Offering defence against pests and diseases

Bioversity International farmer-researcher field trials mark success at several levels

Worldwide, farmers lose more than 25% of their harvests each year due to crop pests and diseases that attack their fields. Pests and diseases not only affect farmers’ family food baskets and income, but they also affect how much food is available on global markets. Ironically, one solution to that loss can be found where the loss is occurring. Consider, for example, that there are some 1,200 varieties of bananas and thousands of varieties of beans – each of these varieties has its own level of resistance to pests, diseases and even to extreme weather conditions that could stem those losses. That is why Bioversity International has set up field trials, working with farmers who plant different varieties of the same crops next to each other in their fields, to see which combinations provide the most effective control against which pests and diseases. Initial results from around the world indicate change. Ugandan farmers have seen the presence of weevils that attack banana plants reduced by 75%. Smallholder farmers in Ecuador who planted diverse bean varieties harvested their crop in spite of a heat wave, while those who invested in one commercial variety lost everything. Chinese farmers in the mountains of Sichuan and Yunnan provinces identified their most resistant traditional maize and rice varieties and established community seedbanks to make them available. The Government of Morocco produced a film promoting the importance of genetic diversity in reducing crop pests and diseases for the general public.

Efforts to explain the importance of having a diversity of plant varieties in the field often fall back on the story of the Great Potato Famine in Ireland in the middle of the nineteenth century. Irish farmers grew only one variety of potato and when a blight hit, the entire crop was wiped out and a million people died of starvation. Yet in spite of what was learned from that shattering event, the story continues to repeat itself in farmers’ fields around the world. In recent decades, a corn leaf blight destroyed US$ 1 billion worth of monocropped corn in the US, while a banana fungus cost Central American countries nearly half of their banana yield.

For more than 15 years, Bioversity International has been studying the diversity in farmers’ fields and how they use it to manage threats. In 2006, it launched a major initiative in four countries – China, Ecuador, Morocco and Uganda – to take the study further by gathering data to show how crop diversity can be used to manage risk in the field, improve resilience and, of course, increase yields. Thus, researchers have walked through fields with farmers in the four countries – gathering information from them about what crops they grow, how many varieties they have, and what damage pests, diseases and weather bring to each variety. Using this data to compare the damage for households that only grow one variety compared to those that grow two, three or four varieties of the same crop, they have clearly shown a general decrease in damage when families grow more than one variety. And even more telling is what they call the ‘variance’ in damage, meaning with more diversity of crop varieties in the farmers’ fields, there is a reduction in damage extremes. For example, farmers who only grow a single variety will have a full harvest in a season when that variety has no threats, but they will be hit far worse in terms of crop damage when there is a change in the pathogen or pest type or in the climate.
Farmers living in rural poverty have much to gain from diversity

This type of work is especially important considering poor smallholder farming families that grow only one variety can be hit hardest by attacks of pests and diseases because they depend on what they grow themselves.

The study included six staple species important to smallholders – banana, barley, common bean, faba bean, maize and rice – and ensured that each crop was grown in at least two of the countries, and that the tools or methodologies could be used at every site so results would be comparable. Researchers found that most smallholder farmers used a portfolio of their crop varieties to protect against pest and disease attacks but often lacked knowledge about varieties from outside their own communities, had no access to quality seed or there was no policy in place to support their efforts to use this diversity with their fields.

In all countries, the varieties of the target crops were collected from each site and grown together in farmers’ fields, so that local farmers could document together with researchers the cross-site differences in how the varieties responded to pest and disease threats. Promising varieties were then further tested in research stations to integrate into national breeding and extension programs and for direct distribution and storage in community seedbanks and local seed exchange networks. The initiative put policymakers together with farmers and extension workers, to make sure everyone understands what the issues are, what the farmers need and how best to establish supportive policies.

Recognizing and building on farmers’ indigenous knowledge

The initiative has now given a scientific basis to the understanding that diversity within the crop can be an additional tool for farmers to minimize risk. Farmers in Uganda who grow diverse varieties of bananas and beans lose less of their harvest when there is high presence of pests or disease, and farmers in Ecuador lose less of their bean crop during weather extremes. But having enough diversity is not enough on its own. Success depends on the farming community having capacity to evaluate the benefits of planting diversity and to share the knowledge with others. In China, the initiative held seed fairs, demonstrations and workshops to teach farmers how to identify diseases and which varieties control which diseases. Ecuador’s farmers have enhanced their mixture of bean varieties by setting up a breeding system for a more diverse base. Uganda set up a community seedbank that now provides 30% of the bean seeds to farmers in the area. Morocco has passed a law that governs the geographical identification of agricultural products.

As the countries involved in the initiative focus on more efforts – such as establishing community seedbanks and seed exchanges and increasing consumer demand for more diverse and environmentally-friendly products – the farmers are strengthening their capacity. They are taking the initiative to collect, multiply and store seeds and to make diversity-based decisions that improve the productivity and resilience of their fields. The governments help farmers register their varieties in the national registries and, just as important, are treating farmers as suppliers of innovation and materials, rather than recipients of technology. It all adds up to a situation in which farmers themselves are able to take a more active role in the management of their fields, their genetic resources and, in turn, their futures.

Partners

China:

Research and academic institutions:
• Sichuan Academy of Agricultural Sciences
• Yunnan Academy of Agricultural Sciences
• Yunnan Agricultural University
• Kunming Institute of Botany, Chinese Academy of Sciences, Yunnan
• Guizhou Academy of Agricultural Sciences
• Liangshan Mountainous Plant Station, Sichuan
• Institute of Agricultural Science of Xishuangbanna, Yunnan
• Minzhu University of China

National and local governmental and extension agencies:
• Agricultural Extension Station of Xiding Community, Yunnan
• Department of Agriculture of Xishuangbanna Prefecture, Yunnan
• Bureau of Agriculture of Menhai County, Yunnan
• Bureau of Agriculture of Yuanyang County, Yunnan
• Bureau of Agriculture of Meitan County, Guizhou
• Bureau of Agriculture of Zhaojue County, Yunnan
• National Agricultural Technology Extension Service Center (NATESC), Ministry of Agriculture, Beijing
• Department of Finance of Yunnan

NGOs, community and farmer associations:
• Center for Biodiversity and Indigenous Knowledge (CBIK), Yunnan, China
• Center for Community Development Studies (CDS), Yunnan, China

Ecuador:

Research and academic institutions:
• Instituto Nacional Autónomo de Investigaciones Agropecuarias (INIAP)
• Facultad de Ciencias Agrícolas, Universidad Central del Ecuador
• Facultad de Ciencias Agrarias, Universidad Técnica Estatal de Quevedo
• Fundación para el desarrollo universitario, Universidad Técnica Estatal de Quevedo

National and local governmental and extension agencies:
• Ministerio del Ambiente
• Departamento del Ambiente de la Alcaldía de Saraguro
• Ministerio de Agricultura, Ganadería, Acuacultura y Pesca (MAGAP), Estrategia ‘Hombro a Hombro’
• Gobierno Provincial de Loja

NGOs, community and farmer associations:
• Unión de Organizaciones Campesinas e Indígenas de Cotacachi (UNORCAC)
• Asociación de Indígenas Saraguros de la Parroquia Tenta
• Junta Parroquial de Celén
• Junta Parroquial de Lluzhapa
• Fundación Kawsay
• Comunidad indígena de Caficapa
• Comunidad indígena de el Sauce
• Comunidad indígena de Gañil
• Asociación de San Cristobal, (La Mana)
• Asociación de Guasaganda (La Mana)
• Asociación de Narcisa de Jesus (La Mana)

Morocco:

Research and academic institutions:
• Institut Agronomique et Vétérinaire Hassan II (IAV Hassan II)
• Ministère de l’Agriculture et de la Pêche Maritime (MAPMA)
• Office National de Sécurité Sanitaire des Produits alimentaires (ONSSA)

National and local governmental and extension agencies:
• Direction Provinciale de l’Agriculture de Taounate (DPA Taounate)
• Office National des Conseillers Agricoles (ONCA): Entité Tissa, Entité Ourtzagh

NGOs, community and farmer associations:
• Association ‘Femmes d’initiatives, de développement et de bienfaisance’

Uganda:

Research and academic institutions:
• Plant Genetic Resources Center of National Agriculture Research Laboratories (NARL) of NARO
• National Crops Resources Research Institute (NACCRI)
• Makerere University
• National Agricultural Advisory Services (NAADS)

National and local governmental and extension agencies:
• Ministry of Agriculture Animal Industry and Fisheries (MAAIF), Department of Crop Protection
• Ministry of Local Government via the higher and lower Local governments of Nakaseke, Kichwamba, Kabwohe and Kabale-Rubaya
• Mbarara Zonal Agriculture Research and Development Institute
• Kachwekano Zonal Agricultural Research and Development Institute
NGOs, community and farmer associations:
- Advocates Coalition for Development and Environment
- CARITAS Kasanaensis in Nakaseke
- Uganda National Farmers Federation

Donors
- International Fund for Agricultural Development (IFAD)
- United National Environmental Program – Global Environmental Facility (UNEP-GEF)
- Swiss Agency for Development and Cooperation (SDC)
- Food and Agricultural Organization of the UN (FAO)

Links
- Crop biodiversity to reduce pest and disease damage

Publications