Beyond Genetically Modified Crops

By Jeremy Rifkin
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For years the life science companies -- Monsanto, Syngenta, Bayer, Pioneer Hi-Bred, etc. -- have argued that genetically modified food is the next great scientific and technological revolution in agriculture and the only efficient and cheap way to feed a growing population in a shrinking world. Nongovernmental organizations, including my own, the Foundation on Economic Trends, have been cast as the villains in this unfolding agricultural drama, and often categorized as modern versions of the English Luddites, accused of continually blocking scientific and technological progress because of our opposition to genetically modified food.

Now, in an ironic twist, new, cutting-edge technologies have made gene splicing and transgenic crops obsolete and a serious impediment to scientific progress.

The new frontier is called genomics, and the new agricultural technology is called marker-assisted selection, or MAS. This technology offers a sophisticated method to greatly accelerate classical breeding. A growing number of scientists believe that MAS -- which is already being introduced into the market -- will eventually replace genetically modified food. Moreover, environmental organizations that have long opposed genetically modified crops are guardedly supportive of MAS technology.

Rapidly accumulating information about crop genomes is allowing scientists to identify genes associated with traits such as yield, and then to scan "crop relatives" for the presence of those genes. Instead of using molecular splicing techniques to transfer a gene from an unrelated species into the genome of a food crop to increase yield, strengthen resistance to pests or improve nutrition, scientists are using MAS to locate desired traits in other varieties of a particular food crop, or its relatives that grow in the wild. Then they cross-breed those related plants with the existing commercial varieties to improve the crop.

With MAS, the breeding of new varieties always remain within a species, thus greatly reducing the risk of environmental harm and potential adverse health effects associated with genetically modified crops. Using MAS, researchers can upgrade classical breeding and reduce by 50 percent or more the time needed to develop new plant varieties by pinpointing appropriate plant partners at the gamete or seedling stage.

While MAS is emerging as a promising new agricultural technology with broad application, the limits of transgenic technology are becoming increasingly apparent. Most of the transgenic crops introduced into the fields express only two traits -- resistance to pests and compatibility with herbicides -- and rely on the expression of a single gene. This is hardly the far-reaching agricultural revolution touted by the life science companies at the beginning of the era of genetically modified crops.

Of course, marker-assisted selection researchers emphasize that there is still much work to be done in understanding the choreography -- for example, between single genetic markers and complex genetic clusters and environmental factors, all of which interact to affect the development of the plant and produce desirable outcomes, such as improved yield and drought resistance.

So, of course, a word of caution is in order. It should be noted that MAS is of value to the extent that it is used as part of a broader, agro-ecological approach to farming, one that integrates introduction of new crops with a proper regard for all the other environmental, economic and social factors that together determine the sustainability of farming.

The wrinkle here is that the continued introduction of genetically modified crops could contaminate existing plant varieties, making the new MAS technology more difficult to use. A 2004 survey conducted by the Union of Concerned Scientists found that non-genetically modified seeds from three of America's major agricultural crops -- corn, soybeans and canola -- were already "pervasively contaminated with low levels of DNA sequences originating in genetically engineered varieties of these crops." Cleaning up contaminated genetic programs could prove to be as troublesome and expensive in the future as cleaning up the viruses that invade software programs.

As MAS technology becomes cheaper and easier to use, and as knowledge in genomics becomes more dispersed and easily available over the next decade, plant breeders around the world will be able to exchange information about "best practices" and democratize the technology. Already, plant breeders are talking about "open source" genomics, envisioning the sharing of genes. The struggle between a younger generation of sustainable agriculture enthusiasts anxious to share genetic information and entrenched company scientists determined to maintain control over the world's seed stocks through patent protection is likely to be hard-fought, especially in the developing world.

If properly used as part of a much larger systemic and holistic approach to sustainable agricultural development, MAS technology could be the right technology at the right time in history.

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