Changing the system from within: participatory plant breeding and ABS in China

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by JINGSONG LI, JANICE JIGGINS and YICHING SONG

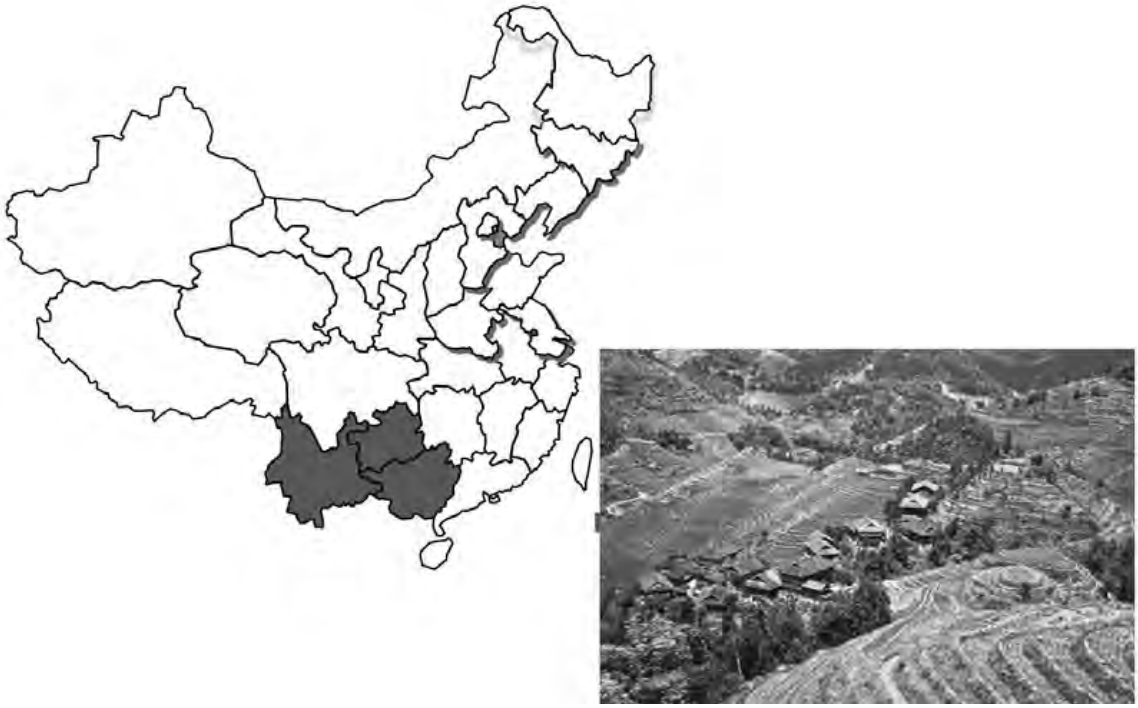
Guangxi – centre of maize diversity

With the rapid loss of biodiversity worldwide, agricultural genetic resources are increasingly under threat. Those in China are no exception.

Guangxi is a mountainous area of southwest China. Although economically poor, Guangxi is agroecologically diverse and one of the centres of maize genetic diversity in China. However, a study in the 1990s revealed that the formal State seed system was operating entirely separately from farmers' own seed systems, resulting in inadequate variety development, poor adoption of formally bred varieties by farmers, and a decrease in both the genetic base for formal breeding and genetic diversity in farmers' fields (Song, 1998). This was impacting on food security and agrobiodiversity. Since 2000, the opening up of the domestic seed market has seen a rapid expansion in the availability of commercial seed, to a great extent marginalising farmers' systems for saving and exchanging seed of local varieties. This has resulted in a dramatic loss of genetic diversity in farmer's fields in the last decade, in favour of modern varieties which are less resilient to the increasingly harsh local climate (e.g. drought).

China's first participatory plant breeding (PPB) programme was initiated in Guangxi and aims to address these challenges.[1] This type of collaborative research between farmers and plant breeders in government institutions has never been done before and is unique in China. The programme not only aims to develop improved crop varieties for farmers but also to develop local agreements by which farming communities can benefit from sharing their genetic resources and related traditional knowledge with breeding institutes. The programme has opened up space for farmers to negotiate ABS agreements and in the process strengthened the legiti-

[1] Participatory plant breeding is an approach to seed development and improvement that involves farmers and breeders in systematic procedures for jointly identifying desirable traits, selecting promising lines, and evaluating the resulting varieties.



Research site in Guangxi, Yunnan and Guizhou provinces. The photo shows a typical landform in this region.

macy of their rights/claims to benefit-sharing. The development of ABS mechanisms is also feeding into ongoing policy discussions on how to implement the ABS provisions of the Convention on Biological Diversity and the Nagoya Protocol.

ABS in China

Plant genetic resources (PGRs) for food and agriculture have been developed over millennia to satisfy the most fundamental of human needs. The free flow and exchange of these resources was once governed by individuals and communities. However, this has changed as intellectual property rights (IPR) regimes have been applied to agriculture. In international and national law, IPRs often overshadow or even extinguish the natural rights of farmers and farming communities to landraces and varieties they have developed, largely benefiting commercial plant breeders.[2] These companies have been able to develop new seeds, often based on farmers' PGRs, and then protect their investment through commercial patents or plant variety protection laws which prevent farmers from legally exchanging and saving seed for future use (Tansey and Rajotte, 2008).

The recently agreed Nagoya Protocol is attempting to address this by requiring those accessing genetic resources for research and development to share the benefits they derive with the countries and communities that provide these resources. But in practise, in China, there is still no formal ABS policy, although in 2011, the Chinese government set up China's National Biodiversity Commission, which has started to draft national ABS regulations. Legislation to promote farmers' rights still lags behind protection of commercial breeders' rights, however.

There are also uncertainties over who 'owns' varieties developed through PPB and how benefits should be shared. Discussions with farmers have shown that the concept of intellectual property is new to

[2] A landrace is a local variety of a domesticated animal or plant species which has developed largely through natural processes, by adaptation to the natural and cultural environment in which it lives. It differs from a formal breed which has been selectively bred deliberately. Landraces are usually more genetically and physically diverse than formal breeds. Source: Wikipedia.

Table 1. The development of participatory plant breeding in Guangxi, southwest China

Date	Activities	Results
Phase 1: PPB (2000 onwards)	• Improve landraces and farmers' varieties • Develop locally adapted hybrids • Build farmers' capacity	Breeding processes documented and evaluated: • Guangxi Maize Research Institute (GMRI) – formal breeder • 13 communities • 100+ individual farmers
Phase 2: Community seed production (2005 onwards)	Community-based PPB seed production as a market-based reward for PPB farmers conducted by a women's farmer group (15 farmers) with technical support from the GMRI breeders.	Detailed information documented and analysed for seed production in terms of scale, yield, local distribution and problems/risks.
Phase 3: ABS contracts (2008 onwards)	ABS contracts developed and agreed between the breeding institute (GMRI) and 12 farming communities.	Contracts signed 2010.

local farmers. Chinese farmers do not own their land. Their perception of rights and property and their intellectual contribution to seed development are not strongly embedded in culture – and are actively discouraged. This creates a barrier for farmers who seek to become rights claimants during ABS negotiation processes.

The PPB programme had to deal with these uncertainties and contradictions as it tried to develop ABS mechanisms to benefit farmers through the PPB process.

The PPB programme

The PPB programme began in 2000. It was initiated and facilitated by a group of Chinese agricultural policy and social science researchers at the Centre for Chinese Agricultural Policy (CCAP) at the Chinese Academy of Sciences, together with concerned plant breeders. It was supported by the International Development Research Centre (IDRC) and the Ford Foundation. The project team consisted of: farmer breeding villages in Guangxi, local extensionists, breeders from Guangxi Maize Research Institute (GMRI) and the Institute of Crop Science (ICS) under the Chinese Academy of Agricultural Sciences (CAAS), and sociologists from CCAP.[3] The programme aims to bring direct benefits to poor maize growers and conserve genetic diversity by:

• developing improved crop varieties for farmers, combining formal and local farmers' genetic resources and knowledge; and
• developing mechanisms for access to genetic resources and benefit-sharing (ABS) between breeding institutes and farming communities.

The PPB team used a process of participatory action research to enable farmers and breeders to work together to learn about, explore and test innovative practical solutions for landrace variety improvement, seed production and related benefit-sharing mechanisms. The programme developed in three stages (see Table 1). From 2000 to 2011, the project gradually became a programme, expanding from one to 13 communities and from individual farmers to farmer groups. The selection of PPB communities was based on two aspects: the richness of local genetic resources, and the willingness of farmer breeders to take part. For both breeders and farmers, PPB became an entry point to

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explore and identify technological and institutional options to bridge farmers' seed systems and the formal seed system, integrate scientific knowledge and farmers' knowledge in breeding and conservation, and build mutual respect and understanding among farmers and public breeders.

Phase 1: from 2000–2003, aimed to develop mutually beneficial partnerships between formal breeders and communities and build farmers' capacity through breeding improved varieties. PPB varieties were successfully developed, but there were difficulties in marketing PPB varieties so that farmers could benefit (see below). Therefore, other ways to generate benefits for farmers were explored.

Phase 2: from 2005 onwards. Farmers suggested initiating community seed production and marketing of varieties bred by the team. Research focused on this activity and drawing lessons from it.

Phase 3: beginning in 2008, the programme started to develop ABS contracts between plant breeders and farmers. This enabled more farmers involved in developing PPB varieties to share in the commercial benefits from the varieties and agree the terms for access to farmers' genetic resources by formal breeders.

Challenges in releasing PPB varieties

By 2007, there were more than 100 newly bred varieties tested in on-station trials and farmers' fields. Five farmer-preferred maize varieties were selected and released to the 13 trial villages. Although the programme results showed that it benefited both farmers and formal breeders through joint breeding and the exchange of maize genetic resources, the programme faced challenges in releasing the new varieties and enabling farmers to claim benefits from their contribution. These challenges arose from China's seed regulations in relation to varietal release criteria, lack of recognition of collective intellectual property rights, and a lack of national ABS legislation.

China's seed regulations

The formal seed release system requires that new seed varieties must pass a series of tests: the Value for Cultivation and Use (VCU) test, and the Distinctiveness, Uniformity and Stability (DUS) test. Existing seed regulations only recognise and release varieties that pass these tests (Seed Law, 2001). But PPB varieties are unlikely to comply with these variety release criteria, such as VCU (i.e. value for cultivation and use) and DUS (distinctiveness, uniformity and stability) testing which are tailored to the characteristics of modern varieties, while farmer improved varieties cannot always show 'clear improvement' under different growing conditions, and can hardly meet the DUS criteria (Visser, 2002; Louwaars, 2007). Four of the five PPB varieties failed at the VCU testing stage in 2003. Only one hybrid PPB variety was officially released, *Guinuo 2006*, and this was registered and later commercialised by GMRI breeders. For the other varieties, the only option was to release the seed unofficially to the surrounding farming communities. But this meant limited recognition of the varieties in the marketplace as they were not officially released.

Intellectual property rights (IPRs)

IPRs grant exclusive rights to individuals or organisations, but these do not apply in PPB, nor to landraces and varieties developed collectively by communities of farmers. Varieties could be introduced into China's formal breeding system by registering them under a breeder's name, but this approach does not recognise farmers' input. There was no mechanism for deciding how each stakeholder might benefit from the sale or use of a PPB product. As a local initiative, community-based seed production provided a way to share both monetary and non-monetary PPB benefits. However, it was limited to farmers in one trial village and at that stage there was no formal mechanism for benefit-sharing with other PPB farmers. An unwritten agree-

ment between the PPB team, the breeding institute and the seed company supplying the commercial market enabled PPB farmers to supply *Guinuo 2006* locally.

Lack of ABS legislation

The lack of legislation meant there was no framework or mechanism for agreeing ABS between breeders and farmers. There was also a continued lack of awareness among both farmers and policy makers about the wider range of potential commercial and public interest benefits of both *in situ* conservation and fair and equitable use of local plant genetic resources.

Developing access and benefit-sharing (ABS) contracts

Given the lack of ABS legislation in China, the project team decided to formalise agreement on access and benefit-sharing among stakeholders through mutually agreed contracts. During the drafting of the ABS contracts from 2008 to 2010, the team reflected on how to protect the public value of crop genetic resources, considering farmers' contribution to agrobiodiversity enhancement and to maintaining the genetic base for hybrid breeding. The team also considered how to recognise farmers' rights to benefit-sharing, individually or collectively. During initiating ABS contracts, both breeders and farmers were interviewed by policy researchers, and later on they were brought together for further discussion and negotiation, based on their current conflicting interest, and the potential benefit from PPB collaboration.

In June 2010, the PPB programme's ABS agreement was signed among farmers and GMRI breeders. The contracting process was facilitated and witnessed by CCAP researchers. The agreement recognises the contribution of both PPB farmers and their genetic resources during the breeding process, and regulates how benefits are shared. This includes e.g. the right to register new varieties, sharing ownership (via registration of joint plant breeders' rights (PBRs)[4]) and royalties, subsidy payments to farmers for landrace conservation and to cover any risks associated with breeding experiments, such as harvest loss due to severe weather conditions. Whilst the ABS contract sets up an initial agreement for benefit-sharing between breeding institutes and farmers, its effective implementation will depend on continuing to develop mutual understanding and collaboration between the parties.

What has the programme achieved?

The PPB process has created a platform for mutual understanding, knowledge creation and social learning between farmers and formal breeders and researchers on the project team. Breeders and farmers were able to learn from each others' experiences, ideas and values, creating a new understanding between these previously distant actors. Although they are from different backgrounds and may not share the same values and aspirations, farmers and breeders are linked by a common goal of developing improved varieties. By engaging stakeholders in practical action, PPB provides a way of actively involving stakeholders in searching for a solution to a problem, and this can change their perspectives. This has led to a recognition of the important role of farmers in plant breeding and conservation, and the need to acknowledge the rights of farmers over PPB varieties and landraces, which is vital for creating incentives for farmers to

[4] PBRs are an internationally recognised instrument for registering the contribution of plant breeders to the development or improvement of seeds that are subsequently commercialised. A PBR confers the right to receive a proportion of the commercial profit. According to the PVP law (1997), Article 2, item 7 (www.caas.net.cn/caasnew/nykjxx/nyxz/6163.shtml), the PBR can be granted to either institute breeders or individual (hobby) breeders. For collaborative breeding, the ownership of PBR is based on contract arrangement. If farmer-breeders and other stakeholders have such recognition, farmers' rights over local genetic resources can be strengthened through contract arrangement.

conserve genetic diversity.

Working in partnership with farmers has greatly strengthened the legitimacy of the farmers' position as a stakeholder claiming rights, and the asymmetry of the existing legal framework in the way it treats farmers and commercial organisations has become apparent. The subsequent development of ABS contract mechanisms has given legitimacy to the idea of benefit-sharing with farmers in policy discussions.

The PPB and ABS innovations at the community level have also influenced formal (public) breeding institutions at provincial and national level, because plant breeders from GMRI (at provincial level) and the ICS (at national level) have been directly involved in the PPB work at local level. At each stage of the project, the CCAP researchers, farmers and breeders jointly defined problems, developed practical solutions and reflected on the tensions between PPB work at the local level and regulations at the national level (mainly seed laws). The resulting learning was documented and shared with government through regular policy workshops and discussions (see below). This reflexive process provided a systematic approach for fostering institutional innovation at different levels, including the adoption of PPB practices by national breeding institutes and extension programmes and creating awareness amongst the Ministry of Agriculture of the need to reform the national seed regimes. Further effort is required to stabilize this capacity in the evolving regime, such as amendment of existing seed regulations in order to accommodate farmer improved varieties, support to public research institutes' role in breeding oriented to smallholders and conservation, protection of the public value created by PPB in relation to agrobiodiversity conservation and farmer empowerment through ABS-related agreements, and support to farmer-led seed production and marketing (Li *et al.*, forthcoming, b).

The project has also had to address power relationships. The national breeding institute leads the national agricultural research system, which has a top-down organisational style, with a clearly defined power hierarchy. But unlike any single disciplinary research project or one confined to local-level research, the PPB programme has facilitated interactions across the power structure (e.g. top-down bureaucratic settings within the formal breeding system) to create a network of relationships among diverse stakeholders with complementary experiences and knowledge backgrounds. The team consists of sociologists and policy researchers from CCAP, besides that the team also has active collaboration with GMRI and CAAS breeders. This has been facilitated by the close collaboration between agricultural scientists at local, provincial and national levels in the PPB process, and the systematic feedback and discussion of local level results at higher levels. At the same time, for both breeders and farmers, PPB became an entry point to explore and identify technological and institutional options to bridge farmers' seed systems and the formal seed system, integrate scientific knowledge and farmers' knowledge in breeding and conservation, and to build mutual respect and understanding among farmers and public breeders.

Influencing policy

The PPB project team is engaged in ongoing discussions and exchanging knowledge with researchers from the CAAS, policy makers from the Ministry Of Agriculture (MoA) and the Ministry Of Environmental Protection (MoEP). The PPB programme has also facilitated and/or contributed to 12 policy workshops and roundtable discussions at provincial, regional, national and international levels since 2000. These discussions have included the direct and indirect involvement of national and provincial policy makers from MoA and MoEP, CAAS, GMRI and international project partners.

Ongoing policy dialogue has created a platform where local-level PPB and ABS innovations can be discussed and assessed. This dialogue has borne fruit: at a policy workshop organised by CCAP in 2002, PPB was considered as an alternative and complementary methodology for crop improvement and agrobiodiversity management for the first time. In 2004, the MoA agreed to include PPB working methods in its national extension reform pilot programme; and from 2008 onward, a national maize breeding programme led by CAAS has collaborated with the CCAP team on one of its sub-objectives: conserving maize genetic resources and developing participatory maize breeding in southwest China.

The dialogue has also raised awareness of the existing barriers in policy and law that prevent farmers from benefiting from PPB, and promoted understanding of the need for changes in policy and law to remove these barriers. This has important implications for scaling-up the approaches.

Clashes between new approaches and established laws can foster change in the government regime. And change is further stimulated by the vacuum in national ABS legislation, which means that policy makers are actively looking for solutions at this point in time. With the implementation of the Nagoya ABS Protocol, CBD member countries are expected to formulate and enact national ABS legislation in the coming years. But the absence of ABS law in China has created a regulatory vacuum for PPB practitioners. There is no formal way for farmers' contributions to seed improvement and development to be recognised under PBR. The PPB programme has demonstrated an alternative approach in the form of ABS contracts between project participants. However, we also need to continue exploring ABS options within the legal system. China has already ratified and implemented the Convention of Biological Diversity (CBD) and is currently preparing to become a signatory to the International Treaty on Plant Genetic Resources (ITPGRFA), which aims to promote the conservation and sustainable use of plant genetic resources for food and agriculture, and fair and equitable sharing of benefits derived from their use, in harmony with the CBD.[5] China is now exploring a two-track policy framework for access and benefit-sharing relating to plant genetic resources, in order to balance the needs of commercially-driven IP protection regimes for a limited list of high value plants (such as ornamentals) and commercially important commodities (such as hybrid maize as a foodstuff for the pig industry), and the protection of farmers' rights.

Conclusion

In a context where farmers face significant legal barriers to securing their rights and benefits, this experience shows how a local-level experimental project, involving formal breeding institutes directly, can demonstrate a new way of doing things. By systematically feeding back the results to government departments, the project has started to change attitudes, practices and policy debates, paving the way for changes in policy and law. It has also strengthened the legitimacy of farmers' claim to share benefits from the use of plant genetic resources. Although concrete changes in law have yet to come, these achievements are significant, and show how positive change can be achieved by working within the system. The ABS agreements could serve as the basis for further exploring appropriate PIC principles and protocols in China (Li and Song, 2010; Song *et al.*, 2012). Although ABS legislation in China is not yet adequately formulated, ABS can still be addressed in local practice in terms of procedural approaches, such as ABS contracts, because the legal basis for these mechanisms already exists (Li *et al.*, forthcoming, a).

[5] The International Treaty on Plant Genetic Resources for Food and Agriculture entered into force in 2004. See: www.planttreaty.org for details.

CONTACT DETAILS

Jingsong Li
Senior Research Assistant
Centre for Chinese Agricultural Policy
Chinese Academy of Sciences
Beijing
China
Email: jingsongli0421@gmail.com

Janice Jiggins
Communication and Innovation Studies Group
Wageningen University
P.O. Box 8130
6700 EW Wageningen
The Netherlands
Email: janice.jiggins@inter.nl.net

Yiching Song
Senior Research Scientist
Centre for Chinese Agricultural Policy
Chinese Academy of Sciences
Beijing
Email: yiching2002cn@gmail.com

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