

Corn

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

ROUGHLY 32 PERCENT OF U.S. FIELD CORN, WHICH IS USED IN A WIDE ARRAY OF FOOD INGREDIENTS, IS GENETICALLY ENGINEERED (GE). GE VARIETIES OF SWEET CORN ARE LESS COMMON, AND THERE IS NO GE POPCORN CURRENTLY MARKETED.

Frequently Asked Questions

Am I eating genetically engineered corn?

Yes. Thirty-two percent of the U.S. corn crop in 2002 was GE corn hybrids. Because GE corn is not separated from conventional corn by mills and processors at harvest time, all corn-based food ingredients are very likely to have been made from a mixture of GE and non-GE corn varieties. Corn-based food ingredients include corn starch, flour, masa, corn syrup, corn oil, sweeteners, baking powder, alcohol, fillers used in pills and tablets, and nutritional supplements such as vitamin C. Sweet corn—in the form of fresh ears—is much less likely to be genetically engineered (3 to 5 percent of the U.S. crop). Most U.S. processors of canned sweet corn do not use GE varieties at all, and there is no GE popcorn on the market.

What new traits have been genetically engineered into corn?

The most common trait genetically engineering into corn is “*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. *Bt*-corn varieties provide resistance to the European corn borer, a moth larva that damages corn by burrowing into stalks.

Some corn varieties have been genetically engineered to be resistant to certain herbicides. In this case, the corn plant has been engineered to “detoxify” a chemical herbicide, allowing the plant to grow when other susceptible plants would not. The trait is used by farmers to simplify weed control: an herbicide applied onto a corn field will kill weeds without harming the corn plants.

What is the history of GE corn?

From the start, several companies were competing fiercely to sell the first GE insect resistant corn. Ciba-Geigy and its corporate ally Mycogen were the first companies to release

genetically engineered corn with *Bt*-based insect resistance, and the hybrid varieties were first grown by farmers in 1996. But Monsanto and Dekalb—also racing to develop *Bt* corn—held some critical patents for the new technology and had been fighting legal battles with their competitors since the mid-1980s. With the release of Ciba's and Mycogen's *Bt* corn hybrids, a new era of lawsuits and corporate mergers was initiated.

Behind the scenes, the battle lines were drawn between two competing camps. On one side was Ciba-Geigy (renamed Novartis after its 1996 merger with Sandoz Pharmaceuticals) and Mycogen. Pioneer Seeds entered the alliance when it purchased critical shares of Mycogen in 1995, and Pioneer itself was later purchased by DuPont. On the competing side, Monsanto allied itself with Dekalb through a technology-sharing agreement in early 1996 (Monsanto later bought Dekalb outright in 1998). Northrup King also entered the fray, developing its own hybrids of *Bt* corn using technologies licensed from Monsanto. Between these companies (and others) literally dozens of patent-infringement lawsuits were filed back and forth over the next few years. By 1999, the *Bt* battle had largely coalesced into a fight between Monsanto and Novartis.

But despite the behind-the-scenes legal battles, the popularity of *Bt* corn has steadily increased. Monsanto and Dekalb first sold their own “YieldGard” hybrids of GE corn in 1997, only a year behind Ciba and Mycogen. Shortly after that, Monsanto (and allies) marketed hybrids of GE corn resistant to their proprietary herbicide “Roundup”. By the year 2000, about 25 percent of the U.S. corn crop was planted with GE hybrids—the majority of that to *Bt* corn (72 percent), and the balance to herbicide-resistant varieties (24 percent) or some combination of both (4 percent). Their prevalence increased again slightly in 2001 and 2002.

Finally, coming late into the game, Aventis CropScience (formerly AgrEvo) hoped to sidestep the legal battles over *Bt* corn by developing its own, proprietary version of the technology. But their version of the *Bt* gene, “CRY9C,” raised concerns with regulators at the Environmental Protection Agency (EPA): it was unclear whether Aventis' version could cause allergic reactions in humans. In 1998, Aventis and the

EPA temporarily agreed that "StarLink"— the trade name used by Aventis— could be marketed for animal and industrial uses only, until questions about human food safety could be clarified. However, in September of 2000, news broke that StarLink had in fact entered into the human food supply, triggering widespread and costly food recalls— despite the lack of evidence that the corn actually caused any allergic reactions.

For more information about StarLink corn, see GEO-PIE fact sheet, *StarLink Corn in Taco Shells*.

Are any environmental risks or benefits associated with GE corn?

The most frequently-cited concern with GE corn varieties is the possibility of pollen drift from corn fields. Although there are no wild corn relatives in the U.S. that could be pollinated by GE corn, it is possible that GE corn could pollinate a nearby non-GE corn field, which would be a potential problem for

growers attempting to produce GE-free corn. Some early laboratory studies suggested that Monarch butterfly larvae may be affected by GE corn pollen, but more recent field studies have demonstrated this risk is negligible.

There are some reports that GE corn may reduce pesticide use, but the reductions are probably not very large. Pesticide control of the European corn borer is not common, and farmers appear to be adopting the varieties as "insurance" against pest outbreaks rather than to allow a reduction in pesticide application. Pesticide reductions may be more substantial in sweet corn production— which is much more pesticide intensive than field corn production— but GE varieties of sweet corn are not widely grown.

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

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