

By R.F. Meyer and J. Carpenter, Golden Plains Area Extension, Colorado State University Extension

Advances in biotechnology have changed the way American farmers produce food. Since 1995, when the first genetically engineered crops became available, American agriculture has been adopting these new tools rapidly. In fact, though not every nation is allowing this new technology to be used by their farmers, global adoption of biotechnology is increasing yearly.

Genetically engineered (GE) crops are described as those varieties that are developed through gene transfer using molecular DNA technology. Usually, the transfer is between species not related to each other. Thus far, the most popular GE crops are herbicide tolerant and insecticide producing crops. In addition to major crops such as corn, soybeans, and cotton, GE canola, summer squash, and papaya also are grown.

Grower impacts from planting GE crops include increased yields, easier and safer managing, a change in pesticide use, and potentially reduced input costs. Input costs are affected by both reduced pesticide applications and amounts, but can be partially offset by technology fees attached to some GE varieties.

Cotton farmers have adopted GE varieties quickly as a strategy against the cotton bollworm, an insect that attacks cotton in most of its production areas. Bt cotton produces its own insecticide, encoded by a gene from *Bacillus thuringiensis*, a naturally-occurring soilborne bacterium that is found worldwide and controls some insects. As a result, insecticide applications for the bollworm are mostly not necessary in cotton fields planted to Bt cotton.

In only five years after introduction of this technology, Bt cotton acres increased by 40 percent. In that time, bollworm insecticide use in the United States went from approximately 4.5 million pounds to 400,000 pounds. Further, the average number of cotton insecticide treatments per acre in Alabama was 6.7.

Today in Alabama, most cotton acres are planted to GE varieties and that insecticide application average now stands at less than one. Further, research after seven seasons of

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commercial cultivation of Bt cotton has indicated that little resistance to Bt has developed in insect populations.

Soybean farmers are adopting biotechnology advancements as well, with glyphosate tolerant (herbicide tolerant) varieties leading the way. Glyphosate is considered by many to be an environmentally friendly herbicide. In 1996, 2 percent of U.S. soybean acreage was planted to GE varieties, while only 7 years later, over 80 percent of the acreage was planted to GE varieties. Today, that figure is even higher. With glyphosate tolerant varieties, soybean farmers can control weeds easier while using no-till or reduced-tillage practices, decreasing soil erosion issues.

In addition, from 1996 to 2001, the use of the soybean herbicide Classic decreased by 53 percent and Pursuit, another popular soybean herbicide, decreased by 58 percent.

Genetically engineered corn varieties also are now available. Corn farmers are planting Bt corn in an effort to control the European Corn Borer, corn earworm and Corn Rootworm. These insects are the most damaging insect pests of corn throughout the United States with past annual losses exceeding \$1 billion.

In addition, new advances in corn technology are leading agriculture into a new era. Smartstax™ is a product developed between two separate brands and is a technology that combines 8 traits into a single hybrid. In addition, most major companies are developing GE corn drought events and future corn hybrids will carry their own resistance to diseases.

Not all crops, however, have been adopted into GE varieties. Genetically engineered potatoes comprised 4 percent of the acreage in 1999 with yearly acreage increases expected. Today, however, the potato GE acreage figure is non-existent.

A Wall Street Journal article reports that fast food chains were not ordering French fries made from GE potatoes due to perceived customer concerns. As a result, potato farmers continue to grow traditional varieties and do not plant genetically engineered potato varieties. In the end, consumers, or at least a companies' perception of consumer concerns, dictated the market trend for this particular crop.

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As agricultural biotechnology advances continue, American farmers will have future choices to make regarding adoption of these advances. But it will be consumers that will have the final say in the direction agriculture takes.