Questions Farmers Ask About Agricultural Genetic Engineering

What are GMOs?

"GMO" stands for "genetically modified organism." In agriculture, it usually refers to plants that are modified by inserting genes from other organisms that have been engineered into them to change the plant in some way. For instance, GMO soybeans can be sprayed with herbicides that would kill a conventional soybean, and GMO corn produces its own insecticide. GMOs can look just like conventional crops but at the molecular level they are different.

Is genetic engineering just like conventional breeding?

Traditional breeding observes the biological boundaries that nature placed between species. Genetic engineering transfers modified genes between totally unrelated species and adds in newly created genes that assist in the engineering process, such as "promoters" made from viruses which are used to overcome a plant's natural defense mechanisms. GMOs are alive, able to reproduce and could effect the environment in unpredictable ways. GMOs are especially prone to out-crossing. For instance, a University of Chicago study, published in the scientific journal *Nature*, found that transgenic plants were 20 times more likely to interbreed with related plants than traditionally produced plants.[1]

How is genetic engineering currently being used in agriculture?

About 100 million acres of GMO crops were planted in 1999, with 99% in just three countries: the United States, Argentina and Canada. The most common GMO crops are those used for weed control, called "herbicide tolerant" (HT) crops. They are engineered to withstand being sprayed with broad spectrum herbicides, which kill the weeds but not the crop. They make up 71% of all transgenic crops.[2] HT soybeans made up 54% of the world's soybean crop, grown on about 53.4 million acres worldwide, mainly in the U.S. and Argentina. In 1999, worldwide, HT cotton was grown on about 4 million acres, HT corn was grown on 3.7 million acres, and HT canola, widely grown in Canada, covered 8.6 million acres.

The second most common GMO crops are used for insect control. They are called "Bt" crops because they produce a genetically engineered form of "Bt" (*Bacillus thuringiensis)* a pesticide that comes from a naturally occurring soil bacterium. Bt crops such as corn, cotton and potatoes account for about 22% of GMO crops and were planted on 21.9 million acres worldwide in 1999. Other GMO crops such as fruits and vegetables with virus resistance and combined "stacked gene trait" crops make up the rest of the products currently available.

Have genetically engineered crops had any field performance problems?

Studies of Roundup Ready (RR) soybeans— which make up 54% of the worlds GMO crops—show that they produce, on average, between 6.7 to 10% less than comparable conventional varieties.[3] A University of Nebraska study released in May 2000 found consistent "yield drag" of RR soybeans of between 6 to 11%.[4] Two agronomists at Iowa State University suggested that, while the cause of this

problem is not yet known, genetic engineering could limit a plant's productivity and even affect its nutritional qualities.[5]

Although manufacturers test GMO crops carefully to avoid marketing defective products, a few HT crops have suffered serious deformities, from stem splitting in soybeans under heat stress[6] to deformed plants and boll drop in HT cotton, leading to the withdrawal of five varieties.[7] The EPA has established standards for insect resistance management plans for Bt crops, including planting buffer zones, to reduce both contamination from pollen flow and their environmental impacts, but it's unclear whether or not this approach will be effective[8].

Are U.S. regulatory agencies testing GMOs for human health and environmental safety?

Three federal agencies are responsible for regulating GMOs in the U.S.: the Food and Drug Administration (FDA), the US Department of Agriculture (USDA), and the Environmental Protection Agency (EPA). None of these agencies perform independent tests for impacts on human health or require any independent analysis because of a FDA policy decision, made in the early 1990's, that determined GMOs to be "substantially equivalent" to conventional crops. The regulatory system is basically passive and the agencies rely on information that is voluntarily submitted to them by GMO manufacturers. Because GMOs have been essentially deregulated, the long term human health and environmental hazards have not been studied.

What are the links between GMOs and corporate control in agriculture?

As corporate consolidation increases the control of agribusiness over the farm economy, farmers have less leverage over prices and market access. The use of GMOs increases the control of corporations over farmers because GMO seeds and inputs are only available when farmers enroll in the manufacturer's highly restricted and expensive technology program. Food and agribusiness companies are responding to the increasing consumer backlash against GMOs. Here in the U.S., polls taken by news organizations and industry show that as much as 93 % of Americans want labels on GMO products. This controversy has created an uncertain economic situation for farmers.

For more information on the economic issues, see the International Market Overview fact sheet.

What about segregation and testing of GMOs?

GMOs are being segregated from non-GMO crops because domestic and foreign buyers are demanding them and farmers can get premiums for segregated varieties. The testing and traceable handling methods used to prevent contamination, and produce an audit trail for non-GMO certification, is a system called Identity Preservation (IP). Neither an "official" system of certification and testing, nor the allowable levels of GMO contamination for sales contracts, have been established yet for non-GMO crops. Tests can vary in their accuracy and reliability. "PCR" or polymerase chain reaction testing detects the presence of any modified genes but is a more expensive and complex laboratory technique. There are a half dozen testing companies in the United States, some of which produce lower cost "strip" tests that can detect GMOs at certain levels, but for detecting low levels of GMO contamination, the PCR method is preferred. On-farm segregation, sampling and testing are added costs that decrease the farmers' bottom line, as well.

What legal issues are farmers concerned about?

- Liability is a major issue for farmers. Farmers who plant GMOs may inadvertently contaminate the conventional or organic crops of nearby farmers, or GMO contamination can occur during transportation or processing, resulting in possible financial responsibility.
- Insurance is not available that covers risks of losses specifically related to GMOs.
- Farmers may face the responsibility of disproving any accusations against them that seed companies might make. In fact, most Technology Use Agreements (TUAs) give GMO manufacturers the right to inspect your records and to enter your property.
- GMOs are patented, which puts legal control over them in the hands of multinational corporations. This erodes farmers and public research agencies involvement in seed research, development and production and is already reducing farmer planting options. It also adds to the increasing corporate concentration in agriculture.

For more information see "Questions Farmers Ask About Legal Issues and GMOs."

What are the benefits of GMOs and who are they for?

This technology is an invention that is still in search of a necessity. While farmers may realize some convenience with easier weed and insect control in the short term, in the long term the environmental damage and economic losses may be the real issues. But GMO companies aren't taking any chances. They have launched a massive $53 million a year advertising campaign aimed at getting farmers to plant GMOs and the public to believe their pitch—that "biotechnology" is a good idea. Polls show that consumers at home and abroad aren't buying the message. And the consumer backlash reveals that GMOs do not offer consumers any particular benefits, while raising significant concerns. The recent international Angus Reid poll found that 65% of American consumers would reject GMO foods if given a choice. The rejection rates in Europe and Asia are as high as 85-90% and the negative trend is growing. What farmers are concerned about, according to the August 2000 Iowa Farm and Rural Life Poll, is the increasing concentration of the food supply in the hands of a few large corporations.

This fact sheet was written by Claire Cummings in collaboration with the Farmer to Farmer Campaign. For additional information on genetic engineering in agriculture, please call (800) 639-FARM. Fact sheet prepared September 2000.

[1] *Bergelson, Joy, et. al. "Promiscuity in Transgenic Plants." Nature, Vol. 395: September 1998.*

[2] *International GMO crop data from "Global Review of Commercialized Transgenic Crops" 1999 International Service for the Acquisition of Agribiotechnology Applications (ISAAA) http://www.agbiotechnet.com/reports/isaaa_briefs/Brief12.pdf*

[3] *Benbrook, Charles. Evidence of the Magnitude of the Roundup Ready Soybean Yield Drag from University- Based Varietal Trials in 1998, Technical Paper Number 1, July 13, 1999.*

More than 30 articles on yield drag are available at www.btinternet.com/~nlpwessex/Documents/yieldproblems.htm

[4] *Soybean Scorecard, Nebraska Farmer, August 2000.*

[5] *Liebman, Matt and E. Charles Brummer. "Impacts of Herbicide Resistant Crops", March 2000.*

[6] *Coghlan, Andy. "Monsanto's modified soya beans are cracking up in the heat", New Scientist, November 20, 1999*

[7] *Bloomberg Business News, February 21, 1998.*

[8] *See the EPA website for details: http://www.epa.gov/pesticides/biopesticides "Best Management Principles for IRM for Bt Crops"*