

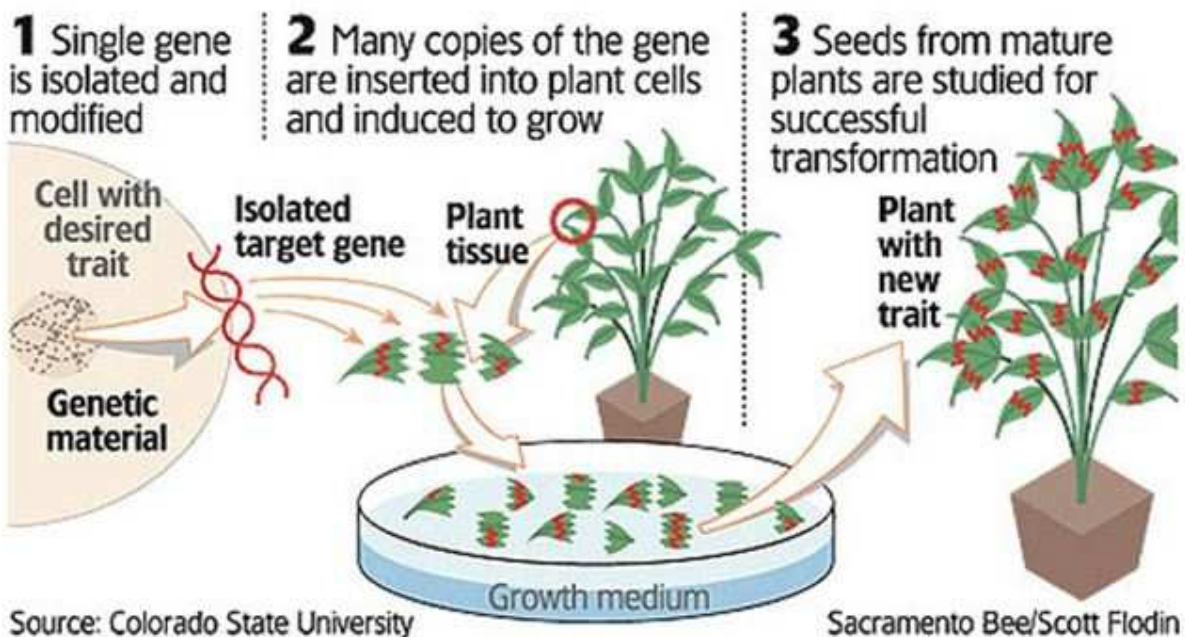
Current status and commercial opportunities of Genetically Modified plants

- Genetically Modified Organisms are the ones in which the genetic material (DNA) has been altered in such a way as to get the required quality.
- The technology is often called ‘gene technology’, or ‘recombinant DNA technology’ or ‘genetic engineering’ and the resulting organism is said to be ‘genetically modified’, ‘genetically engineered’ or ‘transgenic’. A plant is known as GM crops or genetically modifies crops.

The process of Genetic Engineering:

Genetic engineering

Researchers isolate a gene from an organism that has the trait they want to impart to a plant.



Advantages of GM crops:

1. Crop Protection:

- The initial objective for developing GM plants was to improve crop protection. GM crops have improved resistance to diseases, pest, insects and herbicides. They also have improved tolerance to cold/heat, drought and salinity.
- Insect resistance is achieved by incorporating into the food plant the gene for toxin production from the bacterium *Bacillus thuringiensis* (Bt).
- Virus resistance is achieved through the introduction of a gene from certain viruses which cause disease in plants.
- Herbicide tolerance is achieved through the introduction of a gene from a bacterium conveying resistance to some herbicides.

2. Economic benefits:

- GM crops can increase yield and thus income.
- Genetically modified foods have a longer shelf life. This improves how long they last and stay fresh during transportation and storage.

3. Food Security:

- Given the increased growth of global population and increased urbanisation, GM crops offer one of the promising solutions to meet the world's food security needs.

Did you Know?

- The first commercially grown GM food crop was Tomato (called FlavrSavr), modified to ripen without softening by a Californian company Calgene.
- In 2017, the accumulated biotech crop area (planted since 1996) increased to a record 2.3 billion hectares or 5.8 billion acres (Global Status of Commercialized Biotech/GM Crops in 2017, ISAAA)
- The top 5 countries, each of which grew over 1 million hectares in 2017, was led by the USA followed by Brazil, Argentina, Canada and India

Issues with GM crops:

1. Human Health Risks:

- Potential impact on human health including allergens and transfer of antibiotic resistance markers.

Some studies revealing effect of GM crops on human health:

- A scientific report from Argentina found a fourfold increase in birth defects and a threefold increase in childhood cancers in HT soya areas.
- Studies have shown a strong correlation between growth of GM crops, the herbicides they promote, and diseases such as acute kidney injury, diabetes, autism, Alzheimer's and cancers in the past 20 years in the U.S.
- Bayer's glufosinate, the herbicide linked with Indian HT mustard, is an acknowledged neurotoxin banned in the EU. The Supreme Court-appointed technical expert committee recommended a ban on any HT crop in India for this among several other reasons.

2. Environmental concerns:

- They can reduce species diversity. For example, Insect-resistant plants might harm insects that are not their intended target and thus result in destruction of that particular species.
- GM technology could also allow the transfer of genes from one crop to another, creating "super weeds", which will be immune to common control methods.
- Viral genes added to crops to confer resistance might be transferred to other viral pathogens, which can lead to new and more virulent virus strains.

3. Economic Concerns:

- Introduction of a GM crop to market is a lengthy and costly process.
- It does not result in high yields as promised. For instance, the highest yields in mustard are from the five countries which do not grow GM mustard — U.K., France, Poland, Germany and Czech Republic — and not from the GM-growing U.S. or Canada.
- Critics claim that patent laws give developers of the GM crops a dangerous degree of control over the food supply. The concern is over domination of world food production by a few companies

4. Ethical Concerns:

- Violation of natural organisms' intrinsic values by mixing among species
- There have also been objections to consuming animal genes in plants

GM Crops in India

BT Cotton

- The Maharashtra Hybrids Seed Company (Mahyco) jointly with the US seed company Monsanto developed the genetically modified Bt Cotton to tackle the bollworm problem that had devastated cotton crops in the past.
- In 2002, Bt Cotton became the first and only transgenic crop approved by the GEAC for commercial cultivation in six States namely, Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, and Tamil Nadu.

Issue of Pink bollworm infestation:

In March 2018, the Indian government had cut royalties that local seed companies pay to Monsanto, for the second time in two years. This was in the backdrop of pink bollworm infestation plaguing cotton farmers.

Even though Monsanto's second generation insecticidal technology for cotton, was supposed to protect crops against the pink bollworm, the pest has grown resistant to the toxins produced by this trait. As a result, farmers now spend more on pesticides to control infestations. This, along with the high cost of Bt seeds, is driving farmers to indigence.

BT Brinjal:

- It was developed by Mahyco (Maharashtra Hybrid Seeds Company) in collaboration with the Dharward University of Agricultural Sciences and the Tamil Nadu Agricultural University.
- The GEAC in 2007, recommended the commercial release of Bt Brinjal. The initiative was blocked in 2010.

HT Mustard:

- Dhara Mustard Hybrid(DMH-11) is an indigenously developed transgenic mustard. It is genetically modified variety of Herbicide Tolerant (HT) mustard. It was created by using "barnase/barstar" technology for genetic modification by adding genes from soil bacterium that makes mustard self-pollinating plant.
- In 2017, the Genetic Engineering Appraisal Committee recommended the commercial approval of the HT Mustard crop.
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