United States Department of Agriculture

*A report summary from the Economic Research Service*

February 2016


Find the full report at *www.ers.usda.gov/publications/eib-economic-information-bulletin/eib-149*

# Economic Issues in the Coexistence of Organic, Genetically Engineered (GE), and Non-GE Crops

Catherine Greene, Seth J. Wechsler, Aaron Adalja, and James Hanson

## What Is the Issue?

In 1996, U.S. farmers began using genetically engineered (GE) crop varieties containing traits to tolerate herbicides and resist pests in major field crop production. As of 2014, GE varieties had been adopted on over 90 percent of U.S. corn, soybean, cotton, canola, and sugar beet acreage to help producers manage crop pests more easily and effectively. A much smaller percentage of alfalfa, sweet corn, squash, and papaya crops were cultivated using GE varieties. Recently, USDA deregulated (approved) GE varieties for two of the most widely grown fruits and vegetables in the United States—apples and potatoes. Potatoes are the top U.S. vegetable crop in terms of acreage, with over a million acres in 2014, and account for 15 percent of total vegetable farm sales. Bearing apple trees occupied 322,000 U.S. acres in 2014, and apples are the second most popular fresh fruit (after bananas) in America. The addition of these two commodities to the GE roster may heighten issues related to GE/non-GE commingling of crops and products.

GE crops are now widely used to produce processed foods and food ingredients, such as corn chips, breakfast cereals, soy protein bars, corn syrup, cornstarch, corn oil, soybean oil, and canola oil. The small, longstanding market for organically grown food (which excludes GE seed and material) continues to expand and a market for conventionally grown foods produced without GE seed has also emerged. The coexistence of organic, conventional non-GE, and GE production systems has its challenges, however, because GE crop production can increase costs for organic and non-GE producers via accidental pollination or the commingling of materials all along the supply chain.

Many U.S. food retailers sell organically grown food, including their own organic product lines, and some have recently begun developing their own non-GE brands as well. U.S retailers are seeking additional assurance that foods labeled organic and other non-GE foods contain little or no GE material. Many processors, manufacturers, and retailers now require the use of avoidance protocols and testing and have independently set tolerance levels for the unintended presence of GE traits. In order to receive the price premiums associated with organic and non-GE offerings, producers need to minimize the presence of GE materials in their crops. Maintaining

the integrity of GE-differentiated markets relies on practices such as buffer strips to isolate identity-preserved crops from nearby GE crops and product segregation throughout the supply chain.

This report synthesizes data on all three GE-differentiated sectors and compares their magnitudes in terms of U.S. crop production. It also examines the practices used by organic and non-GE producers to avoid the unintended presence of GE material in their product streams, and discusses the economic impacts when GE material is detected in organic crops.

## What Did the Study Find?

Of the 390 million cropland acres in the United States in 2012, producers planted nearly half, 182 million acres, with ***GE seed***. Ninety percent of GE acreage is in corn and soybeans, and GE varieties are also widely used in U.S. cotton, sugar beet, and canola production. In contrast, only 0.6 percent of U.S. vegetable acreage and 0.03 percent of U.S. fruit acreage were planted with GE varieties in 2012.

The United States had 5.4 million acres managed under certified ***organic*** farming systems in 2011, with just over half for cropland and the rest for pasture and ranchland. Only 0.3 percent (234,000 acres) of U.S. corn acres and 0.2 percent (132,000 acres) of U.S. soybean acres were certified organic in 2011 despite large organic price premiums—USDA's Agricultural Marketing Service reports organic corn and soybean prices that are generally two to three times higher than conventional crop prices. A larger share (over 4 percent) of fruit and vegetable acreage is certified organic; organic lettuce, carrots, and squash exceeded 10 percent of total U.S. production in 2011.

In 2014, U.S. farmers planted 6.4 million acres of corn using ***non-GE seed***, and 5.1 million acres of soybeans with certified non-GE seed. About 59 percent of the non-GE conventional soybean producers sold their crop in a market for identity-preserved (IP) non-GE soybeans in 2012. Survey respondents who sold non-GE soybeans (food and feed) in an IP market, reported receiving an average price premium of $2.50 per bushel, about 18 percent higher than USDA's reported average price for all soybeans in 2012. USDA recently began publishing a non-GE price report, which shows non-GE price premiums of $0.75 per bushel for food soybeans (8-9 percent higher than for all soybeans) and $1.13 per bushel for feed soybeans (12-14 percent higher than for all soybeans) in fourth quarter 2015.

Among the challenges of organic and conventional non-GE corn and soybean production is preventing accidental comingling with GE crops and pollen in order to protect price premiums. The top practices that help reduce the risk of commingling include the use of buffer strips, which also reduce the risk of pesticide drift—69 percent of organic corn and soybean acres had buffer strips during USDA survey years. Many organic corn producers delay planting to reduce the likelihood that their crops pollinate at the same time as nearby GE crops. The average planting date for organic corn producers was 2-4 weeks later than for conventional corn producers in 2010. While delayed planting helps prevent the commingling of GE and non-GE pollen, it may also lower yields.

In 2014, 1 percent of all U.S. certified organic farmers in 20 States reported that they experienced economic losses (amounting to $6.1 million, excluding expenses for preventative measures and testing) due to GE commingling during 2011-2014. The percentage of organic farmers who suffered economic losses would be higher if calculated only for those organic farmers growing the nine crops with a GE counterpart (commodity-specific estimates could not be reported due to data limitations and concerns about respondents' privacy). While less than 1 percent of all organic farmers in California, Indiana, Maine, Minnesota, and Michigan suffered losses due to the unintended presence of GE material in their crops, 6-7 percent of organic farmers in Illinois, Nebraska, and Oklahoma suffered losses.

## How Was the Study Conducted?

This study analyzes data on crop production and practices from several USDA producer surveys, including the Agricultural Resource Management Survey (ARMS), the annual USDA Acreage Survey, and the 2014 National Organic Producer Survey. ARMS collects detailed information about the production practices, costs, and returns in major U.S. farm sectors. In 2005, ERS began periodically adding targeted samples from organic producers to ARMS, to enable statistically reliable analyses of the organic sectors. The 2010 ARMS corn survey included a targeted organic oversample and questions on GE testing and shipment rejection in the organic corn sector. The 2012 ARMS soybean survey included questions about non-GE soybean production and marketing. Data on demand for organic and non-GE conventional products were obtained from several privately funded sources. Estimates of U.S. organic food retail sales are based on data from the *Nutrition Business Journal*, and estimates of non-GE product sales are derived from data provided by the private group—Non-GMO Project Verified—that provides verification services for most retail products with a non-GE label.