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

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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 zone*s. 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 imp1roved seeds. The user's attitude is understood though 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 LSSSs 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 Rice: 4 000 ha Maize: 100 ha	Winter production Soybeans: 300 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
- Cultivated rice varieties: San Francisco Carandeño Bluebonette Dourado Colombiano **- Rice yielding:** Hand labour: 1 780 kg. / ha Mechanized labour: 3 204 kg. / ha **- Type of seed used:** Own seed Grain from milling houses Rice producer		**- Improved varieties introduced:** - Tari - Jasayé - Urupé - Panacú - Jisunú **- Organization o fan association:** Association of Yapacaní seed producers – the NGO, APROSEY: 7 seed producers **- Certified seed produced:** 94.90 t **- Seed marketing and use:** 94.20 t of seeds planted in the area 0.7 t of seeds planted outside the region **- Use of Certified seed** Increase in number of seed producers: 20% Increase in area planted: 29.25% **- Yields:** Rice: Hand labour: 2.670 kg Mechanized labour: 4.450 kg **- Grain market:** An increase in the price of grain due to increased quality: US$ 2 to 5/ 178 kg equivalent to 20%.

Table 12: Local seed supply system of "El Chore"

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

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

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 though 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 though 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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Annex I

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 quinua and small amounts of grains: drying blankets.
- Natural drying of quinua 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 quinua 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 DISCUSSIONS[4]

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 extension 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 Club[5] 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 22ºC. The average temperature is 17.9ºC. 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.

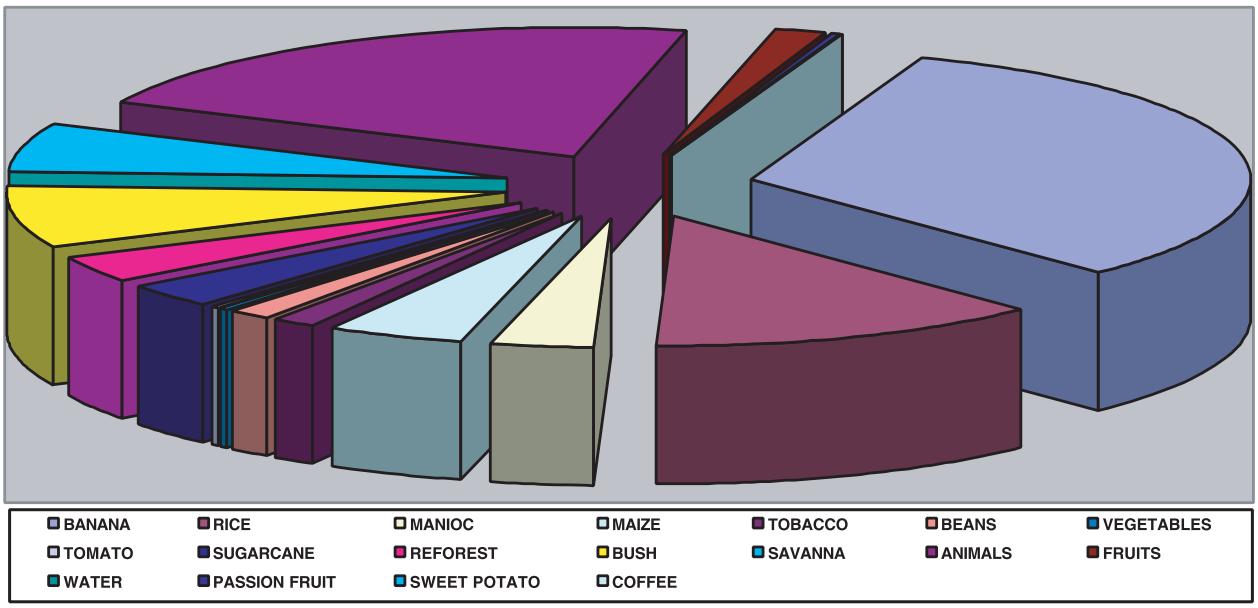
3rd phase: *Cash crops of the modern market*: Beginning in 1958, tobacco was introduced and liquor production increased. In 1970 a big flood caused a rural exodus from the region. Electric energy arrived with technical improvements of agricultural production that utilized imported inputs. Changes resulted 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.

ANNEX 1

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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