Executive Summary

Nothing is more fundamental to agriculture and our food supply than seeds. Whether eaten directly or processed through animals, seeds are the ultimate source of human nutrition. The variety, abundance, and safety of foods are all dependent on the availability and quality of seeds.

The prowess of genetic engineers notwithstanding, seeds cannot be made from scratch. They must be harvested, saved, and shepherded from generation to generation by knowledgeable, engaged individuals. The value to the food supply of the seeds entrusted to our generation cannot be overstated.

In this report, the Union of Concerned Scientists (UCS) examines a new phenomenon that may threaten the quality of the seed supply: the contamination of traditional seeds by DNA sequences derived from genetically engineered crop varieties. These varieties are produced by molecular techniques—variously known as genetic engineering, genetic modification, or transgenic techniques—that allow scientists to move novel traits into plants from distantly related organisms such as animals and bacteria.

The number of transgenes that might potentially contaminate the seed supply is large. Although most commercial transgenic varieties of corn, cotton, soybeans, and canola contain only two traits (herbicide and insect resistance), hundreds of other novel genes have been engineered into crops that have been field tested but have not been, and may never be, commercialized.

Most of the transgenes used by genetic engineers are new to foods and some are not intended for use in foods at all. For these and other reasons, concerns have arisen about the possibility that transgenes introduced into crop varieties through genetic engineering might unintentionally contaminate the seed supply for traditional, or non-genetically engineered, varieties of crops.

The research covered in this report addresses that possibility with a small pilot study of seeds of traditional varieties of three major food crops: corn, soybeans, and canola. The study found that the seeds of traditional varieties bought from the same retailers used by U.S. farmers are pervasively contaminated with low levels of DNA sequences originating in genetically engineered varieties of those crops.

Our conclusion:

Seeds of traditional varieties of corn, soybeans, and canola are pervasively contaminated with low levels of DNA sequences derived from transgenic varieties.

This conclusion is based on tests conducted by two respected commercial laboratories using duplicate samples of seeds of six traditional varieties each of corn, soybeans, and canola. One laboratory detected transgenically derived DNA in 50 percent of the corn, 50 percent of the soybean, and 100 percent of the traditional canola varieties tested. The other laboratory detected transgenically derived DNA in 83 percent of the traditional varieties of each of the three crops. The most

conservative expression of the combined results is that transgenically derived DNA was detected in 50 percent of the corn, 50 percent of the soybean, and 83 percent of the canola varieties tested.

Other than suggesting that the levels are low, the pilot study is too limited to support quantitative estimates of overall contamination levels in seeds of traditional crop varieties. The data available lead us to expect levels of contaminated seed roughly in the range of 0.05 to 1 percent, but larger studies are needed to determine contamination levels with any degree of precision.

In the interim, we are concerned that the significance of low-level contamination might be too quickly dismissed. Contamination levels in the 0.05 to 1 percent range would represent huge absolute amounts of seed. To illustrate, we calculated the tonnage of transgenically contaminated corn seeds that would have been planted in fields of traditional corn varieties if the seed supply were contaminated at a one percent rate. Our calculations, based on U.S. Department of Agriculture (USDA) data on corn acres planted with traditional varieties in 2002, suggest a total of 6,250 tons of transgenically derived seeds—an amount that would fill 240 large tractor-trailer trucks.

Most of the specific DNA sequences for which the laboratories tested are found in popular transgenic crop varieties currently allowed on the U.S. market. Although the study sheds little light on how the seed contamination occurred, there is no reason to believe that the transgenes detected in this study are the only ones moving into the traditional seed supply.

Instead, it seems likely that the contamination is a symptom of generally porous seed production and distribution systems. Until we know otherwise, it seems minimally prudent to assume that novel genes originating in less popular transgenic varieties, as well as the hundreds of engineered varieties that have been field tested in the United States, could potentially contaminate the seed supply of food and feed crops.

IMPLICATIONS

The recognition that the seed supply is open to contamination by low levels of a wide variety of genetically engineered sequences has broad implications. In general terms, seed contamination is important for two reasons. First, seeds reproduce and carry genes into future generations. Every season of seed production offers new opportunities for the introduction of new genes. In the case of genetic engineering, transgenic sequences that enter the seed supply for traditional crop varieties will be perpetuated and will accumulate over time in plants where they are not expected and could be difficult to control.

Second, seeds are the wellspring of our food system, the base on which we improve crops and the source to which we return when crops fail. Seeds will be our only recourse if the prevailing belief in the safety of genetic engineering proves wrong. Heedlessly allowing the contamination of traditional plant varieties with genetically engineered sequences amounts to a huge wager on our ability to understand a complicated technology that manipulates life at the most elemental level. Unless some part of our seed supply is preserved free of genetically engineered sequences, our ability to change course if genetic engineering goes awry will be severely hampered.

Seed contamination by transgenically derived sequences also has implications in a number of other regulatory and policy contexts. Pharm crops, trade, and organic food production are discussed briefly in this summary, but our report also addresses implications for food safety, the environment, intellectual property, the food system, and the agriculture of developing countries.

Pharmaceutical and industrial crops receive special attention in this report because the trans-

genic products they make—drugs, vaccines and industrial chemicals—would raise immediate alarms if they contaminated the food supply, and seed contamination is the back door to the food supply. The realization that seeds for food crops are vulnerable to contamination with pharm and industrial transgenes and that, in fact, some seeds may already have been contaminated is alarming. The report urges prompt action to protect seed production from these sources of contamination.

On the trade front, U.S. grain and oilseed exporters face enormous challenges in a global marketplace bristling with regulatory regimes that apply to genetically engineered crops. U.S. companies need to assure export customers that grain and oilseed shipments do not contain unapproved transgenes and transgenic crop varieties. While gene flow and physical commingling during production and transport probably account for most of the unapproved transgenes and transgenic seed varieties present in exported grain and oilseed, traditional crop varieties carrying transgenically derived sequences may also contribute to the problem. Contamination of the seeds of traditional plant varieties also makes it difficult to supply commodity products free of genetically engineered sequences to those customers who want them.

Transgenic contamination of traditional seed varieties poses a special threat to the future of organic agriculture, an increasingly important sector of U.S. agriculture. To meet both consumer demand and federal standards that forbid the use of genetically engineered crops and inputs, organic growers strive to produce crops that are free of transgenically derived DNA. If, through no fault of their own, they are unable to supply such products, they potentially face eroding markets. The ease with which the traditional seed supply can be contaminated with transgenically derived DNA unfairly frustrates organics farmers seeking to deliver high-quality products.

RECOMMENDATIONS

UCS hopes that, as a result of this report, the seed and food industries, the scientific community, and the federal government will begin to acknowledge and confront the issues raised by the contamination of the traditional seed supply with sequences originating in genetically engineered crops. While not entirely reversible, this contamination can be substantially reduced. With sufficient attention and will, it is possible to look forward to sources of seeds that are free of genetically engineered sequences. The first step, however, is acknowledging and understanding the problem.

More specifically, UCS recommends the following actions:

1. The USDA should sponsor a full-scale investigation of the extent, causes, and impacts of contamination of the traditional seed supply by transgenically derived DNA sequences.

2. The USDA, the Food and Drug Administration, the Environmental Protection Agency, and appropriate coordinating elements of the federal government should amend the regulations for transgenic pharm and industrial crops to ensure that the seed supply for food and feed crops is not contaminated at any level with drugs, vaccines, plastics, or related substances.

3. The USDA should establish a reservoir of seeds for non-engineered varieties of major food and feed crops free of transgenically derived sequences.

4. The USDA and land-grant (agricultural) universities should reinvigorate the public plant breeding establishment to help ensure a supply of pure seed of traditional crop varieties.

5. The Association of Official Seed Certifying Agencies should establish a national standard

for breeder and foundation seed of traditional crop varieties: no detectable level of contamination by transgenes and associated sequences originating in genetically engineered crops.

6. The USDA, the organic agriculture community, land-grant universities, and plant breeders should develop new policies and programs to provide organic agriculture with pure seeds of traditional crop varieties.
7. The USDA, the organic and biotechnology industries, and national growers' associations, among others, should sponsor a series of meetings to begin addressing how those sectors of U.S. agriculture that have adopted transgenic crops and those threatened by contamination with transgenically derived DNA sequences from those crops can coexist.
8. Private seed companies in the United States should periodically test their seed stocks, especially breeder and foundation seed and parental inbred lines, for the presence of transgenically derived DNA sequences. They should then make public the extent to which the seeds of the traditional varieties they market are free of transgenically derived contaminants.