GMOs Revealed: Food, Medicine, and More

Center Forward Basics
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Overview

Since the creation of "genetically modified organisms (GMOs)" in the early 1970s, scientists and engineers have been using modern biotechnology to genetically alter everything from food to medicine to clothing to animals, and even humans. With widespread introduction of GMOs in recent decades, especially in commercial food, some consumer advocates have mobilized to question the potential health and environmental risks associated with GMOs. Farmers, medical researchers, and leaders from other GMOs related industries argue that advanced forms of biotechnology have led to a reduction in global hunger, disease, and waste. This Basic, "GMOs Revealed: Food, Medicine, and More," summarizes the state of the current debate around GMOs, some of the advantages and disadvantages of GMO products, and reviews some of the challenges that food producers and other industries face as federal regulators and market demands change in the face of public opinion campaigns.

What are GMOs?

A GMO refers to any organism that is produced through genetic modification (GM). The United States Department of Agriculture (USDA) defines genetic modification as "the production of heritable improvements in plants or animals for specific uses, via either genetic engineering or other more traditional methods." USDA denotes that while this is how the federal government defines genetic modification, several other countries use the term to refer specifically to genetic engineering.

Though the current discussion around GMOs generally revolves around crop commodities such as corn, soybeans, cotton, and canola, the term GMO also applies to the developments of many live-saving medicines that treat illnesses including diabetes, several forms of cancer, ebola, hepatitis A and B, diphtheria, tetanus, pertussis, and polio. Additionally, many household and everyday items like laundry detergent, dish soap, and clothing are also genetically modified.

Advantages

While the debate around GMOs primarily focuses on the potential health and environmental factors at play, GMOs play many additional roles. Hunger advocates, scientific researchers, and many others point to the development and integration of GMOs into production of food, medicine, clothing and household items, and many other essentials to daily living in the modern world.

Genetic modification has allowed farmers to grow crops in parts of the country and world where conditions would otherwise not permit the growth of commodities such as corn, rice, and wheat. Many GMO crops have also been designed to include greater nutrient levels for consumption, be resistant to insects and disease, and produce stronger yields at harvest time. In addition to a more

Key Statistics

- Number of Countries Around the World that Significantly Limit or Ban GMO Products: **60**
- Adoption of genetically engineered crops in the United States, 1996-2017 (% of planted acres):
  - HT Soybeans **94%**
  - HT Cotton **91%**
  - HT Corn **89%**
  - Bt Cotton **85%**
  - Bt Corn **80%**
- USDA Approved Genetically Modified Crops, 2015:
  - Corn **33**
  - Soybean **20**
  - Cotton **16**
  - Potato **10**
  - Papaya **6**
  - Squash **2**
  - Canola **2**
- Examples of medicines derived from biological sources (including GMOs and GM products) include:
  - vaccines
  - antivenoms
  - bacteria derived toxins
  - Immunoglobulins
  - monoclonal antibodies
  - allergens
  - blood products and clotting factors
  - hormones such as insulin, growth hormone,
  - enzymes such as pancreatins
  - heparins

sustainable approach to solving global hunger challenges, many life-saving medicines and medical treatments are genetically-modified products. Treatments like chemotherapy, flu vaccines, and insulin shots for diabetics are all GMO innovations. These advancements all improve the lives of at-risk populations.

Despite so much of the criticism of GMOs surrounding their potential health and environmental risks, major health organizations such as the American Medical Association (AMA), the U.S. National Academy of Sciences (NAS), and The World Health Organization (WHO) have extensively reviewed the studies and evidence on GMO products to date, and have all similarly concluded that no empirical evidence suggests GMO foods and other products pose any more risk than those that are not genetically modified.

Challenges

Most opponents of GMOs are first to point to potential health concerns. GMO's, specifically as they relate to food, are relatively new and research is minimal, they argue. The long-term effects on the human body may lead to higher rates of disease, nervous, neurological, or muscle deterioration, or genetic mutations. Though, these claims have not been substantiated, opponents point to the fact that more than sixty nations worldwide, including all of the member-nations of the European Union (EU) have deemed GMOs, to a certain degree, to be unsafe and have placed restrictions on the production and sale of GM products. The continued development of GMOs, they argue, puts the United States at a trade disadvantage when the rest of the developed world will not accept certain agricultural products.

Beyond the health and trade concerns, GMO detractors make the case that GMOs can be devastating to the environment and are jeopardizing the stability of ecosystems across the United States. In addition to posing hazards to certain insects that pose no threat to crops, GMOs contain and leave chemicals in the soil that often find their way into wildlife food chains and naturally occurring water systems. All of this can pose a long-term issue for the health of humans, wildlife, and biological ecosystems.

Current Debate

In July 2016, Congress approved a measure with bipartisan support to give consumers the power to know which foods in a grocery store contain GMO ingredients. Additionally, some national food stores and retailers such as Whole Foods, Trader Joe's, and ALDI have gone GMO free or provide packaging that indicates the ingredients of a product.

Tracking from the National Conference on State Legislatures found that in 2016, ninety-five bills relating to GMOs were proposed in twenty-five states with three bills specifically relating to GMO labeling securing passage in Maine and Michigan. This is a topic that will continue to garner fierce arguments on both sides of the conversation and with major stakes to be won or lost,, expect the debate to continue at the federal, state, and municipal level.

Definitions

Genetic modification (GM): The production of heritable improvements in plants or animals for specific uses, via either genetic engineering or other more traditional methods. Some countries other than the United States use this term to refer specifically to genetic engineering.

Genetically modified organism (GMO): An organism produced through genetic modification.

Links to Other Resources

- Australian Department of Health — Medicines produced by genetic manipulation
  https://www.tga.gov.au/guidance-21-medicines-produced-genetic-manipulation

- Center for Science in the Public Interest — Straight Talk on Genetically Engineered Foods
  https://cspinet.org/sites/default/files/attachment/biotech-faq.pdf

- Congressional Research Service (CRS) — Agricultural Biotechnology: Background, Regulation, and Policy Issues
  https://www.everycrsreport.com/files/20150728_RL32809_855750172041540e914df83eed45624b6fe96312.pdf

- Congressional Research Service (CRS) — U.S. Agricultural Biotechnology in Global Markets: An Introduction
  https://www.everycrsreport.com/files/20030619_RL31970_6c366fa0b6f70af94bddb8f5fa97a9689bb4f430.pdf

- Congressional Research Service (CRS) — Legal Issues with Federal Labeling of Genetically Engineered Food: In Brief
  https://www.everycrsreport.com/files/20160311_R43705_67b52708b949381ad078c48fd8fd1fe313509db1.pdf

- Congressional Research Service (CRS) — Agricultural Biotechnology: The U.S.-EU Dispute
  https://www.everycrsreport.com/files/20100408_RS21556_90ae3bd461abd7d052d2e3dd5e1cdeb3b86a071f.pdf

- Food Science and Human Wellness — Genetically modified foods: A critical review of their promise and problems
  http://www.sciencedirect.com/science/article/pii/S2213453016300295

- National Conference on State Legislatures — GMO Legislation Summary
  http://www.ncsl.org/research/agriculture-and-rural-development/state-legislation-addressing-genetically-modified-organisms-report.aspx

- Purdue University Agriculture — What are GMOs?
  https://ag.purdue.edu/GMOs/Pages/WhatareGMOs.aspx

- Science Based Medicine — National Academy of Sciences Report on GMOs
  https://sciencebasedmedicine.org/national-academy-of-sciences-report-on-gmos/

- Scientific American — Why People Oppose GMOs Even Though Science Says They Are Safe
  https://www.scientificamerican.com/article/why-people-oppose-gmos-even-though-science-says-they-are-safe/

- The New York Times — A Lonely Quest for Facts on Genetically Modified Crops
  https://www.nytimes.com/2014/01/05/us/on-hawaii-a-lonely-quest-for-facts-about-gmos.html

- TIME — These Charts Show Every Genetically Modified Food People Already Eat in the U.S.
  http://time.com/3840073/gmo-food-charts/

- United States Department of Agriculture (USDA) — Agricultural Biotechnology Glossary
  https://www.usda.gov/topics/biotechnology/biotechnology-glossary

- United States Department of Agriculture Economic Research Service — Recent Trends in GE Adoption
  https://www.ers.usda.gov/data-products/adoption-of-genetically-engineered-crops-in-the-us/recent-trends-in-ge-adoption.aspx