Conservation Corner for May 31, 2016

Biotechnology

By Jodi Venema DeHate
Wexford Conservation District

Note: Genetic engineering can be a highly polarizing topic, with many people having strong opinions on one side or the other. The Wexford Conservation District neither endorses, nor opposes biotechnology; this article is for informational purposes only.

Do you love cheese? Love papaya? Use insulin? What do these things have in common? Shockingly, biotechnology – otherwise known as genetic modification. Yes, this article is about Genetically Modified Organisms (GMOs), what they are, why farmers use them, and what is coming in the future.

What are GMOs?

Let's start with the basics. There are still only a handful of genetically engineered (GE, which is used interchangeably with GMO) crops. They are: corn (both dent and sweet, but not popcorn), soybeans, sugar beets, alfalfa, canola, cotton, papaya, and a few varieties summer squash, apples and potatoes.

How are they created?

This about to get a bit technical, so hope you can follow along. All living things are made of DNA, it's just in different sequences. Transgenesis is the proper term to describe how scientists have introduced genes from another organism into the target organism. This can be done either through the use of one of two gene guns: Agrobacterium, which is a naturally occurring bacteria that introduces DNA into plants, or through a process using electricity. Another method of altering plants is cisgenesis, which is a technique using a specie's own genes to make a change. Yet another technique is genome editing, which use enzymes to change the DNA of a cell at a specific point in the gene sequence. Genome editing or CRISPR, is a new approach being developed that holds promise for disease resistance. Whew – that's a lot of techy info! In all of these methods, once genetic modification has been done, cells in the plant use that new sequence when they reproduce.

What foods are produced using GE and why?

Cheese benefits from genetic engineering. How you ask? Rennet, the enzyme that creates the curdling that happens in cheese making, comes from the stomach lining of un-weaned calves, primarily veal calves. Since veal production is fairly low, finding rennet was becoming a challenge in the 1970's. Scientists discovered that the enzyme could be recreated through genetically modifying the enzyme in the lab. Hence, cheesemakers no longer needed to rely on the rennet from calves. Insulin for use by diabetics used to be created from the pancreases of cattle and pigs. In 1978 scientists were able to genetically modify E.coli to produce insulin.

Papaya was one of the first crops that became a GMO. The papaya ringspot virus was decimating groves of papaya. Scientists developed a resistant papaya to withstand the virus using GE techniques. Without that development we probably would not be enjoying much papaya today.

Many field crops such as corn, soy, alfalfa, canola, sugar beets, and cotton, have been genetically modified to resist glyphosate, which is the active ingredient in the herbicide Roundup and many Roundup copy cats. This means that the crop is not killed by glyphosate when the field is sprayed for weeds. Most

area farmers use glyphosate at a rate of 12 to 24 ounces per acre depending on soil type and weed pressure.

Corn and cotton have been genetically engineered to have the Bt trait as well. Bt stands for *Bacillus thuringiensis*. Bt is a naturally occurring bacteria that is used to control cutworms, rootworms, corn borers and many other moth and beetle larva that damage crops. These pests can completely kill acres of corn when an infestation occurs. Organic producers have been using Bt for a long time to protect their crops. When Bt traited corn seed is used, the larva eat the corn plant and the protein expressed by Bt kills that larva. A legitimate question is whether or not Bt corn is in part responsible for the decline of Monarch butterflies. The USDA-Agriculture Research Service examined the effect of pollen from Bt corn on the larva of Monarch butterflies, and found that the amount ingested was so low, that it didn't directly harm them. However, the effectiveness of glyphosate in reducing milkweed plants in crop fields did result in fewer food plants for the butterflies. Research has also shown that Bt is not harmful to bees.

In Northern Michigan, farmers may grow GE alfalfa, corn, and soybeans. Dent or field corn is the most prevalent GMO that is grown here, and that kind of corn is intended for livestock feed only. Alfalfa is also intended for hay or silage for dairy cow feed. Speaking with a seed dealer, only 30% of the alfalfa nearby is GMO. Soybeans can be grown here with some success, but it's not the most widely grown. How about sweet corn? In talking with local sweet corn growers, they are not using a GE variety.

Why do farmers use GMO seeds?

So why do farmers use these seeds and not the regular ones? Glyphosate and Bt are very effective pesticides that are less toxic and have fewer environmental hazards than other pesticides. For example, compared to other herbicides, glyphosate doesn't persist in the soil for very long. It has a half-life of 44 days (a half-life is the time it takes for half of any given chemical substance to break down and no longer exist). However, there is evidence that glyphosate is toxic to amphibians. For that reason, the label carries specific instructions for set-back distances from aquatic environments in order to prevent harm to frogs, toads, and other amphibians. Another concern is that some weeds are developing resistance to glyphosate. By using other herbicides and rotating crops, farmers can prevent this resistance from occurring.

Another significant reason to use GE seeds is to reduce tillage. "No-till", a method of growing crops that does not involve plowing, is much easier to do when using GMO crops. In fact, no-till is a very hot topic in the agriculture world because more farms are adopting it. No-till sequesters carbon and thus reduces greenhouse gas emissions. There are also fewer passes by a tractor over a field due less tillage and less spraying, which in turn reduces the amount of fuel being used. Reducing tillage can also significantly reduce soil erosion. Yield has also increased with the adoption of GE seeds. The yield potential of crops was improving with modern conventional hybrids, but the insect and weed pressure were knocking actual yield down. With the pest pressure reduced, many farms are seeing increased yield, which means the farm is getting a better return on investment.

What does this mean for you the consumer?

On May 17, 2016, the National Academies of Sciences, Engineering, and Medicine published their latest findings on GE crops, and they stated that they "found no substantiated evidence of a difference in risks to human health between GE crops and conventionally bred crops." Many farmers believe that GMO crops do help food costs stay low as long as the weather cooperates.

On the other hand, many people are concerned that there are consequences to growing and eating GMO's. Food certified as organic can not contain any GE organisms. For those who desire to avoid GMO's, eating organically is an option that is becoming more readily available.

The future of Genetic Engineering

The citrus trees in Florida are being hit very hard with a disease called Citrus Greening. There isn't much stopping the disease to the point if something isn't done soon there may not be citrus from the US soon. Researchers are working on finding something in the genetic code to try to modify new trees to resist this disease.

A technique called CRISPR, which was mentioned earlier, is a promising new technology that may help improve nutrition in crops, reduce pest damage, increase drought resistance, or develop new medicines for humans.

Two newly developed GMO crops are the Arctic® apple and the Simplot Company's Innate® potato. They were developed to reduce food waste for the consumer by resisting bruising and browning. The apple is expected to start appearing in stores in 2017. No release date is available for the potato.

One thing that is not in the foreseeable future are GMO garden seeds. Currently, all GMO seed is sold to farmers who have to sign a grower's agreement with the seed company to not save seed, or sell saved seed. Plus the seed comes in 50 lb. bags, and gardeners don't typically buy seed in that quantity.

Hopefully this article has shed some light on the subject. Myths and mistruths abound when it comes to GMOs. For more information, please peruse http://nas-sites.org/ge-crops/, and, talk with your local farmers.

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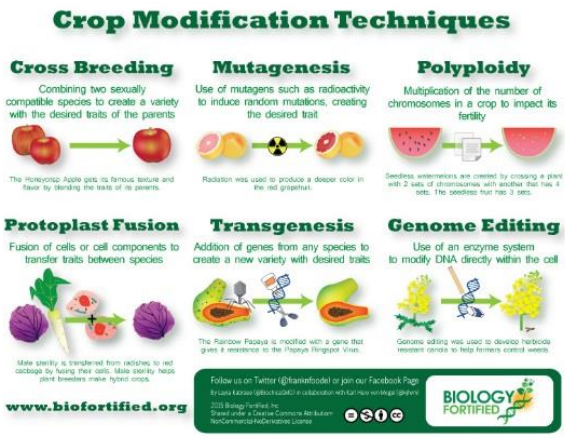
The tag on this bag of GMO seed corn lists the genetic traits that have been incorporated into the seed.

This month has seen many area farmers, like the one shown here, taking advantage of the favorable weather to get their corn crops planted.



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