PLUTUS IAS

CURRENT AFFAIRS

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GM CROPS

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THIS ARTICLE COVERS 'DAILY CURRENT AFFAIRS' AND THE TOPIC DETAILS OF "**GM CROPS**". THIS TOPIC IS RELEVANT IN THE "AGRICULTURE AND SCIENCE & TECHNOLOGY" SECTION OF THE UPSC CSE EXAM.

UPSC MAINS GS3 SYLLABUS: ISSUES AND RESTRAINTS IN AGRICULTURAL PRODUCE, INDIGENIZATION OF TECHNOLOGY

WHY IN THE NEWS?

The Indian government recently persuaded the Supreme Court that genetically modified (GM) crops like mustard will reduce the cost of quality edible oil for the average person while also benefiting national interests by reducing foreign dependency.The **Genetic Engineering Appraisal Committee (GEAC)** has granted permission for the environmental release of **Dhara Mustard Hybrid-11 (DMH-11)**, a genetically modified mustard strain.

ABOUT GM CROPS

- Genetically modified (GM) crops are generated from plants whose genes have been purposefully transformed, typically by introducing genetic material from another organism in order to give them new traits such as higher yield, herbicide tolerance, disease or drought resistance, or nutritional value.
- The efficacy of the GM crop is evaluated under rigorous laboratory and field conditions.
- Previously, India permitted the commercial cultivation of just one GM crop, Bt cotton, but the **Genetic Engineering Appraisal Committee (GEAC)** has endorsed GM Mustard for commercial production.

BENEFITS OF GM CROPS

INCREASED AGRICULTURAL PRODUCTIVITY:

GM crops are frequently bred to withstand pests and illnesses, decreasing the need for chemical pesticides. This can lead to **higher yields** and **lower input burden.** Crop resilience improves adaptation to adverse environmental situations, increasing overall agricultural yield.

NUTRITIONAL IMPROVEMENT (BIOFORTIFICATION):

Genetic modification allows for the improvement of nutritional content in crops via **biofortification**. **Golden Rice**, for example, produces beta-carotene, addressing vitamin A insufficiency in places where rice is a mainstay.

ENVIRONMENTAL SUSTAINABILITY:

Reducing the use of chemical pesticides and herbicides can improve environmental sustainability. Some GM crops are designed to withstand specific environmental challenges, such as drought or salinity, thereby encouraging sustainable farming techniques

GLOBAL FOOD SECURITY:

GM crops have the potential to ease food shortages by raising crop yields and **strengthening agriculture's resilience** to changing climate conditions. **Improved pest and disease resistance** leads to a more constant and reliable food supply.

ECONOMIC BENEFITS FOR FARMERS:

Farmers benefit from **higher agricultural yields** and **lower pesticide costs.** Genetically modified crops may use fewer resources, such as water and land, hence increasing agricultural economic efficiency.

CONCERNS ABOUT GM CROPS:

ENVIRONMENTAL RISKS:

The possibility of unexpected consequences, such as the formation of superweeds or adverse effects on non-target organisms, raises worries about the environmental viability of GM crops. The long-term implications of genetic manipulation on ecosystems and biodiversity are currently poorly understood.

HEALTH IMPLICATIONS:

Some critics are concerned about the potential health dangers associated with the consumption of GM crops. This includes allergens, toxicity, and the spread of antibiotic-resistant genes. Rigorous testing and study are required to assure that GM crops are safe for human consumption.

CORPORATE RULE AND MONOCULTURE:

The concentration of genetically modified crop development in a few large biotechnology companies raises worries about corporate control of global agriculture and seed supply.Monoculture practices linked with GM crops may reduce crop diversity, making agricultural systems more susceptible to pests and diseases.

ETHICAL CHALLENGES:

The ethical consequences of changing the genetic makeup of species, including plants, are debatable.

Questions of genetic resource ownership, farmer exploitation, and socioeconomic impact must be addressed.

REGULATORY CHALLENGES:

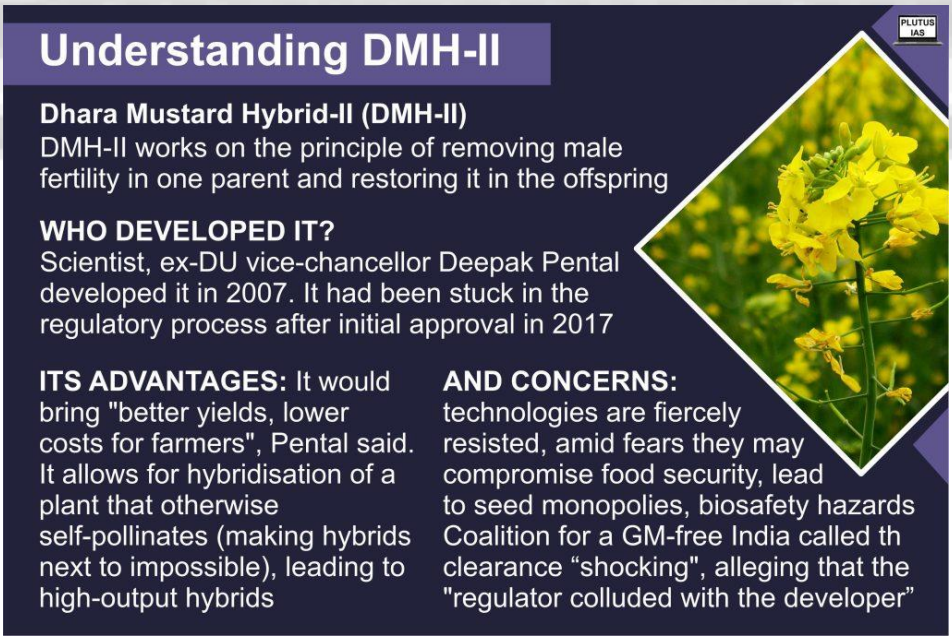
Creating appropriate regulatory frameworks for the safe creation, testing, and commercialization of GM crops is a challenging task. Diverse regulatory procedures around the world contribute to uncertainty and varying levels of public approval.

CARCINOGEN EXPOSURE DANGER:

According to studies, crops that are resistant to commercial pesticides significantly increase the chance of developing cancer in rats. Genetically engineered crops may also offer major risks to human health.

WHAT IS GM MUSTARD

- Mustard hybridization is challenging because the flowers contain both female (pistil) and male (stamen) reproductive parts, making the plant self-pollinating. Thus, producing hybrids for mustard has limitations.
- **Dhara Mustard Hybrid (DMH-11)** was developed by a team of scientists from Delhi University, directed by former vice-chancellor and genetics professor Deepak Pental, as part of a government-funded study.
- To generate DMH-11, scientists crossed a common Indian mustard variety called **'Varuna'** (the barnase line) with an East European **'Early Heera-2'** mutant (barstar). The new hybrid mustard DMH-11 has been produced with two alien genes obtained from a soil bacteria called **Bacillus amyloliquefaciens.**
- The **first gene ('barnase')** encodes a protein that reduces pollen production and makes the plant into which it is integrated male-sterile. This plant is then crossed with a fertile parental line with the second **'barstar'** gene, which inhibits the action of the barnase gene.
- The barstar gene in the second fertile line results in F1 progeny that is both high-yielding and capable of producing seed/grain.



ABOUT GENETIC ENGINEERING APPRAISAL COMMITTEE (GEAC)

- The GEAC is in charge of reviewing proposals for the release of genetically modified organisms and goods into the environment.
- It works under the Union Ministry of Environment, Forests, and Climate Change.
- It functions in accordance with the Environment Protection Act of 1986 and the Rules of 1989.
- It applies to the large-scale usage of harmful microbes and recombinants in research and industrial production from an environmental standpoint.

PRELIMS PRACTICE QUESTIONS:

Q1) Consider the following statements regarding Gene Editing:

1) CRISPR-Cas9 gene-editing system is used in Targeting and Cutting DNA.
2) The term "gene knockout" refers to Turning Off or Disabling a Gene.
3) DNA ligase is commonly used in the CRISPR-Cas9 system to cut DNA at specific locations

Which of the following statements given above is/are correct?

a) 1 and 2
b) 2 and 3
c) 1 and 3
d) None

ANSWER: B

Q2) What is the role of the Bacillus thuringiensis (Bt) gene in genetically modified crops?

A) Enhances nutritional content
B) Confers resistance to pests
C) Improves drought tolerance
D) Increases yield

Answer: B

Q3) What is RNA interference (RNAi) commonly used for in genetic modification?

A) Enhancing photosynthesis
B) Suppressing gene expression
C) Increasing root growth
D) Improving fruit ripening

Answer: B

MAINS PRACTICE QUESTIONS

Q1) Discuss the potential benefits and risks associated with the widespread adoption of genetically modified (GM) crops. Include considerations for both agriculture and the environment.

Q2) Evaluate the role of genetically modified crops in addressing global food security. What challenges and opportunities do GM crops present in this context?

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