

Today's GE crops allow farmers to become more dependent on specific toxins in managing pests, and have dramatically increased overall pesticide use.

Will the rapid spread of resistant weeds push conventional farmers over the cliff?



The First 13 Years of GE Crops

Turbocharging the Pesticide Treadmill

Genetically engineered (GE) crop varieties were introduced commercially in 1996 and now dominate the production of corn, soybeans, and cotton in the United States. GE crops contain one or both of two major introduced traits:

- Herbicide-tolerant (HT) crops are genetically engineered to survive direct applications of herbicides. Glyphosate, or Roundup, is the herbicide applied to the vast majority of HT crops.
- *Bt* crops are engineered to produce toxins from the natural bacterium

Bacillus thuringiensis (*Bt*) in plant cells. These toxins are lethal to certain insect pests. GE crops were developed to alter how farmers manage pests. Today's GE crops allow farmers to become more dependent on specific toxins in managing pests, but do nothing to increase inherent yield potential.

In short, today's GE crops are high-tech pesticide-delivery systems. They are designed to enhance reliance on specific toxins and herbicides, and hence it is no surprise that GE crops have impacted pesticide use since 1996.



Key Findings

Bt corn and cotton were grown on 357 million acres, between 1996 and 2008, with corn accounting for 79% of these acres.

About 1.3 billion acres of HT and *Bt* crops have been grown between 1996 and 2008. HT crops account for 72% of total GE crop acreage.

Farmers planted 941 million acres of herbicide-tolerant corn, soybeans and cotton from 1996 through 2008. HT soybeans accounted for two-thirds of these acres.

HT crops have increased herbicide use by a total of 383 million pounds over 13 years, HT soybeans accounted for 92% of total increase.



How Close is the Cliff?

Impacts on Pesticide Use

GE crops increased overall pesticide use in the U.S. by 318 million pounds over the first 13 years of commercial use (1996–2008), or over 20%, compared to what it would likely have been in the absence of HT and Bt crops.

The good news is that the two Bt crops have reduced insecticide use by about 64 million pounds over the first 13 years of use. Bt corn reduced insecticide use by 32.6 million pounds, or by about 0.1 pound per acre. Bt cotton reduced insecticide use by 31.6 million pounds, or about 0.4 pounds per acre planted.

The bad news, which is getting worse each year, is that herbicide-tolerant crops increased herbicide use by 383 million pounds. The approximate average increase in herbicide use of 0.55 pound per acre planted to HT soybeans accounted for 92% of the total increase in herbicide use across the three HT crops.

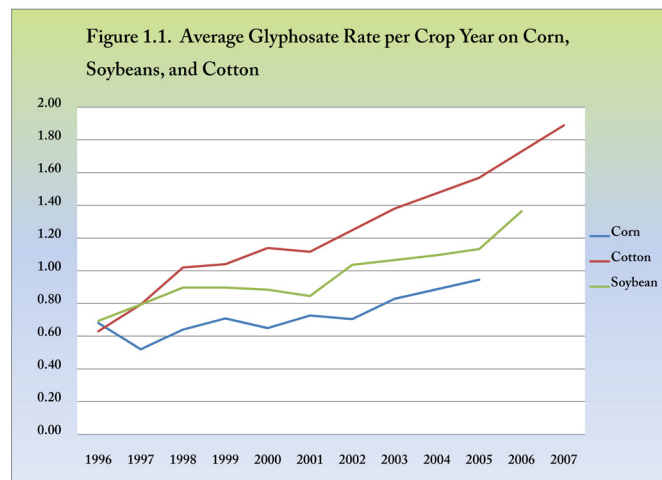
GE crops did reduce overall pesticide use in the first three years of commercial introduction (1996–1998), roughly 2% per year, but increased pesticide use by 20% in 2007 and by 27% in 2008.

Rising rates of glyphosate application (i.e., dose rates), are shown in Figure 1. Higher rates coupled with the need to make multiple applications during a crop year, are driving upward the margin of difference

in the pounds of herbicides needed to control weeds on an acre planted with HT seeds, in contrast to conventional seeds.

Progress made by the pesticide industry in discovering more potent active ingredients effective at low rates is a second factor driving up the margin of difference. For example, corn insecticides targeting the corn rootworm were applied at about 0.7 pound per acre in the mid-1990s and roughly 0.2 pound a decade later.

The cause of rising pesticide use on GE crops is clear – far too much reliance on chemical herbicides in general, and on one herbicide in particular. Excessive reliance on glyphosate, made possible by GE crops, has triggered the emergence of dozens of weed species resistant to glyphosate. Progressively more intense use of glyphosate each year assures that



more resistant weeds are on the way, and that today's already resistant weeds will spread far and fast across the agricultural landscape.



Curtis Burgess, 16, works with a chopping crew outside of Hughes, Arkansas. Cotton farmers have resorted to hand weeding to save crops infested with glyphosate-resistant pigweed. Photo by Brad Luttrell

The Perfect Weed

Resistant weeds are already regarded as a major threat to the sustainability of U.S. cotton and soybean production in the Southeast.

Thousands of acres of cotton have been abandoned in the last few years because of out-of-control resistant weeds. Two major players in the GE seed and pesticide industry – Monsanto and Syngenta – are offering to pay farmers rebates on the order of \$12 per acre to spray herbicides that work through a different mode of action than glyphosate, in the hope of slowing the spread of resistance.

Monsanto's program will even pay farmers to purchase herbicides sold by competitors, a sign of how seriously Monsanto views the threat posed by resistance to its bread and butter product lines.

But inevitably, overall pesticide use is bound to continue rising on GE corn, soybeans, and cotton.

For more details on the impacts of GE crops on pesticide use, see the TOC report entitled "Impacts of Genetically Engineered Crops on Pesticide Use in the United States: The First Thirteen Years". The report is available free of charge via the The Organic Center's website (<http://www.organic-center.org/science.tocreports.html>).



sometimes the greatest ideas are the simplest.



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