

# Seeds that give

## PARTICIPATORY PLANT BREEDING

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## Bridging the Gap between Scientists and Farmers in China

Strengthening local seed development systems is the key

*Farmers and researchers too often work in different realities. Researchers breed exotic hybrids in the laboratory that are successful only under ideal conditions and that require just the right inputs of water, fertilizer, and pesticides to maximize yields. For many farmers such conditions simply don't exist, and as a result they obtain poor results from high-tech seeds offered by the formal research system. In China a group of researchers and extension agents is building bridges to close the gap between scientists and resource-poor farmers.*



IDRC: R. Vernooy

In Guangxi province, China, diversity means choice, diversity means life.

It is market day in GuzHai township, and there is excitement on the streets because the fair has come to town. No ordinary fair this, it is an agricultural biodiversity fair, the first such event ever seen in Guangxi province — or anywhere else in China for that matter.

Many hundreds of local farmers crowd the section of the main street where the fair has been set up to view the diversity of crops and seeds on display. Others are there too — township officials, merchants, curious children, important visitors from Beijing, even a local television crew filming the action. What they see is a rich diversity of crops — 38 crops and 107 varieties. Some are rare and unique to the area, such as black wax maize and mountain lily. They include 31 varieties of maize, 17 of beans, 16 of vegetables, 14 of cereals, and 8 root crops. As well there are traditional herbs, spices, and medicinal plants — almost all of them landraces (farmer-developed varieties).

This cornucopia is displayed in booths just as at the regular market, and at each booth there is a neatly printed card giving details of the type and origin of the items laid out there. Proud farmers and some researchers and extension agents attend the booths, happy to talk about their produce with anyone who asks — and many do.

The fair-goers are impressed. "I didn't know it was possible to grow so many varieties of crops here," says one. An older farmer examines the maize on display and shakes her head in wonder. "I haven't seen these seeds since the 1960s," she says. "There are seven maize varieties here that I've never seen before," responds her companion.

Throughout the day the participants — farmers, researchers, and officials — exchange many opinions, ideas, experiences, and of course seeds. In the afternoon a committee that has been assessing the wealth of diversity at the fair awards prizes to the most outstanding displays. The first agricultural biodiversity fair in Guangxi province is attended by more than 2 000 people. It is a huge success — and it will not be the last such event.

## Opportunity for exchange

The fair was the culmination of a year of planning and preparation by local farmers and a team of researchers who have been working in the province since 1999 to improve the livelihoods of resource-poor farmers through participatory plant breeding (PPB) techniques. It provided an animated demonstration of the results of a project, now in a second phase, that is a joint effort of the Center for Chinese Agricultural Policy (CCAP) and the Guangxi Maize Research Institute (GMRI). This project is built on a study carried out in the 1990s by the International Maize and Wheat Improvement Center (CIMMYT) and is supported by Canada's International Development Research Centre (IDRC) and the Ford Foundation.

The purpose of the fair, says project leader Yiching Song (who conducted the CIMMYT study), was primarily to bring together farmers, plant breeders, extension agents, seed merchants, and policymakers, and to demonstrate to them the diversity of genetic resources, knowledge, and ways to strengthen management of the resource, as well as plant breeding and seed supply.

Yiching Song says the fair also provided opportunities for the exchange of both seeds and knowledge, and a chance to explore the market demand for PPB-improved varieties. Last but not least, she adds that the success of the fair gives farmers the confidence to continue to strengthen local seed-development systems.

## Staple food of the poor

Although the fair displayed a wide range of crops, the project's main focus is on maize improvement. The upland regions of Guangxi province are remote and the conditions for agriculture are difficult at best. Yet this is one of the places in the world where people first began to cultivate maize. Farmers here have cultivated and relied on maize for their survival for countless generations, and they maintain a higher level of maize varietal and genetic diversity than in the rest of the country. Today this region is a treasure trove of maize genetic diversity that is vital to the future of maize cultivation in China.

Maize is now the most important feed crop and the third most important food crop in China. Significantly, it is the staple of the poor — and in this region an estimated 30 million people subsist at or below the poverty line.

Hybrid maize is now grown on approximately 80 percent of the total maize-production area in China, particularly the uniform and high-potential areas of the Northern Plain. The introduction of a market economy has resulted in an increasingly profit-driven seed production and supply system. Hybrid breeding and hybrid seed production have drawn more attention and investments than ever before. Conversely, a study done in Guangxi, revealed that more than 80 percent of the seed supply is from farmers' own seed systems, maintaining diversity for the interests and sustainable livelihoods of all farmers.

The genetic base for maize breeding in China has been dramatically reduced during the last decade. Although the total national maize germplasm collection has around 16 000 entries, five dominant hybrid maize varieties now cover 53 percent of the total maize-growing area in the country.

In Guangxi province, the total maize germplasm collection has around 2 700 entries and among them more than 1 700 are landraces from the region. However, only three main hybrid breeding crosses are used, and all the 14 hybrids bred out in the last 20 years share the same inbred line to different degrees. Meanwhile, in several provinces landraces in farmers' fields are degrading and disappearing.

## Feminization of agriculture

Although China's economic growth has been impressive, poverty remains persistent in many rural areas including Guangxi province — in particular affecting women. Yiching Song has lived among the people of the region and understands the issues facing poor women. "Feminization of agriculture has become a common phenomenon as a result of male migration," she says. "The men leave to look for work elsewhere, and as a result women play a dominant role in food production and are responsible for post-harvest operations, seed selection and storage, as well as food-processing activities."

In her study of the impact of CIMMYT's maize germplasm on poor farmers in the region, Yiching Song looked in particular at the development and diffusion of technology by both the formal and the informal systems. "Women's significant role is not recognized, and their specific needs, interest, and expertise are largely neglected in the technology design, development, and diffusion process," she notes. One of her main conclusions was that a cooperative and complementary relationship between the two systems, rather than the current separated and conflicting situation, is urgently needed to address the challenges in food security and biodiversity facing China as a whole and Guangxi in particular.

This is the background to the CCAP-GMRI project, which has two key goals: to better promote and use the techniques that enable indigenous women and men in local communities to conserve biodiversity; and to find ways to involve



those communities in the design and implementation of on-farm biodiversity conservation.

“Decentralization of the formal systems and involvement of women and men farmers in the technology and the design and development process is essential to stimulate collaboration between the two systems,” insists Yiching Song. “The informal sector needs to know more about the complex ways of biotechnology, while the formal system needs to know more about the complexity of poor farmers’ farming systems and their livelihoods.

## Reaching key decision-makers

Five women farmer groups, six villages, six township extension stations, two formal breeding institutes, and CCAP have been directly involved in both the design of the project and its implementation. Now in its second phase, the project is attempting to link community-based action research with the policy-making process by increasing efforts to engage directly key decision-makers in the maize policy arena at both the provincial and national levels.

The field experiments use both a researcher-led and a farmer-led approach with different research focuses in each trial for comparison. More than 40 varieties were identified as target varieties for PPB trials at the GMRI station and in five villages. Already, three farmer-preferred varieties have been released and used in the project villages. In addition, five exotic varieties from CIMMYT have been locally adapted, and five landraces from the trial villages have been improved through the joint efforts of farmers and breeders. An improved variety from women farmers has been tested and certified by the formal breeding institution and is widely used in the project region.

There are other benefits. The field experiments have proved to be effective in strengthening interaction, communication, and collaboration among the stakeholders. They have also strengthened the local-level organizational and decision-making capacity of farmers. Among the formal breeders there has been an impressive change in attitude — the needs and interests of farmers are now considered and included in the breeding plan and research priorities of the institutions. And farmers’ efforts and knowledge in genetic biodiversity management are increasingly recognized by policymakers at both provincial and national levels.

Yiching Song is particularly pleased at the role of women in the project, both as farmers and as extension agents. “They were very enthusiastic right from the beginning, and have been active participants during the whole process. Some men were a bit surprised at the women’s involvement initially, but they soon accepted it,” she says, adding that “the project has empowered all the farmers, not just the women. It has strengthened the local system and influenced policy.”



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At the GMRI research station in Guangxi province, an extension agent assesses the progress of maize varieties.

## Part of the mainstream

The success of the project has led GMRI to combine gene bank conservation with *in situ* conservation of landraces, and the China Crop Science Institute will include the local germplasm conservation efforts in Guangxi in its national plan for broadening the genetic base. CCAP has played a crucial role in expanding the impact and influence of the results at national policy levels. The project was presented and discussed at a national policy-planning workshop in Beijing in March 2002. This important conference was the first time that 40 prominent national agricultural policymakers and maize researchers had discussed the participatory approach as an alternative and complementary methodology for crop improvement and agrobiodiversity management.

Reflecting on the significance of this conference, Yiching Song says: “We have learned a great deal from the project so far, and we have demonstrated that a grassroots-level network is a sound basis for an effective and sustainable implementation of PPB. However, we also know now that the involvement of policymakers and institutions is crucial if this approach is to become part of the mainstream. Ultimately we would like to see the formal system incorporating farmer participatory research as a recognized part of their activities.”

This case study is one of a series of six on participatory plant breeding written by Ronnie Vernoooy, 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

The Web address of CCAP is [www.ccap.org.cn](http://www.ccap.org.cn).

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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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