SOAPBOX

A Harvest for 9.2 Billion

Pamela Ronald 5 · 19 Share

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The number of people on Earth is expected to shoot up from the current 6.7 billion to 9.2 billion by 2050. How will we feed them? If we continue with current farming practices, vast amounts of wilderness will be lost, millions of birds and billions of insects will die, and farm workers will be exposed to more and more chemicals. And still, we will not have enough food. Clearly, there must be a better way.

Some scientists and policymakers suggest that genetic engineering, a modern form of crop modification, will dramatically reduce our dependence on pesticides, enhance the health of our agricultural systems and increase the nutritional content of food. They believe these genetically engineered crops will help agriculture end decades of dangerous overuse of pesticides and toxic herbicides, leading us to a more ecological way of farming.

Will it? The organic farming community has been particularly vocal in its skepticism, viewing GE crops as unnatural, potentially unsafe to eat and environmentally disruptive. For these reasons, the National Organic Program standards currently do not permit their farmers to grow GE crops.

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Last month the National Research Council weighed in, publishing a comprehensive overview of the environmental, economic and social impacts of GE crops — the three essential pillars of sustainable agriculture. Their report supports the growing consensus that GE crops and ecological farming practices can coexist — and if we are serious about building a future sustainable agriculture, they must.

The NRC found that the use of GE crops over the last 14 years has led to improved soil quality, reduced erosion, massive reduction in insecticide use, higher yields, lower production costs and increased worker safety due to reduced exposure to harsh chemicals. Previous reports have noted that GE crops have not caused instance of harm to human health or the environment.

So are GE crops enough to feed the world?

A premise basic to almost every agricultural system (e.g., conventional and organic) is that seed can only take us so far. The farming practices used to cultivate the seed are equally important. That is why NRC scientists also outlined some of the pitfalls encountered when ecological farming practices are not integrated into the production of GE crops. For instance, one of the most environmentally benign and highly valued herbicides, glyphosate (sold as Roundup), is no longer effective in controlling some weeds because of an over-reliance on that single herbicide. The herbicide resistance that the NRC report documents is not due to the GE crop; it's due to repeated applications of glyphosate without integration of other weed-management tactics, a problem that has to be managed in all crops.

To understand how improved seeds and farming practices work together, you need only look at transgenic *Bacillus thuringiensis* (*Bt*) crops, which are genetically engineered to resist insect pests.

It has long been known that using just one resistant plant variety can spur natural selection for insects that overcome the resistance. Armed with this knowledge, *Bt* crops in the U.S. were deployed using a "refuge" strategy whereby farmers planted a certain percentage of their cotton acreage in non *Bt*-producing cultivars. This would provide pests a refuge where they could feed on plants lacking toxins, thereby maintaining *Bt* susceptible resistance alleles within the insect population.

It worked.

Today, *Bt* cotton farmers in Arizona spray half the insecticide as their neighbors who grow conventional crops yet harvest the same amount of cotton. *Bt* cotton is still an effective pest management tool. At the same time, these *Bt* croplands harbor a higher diversity of beneficial insects (as measured by ant and beetle biodiversity) compared to conventional farms because there are fewer insecticides sprayed that would kill them. In other parts of the world where an integrated approach was not implemented in *Bt* croplands, insect resistance has already evolved.

Another management problem associated with *Bt* crops has recently emerged in northern China where *Bt* cotton has been adopted by 95 percent of cotton growers. It controls the pest cotton boll worm so effectively that farmers dramatically reduced their insecticide applications. So much so, that other pests, called mirid bugs, normally controlled by these sprays, have emerged. As a consequence, farmers are again spraying some insecticides to control the mirids (although still a third less than before the introduction of *Bt* crops).

Ecologically based farming systems and GE crops alone won't provide all the changes needed in agriculture. Other farming systems and technological changes, as well as modified government policies, undoubtedly are also required. Yet it is hard to avoid the sense that ecological farming practices using genetically engineered seed will play an increasingly important role.

We need the best science and technology to achieve sustainable agriculture that will feed the world. Accomplishing this task will require globally coordinated efforts to integrate ecologically sound, but highly productive, agricultural practices, including many of the ideas promoted by organic farmers, such as crop rotation and crop diversity to global agricultural production.

We also need improved seed. This includes not only conventional tools for seed improvement, such as pollination, tissue culture, mutagenesis and grafting (mixing two species to create a new variety), but also modern molecular tools such as marker-assisted breeding and genetic engineering.

It is by looking beyond the ideologies that we will approach the shared goal of a sustainable agriculture that

will feed the world.

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