Diverse farming protects against climate change

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Responding to climate change is a challenge for global agriculture. In the coming decades, differences in rainfall, temperatures and the ranges of plants and pest species will transform agriculture. Developing countries are predicted to experience stronger impacts than others. For example, by the 2050s, densely populated river deltas in South and Southeast Asia are predicted to be prone to seawater flooding. At the same time, fresh water supplies are projected to decrease (IPCC 2007).

While GE (genetic engineering) continues to promise solutions, ecological farming delivers.

Genetically-engineered crops and climate change: hype vs. reality

Commercial GE crops remain focused on crops that are resistant to herbicides or that produce an insecticide. These traits are not related to climate change adaption.

GE is ill-adapted to the task of making cultivars more durable in the face of climate change-related stresses such as heat and drought. This is because management of such stresses in plants is usually controlled by complex genetic systems that involve interaction between large sets of genes and between the plant and its environment. By comparison, GE is limited to insertion of one (or a few) genes with relatively unsophisticated control over the timing and extent of gene expression, making GE far clumsier at gene expression than the complex regulatory systems naturally developed in plants.

Review of scientific literature, including the recent International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD),[1] indicates that the most effective strategy to adapt agriculture to climate change is by growing a greater diversity of crops and increasing genetic diversity of the crop varieties we grow.

Diversity adapts to change

Several recent studies have indicated the importance of diverse ecological farming in modern agricultural systems. These benefits can include improved resistance to disease and drought, as well as increased yields.

Faced with crop losses from rice blast disease, farmers in China's Yunnan Province who adopted a system of growing diverse rice varieties improved their yields by as much as 89%. At the same time, they conserved the genetic diversity of local rice types and reduced use of fungicides (Zhu 2000, 2003). It has also been found that a high level of genetic diversity protects Italian wheat harvests against drought (DiFalco 2006, 2008).

Similarly, planting different species more often is beneficial. In the US, researchers recently compared maize yields under different farming systems. They found that farmers who rotated their crop most often, and who planted cover crops, had yields over 100% higher than maize monocultures (Smith 2008).

Ecological breeding technique means better crop performance

In addition to growing more species and more diverse varieties, developing new varieties that include stress-related traits is a step that could help adaptation to climate change. If commonly cultivated types had greater tolerance of multiple stresses – for example heat, drought, and disease - they would be better suited for unpredictable and/or extreme climate change. The way to do this is through conservation of local germplasm and plant breeding, including use of a new technique called marker assisted selection (MAS).

MAS is a genetic technique that can make plant-breeding involving complex traits faster by taking advantage of gene-mapping. By tracking specific DNA fragments (markers) in the breeding process, breeders can more easily 'see' the result of their work, and more quickly and precisely move genes of interest into new varieties through conventional breeding. MAS breeding takes advantage of genetic markers but does not result in a transgenic plant.

Diverse ecological farming and modern conventional plant-breeding are the methods of choice to respond to climate change in agriculture. Genetic engineering does not provide the complex traits and sophisticated control over them that is needed to create crop varieties primed to withstand climate change. Investment in maintenance and development of on-farm diversity and plant breeding is agriculture's best option for food security in a changing world.

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1 The International Assessment of Agricultural Knowledge, Science and Technology for Development, completed in 2008, was a major international review of agriculture sponsored by the United Nations and governments. Its final report, Agriculture at a Crossroads is available online at http://www.agassessment.org/

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