Seeds that give

PARTICIPATORY PLANT BREEDING

Rethinking Strategies for Agricultural Research

Global program helps farmers conserve the genetic diversity of crops

Resource-poor farmers, a large number of whom are women, produce as much as 20 percent of the world's food, and they may well hold the key to increasing biological and cultural diversity. For in their struggle simply to survive — and produce — on poor soils with limited resources, small farmers continue to allow plant varieties to evolve. The result is that these farmers have become custodians of diversity, maintaining the genetic variation that is essential to the continued evolution and adaptation of plant genotypes.

Potatoes have been a staple food crop in the Andean region of South America for longer than anyone can remember. This is, after all, the original home of the tasty tubers that today are a staple on dinner tables all around the world. Yet here, in a classroom in the town of Puchuni, in the highlands of Bolivia, a small group of farmers — four women and four men — are learning about the potato.

They learn about its history and much more. In 10 sessions they study practical techniques such as how and when to collect pollen, how to cross different varieties of potato, obtain berries, extract seed, prepare nursery beds, transplant seedlings, and evaluate and select potato clones in field. And they learn about a new approach called participatory plant breeding, or PPB, that can help them improve their crops and their livelihoods.

In PPB, instead of playing a supporting role in the research, the farmers are treated as partners in the undertaking. In fact the farmers will often take the lead, sometimes combining their own seeds with the material supplied by the plant breeders. Because the farmers' varieties are well adapted to local conditions, and meet important cooking and consumption preferences, the results are more likely to meet with approval. And when that happens, the farmers don't hesitate to start multiplying and distributing the seed. It is a dynamic process of conservation and improvement.

PPB and the *in situ* conservation of agrobiodiversity — which means maintaining the diversity of plant species on farms in the habitats where they originated and continue to evolve — are two complementary methodologies. PPB is an approach that promotes development while conserving diversity.

PPB gives the farmers a greater measure of control over their livelihoods, and for those living at or near subsistence level it provides the opportunity to break out of the cycle of poverty. Perhaps no group benefits more from the PPB approach than poor rural women. It is the women who provide much of the farm labour, process and store the harvest, and prepare the food. Because in many places they also preserve the best seed for planting, they play a key role in managing plant genetic resources.

Which is why there are as many women as men in that classroom in Bolivia. The participatory potato improvement project, or PROINPA to give it its Spanish acronym, began in 1998 with the goal of developing PPB methodologies that would enable the hill farmers themselves to develop potato varieties that would provide maximum yields under local conditions.

IDRC: R. Vernooy

In Bohol, the Philippines, a woman rice breeder checks on the progress of her crosses.

The project team began by studying the farmers' knowledge of plant breeding, their techniques, the varieties they cultivate, and their preferences. To motivate and educate the farmers they developed a training program designed to build on the farmers' indigenous knowledge and understanding of their environment. They also organized workshops where the farmers visited PROINPA's own potato-breeding program and exchanged experiences and planned future actions.

Despite occasional setbacks, such as an unusually cold snap that wiped out some seedbeds, the project has produced impressive results. Working with the project team, farmers have adopted the PPB methodology and are demonstrating that they are capable of developing new potato varieties that meet their needs and provide increased yields. And, perhaps most important, some farmers are using their newfound skills as breeder–farmers to recover genotypes that were thought to have been lost, helping in this way with the recovery of the potato biodiversity in the region.

PPB on a global scale

The PROINPA project is just one of many funded through a small grants program administered by the Program on Participatory Research and Gender Analysis (PRGA), which is a systemwide program of the Consultative Group on International Agricultural Research (CGIAR). The PRGA is perhaps the most extensive program in support of PPB on a global scale. It is cosponsored by four of the CGIAR research centres and its activities are funded by national governments and several donor institutions, including Canada's International Development Research Centre (IDRC).

The primary goal of the PRGA is to "assess and develop methodologies and organizational innovations for gender-sensitive participatory research and to operationalize their use in plant breeding and in crop and natural resource management." As the name indicates, the PRGA places considerable emphasis on the roles of rural women in managing plant genetic resources.

Projects under the global PRGA program support the worldwide development and assessment of gender-sensitive participatory research methods. The goal is to introduce proven approaches into the international agricultural research centres (IARCs), and eventually into national programs. The small grants program is one of the program's key strategies for advancing gender-sensitive PPB. From the highlands of Bolivia to the highlands of Nepal, small grant projects are helping women gain greater decision-making power and control over resources. Participatory approaches applied in Uganda have resulted in men working more with women; in Kenya, they led to increases in the number of women in local management committees.

The emphasis on women's roles and needs is a logical outgrowth of 20 years of effort to make science more responsive to poor farmers. Women play many roles — growing, harvesting, storing, and preparing food. Perhaps none is more important than their role in plant breeding. Women farmers are prolific and adept plant breeders, as well as key managers of natural resources such as soil and water. They domesticate wild species and play a vital part in selecting and storing seeds for future crops.

Different expectations

Women throughout the developing world have detailed knowledge of, and strong preferences for, specific crop traits, and studies show that men and women often have markedly different expectations and knowledge of crops — differences that research and policies need to take into account, according to Louise Sperling, formerly facilitator of the PRGA's plant breeding working group.

Although in many cases researchers have reported that women's and men's criteria were not significantly different, except for culinary or quality-related criteria, Sperling says that in some instances women's criteria are so significantly different from men's that dual involvement in breeding and selection is necessary. For example, in Mali, maize evaluations showed men placing production and early maturity as the main criteria, with women focusing on qualitative (taste, colour, etc.) and processing aspects. Rice work in West Africa had a similar gender division, with men focused on yield and yield-related traits such as plant vigor, while women concentrated on quality attributes.

Better science

Involving women can make for better science, Sperling says. "They are often plant breeders in small-scale farmer production systems, responsible for domesticating wild

species, selecting germplasm, and saving seed. For instance, many of the world's landraces are maintained and reproduced by women, including cassava, beans, fonio, bambara groundnuts, millet, and many of the minor crops."

A specific example from Namibia: a farmer named Maria Kaharero encouraged outcrosses of her local variety with a station release *Okashana 1* over four seasons, producing a wonderful millet. Researchers swooped on her variety and crossed it with 30 varieties. This participatory breeding composite — known as MKC, for Maria Kaharero composite — is now the foundation for Namibia's national breeding program.

Sperling warns that not involving women may bring negative, not just neutral consequences. For example, in the Gambia, men's production systems involved almost 100 percent adoption of high-yielding varieties of rice, while female production systems remained based on the use of an indigenous rice variety. This wholesale adoption by men marginalized women's products and transferred other rice lands into the hands of men, who received all benefits from commercial sale. Eventually, women withdrew their labour, overextended by the double cropping regime.

On the cutting edge

Although the small grant projects are the PRGA's main arm in the field, the program's staff are also engaged directly in cutting-edge research. For example, conducting a study that addresses the challenging issue of how to attribute intellectual property rights that emerge from collaboration between researchers and farming communities. This work starts to fill a major gap in the international arena, where current agreements draw prime attention to the rights of plant breeders and farmers, but fail to address the division of benefits that could result from collaborative work.

The benefits of participatory research have been well documented, but to persuade more scientists and research managers to begin to incorporate these approaches into their research, it is vital to be able to compare the participatory approach to other, more traditional approaches. Program staff have developed and applied tools for empirical impact studies in both PPB and natural resource management. Both impacts and costs were studied, with a particular focus on documenting process impacts of different types of participatory research, as well as the impact of involving farmers at different stages of research.

Initial findings suggest that involving farmers more closely in the research process and giving them more control yields many positive impacts, including increased profits for the farmers. There is also empirical evidence that participatory research reduces costs by helping to prevent the development of technologies that are not subsequently adopted by the intended users. For example, feedback from Indonesian farmers at an early stage of sweet potato research led researchers to modify their proposed technology.

In a further effort to promote and facilitate the use of participatory approaches, the PRGA has built a network of knowledge and practice. Internet-based listservs encourage an ongoing worldwide exchange of expertise, while international seminars bring together hundreds of practitioners from around the world. Program staff have also created three publicly accessible databases, including a comprehensive inventory of ongoing and past PPB projects so as to allow the PPB "community" to review how others have designed programs, learn of the different kinds of results achieved, and contact each other directly.

In addition, program staff have organized and participated in numerous training workshops on participatory research and gender analysis methods and have published several training manuals.

Key challenges

Louise Sperling believes the PRGA has been an important catalyst for many changes in its five years. "The changes taking place in the plant breeding structure and process — to arrive at a more farmer-oriented science. These are changes for the long-term, not just for a project cycle," she says. "They include changes such as decentralization of testing to off-station sites, as well as on-farm trial designs which the farmers are able to interpret for themselves, and which are conducted under 'real farmer' input levels. We are also now starting to see serious use and integration of farmer evaluations in the formal research system," she adds.

This raises the issue of intellectual property rights. If a farmer develops an improved variety in collaboration with the formal research system, who owns the rights to that variety, who has access and can distribute it, and how will the various benefits be shared? Sperling believes that this and related issues are among the many challenges ahead for PPB and the preservation of agricultural diversity.

"Another key challenge is to set up organizational models that allow the devolution of decision-making and on-farm testing to the local level. That means hundreds of local level units," she says. "We also need to develop better strategies for supporting farmer-led PPB, particularly for the 'minor' crops and those that don't come within the mandate of the formal research system and the IARCs."

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.

www.idrc.ca/seeds

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.

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For more information

The PRGA Web address is www.prgaprogram.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 Vernooy (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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