Cultivating GMO Crops: Destination Unknown

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From Gatherers to Farmers

- Selective breeding
- Gregor Mendel’s principles of inheritance
- Choose traits desired and cross pollinate
Hybridization

- Cultivate varieties with different traits by sequential selecting and breeding
- Cross fertilization between representatives of same species
Genetically Modified Organisms

- Combining traits across species - even across phyla
- Insert a strand of DNA with the desired trait (from a bacterium or virus vector)
- Into the genome of the target plant
- Grow in tissue culture to produce new plants whose seeds carry the new trait

https://royalsociety.org/topics-policy/projects/gm-plants/what-is-gm-and-how-is-it-done/
Applications of GMO

- Medical and pharmaceutical
  - Animal models of human genetic diseases like hemophilia
  - Creating “edible vaccines” for diseases like Hepatitis, HIV and malaria
  - Biosynthesis of pharmaceuticals such as human insulin
Applications of GMO

- **Bioresmediation** - Creating genetically modified bacteria to:
  - Clean up pollution such as mercury
  - RemEDIATE Persistent Organic Pollutants (PCB, PAH, pesticides)
  - Clean up oil spills

Alabaster Corporation Bio-remediation of oil spill
Applications of GMO

- Agricultural Uses
  - Pest management
  - Nutritional enhancement

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3639326/#__ffn_sectitle
US leading user of GMO in crops

Roundup Ready!
Arguments For Agricultural GMO

- Enhance food quality
- Enhance agricultural productivity (yields)
- Enhance nutrition
- Create “drug factories” for producing edible vaccines and pharmaceuticals

“Golden Rice” enhanced with vitamins

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4346933/
Arguments For Agricultural GMO

- Reduce environmental footprint of agriculture
- Reduce fossil fuel use for tilling and harvesting
- Conserve water
- Use “less” pesticides

Glyphosate sprayed just before harvest for crop drying

Arguments Against GMO

- Effects untested, unknown will take decades to manifest
- GMO escape and transfer to wild populations
- Loss of biodiversity and habitat destruction

GMO Monoculture crops

Organic farming
Arguments Against GMO

- Increased use of chemicals in agriculture & persistence in harvested foods
- Unintended transfer to other organisms (for example *E. coli* in your intestines)
- "Super Weeds"

Palmer amaranth is one of the most prolific glyphosate resistant weeds in the US, producing up to a million seeds per plant. (Superior Ag Resources photo/Tom Sinnott)
GMO crops increase pesticide use

Monsanto introduced GMO Roundup Ready crops in 1995
Ecological Effects

- **Essential Pollinators**: Nearly 90 per cent of all wild flowering plants and 75% of food crops depend on animal pollination.

- **Biodiversity reduction**: Herbicide spraying destroys non-crop plants reducing habitat.

- **Pollinator toxicity**: Neonicotinoids, sub-lethal and indirect effects of GM crops on pollinators are poorly understood and not usually accounted for in risk assessments.

Economic Impact of losing Pollinators

Insect pollinators contribute $29 billion to U.S. farm income
Glyphosate residues in finished foods

- FDA has expanded testing for residues of herbicides: glyphosate, 2,4-D and dicamba because of projected increased use of these weed killers on new genetically engineered crops.
- FDA chemist, N. Chamkasem, found “over-the-tolerance” levels of glyphosate at 6.5 parts per million in corn. The legal limit is 5.0 parts per million.

EWG tested granola, oatmeal and cereals - 45 of 47 samples found Glyphosphate at higher levels than safe

https://www.ewg.org/childrenshealth/glyphosateincereal/#.W7JPRy-ZOL
https://usrtk.org/pesticides/fda-foia-documents-regarding-glyphosate-residue-testing/
The EPA’s assessment found “no meaningful risks to human health when the product is used according to the pesticide label.”

“There is potential for effects on birds, mammals, and terrestrial and aquatic plants.”

https://www.epa.gov/pesticides/epa-releases-draft-risk-assessments-glyphosate
Numerous negative health effects have been associated with chemical pesticides. Dermatological, gastrointestinal, neurological, carcinogenic, respiratory, reproductive, and endocrine effects can result from exposure through ingestion, inhalation, contact. Bio-accumulation in fat tissue is another consequence. 

The Ethical Dilemma

Who has the right to decide for the countless legions of people who were not consulted?

- Preserving the Ecosystem Services of the Earth
- Precaution Principle
- Intergenerational Equity
Interconnected Web of life

“...man does not live apart from the world; he lives in the midst of a complex, dynamic interplay of physical, chemical, and biological forces, and between him and this environment are continuing, never ending interactions.”

Rachel Carson
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Resources for further study:


Further resources

- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3558185/
- https://usrtk.org/pesticides/fda-foia-documents-regarding-glyphosate-residue-testing/