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Environmental Science

PART-II

Question no.3:

Answer: Introduction:

a. Genetic Engineering: Advances in the field of molecular biology provided scientists with the ability to manipulate DNA, the chemical building blocks that specify the characteristics of living organisms at the molecular level. This technology is called genetic engineering.

Transfer of DNA Between More Distinctly Related Organisms is Possible:

Genetic engineering also allows the transfer of DNA between more distinctly related organisms than was possible with traditional breeding techniques.

Present-Day Genetically Induced Engineering is More Advanced:

Today, genetic engineering has reached a stage where scientists can take one or more specific genes from nearly any organism, including plants, animals, bacteria, viruses, and introduce those genes into another organism.

Genetically Modified Organism:
Definition: Genetically modified organism (GMO) may be defined as:
A Genetically Modified Orgquism is an organism that has been transformed using genetic engineering techniques.

b. Term 'Genetically Modified Organism' has been Around for a Long Time: The term 'genetically modified organism' is wide used, although genetic modification has been around for hundreds if not thousands of years, since deliberate crosses of one variety/breed with another result in offspring that are genetically modified compared to the parent.

c. Genetically Modified Products are also Widely Used: Similarly, foods derived from transgenic plants have been called "GMPs" (genetically modified products), along with "GMO foods", and biotech foods.

A Glance at the Concept of Biotechnology:

a. What is Biotechnology:

Biotechnology is the application of scientific techniques to modify and improve plants, animals, and microorganisms to improve/enhance their value.

b. Agricultural Biotechnology: A Subdivision of Biotechnology:

Agricultural biotechnology is the area of biotechnology involving agricultural applications.

Agricultural Biotechnology has been practised for a Long Time:

Agricultural biotechnology has been practised for a long time since people have sought to improve agriculturally important organisms by selection and breeding.

Example: An example of traditional agricultural biotechnology is the development of disease-resistant wheat varieties by cross-breeding different wheat types until the desired disease resitant variety was obtained.

Role of Genetic Engineering and GMOs in Dealing with Increasing Food Demands:

1. Increased Crop Productivity:

Biotechnology has helped to increase crop productivity by introducing such qualities as disease resistance and increased drought tolerance to the crops (Figure A). Now, researchers can select genes for disease resistance from other species and transfer them to important crops.

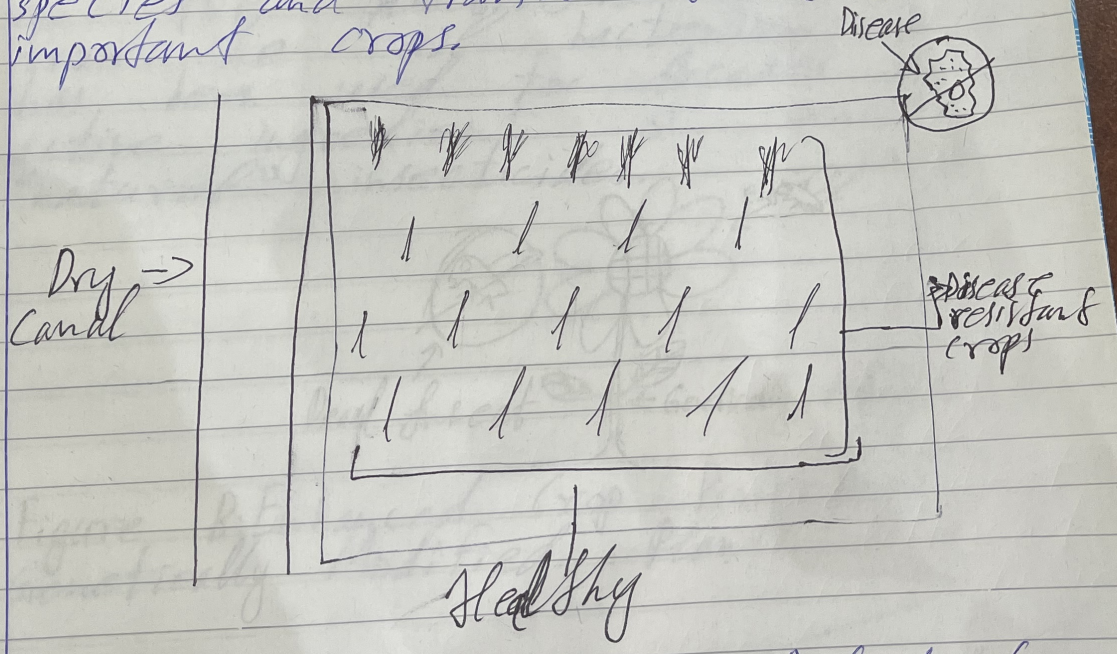

Figure A: Increased Crop Productivity due to GMOs and Genetic Engineering.

2. Enhanced Crop Protection:

Farmers use crop-protection technologies because they provide cost-effective solutions to pest problems which, if left uncontrolled, would severly lower yields (Figure B). As mentioned above, crops such as corn, cotton, and potato have been successfully transformed through genetic engineering to make a protein that kills certain insects when they feed on the plants. The protein is from the soil bacterium, which has been used for decades as the active ingredient of some "natural" insecticides.

Figure B: Enhanced Crop Protection by Genetically Modified Plants.

3. Improvements in Food Processing: The first food product resulting from genetic engineering technology to receive regulatory approval, in 1990. An enzyme was produced by genetically engineered bacteria. Its benefits include increased purity, reliable supply, cost reduction, and high yield.

4. Improved Nutritional Value and Better Flavor:
Genetic engineering has allowed new options for improving the nutritional value, flavor, and texture of foods. Transgenic crops in development include
(i) soybeans with higher protein content,
(ii) potatoes with more starch, amino acid,
(iii) beans with more essential amino acids,
(iv) and rice with the ability to produce beta-carotene.
Better flavor can be altered by enhancing the activity of plant enzymes that transform aroma precursors into flavoring compounds.
Example: Transgenic peppers and melons with improved flavor are currently in field trials.

5. Fresher Produce:

Genetic engineering can result in improved properties to make the transport of fresh produce easier, giving consumers access to nutritionally valuable whole foods and preventing decay, damage, and loss of nutrients. Transgenic tomatoes are produced with delayed softening. Research is underway to make similar modifications to broccoli, carrots, and melons. The shelf life of some processed foods, such as peanuts, has also been improved by using ingredients that have had their fatty acid profile modified.

6. Environmental Benefits:

When genetic engineering results in reduced pesticide dependance, we have fewer pesticide residues on foods, we reduce pesicide leaching into ground water, and we minimize farm worker exposure to hazardous chemicals. According to the US Food and Drug Administration (FDA), increases in adoption of herbicide-tolerant soybeans were associated with a small increase in yield.

Benefits for Developing Countries:

"The biggest innovations of the 21st century will be at the intersection of biology and technology. A new era is beginning."

Genetic engineering technologies can help to improved health conditions in less developed countries. Researchers from the Swiss Federal Institute of Technology's Institute for Plant Sciences inserted genes from a daffodil and a bacteria into rice plants to produce "golden rice," which has sufficient beta-carotene to meet total Vitamin A requirements in developing countries with rice-based diets. This crop has the potential to significantly improve vitamin uptake in poverty stricken areas/countries where vitamin supplements are costly and difficult to distribute, and vitamin A deficiency leads to blindness in children.

Negative impacts of GMOs?

Conclusion:

"The rewards for biotechnology are tremendous: to solve disease, eliminate poverty, age gracefully."

To sum up, responsible scientists, farmers, food manufacturers, and policymakers should recognize that the use of transgenic organisms carefully be considered very to ensure that they pose no environmental and health risks, or at least no more than the use of current crops and practices. Modern biotechnology represents unique applications of science that can be used for the betterment of society through the development of crops with improved nutritional quality, resistance to pests and diseases, and reduced cost of production. Biotechnology in the form of genetic engineering is a facet of science that has the potential to provide important benefits if used carefully and ethically.

Please include question statement in the pdf.