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Some Final Food for Thought

This will be our final Biotech in Focus bulletin. We hope you have found the series informative and useful. As we've examined many detailed questions during the past several years, we have also tried to communicate a broader message about the role of biotechnology in agriculture. We'll revisit that message here.

Genes, the DNA instructions for making proteins, are responsible for the characteristics (traits) of living things. Over the course of evolution, genes have combined and recombined in new ways, even moving from one life form to another. As human society developed and improved farming techniques were used, we learned how to harness and shape these natural events through crop breeding and farming practices. We saved seed from our best plants to sow next year, and we discovered that crop rotations and cover crops conserved soil fertility and helped to manage pest populations.

In later centuries, crop breeding and farming practice advanced rapidly. Farmers learned to select both parent plants and mate them together, controlling more of the traits that seeds inherit. Eventually, tissue culture was used to combine plants that otherwise couldn't be breed. Mutagenesis—using chemicals or radiation to damage DNA—helped create new traits at a faster rate. Synthetic fertilizers and pesticides were evaluated and released. The newer pesticides were more specific in their action, less toxic to animals and were rapidly broken down in the environment. These newer pesticides are generally less to toxic than some of the older pesticides even those used for organic farming. Biological methods of pest control were created and refined, using predators, parasites, or sterile mates to target pest species.

In the 1980s, a new tool became available: recombinant DNA technology. We could build transgenes—new genes made from the DNA of different organisms—and add the transgenes to crop DNA, creating genetically modified (GM) crops with new traits.

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The Farmer's Toolbox

More tools are on the horizon. Some types of gene editing can make targeted DNA changes without permanently adding transgenes to the crop DNA. Regulatory agencies may decide not to define these crops as being genetically engineered.

Farmers and scientists have built a remarkable set of tools. Our current farmer's toolbox includes conventional agriculture that relies on synthetic inputs and organic farming that uses materials found in nature. Some practices, such as sustainable farming and integrated pest management, combine aspects of conventional and organic agriculture to promote crop production and environmental protection.

Another Tool In the Box

In the same way that a contractor uses every tool in the toolbox to build a house, farmers use all the agricultural tools we've invented to grow the food we need. Biotechnology is one more tool in the farmer's toolbox.

Facing Problems

GM crops do not solve all of the problems that farmers face. Like the farmer's other tools, genetic engineering is not a cure-all or magic bullet, but it can have benefits, such as crops that resist viruses or can be grown with less insecticide because they make their own pest-killing proteins.

Potential Benefit

For GM crops engineered for improved nutrition, such as grains of Golden Rice that contain Vitamin A, the potential benefits are great but untested.

Each tool in the farmer's toolbox comes with potential risks. Synthetic pesticides can kill non-target species and sicken farm workers, especially if applied unsafely. Organic farming typically produces lower yields. Genetic engineering can be used to generate a wide range of traits that have different risks and benefits. The scientists who breed and regulate GM crops work to limit those risks. Likewise, scientists are responsible for communicating to the public the risks and benefits of new technologies like genetic engineering. That has been the goal of Biotech in Focus, and we thank you for your readership.

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