Genetically Engineered Foods
Cotton

#6 in a series

A Series from Cornell Cooperative Extension's Genetically Engineered Organisms Public Issues Education (GEO-PIE) Project

MORE THAN 70 PERCENT OF THE U.S. COTTON CROP IS NOW GENETICALLY ENGINEERED (GE). COTTONSEED OIL IS USED IN A VARIETY OF PROCESSED FOOD PRODUCTS.

Frequently Asked Questions

Am I eating genetically engineered cotton?

Yes. Although cotton is usually thought of as a fiber crop for textiles, cottonseed oil is also used in a variety of food products, including cooking oils, salad dressing, peanut butter, chips, crackers, cookies, and pastry crusts. Despite its somewhat rocky history of introduction (see below), GE varieties are widely grown in the United States and now account for more than 70 percent of the total U.S. cotton crop.

What new traits have been genetically engineered into cotton?

Insect Resistance

Roughly half of the GE cotton acreage carries *Bt*-based insect resistance. *Bt* is short for *Bacillus thuringiensis*, a common soil bacterium that produces an insect toxin. Applications of the *Bt* bacteria in powder form have been used to kill insects in agriculture for many years. Recently, several crops have been genetically engineered to produce their own *Bt* toxins, making them resistant to specific groups of insects. Varieties of *Bt* cotton provide resistance to several major insect pests of cotton, including the cotton bollworm, tobacco budworm, and pink bollworm.

Herbicide Resistance

Many GE cotton are resistant to certain herbicides. Farmers use the trait to simplify weed control: an herbicide applied to a cotton field will kill weeds without harming the cotton plants.

What is the history and prevalence of GE cotton?

The first GE variety of cotton marketed to growers was Calgene's "BXN" cotton, resistant to the herbicide bromoxynil (Rhone-Poulenc's "Buctril"). The seed was available in small supply to growers in 1995. Citing concerns over increased use of bromoxynil (which hadn't been applied directly to cotton before), the Environmental Protection Agency (EPA) allowed only temporary use of the herbicide on cotton crops, and limited BXN cotton to 3 percent of the total cotton acres. This temporary approval expired in April of 1997, and was not renewed again until May of 1998, this time allowing 10 percent of the U.S. crop to be BXN cotton. The EPA's restrictions have somewhat limited the adoption of BXN cotton, and it has been less widely grown than varieties resistant to the herbicide glyphosate (see below).

In 1996, two additional types of GE cotton were introduced by Monsanto through the Delta & Pine Land Co: the *Bt*-based insect-resistant "Bollgard" cotton and, on a much smaller scale, cotton varieties resistant to the herbicide glyphosate (Monsanto's "Roundup").

Bollgard cotton was quickly adopted. In 1996, one seventh of the U.S. cotton acreage was planted with Bollgard, even higher in some areas (60 percent of Arizona cotton acres the first year). Many cotton farmers were angered by Monsanto's contract stipulation that farmers would not save their seeds for replanting (despite the fact that most cotton growers don't save their seeds). In Texas, a heavy infestation of bollworm-- the insect pest Bollgard was supposed to protect against-- proved Bollgard to be less effective than farmers had expected, and lawsuits followed. The stock value of Delta & Pine dropped 18 percent in a single day. Yet by the end of the year, farmer evaluations of Bollgard were mixed but generally favorable.

The following year, Monsanto released of its "Roundup Ready" cotton, and it too was widely adopted the first year. By late summer, however, crop failures in Mississippi, hit hard by a drought, were blamed on the new varieties. Apparently Monsanto agreed, quietly compensating farmers several million dollars, and withdrawing several of its Roundup Ready varieties the following year.

Monsanto acquired Calgene in 1997 and in 1998 released cotton varieties combining *Bt*-based insect resistance with Calgene's bromoxynil resistance.

In the 1998 growing season, GE cotton accounted for 50 percent of all U.S. cotton. But bad press and public relation problems continued to plague Monsanto and its GE cotton. In 1998, Monsanto ignored the ruling of an independent arbiter and refused to pay a $1.94 million settlement to several Mississippi farmers who had lost money on Roundup Ready cotton (although Monsanto did volunteer to waive their "technology fees"). Shortly after this, Monsanto began to investigate farmers whom they suspected of saving their seeds, and then published their names in local newspapers.

Concurrently, the company was trying to acquire a "Technology Protection System" developed to make seeds sterile if saved by farmers for replanting—a system dubbed "Terminator Technology" in the press. Responding to public pressure, Monsanto eventually announced that it would no longer seek the technology.

Despite the controversies, GE cotton varieties have been increasingly popular among cotton growers. In 1999, 55 percent of U.S. cotton was genetically engineered, and that percentage rose to 61 percent in 2000, 68 percent in 2001, and 71 percent in 2002. Roughly half of this percentage is herbicide-resistant varieties, and the other half is either *Bt* or a combination of *Bt* and herbicide-resistance. *Bt* cotton is also grown on a smaller scale in China, Australia, Mexico, South Africa, and Argentina.

Are there environmental risks or benefits associated with GE cotton?

To date, genetically engineered cotton varieties provide one of the clearest examples of a notable environmental benefit: *Bt*-based insect resistant varieties require application of substantially fewer insecticides. Unlike other *Bt* crops, *Bt* cotton provides resistance to several major insect pests of the crop, allowing greater reduction in insecticide use.

The main issue associated with herbicide-tolerant crops is whether they increase or decrease agricultural herbicide use. Herbicide tolerant cotton may be grown with a smaller number of herbicide applications, but it is less clear if the varieties require a smaller quantity of herbicides (in pounds applied per acre). Additionally, some sources have argued that the herbicides applied to GE cotton are less harmful than the herbicides they are replacing.

For more information on this topic, see GEO-PIE fact sheet 11, *Environmental Safety and Genetically Engineered Crops.*

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