving enterprises. A licensing agreement will be pursued once successful field trials in India are completed.

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54. Inexpensive bricks made from bauxite waste

In Jamaica’s rural areas, there is a shortage of affordable housing, mainly because of the high cost of building materials. The Jamaica Bauxite Institute, in collaboration with the University of Toronto, has developed an inexpensive building brick made from the waste generated by the country’s aluminum industry, as well as from noncommercial bauxites.

The bauxite waste, or "red mud," when impregnated with a sodium silicate solution, hardens naturally without the need for firing. Its use has many advantages: the raw material is easily available; it requires little energy; it develops local skills; it can be used more cheaply than cement to build schools, community centres, health centres, etc.; it lessens dependence on imported materials such as steel; the bricks are strong when dry; and there is little need of sand or cement. The bricks have the potential to provide cheaper housing and increase employment in rural areas.

A model building has been built to demonstrate the use of the bricks, and training of local people in the brick-making technique has been undertaken. Because labour costs are not significantly different for building a house from cement blocks or from bauxite waste bricks, training in self-help building is also important to keep costs down.

Another Jamaican organization, the Construction Resource and Development Centre, is developing cyclone-resistant housing using the bauxite waste bricks. Red mud could be used for other purposes such as water pipes and floors and could become an export item to other Caribbean islands.

The technology is environmentally friendly, uses waste from a major industry, and requires little energy (unlike production of cement blocks), thereby decreasing deforestation and dependence on imported oil.

Prerequisites

Availability of "red mud" produced by the aluminum industry or access to other

noncommercial bauxites. Sodium silicate is used as a bonding agent. Two major pieces of equipment are used: a pulverizer to grind the mud to the required particle size and a compactor to compress the mixed mud into the mould.

Potential users

Rural people, governments, NGOs, and small businesses close to aluminum processing plants or other noncommercial bauxite material.

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Resources and publications

- **It is envisaged that booklets, books, and video materials will become available after a proposed workshop on bauxite waste bricks planned for February 1992.**

- **Radio Qubec has produced a video program on the project. For information contact Franoise Bertrand, Radio Qubec, Socit de Radio-Tlvision du Qubec, 800 rue Fullum, Montral, PQ, Canada H2K 3L7. Tel.: (514) 521-2424; Fax: (514) 873-7739.**

55. Low-cost wall panels from blast furnace slag cement

In Brazil, as in most of Latin America, increased costs of building materials - especially portland cement - have compounded a housing crisis affecting the country's low-income population. In the search for alternative low-cost building materials, researchers are investigating the use of industrial and agricultural wastes.

Slag is the product of purifying iron ore into pig iron. It sits in huge mounds outside iron furnaces. Blast furnace slag (BFS) is the water-quenched slag that has a high vitrous phase. Brazil produces some 3 million tonnes of BFS per year, and its disposal is a crucial problem for the steel mills. Sold for about Can $5 per tonne, it is an inexpensive source of cement material.

A suitable cement is obtained by mixing ground slag with hydrated lime and gypsum (0.88: 0.02: 0.10 - BFS: lime: gypsum). Researchers in Brazil have designed and manufactured hollow wall panels and a prototype house using the BFS-based cement reinforced with coir fibres, which are widely available in Brazil and other Latin American countries. The hollow panels are 395 cm long and 90 cm wide, and are strong enough for use in load-bearing walls in single-storey buildings.

The process for making the panels is suitable for small scale industrial plants or

even for manufacture on the building site. An ordinary pan mixer is used to prepare the material, which is poured into moulds that are placed on a vibrating table.

In a small plant, the cost of each panel is US $5.70 or an average of US $6.30 per square metre of wall, including labour and grout. This is considerably less expensive than ordinary brickwork, which costs US $8.00 per square metre. These savings may be increased with the development of better manufacturing plants, faster construction time, and the reduction of waste materials on the building site.

In a new phase, the Brazilian researchers are promoting the technology to small-scale panel manufacturers, contractors, housing authorities, architects, and civil engineers. A manufacturing and construction manual will be developed, as well as a video to promote the technology as an alternative for the provision of shelter to low-income people. A manual on the process has been prepared for the public in Portuguese.

Prerequisites

Iron industry producing blast furnace slag; availability of good-quality lime and gypsum; coir fibres.

Potential users

Government, NGOs, construction companies, producers of precast components, and local people building low-cost housing in iron-producing countries such as China, India, Indonesia, Mexico, and others.

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56. Improved methods for firing bricks

To ease Rwanda's housing crisis, attempts are underway to develop construction methods that use cheap, durable local materials. Technologies using minimal energy must be developed because of the increasing shortage of firewood.

Rwanda currently produces some 70 million fired clay bricks; 60 million are produced by cottage industries that are not mechanized, have no financing, and make inefficient use of materials and energy. Their workers have no training, so the quality and size of the bricks varies. Losses of up to 40% can occur using primitive ovens and supply is irregular.

With the cooperation of researchers from the University of Sherbrooke, Canada, researchers at the National University of Rwanda have developed methods for improving local production of fired bricks. These methods reduce losses, improve the quality of the bricks (they are stronger and of a standard size), reduce energy needs, protect the environment, and create new jobs.

Methods developed

- **An improved oven that optimizes firing. It gives an even temperature and uses peat as well as wood for fuel;**
- **Additives to the clay, such as rice husks and sand;**
- **Locally manufactured manual presses;**
- **Drying bricks in the sun or the fresh air in sheds; and**
- **Locally manufactured insulation bricks (for oven construction and other purposes). The improved oven is made from bricks. The walls are three bricks thick, two of them being insulation bricks. The vault is a semicircle covered with a grill onto which a portland cement parging is fixed. A metal clamp collar surrounds the oven.**

The first bricks to be fired in this new oven were an improvement over the previous homemade ones - they are one and a half times more resistant under compression.

Using rice husks in brick manufacturing produces a number of advantages:

- **They strengthen the clay, which can be too malleable, and prevent cracks from developing during drying;**
- **They prevent the bricks from becoming misshapen when stacked up in the oven; and**

- **They improve firing in the middle of the brick.**

In an initial comparison, brick losses dropped 40% to 0.2% with the improved method. The cost of building a simple inner wall using the new bricks was reduced by nearly half.

Prerequisites

Deposits of acceptable-quality clay; rice husks or sand; the construction of the oven requires simple tools and the services of approximately five bricklayers. Regular and insulation bricks as well as steel bands and portland cement are needed.

Potential users

Small producers of fired clay bricks, especially in Burundi, Kenya, Tanzania, Uganda, and Zaire.

Cost and availability

For the construction of the oven and fittings: RWF 300 000; ancillary costs (moulding, handling, fuel, and heater): RWF 1.768 per brick (compared with RWF 2.5 per brick using the traditional method).

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57. Quake-proof adobe housing

A collaborative effort between the civil engineering department of the Pontificia Universidad Catlica del Per and the architectural faculty of Concordia University, Montreal, has produced safer adobe housing for the poor in a major earthquake zone. Adobe houses are built of earthen brick. They are popular because adobe is easily available, inexpensive, the houses can be built by unskilled workers, and they are fire resistant. However, adobe lacks the strength to withstand earthquakes.

Earthen buildings house 66% of the rural and 35% of the urban population in Peru. In the 1970 earthquake, 50 000 people died and 60 000 houses were destroyed - a level of destruction that can largely be attributed to traditional housing styles. When an earthquake occurs, the walls of these houses collapse outwards and the roof of dried mud, which can weigh up to 10 tonnes, crushes the occupants.

The new construction methods that have been developed include several improvements such as reinforcing the walls with inexpensive bamboo or eucalyptus poles anchored to the foundation together with horizontal canes tied to the poles at every fourth row of bricks. The poles are secured to parallel wooden beams on top of the walls, which also act as roof supports. These structural changes allow the walls and roof to react to the vibrations of an earthquake as a structural unit rather than as separate elements.

The improved methods were tested at the Universidad Cat1ica on a "seismic table" which simulates earthquakes. The improvements have succeeded in making the adobe constructions resistant to the force of Peru's strongest earthquakes.

Several prototype models of schools, health outposts, a small cheese-making enterprise, and community centres were built in cooperation with the Ministry of Health, the Ministry of Education, the FAO and community organizations.

Several methods of information dissemination, such as manuals, radio shows, and videos, were also tested. Scale models and photos proved the best means of illustrating the new technology.

Prerequisites

The improved adobe housing requires the availability of soil, straw, sand and cane material. The practical application of the techniques requires no special skill other than that of a common mason.

Potential users

NGOs, community groups, governments, and local people who use adobe as a construction material in earthquake zones.

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Resources and publications

- **The Universidad Catlica has developed educational materials including manuals, videos, photos, and scale models. A technical report on the research was produced in Spanish under the title Ensayos de Simulacin Sismica de Viviendas de Adobe, Pontificia Universidad Catlica del Per, 1989.**

58. Low-cost cement made with volcanic ash

The Centro de Investigaciones de Ingeniera at the Universidad de San Carlos de Guatemala and the Department of Civil Engineering at the University of Calgary are testing pozzolan cement as a substitute for portland cement in such applications as blocks and masonry mortar. Traditionally, portland cement is used in building. This is an expensive option given the high energy costs involved in producing it - it needs to be fired at high temperatures - and transporting it to its final market.

Twenty-five percent of Guatemala is in a volcanic zone that contains large surface deposits of a volcanic ash called pozzolan. Mixed with lime at a ratio of 80:20 or 70:30 (pozzolan:lime), natural pozzolan behaves like cement. Although some grinding is required to make it fine enough to work with, the pozzolan mix does not require firing which reduces production costs. In Guatemala, pozzolan cement currently costs approximately 60% of the cost of portland cement.

Pozzolan cement can be used for blocks, plastering, masonry mortar, and as a stabilizer for adobe walls and road bases. The project has tested the cement for strength and resistance to earthquakes. Four demonstration houses will be built using pozzolan and workshops are being used to encourage small pozzolan cement production plants in rural areas near pozzolan deposits.

About 50% of Guatemala's population lives in inadequate housing, mostly because of the high cost of building materials. Pozzolan cement production has the potential to both generate employment and reduce housing costs.

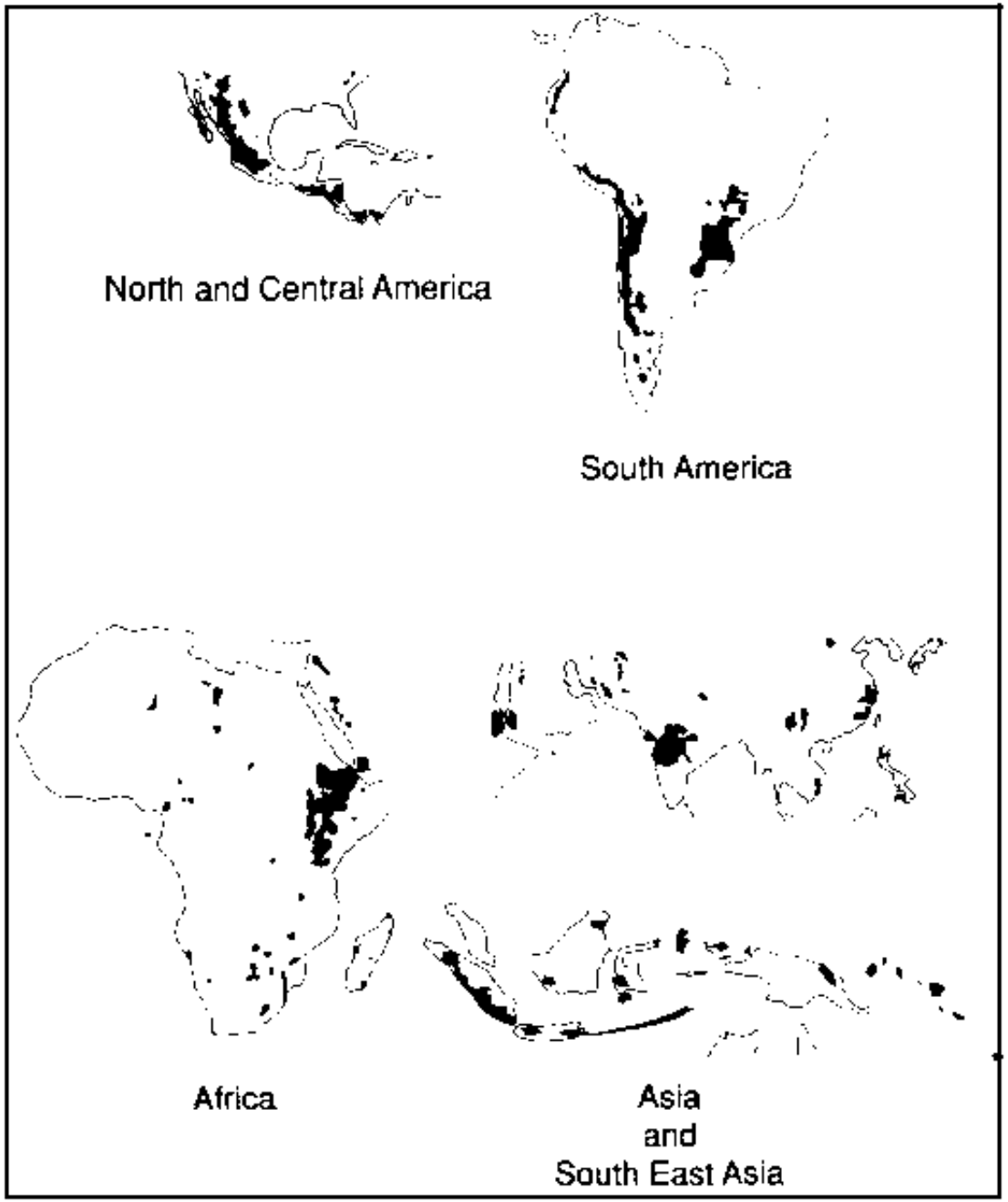
Prerequisites

Supplies of usable quality pozzolan and lime, some skilled workers, building standards, and quality control. Efficient and low-cost local lime production is essential to keep the cost of pozzolan cement low.

Potential users

Local building contractors and government agencies are building low-cost housing in regions of Africa, Asia, and Latin America where there has been volcanic activity resulting in accessible pozzolan deposits of usable quality. Processes and

materials will differ slightly from one region to another.



Volcanic deposits

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Resources and publications

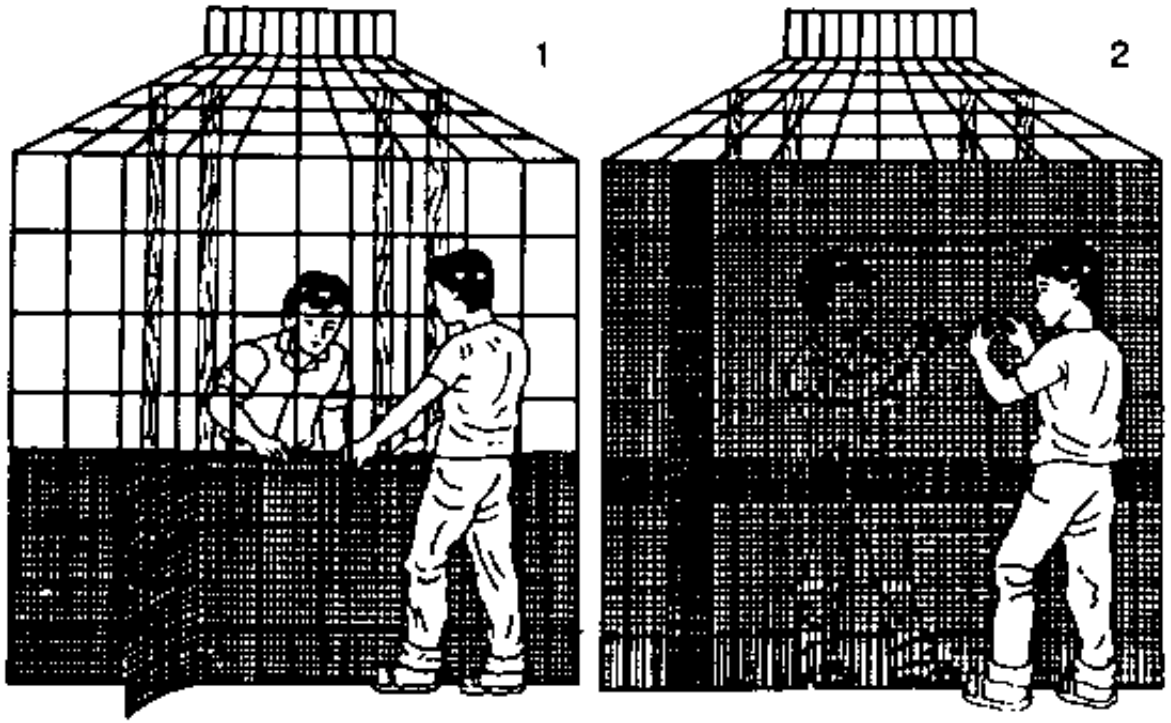
Day, R.L. Pozzolans for Use in Low-Cost Housing: A State-of-the-Art Report, IDRC, Ottawa, September 1990, 157 pp.

59. An international network to promote ferrocement technology

Ferrocement technology, in which mortar (cement, sand, and water) is spread over a steel and wire or bamboo skeleton, is a simple and inexpensive new

building method, with a wide variety of uses.

In the Philippines, ferrocement is being used to build cylindrical rainwater catchment tanks. Although the walls of the cisterns are only a few centimetres thick, they can withstand the water pressure because of the internal reinforcement with large-gauge welded steel mesh covered with fine wire mesh. In various countries, ferrocement has also been used to build silos, biogas holders, boats, roofing elements, biogas digesters, canal linings, and latrines. The technology is currently applied in more than 50 countries including India, Indonesia, Malaysia, and the Philippines.



Figure

The International Ferrocement Information Centre (IFIC) at the Asian Institute of Technology (AIT) was established in 1976 to ensure transfer of ferrocement technology, which has wide application in rural areas. Although the technique is simple in theory, the centre recognizes that translating it into a technically sound, socially acceptable, and affordable village technology requires detailed research and testing. It is therefore looking at novel approaches to teach the use of this technique to rural people.

Training is complemented with "do-it-yourself" brochures and booklets in local languages adapted for use by villagers. Technical information is repackaged to target specific groups, such as women (who are usually involved in construction) or extension workers in each country.

IFIC has agreements with 141 universities in 50 countries to teach ferrocement technology. IFIC has also created 50 reference centres in 32 countries and is seeking to create another 30.

A Ferrocement Information Network (FIN) was established in 1985 to facilitate and accelerate the flow of information among ferrocement users in developing countries. A directory of men and women and organizations knowledgeable in ferrocement technology is available. Network members also organize training programs and demonstrations in rural areas.

Prerequisites

Adequate supplies of cement, aggregate (usually sand), and reinforcement (usually steel mesh, but other materials such as bamboo are also used). The

technique is easily explained by demonstration, pamphlets, and videos.

Potential users

Villagers and technicians working in low-income rural and urban areas. Technicians and engineers can access specialized bibliographies, directories, and computer software for the design of ferrocement structures, such as water tanks and roofing elements. As well, newsletters, brochures, and audiovisual materials are available through FIN and the various reference centres.

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