

# Seeds that give

## PARTICIPATORY PLANT BREEDING

3

## Farmers and Researchers Reshape Cuba's Agriculture

### Necessity drives the search for alternatives

*Faced with a unique economic crisis, Cuba's national agriculture system was near collapse, threatening the country's food security. But working together with groups of farmers, a team of young plant breeders is turning things around. And by working together both the farmers and the breeders are learning valuable lessons that could prove to be valuable to the agriculture systems of other countries in the region.*

"Nature is complex," says the Cuban farmer, surveying a ripening maize crop. "Sometimes when we plant and we expect good results, we actually get poor results. And sometimes it is the other way around. But I can't just discard a variety because it doesn't perform well in one area. I should give it another chance."

The farmer's observations sum up a new approach and a new attitude to agricultural research in Cuba. It is called participatory plant breeding, or PPB. In PPB, researchers work directly with the farmers, and much of the testing takes place on the farm. 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, the results are more likely to meet with approval. And when that happens, the farmers start multiplying and distributing the seed. In Cuba's case, the PPB approach is born of necessity, but it may well be the way of the future for other countries in the region.

While Cuba's situation is undoubtedly unique, it is quite possible that a similar collapse of the industrial agricultural sector could occur before too long in other countries of the region, and perhaps beyond. The current agricultural production practices in many countries are highly dependent

on expensive technology, and chemical inputs, as well as various kinds of government subsidies, and are simply not sustainable in the long term. Thus the Cuban experience will likely have relevance elsewhere in the future.

### Responding to crisis

Cuba's economy is in crisis. The rapid growth in tourism brings in much-needed foreign currency, but nowhere near enough. Agriculture remains the mainstay of the island economy, and it has been hit hard by the economic



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In Cuba, an interdisciplinary group of researchers is working with farmers' organizations to develop and distribute new and more productive varieties of maize (shown here) and bean.

situation. Of necessity, agricultural production in the country is moving away from an industrialized, export-oriented, monoculture-based model that is highly dependent on technology as well as inputs such as fertilizer and pesticides. Seeking alternatives, farmers are switching to more diversified, low-input production systems that are oriented to local markets.

Another result of the crisis — one that could have serious long-term consequences — has been the rapid deterioration of the centralized, conventional system for seed production, improvement, and distribution. New ways had to be found to maintain and improve agricultural diversity to maintain national food security.

In 2000, an interdisciplinary group of dynamic researchers at the National Institute for Agricultural Sciences (INCA) took on the challenge of reshaping agriculture on the island. They began a project designed to improve the yield and quality of the corn and bean crops through a combined effort of increased varietal diversity and strengthened local farmer organizations. The project is already making an important contribution to improving Cuba's food security options.

## Better understanding

The aim of this innovative project is to strengthen the agricultural biodiversity base in Cuba, making a more diverse and better quality range of varieties available to farmers, agricultural research institutions and, in the end, consumers. To achieve these aims, the INCA team had several specific goals in mind. First, they wanted to gain a better understanding of local farmers' knowledge about the management and flow of maize and bean seeds. At the same time, they wanted to develop a methodology for selecting maize and bean varieties with the involvement of the farmers themselves. Finally, they would disseminate the results obtained by the farmers with the selection, production, and distribution of improved maize and bean seeds.

A secondary but nonetheless important goal was to improve the research capacity of the various agencies involved — including INCA, the newly formed farmer experimental groups known by the Spanish acronym of GICs, seed companies, and university staff — through learning by doing.

The key element in the project, however, was to involve the farmers, and this they achieved through GICs. The project team believed that strengthening the organization of farmers increases their capacity to experiment and innovate and to make stronger demands on the formal agricultural research system.

One method the researchers used to introduce farmers to new or unknown varieties or lines was the seed fair. Fairs are organized by plant breeders and take place at the INCA station. Initially, the farmers were wary of this new

approach, but many attended out of curiosity. What they saw overcame their reservations. The researchers managed to collect genetic materials for 92 maize varieties and 63 bean varieties, including, commercial and local varieties as well as promising new lines. The farmers were impressed.

"The display at the fairs demonstrated to farmers the diversity of these staple crops," says project leader Humberto Ríos. "We allow them to select the materials for testing in their own fields, under local conditions. This in turn has shown us that farmers can assess and select from a large number of options — that this skill is not just a breeders-only skill."

## Forging closer links

Ultimately, the fairs have proved to be hugely popular, so much so that farmers quite spontaneously started to organize similar fairs in their own communities. Farmers, breeders, and extension agents rub shoulders at the fairs, assessing varieties, and selecting the ones they like best. The materials are then distributed to farmers for testing on-farm. Breeders assist farmers with the experimental design, but all trials are adapted to the local context.

Farmers say that in addition to introducing new maize and bean seeds, some of which are more resistant to diseases, the fairs provide new knowledge about how to handle and conserve seeds. By developing closer links between farmers and researchers from the formal system, the fairs have also increased the farmers' capacity for experimentation. And last, but by no means least, the fairs have become social and cultural events that bring rural people together, young and old, and give them an opportunity to share their knowledge and experiences.

The project team also organizes regular field days as another way to learn more about farmers' preferences. Here the farmers, both men and women, are interviewed about their preferences. The information gathered is crucial to plant breeders in identifying parental materials and selection criteria.

Interestingly, results show that women and men farmers have different preferences. The men indicate a preference for yield, disease resistance, and pod size. However, women farmers select for yield, culinary grain properties, and esthetic features such as colour, shape, and brightness. Seeds selected "most liked" are given to the farmers a few weeks after the field day.

## Changing attitudes

These interviews also demonstrate how farmers' attitudes to plant breeding are changing. Says one, "We shouldn't discard varieties, but liberate them, give them a chance to grow in new fields so that they can find the environment that they like best."



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Through participatory research and “learning by doing,” the research capacity of INCA, university staff, seed companies, and farmers’ groups is strengthened.

Adds another, “What is good or useful for me, is not necessarily good for other farmers. I’m going to try out three varieties and the others I am going to give away to my neighbours.”

This is exactly what Ríos wants to hear. By broadening the genetic base through the fairs, and assessing “new” sets of varieties at the local level, it is possible to make maximum use of the genotype–environment interactions taking place. These are determined by factors such as local soil type, weather conditions, geography of the farm, and cultivation practices.

To date, the project has been successful at both broadening the genetic base and improving the quality of varieties. This assessment is made based on criteria defined by both breeders and farmers, and compared to the varieties farmers were using previously. In the La Palma district, for example, Ríos says that on average, farmers are now using six or seven varieties — twice as many as before. And farmers rate 50 percent of the newly introduced varieties to be superior to the ones they used previously. In the Havana cooperatives, the average number of varieties is now 14, up from just 2 or 3, and 86 percent of the newly introduced varieties are considered superior.

## Sweeter than the hybrid

Ríos speaks with pride of one experimenter farmer in the Gilberto Leon cooperative who developed a promising, new maize variety that has been named Felo. “This new variety was bred on the basis of 15 lines selected by fellow cooperative farmers during a maize diversity fair and carried home to the cooperative,” he explains. “It is tolerant to attacks by the two predominant diseases and produces yields that on average are 30 percent higher than the previously used hybrid variety.

“But that’s not all: Felo also requires 30 percent less fertilizer application and 50 percent less water. And the taste is better as well — sweeter than the hybrid variety,” Ríos says enthusiastically.

The area of sown Felo is increasing rapidly, and the cooperative members have started to produce seeds for sale. The success of Felo has contributed to the recognition, by other farmers, breeders, and officials that farmers are able to improve varieties, and can do it with success. It has also demonstrated for plant breeders in the formal system the importance of farmers’ participation in disseminating new varieties.

“Farmers are now starting to make decisions about the management of agricultural biodiversity,” says Ríos. “As a result, there has been a considerable increase in the genetic diversity maintained by participating farmers. Farmers who are members of GICs and are participating directly in the project have started to bring other farmers and local stakeholders on board.”

## Something unexpected

Humberto Ríos willingly admits that the researchers are learning much from the project. “The major lesson is how providing access to genetic biodiversity and the stimulation of farmers’ participation in decision-making transforms the attitude of farmers,” he says. “Farmers are now expressing a variety of new ideas and alternatives for local development. This is something unexpected.”

Researchers in Cuba have little previous experience with participatory approaches of this kind, so the project team also tends to function as a resource for other researchers who are interested in similar approaches. The team is also involved in genetic analysis through collaboration with biotechnology scientists at the Cuban National Research Institute of Agricultural Sciences.

The challenge now, says Ríos, is to integrate the participation of farmers in the national seed system “as an organic component,” and to turn PPB into an economically viable and sustainable national alternative system for Cuba. Given the new attitude and understanding of the farmers, the chances for success are good.

“I like this variety, because it struggles to survive,” says a farmer at one of the field days. Then he adds his own unique philosophy of plant breeding. “For me, when I think about varieties, they are like people. We are not all the same: some of us like to work hard, some of us do not show much interest in performing, and there are others who do not so well. But even from the ones performing badly, we can learn something.”

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

Information about INCA (in Spanish only) can be found at [www.programafpma.org.ni](http://www.programafpma.org.ni).

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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](http://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](http://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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