

The Outcome of Networking 24 Latin American and Caribbean Countries on Integrated Use of Sugar Cane and Local Resources in Animal Feeding (The CIPAV Experience)

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Abstract

In 1993, FAO instigated a cooperation agreement for the establishment of the Information Network for Tropical America and the Caribbean on the utilization of the sugar cane and other locally available resources for animal feeding. The Network funded by France includes Antigua and Barbuda, Barbados, Belize, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Honduras, Jamaica, Mexico, Nicaragua, Panama, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, and Venezuela. The objectives of the Network are: I) to promote, the exchange of technical information, practical and theoretical experience, and training methods, within and between countries.

ii) to organize practical demonstrations of the most appropriate techniques under local conditions in the countries with limited experience of the new production systems.

iii) to promote the evaluation and production of local plant genetic resources, which complement rations based on sugar cane, through the

exchange of appropriate plant genetic material among the countries of the Network.

In order to fulfill these objectives, FAO has commissioned the Colombian NGO "The Centre for Research in Sustainable Systems of Agricultural Production" (The CIPAV Foundation) to be the Central Organization, with 10 years' experience in the generation of agricultural technologies based on the use of sugar cane, forage trees and organic residues for animal feeding, decontamination of water and gas production by means of continuous-flow-plastic-biodigesters, and pioneer in the production of a computerized scientific journal.

KEY WORDS: integrated systems, sugar cane, supplementation, protein forages, publications, network, international cooperation, Latin America

Background

Since the 1970s, scientists from different parts of the world, investigating technical proposals for the agricultural development of tropical countries, have found that many technologies developed in temperate countries and transferred to the tropics have had little success in social terms for the agricultural sector of these countries.

In most cases they are based on the import of packages involving production of high-yielding cereals, with intensive mechanization and high inputs derived from oil (fuel, fertilizers and pesticides).

Most of the cereal production, together with imports from temperate countries, is used to feed imported animals with "maximum genetic improvement", whose nutritional requirements can hardly be satisfied under the natural conditions of the tropics (wet and dry).

All the technological elements are, of necessity, imported from the north and consequently require foreign currency which increases the operating costs. This, together with the low yields (compared with those of the countries of the temperate zone), results in minimal financial benefits and, at the same time, they have led to the degradation of the ecosystem and a decline in traditional production systems.

In the search for solutions, since the 1980s, scientists like Drs Ronald

Leng, Thomas Preston, Vilda Figueroa and Rena Perez (among others) have devoted efforts to research that aims at seeking alternatives for agricultural production in the tropics and sub-tropics, based on the hypothesis that "the primary production strategy in the tropics must be based on the efficiency of plants to transform solar energy into concentrated energy sources (sugars, starches and oils), as well as protein production for animal feeding".

With this objective, they demonstrated, initially in Cuba, that it was possible to totally replace cereals as the energy source for animal feeding, with the use of molasses (A molasses, B molasses and final molasses) from the sugar industry, supplemented with unconventional protein sources (yeasts, organic wastes and protein pastes) for pig fattening, without detriment to animal performance. Since 1986, projects were established in Colombia by CIPAV with the advice of Dr. T.R. Preston, where the evolution of research and the commercial application of the technologies have demonstrated that:

- Fattening pigs from 20 to 90 kgs liveweight, using sugar cane juice ad libitum and a restricted protein supplement (200 g/animal/day) based on soya grain or cake permits at least 500 g/animal/day live weight gain.
- The use of forage from trees and aquatic plants as part of the protein supplement for pregnant sows (1 to 2 kg/animal/day on a fresh base) permits litters from 8 to 10 pigs at birth and weaning, with live weight of 1200 g at birth and 9 kg at weaning at 45 days.
- The strategic feeding of dual-purpose cattle with sugar cane bagasse and sugar cane tops or fibrous crop residues, supplemented with leaves of forage trees, poultry litter, rice bran and multi-nutritional blocks, prevents loss in weight and improves the reproductive performance of the herds, even during the dry season and, under good climatic conditions, permits daily gains higher than 600 g/animal/day in the males and average production of 10 to 12 litres of milk/cow/day.
- An appropriate nutritional strategy for dual-purpose cows, allows both milking and restricted suckling which leads to increases in milk production of over 25% and the improvement in the post-weaning growth of the calves.

- The use of females for animal traction (cows and buffalo) in agricultural activities permits an annual saving of the equivalent of 45% of the energy used by an electrical motor, and, at the same time, generates annually 1.73 tonnes of milk, 0.182 tonnes of meat (1.3 calves), 13 tonnes of manure and 1.82 tonnes of waste forage which can be used as a fertilizer.
- Sugar cane with a spacing of 0.7 - 1 m between rows (the sugar industry in Colombia uses 1.5 m) gives a total biomass production of around 250 tons/hectare/year without the use of agricultural chemicals.
- Fractionation of sugar cane for animal nutrition, allows the incorporation of different species into integrated systems of sustainable production, where the sugar cane tops and bagasse are used for ruminants, organic fertilizer and energy production and the juice is used for monogastric nutrition and for the production of molasses for the family. The animals are supplemented with forage trees (which are grown together with the sugar cane), aquatic plants (established in waste ponds), multi-nutritional blocks (for ruminant and rabbits) and soya grain or cake (for monogastrics).
- The integration of biological water de-contamination systems using continuous-flow-plastic-biodigesters and ponds with aquatic plants has enabled the generation of methane gas to be used instead of non-renewable fuels, protein for animal feed and nutrient recycling.
- Different investigations carried out with other scientists from Colombia, Cuba, Venezuela, Nicaragua, Vietnam, Tanzania, United Kingdom, Sweden, Denmark and Australia have shown that there are many plant species in the tropics and the sub-tropics which have great potential for animal and human nutrition. Known species which have a high efficiency in the transformation of solar energy into other forms are sugar cane (*Saccharum officinarum*), bananas (*Musa* spp.), cassava (*Manihot* spp.) and the African palm (*Elaeis guineensis*). With regard to protein production, some of the trees and shrubs which deserve mention are *Gliricidia sepium*, *Erythrina poeppigiana*, *E. fusca*, *E. glauca*, *E. edulis*, *Prosopis juliflora*, *Trichanthea gigantea*, *Morus* sp., *Urera* sp., *Tithonia diversifolia*, *Malvaviscus penduliflorus*, *Canavalia* sp., and the aquatic plants *Azolla* spp., *Lemna* spp. and *Salvinia natans*.

With the practical and scientific demonstration of the hypotheses by the pioneers researchers and continuing investigations, it has been possible to generate, over the last 10 years, technological proposals which, at the same time, have been taken and transformed by farmers in different tropical countries. In 1993, FAO decided to establish the Information Network for Tropical America and the Caribbean on the utilization of the sugar cane and of other locally available resources for animal feeding.

Sugar Cane Network Fao-america

The CIPAV Foundation (Cali, Colombia) was designated as the Central Organization which, under the patronage of the FAO, coordinated the "Information Network for Tropical America and the Caribbean on the utilization of the sugar cane and of other available local resources for animal feeding" (FAO project GCP/RLA/116/FRA funded by the French Government). In each country, a committee has been created as the responsibility of an organization which provides a National Coordinator, who is the principal facilitator of the activities of the National Committee, the permanent liaison between countries, and the direct contact with the CIPAV Foundation, which at the same time liaises with FAO and another Network in Asia. To activate the Network, CIPAV, through short duration missions to each country, has accomplished different activities:

- Training and advice to the National Coordinators, National Committees, other technicians and farmers through field days, demonstrations, tours and conferences.
- Advice to the National Coordinators, National Committees and other technicians in the design of experiments and information analysis.
- Training on the use of software for investigation and communication (spreadsheets, word processors, graphical packages, compression and converters programs, E-mail tools, etc.), documents produced in electronic form (Livestock Research for Rural Development (LRRD), books in Windows Help Format) and templates for presentation and publication of printed books and electronic documents containing information generated in the research.

CIPAV produces technical and scientific material which is distributed between the different country members of the Network, and invites local researchers to write articles to be published in LRRD.

The Sugarcane Feeds Centre (SFC), Trinidad, implemented similar activities for the English-speaking Caribbean countries. This institution was selected as it has a long experience in the use of sugarcane and other local resources as animal feeds in the Caribbean islands and as it also conducts a wide range of on-going experiments and demonstrations concerning these topics. Three international workshops have been organized by the SFC for the Caribbean countries. Furthermore, the SFC director carried out short missions in Guyana, Saint Vincent, Saint Lucia, Dominica and, Antigua and Barbuda, in order to increase liaison with Ministry officials and support and encourage the National Coordinators to strengthen the impact on farmers.

Outcome of the Network

Publications

- a) Material on sustainable agricultural technologies has been published both in Spanish and English, in different formats (computerized journals, posters, proceedings, manuals, books and videos), and distributed between the country members of the Network. These include more than 1,000 copies of 19 issues of LRRD (each one containing 10 articles); all the articles can be obtained through FTP or the World-Wide-Web, in versions for DOS and Windows. In addition there are the computerized journals: "Non-Ruminant Small Herbivores" (CENDI, Venezuela) and "Pig Production" (Instituto de Investigaciones Porcinas, Cuba).
- b) 1,200 copies of 5 primers: "Sugar cane", "Feeding of Cattle for Small Farms", "How to Raise Pigs with On-Farm Resources", "Training of Working Animals" and "The Cipres Production System" (the last two only in Spanish) and some copies of the primer "The Rope Pump to Extract Water".
- c) More than 50 packages of the poster collection "The Bag of Trees to Eat".
- d) Copies of the proceedings: "Forage Trees as Sources of Protein", "Sustainable Systems of Agricultural Production for Small Farmers",

"Nacedero (*Trichanthera gigantea*): an Integrated Production Species" (all in Spanish).

e) 120 copies of the Manual "Continuous Flow Plastic Biodigesters: generation of gas and bio-fertilizer from waste water".

f) 240 copies of 4 books: "Strategy for Sustainable Livestock in the Tropics" (Preston T.R., Murgueitio R.), "Matching Ruminant Production Systems with Available Resources in the Tropics and Sub-Tropics" (Preston T. R. and Leng R.), "Forage Trees and Shrubs Used in Animal Feeding as a Protein Source (CIPAV)", "Pig Production with Tropical Plants and Nutrient Recycling" (Figueroa V.); and some copies of the books "Sustainable Agricultural Systems for the Tropical Mountains (CENDI - CIPAV)" and "Fauna Investigation and Management for the Development of Sustainable Systems (CIPAV)". The first four are printed on paper, the rest were published both on paper and electronic form (Windows Help Format).

g) The video "Didimo's Sweet Pigs" in English and Spanish.

Events

The representatives of CIPAV have held technical conferences for more than 1,500 persons, demonstrations with the participation of more than 500 persons, and training workshops in project design, analysis and data handling with more than 100 persons (technicians, students and farmers). They have participated in technical study tours and evaluation to more than 50 farms (private and state).

The National Coordinators and the National Committees have organized their own training events for groups of farmers, students and technicians.

The National Coordinators of Costa Rica, Honduras, Cuba, Venezuela and Colombia, with the collaboration of their respective National Committees and FAO, have organized international seminars on Integrated Systems of Agricultural Production, with the participation of National Coordinators of different countries and the participation of more than 1,300 persons (technicians, students and farmers).

In 1995, an NGO that works in El Salvador (Veterinaires Sans Frontieres - VSF) organized, with the involvement of other national

organizations and a representative of CIPAV, a national event on Integrated Systems of Agricultural Production with 100 participants (farmers and technicians).

Exchanges

Some National Coordinators, members of National Committees or Institutions of the Central American countries and CIPAV have begun the exchange of technical information, technologies and material:

- tours among neighboring countries (Honduras, Costa Rica, Nicaragua, El Salvador), or to CIPAV (Nicaragua, Costa Rica, Honduras).
- live material of californian red worm (*Eisenia phoetida*), nacedero (*Trichanthera gigantea*) and *Azolla* sp, from Colombia to Honduras and Costa Rica and from Honduras to Costa Rica, Nicaragua and Belize.
- 8 continuous-flow-plastic-biodigesters taken from Colombia to Nicaragua, Honduras, El Salvador and Costa Rica.
- local exchanges of sugar cane varieties resistant to drought and with easy management.

Research, Transfer and Technical Proposals

In several member countries of the Network, the National Coordinators and the National Committees have developed some sort of research activity, and transferred or developed new technologies. Some examples are:

- In Guatemala, the Science and Technology Institute (ICTA) and the Veterinaires Sans Frontieres work in the agricultural characterization, reproduction and use of local forages of the Altiplano and small mountains, for small ruminant nutrition (goats and ewes) with indigenous communities.
- In El Salvador, the National Coordinator and the organization Center of Agricultural Technology Transfer (CENTA) are carrying out research into the reproduction and establishment of *Erythrina verteruana*, and at the same time they are starting work on the use of this forage as a protein supplement for milk production; they have

also begun trials on feeding hens with californian red worms. The NGO's VSF and FASTRAS have established, with different groups of small farmers, different components of the system (sugar cane, forage trees, soya and earthworms for feeding native hens, pigs and cattle, and plastic biodigesters).

- In Honduras, the National Coordinator and the National Committee are carrying out serious research on establishment and resistance to drought of sugar cane and forage trees, pig feeding with sugar cane juice supplemented with different protein sources (soya cake and shrimp meal), grazing of pregnant sows, establishment of a dual-purpose cattle herds, buffalo production, plastic biodigesters and aquatic plants.
- In Nicaragua, the technical personnel of the World Food Programme have set up projects for training and technology transfer on strategies for cattle feeding in the dry season (sugar cane, fibrous residues and multi-nutritional blocks). A technician from the National Institute of Agricultural Technologies (INTA) is working on the adaptation of the dual-purpose cattle system to the severe drought zone of Chontales and he has organized an event with the exclusive participation of farmers, to present the results of the projects on their farms.
- In Costa Rica, the National Coordinator and the National Committee have established different investigations into the use of residues of banana production for animal feeding and multi-nutritional block production, establishment of silvopastoral systems and dual-purpose cattle management, and are starting projects on animal traction.
- In Cuba, the National Coordinator and the National Committee are making progress in the establishment of forage trees and production systems with cooperative farmers, and the installation of continuous-flow-plastic-biodigesters.
- In Venezuela, the National Coordinator and a group of collaborators established an integral farm and are studying different animal species: feeding with multi-nutritional blocks; characterization, behaviour and management of native stingless bees; conservation of wild species in danger of extinction; and systems such as the 'alpargata forrajera', for the fresh forage supply to the animals.

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