

Seed multiplication by resource-limited farmers

FAO
PLANT
PRODUCTION
AND PROTECTION
PAPER

180

Proceedings of the Latin American Workshop
Goiânia, Brazil, 7–11 April 2003

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ISBN 92-5-105217-4

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FOREWORD

Effective seed systems constitute dynamic repositories of Plant Genetic Resources for Food and Agriculture (PGRFA). They are a *sine qua non* for agricultural development and food security of the world. In spite of rapid advances made in the past decades regarding the formal seed sector, the informal seed sector, as largely represented by farmer-saved seeds and on-farm seed multiplication, has seen very little change. Small-scale or resource-limited farmers, who make up nearly 80 percent of farming populations in developing countries, rely on the informal sector for their seed needs, particularly of subsistence crops. There is therefore the need to introduce effective interventions aimed at ensuring that the informal sector is able to provide resource-limited farmers with the seed security that they require to achieve food security.

The relevance and need to strengthen seed systems are fully acknowledged in The Global Plan of Action for the Sustainable Conservation and Use of Plant Genetic Resources for Food and Agriculture (the *Global Plan of Action*). Specific recommendations are contained in priority activity area 13 “Promoting seed production and distribution”, in priority activity area 3 “Assisting farmers in disaster situations to restore agricultural systems”, and priority activity area 2 “Supporting on-farm management and improvement of plant genetic resources for food and agriculture”.

It is in light of the foregoing that FAO, through its Seed and Plant Genetics Resources Service (AGPS), initiated a series of expert consultations, workshops and conferences to generate ideas, develop methodologies and facilitate initiatives aimed at strengthening on-farm seed multiplication (the informal seed system), thereby addressing the seed security needs of smallholder farmers. Just as in sub-Saharan Africa, the informal seed system of the Latin American Region receives inadequate attention by policy-makers and is not accorded the importance it deserves in the agricultural production system. The fact that Latin America also is faced with most of the inequities in the informal seed sector and, particularly, constraints in the conduct and effectiveness of on-farm seed multiplication, was amply borne out during the one-day Round Table organized in Santa Cruz de la Sierra, Bolivia by FAO, with the collaboration of the Pan American Seed Congress. In line with the recommendations of the Round Table, FAO, with funding from the FAO/Netherlands Partnership Programme (FNPP), organized the Latin American Workshop on Seed Multiplication by Resource-limited farmers.

The specific aims of the workshop were: to identify the major constraints facing on-farm seed production, to identify the groups of limited resource farmers to be targeted and to propose solutions for increasing the availability of good quality seed to small holder farmers.

It is the hope of FAO that these proceedings will serve as a good record of the Workshop and be a guide towards the development of interventions by Latin American governments, as well as national and international institutions and agencies that may desire to assist further in this topic.

ACKNOWLEDGEMENTS

The Seed and Plant Genetic Resources Service (AGPS) of the Food and Agriculture Organization of the United Nations (FAO) extends its sincere thanks to the Government of the Netherlands for providing the funding to convene the Latin American Workshop on Seed Multiplication by Resource-limited farmers. AGPS also expresses its appreciation to the Government of Brazil for hosting this important workshop. Specifically, AGPS is indebted to the Fundação Dalmo Giacometti and the Brazilian Agricultural Research Corporation (Embrapa) for shouldering the hosting responsibilities.

Special thanks are addressed to all those who assisted in the implementation of the workshop by providing information and advice during the workshop itself and during preparatory missions to Venezuela, Bolivia and Brazil conducted by Mr. Claudio Bragantini, FAO Consultant. FAO also wishes to recognize the invaluable inputs of the National Organizing Committee and the workshop working group facilitators who assisted FAO staff in the running of the workshop.

The organization of the workshop was coordinated by Claudio Bragantini, in collaboration with Leslie Lipper, FAO economist from the Agricultural Sector in Economic Development Service and two international consultants: Gustavo Blanco, of Uruguay, and Victorio Giusti, of Argentina.

These Proceedings were edited by Michael Larinde, FAO Seed Technologist.

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ACRONYMS

AGPS	Seed and Plant Genetic Resources Service, FAO, Rome
ANIFODA	Asociación Nicaragüense de Formuladores y Distribuidores de Agroquímicos (Nicaraguan Association of Formulators and Distributors of Agrochemicals)
APROSECH	<i>El Chore</i> Seed Producers Association, Bolivia
ASCAR	Associação Sulina de Crédito e Assistência Rural, Brasil (Southern Association for Credit and Rural Assistance)
BAGSA	Bolsa Agropecuaria, Nicaragua (Agriculture and Livestock Fund)
CENARGEN	Centro Nacional de Recursos Genéticos e Biotecnología /Embrapa (Genetic Resources and Biotechnology)
CIAT	International Center for Tropical Agriculture, Colombia
COSUDE	Cooperación Técnica Suiza (Swiss Technical Cooperation)
DGDT	General Division of Territorial Delegations, Nicaragua
EMATER	State Company of Technical Assistance and Rural Extension, Brazil
ESAE	Agricultural Sector in Economic Development Service, FAO, Rome
ESREG	Escritorio Regional (Regional Office of IBAMA, the Brazilian Institute for Environment and Renewable Natural Resources)
FNPP	FAO/Netherlands Partnership Programme
FODA	Forestry Information and Liaison Unit, FAO, Rome
GNP	Gross national product
HCS	Hararghe Catholic Secretariat, Ethiopia
IDR	Instituto de Desarrollo Rural, Nicaragua (Institute of Rural Development)
IICA	Inter-American Institute for Cooperation on Agriculture, Costa Rica
INTA, Chile	Instituto de Nutrición y Tecnología de los Alimentos (Institute of Nutrition and Food Technology)
INTA, Nicaragua	Instituto Nicaragüense de Tecnología Agrícola (Nicaraguan Institute of Agricultural Technology)
LSSS	Local Seed Supply Systems
MAGFOR	Ministry of Agriculture and Forestry, Nicaragua
MHCP	Ministerio de Hacienda y Crédito Público, Nicaragua (Ministry of Treasury and Public Credit)
MST	Movimento dos Trabalhadores Sem Terra, Brasil (Brazilian Landless Workers' Movement)
OEA	Organization of American States
PASA	Programa de Apoyo al Sector Agrícola, Bolivia (Support Programme to the Agricultural Sector)
PNLL	Pound per Pound National Seed Programme, Nicaragua
PRONAF	Programa Nacional de Agricultura Familiar, Brazil (National Family-Farm Programme)
PROSEMPA	Seed Potato Project, Bolivia (Proyecto nacional de semilla de papa)
SADC	Southern African Development Community
STA	Seed Technical Assistance
TCP	Technical Cooperation Programme
UPOV	Union for the Protection of New Varieties of Plants
USAID	US Agency for International Development
WB	World Bank

I. WORKSHOP ORGANIZATION

1.1 Introduction

One major step towards achieving food security in developing countries is to improve their ability to achieve seed security. While seed supply channels of commercial agriculture are usually operational even during emergencies, the seed system of subsistence crops, although resilient, is often fragile and unable to fulfill seed needs. This situation is prevalent in many Latin American countries, particularly in those with many resource-limited farmers.

In view of the above, FAO supported several regional meetings to discuss this important issue. In 1993 in Swaziland, FAO organized a Regional Workshop on On-Farm Seed Production for the Southern African Development Community (SADC) countries. In 1997 in Lesotho, FAO organized the Regional Technical Meeting on the Promotion of a Regional Network for On-farm Seed Production and Seed Security in SADC countries. More recently, in 2002, in conjunction with the Pan American Seed Congress, FAO promoted the organization of a Round Table in Santa Cruz de la Sierra, Bolivia, where representatives of several Latin American countries presented their strategies to increase seed production of subsistence crops. During this one-day Round Table a more comprehensive discussion of the issue was recommended to identify the major constraints for the development of on-farm seed production, to identify groups of resource-limited farmers to be targeted, and to propose solutions for increasing the availability of good quality seed, which is important to smallholders' farming systems.

As a follow up to the recommendation of the Santa Cruz Round Table meeting, the Latin American Workshop on Seed Multiplication by Resource-limited farmers was organized in Goiania, Brazil with the financial assistance of FAO.

1.2 Outline of official arrangements

1.2.1 Preparatory missions

Claudio Bragantini, FAO seed specialist, undertook preparatory missions to Venezuela, Bolivia and Brazil to hold discussions with government officials on ways to improve the efficiency and the sustainability of the "informal" seed sector. Consultations on this issue led to the decision to hold a workshop in Brazil to be organized by the Fundação Dalmo Giacometti and Brazilian Agricultural Research Corporation (Embrapa). The Rice and Bean Research Center of Embrapa in Goiania, Brazil was selected to host the Workshop due to its special commitment to beans and rice, the two most important staple food crops of Brazil and most Latin American countries. During the visits, the formation of the National Organizing Committee (NOC) was discussed and a list was prepared of potential Latin American countries to be involved in the meeting. The NOC invited experts from Argentina, Uruguay, Bolivia, Mexico, Colombia, Nicaragua, Cuba and Brazil to participate in the Workshop.

1.2.2 International Director

Claudio Bragantini, FAO seed specialist, acted as International Director for the Workshop.

1.2.3 National Organizing Committee (NOC)

The NOC represented a broad spectrum of stakeholders, which included the following personnel of Embrapa: National Director, Pedro Antonio Arraes Pereira, the Technical Director, Beatriz da Silveira Pereira, the Committee President, Tarcisio Cobucci, Abilio Pacheco, Dino Magalhães Soares, Geovando Vieira Pereira, Leonardo Cunha Melo, Marina Biava, Murilo Lobo Junior, Roselene de Queiroz Chaves and Valacia Lemes da Silva Lobo. In addition, NOC was complemented by three working group facilitators, Joaquim de Carvalho Gomide, Luiz Cezar Gandolfi and Arthur Eduardo A. de Toledo. During the Workshop, FAO staff were assisted at the national level by the NCO.

1.2.4 *Consultants and lecturers*

FAO provided the services of Gustavo Blanco, an international seed legislation specialist from Uruguay, and Leslie Lipper, an economist from FAO Headquarters. Victorio Giusti, an agricultural engineer from Argentina, was also one of the Workshop lecturers. These contributors greatly assisted with Workshop implementation and enhanced the discussions and debates with their timely interventions.

1.2.5 *Technical arrangements*

The main objective of the Workshop was to discuss on-farm seed production of subsistence crops grown in Latin America. Workshop facilities, meeting rooms for discussion groups and plenary sessions, audio-visual aids, and secretarial services were made available.

1.2.6 *Administrative arrangements*

Most of the participants arrived in Goiania, Brazil before or on 7 April 2003. (See list of participants in Appendix I.) In order to minimize transportation problems, all the participants were accommodated in the Plaza Inn Executive Hotel, which also provided conference and meeting rooms for the workshop.

The opening ceremony was chaired by Clayton Campagnola, the President of Embrapa, who represented the Brazilian Minister of Agriculture, while Pedro Arraes Pereira, Director of Embrapa's Research Center gave the closing speech. The events of the opening ceremony was covered by the local and regional mass media.

1.3 **Workshop implementation methodology**

In order to provide background knowledge, the first part of the Workshop consisted of two days dedicated to presentations of background papers and the experiences of Latin American countries in dealing with seed production and supply of subsistence crops.

The second part of Workshop used a participatory approach and stimulating creativity through a brainstorming technique, to analyze the situation and provide suggestions for their remedy. The methodology was divided into four phases:

Phase 1. *Individual.* In plenary each participant presented the constraints he or she considered most important to the development of effective on-farm seed multiplication systems. A total of 122 constraints were identified through this process. Following the same methodology, in the next exercise, participants identified motivating factors that are immediately available and could facilitate the development of local seed systems. The participants identified 54 of such positive factors.

Phase 2. *Harmonization of factors.* The previously identified factors were grouped by affinities and similarities.

Phase 3. *Prioritization.* Participants ranked the constraints and the motivating factors by importance as detailed in Chapter 2.

Phase 4. *Searching for solutions.* As outlined in Chapter 3, five working groups were formed and each group discussed and proposed possible recommendations to one of the most important constraints, and the possible ways to best take advantage of the identified motivating factors.

1.4 The Workshop Programme

International and national participants arrived on Sunday, 6 April, 2003. The Workshop Programme proceeded as follows:

TIME	ACTIVITY / PRESENTATIONS
DAY 1:	Monday, 7 April 2003
8:00	Registration
8:30	Opening ceremony: Pedro Antonio Arraes Pereira, Director of Embrapa Research Centre Welcome address Presentation of Workshop officers and lecturers Outline of Workshop objectives and introduction of participants
9:30	Presentation: <i>The importance of community-based production for the sustainability of smallholders</i> by Clayton Campagnola, President of Embrapa, representing the Minister of Agriculture
10:30	COFFEE BREAK
10:45	Presentation: <i>Informal seed systems: definitions, perceptions, concepts and prejudices</i> , by Claudio Bragantini, FAO seed technology consultant
11:45	DISCUSSIONS
13:00	LUNCH BREAK
14:00	Presentation: <i>An economic approach to assessing seed systems</i> , by Leslie Lipper, FAO Economist
15:00	DISCUSSIONS
15:30	COFFEE BREAK
15:45	Presentation: <i>Seed production and conservation in rural settlements</i> , by Ciro Correa, representative of the Organization of Landless People in Brazil (MST)
16:45	DISCUSSIONS
17:45	CONCLUSIONS
DAY 2:	Tuesday, 8 April 2003
	Seed production and conservation by smallholders: Case studies in Central America
8:00	Presentation: <i>The Cuban programme for seed production of subsistence crops</i> , by Miguel Socorro Quesada, Rice Research Institute, Ministry of Agriculture, Cuba
9:00	Presentation: <i>Experiences, successes and new perspectives of the Pound per Pound seed distribution programme in Nicaragua</i> , by Luis Mejia Selva, Ministry of Agriculture and Forestry of Nicaragua
10:00	COFFEE BREAK
10:15	DISCUSSIONS
	Seed production and conservation by smallholders: Case studies in the Andean Region
11:00	Presentation: <i>The Seed Technical Assistance (STA) project for seed production with smallholders in Bolivia</i> , by Jorge Rosales King, Director of Regional Seed Office, Santa Cruz de la Sierra, Bolivia
12:00	LUNCH BREAK
	Seed production and conservation with smallholders: Case studies in the Conesul Region
14:00	Presentation: <i>A practical and participatory proposal for seed production with smallholders</i> , by Victorio Giusti, post-harvest expert, Consultant
15:00	Presentation: <i>Harmonization of seed policies, rules and regulations: its potential effects on small-scale seed production</i> , by Gustavo Blanco, seed legislation expert from Uruguay
16:00	DISCUSSIONS
16:30	COFFEE BREAK

16:45	Presentation: <i>Technology transfer to smallholders: Embrapa's maize and bean seed distribution campaign</i> , by José Hamilton Ramalho, Embrapa, Maize and Sorghum Research Center
17:45	DISCUSSIONS
18:15	CONCLUSIONS
DAY 3:	Wednesday, 9 April 2003
8:00	Presentation: <i>The Krahô Indians and Embrapa: an example of partnership for maize germplasm conservation</i> , by Terezinha A. B. Dias
9:00	DISCUSSIONS
9:30	Formation of Working Groups
10:00	Working Groups meetings
12:15	LUNCH BREAK
14:00	Working Group meetings
DAY 4:	Thursday, 10 April 2003
9:00	Working Groups meetings
12:15	LUNCH BREAK
14:00	Working Groups meetings
DAY 5:	Friday, 11 April 2003
8:30	Workshop synthesis
10:00	DISCUSSIONS OF THE ACTION PLAN
11:30	COFFEE BREAK
11:45	Official closing
13:30	LUNCH
	Preparation of Workshop report and proceedings

II. RANKING OF CONSTRAINTS AND MOTIVATING FACTORS IN STRENGTHENING LOCAL SEED SYSTEMS IN LATIN AMERICA

2.1 Ranking the identified constraints

The identified constraints were ranked as follows (in order of importance):

1. Inadequacy and low impact of public policies in promoting appropriate research, technology transfer, credit, commercialization and infrastructure focused on the generation, transfer, production and use of quality seed by resource limited farmers, including the development of appropriate farming equipment.
2. Institutional policies that do not prioritize the integration, coordination and strengthening of governmental institutions involved in research and extension, consequently contributing to the gap between them and potential beneficiaries.
3. Lack of strategy in the application of participatory methodologies that take into account the social, cultural and regional characteristics and experience of the small-scale farmers.
4. Difficulties for agricultural researchers in understanding and identifying the demands of small-scale farmers.
5. Enormous diversity of culture, climate and soil in small-scale farmer communities requiring differentiated strategies.
6. Lack of strategy in valorizing and identifying market niches, and adding value to seeds produced on-farm.
7. Low levels of literacy and professional capacity of small-scale farmers.
8. Inadequacy of small-scale farmers to comply with legal requirements for seed production and commercialization (seed laws).
9. Improved varieties with low availability and/or poor adaptability to local interest.
10. Low level of cooperation in the development and organization of small-scale farmers.
11. Exclusive reliance of small-scale farmers on their own seed for planting due to lack of alternatives - resulting from a lack of an effective demand and the uncertainty of profit for potential investor in the “informal” seed sector.
12. Conflict of interest among actors of formal and informal systems regarding production and use of seeds.
13. The inefficiency of health and education programmes in rural areas contributing to rural exodus and lower life expectancy of the communities.
14. Potential cultural resistance to the introduction of improved varieties and other innovations.
15. The focus of the current agricultural model on entrepreneurial agriculture.
16. Lack of information on the evolution of transgenics.
17. Lack of social, economic and environmental impact studies of seed use.
18. Difficulties related to the access of the informal seed supply system to channels for commercialization and marketing information and to the product quality requirements available to the formal seed supply system.
19. Lack of awareness and use of agricultural aptitude studies by small-scale farmers.
20. Difficulties in producing seeds under intense attack of insects and diseases.
21. Lack of support to infrastructure and the testing of new varieties.
22. Discrimination against small-scale farmers.
23. The lack of prioritization of seed multiplication activities.

2.2 Ranking the identified motivating factors

The identified motivating factors were ranked below in order of importance.

1. Many readily available technologies and production resources (land, hand labour, etc.) for seed production by small-scale farmers.

2. Current political sensibility to the need to integrate the formal and informal sectors with a view of improving the agricultural activities of small-scale farmers.
3. Biodiversity, breeding programmes and facilities for germplasm conservation, and interest in promoting the use of local varieties.
4. Positive experiences with participatory research and development programmes using local germplasm.
5. Public and private organizations involved in teaching, research and extension, strategically distributed and with highly qualified human resources (e.g. Brazil).
6. An official national seed system with laws and regulations that facilitate the development of on-farm seed production (e.g. Brazil).
7. Recognition of the importance of family agriculture by the society in general and by members of the scientific community.
8. Society's growing interest in better quality food through organic agricultural systems.
9. Technical and financial support from international organizations for seed production by small-scale farmers.
10. Encouragement from community organizations to promote the feeling of ownership and self-reliance of small-scale farmer seed producers.
11. The high cost of improved seed and the demand from specific marketing niches, which both stimulate community-based seed production activities and improve competitiveness.
12. Availability of infrastructure and equipment for seed production.
13. Circulation of communication in formal and informal channels sensible to the needs of smallholders.
14. Programmes for credit, health and technical assistance for rural communities.

III. WORKING GROUP PRESENTATIONS AND RECOMMENDATIONS

3.1 Groups: constraints and motivating factors

Each of the five working groups worked separately with one major constraint and one major motivating factor, and presented the related recommendations for discussion in plenary session.

3.1.1 Group 1:

A. Constraint: Inadequate and/or low impact of public policies for promoting research, technology transfer, credit, commercialization and infrastructure focused on the generation, transfer, production and use of quality seed by the resource-limited farmer, including the development of farming equipment appropriate for small-scale farmers.

Recommendations:

1. Create a national programme with specific financial resources for improving production and access to quality seed by resource-limited farmers and other rural communities.
2. Recover and conserve traditional and local varieties, and varieties that were introduced through participatory methodologies.
3. Providing technical assistance and training to local seed multipliers.
4. Make a credit line available to small seed producers for appropriate inputs, equipment and infrastructure.
5. Provide training to local seed producers for their initiation in the production chain and in marketing to ensure that produced seed will reach the market.
6. Create funds to stimulate research and technology transfer at the regional level that are specific for on-farm seed production.

Motivating factor: Public and private organizations with highly qualified human resources involved in teaching, research and extension, strategically distributed in Brazil.

Recommendations:

1. Stimulate the creation and/or development of cooperative projects that can take better advantage of available human resources, particularly at the regional level.
2. Promote training for research and extension teams to work with different ethnic groups of diverse backgrounds.

3.1.2 Group 2:

A. Constraint: Institutional policies do not prioritize the integration, coordination and strengthening of governmental institutions involved in research and extension, thus maintaining the gap between them and potential beneficiaries.

H. Vasconcelos remarked that his working group agreed that the best way to promote the integration of efforts in breaking the barriers to on-farm seed production is to create a “minimal agenda”, where each institution involved is committed to some key activities.

Recommendations:

1. Each public and private organization needs to create an *institutional agenda*; small-scale farmer groups need to be present during the design of action plans and the role of each actor should be well established.
2. An assessment of small-scale farmer communities is needed before developing on-farm seed programme. This assessment will establish the main framework towards which subsequent actions will be oriented.
3. A participatory project should be prepared with common objectives and in agreement with community interests.

4. On-farm seed programmes require special adjustments according to the political and social organization of each Latin American country or region.

B. Motivating factor: Positive experiences with participatory research and development programmes using local germplasm.

Recommendations:

1. Create an “information system” for identifying, cataloguing in logical order and circulating positive experiences with on-farm seed production. The system would serve as a landmark for future seed programme that valorize local knowledge.
2. Seek political support for these positive experiences.
3. Replicate the identified positive experiences.
4. Seek recognition of the importance of these positive experiences by the society and the scientific community.
5. Explore necessary funds and human resources to carry out the above recommendations.

3.1.3 Group 3:

A. Constraint: A lack of strategy in applying participatory methodologies that take into account the regional, social and cultural characteristics and experiences of small-scale farmer communities.

Recommendations:

1. Organize meetings with universities, extension services, research institutions, local and regional administrations, community associations and NGOs to integrate efforts.
2. Promote brainstorming meetings with the above organizations for each target region, with the following objectives:
 - Creating awareness about the problems and prioritizing them in order of importance.
 - Find out the causes and prioritize them.
 - Propose solutions for the prioritized problems.
 - Develop an Action Plan.

Motivating factor: Biodiversity, breeding programmes and facilities for germplasm conservation and the promotion of local varieties.

Recommendations:

1. Encourage the use of local varieties in breeding programmes.
2. Stimulate native germplasm collection.
3. Build capacity in germplasm collection and characterizing available local varieties in local communities.

Discussion:

C. Bragantini: *Do we need to improve or conserve the local varieties?*

C. Camargo: *We are talking about the improvement of seed quality, not genetic improvement.*

E. Vieira: *We could also think about the genetic improvement of local materials, if necessary.*

L. Lipper: *I agree that we should improve both the seed and genetic qualities.*

V. Giusti: *I also agree that traditional or local seeds need to be improved in both ways.*

F. Caporal: *We need to take into account that small-scale farmers need to be more competitive. That's why I also agree that varieties need to be improved in both ways.*

M. Wetzel: *Local materials are usually the basis for many breeding programmes.*

3.1.4 Group 4:

Constraint: Researchers encounter difficulties in understanding and identifying the demands of small-scale farmers due to the lack of community involvement in programme design.

Recommendations:

1. Develop diagnostic study tools to identify constraints in the integration of research institutions and communities of small-scale farmers.
2. Based on the diagnosed constraints, establish strategies that integrate actors *in the correct identification of small-scale farmers' demands*.
3. Internalize the methodologies for participatory actions in research and development for the identified demands.

B. Motivating factor: Current political sensibility to the need to integrate informal and formal sectors, with a view to improving agricultural activities of small-scale farmers.

Recommendations:

1. Prepare and present to potential donors multi-institutional seed projects that improve the socio-economic conditions of smallholders.
2. Evaluate and promote the socio-economic impacts of successful projects.

3.1.5 Group 5:

A. Constraint: There is an enormous diversity of cultural, climatic and soil conditions among small-scale farmer communities that requires differentiated strategies.

Recommendations:

1. Prepare diagnostic studies through multi-disciplinary teams of experts using the participatory methodology that considers smallholders' cultural, social and economic diversity.
2. Take into consideration all the social and agronomic information already available to complement the diagnostic studies.
3. Provide continuing support to obtain different solutions to specific problems.

B. Motivating factor: Many readily available technologies and production resources (land, hand labour, etc.) available for seed production with small-scale farmers.

Recommendations:

1. Look for mechanisms to integrate complementary efforts that would optimize current production factors.
2. Utilize the motivating factor to complement the search for resources to develop on-farm seed programmes.
3. Use the results obtained from the diagnostic study of agricultural systems to develop participatory project proposals.
4. Organize and make available all the technical information on small-scale seed production through the Internet and other means of communication.

3.2 Summary of recommendations

In general, the high-level representatives of national institutions recommended that small-scale farmers of the region should have access to good quality seeds in order to guarantee them a sustainable and continuous supply system. In particular, it was recommended that:

1. Latin American countries should have national programmes to promote on-farm seed multiplication for subsistence crops by local communities. These programmes are expected to coordinate all field activities and promote the establishment and/or development of multi-institutional cooperative projects that would:
 - Promote the recovery and preservation of traditional and local varieties, and preserve biodiversity and local knowledge;
 - Provide technical assistance and training to local seed multipliers, from production to marketing;
 - Make available micro-credit lines for seed multiplication;

- Provide funds for research and technology transfer to small-scale farmers;
 - Offer the available technologies and local production resources (land, hand labour, etc.) to complement the search for external financial support.
2. Any intervention related to on-farm seed multiplication should be preceded by a well-planned economic assessment of local seed systems and their impacts on the farm level. These assessments would require:
- Training of research and extension teams to work with local farmer groups of different ethnic origins;
 - The use of participatory methodology taking into account socio-cultural, regional and economic diversity and farmers' previous experiences;
 - A multidisciplinary team composed of universities, extension services, research institutions, local and regional public services, community associations and NGOs.
3. On-farm seed production activities should be diffused through an information system network that would identify, organize and make such activities available to Latin American countries, using the modern means of communication (Internet, CD-Roms, etc.). Efforts to make local seed systems better known would result in:
- increased political support for on-farm seed multiplication activities;
 - more available human and financial resources for local seed production;
 - greater recognition of the importance of local seed systems by the scientific community and society as a whole.

There was a consensus among Workshop participants that on-farm seed programme priorities may vary among Latin American countries, hence the requirement for special adjustments according to each country's political and social organization.

IV. TECHNICAL PRESENTATIONS AND DISCUSSIONS

4.1 Formal and informal seed systems: Definitions, perceptions, concepts and prejudices

C. Bragantini

4.1.1. Introduction

Since the origins of agriculture, self-sufficiency in seeds has been achieved through the selection and preservation of a part of the harvest for planting in the next season. The evolution of this system started with the exchange of seeds among neighbouring farmers and grain dealers. Since then, some but not all seeds supply systems greatly evolved. While seeds supply systems of cash crops are in constant development, those of subsistence crops, so important for food security, have been slowly evolving and are in constant crises.

There are currently traditional and commercial seed systems in all countries. The informal or traditional seed system supplies seed for subsistence agriculture, while the formal or commercial seed system is the main source of seeds for cash crops.

4.1.2 Description of seed systems

4.1.2.1 Formal seed systems

The formal seed production schemes use organized channels under the supervision and quality control system provided by public or private institutions, in accordance with special rules and regulations. This system is able to meet the demands of modern agriculture and complies with the seed industry's requirements. The formal seed system is market-oriented and characterized by a continuous varietal replacement as a mechanism of technology transfer and as a market strategy. Seeds of most cash and horticultural crops, particularly hybrids, are supplied by the formal seed system. More recently, since agrochemical multinationals have started to dominate the seed market, the formal seed system has been undergoing a tremendous transformation with the advent of transgenic seeds.

4.1.2.2 Informal seed systems

Informal, or on-farm seed systems, vary among countries, regions and crops. They rely on seed-saving practices, that is, keeping part of the harvest for planting in the next season. The system usually plants local varieties of seed kept from the previous year's harvest or obtained from neighbours and/or the local market. This is the predominant system for food crops in subsistence agriculture. It is estimated that in developing countries, the informal seed system is responsible for more than 80 percent of the total area planted with subsistence crops. It is a very resilient system, which is very active even without the support of public or private institutions. On-farm seed systems are essential for improving food security for developing countries. They will likely continue to be the main source of seed for subsistence crops in the world. Since this system is not market-oriented, seeds are usually produced for consumption. Some surpluses can be bartered with neighbours or sold to local grain dealers.

Until the beginning of the 1980s, the informal seed systems were usually ignored by governmental authorities, which were more interested in developing the commercial seed system and the seed industry. Recently, the informal seed system has been receiving special attention and support from NGOs and other agricultural development agencies around the world, but it is still underused as a tool for improving food security.

Formal seed supply systems, then, are designed for commercial agriculture, and use improved varieties developed for a market that responds to the application of new technologies. These varieties are constantly being replaced by new, more competitive ones. The informal seed supply system, on the other hand, responds to the needs of small-scale farmers involved in subsistence agriculture.

While the main goal of the formal seed system is profit, something very hard to attain with subsistence agriculture, the informal seed systems aims at the self-supply of seed, considered an important alternative for improving food security.

4.1.3 Converging and diverging issues related to seed systems

4.1.3.1 The term “informal”

Throughout Latin America the term “informal” connotes illegality when related to seed systems. The reason for this is that “informal” is used to describe grain producers of some cash crops who sell part of their harvest as seed without being legally accredited as seed producers. This is a common practice in most countries. In the United States, it is known as “brown bag” seed because they are conditioned, packed in paper bags and commercialized like regular seed, but due to their illegality, they are without any identification of the seed producer. In Latin American countries they are also known as “pirate seeds”.

Unlike Latin America, other regions of the world use the term “informal” to identify on-farm or traditional seed systems. This informal system is still used as a major source of planting material for subsistence crops. It is important to point out that on-farm seed production, unlike “pirate seed”, is not in an unfair competition with the formal seed system, because they deal with different crops and have different objectives.

4.1.3.2. Seed quality

There is a misperception that all seed from the informal system is low quality, while all seed from the formal system is high quality. In fact, both high and low quality seed can be found in any seed production system. From another perspective, one cannot assume that all seed bartered or even sold by small-scale farmers through the informal system is invariably of good quality just because of the mutual trust between the supplier and the consumer, and therefore no quality control is required. Similarly, seed from the formal system cannot be assumed to be high quality just because it is labelled and fancily packed.

Another controversial issue relates to varietal purity in the two systems. It is a very important quality attribute for the formal system because it provides the uniformity in plant maturation, in product quality and in market appearance that is required for mechanical harvest. This quality attribute is often seen differently in the informal system. For instance, in some African countries small-scale farmers usually intentionally mix early and late maturing bean varieties in order to guarantee some harvest, especially if the rain season is not favourable. This is only possible because beans are hand-harvested.

Another controversial issue relates to the characteristics of varieties. Most modern varieties developed for the formal system are aimed at increasing yields. Plant growth and architecture are adapted for concentrating on grain production, consequently less emphasis are placed on leaves and straw. These characteristics do not always satisfy small-scale farmers because they need to feed some animals on their property. However, seed quality attributes such as physical purity and germination capacity are equally important for both systems.

4.1.3.3 Informal seed systems and the preservation of genetic resources

It is well known that commercial agriculture concentrates on large-scale production of a few high performance varieties, consequently, there is a narrowing of the genetic base. The formal seed system serves commercial agriculture by using the continuing release of new cultivars as a marketing strategy. However, its vulnerability is high because all of these cultivars often have the same genetic base.

There is currently a growing global awareness that traditional seed systems play a very important role in maintaining genetic resources through the multiplication of local landraces.

4.1.3.4 Narrowing the gap between the formal and informal systems

There is an unquestionable need to develop mechanisms to ensure the supply of quality seed of subsistence crops to small-scale farmers. The strategies utilized to reach this objective have been varied. Some attempts were made in the past to motivate the seed industry to produce and market seeds of subsistence crops for small-scale farmers. Success was not always evident because this seed market's size and dispersion do not always allow for a margin for profitability. In addition, the varieties available in the formal system are often not what small-scale farmers want. Other attempts included organizing small-scale farmer groups into small seed enterprises to supply seed to this market. Although there are some small-scale farmers already established as seed producers in their communities, the mechanisms to promote this activity still need to be developed. Another perception of informal seed supply systems is based on the principle that since they have existed since the beginning of agriculture, alternatives should be sought to promote on-farm seed multiplication without trying to make a business out of it. Along these lines, rural fairs for exchanging local landraces have been very successful, not only in providing planting materials, but also in conserving local germplasm.

Any alternative to developing local seed systems obviously requires specific strategies. This Workshop should shed some light on establishing procedures that accommodate Latin American conditions.

4.1.3.5. Limitations and opportunities for the informal seed system

There are some specific limitations to the development of local seed systems. There may be some economic limitations with horticultural crops, for instance, since the cost of producing these seeds in small scale is usually not cost-effective. Hybrid seed production requires isolating seed production fields and is therefore unsuitable for small-scale farmer communities. Another limitation relates to the need for investment in infrastructure such as seed conditioning machinery, tractors and implements. There are, however, seed market niches that can be occupied by organized groups of small-scale farmers. These opportunities are usually neglected by the formal system because the market is not large enough to attract large-scale farmers or because they require hand labour. These market niches need to be identified and suitable conditions developed in order that groups of small-scale farmers may explore them.

4.1.3.6 The modern formal system and the primitive informal system

The success of the "Green Revolution" in increasing global food production has relied heavily on developing countries' capacity to develop their formal seed production systems. At the same time, the local seed production schemes were considered primitive and less important, not only by local authorities, but also by the technical and scientific community. This misconception retarded the development of a closer linkage between the two seed systems, which became widened. While the formal seed system received financial, technical and other support from government, and developed fast, the informal system either remained unaltered or collapsed in eventual crisis due to climatic or social disturbances.

With the present urge to increase food security in developing countries, there is a favourable environment for the development of local seed production systems to reach seed security for subsistence crops. In some African countries, this is being supported by NGOs and other development agencies. It is expected NGOs and Latin American governments will now concentrate efforts on the development of informal seed systems.

4.1.3.7 Discussion

J. Rosales: Regarding terminology, in Bolivia the term "informal" immediately connotes illegality and should therefore be avoided. With respect to the possible conflict of interests between the promotion of modern varieties and on-farm germplasm conservation, there are some organizations with external funds in Bolivia, which, under the umbrella of germplasm conservation, deprive small-

scale farmers from using more productive varieties. They cause these farmer groups to continually obtain poor yields.

C. Bragantini: I have the feeling that the term “informal” will probably have to be replaced with one or more terms that would better describe this important seed system in Latin America. The terminology is also important because it can create barriers within the legislation. The Brazilian seed law is presently being revised and the term “Creole seed” (seed of local varieties) is being introduced to provide resource-limited farmers with access to credit in order to plant this type of seed.

N. Francelino: I would like to add that the new Brazilian Seed Law recognizes farmer groups, such as “family agriculture”, “rural settlements” and “Indian farming groups”, and seed production activities in these communities. In addition, it states that traditional and local varieties are not required to follow the same rules (varietal description and varietal testing, etc) as are modern varieties. I also agree that the term “informal” should be avoided because of its proximity to illegality.

G. Blanco: Many years ago, when the Seed Unit of the International Center for Tropical Agriculture (CIAT) in Colombia was working on the development of other types of seed systems in Latin America, the term “non-conventional” was used in many papers to describe seed systems that were different from the “formal” or “conventional” systems. I find this very satisfactory and propose its use. I would also like to suggest the addition of one of these papers in the proceedings of this Workshop, as an extra source of information.

I would like to comment that, in my opinion, the introduction of modern varieties in small-scale farmer communities should be the farmer’s choice and we cannot keep them poor just for the sake of germplasm conservation. Genetic variability does not provide a direct advantage to the resource-limited farmer, so he or she should be compensated if there is an interest in involving him or her in the conservation of genetic resources.

V. Fukuda: In your presentation you did not mention vegetative propagated crops such as cassava. Are we supposed to discuss this during the Workshop?

C. Bragantini: Of course, particularly because cassava is a typical small-scale farmer crop. In addition, cassava multiplication requires extra care to avoid the dissemination of diseases.

V. Fukuda: By the way, I have a very interesting paper describing small-scale farmers’ multiplication of disease-free cassava plantlets produced *in vitro*. I believe it would be interesting to add a copy of this paper to the Workshop proceedings as an additional source of information.

T. Dias: Years ago, the Centro Nacional de Recursos Genéticos e Biotecnologia (CENARGEN) Embrapa was involved in restarting the multiplication of some special maize germplasm lost by Indian communities and being conserved in the germplasm bank. This is a true example of the importance of on-farm germplasm conservation through seed multiplication activities.

C. Bragantini: Just a reminder that this Workshop is to address seed multiplication problems of Indian communities and other minority groups such as farmers’ groups formed by ex-slaves.

V. Giusti: Returning to the problem of terminology, I think the most appropriate term for replacing “informal system” is “traditional system”.

E. Vieira: I have been recently involved with germplasm collection in several regions of Brazil and notice how important and how rich the genetic variability can be in some regions. My concern is related to the potential loss of genetic variability if local germplasm is replaced by commercial varieties.

C. Bragantini: This is probably one of the most important challenges we face - to increase yields of subsistence agriculture through the introduction of more productive varieties and, at the same time, to promote on-farm maintenance of genetic variability. I am sure that a serious project dealing with this issue would have no problem in finding financial support.

H. Vasconcelos: The solution to this problem could be through the development of market niches for traditional varieties. I had a chance to work with small-scale farmer groups that were interested in maize varieties that could produce some special type of straws and leaves to be used in artisan work. In this specific case, higher yields were not the most important attribute to an introduced variety.

S. Linhares: I would like to mention that the new Brazilian Seed Law indeed recognizes “local”, “traditional” and local varieties in addition to the commercial cultivars and no restriction whatsoever can be imposed on these seed types.

C. Bragantini: This change in the Brazilian legislation is a big step forward and I am sure that other Latin American countries could use this new approach as a model when updating their own seed legislation.

K. Petan: Just a comment: the Ministry of Agrarian Development always supported the multiplication of local varieties through the organization of seed fairs, through the Programa Nacional de Agricultura Familiar [National Family-farm Programme] (PRONAF).

N. Francelino: I realized that there were many attempts to address this problem, but the information on these experiences with on-farm seed multiplication are scattered. It would be very useful to have it organized, either through publications on a CD-ROM or an Internet site.

4.2 An economic approach to assessing seed systems

L. Lipper

4.2.1 Introduction

In June 2001, FAO initiated a project to develop and test a methodology for conducting an economic assessment of seed systems and their impacts on farm level benefits and crop genetic diversity. The project is funded by the FAO/Netherlands Partnership Programme (FNPP) under its Access, Exchange and Sustainable Utilization of Agricultural Biodiversity component. The programme of work involves collaboration between the FAO Agricultural Sector in Economic Development Service (ESAE) and FAO Seed and Plant Genetic Resources Service (AGPS) in providing information and tools to improving the capabilities of FAO and member countries to facilitate farmers' access, exchange and sustainable utilization of plant genetic resources for food and agriculture. A key area to work on is the provision of information on the economics of seed system supply and demand, and how it affects farmer welfare and the conservation of crop genetic resources. This presentation focuses on the motivation, strategy, methods and preliminary outcomes of one FNPP-supported project over the last two years on the economic analysis of seed systems aimed at meeting this objective.

4.2.2 Motivation

Seed systems are comprised of a set of dynamic interactions between seed supply and demand, resulting in farm-level utilization of seeds and thus plant genetic resources. The seed system is essentially the economic and social mechanism by which farmers' demands for seeds and the various traits they provide are met by various possible sources of supply.

The primary research issues addressed by this project are:

- the degree to which this mechanism functions effectively, that is, the extent to which farmers' demands are met by supply;
- the way in which this mechanism affects farm-level outcomes, specifically household welfare and the conservation of plant genetic resources.

A key means for improving incomes and reducing food insecurity of small agricultural producers throughout the developing world is increasing agricultural productivity. Productivity is increased by improving farmers' access to crop genetic resources that are appropriate for their production and consumption conditions. For these producers, the primary means of access to crop genetic resources is through informal sector transactions, which include farmer-to-farmer exchanges, purchases from local markets or traders, and seed-saving from farmers' own production. In order to improve our capability of intervening in seed systems to improve farmers' access to plant genetic resources and the seeds that embody them, we need to know more about the incentives and constraints farmers currently face in accessing plant genetic resources. We need better information on the nature and determinants of farmers' demands for crop genetic resources, as well as the effectiveness of various supply mechanisms in meeting this demand. We also need to better understand how access to crop genetic resources translates into farm-level benefits or costs in terms of production and consumption. With this information we can design better policies and programmes aimed at improving the welfare of small producers and reducing food insecurity.

Promoting the *in situ* conservation of crop genetic resources is another important policy objective that must be taken into consideration in designing interventions in seed systems. At present, most of the world's *in situ* conservation of crop genetic materials occurs on the fields of small and low-income agricultural producers in developing countries. The *in situ* conservation of crop genetic resources involves the preservation of a process of genetic material evolution, driven by interactions between genes, the environment and humans in an agricultural production setting. In addition, *in situ* conservation preserves farmers' knowledge on the identification, use and value of the genetic

resource. This form of conservation has become increasingly recognized as an important aspect of biodiversity conservation, which is explicitly included under international agreements for the conservation of biodiversity, such as the Convention on Biological Diversity and the International Treaty on Plant Genetic Resources. Understanding how seed systems affect the tradeoffs farmers face in selecting and utilizing crop genetic resources is therefore essential in designing interventions that generate both improved farmer welfare and the conservation of crop genetic resources.

4.2.3 Strategy

The strategy adopted by the FNPP programme is to use a case study approach for developing a methodology for measuring seed systems and their impact on farmer welfare and crop genetic diversity. Ethiopia was selected for the case study site because it is a country where improving seed system management is a critical aspect of improving farm-level productivity and meeting its national food security objectives. Ethiopia is also a primary or secondary center of origin for several crops, including sorghum, wheat, barley and coffee.

The case study was built on an impact assessment of a seed system intervention implemented by the NGO Hararghe Catholic Secretariat (HCS) in a drought-prone region of eastern Ethiopia. HCS has implemented a seed system project over the past seven years, which involves selecting and cleaning local landraces of wheat and sorghum for multiplication and distribution to seed-insecure households. HCS also supplied improved varieties of wheat and haricot beans to participating farmers in some areas. Seeds were provided under a credit arrangement, which required repayment in the form of seed with a 15 percent interest charge.

The strategy adopted by the FNPP project was to use the HCS intervention as one means of defining a seed system, and to conduct detailed surveys at the plot, household and community level on socio-economic and agro-ecological conditions, seed supply, demand and utilization patterns, and agro-morphological characteristics of crop varieties. Communities sampled for the study were divided into participants and non-participants in the HCS project. The household sample was divided into three groups: (i) those who were participants in the HCS project, (ii) those who were not participants but who resided in communities where HCS had intervened; (iii) and those who were not participants and who resided in non-participant communities. The sample was designed to limit the degree of variation arising from agro-ecological factors in order to better isolate the impacts of the project.

In the HCS project area there are three major agro-ecological regions – lowlands, midlands and uplands. They mainly differ in elevation, and thus rainfall and cropping patterns. The sample was limited to midlands and uplands areas where sorghum, wheat and haricot beans are the primary crops. The non-project participant households (e.g. the control group) were selected to match the characteristics of HCS project participants to the greatest extent possible. A total of 720 households were surveyed in 30 peasant associations (equivalent to a municipality).

4.2.4 Methods

The method used for this project was the development and implementation of five different surveys on various aspects of seed systems, all interlinked by location. The household, community and market surveys were used for collecting information on seed supply and demand, and impacts of seed systems on farmer welfare. The agro-morphological and community focus group surveys were used to collect information for measuring crop genetic diversity.

For each of the selected Peasant Associations a survey was carried out on the community characteristics, infrastructure, marketing facilities and sources of seed supply. A key informant from the community, usually a government official, provided the information source. In addition, a group of households was surveyed within each of the selected Peasant Associations. In the non-participant communities 15 households were surveyed; in the participant community, 15 participating households and 15 non-participant households were surveyed. A total of 360 participant households were surveyed - 180 non-participants in participant communities and 180 non-participants in non-participant communities.

The household survey was conducted in two rounds: the first in August 2002 after the planting of the main crop of the year, and the second in February 2003 after the harvest. The household survey collected information on family structure and labour availability, agricultural and non-agricultural assets, crop and variety identification by plot, farm production (input and output) by plot, off-farm income sources, finance and access to credit, vulnerability, and coping strategies for disasters. In addition, the household survey covered detailed information on the farmers' seed demand and supply for wheat and sorghum crops. For these crops, information was collected on specific varieties. Questions covered where varieties are obtained, how often they are renewed, how much they cost to obtain and why they are preferred. Farmers were also asked to name varieties that they had planted in the past or would like to have.

The market survey involved the weekly collection of data over a two-month period (at planting time) from local markets where seed and grain were sold. The markets were usually located within the sample Peasant Associations, although some larger markets were outside. Data was collected on the prices and quantity of seed and grain sold by variety.

The agro-morphological and community focus group surveys were designed in cooperation with the International Plant Genetic Resources Institute (IPGRI). The main objective of the agro-morphological survey was to determine the characteristics of varieties that are consistently identified by farmers, in order to be able to link variety names and traits. The survey required characterization of 30 plants per plot in farmers' fields, listing all traits of a given variety. The community focus groups were another means of validating variety names. The main objective of the survey was to analyse the content of variety names, and the extent to which they are consistent across and within communities.

The data collected was entered into a computerized database and analyses were initiated. Statistical methods are used to identify relationships between variables, such as spatial econometrics, analysis of variance and principal components analysis.

Data will be used to define seed systems in various ways, to examine how well they function and their impacts at the farm level. We will begin by defining seed systems by the cost of obtaining seed, using our data on prices paid, value of in-kind exchanges and value of time and travel costs in obtaining seed to derive a cost of obtaining seed for each particular variety. We will analyse the variability in seed costs – if it varies mostly between communities or if there also significant variation within a community. We then plan to examine why some people face higher costs than others – if this is related to social networks, locations and/or income groups. The surveyed farmers will then be divided into groups based on the amount they pay to obtain seed of a particular variety; this information will be used to define the seed system of each household. Differences between farmer productivity, income and food security, as well as utilization patterns of plant genetic resources between these different groups will then be analysed.

In addition to using the cost of obtaining seed as one measure of a seed system, we plan to develop others that are not variety-specific, but crop-specific. One crop-specific measure is whether a household participated in the HCS programme or not. In participating in HCS, we assume a household is in a different seed system than are non-participants. We will then analyse the differences in farm benefits (productivity, consumption, income) and in farm conservation of crop genetic resources. Other measures of seed systems to be developed will be based on primary seed source and social networks.

4.2.5 Initial results

At this point we have only preliminary descriptive results from our study. A selected sample of the descriptive statistics on seed supply and demand is summarized in this section. Figure 1 shows ample variation in the sorghum varieties planted by farmers. Almost all sorghum varieties grown in the area are landrace varieties. Some improved varieties of sorghum have been developed but are not widely grown.

Figure 1 Sorghum variety distribution by household in 2001 planting season
Percentage of households planting

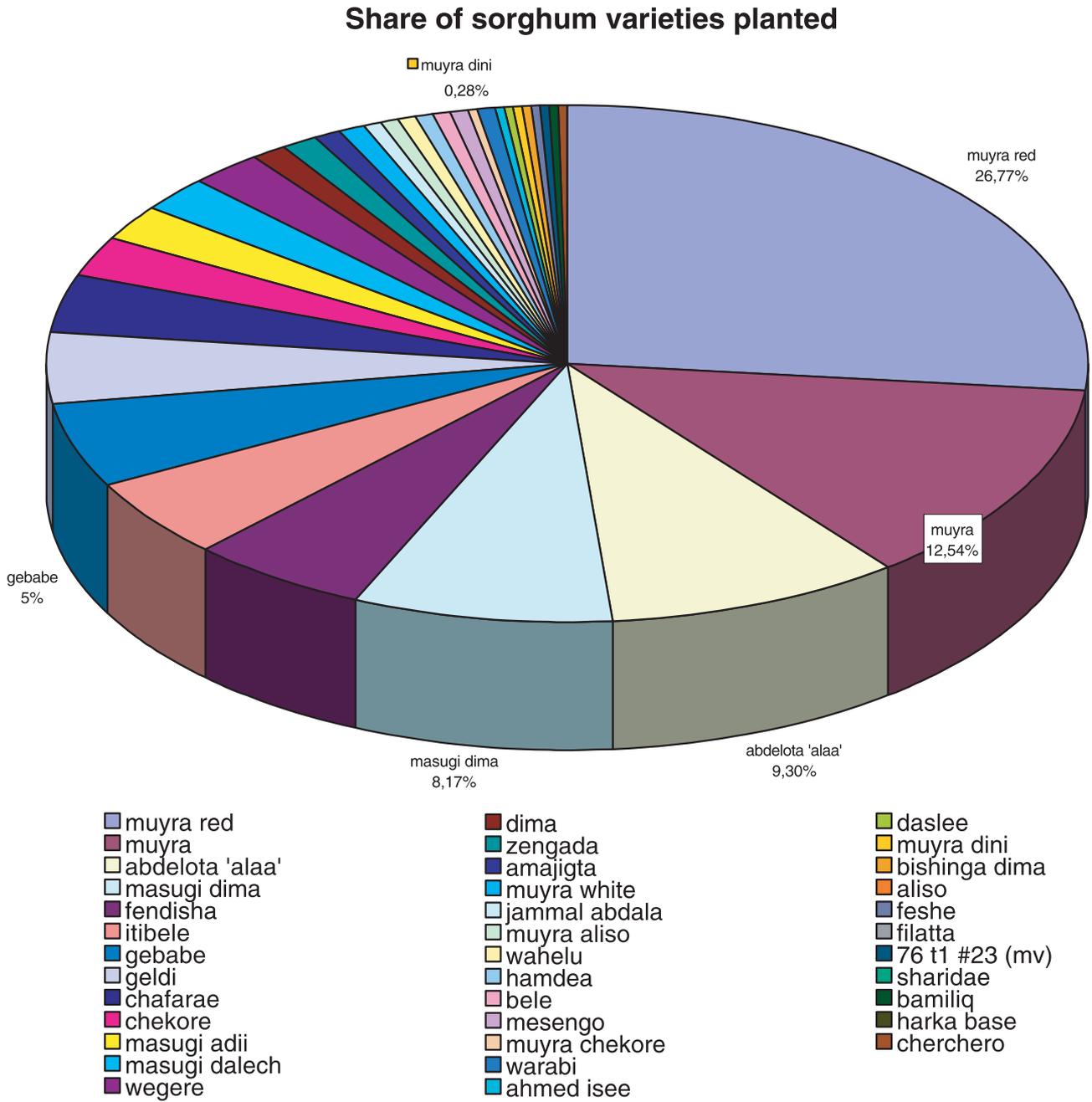


Table 1: Results from community focus group survey on descriptors for sorghum varieties

Varieties/ Descriptors	Stalk height	Grain Colour	Market value	Food quality	Grain yield	Grain size	Maturity	Tiller count
1. Chefero	Short	Red/ White	Best	Sweet	High	Small	Late	High
2. Muyra (Red)	Tall	Red/ White	Medium	Poor	Medium	Bold	Medium	Poor
3. Zengada	Tall	Red	Less	Bitter	Low	Small	Early	High
4. Fendisha dima gebabe	Short	Red/ White	Best	Sweet	Medium	Medium	Late	High
5. Fendisha adi gebabe	Short	Red/ White	Less	Sweet	Medium	Medium	Late	High
6. Chukura	Tall	Brown	Less	Sweet	Low	Medium	Early	Medium
7. Jengatelil	Tall	Yellow	Less	Bitter	High	Bold	Late	Poor
8. Dasle	Tall	White	Best	Sweet	High	Bold	Early	Medium

Table 1 shows some results from the community focus group survey where groups of farmers assigned values to varieties of several characteristics. It is interesting to note that the most commonly grown sorghum variety, muyra red, has only medium market quality and poor food quality, while the much lesser grown variety, daslee, is very high in market and food quality. The question then becomes, why isn't the latter being grown more? Figure 2 gives some insight into the answer.

Figure 2 Difficulty in obtaining sorghum varieties
Reported by sample farmers: Ethiopia seed study

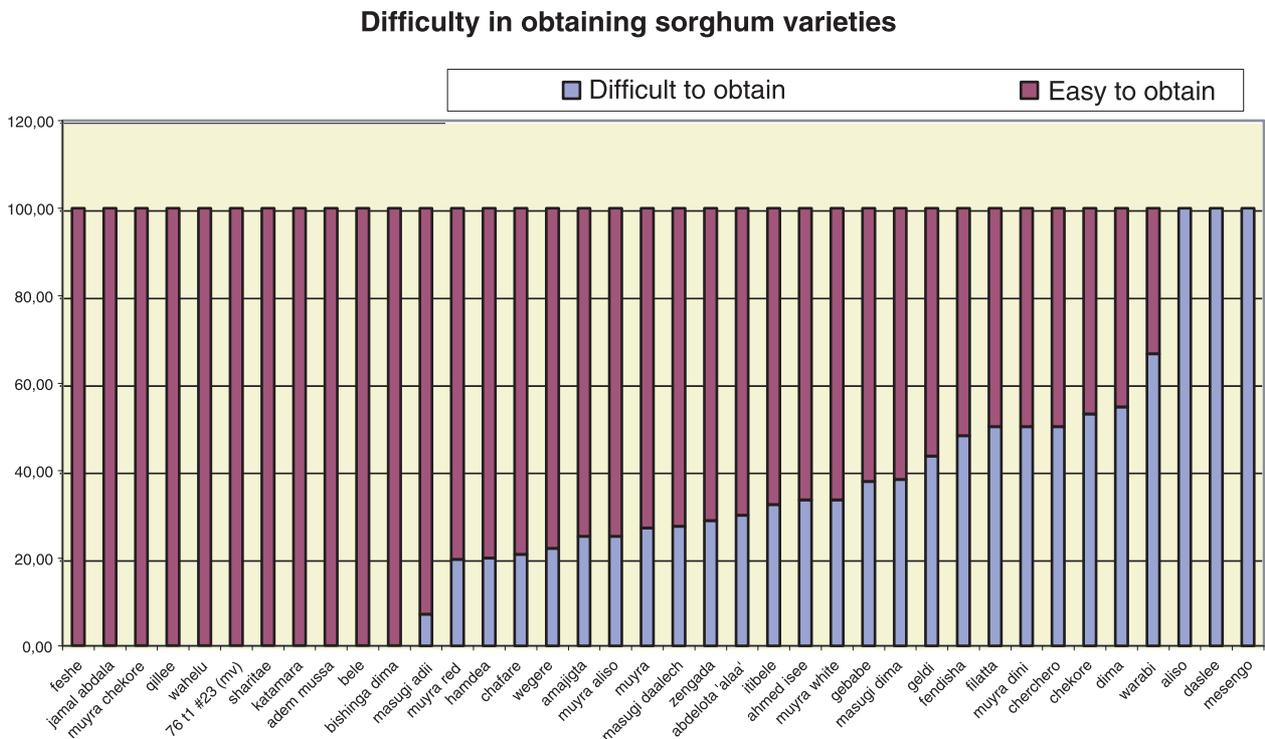
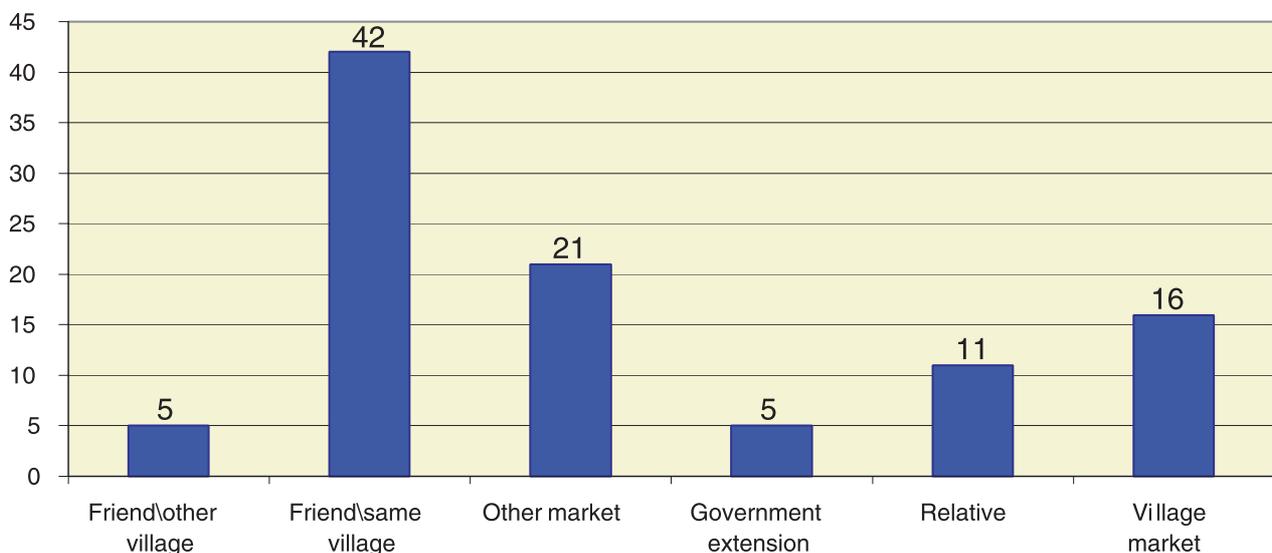


Figure 2, derived from data from the household survey, shows that according to the surveyed farmers, muyra red is a much easier variety to obtain than daslee. All of the farmers (100 percent) who have planted or are planting daslee report that it is a difficult variety to obtain.

Figure 3: Sources of sorghum seeds
Reported by sample farmers: Ethiopia seed study



In order to understand why daslee is a more difficult variety to obtain than muyra red, we need to look at the sources of these varieties. Figure 3 shows the overall percentage breakdown of the source of sorghum seeds from the households surveyed. More detailed analysis of sources by varieties will be conducted by the project in the future.

Figure 4: Wheat variety distribution by household in 2001 planting season
Percentage of households planting

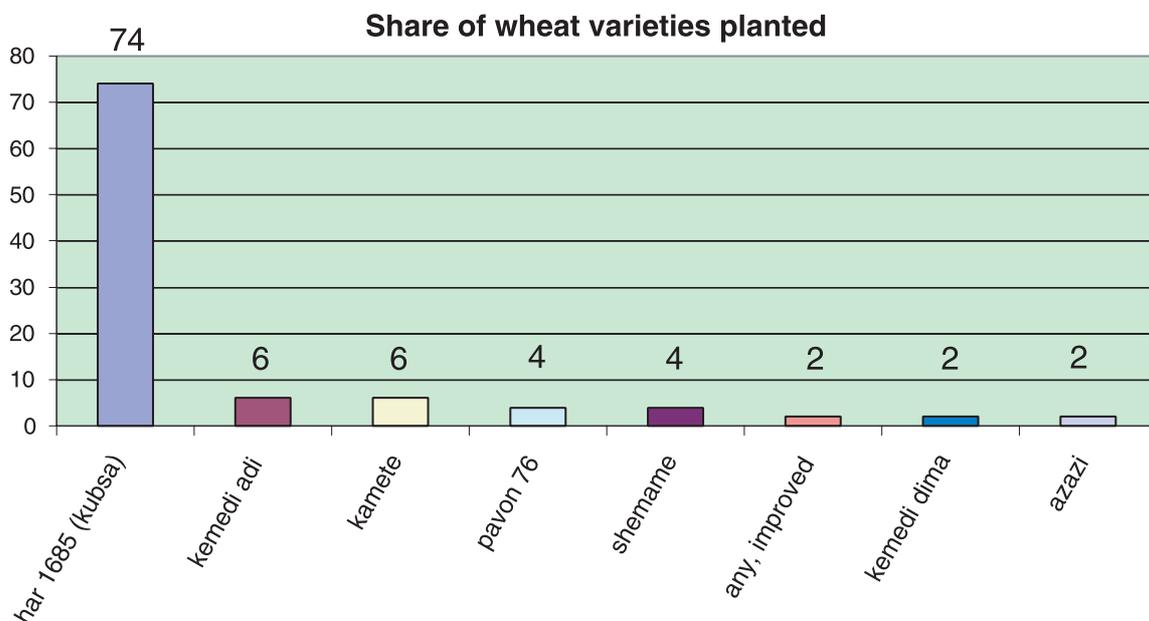


Figure 4 shows the percentage share of households that reported planting specific wheat varieties. As shown, there is a significantly lower number of varieties planted compared with sorghum. Most of the wheat-planting households used a modern variety (HAR 1685), in contrast to sorghum growers who used mostly landraces. Our data also indicates that a much higher percentage of seeds purchased for

wheat than for sorghum. It suggests that the seed system for wheat is quite different than that for sorghum, although this difference at the household level has yet to be analysed.

4.2.6 Discussion

C. Bragantini: Based on your experience in Ethiopia and Brazil, do you think that the methodology developed for Ethiopia would work for the target groups in Latin America?

L. Lipper: Based on the experience we gained in Ethiopia, we could now make this diagnosis for Latin American groups much better and faster. Of course, the methodology will always need some adaptation to local conditions.

V. Giusti: In Latin America, formal and informal seed systems are evident. Is this true for Ethiopia?

L. Lipper: The formal system in Ethiopia is not well developed and the seed produced through the informal system represents almost all the seed produced in the country.

J. N. Francelino: It seems to me that a good way to integrate small-scale farmers in the market is to first identify the local materials available and then look for market niches for these products. Partnership with NGOs through networking is very important.

L. Lipper: NGOs are very important in the network, but keep in mind that it is not always easy to establish partnerships between them and public institutions. They can be very resistant to this type of networking.

T. Dias: The diagnosis is also very important in identifying cultural barriers. For instance, when I first started working with the Krahô Indians, I learned that they believe that youngsters should not work with groundnuts because it could interfere with their fertility. I found your methodology very interesting but would like to have more detailed information.

L. Lipper: I have all the details here with me and I can discuss it with you later.

S. Teixeira: I believe that interviewing 720 farmers for this study is a little exaggerated. It could be done with many less interviews.

L. Lipper: We wanted to understand the relationships between productivity and germplasm conservation, and we needed to have a large sample to capture heterogeneity within and among the various groups.

K. Pettan: Seed certification and any other kind of quality control do not seem to be adapted to family agriculture because they are not market-driven. Family agriculture seeks self-consumption.

V. Fukuda: What is your opinion on the researchers' needs to leave their laboratories to go to interact with the small-scale farmers communities?

L. Lipper: There are still many communication problems between researchers and small-scale farmers' communities. I would like to mention that FAO is deeply interested in establishing its role in both technical and political scenarios.

4.3 Speech on sustainable development

Ciro Correa

4.3.1 Historical background

We are now facing the third of three phases of the rural reality in Brazil's history that has led the country to monoculture exports, poor management of environmental resources, poor work conditions, and domination by large property owners.

Phase 1 – *The Plantation model*. This model relied heavily on manual labour. Two good examples are the ancient coffee and sugarcane plantations in Brazil.

Phase 2 – *The Industrial model*. The Green Revolution was environmentally and economically unsustainable, socially unfair and culturally inappropriate. Agriculture aimed at exporting agricultural products, producing cheap food to keep salaries low, producing raw material for industry, releasing manual labourers to cities, and using industrialized products like seeds, chemical fertilizers, equipment and pesticides. All of this generated an unprecedented, enormous socio-environmental crisis. During the 1980s this model became exhausted and brought agriculture into crisis.

Phase 3 – *The North American model*. During the 1990s the new economic model started in Brazil and subordinated the economy as a whole to foreign capital. Agriculture became totally subservient to the logic and the integration of agrarian, industrial, commercial and financial capital. The search for profit greatly aggravated problems of land tenure, means of production and the production itself, creating a total subordination of agriculture to the industry. The State, totally subjected to this model, altered the following social relations with the rural environment:

- The control of agricultural market by large multinationals. The State left the control of food supply and prices to the market, which is now being controlled by a small number of large corporations. These corporations are now establishing the price of agricultural products at national and international levels. Examples include Bung, Cargill and Monsanto.
- Promotion of agricultural production for export through large-scale farmers with investments in infrastructure for transport of produce and the opening of new agricultural frontiers.
- Changes in agro-industries, which are sold to multinationals, concentration and monopolization; selectivity of integrated farmers, changes in the technological standards of production.
- Dismantling of the agricultural public sector: rural credit, technical assistance, CONAB (National Food Supply Company), research and insurance, etc;
- A new technological package in progress - biotechnology. The international financial capital of three different sectors that were historically separated (pharmacological, agro-chemical and food supply) is now being merged into one single company.

4.3.2 Consequences of the current agricultural model

This current model is transforming agriculture into a factory assembly line, with production being turned into an industrial process. Since the model concentrates power and profits, family agriculture has become totally unviable and any policy that tries to promote it becomes only compensatory, simply delaying its failure. These are the consequences:

- a) *Land concentration*. From 1985 to 1995 almost one million rural properties with less than 100 ha disappeared, while rural properties with more than 2 000 ha increased from 19 000 to 27 000. These large rural properties now control 127 to 177 million ha. In addition, land utilization does not represent the interests of the society as a whole and even less the interests of workers; it represents the interests of payment balance, neglecting economic progress and people's wellbeing. Our best lands are planted with monocultures of soybeans, citrus, coffee, sugarcane and cotton, while food production has stagnated. From the 350 million ha of farmer-owned agricultural land, only 40 million ha are being cultivated. If the agrarian legislation were effectively applied, there would be 120 million ha available for agrarian

reform. This concentration of land ownership in the hands of a few is causing an enormous rural exodus. In the last 40 years, more than 40 million people left rural areas in Brazil, and more than 500 000 migrated to Paraguay, Bolivia and Argentina.

- b) *Concentration of capital and profits.* Out of almost 5 million agricultural properties only 600 000 are presently able to survive within the current agricultural model. Rural properties with less than 50 ha in the southern region of Brazil have monthly incomes of less than one minimum salary, with very rare exceptions.
- c) *Reduction of agricultural employment.* More than two million people that used to live on their agricultural salary have lost their jobs in the last eight years. Around 50 percent of these rural workers earn up to US\$ 30/month, 64 percent of their work being informal, without labour contracts. The indicators of development such as electricity, home appliances, literacy levels, availability of medical doctors and per capita income resemble those in the poorest regions in the world.
- d) *Increase in agricultural imports* such as wheat, rice and beans that are the staple crops that used to be produced locally by small-scale farmers.

The adoption of this model is under way globally, but at a different pace in Chile, Indonesia, Mexico, Europe and the United States. All these countries face similar problems as in Brazil.

4.3.3 The popular project for agriculture

The only way to challenge the current agricultural model is through a national project that would reconstruct Brazil's political and economical geography, and guarantee political, economical, social and cultural democracy:

- *Democratization of access to land.* Wide, massive and rapid agrarian reform should be developed, promoting the return to rural areas and the resettlement of farmers in their land. The maximum size of rural property and small-scale farmers' credit lines should be established.
- *Public policies.* Public policies must lay the foundations for development, with subsidized credit as a form of redistributed income. This should avoid small properties from becoming poor, making available public technical assistance, education, infrastructure and housing, roads, energy and communication.
- *Promote cooperation.* Cooperation should be developed in many different ways not only as the driving force for production, but also as a personal and social value. Such values would avoid the degradation of human relationships caused by the current stimuli to individualism and competition.
- *Technological model.* A technological model should be developed to promote the basis of sustainable development, free from agro-industrial monopolies.
- *Agro-industry.* Small and medium-size agro-industry in all provinces should be implemented. These small businesses would aggregate profits, avoid the exploitation of farmers, stimulate cooperation, and decentralize economic development, generating youth employment.

4.3.4 The Vía Campesina Proposal

The principles of this Proposal are:

- *Biodiversity.* Biodiversity cannot be privatized. Patenting of living organisms have to be combated. Biodiversity should be available to and controlled by the people.
- *Seeds are the patrimony of people.* Seeds have been collected, improved and multiplied by rural and traditional populations for more than 10,000 years and should be kept as the patrimony of people. They do not belong to any multinational company.
- *Agriculture should not be part of the World Trade Organization (WTO)* . We propose that the WTO should not legislate on agriculture. Agriculture is beyond the laws of the free market

because food production is a basic condition in building citizenship. We defend the food sovereignty of people as a right in all countries, allowing them to produce food autonomously.

4.3.5 Seed production in rural settlements

Seed production in rural settlements is a tool for challenging the current neo-liberal model of agriculture and is the first step for the construction of a new agricultural model based on agro-ecology. Seed production is not limited to building farmer's autonomy in seed, but belongs to a much broader context, requiring reflection on values and strategies for farmer's resistance to the current model, including:

- *Cooperation.* We develop a politic awareness that cooperation is fundamental for the strengthening of agrarian reform and small rural properties. Cooperation will lead us to build something new.
- *Solidarity.* We promote harmonious human relations, emphasizing that we are all equal.
- *Cultural return.* We promote the return of rural cultural practices as part of people's culture. Seeds have always been selected, improved, multiplied and exchanged among rural families.
- *Technological model.* We promote the debate and the search for autonomy from external inputs, minimizing the impact in the environment and avoiding the drainage of family profits.
- *Gender relations.* We promote the valorization of men, women, children and elderly people and their participation inside the family as a whole.

4.3.6 Discussion

C. Bragantini: You mentioned the creation of Bionatur, a horticultural seed production company within the Landless Rural Workers' Movement (MST). It seems to me that this seed company complies with all normative requirements and is therefore part of the "formal" system. Could you explain how the seeds from Bionatur are made available to farmers in rural settlements (sale, barter and donation, etc.)?

C. Correa: Bionatur started small, with 12 farmers who became seed producers. Presently, seeds are distributed through seed fairs and direct sale in 23 states of Brazil. Sometimes the negotiation of seeds does not include payment in cash.

N. Francelino: Bionatur is surely under the formal system because it complies with all the requirements.

C. Bragantini: How does MST deal with the supply of seeds in new rural settlements?

C. Correa: The agrarian reform in Brazil does not support new settlements; farmers plant the seeds they buy. In the first season after settlement MST is concerned with how to improve food security. The ideal situation for MST would be for each farmer to produce his or her own seed.

C. Bragantini: Why doesn't Bionatur diversify and produce seeds of major subsistence crops such as rice, beans and maize?

C. Correa: We are thinking of producing maize seeds next year.

N. Francelino: Who is presently in charge of the certification of the Bionatur organic seed?

C. Correa: The organization that is supervising our organic seed production. Ecovida does not have the credentials for this activity so we foresee problems in the future. However, we are planning to question the current legislation on organic materials because we understand that it is another means of making a monopoly of this activity.

C. Bragantini: Since seeds are not offered for sale in the open market, I cannot understand why MST wants to have the organic seal.

C. Correa: Because legislation will probably force us to remove the term "agro-ecological" from our seed bags.

A. Didonet: In your opinion, what are the research priorities of the rural settlements?

C. Correa: There is a need to build the foundation of technical knowledge as a whole, but I would also mention ecological soil management, insect control and recuperation of degraded soils. In reality, so far governments have only served entrepreneurial agriculture. This situation needs to be changed.

V. SEED PRODUCTION AND CONSERVATION BY SMALLHOLDERS; CASE STUDIES IN CENTRAL AMERICA

5.1 The Cuban project of seed production with small and medium-scale farmers

Miguel Socorro Quesada

5.1.1 Introduction

Seed production in Cuba is organized to comply with technical requirements that ensure the quality that the market needs. In Cuba, as well as other countries, seed production is done through pre-established schemes by parastatal companies and cooperatives.

Recent changes in production arrangements have strengthened new forms of production (individual producers, contract growers and land users) and led to the need for alternative schemes for seed production. Local producers usually plant their own seed because it is available at the right moment and helps keep production costs low with the grain quality they like. In order to reach this objective some farmers separate part of their production area and keep it for seed. This procedure is not correct, however, because it does not meet the required quality standards that are usually met with more sophisticated procedures like drying, conditioning, storage, and the evaluation of physical, physiological and sanitary quality standards.

In this context, the United Nations Development Programme (UNDP) was requested to find financial support that would comply with the following objectives:

- To establish a seed production system for small and medium-size properties (known in Cuba as “Popular Production”).
- To develop a training programme for seed producers under the above conditions.

FAO contributed to project implementation, supporting all training activities and requisite consultancies.

5.1.2 Materials and methods

In 1999 several communities were selected in four provinces in the eastern region of Cuba for project installation, taking into consideration the food insecurity of this region due to El Niño and the intense dry spell that followed as a consequence. In addition, this zone had seed supply problems because of its poor links with research institutions located in the capital and in the neighbouring Province of Havana.

Several agricultural production institutions actively participated in each community with more experienced producers in the following crops:

- **Rice** (*Oriza sativa*), a basic component of the Cuban diet.
- **Beans** (*Phaseolus vulgaris*), a basic and important food for the Cuban diet, like rice.
- **Maize** (*Zea maíz*), traditionally cultivated for human consumption and animal feed.
- **Sunflower** (*Helianthus annuus*), a source of cooking oil for human consumption.

In Cuba, there are four classes of seed:

- original or genetic
- basic
- registered
- certified.

The Project supported the production of genetic and basic seed through the research institutions and research stations in the region, while registered and certified seeds were produced in provincial farms and by growers in their own land or in cooperatives, supported by project resources.

In Cuba, all classes of seed produced pass through a rigorous quality control programme done by the State that controls varietal purity, off-type plants, noxious weeds, presence of pests and diseases and germination capacity. The total volume of sunflower, rice, beans and maize seed produced by the Project between 1999 and 2001 are shown in Table 2.

Table 2: Volume (metric tonnes) of seed produced in four Cuban provinces in 1999 and 2001

Province	Crop/class	Basic		Registered		Certified	
		1999	2001	1999	2001	1999	2001
Las Tunas	Sunflower	0	0.7	0	7.9	0	0.40
	Rice	0	0	0	5.7	0	36.10
Granma	Rice	0	2.3	0	25.5	0	625.50
Holguín	Beans	0	3.95	0	46.9	0	26.15
	Maize	0	2.6	0	50.1	0	10.27
Guantánamo	Maize	0	0	0	0	0	136.70

The project objectives aimed at showing farmers the value of good quality seed and implemented a large training programme for many farmers with courses and field days.

5.1.3 Main results

The main results were:

- increase in availability of seeds;
- increase in yields;
- increase in quality seed use;
- better seed prices;
- increase of available jobs;
- use of available land for food production.

In 1999, before the start of the Project, no seed of any class was produced because there was no official seed produced under the local system.

Another important achievement was related to seed commerce. Producers and small-scale farmers that were once isolated now sell their seed to seed companies that process and commercialize seeds identified by class, providing some control of generations and then improving genetic purity.

The good seed price policy contributed to the promotion of seed production and commercialization by these participatory farmers.

Another successful programme that strengthened the informal seed production was the distribution of a varietal collection of some crops such as rice, promoting the use and improvement of local varieties by local farmers. In plant-breeding experiences, farmers have better-adapted materials and a much wider genetic diversity; they *test, select and distribute* seeds, which speeds up the adoption by neighbouring farmers.

5.1.4 Conclusions

As in the formal seed system, seeds are produced through local production of food crops and may be labelled into classes. The training programme for seed producers has been vital in meeting the proposed objectives.

5.2 Experiences, success and new perspectives of the “Pound per Pound” National Seed Distribution Programme in Nicaragua (PNLL)

Luis Mejía

5.2.1 Summary

In 2002, through the Nicaraguan Ministry of Agriculture and Forestry (MAGFOR), the Government of Nicaragua started the Pound per Pound National Seed Programme (PNLL) with the main objective of promoting the use of certified seed by small- and medium-scale farmers.

The programme distributes seeds through a coupon system, giving priority to crops like maize, beans, sorghum and rice, implemented by provincial field units, which furnishes one coupon per farmer per crop. In addition to the distribution through coupons, seeds are also directly transferred and exchanged with traditional grain, providing farmers with higher yield varieties.

During the first year the programme invested 3 000 000 dollars, reaching 91 558 farmers and covering an area of 127 745 mzs¹ in 120 municipalities. During the next growing season, 98 843 small-scale farmers received 59 917 quintals (qqs)² of certified seeds for planting 137 015 mzs, which represents around 14.5 percent of the total area planted in the country.

The programme is financed by several donors, including the World Bank, US Agency for International Development (USAID), FAO and the Government of Nicaragua, with private sector participation through the coupon distribution services, NGOs, local governments, commercial companies and public sector technical assistance.

5.2.2 General objective

Promote the development of a seed market through increasing seed demand and establishing the seed supply chain.

5.2.3 Specific objectives

Specific objectives include:

- massive distribution of certified seed (hybrids and improved varieties) through a coupon system, distributed through the local supply chain;
- strengthening local seed distribution systems to ensure access to certified seed on time to farmers throughout Nicaragua;
- contributing to the improvement of concepts and the implementation of marketing systems for the development of economically sound and sustainable seed enterprises;
- promoting the certified seed trade through financial institutions and NGOs;
- ensuring that grain received as payment from beneficiaries are properly handled.

5.2.4 Programme implementation strategy

Historically, most farmers in Nicaragua involved in subsistence cropping use their own commercial grain as seed, which has a direct effect on their yield because no improved varieties are adopted. Exceptions are sorghum for industry and oleaginous crops.

Since the beginning of PNLL, a seed supply system through coupons or vouchers enabled the set-up of a system strategy.

MAGFOR is the National Coordinator of PNLL, represented by the General Division of Territorial Delegations in each department and a technical team. MAGFOR determines the total area to be accomplished each planting season by department, crop, and the total number of beneficiaries, and has prepared a manual indicating the procedures in seed delivery.

¹ 1 ha = 1.42 manzanas (mzs)

² 1 quintal = 46 kg

During the period 2002/2003, certified seed distribution through coupons campaign, 91 658 farmers in 120 locations were able to plant better hybrids and varieties that were available in the market, tested and approved as being adapted to the local conditions. Under this programme, each beneficiary was given enough certified seed to plant 1.5 mzs of maize, 1 mz of beans, 1 mz of rice and 2 mzs of sorghum or sesame seed, depending on the region in which beneficiaries are located.

The subsidy for the seed distribution is to phase out with time, from 100 percent of the cost in the 2002/2003 season, to 80 percent in the 2003/2004 season, to 40 percent in the 2004/2005 season.

Other strategic approaches for the medium term are:

- diffusion of information on new cultivars and how to find them.
- massive certified seed distribution campaigns to small and medium-scale farmers through the coupon system with the objective of disseminating new cultivars. These campaigns will be implemented through public and private extension services in order to ensure the correct utilization of these inputs.
- improvement of the capability to generate and transfer market information that will increase the efficiency of seed businesses.
- training and support of seed companies in the development and implementation of seed marketing plans, taking advantage of the present and future market potential.
- development of the administrative and entrepreneurial capacities of seed companies in order to improve their financial efficiency and sustainability.
- strengthening of seed distribution systems under a network that will improve access to high quality certified seed. Seed companies will be motivated to develop their own network to create a seed distribution network.
- training of extension workers whose opinions will influence the small- and medium-scale farmers in the use of quality seed of improved varieties and hybrids. Workers may come from the Nicaraguan Institute of Agricultural Technology (INTA), NGOs and/or other extension agencies, as well as other agents in charge of certified seed distribution.
- promotion of credit availability to acquire certified seed through NGOs and other financial institutions.

5.2.4.1 Coupon distribution and grain-bartering

The programme established a pound per pound barter system where farmers provide grain ready for planting and receive certified seed. Farmers therefore have the opportunity to access certified seed with a much higher quality and yield capacity.

For the main 2002/2003 planting season, PNLL subsidized all the costs of seed distributed. The barter is implemented by the executing agency selected in the region, which fills out forms with farmers' data and seed delivered.

The goals of this system aimed to: (i) clearly demonstrate to the beneficiaries the differences in cost between the seed and the grain; (ii) promote the habit of paying for the high quality input being co-financed; (iii) use the bartered grain to feed families stricken by natural disasters.

The MAGFOR administration hired a private company with nationwide coverage for coupon and seed distribution, and for handling the grain received during the 2002/2003 season. This company cooperated with all executing agencies of each department in sharing information and responsibility in control.

5.2.4.2 Coupons and seed distribution by agro-services

The local agro-services outlets shown in Table 3 promoted seed marketing, making new and more productive varieties available by using coupons identified by different colours, and delivering seeds at a prices established nationwide.

The coupon system identifies the beneficiary and all personal and technical information so that the seed market may be understood by small-scale farmers. Figure 5 shows a Seed Coupon System.

Figure 5: A schematic view of the seed coupon system

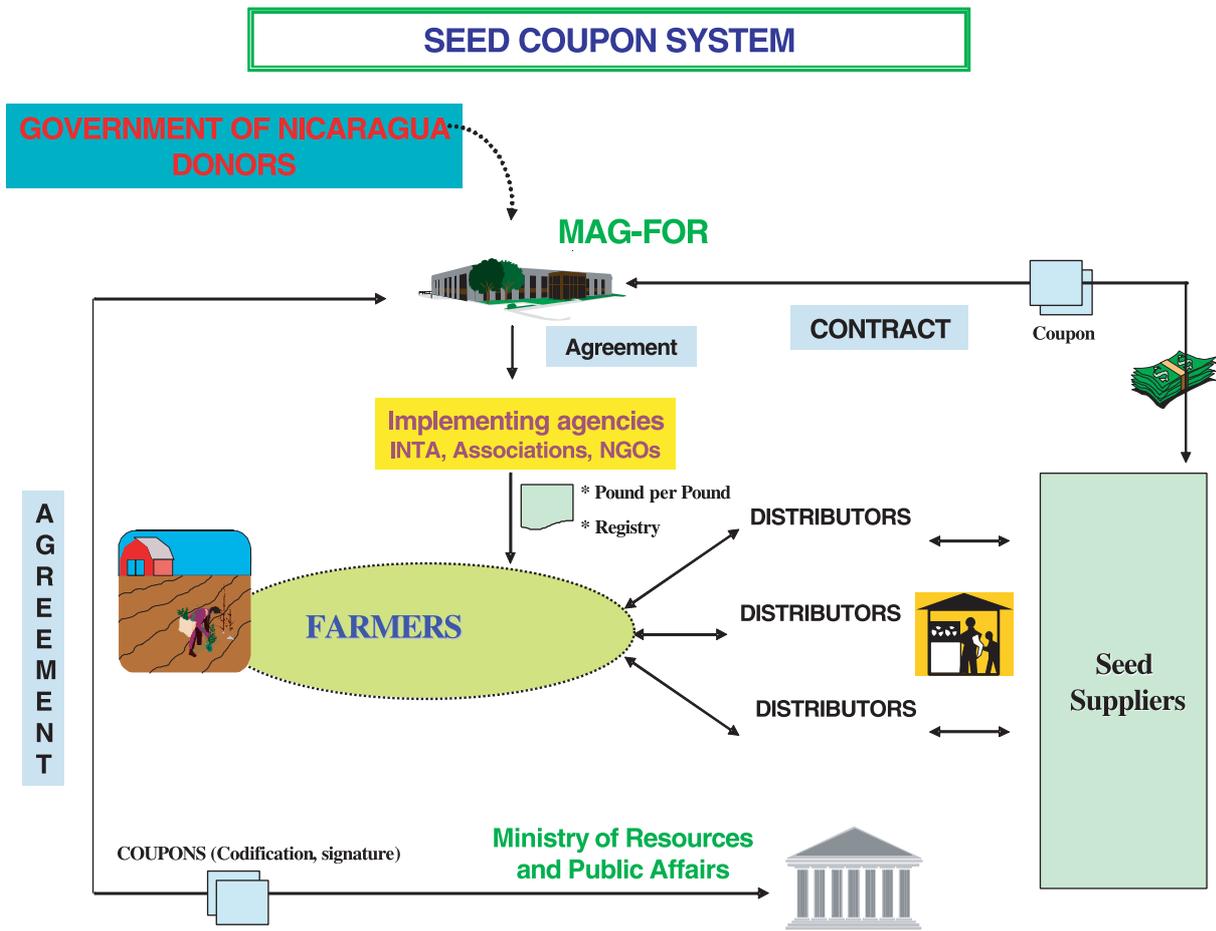


Table 3: Seed coupon programme: Participants' functions and responsibilities

SYSTEM ACTORS	FUNCTIONS/ RESPONSIBILITIES
DONORS WB, PL-480, USAID, FAO, IDR	- Define the financial share base of prioritized departments of donors
MAGFOR	- Define policies and norms - Administer funds - Produce and check coupons - Coordinate, supervise and evaluate Programme implementation - Inform other cooperating agencies

MHCP	<ul style="list-style-type: none"> - Codify and legalize coupons - Verify the authenticity of coupons - Comply with all conditions imposed by the agreement with MAGFOR.
ANIFODA / SEED PRODUCTION COMPANIES, LOCAL AGRO-SERVICES	<ul style="list-style-type: none"> - Ensure availability of seed through the network of suppliers at the local level. - Comply with all conditions imposed by the agreement with MAGFOR.
IMPLEMENTING AGENCIES INTA, NGOs, ASSOCIATIONS	<ul style="list-style-type: none"> - Deliver coupons to beneficiaries and formalize the seed delivery. - Receive the grains bartered with certified seeds. - Provide technical assistance to beneficiaries. - Comply with all conditions imposed by the agreement with MAGFOR.
COMMERCIAL COMPANIES/ BAGSA	<ul style="list-style-type: none"> - Receive the grains bartered with certified seeds. - Process, store and commercialize the production. - Promote seed saving practices / improve commercialization.
LOCAL AUTHORITIES	<ul style="list-style-type: none"> - Promote the Programme at the local level. - Participate in the integration of prioritized communities.
FARMERS	<ul style="list-style-type: none"> - Use delivered seeds satisfactorily. - Provide information on their production.

5.2.5 Profile of beneficiaries and programme focus and coverage

In Nicaragua, the production of food crops, particularly white maize and red beans, are in hands of around 150 000 small and medium-scale farmers who plant in an average 1 to 5 mzs³. There are three planting seasons in the country: “primera”, “postrera” and “apante” (first, second and third crop seasons, respectively).

The programme selected farmers with the maximum area of 5 mzs in order to prioritize farmers whose main agricultural activity is food crops (maize, beans, white sorghum and rice), and who produce under rainfed conditions.

During the Programme’s first production season there was an expectation of a worsening of the “El Niño” phenomenon, forcing the Programme to locate hybrid maize production in less risky zones, the maize varieties and beans in zones of intermediate risk, and white sorghum in zones of low rainfall pattern.

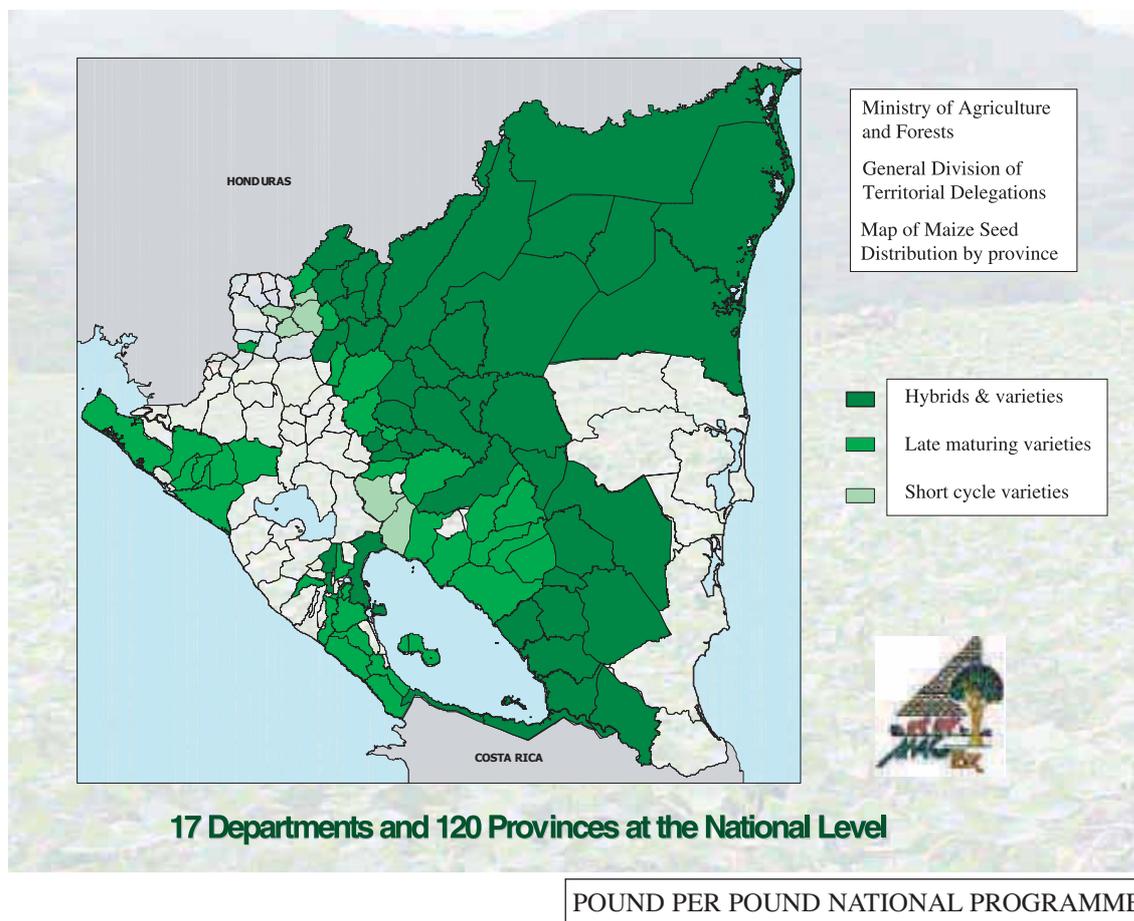
The Programme’s scope was nationwide in 120 municipalities in 15 departments and 2 special regions in the Atlantic, covering the entire political divisions in the country. Special attention was given to three zones with a majority of small and medium-scale farmers, which are more exposed to dry spells and where some kind of technical assistance is available.

It is important to note that province selection criteria used the agro-climatic zone studies, adjusted according to the priorities of the executing agencies.

³ 1 manzana (mz) = 0.7 ha

MAP OF NICARAGUA AND THE AREA COVERED BY THE PROGRAMME
THE MAIZE PROGRAMME

Where we Implemented



The map shows hybrid maize and varieties distribution following technical recommendations. Similar maps were developed for beans, white sorghum and rice.

5.2.6 Results and perspectives of the PNLL Programme

The first planting season of the PNLL programme provided the expected number of beneficiaries with certified seed, and included the participation of all partner institutions from the Government, the private sector and NGOs. As shown in Table 4, a total of 51 944 qqs of certified seed of targeted crops were distributed to plant 127 246 mzs in 120 Nicaraguan municipalities in 2003/2004. Overall, 91 658 farmers, representing 46 percent of the total in the country, were assisted at a total cost of a little more than US\$ 3 million. In addition, the following results were obtained during the period under review:

- 12 seed supply companies were integrated.
- 120 implementing agencies participated.
- 640 agro-services were available in the provinces.
- Technical assistance was provided by 376 extension agents in the country.

Ministry of Agriculture and Forestry (MAGFOR)
General Division of Territorial Delegations

Table 4: Comparing PNLL crops in 2002/2003 season with 2003/2004 season

CROPS	Producers	Manzanas	Quintals	Amount (US\$)	Producers	Manzanas	Quintals	Amount (US\$)	Percentage % (mzs)
Hybrid maize	27,608	41,413	12,423	1,090,794	29,010	43,315	13,055	1,028,835	105.1%
Maize variety	27,043	40,565	13,521	553,403	22,333	33,500	11,167	419,086	82.6%
Red bean	25,501	25,501	20,401	1,187,814	20,000	20,000	16,000	848,448	98.0%
Black bean	-	-	-	-	5,000	5,000	4,000	192,000	
Rice	2,745	2,745	2,745	79,510	10,000	10,000	12,195	341,210	364.3%
White sorghum	6,761	13,522	2,704	114,735	7,500	15,000	3,000	96,216	110.9%
Sesame	2,000	4,000	200	15,798	5,000	10,000	500	45,000	250.0%
Total	91,658	127,746	51,994	3,042,056	98,843	137,015	59,917	2,970,795	107.3%

Figure 6: Participants in the PNLL Programme



The major factors that led to the programme's success were the clear establishment of stakeholders' roles that ensured the timely distribution of certified seed and the set-up of marketing channels providing a solid base for the development of economically sound and sustainable seed enterprises. In all these efforts, the provincial governments consider the beneficiaries to be central to the programme.

5.2.7 Conclusions

The President of Nicaragua, Enrique Bolaños Geyer, in his first speech to the Nation, emphasized the importance of the PNLL programme and its contribution to the improved quality of life for poor farmers in the provinces. He stated that the increase in food production improved the food security of farmers' families.

It is estimated that use of certified seed has increased from 10 to 35 percent since the advent of the PNLL programme. The largest impact was found with maize, reaching a record of production in the first crop season of about 7.0 million qqs.

The Government has announced that the PNLL programme will continue until 2006.

VI. SEED PRODUCTION AND CONSERVATION WITH SMALLHOLDERS: CASE STUDIES IN THE ANDEAN AND “CONESUL” REGIONS

6.1. Bolivian National Seed Programme: Seed Technical Assistance (STA) Programme to small-scale seed producers in Bolivia

Jorge Rosales King

6.1.1 Foreword

Bolivia is a country with an agricultural aptitude, with 42 percent of the population living in rural areas and where agricultural activities represent 23 percent of the gross national product (GNP). There are basically two types of agriculture in Bolivia - small-scale farmer-based agriculture and commercial agriculture. The first is located in the country's highlands, more specifically in the high plains and in the Andean valleys, and the second is in the sub-tropical lowlands.

The highlands represent 246 254 square kilometers (22.42 percent), having an altitude above 2 800 meters and an annual rainfall of around 400-600 mm/year and low level of mechanization. The average plot size is 1 to 4 ha/farmer. Main crops are potatoes, wheat, barley and oats.

The Andean valleys represent 15.32 percent of the total area (168 320 square kilometers) and are located at an average altitude of 800 to 2 800 meters, with an average annual rainfall of 600 mm, a low level of mechanization, and an average plot size of 1 to 3 ha/farmer. Main crops are potatoes, maize, horticulture, pastures, wheat, barley and oats.

The eastern lowlands represent 62.26 percent of the total area (684 007 square kilometers), with an average altitude of 130-600 meters and an annual rainfall between 600 to 3 000 mm. The main, highly mechanized crops are soybeans, sugarcane, maize, rice, wheat, sorghum, sunflower, cotton, dry beans and tropical pastures.

Presently, 1 800 000 ha are annually sowed in Bolivia, 600 000 ha in the highlands and Andean valleys, and 1 200 000 ha in the subtropical lowlands.

The Bolivian Seed Programme started in 1982 with the aim of “improving yields through the use of high quality seed”. Currently, 42 percent of the agricultural area is sowed with certified seed and there has been a significant increase in yields for soybeans, maize, wheat, rice and dry beans, among others. It is important to note that the use of certified seed among large-scale farmers in the subtropical lowlands reaches 62 percent of the total area, while in the highlands and Andean valleys, it represents only 10 percent of the sowed area.

In order to increase the use of high quality seed, both certified and uncertified, by small-scale farmers, the Bolivian National Seed Programme started implementing pilot activities with small and medium-scale farmers in 1990. Bolivia initiated the implementation of the Seed Technical Assistance (STA) Programme in 2001.

6.1.2 Seed Technical Assistance (STA) Programme

6.1.2.1 General aim

The STA Programme aims at increasing the use of good quality seed by small and medium-scale farmers in the seven regions where the National Seed Programme is operational.

6.1.2.2 Missions

The missions of the STA Programme aim at providing technical assistance to the establishment of local seed supply systems and to the development of seed businesses among seed suppliers and consumers.

6.1.2.3 Objectives

The objectives of the STA Programme are to:

- transfer appropriate technologies for seed production and use;
- transfer appropriate technologies for the organization, administration and commercialization of agricultural production;
- transfer appropriate technologies to build capacities in terms of accessing and negotiating in the demand and supply of services.

6.1.3 Local seed supply systems

The *local seed supply system* is a series of activities (varietal development, genetic, foundation and certified seed production, conditioning and distribution, and seed quality control and training, among others) implemented in an orderly manner by different stakeholders, with the final goal of supplying small-scale farmers with high quality seed at the right time in the right quantities.

This definition is very broad and includes the mission of the National Seed Programme, as previously indicated. Since the use of high quality seed by small and medium-scale farmers in Bolivia is very low, it is necessary that specific interventions are developed to enhance improved seed adoption among those classes of farmers. For this purpose, the local seed supply system was established. The term “local” means geographically limited. A *local seed supply system* is, then, a series of activities implemented for rural farmers in one or more communities from a certain geographic zone by different actors involved in the seed supply system, with the objective of promoting the use of high quality seed in these communities.

6.1.4 Strategic procedures

The following are strategic procedures used to implement the STA Programme. They are not pre-established procedures, but a series of criteria for the development of sustainable local seed systems independent of local conditions:

- The seed user location should be inside a local seed supply system, which is considered the main component in the whole process.
- Technical assistance should be adapted to the local conditions, introduced into the agricultural structure and the various socio-economic scenarios, avoiding pre-established “recipes”.
- Technical assistance should aim at training seed producers and users, convincing both groups that it improves community wellbeing.
- The development organizations should not move agricultural enterprises and farmers’ groups away from their productive and commercial activities.
- The systems should be established in communities that facilitate information-sharing among beneficiaries.
- Seed producers and users must be oriented to markets in and surrounding their region.
- Seed producers should be able to function without the direct intervention of other organizations in the region.

6.1.5 Implementation of local seed supply systems

6.1.5.1 Intervention zones

The STA Programme includes agricultural zones in seven regions where the National Seed Programme offers its services: Cochabamba, Chuquisaca, La Paz, Potosí, Santa Cruz, Tarija and Gran Chaco.

6.1.5.2 Intervention scenarios

There are various scenarios in each intervention zone, which are defined according to how seed reaches users. The definition of scenarios is important because it influences the mechanisms of technology transfer.

The most frequent scenarios in the intervention zones are:

- improving the local seed.
- using farmer-saved seeds in zones where they do not buy seeds. For instance, in an isolated zone where the commercial flow of inputs is not possible; technical assistance will concentrate on improving local seed and promoting exchange inside the zone.
- producing and using seed within the community.
- using good quality seed in the same area or geographic zone.

6.1.5.3 Producing and using seed in different communities

Using good quality seed from other provinces or other geographic zones. There is no middleman in the buying-selling relationship between the seed producer and consumer. It is assumed that technical assistance will promote seed production, commercialization and use.

6.1.5.4 Seed production and use in provinces with middlemen intervention

The use of good quality seed sold by middlemen. Middlemen complement the links between seed producers and users. They take over the technical assistance in the whole process.

6.1.6 Implementation

Programme implementation starts with identifying potential zones through surveys and evaluating local systems as the bases for establishing local seed supply systems. Implementation entails the following phases:

1. induction;
2. preparation of strategies and plans;
3. offer of seed technical assistance;
4. promotion and diffusion of seed production and use;
5. monitoring and evaluation.

The regional surveys are the first step towards identifying potential zones where the STAProgramme develops its activities. The general aim of surveys is identifying potential agricultural communities for the establishment of local seed supply systems where their limitations could be overcome by the STA component.

The main objectives of the surveys are to:

- identify zones with high potential for production, based on key factors such as soil and climate, and availability of infrastructure (irrigation, equipment, etc.), appropriate technology, inputs and financial resources.
- identify zones based on their potential to access and links with markets, based on key factors such as distance to suppliers and consumers, quality of access roads to market, availability of distribution channels, characteristics of middlemen, product prices and availability of infrastructure for commercialization and collection.
- identify zones based on their institutional potential such as experience, technical, administrative and financial capacity, entrepreneurial ability, human resources, availability of adequate infrastructure and complementing programmes and projects, and recognition inside the community.

A consulting firm was hired to collect information in a database, which identifies the variables that characterize each zone and establishes the “baseline of each zone”. Special attention was given to variables showing an evident improvement in food security conditions.

6.1.6.1 Induction

After identifying potential communities, the next step involves the induction process, which is designed to catch the interest of potential users of STA services and consolidate local seed supply

systems. Induction aims at persuading and motivating farmers to request STA to set up local seed systems.

6.1.6.2 Preparation of strategies and plans

Strategies and plans for intervention are developed only for communities that have requested STA services. Plans should be based on the community's scenario and current developmental state; STA instruments should be designed accordingly (see Table 5).

In general, three developmental stages can be identified:

Creation – The stage at which STA services focus on promoting production and use of seed, providing clear messages regarding the technical and economic advantages of seed production and use. STA services are mainly directed to the internal processes of management and the organization of production, under the agribusiness scope.

Consolidation – The stage at which STA services focus on the development of better technical capacity and on the improvement of entrepreneurial management of production and commercialization processes.

Stabilization – The stage at which STA services diminish their intensity as local seed systems begin to function without the major intervention of the National Seed Programme.

Table 5: No. of STA Programme interventions during the first three years of implementation

DESCRIPTION	STA PROGRAMME IMPLEMENTATION PERIOD		
	YEAR 1	YEAR 2	YEAR 3
INITIAL PHASE			
Survey			
Number of companies already established when STA Programme started*	10		
Number of STA interventions for induction	30		
IMPLEMENTATION PHASE			
Number of interventions for Analysis	6	6	6
Number of interventions for Plans and agreements	6	6	6
Seed Technical Assistance (STA)			
Training events – Year 1		6	6
Training events – Year 2			6
Training events – Year 3	2		
Training events – Year 4 (programmed)	2	2	
Training events – Year 5 (programmed)	2	2	2
Training events – Year 6 and after (programmed)		2	4
EVALUATION PHASE			
TOTAL			18

* Companies supported by PROSEMPA and the Participatory Promotion Project.

6.1.6.3 Objectives of developing specific strategies and plans for each system

The objectives are to make available a three-year strategic plan for each seed supply system, discussing where, how, when, and with whom (human and financial resources) STA activities will be implemented. The services offered by STA include:

- promoting good quality seed use through motivation, information and training in technology management.
- assisting in the improvement of practices like renovation, maintenance and production of farmers' seed where the technical and economic conditions are not favorable.
- organizing agribusiness through training and assistance in management.

- supporting the development of local capacity to negotiate and utilize the services offered by other actors in the seed production chain.
- assisting in the development of access to and negotiation of credit for the production and use of seed.
- researching and promoting innovative processes and products.
- assisting in the promotion of business through the information and support of the enterprises network and the services market.

6.1.6.4 *Seed Technical Assistance (STA): Concepts and definitions*

The User

The user is the STA Programme target group. Undoubtedly, small and medium-scale farmers with limited economic resources are the potential and current users of good quality seed.

Under the Project, the beneficiaries are classified by:

- rural community (OTB)
- zone or district
- department
- province
- region

In order to facilitate strategic partnership with “partners” of STA Project, beneficiaries should belong or be affiliated to:

- NGOs
- unions
- cooperatives
- agricultural chambers
- associations
- other

6.1.6.5 *Promotion and diffusion of seed production and use*

Promotional activity is the process of communicating an idea to a specific social group through channels in a well-defined context and time period. Indeed, the context will determine the efficiency of this communication-promotion process. Promotion is considered a process of social communication and technology transfer (rural communication) directed towards users with limited economic resources in order to improve the benefits of quality seed of food crops, for example.

6.1.6.6 *Promotional strategies*

Promotional strategies are aimed at establishing seed systems in accordance with the scenario previously identified. They stress:

- **Motivation** - the process of eliciting or increasing beneficiary groups’ interest through the use of improved seeds. The user’s attitude is understood through an assessment of the current situation at the local level.
- **Information** - access to a series of data and situations that allow the beneficiaries to identify their problems and possible solutions.
- **Training** – teaching technological abilities to correctly use improved seeds, and other necessary skills.

Table 6 is a summary of STA services offered in each phase of the Local Seed Supply Systems (LSSS). The changes in orientation of STA intervention can be easily seen, depending on which phase of the programme is being implemented. While the first phase of the services focuses on diffusion and

promotion, the second emphasizes training. During the third phase, technical assistance aims at self-sustainability.

Table 6: Technical assistance services Offered by STA Programme in each development phase of local seed supply systems (LSSS)

Development phase	Technical assistance services
1. Diffusion and promotion	Use, production, selection, conditioning and storage of good quality seed. Assistance to farmers in increasing seed renovation, maintenance and production practices for better quality in a scenario where other agribusiness approaches are not feasible.
2. Enterprise development	Organization, planning, transport, distribution, bagging and marketing through agribusiness approaches. Promotion of local capacities for negotiation and access to services offered by others.
3. Financing assistance	Information, support and financing provided to production, storage, equipment, infrastructure and acquisition of seeds and inputs.
4. Innovation and support to competitive production	Incorporation of new techniques, technologies, new cultivars and the recuperation of traditional varieties. Technical assistance in improving seed renovation, maintaining and production practices of farmers' seeds where other agribusiness approaches are not feasible.
5. Enterprises promotion	Promotion of the formation of enterprises networks, strategic alliances, seed and service market information. Financial support (under a strategy of a growing counterpart) for negotiation and access to services offered by others.

6.1.6.7 Monitoring and evaluation

During the first semester of 2000, an expert was hired for the design and implementation of a monitoring and evaluation system of an STA project under the National Seed Programme.

The system provides for a permanent check-up of programmed activities, together with the organization of workshops, courses and follow-up visits.

The system allows feedback, updating and reorientation of programme activities depending on:

- the level of fulfillment of objectives and goals;
- the degree of development attained by the various groups (promoters, producers, users);
- complementarities with other ongoing projects in the Project zones.

At the end of each year, a National Evaluation Workshop is held with the aim of continuing the monitoring of project accomplishments and reorienting activities and developmental strategies.

6.1.7 Financing

The Project financing structure is summarized in Table 7. It is important to make the following observations:

1. **PASA:** *Counterpart resources.* This financial source is for personnel services of technical experts, non-personnel services, materials and financing of existing goods.
2. **COSUDE:** *Resources made available by the Project with Swiss Cooperation.* This financial source is assigned to strategic studies, research coordination, training technicians, and providing exclusive technical assistance to small-scale farmers and seed users, complementing PASA activities.

Table 7: Sources of project financing in 2001/2003 period (in US\$)

SOURCE OF FINANCING	2001	2002	2003	TOTAL
PASA	582 955	892 861	950 871	2 426 687
COSUDE	427 569	360 309	0	787 878
OWN RESOURCES	130 989	180 989	330 989	642 967
Total	1 414 513	1 434 159	1 281 860	3 857 532

6.1.8 Goals

The target is to achieve a total of 35 LSSSs in the project areas on an annual basis by forming five LSSSs per year in each of the seven regions.

6.1.9 Results

The results obtained are very promising - in a ten-year period the use of high quality seed in these agricultural zones increased up to 30 percent, showing that efforts and investments have been effective. Currently, there are 74 LSSSs being developed with important results, increasing productivity of several species in these deprived regions of Bolivia. Table 8 shows the production of 2 356 metric tonnes of certified seed marketed under LSSS. It is estimated that 9 186 ha were planted with these seeds, as presented in Table 9.

Table 8: Seed produced under LSSS in Bolivian regions in 2002/2003 season (metric tonnes)

BOLIVIAN REGIONS	SEED PRODUCED									TOTAL
	Rice	Soy Bean	Maize	Beans	Peas	Potato	Green beans	Wheat	Garlic	
COCHABAMBA			3	14		20				37
LA PAZ						1 281	1			1 282
SANTA CRUZ	110	23	15	30						178
GRAN CHACO			49							49
POTOSI			19			7	116		33	175
TARIJA			22			293	4	38	3	363
SUCRE			30			242				272
TOTAL	110	23	137	45	5	1 843	120	38	36	2 356
Percentage of TOTAL	4.66	0.98	5.8	1.89	0.2	78.22	5.09	1.59	1.53	100.00

Table 9: Bolivian regions planted with LSSS in 2002/2003 season (ha)

BOLIVIAN REGIONS	SEED PRODUCED									TOTAL
	Rice	Soy bean	Maize	Beans	Peas	Potato	Green beans	Wheat	Garlic	
COCHABAMBA			127	283		11				421
LA PAZ						696				696
SANTA CRUZ	1 090	288	730	380						2 488
GRAN CHACO			380							380
POTOSI			950			4	829		33	1 815
TARIJA			1 100		56	159	29	413	3	1 759
SUCRE			1 495			131				1 626
TOTAL	1 090	288	4 782	663	56	1001	857	413	36	9 186
Percentage of the TOTAL	11.87	3.14	52.06	7.22	0.6	10.9	9.33	4.5	0.39	100.00

It is important to note that seed production in all LSSs follow the certification process, which shows that small-scale farmers are also able to produce high quality seed and at a lower cost due to lower production costs. For instance, while conventional rice seed costs US\$ 460 per metric ton, small-scale farmers are able to produce it at US\$ 400 per metric ton. Rice producers who buy local seed not only pay a lower price, but also pay less for transport.

The promotion and use of high quality seed has been very helpful in attaining the proposed objectives. A total of 32 224 announcements by 12 rural radio stations and 1 376 micro-programmes were broadcasted. Rural TV also broadcast 3 266 seed-related items.

Printed materials were another well-explored means to communicate with farmers (see Table 10).

Table 10: Printed materials distributed in Bolivian regions in 2002

TYPE	QUANTITY	THEME
PAMPHLETS	30 700	Good seed, crop seeds, categories of seeds, seeds for sale, STA, red rice, etc.
CALENDARS	20 500	Seeds for sale; STA; agricultural calendar, use of good quality seed, etc.
FOLDERS	42 500	Regional Seed Office, good quality seed, labelling, etc.
BOOKLETS	25 000	Seed planning and production; financial management; organization; commercialization; the FODA technique; quality seed; pests and diseases, etc.
TOTAL	118 700	

Table 11: Local seed supply system of “El Platanal”

REGIONAL CHARACTERISTICS	
Location : Northwest, 200 km from Santa Cruz	
Province: Ichilo	
County: Yapacaní	
No. of families of LSSS: 220	
Production: 4 400 ha	
Summer production	Winter production
Rice: 4 000 ha	Soybeans: 300 ha
Maize: 100 ha	
- Production system:	
Hand labour: 60%	
Mechanized labour: 40%	
- Area planted by family:	
5 to 10 ha	
- Certified seed use:	
Initially 0 %	
- Beginning of STA seed activities: 2001	

INITIAL SITUATION	CURRENT SITUATION
<p>- Cultivated rice varieties: San Francisco Carandeño Bluebonette Dourado Colombiano</p> <p>- Rice yielding: Hand labour: 1 780 kg. / ha Mechanized labour: 3 204 kg. / ha</p> <p>- Type of seed used: Own seed Grain from milling houses Rice producer</p>	<p>- Improved varieties introduced: - Tari - Jasayé - Urupé - Panacú - Jisunú</p> <p>- Organization o fan association: Association of Yapacaní seed producers – the NGO, APROSEY: 7 seed producers</p> <p>- Certified seed produced: 94.90 t</p> <p>- Seed marketing and use: 94.20 t of seeds planted in the area 0.7 t of seeds planted outside the region</p> <p>- Use of Certified seed Increase in number of seed producers: 20% Increase in area planted: 29.25%</p> <p>- Yields: Rice: Hand labour: 2.670 kg Mechanized labour: 4.450 kg</p> <p>- Grain market: An increase in the price of grain due to increased quality: US\$ 2 to 5/ 178 kg equivalent to 20%.</p>

Table 12: Local seed supply system of “El Chore”

REGIONAL CHARACTERISTICS
<p>Location : Northwest, 180 km from Santa Cruz</p> <p>Province: Sara</p> <p>County: Santa Rosa</p> <p>No. of Families of LSSS: 160 families</p> <p>Production: 2 200 ha. Summer production Winter production Rice : 1.500 ha Soybean: 150 ha Maize: 300 ha Beans: 250 ha</p> <p>- Production system: Hand labour: 70% Mechanized labour: 30%</p> <p>- Area planted by family: 5 to 10 ha</p> <p>- Certified seed use: Initially: Rice: 0 % Maize: 20% Beans: 0 % Soybean: 6%</p> <p>Beginning of STA seed activities: 2000</p>

INITIAL SITUATION	CURRENT SITUATION
<p>- Cultivated varieties:</p> <p>Rice: Dourado Bluebonette IR – Dominicano</p> <p>Maize: Swan</p> <p>Soybean: Cristalina, Doko</p> <p>Beans: Cambita</p> <p>- Yields:</p> <p>Rice: Hand labour: 1 424 kg / ha Mechanized: 2 780 kg / ha</p> <p>Maize: 50 qqs/ha</p> <p>Beans: 15 qqs/ha</p> <p>- Types of seed in use: Own seed Grain from milling industry. Grain market Commercial stores</p>	<p>- Introduced improved varieties: Rice: Tari, Urupé Maize: Chiriguano 36 Beans: Carioca Mairana Soybeans: Cachete 02, Uirapuru</p> <p>- Organization of seed producers: El Chore Seed Producers Association (APROSECH), 4 seed growers</p> <p>- Production of Certified seed: 101 t</p> <p>Market and use of Certified Seed 30.8 t. sold locally 70.20 t. sold outside the region</p> <p>- Use of certified seed Compared with seed planted: 31% Compared with area planted: Rice: 20% (18 t.) Beans: 46% (4.6 t.)</p> <p>- Yields Rice: Hand labour: 2 770 kg./ha Mechanized labour: 3 560 kg./ha</p>

6.1.10 Discussion

N. Francelino: If I understood correctly, the STA programme is bringing small-scale farmer communities into the formal system of seed certification. Am I correct?

J. Rosales. Correct. It is much more expensive to certify small-scale farmers' seed, but it is worthwhile. It is important to mention that varietal replacement with new cultivars only occurs when it is in the community's interest.

C. Bragantini: Doesn't the success of STA disturb the formal sector?

J. Rosales: Indeed. For example, certified potato seed production used to be almost a monopoly in Bolivia. There is much more certified seed now in the market. Complaints about the formal system are related to our technical assistance to these small-scale farmers, because it is provided free of charge. We feel that this is our duty to provide such free assistance.

T. Dias: Did the small-scale farmers participate in the conception of the STA project since the beginning?

J. Rosales: No. It started inside the International Center for Tropic Agriculture (CIAT), Colombia in 1991. They are currently involved in the decision-making.

C. Rezende: If I understood correctly, there are two types of formal systems in Bolivia, one for the large-scale farmers and the other for small-scale farmer communities reached by the STA programme.

J. Rosales: This is not correct. The system is the same for both as are the quality standards to be attained. The only difference is that we provide technical assistance to the communities.

6.2. On-farm seed production - a practical and participatory proposal for seed production with smallholders

Victorio Giusti

6.2.1 Introduction

Global agriculture has experienced considerable technological development during the last decade that has been responsible for the expansion of world food production. The innovations came from different fields of knowledge and were incorporated into agricultural activities. However, commercial agriculture has benefited more from this process than have small-scale farmers involved in traditional agriculture, due to the latter's marginal access to knowledge and techniques, and their potential benefits.

The breeding programmes of major crops and the diffusion of high-yield varieties that they release followed the same pattern.

This paper discusses the causes for this unbalanced distribution of benefits from technological advances, together with some proposals that would contribute to the solution, in particular those related to on-farm seed production in Latin American developing countries.

This situation, among other consequences, determines a slow increase of yields in traditional agriculture, resulting in low payment for family field work, low return of invested capital and insufficient levels of income, leading to rural poverty and food insecurity, malnutrition and health problems. Low levels of rural development decrease this sector's capability in contributing to national development. Large areas of Latin America suffer from this and similar situations.

6.2.2 Promotion of seed production by small-scale farmers

The proposal is based on the possibility of improving traditional agriculture by certain changes in local seed systems. It promotes an innovative process or technological change aimed at a better insertion of seed systems into the market through improving the current local system. Such improvement entails transforming small-scale farmer groups into market-oriented micro-seed enterprises dedicated to the production of seeds of improved varieties.

Links between the formal and informal seed systems are then established to develop a favourable environment for small-scale farmers to get into seed businesses. The replacement of local seed with a better quality seed produced by local farmers will make the benefits of improved varieties available to them.

In order to reach this objective, the implementation of a participatory approach is proposed, based on the successful experience of an FAO project in Bolivia that improved post-harvest and marketing operations of small-scale farmer communities. The results were increased incomes, technological levels, market orientation and sustainability. The project was then adapted to promote seed production through small-scale farmer associations, which is at the core of this proposal; its implementation can significantly contribute to the development of informal seed systems.

The proposal can be implemented as a rural development programme or as a component of such programmes, as a seed programme or as a seed production and market project for small-scale farmers, integrated by a large number of micro-projects located in rural communities and implemented through an inter-institutional strategy.

The allocation of resources by farmers is highly promoted, together with the commitment of official institutions, NGOs, programmes, projects, commercial input companies and the formal seed sector.

The main restrictions faced during the implementation of this kind of proposal come from the traditional sectors of agribusiness that are already installed. The most important are:

- lack of adequate prioritization for these activities within national agricultural policies that would allow for the use of innovative modalities in existing organizations, such as research institutions;
- lack of participatory validation of technologies;
- lack of seed of improved varieties adapted to local, small-scale farmer agricultural systems;
- low availability of technical assistance, training and financing;
- resistance of small-scale farmers to changes;
- reduced availability of resources ;
- commercialization problems.

Improving the informal seed system and linking it to the seed industry remains a challenge. This approach would minimize the negative influences created by the above restrictions, generate savings and release funds to farmers. The farmers would improve current conditions through the informal seed production, and redirect their activities towards a market-oriented seed system, integrated with micro-enterprises at the community level.

6.2.3 Policies and priorities

A very common objective presented by governments in developing countries is the gradual conversion of traditional agriculture as a more commercial activity. This proposal has the same objective and relies on the establishment of necessary policies and measures, resource allocation for its implementation and the promotion of technological changes.

The main policy instruments to be utilized are research and participatory validation, technical assistance, training, and financing of new approaches designed to meet specific requirements of small-scale farmers. All of these instruments should be implemented simultaneously in order to improve and increase the level of formalization of the informal seed system in the country.

On-farm seed production requires a change in current production orientation, focusing on self-consumption as well as making it a more market-oriented approach. In order to succeed with this change, some countries will likely need to revise their agricultural policy. Most Latin American countries already have an agricultural policy that includes national programmes that support small-scale farmers. While some countries have policies for both formal and informal seed systems, there is stronger support for the formal system.

Other countries should establish new priorities to promote market-oriented small-scale farmer activities in addition to promotional activities designed to introduce them into local/national markets. The focus should be to re-define policies and implement programmes and plans.

This approach rarely requires major revisions to the National Agricultural Policy, but rather, a few adjustments in countries' rural development programmes. The simplest and most traditional way to include seed production activities in the agricultural policy is through the implementation of a National Seed Programme.

If such a decision is made, the strategy should be to assist the informal seed production systems. When the seed programme is already being implemented, a reorientation and strengthening will probably be necessary. In both cases, a series of projects and activities needed for project implementation should be defined.

This new policy should promote technological improvements in small-scale farmers' circumstances through participatory research and validation of new appropriate technologies. At the same time, extension, technology diffusion and training, together with financing activities should be reinforced and redefined. These are the minimum necessary adjustments for the establishment of a strategy for the development of a market-oriented traditional seed production.

6.2.4 Participatory research and validation of technologies

The participatory research activities of this proposal have two main components: the adaptation of intermediate technologies already developed by FAO, and the breeding of traditional varieties of local crops.

The improved technologies should comprise all production phases to ensure product quality through certification, where necessary. Seed certification is likely necessary in order to have seeds recognized by the formal sector. The validation of post-harvest technologies, seed conditioning and commercialization should also be considered to complement traditional technology.

6.2.5 Adaptation of appropriate technologies

The procedures for traditional technologies used by small-scale farmers are transmitted from one generation to another. The techniques developed by ancestors and the optimization of handwork are the most available resources in rural family households. These techniques produce goods with inferior quality and consequently have low selling prices. On the world market, there are modern commercial technologies for the formal seed system, but these are frequently beyond small-scale farmers' capabilities; they have high operational costs, require specialized knowledge entailing a strong training programme, and are impossible for most rural families to maintain. This is the reason why technology transfer to small-scale farmers is not an easy task.

This proposal, which includes a participatory research procedure, enables the validation of a group of technologies that are very simple in principle. The technologies cost little and require low investment, and avoid quality loss during storage (see Annex I). They permit farmers to increase their income, improve food security and reduce rural poverty.

Promoting the cleaning and classification of agricultural products at the farmer level is a good example, resulting in significant price increases. The cheapest commercial seed-cleaning machine in Bolivia costs about US\$ 4 000. Traditional technology uses only the wind and hard work to separate inert matter from the seed.

Grain-cleaners

Model 1: Hand blower. Cost US\$ 100

Model 2: Electric blower. Cost US\$ 250

Grain-cleaners and classifiers

Model 1: Three screens with electric motor. Cost US\$ 650

Model 2: Three screens with gasoline engine. Cost US\$ 1 000

Model 3: Four screens with electric motor. Cost US\$ 1 400

Potato seed-cleaner and sizing

Model 1: Hand selection and gravity table (hand-held). Cost US\$ 200

Model 2: Classification table and gravity table (hand-traction). Cost US\$ 320

Small-scale farmers and their organizations, women groups, and some seed producers tested and approved these alternatives, making it possible to purchase more than 500 machines from small crafters in the next four years. None of these farmers would otherwise have had the possibility to purchase any commercial equipment in this period.

The same process applied to other technologies improved other tasks such as shelling, drying, storage and other traditional rural work (Annex I). Countries that implemented these practices were then able to take advantage of these advances and reduce costs to develop new technologies.

6.2.6 Breeding traditional varieties

The lack of seeds of improved varieties of subsistence crops with the particular characteristics appreciated by small-scale farmers is due to the lack of participatory breeding programmes specific to these crops. Breeding programmes usually look for high yields, wide adaptability and responsiveness to a high level of inputs. In an attempt to change this situation, research centers should participate with small-scale farmers, working with them to satisfy their needs for traditional varieties with other characteristics.

Small-scale farmers could obviously improve their yields just by using more vigorous seeds that are free from contaminants, instead of a low quality seed. Although some literature can be found in this regard, the use of traditional varieties produced with better care is recommended because good responses were found by user groups. On the other hand, these local varieties that are highly adapted to the ecosystem are often characterized by low quality seed and lack supportive breeding programmes, particularly with regard to subsistence crops. The seed quality problem occurs because a good part of the harvest is usually either sold or consumed by the family. The rudimentary ways in which seeds are stored completes the scenario.

For this reason, at times there is misperception that informal seed is synonymous with low quality. Since production is not market-oriented, the available seed does not comply with the demand, and vice versa. On the other hand, commercial seed is usually produced under rigid control and therefore has the quality required by the formal market. Reducing these differences in quality between the formal and informal seed should therefore be a main objective.

This proposal starts with the improvement of the physical, physiological and sanitary quality of seed produced and consumed by small-scale farmers through the use of available technologies. The benefits will be better yields and better profits. Group training plays a major role in technology transfer, which provides small-scale farmers with opportunities for commercial seed production.

6.2.7 Technical assistance and training

The availability of new technologies alone does not ensure the beginning of technological changes or that small-scale farmers will adopt them. Other actions need to be implemented at the same time, like technical assistance and training of rural families and small-scale farmers' groups.

This proposal implies using a special kind of technology diffusion, the strategy of "learning by doing". In addition, non-conventional financing methods complement the proposal.

The first step is to inform rural families on how it is possible to improve the quality of seed that they traditionally utilize and sell to neighbours. Interested groups prepare a working plan, designed to train people in the changes to agricultural practices to be adopted. The plan's schedule needs to consider farmers' time availability and interests; the main expected advantages and restrictions should be discussed with the families at this time. Each task is organized for each group, using equipment for demonstration.

The following are examples of training activities oriented to diffuse technologies for maize seed production in Bolivia:

- new technologies appropriate to traditional seed production and requirements of quality (information transfer);
- shelling maize for seed;
- factors and indicators of seed quality, control and recommended practices;
- use and handling of small silos for seed and grain storage;
- construction of small silos (with possibility of financing);
- cleaning, selection and classification of grains;
- insecticide treatment for storage insects;

- maize processing for family consumption (the possibility of borrowing the small US\$ 250 milling machine);
- community administration of grains and seeds (the possibility of creating a fund for financing the acquisition of other new technologies);
- preparation in the commercialization of the production (seeds, grain and maize flour, etc.)

The application of these methods is presented below. Fifty-two thousand items of improved equipment and tools were adopted in the four-year period.

6.2.8 Financing

Commercial banks do not have credit lines that are appropriate to small-scale farmers, which are the instruments for promoting technological innovation.

These policies should improve access to new technologies and help small-scale farmers become small seed enterprises. These funds need to be partially subsidized and the group members would provide a joint guarantee.

The author worked with many vulnerable groups in this approach, such as the rural poor, female farmers and original ethnic communities. The system consists in financing an additional capital with the requirement of adopting a new technology. Various forms of attraction are used, including some very old strategies such as borrowing equipment and organizing small funds managed by the groups. Financing only occurs if income-generation activities such as seed production are implemented. In order to pay back the credit, the farmer needs extra income provided by the new technologies adopted. More income comes from better handling after harvest. Since money only comes after harvest, the new technology will be financed at the beginning of the season through credit. In order to fill this gap, each group needs to make its own investment that is complemented with group funds.

This equipment adoption programme is necessary during a three-year period. Since equipment is borrowed, it is important to choose the best time for the final sale to farmers.

6.2.9 Availability of resources for small-scale farmers

The lack of resources for improving farmers' activities can be attributed to their location in marginal areas, among others. The links with markets are weak and the use of their own or neighbours' grain for planting is very frequent.

This method provided for a more participatory and less paternalist involvement of small-scale farmers in the process with an increased efficiency in the use and availability of resources.

The participation of farmers in the process is very important for the acceptance of new market-oriented activities like producing and selling seeds, and for incorporating profits in their activities. It will also make it possible for small-scale farmers to invest their own resources. These changes need to be introduced with care, avoiding ruptures to small-scale farmers' food security strategies.

Small-scale farmers' resources include their local knowledge and their varieties, both very important to maintain biological diversity and to handle the local market. Resources also include their land and other types of infrastructure, such as constructions, equipments, tools, saved seed and money. However, these resources are not always readily available for a new activity like seed production. In addition, they have the requisite family manual labour available. Once these resources are evaluated, new activities should be designed as the starting point, such as the organization of farmers' groups for seed production.

6.2.10 Resistance to changes

Resistance to changes is usually the reason used by technicians to justify low adoption of new technologies. In order to estimate the influence of this restriction in rural development programmes, the following results during four years of application of this strategy, working with 462 female farmer groups in Bolivia show that resistance to new technologies is very low:

- 6 percent of the groups decided not to participate after attending the training programme;
- 48 percent of the groups were interested in improving the quality of their lives through the adoption of technologies;
- 46 percent remaining were willing to change their self-consumption activities and were interested in moving towards a more market-oriented agricultural production. The results obtained under this category were:
 - 42 percent of the groups decided to adopt new technologies as a group, with orientation to the market;
 - the remaining 4 percent adopted some technological innovations in forming small informal rural enterprises.

6.2.11 Commercialization

This is a very important item in the process and decisive for sustainability of small-scale farmers in market-oriented activities.

6.2.12 The functions of and profits from commercialization

Commercialization allows for the accumulation of profits with time and the possession of agricultural products when the consumer's requirements (quantity, quality, etc.) are taken into consideration. Product conditions such as storage and packing, and prices are important.

Technical and economic efficiency depends on the available infrastructure and the technology utilized in all production phases. The proposal mainly involves the first steps of the process, slightly improving the commercialization infrastructure (operational centers) and incorporating several improved technologies.

Nonetheless, small-scale farmers' face commercialization problems, including:

- low prices;
- lack of appropriate technologies;
- low bargaining power in negotiations;
- quality not always meeting consumer expectations;
- lack of infrastructure.

6.2.13 Main aspects of the proposal

This proposal was designed to contribute to transforming the informal seed system into a participatory, practical and market-oriented activity. The implementation requires permanent monitoring and evaluation of its progress. This is a sustainable proposal, consistent with market mechanisms that create demand and supply, and commercialization channels.

6.2.14 Proposal implementation

In order to improve and increase the availability of good quality seed in small-scale farmer communities the following three levels of activities are proposed, according to the type of seed to be produced - traditional, improved seed, and good quality seed for traditional and commercial varieties. These activities should be organized to:

- improve the physical, physiological and sanitary aspects of seed in use by traditional farmers,
- improve and producing seed of traditional varieties using participatory approaches;
- produce seeds of commercial varieties through agreements between seed companies and traditional farmers.

According to the resistance to change discussed above, it is expected that 6 percent of potential beneficiaries may not be interested in improving the quality of their seed. *The quality improvement of traditional seeds is the first level* of this proposal and will help in selecting groups for the next phase of the proposal. The improvement of seed quality is the necessary condition that will lead to the generation of additional resources. The activities that make up this first level are participatory

validation and improved technology transfer through workshops on constructing small equipment, training in cultural practices and activities related to post-harvest and commercialization. When this level is attained, 94 percent of the participants should have improved the seed quality of the seed they produce and use, obtaining profits. In addition, improvement of seed quality will contribute to the objectives of formal seed systems and reduce the risks of losses in biodiversity; from the Government's viewpoint, it will contribute to the alleviation of poverty in rural areas.

The *second level of activities is the participatory breeding and seed production of traditional varieties*. Local varieties are selected from smallholders in each region. Approximately 42 percent of the initial groups may be interested in producing and selling this kind of seed, which it is appreciated in the rural market. Activities start with identifying the basic elements for selecting local varieties, together with small-scale farmers. Major activities are training, selection of groups and technical assistance. The next activity is the selection of equipment and the search for financial resources for the implementation of rural-based small seed enterprises.

The *third and final level is related to the development of market-oriented activities*, including the commercialization of improved seed of traditional varieties of subsistence crops. The final activity is the activity closest to the formal seed system - the production of seed of commercial varieties by small-scale farmers. Small-scale farmers could also become contract growers for formal seed enterprises. The incorporation of traditional varieties into the formal sector would be the less expensive way to protect biodiversity.

At the end of the process, it is expected that 4 percent of the groups would become micro-enterprises, located in rural areas, producing commercial seed and selling it to the formal system through agreements with the intellectual property owner of the varieties.

6.2.15 The market for the produced seed

All of the informal seed already have their market. Year after year the informal seed supply system supplies the seed demand of smallholders through different arrangements such as self-supply, barter and payment with service.

The first question that comes to mind is related to how the informal system would be able to handle an additional demand for improved seed of traditional varieties. The above proposal is based on the premise that there would no significant imbalance between demand and supply of quality seed of traditional varieties.

The market for improved seed produced by small-scale farmers at this stage is the small-scale farmer himself or herself. The accomplishments at this stage are measured through the improvement of seed quality, not through an increase in seed supply. Groups or small-scale farmers' associations supported by the project will analyse the seed market in order to explore other commercialization possibilities. They will have access to local markets and knowledge of their peculiarities.

Other potential markets for this seed are the peri-urban populations, because they prefer traditional dishes. Other markets like organic seed can also be explored.

Finally, in the case of seeds of commercial varieties from the formal system, agreements should be established regarding prices and selling conditions.

6.2.16 Institutional coordination

A multi-institutional coordination is needed for a good participation in seed production with small-scale farmers. Interested stakeholders include international organizations, NGOs, governmental organizations, commercial enterprises and the agro-producers and their organizations.

FAO has traditionally been concerned with this issue due to its importance to food security, actively participating in institutional building and national seed policies of Member States. FAO can also support member countries in the preparation of Technical Cooperation Projects (TCPs) to be applied in pilot areas of Latin America and in promoting opportunities to share experiences among countries.

Once the seed policy is established and the political decision taken, actions to promote and facilitate its implementation play an important role. Donors and international cooperation should

provide financing, technical assistance and technologies for project implementation, while national governments should make counterpart resources available. Private companies should make their varieties available, offering partnerships with farmers and rural micro-enterprises, providing technical assistance and financing part of their needs (seed, inputs, small equipment) for high quality seed production.

Small-scale farmer groups, as explained in item 10.2, should invest their resources, such as land, buildings, operational funds and hand labour. Finally, NGOs, foundations, input suppliers and other institutions should participate in the implementation of projects or parts of them.

6.2.17 Conclusions

The incorporation of small-scale farmers in commercial seed activities is necessary in order to improve rural development in many Latin American countries. Experiences and accomplishments in many countries indicate the suitability of working in this direction. Still, it is necessary to establish clear policies that prioritize these activities in order to obtain financial resources for the implementation of projects with small-scale farmers.

The benefits include increasing agricultural production through increments in productivity, increasing the income of small-scale farmers and improving agricultural seed and other input markets. In addition, it is possible to create changes that will improve the standard of living of the rural population, reducing poverty and improving food security, and promoting the transformation toward a sustainable commercial agricultural sector.

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Appropriate technologies available for implementing the proposal

- Natural grain drying on different surfaces: drying floors.
- Use of rustic structures for drying maize on the cob: improved cribs.
- Natural drying of quinoa and small amounts of grains: drying blankets.
- Natural drying of quinoa plants: drying tables.
- Maize shelling: manual equipment.
- Maize shelling: manual equipment with pedals.
- Maize shelling: equipment with electric motor.
- Maize shelling: gasoline engine equipment.
- Grain cleaning: electric motor for beans, soybeans, peas and cowpeas.
- Grain cleaning: electric motor for maize, wheat and beans.
- Cleaning of small seeded cereals.
- Pre-cleaning of grains.
- Manual grain cleaners.
- Use of grain classifiers.
- Potato selection: special tables.
- Potato classification by size.
- Improving grain storage at home in silos.
- Improving seed storage at home in silos.
- Potato storage in diffuse light.
- Insect control with gases.
- Use of disk-type grain miller.
- Use of hammer-type mills.
- Improving wheat and maize peeling.
- Improving groundnuts sheller.
- Shelling groundnuts through milling equipment.
- Improving farm-household commercialization.
- Rural community commercialization: rural operational centre.
- Integration of improved post-harvest technologies: supply services centre.
- Selective harvest of rice panicles.
- Cutting of quinoa plants.

Other technologies developed to offer options for the substitution of illicit crops include:

- Sun-drying of ginger.
- Mechanical cutting of curcuma: manual equipment.
- Pepper cleaning: pedal-cleaner.
- Use of manual coffee peeler.
- Threshing and clearing of achiote.
- Achiote and pepper cleaning and classification.
- Honey extraction by centrifugation.

VII. ADDITIONAL PAPERS AND DISCUSSIONS⁴

7.1 Small-scale farmers' seed production systems: a non-conventional approach

C.P. Camargo, C. Bragantini, A. Monares

7.1.1 Introduction

The reality of Latin America, the Caribbean, Africa and other developing regions of the world shows that extension agents, including seed producers and sellers, and seed users may belong to different socio-economic groups. On the one hand, there are commercial seed production and marketing companies and their usual clients in the developed world, agro-entrepreneurs, and on the other hand, most farmers in the developing world. Most of these farmers, due to their economic, social and cultural characteristics, do not receive the benefits of a good quality seed, yet contribute a significant part of food production in their regions.

In the case of crops with significant social characteristics, such as cassava, beans, maize, rice, yucca, sorghum and potato, among others, the transfer of new technologies are constrained by the inadequate agrarian structure, the subsistence characteristics of crops, lack of access to technical assistance and financing, and other important variables. In addition, production systems are usually inadequate for small-scale farmers' needs.

7.1.2 Seed production systems

The main objective of breeding programmes is to develop new high yielding cultivars that carry agronomical and morphologic characteristics that may bring positive impacts to the agricultural sector. In order to achieve this aim, the seed of new cultivars should be transferred from researchers to farmers in the time, place, quantity, quality and price that are appropriate to their socio-economic, cultural and developmental conditions.

With the search for alternative methods of seed production and marketing we expect to keep the characteristics that were incorporated in the new cultivars during the multiplication process through breeding, and to make the seeds of new varieties available to small-, medium- and large-scale farmers. The alternatives described below are based on the principle that seed will be made available through public and private institutional building and quality control.

The institutional organization for seed production and distribution in developing countries is very heterogeneous. Some regions, crops, private companies and governmental institutions are adequately oriented towards the conventional systems of seed production and marketing. On the other hand, in these regions but with different crops (subsistence crops, particularly) there are traditional systems: year after year small-scale farmers plant grains or other vegetative parts of plants that come from their own or a neighbour's harvest. There is a huge gap between the two seed sources, which finds small-scale farmers hindered in the improvement of the quality of their planting material.

The application of quality control principles is obviously limiting. It is not possible to implement a credible seed programme without an effective quality control system that would enhance real positive effects on yields. In addition to other advantages, the objective of quality control is to minimize the effect of **qualitative dilution**, that is "the speed of quality loss that occurs generation after generation during the process of seed multiplication". Furthermore, opportunities are lost for new cultivars to express all of their potential and for breeders to find satisfaction in seeing the effectiveness of their

⁴ Although these papers were not included in the workshop programme, they are presented in the Proceedings at the participants' request.

contribution to the increase in production and productivity. For example, imagine that 50 kg of breeder seed of a new rice variety are distributed to five rice farmers. Without a quality control programme, 50 kg of seeds will produce 1 000 kg, probably contaminated with weeds, diseases and low physiological quality. This is a qualitative dilution of 50 kg of genetic material. The right seed programme would optimize the genetic potentialities of the material and provide a good transfer of technology.

For this reason, it is important to understand the mechanisms for transferring materials to farmers. The realities of Latin America, the Caribbean, Africa and other developing regions show us that seed production and distribution systems can be classified in three categories: traditional, conventional and non-conventional.

7.1.3 Traditional seed production and distribution systems

Under this system, farmers produce their own planting material or obtain it from neighbours or from other areas through mechanisms that do not always represent financial expenditures (i.e. seed for labour). It is possible to improve the quality of planting materials through very simple cultural practices. Studies have shown that farmers rarely totally substitute their varieties and cultural practices. Most of the time they apply both new and the traditional practices, apparently with the objective of satisfying the market and their own taste.

The current extension services have not been efficient in identifying farmers' needs, limitations and the possible technological solutions for their problems. Due to the large number and geographical dispersion of farmers in the traditional system, special extension programmes are required. This is a priority area for future work because the conventional strategies for technology transfer of seed systems are expensive and too sophisticated for small-scale farmers to handle. One solution is to implement training programmes oriented towards the adoption of very simple cultural practices. Extension agents should be especially prepared for this task. The following are some examples of simple cultural practices:

- rogueing of off-types (negative selection) and plants with disease, and separate harvest of healthy and vigorous plants (positive selection);
- selecting typical panicles of rice plants to avoid dissemination of red rice;
- eliminating maize seeds from the two extremes of the cob;
- using special parts of cassava plants as propagating material;
- selecting cassava plants based on their root production,
- timely harvesting of seeds to avoid field deterioration and to improve physiological quality,
- natural or artificial drying of seeds right after harvest;
- storing seed in fresh, aerated rooms, free from insects, birds and rodents;
- using diffuse light for bud growth in potato for planting.

Applying other recommendations to traditional seed production systems will provide small-scale farmers with the benefit of better seed in hand and new and traditional varieties.

In the very initial stages of technology transfer in traditional seed systems, farmers are not specialized in the "irradiation" effect (that is, the multiplying effect of technology transfer), which occurs by diffusing best practices of innovative farmers to their neighbours. When this condition goes beyond the traditional communication means, favorable conditions are created for the integration of these farmers into the country's agricultural sector.

7.1.4 Conventional seed systems

Seed producers of conventional systems are characterized by their financial ability to invest in infrastructure, as required under the official seed rules and regulations. They are highly organized and represented by their associations. Profit is their main objective and the guarantee of their company's survival.

The conventional system relies on a complex network of public and private institutions working on research, extension, certification and credit, among others that keep the business fairly stable and sustainable. It is based on the premise that seed producers are in fact extension agents that contribute to increments in production, productivity and food supply.

7.1.5 Non-conventional seed systems

In this system, farmers develop seed production and distribution strategies that are close to the conventional system but follow rules, regulations and standards that better apply to their reality. Seed quality is always superior compared to regular grain, and often have the quality of seed produced under the conventional system.

Non-conventional systems are usually a variety of production arrangements to ensure quality where regular certification programmes are unavailable or unviable. These systems offer advantages to small-scale farmer regions. The technical requirements are less demanding and permit the system to be adapted to the socio-economic peculiarities and the level of development of the region. In addition, successful non-conventional systems profit from their capabilities in innovation and from the cooperation of rural communities. It is important to consider similarities and interactions between conventional and non-conventional seed systems. Non-conventional systems may at times utilize institutional components from the conventional system and become part of it by introducing the certification programme at the final phase.

Two of the major characteristics of non-conventional seed systems are their institutional flexibility and the important role played by the associations, which are very appropriate for regions with a variety of agro-climatic conditions and cultural values. Where small-scale farmers' associations are lacking, progressive farmers can take on the leadership, producing and commercializing their seeds under this system.

7.1.6 Organization of non-conventional seed systems

The complexity of these systems does not allow only one scheme of non-conventional seed production. The objective of these systems is to comply with the requirements of each country, region or community in order to meet the needs of farmers and avoid pre-established schemes that do not take into consideration their limitations and their productive capacity.

Successful examples show that farmers first try to overcome the following obstacles:

- lack of seed in the region;
- constant losses of small-scale farmer's crops;
- high prices of available seed;
- the agrarian structure of the region;
- lack of interest of private companies in exploring the region.

The solution to these problems is more effective through associations. During this phase, the leadership of local farmers is very important in carrying out the following activities. These and many other actions can be carried out simultaneously as the work evolves:

- performing soil preparation and sowing, individually or jointly.
- building up small infrastructures for storage and quality control.
- requesting training and technical assistance for official organizations.
- legalizing the association and/or cooperative as the official organization in the country.
- adopting a brand name for the seed to be commercialized.

The most common types of organizations count on support from governmental institutions and development projects to reduce the barriers to their development. There is always a need for the government to make decisions to accept less restrictive production systems under the agricultural policy, searching for a solution that is more social than economic. The flexibility of seed certification systems is a good example.

7.1.7 Operational mechanisms of non-conventional seed systems

Non-conventional systems follow less rigid rules. Farmers carry out special quality control procedures applied to smaller volumes of seed, but with quality standards similar to the conventional system, as follows:

In the field:

- sowing foundation seed of recommended varieties accepted by consumers;
- rouging off of types and diseased plants;
- utilizing other inputs (when available);
- harvesting close to physiological maturity;
- adequate drying and clearing;
- storing in fresh and aerated rooms;
- supplying seed within and outside the region;

In addition to these actions, it is recommended to establish non-conventional seed systems as pilot projects that initiate and complement the following activities:

- evaluating seed quality in each agro-ecological zone;
- establishing training programmes focusing on non-conventional seed systems and providing specialized technical assistance to seed producers;
- establishing training programmes to extension agents for regular technical assistance (the Agricultural Technical Cooperation Working Group) to grains, roots and tubers producers.
- establishing training programmes to farmers, focusing on the use of quality seed.
- searching for new sources of foundation and certified seed;
- increasing awareness and diffusing information in the region and neighbourhood, increasing seed demand.

7.1.8 Final considerations

Seeds systems are managed by institutions with varied administrations, from simple to very complex. Although the foregoing considerations have been almost exclusively on non-conventional and traditional systems, the conventional seed industry is not perfect and does require improvement. Many actions could be proposed for the conventional system, from production to distribution.

A priority task for the three systems is the willingness to improve the process of technology transfer that would improve internal quality control, independent from governmental actions.

This paper neither establishes final orientations nor expects to be a conceptual landmark for innovative development programmes that benefit the small-scale farmer. On the contrary, it is open to suggestions and critical discussions for immediate analysis.

7.2. Restoring “Creole” maize seed in Ibarama Province, RS, Brazil

Giovane Ronaldo Rigon Vielmo and Clarice Vaz Emmel Böck

7.2.1 Summary

From 1998, small-scale farmers in Ibarama Province started to develop agro-ecological activities inside the Pilot Plan for Agro-ecological Agriculture of the Centro Serra Region. The main objective was to make the region a reference for pesticide-free agricultural production. Farmers were organized in groups for training purposes in the Agro-ecology course, excursions, field days, meetings, seminars, and exchange of experiences. Forty-five people participated, including male and female farmers, youth, professors and agricultural technicians of the Province.

The Pilot Plan aimed at, among other things, creating the Creole seed bank by involving farmers through contacts with the extension agency (Emater/RS). It was discovered that several families carried on the tradition of cultivating Creole maize on a small scale. These families were identified and visited and their maize germplasm identified. After various meetings with Emater/RS, the Mayor of the Province and the Union of Rural Workers of Ibarama, a Creole maize seed production was established.

Throughout the next four years, 20 rural families became involved in the process, producing seeds of 15 Creole maize varieties. The work made it possible to conserve, multiply and distribute Creole maize seeds to many families. During the 2001/2002 season, 6 830 kg of seeds of 14 varieties were produced. The first Creole Seed Exchange Day was also organized, with 200 farmers participating.

7.2.2 Context

Ibarama became a county in 1987. The county is essentially agricultural, located in the micro-region of Centro Serra, in the Rio Pardo Valley, with 197.7 km² and 975 rural properties. Most of its population of 4 454 people live in rural areas. The main crops are maize, tobacco, beans and horticultural crops produced as subsistence agriculture. The average size of rural properties is 23 ha, cultivated with animal traction. Topography is hilly with mother rock. Water is abundant, with two main rivers, Jacui and Jacuizinho, and several others. More than 30 percent of the land is covered with native vegetation and artificial forests (eucalyptus).

The agro-ecological focus in food production, developed by Emater/RS, was to bring back Creole seeds that were at risk of extinction. Farmers who were still preserving these seeds were identified and seed multiplication started in 1998. Seed producers became multipliers and extension agents in their neighbourhood. This experience was developed by all members of rural families in partnership with the county government, the extension agency, and the Union of Rural Workers.

The experience reduced the use of hybrid seed from 90 to 50 percent, being replaced by Creole maize seed. It is easy now to find Creole seed for exchange or sale in the county, which reduced the cost of maize production and the use of pesticides, and increased farmers' incomes.

Other positive experiences include the exchange of knowledge and the integration of several stakeholders. Elderly farmers were valued for their unique knowledge in Creole seed.

7.2.3 Description of the experience of agro-ecological focus in food production

7.2.3.1 Main objective

The main objective is to promote the use of Creole maize seed, its multiplication and the increase in numbers of farmers using these seeds. (The genetic material is almost lost, but has still been used by small-scale farmers for many years.)

7.2.3.2 Specific objectives

The specific objectives are:

- reduction of farmers' dependence on hybrid and transgenic seed of transnational companies;
- adequate seed for agro-ecological cultivation;

- varieties brought back from the brink of extinction;
- sustainability and maintenance of biodiversity;
- the valorization of rural knowledge;
- stimulation of the organization of farmers for germplasm conservation;
- identification of seed producers; field visits, meetings, and the first Creole Seed Day in Ibarama.

The strategy was to demonstrate to farmers the importance of Creole maize for the agro-ecological system and train them on maize production in order to make available more good quality seed of Creole maize varieties.

During meetings each farmer brought his or her own Creole seed to be evaluated and identified by others. Farmers were then identified as “guardians” of specific varieties. This work was done during a three-year period, starting in 2002, with the county reaching self-sufficiency in Creole maize seed. The first Creole Seed Day was then organized.

The Union organized farmers and the sale of seeds. The local government and the extension agency provided the technical assistance.

7.2.4 Results

Results included increase in number of farmers involved and the return of Creole seed in the local market (see Table 13):

Table 13: No. of Farmers Involved in Restoring Local Seed Varieties for Commercialization from 1999 to 2002

Year	Farmers involved	Varieties rescued	Total sold
1999/2000	10	8	400 kg
2000/2001	18	14	750 kg
2001/2002	20	15	6 830 kg*

* During the first Creole Seed Day in 2002, 1 200 kg of seeds were exchanged.

Other results obtained were:

- The area planted with Creole maize increased from 5 to 40 percent (presently 3 000 ha);
- the Seed Bank was created, with 15 Creole maize varieties;
- “Seed guardian” farmer groups were created;
- seed was sold to other counties in the region;
- the cost of crop production was reduced by 10 percent;
- the use of pesticides during storage was reduced;
- rural farmers became independent of hybrid seed;
- genetic resources were preserved;
- experiences among rural families were exchanged, increasing their enthusiasm;
- creole seed was valorized, which improved farmers’ concentration on their varieties: yields reached 4 800 kg/ha.

7.2.5 Impacts of the results

Impacts of the results are:

- more family visits;
- preservation of cultural and ancestral values;
- utilization of by-products such as maize flour, crafts and others;
- no similar service is provided by the government.

7.2.6 Advantages

Advantages include:

- high participation of farmers, including women farmers and youth;
- farmers' interest in participating and discussing the use of Creole maize;
- the beginning of studies on Creole maize;
- increasing the number of beneficiaries by the distribution of Creole seeds to other counties in the region;
- high appreciation of the value of genetic resources by rural farmers.

7.2.7 Limitations

Limitations are:

- technicians' and farmers' disbelief;
- groups and media undervaluing Creole seeds;
- difficulties in classifying and standardizing seeds;
- natural crossing among varieties;
- very high plants, prone to lodging and difficult to harvest;
- lack of research on Creole seed.

7.2.8 Concluding Remarks

There is a great potential in some traditional varieties, which are truly adapted to local conditions, to minimize dependence on agricultural chemicals and other expensive farm inputs, which often farmers cannot afford. Experiences gained in this exercise have shown that rural populations can be mobilized to rescue such cultivars that are on the brink of extinction if it can be demonstrated that their actions can bring them real economic and social benefits.

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7.3 The Optimization of seed exchange in Mampituba

Alice Fernandes Prestes, Luis Bohn, Sérgio Francisco Barchet and Telma Naiara PereiraValim Ribeiro

7.3.1 Summary

In the Province of Mampituba (RS), all women in the Mother's Club⁵ participate in community horticultural production, the exchange of seeds and the identification of their preferences. The habit of cultivating, eating and exchanging the "weeds" among community members is a cultural characteristic of families in the region. The exchange of seed and other planting materials such as tubers and plantlets are registered by *seed guardians*. Seeds are later collected and registered, and information is organized according to adequate cultural practices, preparation, consumption and storage. This activity started in 1998 as a partnership between the extension agency Emater/RS-ASCAR and the Provincial Council of the Mother's Club.

The strategy has been very effective in preserving and multiplying a significant genetic bank and increasing food crop consumption. One should bear in mind the enormous pressure of current, pre-established production models that are leading to monoculture, causing irreparable losses in biodiversity and local culture.

Presently, around 126 rescued species are being multiplied by small-scale farmers in 15 communities with more than 70 families.

7.3.2 Context

7.3.2.1 Characterization of the region

Mampituba is located in the northeast of Rio Grande do Sul State, in the micro-region of Torres. The climate is subtropical, hot and humid, with a well-distributed rainfall and average temperature during the hottest month higher than 22°C. The average temperature is 17.9°C. The average annual rainfall is 1 423 mm, with predominant winds from the northeast. Since the province is located in the "Mata Atlantica" system, there is enormous animal and vegetative biodiversity to be preserved. The region is protected from the cold winter winds by the Serra do Mar, being exposed to the effects of ocean and mountain.

This micro-region is divided into three levels, typical of the basalt hillsides of Rio Grande do Sul:

- the level formed by flat lowlands with sandy soils.
- the level formed by areas with moderately uneven topography.
- the level formed by sloppy topography with rocks (hillside), consequently shallow soils.

Farmers occupy areas on the hillside of valleys of micro basins, with an average slope of 20 percent. The land is predominantly covered with bananas, small animal raising and subsistence crops. Animal manure, although inefficiently utilized, is now being used in horticulture and subsistence and commercial crop production. The province has been recently emancipated, but has a precarious social infrastructure. Some roads require river-crossing. During the rainy season, the water carries the roadbed to the rivers. The frequent overloads of riverbed impede the movement of rural people and the transport of local production. Rural electrification is still deficient in the communities. The communities are organized into Provincial Administrative Councils, where development priorities are discussed and ranked. A commission is elected to monitor the administration of the province.

⁵ The Mother's Club is an association of women farmers that is recognized by the county administration and has a representative within the County Council.

7.3.2.2 Roadmap for Development – the region’s approach

1st phase: *Beginning with the communities:* Around 1880, the following communities were formed: Costãozinho, Rio de Dentro, Roça da Estância and Rua Nova. As the roads became operable, 12 other communities were formed. Subsistence activities were prevalent.

2nd phase: *Subsistence agriculture and animal-raising:* Beginning in 1940, lumber commerce was established and troopers came from the Serra dos Pintos bringing foodstuff and beans, bananas, liquor, sugar and cassava flour, among others.

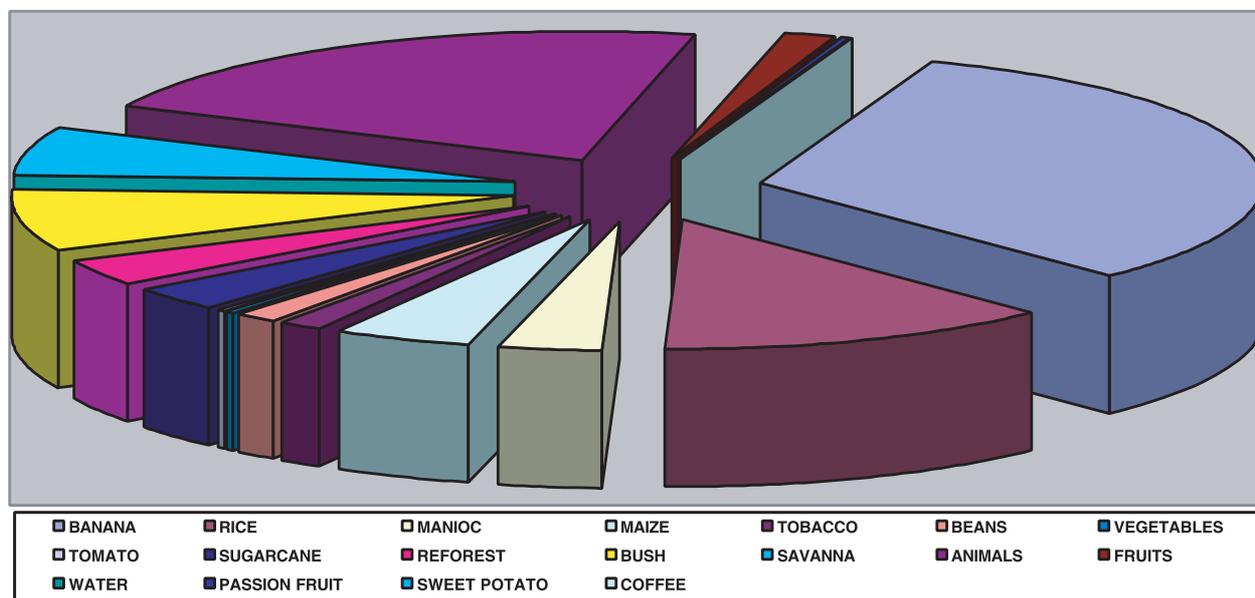
3rd phase: *Cash crops of the modern market:* Beginning in 1958, tobacco was introduced and liquor production increased. In 1970 a big flood caused a rural exodus from the region. Electric energy arrived with technical improvements of agricultural production that utilized imported inputs. Changes resulted in food consumption habits and “local” crops; consumption of imported, industrialized food increased. In the 1980s irrigated rice was introduced and banana production was pushed, with reductions in liquor and subsistence crop production.

4th phase: *Emancipation:* Since 1995, the province has improved infrastructure, roads, electricity, telephone, health and education. Local organizations and their relationship with public administration have been strengthened. Banana production has increased, while tobacco and subsistence crops have decreased. Strong winds in 1999 and killing frost in 2000 brought economic crises. The opening of roads improved the commerce of production, leading to more changes in consumption habits, further reducing subsistence crop production. As a consequence, technical information on the cultivation of low market value crops was lost.

7.3.3 Current situation of seed exchange project

Seed exchange occurs on small-scale farmers’ properties in 15 Mampituba communities where there is still subsistence agriculture, which includes community horticultural gardens, local fruit yards and larger horticultural production. Figure 7 shows how these rural properties are organized:

Figure 7: Typical Mampituba rural property in September 1999



SOURCE: EMATER/MS
SEPTEMBER 1999

The family characteristics in the Province are:

- many young families at the productive age that are interested in staying in the rural environment;
- strong family ties;
- women as main seed guardians;
- families interested in seed conservation;
- cultural and genetic richness.

Women are the family members with the most responsibility in seed and subsistence crop production and in nourishing their families, although all family members participate. Children often accompany their mother in these tasks.

The origin of the Seed Exchange was the Food Project launched by the partnership between the Mother's Club, the provincial administration, and the extension service and is based on three main axes:

- *Food security* - Domestic horticultural production is the source of good quality and quantity food.
- *Nutrition* - Basic nutritional understanding improves health through better nourishment.
- *Agro-industry* - Training of farmers in processing, physical infrastructure, legislation, administration and marketing.

7.3.4 Description of the Food Project experience

The Food Project is based on the principle that balanced, rich and diversified nutrition is the basis for a healthy life. Promoting the community horticultural garden therefore improves family nutrition, diffusing and guiding agro-ecological production and home processing of food crops.

Using the Women as hosts of visits to the rural properties allowed better access to agricultural production structure and knowledge on species being preserved through domestic horticultural gardens.

Taste preference for these species was already within the local eating habits and memory, together with local, rustic agricultural practices that were adapted to their way of life. However, losses of genetic material are already visible due to the simplified model of production and living.

In response to this tendency and with the objective of being effective in food security, the exchange of seeds was adopted as a strategy improving food security. Other ways of improving sustainability of agriculture in Mampituba include carrying out seed stocking systems, optimizing the exchange, and orientating and promoting propagating material (seeds, plantlets and tubers).

This study aims to rescue and preserve plant genetic resources as well as improve production, exchange and consumption of propagating materials from cereals, tubers and plantlets by families in the region. These actions will stop the process of cultural and genetic erosion in the communities through strengthening interpersonal relations, and by using the system as a reference and validation for agro-ecological principles.

Seed exchange is a strategy to ensure food security, and focuses on the following aspects:

- *Sociological aspect* - integrating questions of nutritional education by providing nutrition education to the families.
- *Environmental aspect* - the preservation and rescue of biodiversity, the ideal place for exercising agro-ecology.
- *Cultural aspect* - providing continuity of knowledge and customs while reinforcing the local identity typical in the region.
- *Economic aspect* - diminishing costs of food in the family budget through the use of subsistence crops and diversified food products. Diversity enriches the nutritional pattern, generating healthier people and, consequently, higher productivity and less expenditures on health care.

7.3.5 Chronology

The following events helped create the Food Project through seed exchange:

- 1998 – Request for action in nourishment, nutrition, food utilization and domestic horticultural gardens in the Mother’s Club.
- November 10, 1998 – Participation of the coordinating Council of the Mother’s Club in the first State Journey to Food Security.
- 1999 – Based on the above, a strategy was prepared for the promotion of agro-ecological techniques of production, the guarantee of food security and stimulus to home food production. The Horticultural Contest and several courses on food processing were included.
- 2000 – When the food issue was evaluated the team of the Mother’s Club selected the major working lines called the “Food Project”, which registered information on the process and the identification of items to be developed during the year, including new communities and families and their eating habits. The Food Project included courses and demonstrations of processing methods and agro-ecological cropping.
- April 2001 - During the evaluation visits in the horticultural plots “different” and “ancient” plants were identified and consumed by many families in all communities. This led to the rethinking and development of a system to increase knowledge on these plants, their consumption and the optimization of current seed exchanges among families.
- May 2001 – Collection and distribution of some seeds and tubers among the participants of the Horticultural Plots Contest. First, pictures were taken, then people with more affinity to plants were identified and classified as “guardians”. A list of guardians was made and a collection of seeds, separated by colors, identified the original name given by families.
- July 25, 2001 – Seed and Food Exposition of Horticultural Plots during the Field Day in Costãozinho.

- October 1, 2001 – Citizenship Fair with the distribution of seeds and plantlets for 300 participants in the event.
- March 2, 2002 – Exposition in the Small-scale farmers’ Movement (MPA) Assembly in Rio de Dentro for 106 farmers. These expositions were used as a strategy to valorization and promotion germplasm conservation.
- April-July, 2002 – The distribution continued and the return of seeds previously distributed began. New species were included and new experiences brought by families.
- June, 2002 – Recording of the TV programme “Rural Rio Grande” showing the exchange of seeds and new recipes of maize bread with other tubers, with the presence of some germplasm guardians.
- July-November, 2002 – The project implementation practices were re-examined.
- Mixtures of colors as planting practices were identified.
- Information was enhanced on the eating habits for recording and diffusion (inside the county);
- The classification system of the seed collection involved:

B - Beans. ex.:	B1 black and ancient beans - Hosana Alves, Rio do Meio;
M - Maize. ex.:	M4 white maize - Alzemiro Moraes da Silva, Pedra Branca;
Ri - rice. ex.:	Ri2 upland rice chort-grain - Lindomar Pereira Ramos, Costãozinho;
P - peas. ex.:	P1 bush peas - Ercíria Lumertz, Costãozinho.
- Change of name to “Seed Bank by Seed Exchange” because the term “exchange” is used more often than by communities to describe seed-sharing.
- July-December, 2002 – First return of exchanged seeds, beginning of formation of stocks.
- Visits to the horticultural plots for evaluation in the Annual Contest. During these visits a seed “kit” was prepared for participants according to individual preferences, with the objective of better protecting endangered species. There was an intense search for seeds in the project office. New entries were included in the catalogue.

7.3.6 Results

Considerable results have been attained after four years since the beginning of the process. Around 70 families of 15 communities are presently involved with the Seed Exchange, preserving 126 rescued species. These families have increased their production, ensured seed multiplication and improved food security within the communities.

The process is very effective in improving food security and preserving biodiversity in Mampituba.

The Exchange strategy was very effective in reaching the objectives of the Food Project, and complies with the principles of agro-biodiversity.

Collection and stocks composition of “weeds” currently being exchanged, by category are:

Beans=49
 Maize=6
 Groundnuts=7
 Rice=3
 Cucurbitaceous=12
 Spices=7
 Peas=2
 Horticultural=8
 Coffees=3
 Fruits=16
 Potatoes=9
 Others=4

Presently, there are 202 participant families in all the communities combined.

The Seed Exchange:

- increases alternatives of subsistence agriculture, diversifying food production;
- strengthens the links among families within and outside the community;
- improves ecological education within the communities;
- includes all families, rural or urban;
- reduces the risks of frustration at harvest time;
- improves integration among families now and for future generations;
- produces clean food;
- diversifies food and sources of nutrients.

As an additional benefit, the schools received the surpluses of production for their school lunch, which improves the nutritional quality.

7.3.7 Advantages and limitations

The positive aspects of this Project are:

- families are interested in the issue;
- this activity is part of the culture kept alive within the community;
- it adds to current cultural and genetic richness;
- habits and diversity are promoted and preserved;
- there is demand for technical information on crop production and the nutritional aspects of species;
- it does not pollute the environment since it does not incorporate the use of pesticides;
- it is a participatory model that emancipates communities;
- the rural family does not become dependent on the inputs (seeds) every year.

The limitations and weaknesses are:

- there is pressure of the simplified system on the proposed system;
- some information is lost on crop production and food preparation in the long run;
- new cultural patterns are developed;
- technical information is lacking.

BRIEF DESCRIPTION OF THE MAMPITUBA FOOD PROJECT

Balanced rich and diversified food is the basis for health. It is fundamental to develop people's habits of eating vegetables and fruits.

HORTICULTURAL GARDEN

The Horticultural Garden is an initiative that stimulates the improvement of eating habits through the orientation toward production and processing of some horticultural crops.

Diseases can be avoided by good food, a secondary aim of the Horticultural Garden. In addition, the Project will disseminate the natural techniques for the agro-ecological production of horticultural crops, providing occupational therapy integration among neighbours and exchanging plantlets and ideas to reinforce the domestic economy.

The objectives of the Project are to:

- provide healthy nourishment to rural families;
- diversify food;
- produce one's own food;
- act as the reference and validation for agro-ecological principles;
- re-introduce seed exchange species, flowers, and medical herbs;
- re-introduce and exchange crop cultivation techniques;
- improve integration among neighbours;
- contribute to family income.

DISTRIBUTION AND SEED EXCHANGE

The Food Project consolidated two types of seed exchange –the horticultural kit and seed exchange.

Horticultural kit is composed of folders with information and some horticultural seeds, and designed to enrich the planted species and solve problems in homeyard horticultural production. The return of these benefits is expected to include the donation of some harvested plants to the School Lunch or another social initiative.

Seed Exchange aims at bringing back home seeds and making exchanges possible among interested families. Interested families are provided with a handful of seed for sowing; they return two after harvest. Those interested in cultivating home seeds and participating in the seed bank may contact Emater/RS-Ascar.

7.4. The Krahô Indians: researchers' work in partnership with the native Indians of Tocantins

Terezinha Aparecida Borges Dias

7.4.1 Introduction

Innovative Embrapa researchers contacted the Krahô Indians in the north of Tocantins and introduced them to technologies that help restore their traditional agriculture. The first contract signed between a public corporation and an indigenous community in Brazil, mediated by Funai (the National Indian Foundation), was based on these principles: respect for the local culture, participation of the Krahô Indians in all stages of the process, and the return of all work to the community. The document was held up as a model for other works of this type in Brazil.

The first contact took place in 1995; researchers were curious about the Indians and, in turn, indigenous people like Chief Haprô sought something lost in the past that was valuable for his people's future. What the Krahô wanted could be stored in cold chambers at Embrapa in Brasilia, at a temperature under -20 degrees centigrade: pôhypey grains, a dark, sweet and very soft grayish corn.

Researchers did not then know that those seeds, which were collected by their colleagues in the 1970s from the Xavante Indians of Mato Grosso, meant so much to the Krahô. Until then they were a scientific subject to be analysed and preserved together with a collection containing over 86 000 genetic accessions of plant species, known and unknown - a strategy for Brazilian and world agriculture.

But for the Indians, pôhypey had greater value than an exotic corn to be preserved. This species with a long cob, soft grains and very rich in starch was fundamental to their diet, which disappeared from the Krahô reserve since rice took over plantations as a single crop. It had been part of Indian policy that began in the 1960s to distribute rice seeds and hybrid corn for the major Brazilian tribes. In addition to depending on a yearly supply of fresh seeds, hybrid seeds required new production techniques that the Indians did not master. The result was low production and productivity, as well as changes in their daily life.

The grains preserved by Embrapa could help recover the traditional and diversified family plantations of the Krahô. According to the Indians, pôhypey was a more resistant variety of corn that sprouted again naturally after the harvest and did not require as much care as the hybrids. Researchers then selected a sample to be distributed and planted by each family in the Indian villages.

"The return of these and other seeds has caused a revolution in the community, bringing an unimaginable cultural impact", explains Indian expert Fernando Schiavini from Funai. Ancient chants and dances linked to planting and harvesting pôhypey are being practised again. The impact of this work has gone beyond the reservation's frontiers: the project *Recovery of Indigenous Traditional Agriculture and its Cultural Values* has been granted the highest award of the Public Management and Citizenship Programme of the Getúlio Vargas Foundation in 1998.

7.4.2 A new attitude

Embrapa committed to following up the process of multiplying seeds in the major Krahô villages. The first visit occurred in the following year and its objective was to learn the reality of the tribes and to survey their main needs for genetic resources for agriculture and food.

"This was when we found out that a great part of the experience that we accumulated during all these years would not be useful for that work", explains researcher Terezinha Dias, of Embrapa Recursos Genéticos e Biotecnologia (Genetic Resources and Biotechnology)(CENARGEN), Brasilia. "Usually the researcher arrives at a rural community presenting solutions or investigating the cause of a problem. But there, with the Krahô, we realized that we needed to listen to those people sensitively and carefully. That demanded a new attitude on our part, a new line of research," she concludes.

They needed to be daring and to experiment with methodologies that were typical to Embrapa. After many years of studies and discussions, the group of researchers chose two lines of approach:

ethnobiology, which studies the way in which a human group relates to its biological resources, with long-term results, and a *participatory rural diagnosis* adapted to the Krahô reality, which has an ethical approach, with quicker results. The researcher Rosa de Belém das Neves Alves comments:

We needed to know whether the Krahô were preserving genetic resources and how they treated and handled those resources. Ethnobiology became an excellent tool for us to understand how they organized themselves and how our work could be done without disturbing such an organization, without infringing upon established rules or creating conflicts.

The approach consisted in collecting data from the point of view of the object studied, in this case, the Krahô themselves.

The participatory diagnosis collected information from the researcher's point of view. "We wanted to understand how the community itself interpreted its physical space and how the agricultural systems and the environmental supplying that space were characterized", recalls Lucimar Moreira, of Embrapa Cerrados (Planaltina, Federal District). After all the techniques were employed, such as the preparation of maps, life stories, interviews, observation walks and seasonal calendars, the result of the entire work was passed on to the Krahô. She concluded:

This was when we checked whether our vision fit in with theirs. From then on, the Indians themselves prioritized the problems that needed to be solved and re-framed the work according to their point of view. A copy of everything stays with them.

7.4.3 Technical cooperation contract

The experience led to signing a technical cooperation contract between Embrapa and the Union of Krahô Villages (Kapèy), mediated by Funai. It officially approved some procedures that were already being carried out by the team since the beginning, such as a Krahô and a Funai technical person being present throughout all work carried out within the reservation (from collecting soil and genetic material to holding interviews with specific groups), and caution when meeting with legitimate representatives (pahhi or chiefs) in decision-making.

The work left deep marks. "I can say that the project changed my way of thinking and doing science. The strictness of the scientific method is not worth much when you make contact with them", reveals André Terra Nascimento, doctoral student in Ecology from the University of Brasilia, who has participated in the Embrapa project by surveying and studying the biodiversity of palm trees in the Krahô reservation. Mr Terra Nascimento adds:

I have passed on a lot of knowledge to them and have been given back as much. This exchange is the great finding of this work. I am very proud to know that my efforts can be useful to that ethnic group and that they will not be merely recorded in the pages of a scientific paper.

For Terezinha Dias, the major contribution by the project is to make the Krahô aware of the importance of their traditional knowledge accumulated during centuries and that no information gets lost in this process anymore. "It is very exciting to verify that a scientific work helps in some way to recover lost cultural ties and the self-esteem of the people," she explains.

One of the results of the participatory diagnosis carried out in one of the villages confirms this statement. The objective was to carry out a survey by interviews with the Indians to determine the major genetic resources needed by the community. Researchers expected to face demands for typical products of the kupén (white man), but the response of the community was surprising: of the four resources most needed, only coffee was not a part of the Krahô agriculture. They most desired new genetic materials for sweet potato, cassava and yam, all of which were disappearing from village plantations.

7.4.4 The Krahô Indians

The reservation where some 2 000 Krahô live may be considered the largest preserved fragment of the native Brazilian Savanna. It is located in an area of 3 200 square kms in the north of Tocantins, which was demarcated in the 1940s and is home to 16 villages.

In the last 50 years, they were encouraged to practice agricultural production systems that were different from those they traditionally used, resulting in the loss of seeds and their food surveillance

system. They therefore lost traditional varieties, which were related to cultural practices of thousands of years old in rites, festivals and other social activities. The creation of the Association of the Union of Krahô Villages (Kapèy) was the first major step towards recovering the Krahô identity.

7.4.5 Cashew fruit can improve the Krahô diet

One of the technologies that Embrapa has been transferring to the Krahô concerns the precocious dwarf cashew tree. Two thousand seedlings have been distributed and planted in the villages as a means of improving the Krahô diet. According to Kyhcaprô Krahô, a member of Kapèy who is coordinating the work, the objective is not commercial and aims at serving the community in the production of sweets, juices and in the usage of the cashew nut kernel.

"The reservation has only Savanna native cashew trees and the introduction of clones can encourage its cultivation near the villages without causing any kind of cultural damage to the community," reveals researcher Francisco Nelsieudes Sombra, of Embrapa Agroindústria Tropical (Fortaleza, Ceará). The precocious dwarf cashew tree is shorter and bears fruit earlier than the common cashew tree.

7.4.6 Contract establishes partnership between the parties

The Technical Cooperation Contract was signed by Embrapa and Kapèy in 2000; before that, actions by the Corporation were legally backed by a covenant signed in 1996. "We did not have a model and the document ended up reflecting the results of an intense debate among Embrapa, Kapèy and Funai. Many principles being debated in other fora such as the national Congress and the Genetic Heritage Management Council were also brought into the contract," explains Elza Brito da Cunha, of the Embrapa Industrial Property Secretariat. There are clear clauses on usage rights and intellectual property of the materials collected within the Krahô area and on the traditional knowledge of their uses and processing.

Embrapa will have preference in the research of native or exotic materials collected, but it will only be allowed to make available to other public or private institutions those referring to genders of known species and varieties intended for food and agriculture. "Unknown resources will be under the exclusive domain of the Indians. Embrapa will be allowed to maintain samples of these materials in its laboratories and germplasm banks, but it can only pass them on to other institutions by authorization from the Kapèy," explains Elza. As soon as the economic potential of any of these products is verified, the parties will sign a specific contract, establishing the conditions in which they will share the benefits arising from their use by the parties or by third parties.

The clauses are also inflexible in Indians' traditional knowledge concerning unknown genetic resources. Genetic resources cannot be traded, used or taken possession of by third parties without the specific authorization of Kapèy, mediated by Funai. All results arising from the contract are the exclusive property of Kapèy and Embrapa. The distribution of information generated by the contract, and the reproduction and trading of presentation material will also be done through authorization from the parties.

"Today the contract has put Embrapa at the forefront of discussions on access to benefits and their sharing the use of traditional knowledge," says Terezinha Dias. No wonder it is being broadly publicized in various agencies and organizations such as the National Institute of Intellectual Property (INPI), the World Intellectual Property Organization (WIPO), the Federal Department of Justice, and Pastoral of the Child (CNBB).

To Elza Brito, the document is a landmark in the evolution of the contact between scientists and Indians. "First, we are treating the Krahô as our partners. We have discarded the paternal approach and practices, and we hope that our experience may contribute to enlarging the debate on protecting the traditional knowledge of Brazilian Indians."

7.4.7 Discussion

M. Wetzel: I would like to add to the information on the CENARGEN experience with the Krahô Indians by mentioning that on-farm conservation needs to be discussed in depth with a larger group. I believe that FAO could play a strategic role in this aspect. In fact, on-farm conservation is something new to all of us. We still do not know how to approach the small-scale farmers' groups nor have strategies for promoting on-farm conservation with them.

S. Peske: Since we have discussed terminology very often in this Workshop, I propose the use of the term "in-situ" instead of "on-farm" conservation.

M. Wetzel: There is a big difference between the two terms: "In-situ" conservation is appropriate when germplasm is being conserved in its center of origin and "on-farm" conservation is a broader term.

APPENDIX I

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