

LEVELED BOOK • Z¹

Are GMOS Safe?



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Focus Question

Why is agriculture being altered with GMOs?

Words to Know

agriculture	consumers	mandatory
altered	genetically	pesticides
assess	herbicides	processed
beneficial	hinder	proponents
biased	ingest	vulnerable

Title page: A lab worker at the Monsanto company maintains GMO corn specimens.

Page 3: Demonstrators in Tucson, Arizona, protest GMO foods and the Monsanto company.

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The Birth of GMOs

In 1994, the Food and Drug Administration (FDA) approved a new kind of tomato for sale in the United States. Called the Flavr Savr, the tomato was grown from seeds that researchers **altered** in a laboratory. Unlike traditional tomatoes, this new variety stayed firm long after ripening. This feature allowed the tomatoes to ripen longer on the vine before they were picked and sent to market.

Flavr Savr tomatoes were clearly labeled as being grown from seeds that were **genetically** modified. Initially, they sold very well. Within two years, however, concerns over safety had turned public opinion against them. They were removed from sale. The argument over genetically modified organisms (GMOs) had begun.



Dr. Virginia Ursin (main) worked on the first genetically modified tomatoes (inset).





Genetically modified cornfields (main) look exactly like those that have not been modified with the Bt soil bacterium (inset).

Since the birth of **agriculture**, humans have bred plants to grow food crops not found in the wild. For example, corn as it is known today never grew wild. Instead, farmers developed it from a wild grass called *teosinte* by replanting only the seeds of plants that had qualities they desired.

Farmers still use that method to improve the crops they grow in their fields. In addition, over the past few decades, scientists have developed new methods to introduce foods that never existed before. Now, people don't have to grow generations of plants to make them look, taste, or behave differently. Scientists can give a seed a new trait in the laboratory simply by giving it a new gene. The gene can come from another type of plant or from a completely different organism.

For example, the United States Department of Agriculture (USDA) states that most of the corn grown in the United States today has been changed to include genes from a soil bacterium called *Bt*, which kills insects that **ingest** it. As a result, the new corn also has the ability to kill insects that feed on it.

Creating a brand-new organism by combining the genes of existing, unrelated organisms is known as *genetic engineering*. The new varieties are known as *genetically modified organisms* (GMOs). Some GMOs are common among the foods people in the United States buy and consume every day.

What—and Where—are GMO Foods?

The USDA says that about 40 percent of all crops grown in the United States are genetically modified. The most common crops currently grown with GMO technology are alfalfa, cotton, canola, corn, sugar beets, soy, and zucchini. About 90 percent of the corn, cotton, and soybeans grown in the United States are GMOs.

It can be surprising to learn about all the places these modified foods turn up. After all, corn isn't just that familiar treat roasted on the cob or popped to eat at the movies. The kernels

are also made into products like corn meal and corn syrup. In turn, those products become ingredients in cereal, cookies, pet foods, and countless other foods. In all, it's estimated that between 60 and 80 percent of **processed** foods in the United States contain GMOs.

In other words, most Americans have eaten GMO foods of some kind without knowing it. Even when reading every ingredient on food labels, it can be difficult to know which of those ingredients may have been genetically modified.

Some people are working to change that by asking the U.S. government to require that manufacturers label all food products containing GMO ingredients. The law already requires that most food products have labels showing **consumers** ingredients and nutritional facts. People who want labels for GMO foods believe that consumers also have a right to know if they're eating GMO foods.



All the foods pictured above are made with corn.

The Benefits and Risks of GMOs

GMO food products became part of the U.S. diet in the mid-1990s. Spokespeople for the new technology listed many benefits of GMO foods for world agriculture. However, many people are concerned about possible risks to their families and the environment from these genetically modified foods.

The vast majority of GMO crops on the market today have been modified by adding genes to help them resist crop-eating pests or weed-killing chemicals. Some experts say that, as a result, farmers can spray fewer **pesticides** on their fields. Farmers can also apply **herbicides** to an entire field and kill unwanted weeds without killing GMO crops designed to survive those chemicals.



Farmers raising GMO crops can spray their entire fields with herbicides, which reduces the time and labor it takes to raise those crops.

Some scientists say that because GMO crops can be grown using fewer chemicals, they can make agriculture less harmful to the environment and food safer for human consumption. They also say that those GMO plants can increase crop yields, making agriculture more profitable.

However, some researchers say that, as a whole, farmers have used more chemical weed killers since they started planting GMO crops. Others say that some insects and weeds will become stronger by adapting to the new crops' built-in insecticides and farmers' increased use of herbicides. They fear that farmers will eventually need to use stronger chemicals to battle these new breeds of "superbugs" and "superweeds." This ongoing cycle could create new safety risks for humans as well as the environment.

GMO supporters say that any unknown risks are outweighed by the potential for genetically engineered crops to solve world hunger. They say GMOs' larger crop yields will be needed to supply food to people as Earth's human population grows. Researcher David Weisser says that limiting GMOs "only hurts the world's starving population."

But some opponents say that as more farmers plant the same few varieties of GMO crops, the world's food supply becomes more **vulnerable**. Experts at Princeton University warn that planting fewer varieties of crops "can lead to the quicker spread of diseases" in plants. For example, imagine if everyone grew the same GMO corn seeds and a disease came along that wiped out that corn. It would then wipe out an entire key food source.



Scientists at Cornell University document growth rates of genetically modified plants on the lids of petri dishes.

GMOs in the Environment

Scientists develop the seeds for GMO crops in laboratories. But part of the GMO experiment is growing those crops in real life. Only then can experts discover how GMO seeds affect the surrounding environment and the plants and animals that live there.

For example, wind can carry pollen from a field of GMO crops to a neighboring field of wildflowers. If that pollen fertilizes some

of those wildflowers, the wild plants might then take on genetically engineered traits from the food crop. More studies need to be done to determine the effects that GMOs might have on insects such as ladybugs, bees, and butterflies, all of which help farmers. Some consumers fear that crops engineered to kill “pest” insects will also kill these **beneficial** insects, but that has not been proved.

The monarch butterfly is one of many beneficial insects that pollinate crops and other plants. Populations of the monarch butterfly have dropped by almost 90 percent in the past twenty years. Scientists have disagreed about whether or not Bt

Who Profits from GMO Crops?

The broad shift to an industry dominated by GMO crops has had mixed consequences for small-scale farmers. Pollen can drift from a GMO farm to a neighboring non-GMO farm, and a farmer may wind up growing a crop he or she didn’t plant. This situation can be a problem for organic farms that don’t buy GMO seeds. In addition, the GMO seeds are owned by the company that developed them, not the farmers, so saving seeds for the next year is illegal.





The amount of milkweed (main), the main food source for monarch butterflies (inset), is being reduced due to herbicides being sprayed on neighboring GMO fields.

Toxins harm monarch larvae that hatch and feed on GMO plants. Some experts say that too much spraying of weed killer on herbicide-resistant crops is killing off other plants that monarchs need in order to survive. Other experts say that the reason monarch populations are shrinking is that they have fewer open areas to call home than in the past, meaning GMOs might not be to blame.

Are GMO Foods Good for People's Health?

In some cases, people who support growing GMO foods say that those foods can solve serious human health problems. They say GMOs can produce more food for people in the world's poorest areas. In addition, some GMO crops have been developed to help fight disease. For example,

scientists are experimenting with growing rice that has been changed to produce vitamin A. That rice might help people in areas where a lack of vitamin A in the diet contributes to widespread blindness.

However, some people say humans shouldn't eat genetically modified food without more studies to investigate its long-term effects on health. They are concerned that GMO crops designed to kill insects or crops that have been heavily sprayed with herbicides may cause diseases such as cancer. Another concern is the rise of new food allergies, as people eat GMO foods that contain new proteins they have never eaten before.



Soy, eggs, milk, and peanuts are common food allergens.

Many studies have been done over the past twenty years to **assess** the health risks of eating GMO foods. However, people debate whether or not these studies have provided good enough answers. **Proponents** of GMO foods cite a study that reviewed nearly eighteen hundred published papers and concluded that they did not show that GMOs are harmful to human health.



Despite protests, in 2013 Oregon passed legislation that prevents the banning of GMO crops within the state.

However, that same year, nearly three hundred scientists and other experts signed a statement saying science has not proved that GMOs are safe. Meanwhile, opponents of GMOs point to several hundred studies that they say do show GMOs are harmful to human health and the environment. For example, studies have charted increases in depression, weight gain, and Alzheimer's disease since GMO foods went on the market.

People on both sides of the issue can't agree on the conclusion because they can't agree on the evidence. Each side questions whether the other side's research is fair and accurate. GMO opponents say that the studies showing GMO crops are safe are not reliable because they are carried out by the same companies that profit from those crops. Advocates for the industry say that studies cited by anti-GMO activists are faulty or **biased**. In addition, private companies own the patents for most genetically engineered seeds, so some independent researchers have reported

difficulty doing their own unbiased studies on those seeds. The positive or negative effects of any new technology cannot be fully understood without long-term study.

To Label or Not to Label?

The debate about the benefits versus the risks of GMO foods has met with a different reaction in the United States than in many other countries around the world.

In more than sixty countries, GMOs have either been banned until further study can prove them safe, or foods containing GMOs must be labeled. In the United States, GMO foods are allowed on the market unless they can be proved to be harmful. The government does not require special labels for foods made from GMOs.

Yet public opinion polls show that most consumers in the United States want to see labels on foods containing genetically modified ingredients.



In the United Kingdom, items that contain GMO foods must be labeled (right). In the United States, some non-GMO foods carry labels (left).

Many people believe that by clearly labeling products containing GMO ingredients, they can choose for themselves whether they want to consume GMO foods.

Some people are working to get new laws passed that would require labeling of GMO foods in the states where they live. So far, most of those efforts have been unsuccessful. In 2014, Vermont became the first state to require labels on GMO foods sold within its boundaries. Some businesses across the country, such as specialty grocery stores, have also pledged to label any GMO foods they sell.



At a two-day environmental conference in Paris in 2012, France's Prime Minister Jean-Marc Ayrault (standing) voted to maintain a temporary ban on the cultivation of GMO foods in his country.



Scientists record temperatures and light readings on laptops to learn how those variables affect plant growth.

The companies that develop, grow, and market genetically modified foods say that requiring GMO labels on their products will unfairly hurt their business.

Spokespeople for the GMO industry argue that labels won't help educate the public with the facts about GMOs. Some say that due to public fears about the risks of GMO foods, any label that says "GMO" will automatically keep people from buying a product. Many industry insiders fear that **mandatory** labels will lump all GMO products into one category. They warn that labels will only promote more fear and **hinder** development of new GMO products that might benefit people in the future. Finally, they say that labeling every product will be expensive and complicated.

The Future of GMOs

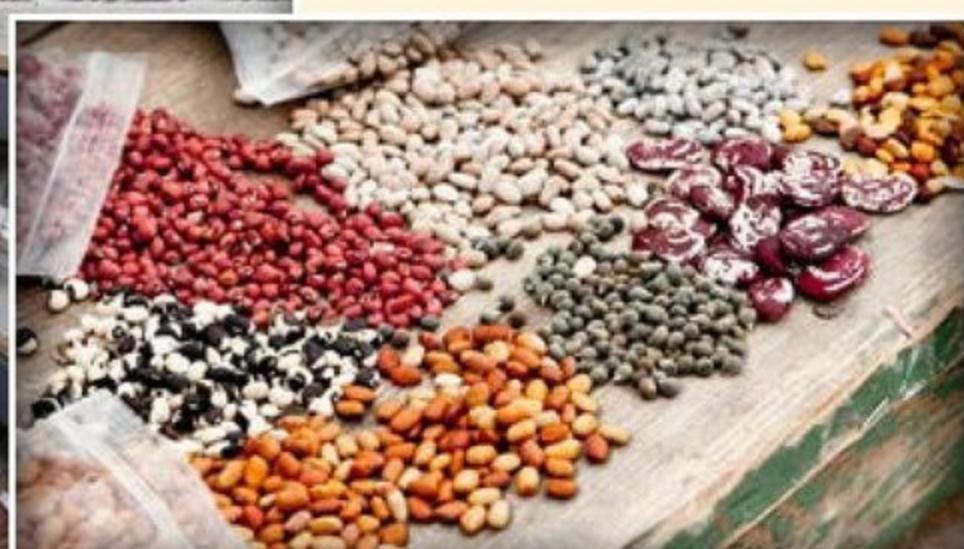
People have been eating foods grown from genetically engineered seeds for only the past two decades. While hundreds of published reports have explored the benefits and risks of GMO foods, many people believe the jury is still out on whether or not GMO foods are safe.

Saving Seeds for a Rainy Day

A century ago, farmers could buy seeds for more than three hundred unique varieties of corn. Today, most commercially grown corn comes from hybrid seeds from the same few varieties of corn. Meanwhile, many of the world's historic and traditional foods have gone extinct—including 90 percent of historic fruit and vegetable varieties in the United States.

To address this problem, people have started seed banks around the world to save seeds from traditional, or "heirloom," crops. By preserving a diverse array of crops—as well as the knowledge of the people who grew them—

they hope to ensure more food choices for future generations.



Glossary

agriculture (<i>n.</i>)	the science or practice of farming and raising livestock (p. 5)
altered (<i>v.</i>)	made different; changed (p. 4)
assess (<i>v.</i>)	to evaluate or measure something (p. 13)
beneficial (<i>adj.</i>)	having a positive, useful, or favorable effect (p. 11)
biased (<i>adj.</i>)	having or showing unfair support for one opinion, group, or set of beliefs over another (p. 14)
consumers (<i>n.</i>)	people who buy or rent goods or services and use them (p. 7)
genetically (<i>adv.</i>)	in a manner having to do with heredity and variation in living things (p. 4)
herbicides (<i>n.</i>)	biological or chemical agents that kill unwanted plants (p. 8)
hinder (<i>v.</i>)	to slow, delay, obstruct, or stop an action or process (p. 17)

ingest (<i>v.</i>)	to take in food or some other substance (p. 6)
mandatory (<i>adj.</i>)	required; related to something a person must do (p. 17)
pesticides (<i>n.</i>)	chemical or biological substances that kill harmful animals or plants (p. 8)
processed (<i>adj.</i>)	treated or modified to improve something or make it last longer (p. 7)
proponents (<i>n.</i>)	people who support or argue in favor of something; advocates (p. 13)
vulnerable (<i>adj.</i>)	able to be hurt easily (p. 10)

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Connections

Writing

Are GMOs safe? Take a stand. Write an article supporting or opposing the use of GMOs. Use information from the text to support your position.

Health

What food-labeling regulations has the U.S. Food and Drug Administration (FDA) established? Use the information in the book and your research to write food-label regulations based on what you think every consumer should know.

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