Types of GMO

The first generation of genetically modified seeds were originally designed to increase production by being tolerant to chemical sprays or to resist pests. The crops from this generation of genetically engineered seeds do not look or taste differently than traditionally grown crops.

**Herbicide Tolerant**

In 1996, soybeans became the first commercially produced glyphosate herbicide tolerant crop in the United States. Scientists genetically altered a gene in the soybean to tolerate glyphosate herbicide, known by brand names such as Roundup®, Accord®, Rodeo®, and Touchdown® or tolerant to Glufosinate herbicides, known by brand names such as Roundup Promax®, Liberty® Basta® and Zorro®. This technology has been adapted for corn, cotton, soybean and rapeseed (canola oil) that allow farmers to effectively kill weeds without hurting the crop.

**Pest Resistant**

Bacillus thuringiensis (Bt) corn is a genetically modified corn that produce their own toxin. Bacillus thuringiensis (Bt) is a bacteria that lives in the soil and naturally produces a toxin that acts as a pesticide. Scientists genetically extracted the gene that produces the neurotoxin from the Bt bacteria and inserted it into the plant’s DNA. Bt corn produces the neurotoxin within its pollen, which defends the crops from pests, such as the European corn borer. Soybean and cotton crops have also been genetically altered to be resistant to pests by producing Bt toxin.

**Multi function crops**

Many crops have been engineered to include stacked traits, such as the ability to produce Bt toxin as well as resist herbicides. These bioengineered crops are known as stacked trait crops. Additional testing of these crops are not required by the FDA or USDA, however the U.S. Environmental Protection Agency (EPA) may require additional review before product is released to market.

Besides soybean, corn and cotton, other genetically modified crops grown or imported into the USA are lettuce, strawberries, cantaloupe, carrots, Hawaiian papaya, zucchini, and sugar beets.

**GMO - Good?**

New crops approved by the FDA and USDA are: three types of apples; the Innate potato; and the first GMO animal, Atlantic Salmon®. Future GM crops include pink pineapples from engineered with lycopene, an antioxidant that may fight cancer; purple tomatoes engineered to have high levels of anthocyanins, a compound similar to what exists in blueberries that may lower cardiovascular risk; or orange trees with a spinach gene to resist citrus greening disease.

Third generation of genetically modified crops are a new frontier that include genetically engineered plants and animals that produce vaccines or medication. Some plants, such as maize (corn), potatoes, spinach, and tobacco have been genetically engineered to grow edible vaccines for HIV, Hepatitis B, Non-Hodgkin’s lymphoma, rabies, and tooth decay, which are in various phases of FDA trial. Unlike the bioengineered salmon that is FDA approved for human consumption, other transgenic animals are used in the production of vaccines and medications, which is less expensive than the traditional means of making drugs. GE chickens produce a drug in their eggs for lysosomal acid lipase deficiency, goats have been GE altered to produce an anticoagulant medicine in their milk, and GE rabbits generate a drug to treat hereditary angioedema.

**GMO - Bad?**

Super weeds

Nature adapted to the genetically engineered crops. Over utilization of herbicides have created glyphosate resistant weeds. These super weeds have caused scientists to create new herbicide compounds, thus introducing additional genetically engineered herbicide resistant crops, such as Enlist Duō® glyphosate and 2, 4-Dichlorophenoxyacetic acid (2,4-D) or Roundup Ready 2 Xtend® that is a combination of glyphosate and Dicamba.

Decrease in Population of Pollinators

The utilization of glyphosate on genetically modified crops has contributed to the decline of the milkweed, which is the main source of food for Monarch butterflies’ developing larvae. Recent studies have been published that show glyphosate and Dicamba herbicides have affected the behavior of honeybees.

Potential Consumer Risks

According to the World Health Organization (WHO), the three main areas of concern on genetically altered crops are the potential for allergic reactions to food proteins, gene transferring from genetically altered plant to human through skin or digestive tract, and outcrossing of genes from genetically engineered crops mixed with traditional crops.

The introduction of novel (new) proteins into plants can cause an allergic reaction, such as the Cry9C protein that is found in Bt StarLink corn. The EPA and FDA approved StarLink corn for animal feed only, but the DNA was found in taco shells after people with food allergies reported symptoms after eating the product. Allergen protein 2S17 from the brazil nut caused people with nut allergies to react when GE soybean with hazel nut protein was consumed. This showed scientists that proteins that can be transferred in genetically engineered plants and potentially cause reaction in people with food allergies.

Examining novel proteins for potential allergic reactions is difficult due to lack of decisive standardized tests, so scientists are encouraged to consider incorporating known allergenic protein when making genetic modifications. According to WHO, no known allergic effects have been linked to genetically engineered food currently marketed. Scientific literature report toxin from genetically engineered crops with Bt bacteria can transfer to human cells, such as to the gastrointestinal tract or kidneys. Bt corn that is consumed daily by animals and humans contains the Cry1Ab toxin from the Bt bacteria to control pests. Residue of the Cry1Ab toxin was found in the blood of pregnant women and their unborn babies in Quebec, Canada. The conclusion of this study proves that additional testing of GE crops is required to ensure safety for human consumption.

Outcrossing of genetically engineered crops has occurred through the mixing of seeds, pollen drift from wind and insect pollinators. In 2000, DNA from GE StarLink corn that was approved for animal feed only was found to have contaminated the human corn food supply as determined through the DNA testing of taco shells and other products. In North Dakota, ecologists discovered genetically engineered rapeseed (canola) plants growing on the side of the road and in other locations far from the planted GE rapeseed crops. After careful study, they determined that the GE rapeseed plants are cross-pollinating in the wild with other genetically similar weeds and resulting with the same stacked genes as those grown by farmers miles away.

An additional potential consumer risk is that genetically modified crops fall within the government’s legal term of GRAS, which means generally recognized as safe, which means the government does not perform the safety tests. Companies wishing for approval are responsible for the product safety testing for human and/or animal consumption. Thus, genetically engineered soybean oil can be used in place of traditionally soybean oil and does not have to be labeled differently.

**Processed Foods Containing GMO Ingredients**

According to the Grocery Manufacturers Association, 70-80% of the foods we eat in the United States, both at home and away from home, contain ingredients that have been genetically modified. If food or beverage product label lists corn, soy, or sugar, then they most likely contain genetically modified ingredients, as these crops grown in the U.S. use GM technology. Examples of common ingredients made from GMO crops that are found in processed foods include: Aspartame, Canola oil, Cotton seed oil, Flavorings, High-Fructose corn syrup, Hydrolyzed or Textured Vegetable Protein, Monosodium glutamate (MSG), Soybean oil, Soy-Lecithin, Vitamins (B, C), and Yeast products. Products with “all natural” on labels may also contain ingredients processed from genetically modified crops. Graduate students reports in 2013 that 19 out of 31 tested products labeled “all natural” were positive for GMO ingredients.
Known Non-GMO Foods

The U.S. Food and Drug Administration (FDA) does not currently require the labeling of genetically modified crops grown in the United States or processed foods made from these crops. Some companies are labeling their products with “bioengineered” or “genetic engineering” due to new Vermont law effective July 1, 2016. Purchasing 100% Organic labeled product is the only guarantee that ingredients are 100% organic and GMO-free. The purchase of USDA Organic or Certified Organic means that products labeled “Made with Organic” have 70% of the USDA’s National List and genetically engineered products are not on the list. Products labeled “Made with Organic” have 70% of the ingredients organic, leaving the remaining ingredients as a possibility of being genetically altered.

Easily Recognized Symbols

Non-GMO Project’s Seal:
Not-for-Profit organization that offers GMO testing and verification labeling for companies wanting to use the label on their food products.

USDA GMO-Free Label:
Companies submit documentation and USDA auditors verify that companies do not use GMO products as food ingredients.

USDA Organic Labels:
The National Organic Program is United States Department of Agriculture regulated to ensure farmers follow a strict process-based certification. Farmers are prohibited to growing produce from GMO seeds, by producing its own toxin.

Available Smart Phone Apps to Aid Shopping

GMO means genetically modified organisms, which are also described as transgenic, genetically engineered, (GE) or bio-engineered within scientific literature. According to the U.S. Department of Agriculture Economic Research Service, over 90% of genetically engineered corn, soybeans, and cotton crops are grown within the United States. If you eat corn or corn oil products, cook with canola oil, eat breakfast cereals or eat processed foods, then chances are you have eaten genetically modified foods and/or ingredients from plants that have been genetically engineered. Scientist modifies plants by taking a gene from a virus, bacteria, or another plant with the intent to emphasize a trait that could make the plant resistant to cold or heat, diseases, pesticides, or weed killers. There are many bioengineered crops produced in the United State that are either herbicide tolerant (weed killer resistant) or pest resistant by producing its own toxin.

What is GMO?

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