Box 1. Options for Adding Benefits through Market Incentives

Adding benefits through market incentives

- Exploiting price incentives by better processing and marketing
- Creating consumer awareness of local products
- Linking market with food culture
- Linking market with eco-tourism and local cuisine
- Developing new food products using local landraces
- Adding benefits through participatory pest management (organic agriculture, green marketing)
- Improving farmers' skills on seed production of specific valuable landraces
- Appellation of local products through development of cook book of keystone crops across ethnic cultures
- Direct sale of genetic resources using IPR or contract (e.g., seed)

Source: Sthapit and Jarvis (1999).

Identifying local promoters and then linking them with local producers and markets are crucial processes. In Begnas, Nepal, a series of consultations was carried out to identify major local products that have market potential, assessing total production, price negotiations, quality control, and marketing outlets. In Nepal, the project identified local promoters like *Gunilo* and *Bandobasta* who played a catalytic role in establishing linkages between promoters and consumers with the farming community. NGOs have been involved in the project to facilitate networking. Associations of hotel and tourism, Pokhara chambers of commerce, hostels, and hospital networks have also been sensitized to use more domestic products. The impact of such networks is yet to be seen.

The project is keen to develop markets to enhance the value of local crop diversity through direct sales. Rice landraces, *Jethobudho*, aromatic sponge gourd, *Khari* in taro, and *Samdi kodo* in finger millet, are a few examples. To succeed, this initiative must also be supported by policy reforms.

Table 2. Strategic Options Employed for Adding Benefits to Local Crop Diversity through Market Methods, Case of Begnas

Crops	Varieties	Farmers' values	Indicators of assessment
Rice	*Anadi*	*Latte*, *khatte*, and *siroula* in festivals; Medicinal value	Research base recipes developed Number of grower farmers' increased Status of nutrition known Grain demand created and area under production increased Number of growers increased
	Bayami	Fine, medicinal and high quality; High quality and price	
Taro	*Khari, Khujure, Hattipow*	*Masaura*, *tandra*, corm quality; Gava	
Sponge gourd	*Basaune ghiroula*	Aroma and excellent eating quality	Quality seed produced and marketed widely
Finger millet	*Samdi kodo*	Special gruel; Possibly suitable for pizza making	Demand created locally that motivates farmers to grow

Source: Adopted from Rijal (1999).

Discussion of strategic choices for PGR conservation

The role of local crop varieties in securing food at the household level is apparent, but diversity has also been enhanced for socioeconomic reasons (Rana et al. 1999). Nepali farmers use local rice landraces for at least six specific purposes (Rijal et al. 1997). On the one hand, these deserve special value and there is less competition, so a nonbreeding strategy is appropriate. On the other hand, breeding strategies are employed to make local crops competitive with other options, particularly those that have value and benefits in terms of ecology or physical indices like yield, disease resistance, etc. For example, the best quality of *Jethobudho* is grown with cold water, as is *Phewa* and *Kundahar* of the Pokhara valley, and always fetches a higher market price than when grown in an irrigated field. The strategies employed for adding values are presented in table 3.

In niche- or ecology-specific areas where food security is the main concern, as in Jumla, farmers always go for increased yield. Low yield is associated with rice blasts, poor response, and cold injury, for which the only way of addressing the problem is through breeding methods.

Table 3. Strategic Options for Adding Benefits to Local Crop Diversity

Values	In situ strategies employed for on-farm conservation			
	Breeding	Market	Awareness	Improved access
Ecology (e.g., JB)	✔	✔	✔	✔
Genetic (yield, height, disease, etc.)	✔	✁	✔	✔
Medicinal, cultural, religious	✁	✔	✔	✔
Traditional recipes	✁	✔	✔	✔

Conclusion

Developing an in-depth understanding of the value of landraces through appropriate methods is the prime need prior to deciding on any conservation strategies. Local crop diversity can be desegregated into broad categories by value—genetic, sociocultural, medicinal, or religious—to strengthen conservation of crops in situ by the farm community. Three broader categories include market, non-market, and policy perspectives for improving direct and indirect benefits. No single strategy is perfect for addressing the goal of conservation; a combination is required.

Of the many innovative tools available, the diversity fair and community biodiversity register have been most effective in terms of documentation and sensitizing communities of farmers, researchers, promoters, and policymakers. Furthermore, these two tools are very useful in monitoring diversity along with status. Values documented through these tools can be used for R&D purposes, where researchers, promoters, and planners may benefit. They also provide a basis for breeding work in the short term as well as the longer term.

For local crop diversity with socioreligious, cultural, or economic value, strategies that strengthen information, seed, and market networks are particularly important if CGR and their products are to be promoted *per se*. The diversity of these sets of crops will be maintained as long as the local culture associated with them continues. On the other hand, for crop diversity associated with ecological and genetic traits, the breeding strategy is the right choice. Thus, for effective conservation of

CGR on-farm, a number of strategies are essential. We argue that valuable genes can be captured and conserved only when they are utilized locally for both breeding and non-breeding purposes and when there is effective local conservation.

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Appendix

Appendix 1. Comparative Value of Local Diversity of Rice, Taro, Finger Millet, and Sponge Gourds at Different Eco-Sites of Nepal

Crop/Varieties	Location/habitat	Direct value
1. Landraces with ecological benefits		
Jumli marshi in rice	Jumla (2200m)	Cold tolerance, taste, and *aadilopan*
Naltumme	Kaski (670–1400m)	Adapted to shaded areas
Mansara, Aanga, Kathe gurdi	Kaski (670–1400m)	Adapted to entirely rain-fed, low-input ecosystems
Taro: *Khari pindalu*	Kaski (670–1400m)	Compatible for intercropping with maize, etc.
Bhati, Silhat, Laltangar, Aamaghauj, Sakhar	Bara (85m)	*Dhab* (swampy land)
Nakhisaro, Rango, Sokan, Mutmur, Sotwa	Bara (85m)	*Ucha/Bhith* (upland, rain-fed)
Batsar, Lajhi	Bara (85m)	*Nicha* (low land)
2. Socioeconomic values related to specific use		
Jetho budho	Kaski (670–850m)	High quality; High price
Panhele	Kaski (670–850m)	Fine, aroma; High price
Gurdi	Kaski (670–1400m)	*Sel roti* (Nepal donut)
Anadi	Kaski (670–1100m)	Special recipe for local festivals; Not accepted for religious ceremonies
Basmati	Bara (85m)	Aroma and eating quality
3. Medicinal, cultural, food, and religious values		
Basmati, Sathi, Aanga, Lajh, Sotwa, Sokani	Bara (85m)	Religious (guest, feast, recipe)
Khera	Bara (85m)	Religious (local diets, *Karik maharaj*)
Bayarni, Anadi	Kaski (670-1900)	Medicinal (back pain, taste, recipe)
Sponge gourds: *Basaune*	Kaski (670-11200)	Aroma, taste, eating quality
Khari pindalu	Kaski (670-1400)	Special recipes: *Masaura tandra, Gava* and cormels
Dudhe	Kaski (670-1400)	Petiole for special pickle

Source: Baseline survey, PRA , diversity fair, and FGD.

Participatory Improvement of Rice Crops with Tribal Farmers in India

V. Arunachalam

Abstract

Participatory research, including participatory plant breeding (PPB), is now a recognized option for improving the livelihood security of unreached farmers. Tribal farmers in India provide an ideal group for testing the potential of participatory interventions. They live in remote areas, are intensively bound by tradition, and continue to cultivate crops using traditional practices. For instance, the sowing time of crops is often based on a particular month, with an almanac date to harvest the crop in time for its use during festive occasions. Although these traditional cultivation practices are often poorly matched with the weather, they continue because they are consonant with the habitat, soil, agroecology, and available infrastructure. Soils are relatively free from the problems of continuous chemical fertilization. Most cultivated varieties are specific landraces that carry special traits for cooking quality and taste, catering to the tribal farmers' methods of processing food. Tribal farmers live in small villages, inconveniently distant from one another, and do not have readily accessible means of producing and exchanging community seed. Traditional varieties/landraces are also not commercially competitive. Driven by poverty, the tribal farmers yield to commercial exploitation where the cultivation of landraces, local varieties, and other valuable genetic material is replaced by the cultivation of modern varieties despite the fact that they are not preferred by the tribal community. The result is a gradual erosion of precious genetic diversity, most of which is also site-specific. This situation calls urgently for preventive measures.

Jeypore tract in Orissa State is a secondary center of rice origin. Yet farmers do not realize the potential yield of the rice landraces growing there. One reason is that the traditional practices developed essentially for avoiding risks are out of tune with those needed for realizing high yields. Participatory initiatives, setting appropriate methods of cultivation based on a realistic evaluation should provide the right corrective step. This paper describes and discusses such initiatives in the Jeypore tract of Orissa.

Keywords: Tribal farmers, participatory research, rice, landraces, participatory plant breeding, India

Introduction

We describe below a situation typical of tribal farmers in India, where any option, including participatory plant breeding (PPB), has to coexist with the site constraints if it is to be feasible. Orissa state is situated in the southeast region of India between latitude 17°48' and 22°34' N and longitude 81°24' and 87°29' E. The total geographical area is approximately 156,000 km^2 and accounts for 4.74% of India's geographical area. As per the 1991 census, the state has a population of 31.66 million, of which 7.03 million (22.2%) are tribal. The tribal people consist of different ethnic groups (at least 62 were identified in a recent survey) and form three broad categories of farmers—backward, peasant-like, and semi-urbanized—based on their level of development. The backward tribes live partially in isolated pockets and practice shifting cultivation. the peasant-like farmers depend largely on sedentary cultivation, and the semi-urbanized farmers have their mainstay in settled agriculture and wage earning. But all the tribal farmers are characterized by their own traditional life-styles, ancient customs, beliefs, rituals, and sociocultural identities.

Koraput is a district in Orissa State where the economy is based predominantly on agriculture. Jeypore, previously a part of Koraput, was made a separate district in the recent past. Cultivation is carried out in Jeypore at different altitudes, ranging from 600 to 1350 feet above mean sea level.

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Usually lands situated above 900 feet are classified as upland; around 600 feet and below is low-land, and the rest is medium land.

Agricultural practices are more primitive in Jeypore than in the neighboring states. Irrigation is rarely possible, all lands are completely rain fed, and rainfall is erratic. Farmers occasionally apply farmyard manure. Rice is the most common food crop of the region. Landraces and local varieties are mostly preferred because they cater to the cooking quality and taste of the tribal people. High-yielding varieties (HYVs) are not preferred and only commercial incentives compel some farmers to grow them. Government agencies and some private organizations are the ones that encourage this. The planting and maturation of traditional varieties are timed so that their harvest coincides with the time of festivals and family rituals (table 1). The varieties are usually photosensitive and of longer duration than high-yielding varieties. A large number of farmers still practice monocropping.

Table 1. Some Valuable Land Types Cultivated by Tribal Farmers of Orissa State in India for Use in Their Religious Functions

Rice Variety	Predominant Quality	Festivals	Time of Maturity (Month)
Kalakrishna	Scented	All festivals	January
Tulsi	Scented	*Chaitra Parva*	April
Machchakanta	White slender, short grains, good taste	*Manabasa* and *Lakshmi Puja*	November
Mer	Black grains with medicinal properties	Annual ceremony of forefathers	November
Haladichudi	White slender, long grains, good taste	*Shakti Puja*	December
Deulabhoga	Bold, short grains, reddish tinge on cooking with mild scent, preferred during worship at temples	Temple deities	December

Thus we have the following basic realities in which PPB options have to be optimized:

- Tribal farmers live in villages rich in genetic diversity and occupied by one or two tribes. They are situated far away from the reach of government extension agencies.
- Farmers are highly tradition-bound socially and religiously, and would have reservations about switching to new options.
- The enhanced yields of HYVs do not attract them as much as the quality and taste of their lower-yielding landraces and local varieties, which they prefer.
- They have rich indigenous knowledge of their crop diversity but poor knowledge of modern agriculture.
- Their habitats are poorly connected by roads and are typified by poor or absent marketing facilities.
- Against this backdrop, they are vulnerable to commercial exploitation of their natural resources.
- They are ready to learn and practice profitable methods of cultivation, provided such methods can produce perceptible returns.

- Currently there is neither a feeling of strong ownership of natural resources nor any awareness of intellectual property rights.

New PPB paradigms need, therefore, to be simple and productive to promote voluntary participation. They should be cost-effective and, at best, attempt to optimize practices under existing site constraints. They should respect farmers' tastes and be consonant with their strong preferences. They should be risk-insulated and entail a low cost-benefit ratio. Complex PPB options can only be a long-term goal and should be based on short-term benefits.

The method

A number of years of work and association with farm families of several villages in the Jeypore district by the M.S. Swaminathan Research Foundation (MSSRF), based at Chennai, India, has prepared the ground for cooperative and participatory work to improve the productivity of farmer-preferred local varieties/landraces. The work plan envisaged a three-year activity module. The first year was earmarked to survey local varieties sown by farmers and to introduce organized planting of preferred varieties. The seeds of those varieties would then be distributed by MSSRF. A few farmers would be encouraged to raise the crop in their plots by their own methods. The yield data would be analyzed and a few varieties selected for further evaluation.

In the second year, the selected varieties would be grown by PPB farmers in a field design in which farmers and formal practices would be the two treatments. Data on grain yield and its components would be statistically evaluated to select the top two varieties for upland, medium land, and lowland conditions. In the third year, the selected varieties would be grown in large plots under formal technology, provided it proved superior to farmers' practices in the second year of evaluation. Varieties to be evaluated, the sites for testing their performance, and the farmers who would participate in the program would all be selected by the farmers themselves. Periodic checks on the progress of the experiments, the problems that cropped up in the execution of experiments, and related issues would be discussed in periodic PRAs with farmers, and acceptable solutions found.

Results

During the rainy season of 1998, three districts and two blocks per district were selected for upland (U), medium land (M), and lowland (L) cultivation in the Jeypore tract of Orissa State. Fourteen farmers were chosen to raise 10 upland, six medium land, and 10 lowland local races/varieties in their own plots of approximately of 80 m^2. The crop was raised using farmers' practices common in the respective areas. However, a severe cyclone at the time of crop maturity affected crop yields; the data could only be used for a relative evaluation. We devised a form to record various field activities, with which data on cost-benefits were gathered not only on the PPB plots but also on farmers' own holdings. The overall performance and characteristics of varieties were discussed in a PRA with a large number of farmers from the sites.

Only 3 U, 1 M, and 5 L varieties were selected in the PRA from the original 10 U, 6 M, and 10 L varieties tested in 1998. In consultation with the farmers, 3 U, 7 M, and 3 L varieties were added to get a total of 6 U, 8 M, and 8 L varieties for experimentation in the crop season of 1999.

To facilitate periodic visits to plots, it was decided to confine the experiment to two blocks and five villages in the Koraput district, near the MSSRF site office at Jeypore. Nine PPB farmers agreed to

test the selected varieties in two test plots of 90 m^2 each. One of the test plots was divided into three replications of 30 m^2 and the selected varieties were grown in a randomized block design. The other was divided equally between varieties to be tested. They were planted unreplicated by farmers using their own traditional practices. In the replicated plots, formal methods of cultivation were introduced (box 1).

Box 1. Formal Methods Introduced to Cultivate Local Varieties and Landraces in Jeypore, India

- Preparing land and applying farmyard manure in residual moisture when the previous crop has been harvested
- Raising nursery stock in well-prepared land in rows spaced 20 cm apart with optimal moisture
- Pre-soaking seeds in water for 12 hours and selecting only those seeds that sink
- Direct seeding (in U and some M), or transplanting (in some M and L) of about 25-day-old seedlings, in rows spaced 20 cm apart, with plants at 10-cm intervals within a row
- Setting rows north-south to maximize sunlight on growing plants.

Those formal methods were developed as a result of a survey of farmer's plots grown to rice in the first year, where a number of problems were predominant (box 2).

Box 2. Problems with Rice Crops Raised under Farmers' Traditional Practices

1. Erratic rainfall, leading to the tradition of high seeding rate of about 40–60 kg/ha
2. Consequent dense plant populations that lead to yellowing and poor plant growth
3. Ill- or unprepared lands due to lack of moisture prior to the planting season, resulting in poor germination
4. Poor seedling growth, leading to severe disease and high pest incidence
5. Farmyard manure occasionally applied in small quantities during sowing, resulting in no benefit to the crop
6. Nursery plants raised in poor, most often unprepared lands with flooded rain water
7. Transplanting most often with very old seedlings, sometimes even 60 days old

Crop growth on formal and farmers' plots was evaluated in periodic PRAs with farmers. Scientists recorded data on days to flowering, number of tillers, number of panicles, number of grains per panicle, and grain and fodder yield with the help of farmers in each plot. The data were used to compute grain filling and harvest indices. Based on multivariate statistical analysis of yield and its component characteristics, the varieties were ranked on their joint performance across all traits.

The results were striking. They are summarized and shown only for the varieties common in 1998 and 1999 in table 2. The advantages of changing over to scientific methods of cultivation are obvious.

The following inferences stand out:

a. Fluctuations in the yield of varieties occurred even under traditional (farmers') methods of cultivation. For instance, the variety, *machchakanta*, was the top yielder in 1998—a year characterized by cyclonic weather and heavy rainfall. It gave low yields in 1999 under farmers' practices despite consistently good weather. In general, however, varieties responded by giving good yields under the better climatic conditions in 1999.

Table 2. Comparative Benefits of Formal Methods over Farmers' Traditional Practices of Rice Cultivation in Jeypore Tract, India

		Average Yield (k/ha)			
		1998	1999		FO/FA
Land Type	Variety		FO	FA	
Lowland	*Machchakanta*	2189	1671	1418	1.2
	Bayagunda	1755	3679	2321	1.6
	Gadakuta	13352	1524	961	1.6
	Barapanka	1643	3438	2533	1.4
	Kalachudi (*Umriachudi*)	1309	2562	2007	1.3
Medium Land	*Bodikaburi*	1261	2838	1736	1.6
Upland	*Pandakagura*	393	1188	1178	1.01
	Paradhan	562	1028	622	1.7
	Matidhan	839	1199	1133	1.06

Note: FO=Formal methods; FA=Farmers' traditional methods.

b. Yields under formal methods were consistently and significantly superior than those under farmers' methods. Lowland varieties, which gave fairly good yields under farmers' practices, responded to formal methods by giving up to 60% higher yields (table 2). One popular upland variety, *paradhan,* preferred by all farmers, had a yield advantage of 70% under formal methods. The trend of improvement was about the same for the other 13 varieties (data not shown).

c. Yield improvement using formal methods was achieved at no extra cost. Initially farmers found it difficult and time-consuming to space-plant in rows, but quite soon they saw that they could achieve higher efficiency (see d.1, below).[1]

d. Preliminary data show that the cost-benefit ratio is substantially more favorable under formal methods for the following reasons:

1. The seeding rate is about one-fifth of that used in traditional methods (12 versus 60–65 kg/ha). Hence even row planting with uniform space between plants could become less time-consuming.
2. Nursery seedlings produced under formal methods grew vigorously and were free from weeds, insects, and diseases.
3. Seedlings were well and quickly established in plots because of initial seed selection and healthy nursery plants.
4. The healthy initial stand discouraged weed competition and helped healthy crop growth without being affected by biotic stresses.
5. Row and space planting made interculturing operations easy, where needed, and harvesting of the crop took significantly less time.
6. The 20-cm spacing between rows proved ideal for the harvested plants to be stacked in a slanted, reinforcing standing position for the produce to dry in the sun in the field before transfer to threshing yards.

1. In a recent PRA in August 2000, farmers reported that seed placement has become more efficient and reduced the labor requirements for planting in rows.

These small but significant benefits added up to a cumulative advantage, reduced the drudgery of field operations, including weeding and harvest, and resulted in a more favorable cost-benefit ratio.

In conclusion, we learned a number of lessons, and the experiments evoked the desired response among farming families in both the experimental sites and surrounding areas.

Lessons learned

1. Situations exist which do not exactly fit a typical case for PPB. Any participatory initiative, including PPB, is a function of the target site, environment, site farmers and their traditions, practices, and social and cultural norms.
2. Participatory programs must recognize this circumscribing frame, most often rigid, within which actions must be confined.
3. Initial action plans must produce perceptible benefits in order to ensure voluntary participation.
4. When the basic constraints and opportunities for initiating participatory actions are recognized, respected, and acted upon, even farmers in difficult economic conditions will willingly participate without incentives.

Effects induced by participatory improvement initiatives

1. Farmers were clearly convinced that the traditional high seeding rate and dense planting are not the way to counter their difficult environment, harsh climate, and unpredictable yields. They have realized by their own experience the logic of the formal methods they were shown.
2. The message of formal methods of cultivation has spread so far and fast that a number of surrounding villages have started adopting the same practices, not only in rice but also in other crops, like red gram and finger millet.
3. There is a high demand from the tribal farmers for training programs in various sites to ensure proper adoption of formal methods of cultivating traditional rice varieties.
4. Farmers are willing to extend their participation to breeding productive pure lines, initiating from parents chosen from their site-specific local races and cultivars.

Thus, the experience of participatory rice improvement has been exhilarating and productive, and efforts are under way to replicate the benefits of formal methods of cultivation by initiating site-specific PPB paradigms.

CONSERVE's Experience and Work on Participatory Plant Breeding in Rice

Gilda T. Ginogaling

Abstract

In this paper CONSERVE's experiences in handling two research approaches in participatory plant breeding in rice are discussed: researcher-managed or on-station trials (OSTs) and farmer-managed trials. OSTs are done on CONSERVE's farm. CONSERVE crosses (CC) were used as materials for evaluation on-station for three filial generations before the material was given out to farmer-partners for the farmer-managed trials. All distributed segregating materials were tried in their respective fields. Activities taken on-station and in farmers' fields is assessed. Lessons on the management of on-station trials and farmer-managed trials are discussed.

Introduction

There are some organizations that conduct research on how the development of seed is improved. Some do experiments both on-station and in farmers' fields. Community-Based Native Seeds Research Center, Inc., (CONSERVE) is one of these. It was established to conduct both researcher-managed trials and on-farm field trials using rice seeds as materials. CONSERVE is an NGO established in 1992, which started as a project of the Southeast Asia Regional Institute for Community Education (SEARICE). It has a 1.7-hectare demonstration farm for field research and a space for the project office and training center. The organization is involved in the conservation and development of plant genetic resources for sustainable agriculture and food security, particularly rice and corn, in the Arakan Valley Complex that covers 35% of the total land area of the Cotabato Province in the Philippines. The Arakan Valley Complex is composed of five municipalities where farmer-partners are 60% tenant farmers and 40% landowners. The majority of them (60%) are men. Farmer-partners are organized either through people's organizations or as individual curators and indigenous people in the uplands. CONSERVE's initial activity was to collect 299 rice varieties from Cotabato and Maguindanao provinces in 1992; 389 varieties were added in 1995. Aside from rice, 42 varieties of corn, along with millet, sorghum, vegetables, and 59 varieties of unidentified cereal crops were collected. The center is maintaining local storage as a back-up of these materials.

The problems created by the Green Revolution in the 1960s through the introduction of modern varieties inspired CONSERVE to initiate a program of conservation of plant genetic resources (PGR). Over the years, farmers had mainly relied on what was being introduced by the formal system and through the local seed supply. Very few practiced seed selection from segregating materials but, many selected from mostly or almost uniform varieties. This is where the seeds for the next cropping season came from.

CONSERVE's approach to participatory plant breeding[1]

Since the project's beginning in the Arakan Valley Complex, CONSERVE has been involved in various research projects at both the center and on farmers' fields. PGR research has mostly been

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1. Participatory plant breeding (PPB) is involving farmers in the selection of genotypes from genetically variable, segregating materials (Witcombe and Joshi 1996).

linked with sustainable agriculture. Farmer-partners have taken part in the research as the evaluators and observers at the central farm's research, while at the same time, they have had their individual research projects. Program staff provide assistance and venue through training, cross visits, regular meetings, and consultations.

From this research, CONSERVE has gained experience and learned lessons, especially since it is one of the pioneering projects in the Philippines to focus on conservation and utilization of plant genetic resources. The seeds collected by CONSERVE have played a vital role in this research.

CONSERVE conducts both approaches—researcher-managed (or on-station) and farmer-managed trials—at the same time.

Researcher-managed (center-based trials)

The researcher-managed trials are conducted in the center's production farm, facilitated by program staff and later conducted by farmer-partners. Farmer-partners are invited to visit the station and identify materials that are acceptable to them, usually before harvest season.

There were 22 single crosses done by the center and coded as CONSERVE crosses (CC). Varieties crossed were mostly materials from the uplands, which were crossed with lowland rice in order to determine if the product of the cross will adapt or not. Out of these crosses, only 10 crosses survived at the first filial generation. These were planted in on-station (lowland) fields by plot, where program staff observed and evaluated the seeds. Records of the crosses and the number of selections have been kept. Distinct characteristics of the materials selected were noted, such as resistance to pests and diseases, yield (panicle length), number of tillers, height, and other agronomic characteristics. No back-up of the crossed materials has been made. After two cropping seasons, various selections were obtained and planted in the production area. Bulk selection was practiced. Program staff made the decisions involving rejecting seeds not adaptable to the center's conditions and did the selection. Before the selection at harvest time, farmers were invited to the station and took part in the evaluation of the segregating materials. Group discussions were held and criteria were obtained to provide the basis for selection. Farmer-partners also took part in the selection; they freely selected what they wanted from the segregating materials on-field. This material was simultaneously distributed to 89 farmer-partners starting in May 1995.

Breeding materials were continuously segregated and diverse characteristics were obtained. The center had difficulty managing all the materials, and the focus of the program staff was limited to keeping records of significant developments in the materials; thus, it was decided to distribute to farmer-partners. All in all, CONSERVE was able to produce 100 lines from 10 single crosses. These were distributed to increase the number of selections and to enhance participatory research by exploring the process of selection until farmers can produce a stable selection for mass production.

Lessons learned and recommendations:

- It was interesting to note that the center did not keep a back-up of those 10 crosses that might have served as good material for selection in the future. The center is maintaining short-term back-up storage of the seeds collected in the beginning of the project.
- The crosses made also provided a good learning experience—an upland variety crossed with the lowland but with the experimental plots in the lowland area. The center should have tried conducting the same experiment in the upland area to know the performance of the offspring.

- The involvement of farmer-partners in the activity was very limited since they were only involved in the later part of the research and most of the selections were done by program staff. Farmers should have been involved not only in the later part but also in the whole process so that they could learn how the research is conducted.

Farmer-managed (farmers' field trials)

Farmer-managed trials are actually conducted on an individual farmer's field. Farmers have their own way of designing the experiment, either within the farm or across farmers. The evaluation is usually informal, with their criteria providing the basis for selection.

After the segregated materials were given to the farmer-partners in the Arakan Valley Complex, project staff monitored their progress and provided assistance to them. The majority of farmers received a minimum of five breeding lines in small amounts (around 5-10 grams) to try in their respective fields. Some planted the seeds in separate plots and others planted them in a portion of their rice field. Most of the farmers who received the segregating materials were graduates of the Ecological Pest Management–Farmers' Field School (training given to farmers on a weekly basis for one cropping season of about four to five months, to give them an understanding of rice production activities using the seven dimensions of sustainable agriculture).

Farmers selected plants according to their own individual criteria. They practiced two types of selection methods: bulk and pedigree. Some farmers discarded materials, while others mass produced. As these materials expressed their characteristics under the conditions of different farmers' fields, materials were exchanged among farmers, not just within the village but to other municipalities. Selection continued even when the materials reached the mass-production stage. Farmer-breeders continuously bred, selected, and distributed their stable lines to other farmers. It happened, too, that rejected materials were passed on to other farmers, still undergoing the process of selection according to individual preference. While the flow of materials continuously moved, the process ended when the breeding lines reached the mass-production stage. The flow of genetic materials from one farmer to another is extremely fast. The farmers' efforts to explore and experiment through selection were a very good example of participatory research and how farmers can be empowered by giving them control of the seeds and the resulting exchange of seeds within the area and to other villages.

From the survey conducted by CONSERVE in 1998, a total of 19 lines out of the 57 lines originally distributed from six single crosses (CC1, CC2, CC5, CC7, CC13, and CC20) were still maintained by farmer-partners. At present, the breeding lines are widely used for mass production not only by farmer-curators but also by other farmers. CONSERVE Crosses 5 and 13 are commonly used. Selections by farmer-partners are continuously enhanced in farmers' fields, which has led to an increase in stable lines. On the other hand, it was observed that over the years, although stable lines had been identified, the number of lines has decreased as farmers continue to select and adapt the materials given to them. Their selection criteria and the adaptability of the breeding lines are based on the conditions present in their respective fields. Moreover, only a few farmers keep many selections. Usually, they only keep two to three lines, on average. Farmers who keep many selections have the capacity to manage them and lack storage facilities, leading to a diffusion of selections.

Lessons learned and recommendations:

- It was noted that farmers did not keep the original lines given to them, as the center also neglected to do. Like CONSERVE, they have lost the opportunity to go back to the mother

population in order to replace the lost selections. They have kept improving the selected materials until they became stable and uniform, based on their own criteria. There are only a few farmers who have the capacity to use all of the selected materials at a time. Since labor is limiting factor, farmers have discarded those materials that are not of use to them. Storability is another factor, because of the humid conditions of the program area—seeds lose their viability in a very short time.

- Therefore, there is a need to provide farmers with support in maintaining their selections and training them how to manage their seeds to preserve longevity.

Reasons for distribution and nondistribution

In order to determine farmers' acceptance of the segregating materials distributed, the reasons for distribution and nondistribution of materials in the field were examined (table 1). In the same survey conducted by CONSERVE in 1998, it was found that 31% of the farmers distributed the segregating lines they obtained from the center to other farmers. Most of them reasoned that it was ready for mass production. Another reason was that the person who requested it was a close relative.

Table 1. Farmers' Reasons for Distribution and Nondistribution of Segregating Lines to Other Farmers, Arakan Valley Complex, Cotabato, Philippines

Distribution	Nondistribution
Relative/kin	Minimum quantity
Morpho-agronomic characteristics	Infested by rats
Ready for mass production	Tungro infested
	Not yet uniform
	Mixed
	Infested by rice bugs
	No selection done
	Milled
	Eaten by ducks
	Neighbors have the same seed

When farmer-partners did not distribute the breeding lines to other farmers, it was because they only had a minimum quantity of the material. Some said this was because of an infestation of pests, such as rats and rice bugs, that the materials were not yet uniform, that the materials were mixed, etc. Some farmers were very reluctant to distribute because of the small quantity given. In time—with further field testing, improvement, and multiplication—farmers started to appreciate and find ways to obtain, develop, and increase the quantity of good varieties.

Reasons for adoption and rejection

There are also reasons why farmers adopt or reject varieties given to them. These reasons can be agronomic, morphological, gastronomic, social/cultural, and technological (table 2). Agronomic

Table 2. Why Farmers Adopted or Rejected the Breeding Lines Distributed, Arakan Valley Complex, Cotabato, Philippines

Adoption	Rejection
Agronomic:	**Agronomic:**
• adaptable to the area	• cannot adapt to the area
• resistance to lodging	• susceptible to lodging
• resistance to pests and diseases	• susceptible to pests and diseases
• medium maturity	• maturity is not the same
• high yielding	
• early maturing	
Morphological:	**Morphological:**
• long panicle	• discouraged by the segregation
• medium height	• height (tall)
• shiny seeds	• late maturing
• thin (lemma and palea)	
• good tillering ability	
• filled grains	
Gastronomic:	**Gastronomic:**
• good eating quality	• eating quality is not good
• aromatic	
• glutinous/oily	
Social/cultural:	**Social/cultural:**
• low cost in production	• busy with other obligations
• neighbors are encouraged	
Technology:	**Technology:**
• learn selection	• laborious

reasons include resistance of the breeding lines to pest and disease, resistance to lodging, and adaptability in the area. Adaptability was measured as having good standing performance/growth under specific environmental conditions.

Morphologically, farmers adapted breeding lines according to the length of panicle, number of productive tillers, grain characteristics, and plant height. Eating quality or palatability was also considered. Other farmers mentioned the low cost of production and knowledge gained in selection techniques as reasons for adoption.

The reasons for rejection were also classified according to agronomic, morphological, gastronomic, social/cultural, and technological. Usually farmers rejected the material because of the susceptibility of the segregating lines to lodging, while others were discouraged by non-uniform maturity or because of the height and maturity of the material. Few farmers rejected the materials for poor eating quality but others were hampered by other responsibilities and said that the activities were too laborious.

It was generally learned through the farmers' evaluation that farmers discard those materials that do not fulfill their selection criteria, especially materials that are susceptible to pests and diseases. Sometimes, however, rejection can lead to success. One of the farmer respondents rejected a selection that he then gave his neighbor. The neighbor grew the variety successfully and later multiplied the seeds for other farmers.

Conclusions

The approach initiated by CONSERVE has enhanced the farmers' capacity to develop varieties from the segregating materials distributed. Farmers' direct involvement with these materials has helped to providing access to diverse genetic materials, that has led, in turn, to opportunities for them to develop what they want from the genetic materials distributed. This approach has also helped in promoting farmers' involvement in farm-based varietial-improvement activities. In general, the approach is better if farmers are involved.

Summary

1. There are two PPB approaches initiated by CONSERVE, namely, researcher-managed or on-station trials and farmer-managed trials.
2. There were 22 single crosses made between upland and lowland rice by the center, coded as CONSERVE's crosses (CC). Ten crosses survived at the first filial generation and were planted on-station for three filial generations before distribution to farmer-partners. One hundred lines were derived and distributed to 89 farmer-partners, with a minimum of five lines per partner at 5–10 grams per line.
3. All the segregating lines given to farmer-partners were grown in their own fields. Two methods of selection were practiced: bulk and pedigree.
4. Nineteen lines distributed from six single crosses (CC1, CC2, CC5, CC7, CC13, and CC20) are still maintained by the farmer-partners. CC5 and CC13 are the most common. In their fields, farmer-partners keep two to three lines, on average. Farmers who maintained many lines have a greater capacity to manage and store them, resulting in diffusion of selections.
5. Selections are continuously enhanced in farmers' fields, leading to an increase in stable lines, but as this happens, the number of lines in the farmer's fields decreases. Farmer's selection criteria and the adaptability of the segregating materials contribute to this.
6. Farmers distribute selections for reasons such as readiness of the selection for mass production and requests for materials from close relatives. Reasons for nondistribution were because of the small quantity of materials, infestation by pests and diseases, the materials were not yet uniform, they were mixed, etc.
7. Farmer-partners adapted the segregating materials distributed for resistance to pests and disease, resistance to lodging, and adaptability in the area. Some adapted length of panicle, number of productive tillers, grain characteristics, and plant height.

8. Reasons for rejecting materials were due to susceptibility of the segregating materials to lodging, non-uniformity, and maturity. Some farmers felt that the activities were laborious and conflicted with other responsibilities.

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