

Plant Genetics – History of Genetic Modification of Crops We Eat

WHAT?

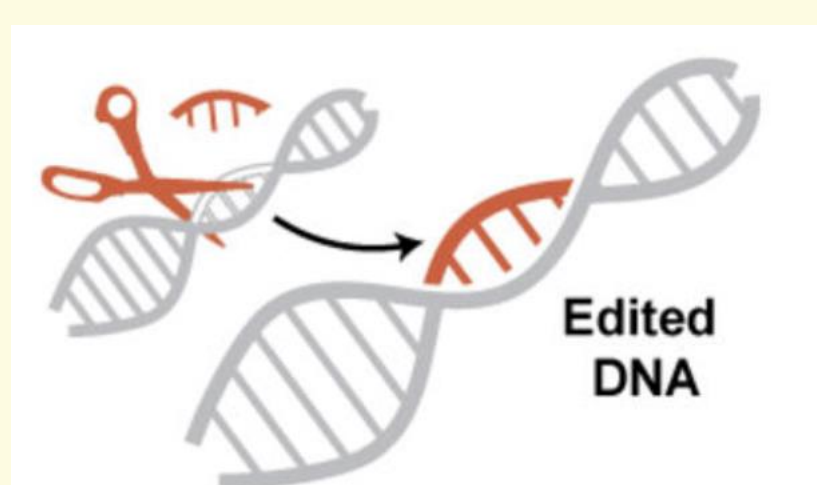
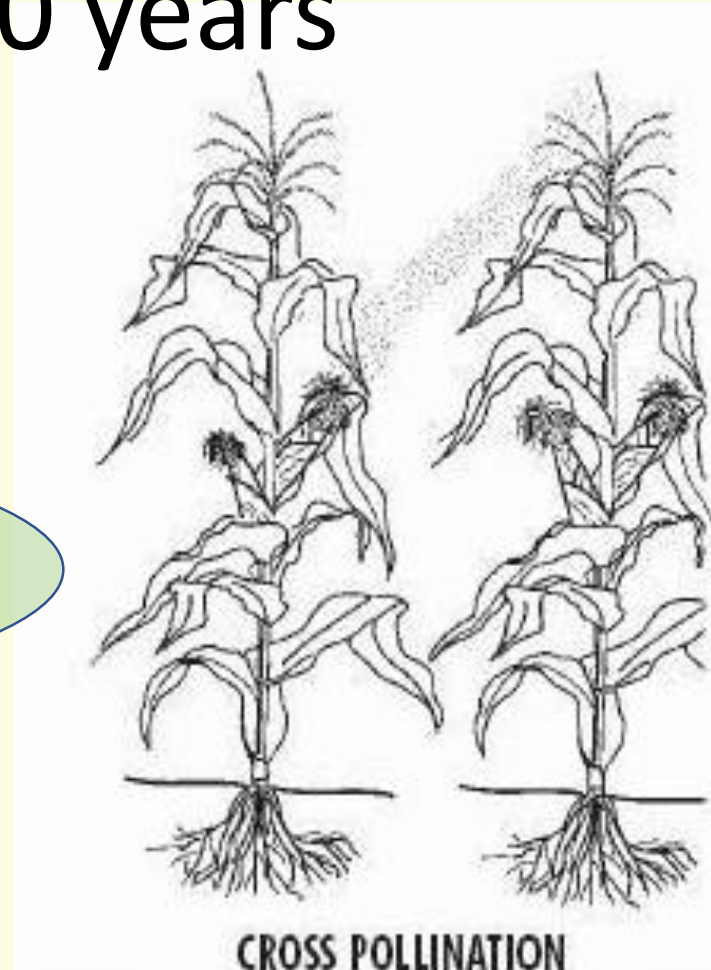
- Virtually all plants we eat have been **genetically changed or modified** by humans
 - This means we have been determining what **genes or traits** are propagated

WHY?

- Modifying and selecting plants that have **desired traits** for yield, taste, quality, texture, disease resistance, etc. benefit farmers and consumers
 - Responsible for half of crop yield improvements over the last 50 years

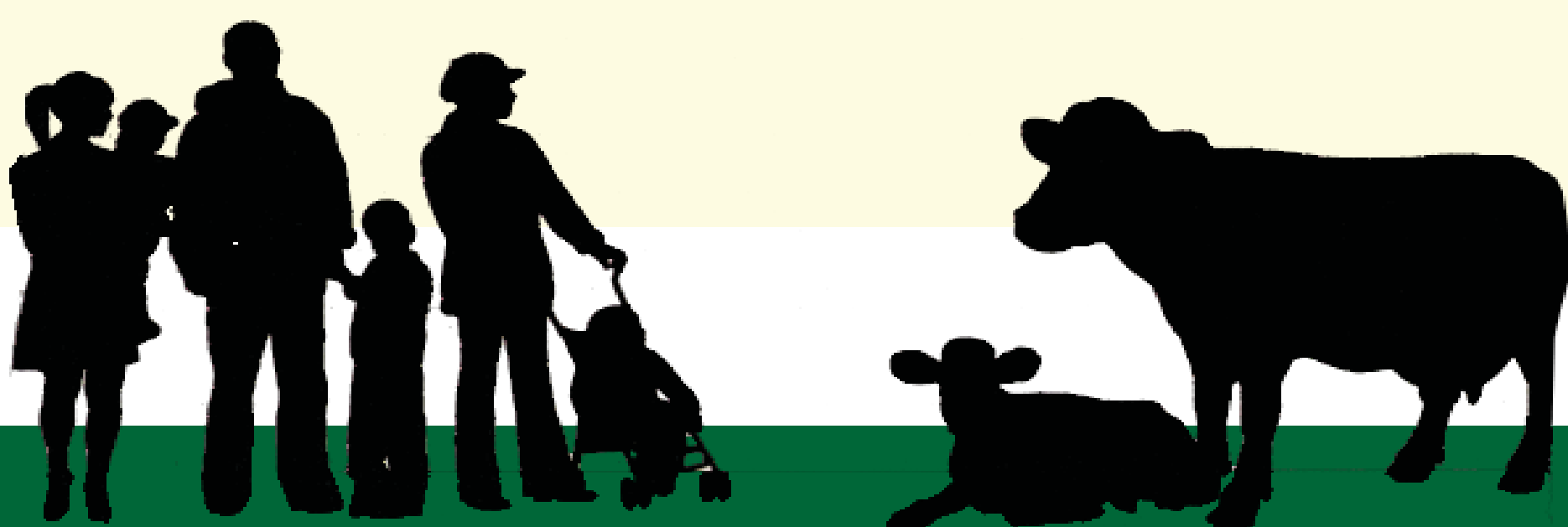
HOW?

- Natural mutations in genes or DNA
- 10,000 years ago humans begin to **select and breed crops**
- **Crossbreeding** of plants of the same species
 - Mid 1800's modern genetics began with Gregor Mendel cross pollination of peas
 - To improve existing plant characteristics by crossing two varieties
- 1940s- **Man-made mutations** or mutation breeding using chemicals and radiation to create new plant varieties
 - Example: Ruby red grapefruit which is cold tolerant
- 1980s- **GMOs** or genetically modified organisms: Scientists learned to copy a gene (DNA code) from one organism to another to add a new desired trait called transgenes using gene engineering (GM/GE).
 - 1990s first GMOs on the market
- 2015- **Gene editing** makes a tiny, controlled, modification of a gene by editing the DNA code
 - Works like find and replace in word processor for specific, known genes which are modified without changing other genes



Source: University of California, Berkley

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GM/GMO Crops: What's in a name?

- **Genetically Modified Organism** or **GMO** is commonly used to describe several terms:

- Genetically modified (GM)
- Genetic engineering (GE)
- Biotech seeds

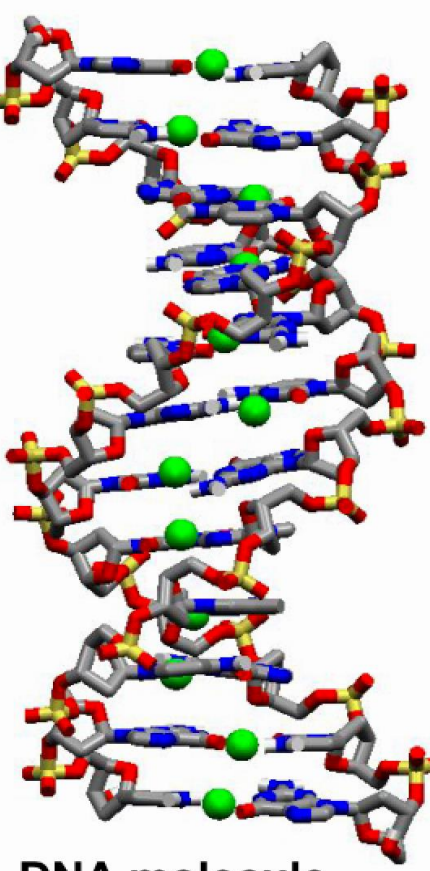
- GMO refers a modern **method of breeding** that improves plant genetics by adding a **gene(s)** to a plant by “directly inserting” the gene or DNA from another organism into the genetic code to add a new trait such as insect or disease resistance, drought tolerance or enhance nutrition.

- This method is called **transgenic** by scientists
- Used primarily in bacteria (1980s) and plants (1990s)
- Example: 1980s, bacteria make 90% of **human insulin** (a protein)

- **GMO foods** are foods made from GM (genetically modified/ genetically engineered) crops or crop products

- **What are genes? What is DNA?**

- Anything that is alive or has lived **has genes**.
- **Genes** are made of DNA.
- DNA is like computer code that codes for genes or traits
- Plant and animal genes have been **mutating** forever
- **When we eat DNA** (or an animal we eat, eats DNA) the DNA is broken down by the digestive system along with other food components (e.g., proteins, carbohydrates)



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GM/GMO Crops: How do I know I am purchasing foods containing GMOs?

There are 10 commercialized **GMO crops** in the United States

- Field corn & Sweet corn
- Soybeans
- Cotton
- Alfalfa
- Canola

- Rainbow Papaya
- Sugar beets
- Summer Squash
- Potato
- Apple

- Foods from corn and soybeans likely are derived from GMO plants as **over 90%** of these crops are GM/GE varieties
- USDA is developing standard U.S. labels for products derived from GE plants. These ingredients are considered **safe**. The label is required because Congress passed a labeling law so people know what products contain GM/GE plant products
- All plants developed using GE or transgenic methods must go thru **FDA approval** and testing to ensure safety
- Other organizations and companies are labeling some of their products **non-GMO**

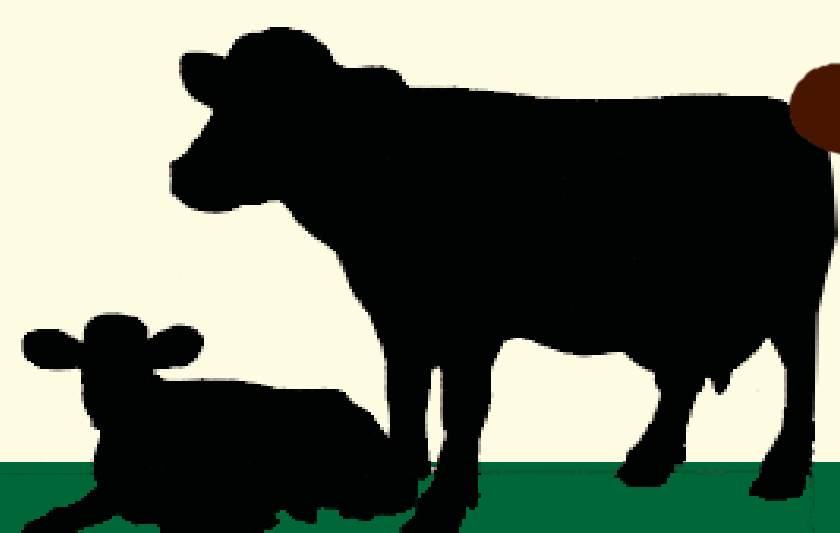


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GM/GMO Crops: WHY DO FARMERS GROW GM/GMO CROPS?

GM/GMO crops improve crop production in a number of ways:

- **Insect resistant plants are sprayed less reducing pesticide use, carbon footprint, and costs**
 - Reduced labor, fuel and equipment costs to apply pesticides
 - Reduced crop insurance costs
 - Decreased insecticide exposure to farmers and the environment
- **Reduced impact on the environment**
 - Herbicide resistant crops allow farmers to kill weeds without tilling, which protects soil health
 - Drought resistant crops don't need as much irrigation, saving river and ground water
- **Higher returns per acre**
 - Reduced crop losses from insects, diseases and weeds
 - Improved crop quality – less mold toxins = better price
- **Ease of production**
 - Less time spent on the tractor spraying pesticides or cultivating fields; reduced time/labor scouting fields
 - Some plant diseases can't be controlled, so disease resistant crops are farmers' only options
- **Benefits to consumer**
 - Less insect damage = less toxin producing molds = improved human safety
 - Healthy crops that spoil slower prevent food waste



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