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.

Bibliography

CONSERVE. 1996. Community-Based Native Seeds Research Center, Inc., Annual Report. Cotabato, Philippines: Community-Based Native Seeds Research Center, Inc. *Unpublished.*

CONSERVE. 1998. *Farmers' Responses to Breeding Lines Distributed to Farmer-Partners in Arakan Valley Complex, Cotabato, Philippines.* CONSERVE Technical Report No. 5. Cotabato, Philippines: Community-Based Native Seeds Research Center, Inc.

Elings, A., 1999. *Some theory and practice of participatory plant breeding and variety selection.* (First version). Wageningen, The Netherlands: Community Biodiversity Development and Conservation Program (CBDC), Centre for Genetic Resources (CGN)/CPRO-DLO.

Sthapit, B.R., K.D. Joshi, and J.R. Witcombe. 1996. Farmers participatory high altitude rice breeding in Nepal : Providing choice and utilizing farmers' expertise. In *Using diversity: Enhancing and maintaining genetic resources on farm,* edited by L. Sperling and M. Loevinsohn. Ottawa: International Development Research Centre.

Witcombe, J.R. and A. Joshi. 1996. The impact of farmer participatory research on biodiversity of crops. In *Using diversity: Enhancing and maintaining genetic resources on farm,* edited by L. Sperling and M. Loevinsohn. Ottawa: International Development Research Centre.

Enhancing Farmers' Participation in Plant Breeding: Community Biodiversity Development and Conservation Program (CBDC), Bohol Project, Philippines

Hidelisa M. de Ramos

Abstract

The Community Biodiversity Development and Conservation Program (CBDC) is a global undertaking aimed at halting or minimizing genetic erosion and strengthening the farmers' role in on-farm conservation and development of plant genetic resources (PGR). It also aims to seek ways on how the formal and informal sectors can complement each other in on-farm conservation and development. In this paper, the project's general approach is illustrated in a case study on rice, conducted in Bohol, Philippines. The objectives of the study were to increase the genetic diversity of rice planted by farmers and to determine farmers' criteria for evaluating and selecting rice. Genetic materials were distributed to farmer-partners, evaluated by farmers, and subsequently exchanged within the community through the local exchange system. Workshops were conducted every season to identify researchable areas and to design field experiments. Community workshops were also held to analyze research results and identify new problems for the next season. Farmers decided which varieties or technology to adopt after each season, based on their observations and evaluation of the on-farm research. The study documented the results of two types of farmers' evaluation of the varieties.

Introduction

Farmers have traditionally exchanged and shared seeds among themselves. Seed sharing and exchange enable farmers to evaluate and select new crop varieties that suit their needs and preferences and adapt to specific environmental conditions in their fields (Berg 1994). Farmers are therefore able to continually produce diverse crop varieties that are specifically adapted to local needs and conditions.

However, when the Green Revolution started in the 1960s, the conservation and development of crop varieties were mainly taken over by agricultural research centers (Berg 1994). For instance, the International Rice Research Institute (IRRI) developed new varieties of rice that displaced many of the traditional varieties. Formal breeding programs not only displaced local varieties but also much of the farmers' role in crop conservation and development (Salazar n.d.).

Formal breeding programs differ from farmers' methods of developing new varieties. Breeders set breeding objectives with broad rather than specific adaptability in mind (Berg 1994). This means that the new varieties are designed to adapt to a wide range of field conditions. High yield is the top consideration for breeders, while farmers consider yield along with other characteristics deemed important, such as aroma and eating quality.

Furthermore, breeders produce new varieties in very favorable environments. Varietal trials are carried out in fields that are highly fertile and highly seeded (Atlin and Frey 1989), where optimum amounts of fertilizers are applied. The new varieties, however, perform differently in farmers' fields where conditions are more variable and management practices are different.

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This project is implemented by the Southeast Asia Regional Institute for Community Education (SEARICE), a regional NGO working on issues about access and control of plant genetic resources (PGR) and farmers' rights, and currently implementing community-based PGR projects in Southeast Asia.

Ceccarelli (1989) states that direct selection of varieties in the target environment is an efficient breeding strategy since this will produce varieties that satisfy specific farmers' needs and conditions better. This calls for a decentralized and participatory breeding approach where farmers are involved in the development and selection of new varieties. Participatory breeding will generate greater crop diversity in farmers' fields that can meet the diverse needs and conditions of farmers.

Approaches and methods in on-farm research

The Community Biodiversity Development and Conservation Program (CBDC) is a global undertaking aimed at halting or minimizing genetic erosion and strengthening the farmers' role in on-farm conservation and development of plant genetic resources (PGR). It also aims to seek ways on how the formal and informal sectors can complement each other in on-farm conservation and development.

The Southeast Asia Regional Institute for Community Education (SEARICE) is implementing the CBDC project in Bohol, Philippines. It started in 1994 and focuses on conservation and development of rice, corn, and root crops, such as cassava, sweet potato, and yam (*Dioscorea alata*). The project's general approach in conducting participatory on-farm research is shown in figure 1. The project, together with farmer-partners in the community, conduct workshops every season to identify researchable areas and to design experiments to be conducted in the field. On-farm research is evaluated at three levels: by the staff, by individual farmers, and by the farmers' group. Another community workshop is conducted at the end of each season to analyze research results and to identify new research problems for the succeeding season. Farmers decide which varieties or technology to adopt after each season, based on their observation and evaluation of the on-farm research.

The key players in the project's approach participatory plant breeding (PPB) and participatory varietal selection (PVS) are shown in figure 2. The genetic materials distributed by the project to farmer-partners come mainly from three sources: local communities; formal institutions, such as

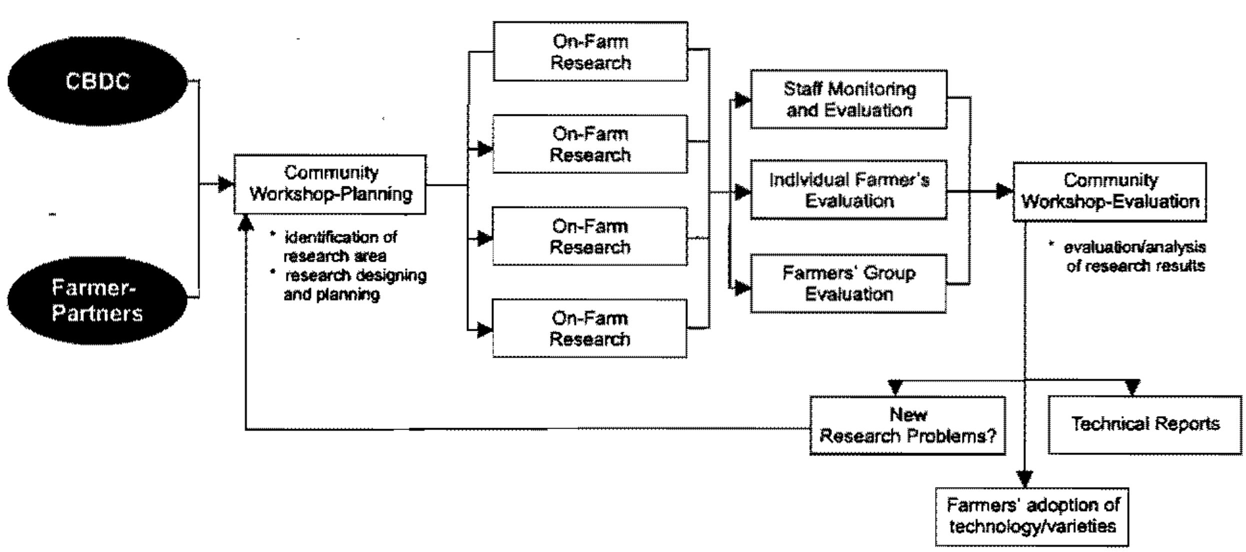

Figure 1. CBDC Bohol Project's approach in on-farm participatory research

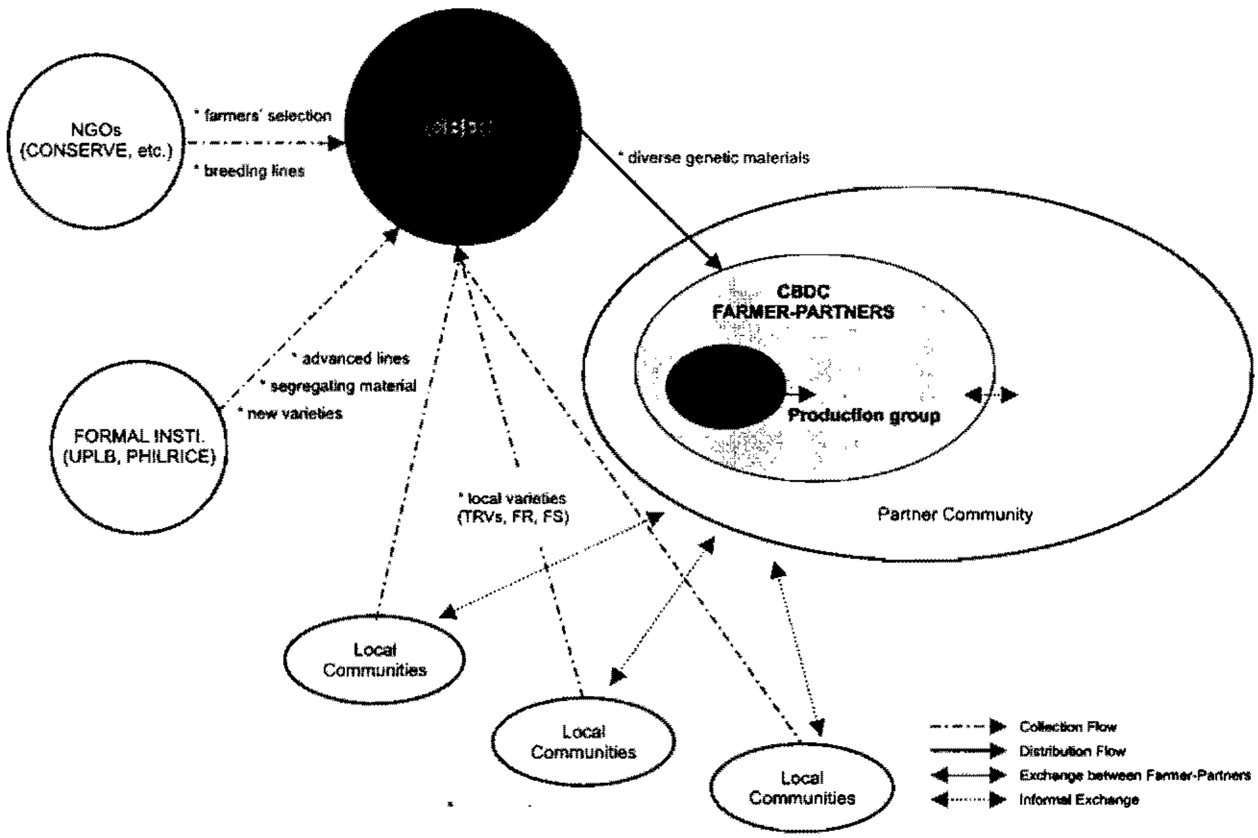

Figure 2. Key players in PPV/PVS

the University of the Philippines–Los Baños (UPLB) and the Philippine Rice Research Institute (PHILRICE); and nongovernment organizations (NGOs), like the Community-Based Native Seeds Research Center (CONSERVE). The distributed genetic materials consist of stable varieties, such as traditional varieties, farmers' selections, and formal release varieties. The project also distributes segregating lines (F1-F8) collected from NGOs and formal institutions. These genetic materials are evaluated by farmers and subsequently exchanged within the community through the local exchange system.

Methodology

The project's general approach is elaborated in a case study conducted in collaboration with the Research and Development Department of the Central Visayas State College of Agriculture, Forestry and Technology (CVSCAFT), a local institution.

Fifteen varieties of rice were distributed to 12 farmers in Zamora village in Bilar town during the second cropping season from October 1999 to March 2000 (table 1). The materials came from different sources and consisted of both white and red varieties. Boholanos are known to prefer red rice varieties. Each farmer received three varieties at 0.5 kg per variety. The farmers grew the varieties using their own management practices in combination with organic fertilization. The methods of

Table 1. **Types of Varieties Distributed to Farmer-Partners**

Set	Variety Name	Origin/Sources	Seedcoat color	No. of farmer recipients
1	MB	Farmers' selection from RC 10	Red	
	08	Local variety	White	3
	CC 13-3-4-3	NGO-bred and released to farmers at F3	White	
2	03	Local variety	White	
	RC 28	Formal release	White	4
	Los Baños	Local variety	White	
3	CFS-JR-06	Farmers' selection from Japanese variety	Red	
	MS 1-29	NGO/farmer-bred	White	3
	RC 4	Formal release	White	
4	66 Puwa	Farmers' selection from IR 66	Red	
	MS 2-AV	NGO/farmer-bred	White	4
	Japan	Local variety	White	
5	Ceres	Local variety	Red	
	MS 13	NGO/farmer-bred	White	3
	CC 13-3-4	NGO-bred and released to farmers at F3	White	

distribution and trial arrangements with farmers were based on lessons gained by the project in previous years of conducting on-farm experiments and studies.

The study documented the results of two types of farmers' evaluation of the varieties. In one evaluation, farmers who received the same set of varieties ranked the varieties in comparison with IR66, the most commonly planted variety in the village. Farmers ranked the varieties according to different parameters they themselves identified. Ranking in each parameter ranged from one to four, with four representing the highest preference by the farmers. In the other evaluation, the farmers participated in a field day to observe and evaluate all the varieties as standing crops. Farmers identified the varieties they preferred and the reasons for their preferences.

Objectives of the study

The objectives of the study were

1. to increase the genetic diversity of rice planted by farmers in Zamora village
2. to determine farmers' criteria for evaluating and selecting rice

Results and discussion

Farmers' preferences in a variety

Farmers identified at least 13 specific traits they look for in a variety (table 2). Their criteria are very comprehensive, ranging from percent germination to yield. Farmers evaluated the varieties from seedling stage until harvest. Yield is one of the major criteria, as shown by the identification of related traits such as big grains, long panicles, and high tillering ability. In addition to yield, maturity also matters to farmers since early maturation allows them to maintain at least two cropping seasons per year. From the evaluation results during the farmers' field day, farmers cited one addi-

Table 2. Sample Matrix Ranking of Varieties by Farmers Receiving Same Set

Preferred Traits	MB	08	CC 13-3-4-3	IR 66
1. High percent (%) germination	4	1	2	3
2. Healthy and strong seedlings	4	2	1	3
3. Panicles				
a. long	4	3	4	3
b. low % of unfilled spikelets	4	4	4	3
c. low shattering	3	4	4	3
d. heavy branching	3	3	4	4
4. Big, healthy spikelets	4	4	3	3
5. High tillering	3	4	4	4
6. Early maturing	3	3	4	4
7. Strong culm	4	4	4	3
8. Resistant to pests	4	4	4	3
9. Medium height	4	4	3	3
10. High yield	4	3	4	3
Average ranking	3.7	3.3	3.5	3.2

Note: 4 = highly preferred; 1 = least preferred.

tional criterion not identified in the matrix ranking, namely, tolerance to water logging (table 3). This criterion is significant because certain areas of the village are waterlogged. This is a good example of selection by farmers for a very specific field condition. On the other hand, formal breeding programs would be unable to capture such selection because varieties released from the formal sector are generally bred for broad adaptability.

Culture, as it relates to diversity conservation and development, is also not addressed by the formal sector. For example, Bohol farmers maintain a diversity of red rice varieties, either traditional varieties or farmer-developed varieties (table 1). Boholanos are known to prefer red rice because it is generally equated with better eating quality. Farmers also claim that they can work longer in the field after eating red rice (CBDC 1996). In fact, local red rice is priced higher in the market than local white rice. Red rice is also preferred by a number of ethnic groups in Luzon and Mindanao (Borromeo, personal communication). However, the Philippine Seed Board has not released any red rice variety since it was established in the 1950s (Borromeo, personal communication).

Increased genetic diversity

Seven of the 15 varieties distributed were replanted by the farmers who participated in the trial. Previous to the trial, farmers in Zamora were planting only three varieties (CBDC and CVSCAFT 1999). This represents a significant increase in the number of varieties planted in the community after one season.

The selected varieties have diverse qualities. Two are farmers' selections, three came from an NGO-farmer breeding program, one from the formal sector, and one is a locally adapted variety (table 4). The replanted varieties either ranked higher (in sets 1, 3, and 5) or slightly lower (in sets 2 and 4) in comparison to IR 66, the check variety.

Table 3. Result of Collective Farmers' Field Evaluation of Standing Crop

Variety name	Preferred traits	No. of farmers who preferred the variety
MS 13	Uniform hull color and absence of spots Healthy, big and many spikelets White grains Long panicle Strong culm, lodging resistant Tolerant to water logging	10
CFS-JR-06	Good panicle Healthy and big spikelets Red grains Strong culm, lodging resistant Tall	10
MS 2 – AV	Healthy and long panicles Early maturing Tolerant to leaf folder and rice bug Lodging resistant Resistant to diseases Uniform height Short height	7
MS 1-29	Healthy spikelets Many but small spikelets Uniform hull color, absence of spots Long panicle Tolerant to diseases	7
MB	Big panicles and grains Uniform hull color, absence of spots High tillering Tolerant to water logging Lodging resistant Big culm Resistant to leaf folder Tall	4
Los Baños	Many spikelets and panicles Heavy branching Tall Relatively late maturing compared to other varieties	3
66 Puwa		1

Varieties that scored high in both the field day evaluation (table 3) and the matrix ranking (table 4) had a higher rate of adoption than the other varieties with lower scores. This implies that if farmers' criteria are be taken into consideration and varietal performance is evaluated in farmers' fields using farmers' practices, then varietal adoption rates could increase considerably. This could shorten the time for a material to be evaluated and adopted by farmers. Release of a new variety in

Table 4. Summary of Matrix Ranking by Farmers According to Set

Set	Variety name	Average ranking	No. of farmers from same set replanting the variety	No. of farmers from other sets replanting the variety
1	**MB**	3.7	1	3
	08	3.3	0	0
	CC 13-3-4-3	3.5	0	0
	IR 66	3.2	local check variety	—
2	03	2.8	0	0
	RC 28	2.8	1	0
	Los Baños	2.8	0	1
	IR 66	3.4	local check variety	—
3	**CFS-JR-06**	3.2	1	0
	MS 1-29	3.7	1	1
	RC 4	2.7	0	0
	IR 66	2.8	local check variety	—
4	66 Puwa	3.7	0	0
	MS 2-AV	3.5	0	1
	Japan	3.2	0	0
	IR 66	4.0	local check variety	—
5	Ceres	3.2	0	0
	MS 13	3.7	1	4
	CC 13-3-4	only few seeds germinated	NA	NA
	IR 66	3.2	Local check variety	—
Total no. of farmers who replanted the distributed varieties			5	10

Note: Varieties in bold letters were those replanted by farmer recipients: seven varieties replanted out of 15 varieties distributed (47%).

the Philippines normally takes about eight to 10 years, starting from the selection of parent materials (Borromeo, personal communication). Moreover, with farmers' participation in varietal trials, on-farm genetic diversity can be increased almost immediately. With their experience in doing PVS, farmers can later be trained to do PPB through handling of segregating generations or actual crossing of varieties. Through PPB, farmers can produce even more specifically adapted varieties that will contribute to overall local crop genetic diversity.

Conclusions and recommendations

1. Providing diverse materials that suit farmers' criteria and conditions can enhance genetic diversity in farmers' fields.
2. PVS is a good entry point towards implementing PPB, where farmers play the central role in the development of new varieties.
3. PVS/PPB approaches should continually evolve according to local farmers' needs and conditions.
4. Feedback mechanisms between breeders and farmers should be established to ensure that appropriate materials are disseminated to farmers.

5. In providing germplasm to farmers, one should consider not only farmers' criteria but also their capacity, skills, and resources in order to determine their levels of participation.

References

Atlin, G.N. and J.K. Frey. 1989. Breeding crop varieties for low-input agriculture. *American Journal of Alternative Agriculture* 4(2):53–58. (From *Local crop development: An annotated bibliography,* by W.M. van der Heide and R. Tripp [Eds] and W.S. de Boef. 1996. Rome: International Plant Genetic Resources Institute.)

Berg, T. 1994. In *Growing diversity in farmers' fields. Proceedings of a Regional Seminar for Nordic Development Cooperation Agencies, Lidingö, Sweden, 26-28 September 1993,* edited by Peter Einarsson. Sweden: Naturskyddsföreningen.

CBDC. 1996. Development of farmers selections in Bohol. Philippines: Community Biodiversity Development and Conservation, Bohol Project. *Unpublished document.*

CBDC and CVSCAFT. 1999. Participatory rural appraisal (PRA) in Zamora Village, Bilar, Bohol. Philippines: Community Biodiversity Development and Conservation, Bohol Project, and Central Visayas State College of Agriculture, Forestry and Technology. *Unpublished document.*

Ceccarelli, S. 1989. Wide adaptation: how wide? *Euphytica* 40:197–205. (From *Local crop development: An annotated bibliography,* by W.M. van der Heide and R. Tripp [Eds] and W.S. de Boef. 1996. Rome: International Plant Genetic Resources Institute.)

Salazar, R. *n.d. Erosion of genetic resources—The reasons why.* Oslo: Forlagstrykkeri.

Developing Local Organizational Capacity for Participatory Seed Management: Experiences from the Eastern Himalayas

Barun Gurung and Prem Gurung

Abstract

This paper describes the objectives and goals of a participatory seed-management initiative that is presently being conducted in the Sankhuwasabha District of eastern Nepal as part of the Gender, Ethnicity and Agrobiodiversity Management" project. The long-term goal of the project is to develop local capacities to effectively manage existing genetic resources through the development of skills that enhance crop improvement. The research is based on an interactive methodology that emphasizes devolution through varying levels of farmer participation in the research process. Both men and women farmers are included in the project, with the requirement that they be involved in farming as a full-time subsistence activity. Specific problems faced by farmers in the area, such as out-migration of men looking for wage-work and a yearly period of food scarcity lasting as long as six months, are highlighted.

Introduction

Situated in the remote mountain regions of the eastern Himalayas, the "Gender, Ethnicity and Agrobiodiversity Management" project proposes to develop the research capabilities of selected local people in four sites: eastern Nepal, Sikkim, Bhutan, and Nagaland. The immediate objective of the project is to develop a local capacity to conduct research to better understand the causal links between ethnicity and gender and how these components affect and influence decisions related to management of agro biodiversity. However, the broader, long-term goal of the project is to develop local capacities to effectively manage existing genetic resources through the development of skills that enhance crop improvement. Within this latter context, a participatory seed management initiative is currently being implemented in one site (Nepal) with the objective of broadening the experiences gained from this process to other sites in the region.

The participatory seed management project is being conducted in three adjoining "village development committees" (VDCs), which are village-level administrative units of the Sankhuwasabha District of eastern Nepal. In broader terms, the project aims to enhance and develop new technologies for seed management in marginal mountain communities that lack access to new seed sources. The following hypotheses articulate the more specific objectives of the research project:

- The development and enhancement of seed-management technologies will occur most effectively through a process of interactive learning between indigenous and formal systems of agricultural development.
- Access to improved technologies can be most effectively sustained through community action. This necessitates the enhancement of existing technical skills for seed improvement, along with the organizational capacity of community-based organizations to ensure community access to these improved technologies.

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- Finally, the success of community action to manage development processes will depend fundamentally on the community's ability to control the processes of knowledge production, design, and implementation of actions.

The practical implications of this methodology can be summarized as the need to search for ways in which participatory research can be part of an ongoing process. Inherent to the process is the acknowledgment that power relations between researchers and the *researched* is problematic and that there is a need to develop a process of critical reflection that situates the production of knowledge and action within a specific context of a negotiated process, emphasizing community action (see also Koning and Martin 1996).

The setting

The major ethnic group inhabiting the research sites is an ethnically distinct but heterogeneous group of people known as the Rai. Together with a related group of people known as the Limbu, the Rai refer to themselves as *Kirats*, a term employed as much to unify all the various "tribes" and clans as it is a political statement employed to distinguish them from the dominant Hindu majority. Having until the recent past practiced a distinct system of communal land tenure known as *kipat*, the *Kirats* constitute one of the oldest ethnic components of the region. Yet in decades following their integration into Nepal after the "unification" in the mid-18th century, the *Kirats* have been confronted with numerous challenges to their traditional way of life. Dominant lowland influences have resulted in changes in sociocultural practices associated with traditional land-management practices and given rise to the ubiquitous rain-fed and irrigated terraces (*bari/khèt*) that suit wetland paddy and other lowland crops. In the process, engineered landscapes have replaced extensive areas of forest cover where traditional swidden (slash-and-burn clearing) was practiced.

Compounding the asymmetry of historically derived center/periphery relations are constraints imposed by the harsh mountain environment. Typical of the eastern Himalayan region (see Shrestha 1989), human settlements are situated in elevations ranging from 500–2000 meters, where land-distribution patterns combine with steep slopes and shallow soil depths to severely constrain agricultural activities. The land-distribution figures of Tamku VDC (table 1), where the research sites are located, demonstrate the environmental constraints that the inhabitants are confronted with. From the total available land, only 10.6% is suitable for agriculture, and from this total arable area, 54% has slopes of 40 degrees and soil depths of not more than 20 cm (Goldsmith, 1982).

Asymmetrical center/periphery relations embedded in historical processes have contributed significantly to the present deteriorating state of local institutional capacities to negotiate and orient

Table 1. Land Classification of Tamku VDC

Agricultural lands	10.6%
Grazing lands	14.6%
Shrubs	7.8%
Deciduous forests	35.6%
Subtropical forests	10.8%
Rock ice	20.6%

Source: Khanal (1992).

development services to their benefit, especially to counter the period of food deficit that typically lasts for four to five months a year. Unable to support their subsistence needs through crop yields alone, many households have male family members migrating in increasing numbers to urban centers in search of employment, leaving women and children to manage and care for the farm. An additional outcome of prolonged periods of food deficit is the inability of households to save seeds from consumption in times of stress. This, along with deteriorating local knowledge about seed-management practices and the absence of organizational capacities to access external sources of improved seed technologies has profound implications for the long-term subsistence of households in the region. It also significantly determines the nature and type of research methodology to be adopted for particular sites.

The research process: An interactive methodology

The objectives of the project evolved in several stages of a diagnostic process that sought devolution by emphasizing community participation in increasing stages during the research process. In order to facilitate community control and ownership, the methodology was developed from the principles of problem posing, dialogue, and reflection based on the Freirean (1972, 1973, 1978) notion that community involvement in the development process can be generated through developing a critical awareness of the causes of problems. The diagnostic process involved the following steps:

1. A survey was conducted to establish the need for a participatory seed-management initiative, based on the following research themes:
   - assessing the capacity of local community-based organizations
   - determining existing patterns of food sufficiency
   - identifying appropriate crop(s) for enhancing improved seed-management strategies
   - determining factors for farmer participation through gender-differentiated varietal assessment of identified crop(s)
   - determining the source of germplasm, either in existing local varieties or through external means
2. Analysis was done through a critical examination of baseline data to determine how the problem of food deficit is contextualized by community members. That is, are problems of food deficit linked to just economic issues of subsistence or are they affected by social dynamics of decision-making? And to what extent are these embedded in the values and cultural constructs of the community? Conceptualized problems in this way necessitates posing the following questions:
   - Do the issues deal mainly with problems of subsistence, decision-making, or values?
   - Where will action most likely come from?
   - What will most effectively motivate people?
3. Problem-posing material was prepared through the development of codes, which are representations of existing problems in the form of stories, dramatized enactments, pictures, results of participatory rural appraisal (PRA), etc. Fundamental to the preparation of codes is the need to ensure that they present a scene showing a concrete experience of the problem, which is familiar to the participants.

4. Discussion was directed through an interactive workshop whereby community members participated in defining the problem of food deficit and searching for solutions. The primary objective of this process was to develop a critical awareness of the problem of food deficit through the search for potential solutions. Additionally, the process also creates a context for the community to provide comments on the research results and to define the direction of the process. The process begins with a description of codes, followed by a first analysis, which is then related to real life and followed by a deeper analysis, ending in self-reliant action planning.

Farmer participation in the research process

The degree and type of farmer participation depends principally on the objectives for participation, as well as the context, as determined by the particular stage of the process. Thus, the diagnostic phase, consisting of the survey, analysis, code preparation, and discussion, involved varying levels of farmer participation. In the survey, three members of the community and two project members comprised the research team. Clan elders and farmers selected on the basis their knowledge related to seed management were consulted about the relevance of the project. In addition, the executive body of community-based organizations were consulted to establish interest in developing a working partnership to conduct the project.

The survey was conducted to establish (1) a crop inventory, (2) to determine the needs and priorities of different groups, based on gender and wealth considerations, and (3) to identify crop for improving seed-management technology. At the same time, farmers were selected for consultation on the basis of their knowledge, financial status, and gender. The subsequent analysis of the data to develop appropriate codes was conducted in collaboration with local researchers and farmers.

The main objective of the workshop that followed was to present the codes to the larger community to understand the root causes and potential solutions to problems of food deficit in the region. The selection of community members was based on the criteria developed in prior consultation with local members of the research team. During this stage of the interface, farmers were more extensively involved in the direction of the discussion of research findings, as well as decision making to determine the level of participation in setting the agenda for future action.

Table 2. Types of Farmer Participation

	A	B	C	D
Survey		x		
Analysis		x		
Code preparation			x	
Discussion				x

Source: Adapted from Biggs (1989).
Note: A = contractual; B = consultative; C = collaborative; D = collegiate.

User differentiation

The selection of participants was determined by the following criteria:

- demonstrated instances of innovation in seed management and knowledge of causal links between problems of food scarcity and gaps in existing seed-management practices
- gender-differentiated knowledge and gendered experiences
- farming for subsistence as a full-time subsistence activity

Innovation

The participants selected for participation in the research process demonstrated varying degrees of innovation in crop management. The type of innovations ranged from pre-harvest selection practices to post-harvest storage practices. In some instances, the practices were learned from experience gained externally, as in the case of selecting for desired traits of rice during the pre-harvest period or experimenting with new strategies as in the case of post-harvest storage of maize mixed with millet to reduce pest attack.

While post-harvest selection practices were common for crops such as maize and millet, pre-harvest selection was practiced only on paddy. One farmer, selecting specifically for larger panicles, denser grain quality, and tall height in a landrace (*punche dhan*) was successful in producing a "variety" subsequently named after him (*changkhu dhan*, literally "Changkhu's rice"). This "variety" is currently widely adopted by other farmers in the community, with Changkhu presently selecting for early maturation to coincide with the planting of winter wheat.

In seed-storage technology, some innovative farmers experiment with the leaves of a locally available plant (*bojo*) to ward off pest attacks on maize seeds. Dried leaves of this plant are placed in the bottom of the seed container and alternately in several layers approximately every three to four inches, then the container is sealed by additional leaves at the top. Sealed in September or early October, the relatively airtight spaces and the toxic nature of leaves sufficiently wards off pest attacks.

In another example, one woman farmer, noticing that millet grains were free of pests that attacked maize seeds, began mixing a handful of millet grains in the container where maize seeds were stored. This relatively simple practice was based on her observation that millet seeds were free from the pests that attacked the maize seeds that were stored in close proximity to the millet.

Knowledge and gendered experiences

In varietal assessments of maize, conducted separately between women and men farmers during the initial research phase, women and men listed different categories of preferences based on their roles and experiences. Men listed four varieties of maize, mostly modern varieties that had been introduced into the community in the last several years. Women, on the other hand, listed eight varieties, mostly landraces whose use had been discontinued in the project site but existed in the women's natal villages. Women cited fodder quality, ease in grinding, and taste as the primary criteria for their preference of landraces. Men, on the other hand, cited high yields, early maturation, resistance to drought conditions, and market prices as important in their preference for modern varieties. An additional ranking of maize varieties among farmers revealed differential knowledge and preference priorities between women and men (table 3).

Farming for subsistence

That participating farmers be involved in farming as a full-time subsistence activity was an important criteria for selection for two reasons: the first was prompted by the project need for the uninterrupted involvement of participants for two production seasons (for most farmers in the area,

Table 3. Varietal Knowledge and Preference Ranking of Maize for Men and Women

Women	Men
1. bhote' paheli	1. manakamana-1 (MV)
2. paheli	2. dhude' seti
3. dudhe' seti	3. paheli
4. bhote' seti	
5. tamlunge' seti	
6. arun-2 (MV)	
7. manakamana-1 (MV)	
8. chepti seti	

food-scarcity periods necessitated involvement in off-farm activities for supplementing household incomes); the second was because those farmers who were involved in farming as a "full-time" activity showed a greater inclination to be relatively self-sufficient in food production, even during the scarcity period. Of the nine farmer participants in Tamku VDC who were included in the "innovative" category, all claimed sufficient food security during the year and could be counted upon by other community members for food loans during periods of food deficit.

Out-migration of men to urban centers in search of employment is one of the primary strategies employed to counter food deficits. In the past, it was common for men and women to become involved in reciprocal arrangements within the community during times of food shortage. Usually this involved providing labor for wealthier farmers in return for food provisions during times of scarcity. Increasingly, however, the present trend is for the majority of young men to migrate to urban centers to work as porters for trekking companies, perform menial jobs in restaurants and hotels, or migrate to the Middle East (*arab*) through the numerous employment agencies that have sprung up in Nepalese townships.

In addition to out-migration, people also forage for a variety of forest foods (*kandamul*), although a degree of social stigma surrounds foraging activities, principally through the perceived notion that it is part of the "primitive" past.

At the household level, food-preparation strategies also play an important role in "making it last longer." Grains are boiled with excess water, creating a porridge-like consistency to increase the quantity. "Visitors and guests" during the time of scarcity are actively discouraged from visiting, though some women participants cited visiting relatives (preferably the natal home, for married women) as an option to combat food shortages.

A seasonal calendar for food production reveals a period of severe food scarcity between the months beginning in late February and lasting till early July. The relationship between food production and out-migration, especially of males to urban centers in search of employment, is directly proportional to the increasing number of female-headed households as well as the additional, "gendered" burden of farming responsibilities that this trend implies. Moreover, there was a strong relationship between decreasing food production and poor access to seed sources and deteriorating seed-saving practices. Research suggested that the deterioration of seed saving was not necessarily related to loss of knowledge but was, rather, determined to a large extent by food scarcity and the additional burden of farm households to do "other things." Increasing trends in food scarcity over the last few generations have resulted in people consuming instead of saving seed material.

Though there were many reasons for food scarcity, research demonstrated a causal relationship between decreased crop yields and the inability to manage seed, in terms of both maintaining seed purity (*saadha biyu*) and poor seed storage practices. Moreover, access to the Agriculture Input Sector (AIC), a public-sector undertaking responsible for seed supplies was difficult, since it is situated in district headquarters a day's walk from the village and using it often proves to be a difficult bureaucratic process beyond the reach of individual farmers. The consequences of low yields, the inability to maintain seed purity, and lack of access to reliable sources of new germplasm all contribute to food scarcity in Tamku.

Lessons learned: Reconceptualizing participation and knowledge

In order to address the objective of developing improved seed technologies in marginal mountain environments while emphasizing community control of the management of the process, it becomes important to conceptualize farmer participation in the research process as an instrument of empowerment. One principle way forward in this direction is to situate farmer participation in the context of local knowledge. In doing so, however, it becomes important to view knowledge, or indigenous technical knowledge, beyond common representations of its being produced as a rational response to environmental contingencies (e.g., Mathias-Mundy et al. 1991; Howes and Chambers 1980; Brokensha, Warren, and Werner 1980). Instead, it becomes important to situate indigenous technical knowledge within cultural categories of meaning, which can then become an empowering base for participation in the interface with more powerful external categories of knowledge.

The workshop discussions revealed how empirical experiences cannot be separated from cultural experience, especially in the way Rai farmers talk about food scarcity and place the phenomenon in a mythic context. Local discourse of food scarcity finds expression both in the dominant Nepali language as well as the various dialects of the Rai group. The words to describe food scarcity range from *anikal* (food shortage), *bhokmari* (to kill hunger), *mahamari* (the great killer), and *sisawa* (famine) in the Kulung dialect of the Rai. It also finds expression through simple expressions such as "*khana ko abab hunu*" (to be short of edibles), "*dhayrai/chitto bhok lagnu*" (to experience hunger pangs sooner and more frequently than normal), "*chasum na hunu*" (to lack prosperity), as well as more abstract expressions, such as in this lament in the Kulung dialect "*Etenay sisawa udanai lay tay ho wumche*" (dear friends and brothers, . . .how do we survive the *sisawa* [food shortage] this year?) or the more common instructional verse admonishing people to save seeds to combat food shortages "*Almal ma jiyu bachhaunu, Anikal ma biyu bachhaunu*" (save oneself in times of confusion, [but] save seeds in times of [food] shortage) or "*Chha geda sabai mero Chhaina geda sabai tendo*" (having seeds, all is mine, [not] having seeds, all is not mine [i.e., lost]).

In the indigenous schema, food scarcity is a condition of cultural "disorder" that has its genesis in the curse that one warring ancestor castes upon another for perceived treachery. In cultural terms, the condition becomes inevitable and requires annual propitiation of the ancestor through ritual appeasement. The myth, consisting of ancestral deeds that include the settling of present territories, serves as a metaphor for the sacred relationship that exists between the Rai and the delimited territory they occupy. Traditional Kirati notions of ethnicity cannot be separated from this relationship and are symbolized by an ancestor stone that is situated in every village and propitiated in annual agricultural ceremonies (*ca:ri*).

What such a view of knowledge implies is that by granting legitimacy to cultural epistemologies, indigenous explanations for empirical categories are not subjugated by rationalist scientific explanations and thereby become an empowering element for farmer participation. Within such a context, the transfer of technical skills to enhance seed technology neither diminishes nor disempowers indigenous systems of meaning.

References

Biggs, S.D. 1989. *A multiple source of innovation model of agricultural research and technology promotion.* Agricultural Administration (Research and Extension) Network, Paper No. 6. London: ODI.

Brokensha, D., D.M. Warren, and O. Werner (Eds). 1980. *Indigenous knowledge systems and development.* Lanham, Maryland: University Press of America

Freire, P. 1972. *Pedagogy of the oppressed.* New York: Seabury.

Freire, P. 1973. *Education for critical consciousness.* New York: Seabury.

Freire, P. 1978. *Pedagogy in process.* New York: Seabury.

Goldsmith, P.F. 1982. *The land and soil resources of the KHARDEP area, Koshi Hill Area Rural Development Program.* Report no. 16. Kathmandu: Koshi Hill Area Rural Development Program.

Howes, M. and R. Chambers. 1980. Indigenous technical knowledge: Analysis, implications and issues. In *Indigenous Knowledge Systems and Development,* edited by D. Brokensha, D.M. Warren, and O. Werner. Lanham, Maryland: University Press of America

Khanal, N.R. 1992. *Study of geo-hydrology, landuse and population in the Makalu Barun Conservation Project area.* MBCP Working Paper Series 14. Kathmandu: Woodlands Mountain Institute.

Koning, K. de and M. Martin. (Eds). 1996. *Participatory research in health: Issues and experiences.* New Delhi: Vistaar Publications.

Mathias-Mundy, E., O. Muchena, G. McKierman, and P. Mundy. 1991. *Indigenous technical knowledge of private tree management.* Ames, Iowa: Iowa State University Press.

Shrestha, T.B. 1989. *Development ecology of the Arun River Basin.* Kathmandu: International Centre for Integrated Mountain Development.