Commercial Cultivation of GM Mustard

For Prelims: Genetic Engineering Appraisal Committee (GEAC), Genetically Modified (GM) mustard, Dhara Mustard Hybrid (DMH-11), Centre for Genetic Manipulation of Crop Plants.

For Mains: GM Crops and their significance.

Why in News?

Recently, the **Genetic Engineering Appraisal Committee (GEAC)** that functions under the Union Ministry of Environment, Forest and Climate Change has approved seed production prior to commercial release of **genetically modified (GM) mustard**.

What are Genetically Modified (GM) Crops?

- **About:**
  - GM crops are **derived from plants whose genes are artificially modified,** usually by **inserting genetic material from another organism,** in order to give it new properties, such as **increased yield, tolerance to a herbicide, resistance to disease or drought, or improved nutritional value**.
  - Probably the **best-known variety of GM rice is golden rice**.
    - Golden rice involves the insertion of genes from a plant - both daffodils and maize have been used - and a soil bacterium to create a grain that is enriched with Vitamin A.
  - **Earlier, India approved** the commercial cultivation of **only one GM crop**, **Bt cotton**, but GEAC has recommended GM Mustard for commercial use.
- **Advantages:**
  - **Increased Yield:** Genetically modified seeds dramatically increase the yield of the plant. This means that with the same plot of land, a farmer can now produce noticeably more crops.
  - **Beneficial in Specific Climates:** Genetically modified seeds can also be **produced for specific conditions or climates**. For example, drought-resistant seeds can be used in places with little water to ensure healthy crop growth.
- **Disadvantages:**
  - **Manipulation of Seeds Cost:** Only a few companies are in charge of creating and selling modified seeds. With a near monopoly, this means that there are few choices available to those buying seeds.
  - **Seeds can’t be Replanted:** Genetically modified seeds do not create viable seed offspring by design. This means that every time you want to plant a new crop, you have to go to the company you originally bought the seeds from.
  - **Environmental Concern:** They can decrease species diversity. For example, insect-resistant plants might harm insects that are not their intended target and destroy that particular insect species.
  - **Ethical Concern:** GM crop is the violation of natural organisms’ intrinsic values by mixing among species.

- There have also been concerns of mixing animal genes in plants.

What is GM Mustard?

- **About:**
  - **Dhara Mustard Hybrid (DMH-11)** is an indigenously developed transgenic mustard. It is a **genetically modified variant of Herbicide Tolerant (HT) mustard**.
  - It contains **two alien genes** ('barnase' and 'barstar') isolated from a soil bacterium called Bacillus amyloliquefaciens that enable breeding of high-yielding commercial mustard hybrids.
  - It has been developed by the **Centre for Genetic Manipulation of Crop Plants (CGMCP) at Delhi University**.
  - In 2017, the GEAC recommended the commercial approval of the HT Mustard crop. However, the Supreme Court stayed its release and asked the central government to seek public opinion.
- **Significance:** India produces only 8.5-9 million tonnes (mt) of edible oil annually while it imports 14-14.5 mt which entailed a record foreign exchange outgo of USD 18.99 billion in the fiscal year ended March 31, 2022. Further, GM mustard would make **India self-reliant in oil production and help in saving forex**.
  - Mustard varieties in India have a narrow genetic base. The barnase-barstar system enables breeding of hybrids from a wider range of mustards, including those of **East European origin such as 'Heera' and 'Donskaja'**.

What is the Status of other GM Crops in India?

- **BT Cotton:**
  - In order to tackle the bollworm attack that had devastated cotton crops in the past, Bt cotton was introduced which was **jointly developed by the Maharashtra Hybrid Seeds Company (Mahyco) and the US seed company Monsanto**.
  - In 2002, the GEAC approved Bt Cotton for commercial cultivation in 6 states such as Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, and Tamil Nadu. It has to be noted that, Bt cotton is the first and only transgenic crop approved by the GEAC.
- **BT Brinjal:**
  - **Mahyco** jointly developed **Bt Brinjal with the Dharwad University of Agricultural Sciences and the Tamil Nadu Agricultural University**.
  - Even though GEAC 2007 had recommended the commercial release of Bt Brinjal, the initiative was blocked in 2010.

What is Genetic Engineering Appraisal Committee (GEAC)?

- It is responsible for the appraisal of activities involving large-scale use of hazardous microorganisms and recombinants in research and industrial production from the environmental angle.
- The committee is also responsible for the appraisal of proposals relating to the release of genetically engineered (GE) organisms and products into the environment including experimental field trials.
- GEAC is chaired by the Special Secretary/Additional Secretary of MoEF&CC and co-chaired by a representative from the Department of Biotechnology (DBT).

Way Forward

- Rigorous monitoring is needed to **ensure that safety protocols are followed strictly,** and enforcement must be taken seriously to prevent the spread of illegal GM crops.
- Further, **Environmental impact assessment** should be carried out by independent environmentalists, as farmers do not and cannot assess the long-term impact of GM crops on

ecology and health.

UPSC Civil Services Examination Previous Year Question

Prelims:

Q. Other than resistance to pests, what are the prospects for which genetically engineered plants have been created? (2012)

1. To enable them to withstand drought
2. To increase the nutritive value of the produce
3. To enable them to grow and do photosynthesis in spaceships and space stations
4. To increase their shelf life

Select the correct answer using the codes given below:

(a) 1 and 2 only

(b) 3 and 4 only

(c) 1, 2 and 4 only

(d) 1, 2, 3 and 4

Ans: C

- **Genetically modified crops (GM crops or biotech crops) are plants used in agriculture, the DNA of which has been modified using genetic engineering methods.** In most cases, the aim is to introduce a new trait to the plant which does not occur naturally in the species. Examples of traits in food crops include resistance to certain pests, diseases, environmental conditions, reduction of spoilage, resistance to chemical treatments (e.g., resistance to a herbicide), or improving the nutrient profile of the crop.
- Some potential applications of GM crop technology are:
    - Nutritional enhancement – Higher vitamin content; more healthful fatty acid profiles; **Hence, 2 is correct.**
    - Stress Tolerance – Tolerance to high and low temperatures, salinity, and drought; **Hence, 1 is correct.**
    - There is no such prospect that enables GM crops to grow and do photosynthesis in spaceships and space stations. **Hence, 3 is not correct.**
    - Scientists have been able to create certain genetically modified crops which stay fresh for a month longer than usual. **Hence, 4 is correct. Therefore, option (c) is the correct answer.**

Q. Bollgard I and Bollgard II technologies are mentioned in the context of

(a) clonal propagation of crop plants

(b) developing genetically modified crop plants

(c) production of plant growth substances

(d) production of biofertilizers

Ans: B

- **Bollgard I Bt cotton (single-gene technology) is first biotech crop technology approved for commercialization in India in 2002,** followed by Bollgard II- double-gene technology in mid-2006, by the Genetic Engineering Approval Committee, the Indian regulatory body for biotech crops.

- Bollgard I cotton is an insect-resistant transgenic crop designed to combat the bollworm. It was created by genetically altering the cotton genome to express a microbial protein from the bacterium Bacillus thuringiensis.
- Bollgard II technology contains a superior doublegene technology - Cry1Ac and Cry2Ab, which provides protection against bollworms and Spodoptera caterpillar, leading to better boll retention, maximum yield, lower pesticides costs, and protection against insect resistance.
- Both Bollgard I and Bollgard II insect-protected cotton is widely planted around the world as an environmentally friendly way of controlling bollworms. **Therefore, option (b) is the correct answer.**

Mains:

Q. How can biotechnology help to improve the living standards of farmers? (2019)

Source: TH