

# Genetically Modified Organisms

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## Outline

- What is a GMO
- Deregulated Plant in U.S.
- Top 10 GMO crops in U.S.
- Break down of the traits
- Why GMO
- Why farmers use GM Crops
- Concerns
- Evidence
- Conclusion



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## What is a Genetically Modified Organism?

- \*A genetically modified organism (GMO), also known as a transgenic organism, is any organism whose genetic material has been altered using genetic engineering techniques. (Wikipedia)
- \*An organism or microorganism whose genetic material has been altered by means of genetic engineering. (Dictionary.com)
- \*A genetically modified organism (GMO) is any organism the genetics of which have been altered through the use of modern biotechnology to create a novel combination of genetic material. (Monsanto Dictionary)
- \*Organisms whose genetic material has been artificially manipulated in a laboratory through genetic engineering, or GE. This relatively new science creates unstable combinations of plant, animal, bacteria and viral genes that do not occur in nature or through traditional crossbreeding methods. (NONGMO Project)

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### APHIS regulates GMOs

- Release to environment
- Importation
- Interstate movement
- Doesn't regulate already contained experiments
  - Field
  - Laboratory
- Regulates under the Plant Protection Act:
  - Authorizes the Secretary of Agriculture to "prohibit or restrict the importation, entry, exportation, or movement in interstate commerce of any plant or plant product."




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### APHIS grants authorization in 3 ways

- Notification
- Permitting
- Determination of Nonregulated Status




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## Notification



- Lower risk plants
  - Not classified as noxious weeds, or weeds in the release area
  - Have to meet certain criteria
    - Plant must be stably integrated
    - Expression of genetic material must not result in plant disease
- If notification denied, applicant can pursue a permit




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## Permit



- More restrictive; higher risk plants
- Applicant must submit information on:
  - Donor organism
  - Recipient organism
  - Expression of genetic material and biology of system used to produce the plant
  - Loci of gene alteration
  - Purpose
  - Quantity to be produced
  - Process to prevent release
  - Intended destination
  - Use and distribution
  - Final disposition

If a permit is granted, APHIS designs conditions to ensure both the regulated plant remains controlled and the APHIS can maintain regulatory oversight.




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## Determination of Non-regulated Status

Plants have been tested and have shown to not pose a risk may be eligible for determination of non-regulated status

Petition must include:

- Detailed biological information
- Published and unpublished data
- Any other information from APHIS permit conditions




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## Concerns?

Overall, risk to the environment or human health

- Hybridize with non-GM plants through pollen (canola)
- Pests will become resistant (refuge in a bag)
- Conditions required to grow GM crops will interfere with wildlife habitat (biodiversity)
- Adverse effects on human health
  - Carcinogen, toxic, allergens

Source: Key et al. 2008

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## Hybridize with non-GM plants through pollen- Canola (*B. napus*)



- Pollenmediated, intraspecies gene flow from canola to its wild relatives.
  - *B. rapa* L. (rapeseed), *Raphanus raphanistrum* L. (wild radish), *Sinapis arvensis* L. (wild mustard), and *Erucastrum gallicum* (common dogmustard)
- *B. napus* → *B. rapa* = ~7% in commercial fields and ~13.6% in the wild
- GE *B. napus* → three wild varieties was shown to be low (<math>2 \times 10^{-5}</math>)
- Genes could move via wild volunteers
- Most outcrossing occurred in the first ten meters from the field
- Rate of outcrossing was influenced by factors relating to the field, plant, pollen, and environment influenced the rate

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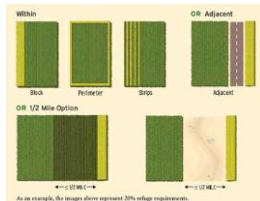
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## Pests will become resistant

### Refuge in a bag

- Mandatory refuge requirements—planting sufficient acres of the non-Bt crop near the Bt crop—were needed to reduce the rate at which targeted insect pests evolved resistance
- Such refuges slow the rate at which Bt resistance evolves by allowing target insects that are susceptible to the Bt toxin to survive and reproduce




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Conditions required to grow GM crops will interfere with wildlife habitat

- A lot of bird species returned to cotton fields as soon as GM cotton replaced conventional insecticides.
- Before GM cotton, birds were eating insecticide-laden insects and dying as a result.




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Safe or no?

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A project to develop genetically modified peas by adding a protein from beans that conferred resistance to weevils was abandoned after it was shown that the GM peas caused a lung allergy in mice.

SCIENCE

Safety testing of GM plants is effective by having identified allergenic potential before the product was released on the market.

EMOTION

All GM is unpredictable and if this caused allergic reaction then all GMOs probably due. The process is unpredictable and dangerous.

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## References

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Google images

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