Comparing Second Generation GE Crops to First Generation GE Crops

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In a little over a decade the adoption of genetically-modified or genetically-engineered crop varieties has increased dramatically (Figure 1). With this new technology comes a need to understand a new vocabulary or glossary of terms, including biotechnology, transgenic plants, Bt crops, HT crops, gene stacking, genetic engineering, and genetically modified organisms. These new crop varieties feature resistance to pests and the ability to tolerate herbicides.

First Generation and Second Generation Varieties

Input traits such as pest resistance and herbicide tolerance represent the first generation or wave of the new agricultural biotechnology, offering advantages to farmers in the production phase without changing the final product. Farmers' rapid-fire adoption of these varieties was propelled by potential cost savings, including reductions in input use—particularly chemical use—and conservation tillage. The first generation of genetically modified (GM) crops has the potential to increase farmers' net returns through savings in production costs, reductions in chemical use, increased flexibility in crops planted, and, in some cases, yield advantages.

The second generation or wave of genetic modifications focuses on output traits such as improved nutritional features and processing characteristics. Development of genetically modified organisms (GMOs) is an advance over conventional breeding techniques. The second generation varieties should have little or no direct impact on prices received by farmers, assuming the varieties are accepted by consumers and by other countries, because the products are basically indistinguishable from conventional crops. Output traits will, however, enhance the value of the crops for end-users, leading to more pronounced effects on pricing and marketing.

The driving forces behind the development of second generation GE crops include enhanced product quality, especially oils; stress tolerance (temperature, water); altered growth habits (biomass for alternative energy sources); and value-added proteins for pharmaceuticals. Cost savings, convenience, and reduction in management tasks for scouting, and simplification or elimination of pesticide (insecticide, herbicide, fungicide) use. Most of the new generation technology is not aimed explicitly at increasing yields, although yields may be effectively increased by cutting losses to pests or weeds, thereby protecting the yield potential of the particular hybrid. Benefits will vary from year to year and over different locations, depending on environmental factors.

References

Fernandez-Coprnejo and McBride. 2000.
USDA-ERS. "Adoption of Genetically Engineered Crops in the U.S."

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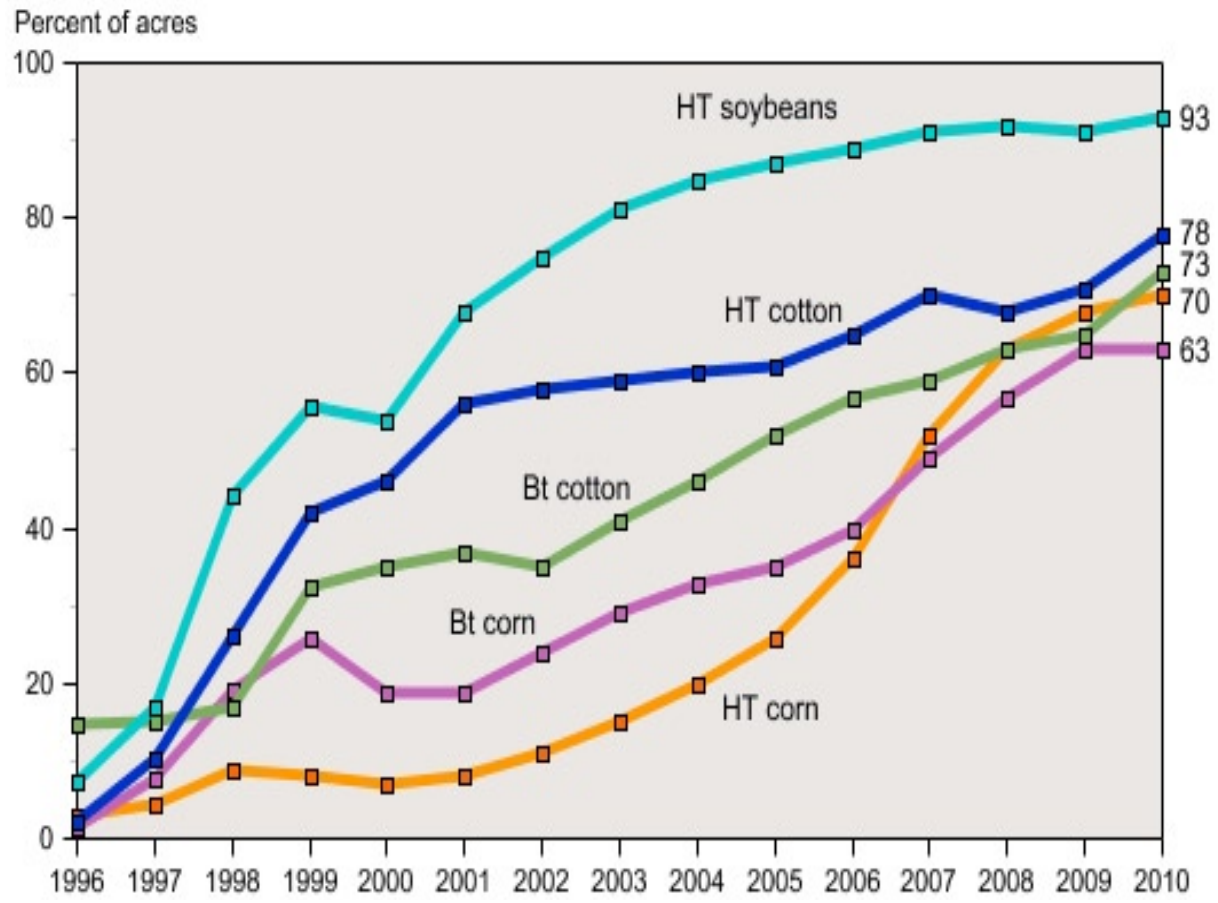

Figure 1. Rapid Growth in Adoption of Genetically Engineered Crops in the U.S.

Data for each crop category include varieties with both HT and Bt (stacked) traits.
Sources: 1996–1999 data are from Fernandez-Coprnejo and McBride (2000). Data for 2000–2010 are available in USDA-ERS (2010) Tables 1-3.