

Seeds that give

PARTICIPATORY PLANT BREEDING

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Discovering Diversity in the Hills of Nepal

Farmers and researchers work together to improve rice and maize

The local cereal varieties found in the upland regions of Nepal show great promise for improving the food supply, but have long been ignored by the formal research system. What if farmers could learn from researchers about plant breeding? And what if the researchers left their laboratories to work alongside the farmers and learn from their indigenous knowledge to develop new varieties? That is exactly what is happening in Nepal thanks to the pioneering work of a local NGO that is gaining international recognition.



IDRC: D. Buckles

In LI-BIRD's programs, women play key roles in seed selection and in assessing and disseminating preferred varieties of maize and rice.

Biodiversity sometimes flourishes in unlikely places. Nepal, in the shadow of the world's highest mountains, is a good example. For all its rugged topography, this remote Asian country on India's northwest frontier is home to fully two percent of the world's flowering plants. Here also can be found many unique varieties of maize and rice, the two staple cereal crops of the rural people who farm in the foothills of the Himalayas.

To say that farming here can be difficult is an understatement. The terrain is rugged — some regions are so remote that they are accessible by road only at certain times of the year. The weather is unpredictable, rainfall unreliable. Because the land is so mountainous there is relatively little arable land, and what there is continues to be divided into ever-smaller plots in response to the demands of a growing population. The soils are generally poor, and decreasing in both fertility and productivity. In the upland areas, the land is marginal at best, and subsistence farmers grow a range of crops in very small plots simply to survive.

It is a bleak picture. Yet there is hope here, and progress. Hope based on the richness of the land's biodiversity, and progress thanks to a group of pioneering plant breeders who have begun to work with the farmers, demonstrating how to take advantage of that richness to grow more and better food for themselves and their families.

Improving rural livelihoods

Local Initiatives for Biodiversity, Research and Development — better known as LI-BIRD — works to support sustainable management of renewable natural resources and to improve the livelihoods of rural people in Nepal. An NGO established in 1995, LI-BIRD contributes to

conservation and utilization of biodiversity for sustainable development through its participatory research and development initiatives.

Many of the staff at LI-BIRD are pioneers of participatory plant breeding (PPB), which aims to empower farmers to play an active role in developing and distributing new varieties of staple crops. In PPB, most of the research is carried out on the farm instead of in a research station, and the researchers work alongside the farmers to select varieties that meet their needs.

“There were comments from people at the National Research System some years back that LI-BIRD was creating propaganda for participatory research in the country,” jokes Sanjaya Gyawali, a project leader with LI-BIRD. “But we have been able to demonstrate that PPB is an important approach to develop farmers’ preferred varieties, and that it is efficient in terms of both time and cost.”

Nepal is rich in the diversity of both cultivated and wild relatives of rice, and is home to as many as 2 000 different landraces. Farmers in Nepal grow different rice varieties for different purposes. These include home use of course, but also for festivals, selling at market, to serve to guests, and even for medicinal use. Many of the projects undertaken by LI-BIRD to improve rice production through PPB are supported by international agencies and governments, including Canada’s International Development Research Centre (IDRC). In addition, LI-BIRD has created partnerships with other NGOs and has gained recognition from Nepal’s National Agricultural Research Council for its PPB work.

Pioneering researchers

As far back as 1985, current LI-BIRD staff (then employed by the Lumle Agricultural Research Centre) pioneered PPB work through decentralized testing of cold-tolerant rice in the high-altitude mountain village of Chhomrong. Several other participatory rice and maize breeding projects followed, carried out in both favourable or higher productivity areas and unfavourable or lower productivity areas. The projects had a mix of goals including productivity increase, biodiversity enhancement, strengthening farmers’ breeding skills, and policy changes, as well as specific breeding goals.

Researchers in Chhomrong found that even with no formal dissemination system, crop varieties can spread over long distances through personal contacts and networks. However, this informal system of dissemination is slow — typically it is four years before farmers exchange or sell new seeds outside their own village. This highlights the need to speed up the dissemination process in the interest of the whole community.

Another project studied upland rice, locally known as *ghaiya*, which is grown under rainfed conditions on flat land, terraces or hill slopes of newly cleared forests. This crop is mainly grown by poor farmers on unirrigated ancient alluvial river fans called *tars*. *Ghaiya* has considerable

importance in the farming system and farmers prefer it to maize both for its food value and its straw for animal feed.

The study found that *ghaiya*-growing farmers possess a wealth of knowledge in managing their soils to maximize the crop yield. Farmers also demonstrated that mixed cropping *ghaiya* with maize results in a higher combined yield. Some farmers, however, prefer to plant maize after *ghaiya*, saying this helps to maintain soil fertility. Diversity still exists for indigenous *ghaiya* varieties, although the number of varieties farmers maintain varies according to the size of their land holding — the larger the holding, the more varieties. In a majority of the areas studied, farmers maintain at least two varieties that mature at different times.

Committees increase understanding

One of the keys to the success of PPB in Nepal has been the creation of Farmer Research Committees (FRCs), says Gyawali. Committee members visit government research stations to learn about the process of varietal development. They then pass on their knowledge to other farmers.

“Before their exposure to research they had never understood that there could be crosses, segregation of traits, and long evaluation processes during varietal development,” Gyawali says. “Now their understanding has been increased, but their perception is still that the farmers’ research agenda gets the lowest priority in the formal system, and that the scientists have their own priorities.

“They say, for example, that lodging and drought tolerance in local maize landraces never got priority in the national maize research program until the scientists became involved in farmer-led participatory maize breeding.

“Within five years we are able to breed farmers’ preferred cultivars,” Gyawali adds. “In rice, there are several promising lines coming up, and we are planning to release some of the best materials in the next five years. Similarly in maize, *Resunga composite* is one of the excellent genotypes developed by farmers in recent years. PPB can develop good cultivars in a relatively short time period at minimal cost.”

The maize variety *Resunga composite* was developed and named by farmers in a maize-improvement project carried out by LI-BIRD in the remote western hills region of Nepal. The geophysical environment here is different from other maize-growing environments in the country, and farmers had little access to improved plant genetic material and information. So LI-BIRD, this time in collaboration with the national research system, set out to improve maize productivity by showing farmers how to use their knowledge and resources to increase maize productivity by improving the performance of local landraces.

The program was farmer-led, with both the farmers and the researchers learning variety improvement by working together. The objective was to build the farmers' skills in plant breeding and seed selection, and once again the FRCs played a key role in the success of the project, which was funded by IDRC through a grant to the Program for Participatory Research and Gender Analysis (PRGA) of the Consultative Group for International Agricultural Research (CGIAR).

Key roles for women

"The FRCs have become able to take the lead in all the project activities independently, and they have established linkages and coordination with other local organizations," reports Gyawali. These organizations include seed producer groups, a seed management and marketing committee, and a women's subcommittee."

The latter was another important element. LI-BIRD has consistently paid special attention to the roles of women in its programs. Women make up almost 40 percent of the membership of the FRCs in the maize-improvement project for example. "In PPB, we have found that women's knowledge, particularly in postharvest traits, is very important," says Gyawali. Women also play key roles in seed selection, dissemination of preferred varieties, and in assessing the eating quality of different varieties of rice and maize.

"The involvement of women in our project activities is an integral part," Gyawali adds. "Women are involved in the participatory technology generation right from need assessment to final product evaluation and dissemination. The men farmers are very supportive of the women's involvement and encourage them to participate."

Insights and achievements

Over the years, LI-BIRD's pioneering work in Nepal's various agroecological regions has resulted in important insights as well as achievements. First among these is that the direct participation of farmers often leads to new breeding objectives. It has also demonstrated clearly that involving women and men farmers in the planning process results in breeding objectives that are much closer to farmers' perceived needs and interests.

Biodiversity seed fairs, kits, and community registers are useful tools to encourage farmers' involvement. "We have developed participatory tools for PPB and agrobiodiversity management in various crops," explains Gyawali. "These tools have been recognized and followed by various formal research systems, and not just in Nepal. They are becoming popular in many African countries as well.

"Farmers and the farming community as a whole have a great deal of indigenous knowledge of biodiversity management," says Gyawali. "We need to better understand and capitalize on this knowledge, and consolidate it into



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Biodiversity can flourish in unlikely places and, through PPB, can be tapped to produce more and better food.

the formal research system." For example, in Nepal the National Agriculture Research Council and the National Rice Research Program now both endorse PPB techniques. Also, LI-BIRD is participating in a PPB program for wheat currently being implemented by the Asian regional office of the International Maize and Wheat Improvement Center (CIMMYT).

Challenging future

For all its success, LI-BIRD still faces some major challenges in the future. One of these is to find ways to protect farmers' rights to the farmer-bred varieties during the release process. Then there is the release process itself. The varietal release system in Nepal is slow, requiring two years of screening for diseases in the nursery and a further two years of multilocation testing. Simultaneous screening and testing would cut the time to release in half. And time is a critical factor, as Gyawali explains.

"For an NGO, the continuity of varietal development is a challenge because it needs long-term financial commitment. For example, we bred *Resunga composite* in four years. The project was a success, but the PRGA support has now ended, and LI-BIRD and the FRCs now face a problem of lack of funding. Similarly in PPB rice production, we need to explore new funding sources by 2005. Long-term financial commitment is the major constraint on varietal development projects."

This case study is one of a series of six on participatory plant breeding written by Ronnie Vernooy, senior program specialist at IDRC, and science writer Bob Stanley.

Why diversity matters

Modern agriculture rests on a precariously narrow base. Genetic erosion could threaten the future food supply if anything should happen to reduce the effectiveness of the high-yielding varieties that much of the world has come to rely on. Crop breeders tend to rely increasingly on a narrow set of improved varieties, making it more and more difficult to broaden the diversity base. In the past, researchers have been able to depend on farmers to retain sufficient crop diversity to provide the "new" genetic material they need, but homogeneous modern agriculture threatens that source of genetic diversity, and thus threatens both local and global food security.

The high-yielding varieties developed by the formal research system are often high-maintenance varieties. They may require regular applications of fertilizer and other inputs. These constraints effectively put them beyond the reach of millions of small-scale farmers who cannot afford the high-priced seed and fertilizer. Many of these farmers reject the plant breeders' offerings because they simply are not designed for marginal farmland — they meet neither the farmer's needs nor local preferences.

Rethinking conventional breeding strategies means above all recognizing the key roles of farmers and their knowledge and social organization in the management and maintenance of agrobiodiversity. Recognizing these roles is the basis of the approach known as PPB. Simply stated, the aim of PPB is to ensure that the research undertaken is relevant to the farmers' needs.

Sustainable Use of Biodiversity

IDRC's Sustainable Use of Biodiversity program initiative looks at ways to conserve biodiversity by promoting its sustainable use by indigenous and local communities. It emphasizes research approaches that are sensitive to gender issues and inclusive of indigenous knowledge and culture, and seeks ways to inform policies with these approaches.

For more information

LI-BIRD's Web address is www.libird.org.

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References

For an overview of the issues raised in this article, read *Seeds that Give: Participatory Plant Breeding*, by Ronnie Verwooy (IDRC 2003) and browse www.idrc.ca/seeds.

For more information on agricultural biodiversity in general visit the Web site of the International Plant Genetic Resources Institute, www.ipgri.cgiar.org, or see *The State of the World's Plant Genetic Resources for Food and Agriculture* (FAO 1998).



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