

UNDERSTANDING GMOs

What is a GMO, or Genetically Modified Organism?

“GMO” has become the common term consumers and popular media use to describe foods that have been created through genetic engineering. A GMO, or genetically modified organism, is a plant, animal, or microorganism that has had its genetic material changed using technology called genetic engineering.

Types of food modification

For thousands of years, humans have been using conventional (also known as "traditional") modification methods to breed plants and animals with more desirable traits. Cross-breeding, selective breeding, and mutation breeding are all examples of conventional breeding. These methods often involve random combinations of genes from two different sources. Conventional methods have been used to create most of the plants and animals we eat today, including common crops like modern corn varieties.

Genetic engineering is a breeding tool that generally involves the modification of DNA, including the transfer of specific DNA sequences from one organism to another. Genetic engineering can be more precise and faster than conventional breeding.

Reasons for genetic modification

The reasons for genetic modification today are similar to what they were thousands of years ago, when humans began to breed crops.

- Higher crop yields
- Less crop loss to disease and pests
- Longer storage life
- Better appearance
- Better nutrition



GMO products in the U.S.¹

GMO plants:

 Alfalfa	 Pink Pineapple
 Apples	 Potatoes
 Canola	 Soybeans
 Corn	 Sugar beets
 Cotton	 Summer squash
 Papaya	

Approved GMO foods from animals:

 Atlantic salmon	 A type of Pig
------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------

A farm-raised Atlantic salmon and pork from a type of pig have been approved for food use. But you may not see them in the market because they are not widely available yet.

While there are not many genetically engineered fruits or vegetables in the produce section of your grocery store, ingredients from genetically engineered crops are a common part of today's food supply. Most of the genetically engineered crops we eat are used to make ingredients that are used in food products like cereal, snack chips, and vegetable oils.

Are GMOs safe to eat?

Yes, GMO foods are carefully studied before they are sold to the public. These studies show that [GMOs are as safe](#)² and nutritious as their non-GMO counterparts and that GMOs do not affect our health any differently than non-GMOs.

Health and GMOs

Allergies

Allergenicity testing is routinely part of the process for developing genetically engineered foods. As part of this testing, developers consider whether any new proteins in the food have characteristics of allergens, such as whether they come from an allergenic source or whether the new proteins are similar to known allergens. Research shows that GMO foods currently on the market are no more likely to cause allergic reactions than non-GMO foods.

Celiac disease

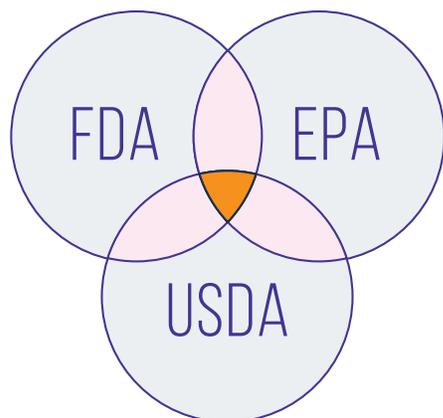
Celiac disease is a serious condition that affects the digestive system. It is caused by an immune reaction in response to gluten, a protein found in wheat, rye, and barley. At this time, there is no genetically engineered wheat, rye, or barley available for sale to consumers in the United States. If wheat, rye, or barley were ever to be used as a source of a protein in a GMO food, the U.S. Food and Drug Administration (FDA) would very carefully consider whether that protein was one that would cause a reaction in people with celiac disease.

Cancer

Genetically engineered crops are not changed in ways that would increase the risk of cancer. A [comprehensive study](#)³ by the National Academies of Sciences, Engineering, and Medicine found that cancer rates in the United States, where GMOs are commonly eaten, are similar to cancer rates in Europe and the United Kingdom, where people eat less GMO foods.

Regulation of GMOs

Multiple federal agencies regulate GMOs. The [Coordinated Framework for Regulation of Biotechnology](#),⁴ established in 1986, describes how the agencies work together to regulate GMOs.



The Food and Drug Administration (FDA) in the Department of Health and Human Services (HHS) makes sure that foods from GMOs it regulates meet the same safety standard as non-GMO foods.

The U.S. Environmental Protection Agency (EPA) is responsible for protecting human health and the environment, which includes regulating pesticides. EPA regulates the safety of the substances that protect genetically engineered plants, referred to as [plant-incorporated protectants](#),⁵ that are in some GMO plants to make them resistant to insects and disease. EPA also monitors all other types of pesticides that are used on crops, including on GMO and non-GMO crops.

The U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) protects agriculture in the United States from pests and diseases. Before going to market, most genetically engineered crops are tested for several years in field trials regulated by APHIS for plant pests and EPA for pesticides.

What can GMOs do?

GMOs help farmers prevent crop loss.

Most of the genetically engineered crops grown today were developed to help farmers prevent crop loss. Some were developed to be resistant to insect damage, so farmers can apply fewer spray pesticides. Some are tolerant to herbicides, which helps farmers control weeds without damaging the crops. With herbicide-tolerant crops, farmers do not need to till the soil, which they normally do to get rid of weeds. This “no-till” planting helps maintain soil health and lower fuel and labor use. Studies have shown that farming with genetically engineered crops can have positive economic and environmental impacts.

GMOs can improve food security in developing countries

In Bangladesh, a pest, the eggplant fruit and shoot borer was devastating eggplant (Brinjal) crops. Eggplant is a staple crop for many Bangladeshis. In response, scientists developed genetically engineered eggplant varieties, more commonly known as Bt eggplant, that are highly resistant to the eggplant fruit and shoot borer. [Research](#)⁶ found that the Bt trait worked exactly as expected: It provided near-total protection against the eggplant fruit and shoot borer, and Bt eggplant led to a 42% increase in yields compared with the non-GMO eggplant varieties.

GMOs can help increase profits for small-scale farmers in developing countries

The same study of Bt eggplant in Bangladesh revealed farmers who grew Bt eggplant earned around \$400 more in profits per hectare (1 hectare = approx. 2.5 acres)—14% higher than non-Bt eggplant farmers.

GMO crops can reduce pesticide use

Some GMO plants contain plant-incorporated protectants to make them resistant to insects, reducing the need for and use of many [spray pesticides](#).⁷ For example, in Bangladesh, Bt eggplant farmers sprayed their crop half as many times as non-Bt eggplant farmers, and they sprayed 39% less total pesticide.

Find out more about GMOs.
Visit www.fda.gov/feedyourmind.



¹ <https://www.ams.usda.gov/rules-regulations/be/bioengineered-foods-list>

² <https://www.nap.edu/read/23395/chapter/8>

³ <https://www.nationalacademies.org/our-work/genetically-engineered-crops-past-experience-and-future-prospects>

⁴ <https://usbiotechnologyregulation.mrp.usda.gov/biotechnologygov/about>

⁵ <https://www.epa.gov/regulation-biotechnology-under-tsca-and-fifra/overview-plant-incorporated-protectants>

⁶ <https://agrilinks.org/post/impact-study-demonstrates-bt-brinjal-eggplant-helps-farmers-earn-more-less-pesticide>

⁷ <https://www.epa.gov/ingredients-used-pesticide-products/basic-information-about-pesticide-ingredients>