

Module 11, Lesson 3 Handout:

Basics of GMOs

Genetically modified organisms (GMOs) can be an intimidating topic. There are so many opinions from the consumer and producer sides, and pages of research to sort through that you may be lost about where to even start with your understanding of GMOs. Plus, this is a relatively new area in food science so the research is evolving all the time. Your clients will have questions about them, so you need to educate yourself to help your clients make sense of all this information.

What is a GMO?

GMOs are living organisms whose genetic material has been artificially manipulated in a lab with genetic engineering. Essentially, scientists identify a desirable trait in one organism, find the genetic information for that trait, and then insert that genetic material into a different organism, creating a plant or animal that does not occur in nature or through traditional crossbreeding.

Here's how it typically works: Researchers will look in nature for desirable traits. For example, if they want to develop a crop that will survive in a specific environment, they'll look for organisms that naturally survive in the same environment. Then they'll investigate that organism's genetic makeup to find the part that contains the desirable trait, and they'll isolate that bit of DNA. Next, they need to get that DNA into a completely different organism. This is typically done through a genetically engineered invasive bacteria. Basically, researchers will use enzymes to cut and paste a DNA sequence into a plasmid (a small, circular DNA molecule) and then insert the plasmid into a bacteria using heat or electricity. The engineered bacteria will then naturally invade a crop's genome to introduce the new desirable trait, creating a brand new version of that crop.

True GMO is not to be confused with other types of genetic manipulation such as CRISPR genetic editing, which is gaining more traction. With CRISPR technology, scientists are tinkering around with an organism's DNA but are not adding anything from a different organism or bacteria. It's more like enhancing a trait that's already naturally present in the DNA sequence rather than introducing something completely new.

Pros & Cons of GMO

Supporters of GMOs say that they are simply accelerating natural selection and breeding superior organisms. There are arguments that GMOs can help cut down on insecticide or herbicide use because that defense is already built into the plant. Some say we can increase crop yield, improve

drought tolerance and enhance nutrition in our food supply with GMOs. Some GMOs, such as Golden Rice, have been developed to help end nutrient deficiencies in developing countries.

Okay, so some of the support for GMOs may sound convincing, but are they safe? And are they necessary?

Preliminary research is saying they are safe for consumption, at least as of now, because the research is still very new in the grand scheme of research. A 2017 analysis published in *Critical Reviews in Biotechnology* concluded that current data on GMO safety provide “weak evidence of harm that cannot be differentiated from chance.” The reality is that there’s simply just not enough research right now to say for sure if consuming a plant grown from a GMO seed has any true risks. However, the evidence is mounting that GMO crops are wreaking havoc on the environment.

GMO technology has led to the practice of monocropping, which means growing just one thing repeatedly on the same land. This allows for uniform growing, harvesting, purchasing, packaging, transportation and predictability of crop output that you can’t get from organic farming. If a farmer’s GMO crop is all uniformly sized and ripens at the same time, that farm is at an advantage. They can better plan their harvests, their packaging materials can be uniform, and there is little room for surprise. On the contrary, organic farms plant several types of crops that all come in many shapes and sizes, making the business harder to reliably plan for.

Monocropping may put farms at a business advantage, but the environment is suffering. This practice drains nutrients from the soil, so chemical fertilizers are needed, and these fertilizers can end up in our groundwater and harm the insects, animals, and ultimately humans. Sometimes some of the inputs like the fertilizers and herbicides or pesticides that are sprayed at farms up the road find their way down to other farms and contaminate unsuspecting neighboring farms.

As for the “are they necessary?” question: There are plenty of less-than-necessary examples of GMOs just simply meant for convenience, like GMO apples that don’t brown as quickly.

Bottom Line

GMOs are probably here to stay for a long time. Even though the government has deemed GMO foods safe to consume, the ethical and environmental considerations are still there.

When it comes to making recommendations, meet your clients where they are. If you have a client who doesn’t feel strongly about GMOs, you don’t need to actively put it on his or her radar. If you have someone who is really concerned about GMO, you can point that client in the direction of shopping at farmer’s markets and co-ops where they can see where and how their food is sourced. Lots of companies are opting to put a label that says Non GMO Project Verified or Organic, since

organic farmers cannot plant GMO seeds. Note that these labels are costly, and just like there are many organic foods that don't have a certified organic label, not every food that doesn't have the Non GMO Project Verified label is going to contain GMOs.

The foods and ingredients at highest risk of being GMO are:

- Alfalfa
- Canola
- Corn
- Cotton
- Papaya
- Soy
- Sugar beet
- Zucchini
- Potato