4. Enhancement in Food Production

Plant Breeding

- It is the process in which two genetically similar varieties are purposely crossed to produce a new hybrid variety.
- **Steps involved in plant breeding are –**
  - Collection of genetic variability
  - Evaluation of germplasm and selection of parents
  - Cross-hybridisation between selected parents
  - Selection and testing of superior hybrids
  - Testing, release and commercialisation of new cultivars

1. A significant increase in the agricultural production with the introduction of high yielding varieties of seeds, increased use of fertilizers and pesticides, and improved agricultural practices is known as **green revolution**.

2. Norman Borlaug is known as the **father of green revolution**.

3. Various initiatives involved in green revolution were:

(i) Development of high-yielding varieties of seeds

(ii) Improvement of irrigation facilities

(iii) Modernisation of management techniques

(iv) Distribution of hybridised seeds, chemical fertilizers and pesticides to farmers

4. In India, green revolution stared in the 1960s.

5. Dr. M.S. Swamynathan is known as the **father of green revolution in India**.

6. The production of wheat and rice has improved in India due to the impact of green revolution

7. Negative effects of green revolution

8. Due to overuse of chemical fertilizers and pesticides, green revolution has resulted in the following:

(i) Soil and land degradation

(ii) Water pollution

(iii) Environmental degradation

Applications of Plant Breeding

- Plant breeding is one of the suitable ways to lower the dependency of plant on various insecticides**.**

- **Fungal, bacterial and viral pathogens affect the yield of crops.**
  - **Examples** –
  - rust of wheat, red rot of sugarcane
  - rot of crucifers
  - mosaic, turnip mosaic

- Disease resistance can be provided by conventional breeding, mutational breeding or genetic engineering.

- **Conventional breeding**: It includes the basic steps of screening, germplasm, hybridisation, selection, testing and release.

- **Mutational breeding**: In this method, genetic variations are created, which then result in the creation of traits not found in the parental type.
  - Mutations are induced with the help of mutagens (like chemicals) or irradiation.

- **Genetic engineering**:

- Certain wild varieties have disease-resistant characteristics, but they are low yielding.
- Disease-resistant genes from such varieties are introduced in high-yielding varieties through recombinant DNA technology.

- **Pest-Resistant Crops**

- Certain morphological characters and biochemical characters provide resistance from insects and pests.

- Such varieties are bred with non-resistant varieties to produce pest-resistant hybrids.

- **Examples of crop variety that provides resistance against diseases –**

- *Pusa Komal* is a variety of cowpea which is resistant towards bacterial blight disease.
- *Himgiri* is a variety of wheat which is resistant towards leaf and stripe rust.

- **Examples of crop variety that are resistant towards insect pests –**

- *Pusa Gaurav* is a variety of *Brassica* which is resistant against aphids.
- *Pusa Sawani* is a variety of *Okra* which is resistant against shoot and fruit borers.

- **Biofortification:** Process of breeding crops that have higher levels of vitamins, minerals, higher proteins and healthier fat content.

Single cell protein and tissue culture

- Single cell protein is the alternate source of proteins for animal and human nutrition. *Spirulina* can serve as the source of food rich in proteins, fats, carbohydrates, etc.
- **Tissue culture**

  - Manipulation of plants in vitro to produce new variety of plants.
  - Apical and axillary meristems of plant are used for making virus-free plants.

- **Somatic hybridisation:**

  - It is the technique that involves the fusion of protoplasts derived from two different plant varieties. The hybrid cells are known as **somatic hybrids**.

- **Micro-propagation:**

  - It is the method of producing new plants through tissue culture in a short duration. The plants produced are genetically identical and are known as **somaclones**.