

## 15 China

### The Xiding gene bank in Yunnan

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#### **Purpose and evolution**

Since 2006, a team of Chinese researchers and Bioversity International colleagues has been engaged in the project, 'Conservation and use of crop genetic diversity to control pests and disease in support of sustainable agriculture' in Xiding township, Menghai county, Xishuangbanna prefecture of Yunnan province. Menghai is an area of rich agricultural biodiversity, especially in terms of rice and maize varieties. Farmers use specific selection criteria when saving and improving varieties to respond to the demands of the environment. In the mountainous regions of Yunnan, the diverse ecological niches, even within the same agricultural region, require specially adapted crop varieties. Socioeconomic, cultural and market forces also influence farmers' portfolios of crops and varieties. Although this has led to rich overall biodiversity in this part of China, intensification and modernization of agriculture have made it difficult to maintain. Only a few agricultural scientists are paying attention to the negative trend.

The research team has identified more than 300 rice and maize varieties known to local farmers from ancient times. With time, some of these varieties have disappeared for various reasons, such as low yield or lack of resistance to diseases and pests. Genetic resources, in the form of landraces, are precious to agriculture development, particularly for crop variety breeding as they could be a source of important adaptive traits. The maintenance of these traits on farm is essential for sustainable agriculture and for their capacity to adapt to climate change.

In 2010, with support from the Institute of Agricultural Science in Xishuangbanna Dai Autonomous Prefecture, the Menghai county agricultural bureau, the Xiding government, the Xiding agricultural sciences station and the village committee, we set up the Xiding gene bank in the committee building, Manwa village, Menghai county.

This gene bank is a farmer-owned facility that conserves the diversity of local crop seeds and provides a seed-exchange service to farmers. The specific objectives of the Xiding gene bank are to collect seeds from current and ancient local crop varieties, demonstrate them to local farmers and make them

available through seed exchange. The efforts of the community gene bank are supported by participatory propagation.

To ensure efficient management of the bank according to established standards and procedures, we established the Xiding Crop Gene Bank Management Committee and the Expert Advisory Committee. The latter consists of 12 experts from scientific institutions in Yunnan who provide technical support for management of the community gene bank. As far as we know, this initiative represents the first of its kind in China. The above-mentioned 'Pest and disease' project provided some initial financing and technical support through funding from the United Nations Environment Programme and the Global Environment Facility. Currently, some funds are provided through the International Fund for Agricultural Development and in-kind support from the Chinese authorities.

### **Functions and activities**

The main functions of the community gene bank are conservation, demonstration of Xiding's crop diversity and the organization of biodiversity fairs, which help connect the past with the future by ensuring the continuing availability of genetic resources for research, breeding and improved seed delivery. In 2010, the gene bank started with 20 local varieties of rice and ten of maize (Plate 7). By 2013, the collection had grown to nearly 70 varieties of rice and ten of maize, as well as seeds of other crops, such as sunflower, white gourd and peanut.

The different varieties have different characteristics. Most are drought tolerant and some are resistant to disease and pests. About 300g of seed of each accession is kept in the community gene bank. Seeds are replaced every year by the research team and some local farmers. Farmers dry their seeds directly after harvest on a bamboo screen, check for pests and diseases and remove affected seeds. The seeds are then treated with organic material, such as ashes or pepper, to protect them from disease. Women are often in charge of seed selection.

The rice genetic resources group at the Yunnan Academy of Agricultural Sciences (YAAS) covers the cost of reproducing seeds. The community provides the storage site and government institutions provide the technical support, e.g. the correct methods of collecting, storing and managing the seeds. Duplicate seeds are stored in the YAAS gene bank in modern facilities for mid-term conservation backed up by a complete documentation system. Both farmers and breeders have access to these seeds, on request by telephone or email.

The establishment, operations and management of the gene bank are guided by rules and regulations formulated by the agencies and farmers involved. For example, for germplasm entering the bank, the following guidelines have been agreed to:

- Farmers from the various villages bring their seeds (about 300g each) to the gene bank, encouraged by notices at crop seed diversity fairs and

locally displayed posters. At field days, farmers are exposed to different species of rice, corn, etc. from the gene bank, and gene bank personnel explain how seeds are stored and how farmers have access to them.

- The gene bank administrator collects passport data and registers the name of the variety, its origin, time of collection and its characteristics.
- The seeds are then stored in a bottle sealed with a paper label containing all the associated information.

Farmers who want to obtain seeds that are different from their own must deposit an equal quantity in the gene bank. To guarantee seed viability over the long term, some seeds must be propagated by the gene bank. Every year, about half a bottle of each variety is planted in the local breeding area in Gasa township, Jinghong city.

The aim is to make available to users as many accessions as possible along with associated data. Transactions are free. To obtain an accession from the gene bank, a farmer must fill in an application. The staff of the gene bank draw up a contract with the seed seeker based on compliance with China's Seed Law under the Crop Germplasm Resources Management Measures. The farmer is responsible for complying with the local or national requirement for seed importation, in particular the phytosanitary regulations to prevent the spread of pests or invasive species that could seriously affect local production.

Farmers may not apply for recognition of new varieties and other intellectual property protection for germplasm obtained from the gene bank. Those who access germplasm from the gene bank have to promptly report to the gene bank and later give feedback about the performance of the obtained germplasm. If this is not done on time, the gene bank is no longer obliged to provide germplasm. We usually provide 20g of seed for each request. When the quantity of a variety falls below 200g, we will use 100g to multiply the stock at the local breeding base in Gasa township.

Apart from the more common crops and varieties, the community gene bank also aims to collect local neglected and underused species. Farmers are interested in finding rare varieties, such as Abie, a kind of glutinous rice that has large grains and a very good taste, but is prone to disease and has a low yield. In some villages, such as Bada in Xiding township, farmers planted this variety up to a few years ago, but now can no longer find seeds. They are hoping that through the community gene bank they will be able to conserve and continue to use some of these neglected species.

About 100 villagers from ten villages and about ten technical staff from the agricultural extension service are currently involved in and benefitting from the gene bank's collection. Researchers, including staff of YAAS, Institute of Agricultural Sciences of Xishuangbanna (XIAS), use the collection mostly for crop evaluation, genetic improvement and scanning for useful genes. Women farmers are involved in decision-making, especially about seed storage, seed distribution and the daily management of the gene bank.

## **Policy and legal environment**

The community gene bank has not yet been officially registered. If it can attain legal status, it will become more influential, standardized and sustainable. There is a need to better inform government agencies at all levels about the relevance of community gene banks. Currently, they do not understand the need for relevant laws and regulations, ensuring the normal operation of gene banks, standardized seed identification, registration and preservation, reproduction and use and distribution.

A series of laws and provincial and local regulations, promulgated in Yunnan, have had an impact on the conservation and sustainable use of agricultural biodiversity; examples are the provincial protection regulations for new varieties of registered horticultural plants and the agricultural environmental protection ordinance. However, in general, the institutional environment is not very supportive and awareness of the need to protect agricultural biodiversity is poor. One major problem is that farmers can easily be bypassed when it comes to registering intellectual property rights over biological resources. A more general problem is that laws are not enforced strictly and people tend not to obey them.

The research team has identified some effective ways to create an enabling policy and legal environment. These include the development of special regional laws and regulations that consider Yunnan's unique natural conditions and that offer strengthened special protection of its natural resources. A second alternative is to develop national agricultural biodiversity laws and a regulation system. A third mechanism is to increase government accountability for biodiversity conservation. Finally, there is a need to increase public awareness, education and training related to agricultural biodiversity. The research team has also proposed the establishment of a traditional variety protection system based on farmers' rights that encourages farmers to participate in regional and national germplasm conservation projects, strengthens community capacity development, promotes technology transfer and increases public financial support.

## **Sustainability and prospects**

To make the community gene bank more effective, its staff must be trained in areas such as documentation, seed procurement, handling and overall management. There is also a need to increase awareness of the community gene bank through television and local government communication channels, connect it with crop conservation activities at the regional level and attract more support from farmers' organizations in the province. We plan to strengthen ties with the YAAS gene bank, which has more experience in conservation, and also to learn from the national gene bank system. Achieving financial sustainability will require more support from local government and other local organizations.

All in all, there is still a long way to go to make the bank part of a national or international network of community gene banks. First, we must obtain

financial support from the local government and, at the same time, apply for national or international funding. Second, there is a need to continue creating awareness through diversity fairs; for further training in field crop cultivation and management and in pest and disease control; and for actively participating in conserving germplasm at the gene bank and through other crop genetic diversity activities.