

B.Sc (Agriculture) - III Sem.

Sub – Principles of Plant Breeding

Sub. Code- BSCAG-212

**D+1**

## **Introduction of Plant Breeding:**

### **Define plant breeding**

Plant breeding is the science and art, it is only technology don't branch of any other streams. In other words the plant breeding is the genetics adjustment of plants to the social , cultural, economic and technological aspects of the environment.

Classical **plant breeding** uses deliberate interbreeding (crossing) of closely or distantly related individuals to produce new **crop** varieties or lines with desirable properties.

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**Plant breeding**, application of genetic principles to produce **plants** that are more **useful** to humans. This is accomplished by selecting **plants** found to be economically or aesthetically desirable, first by controlling the mating of selected individuals, and then by selecting certain individuals among the progeny.

**Gregor Mendel** (1822–84) is considered the "father of genetics". His experiments with plant hybridization led to his establishing laws of inheritance. Genetics stimulated research to improve crop production through plant breeding.

Gregor Mendel's experiments with plant hybridization led to his laws of inheritance. This work became well known in the 1900s and formed the basis of the new science of genetics, which stimulated research by many plant scientists dedicated to improving crop production through plant breeding.

However, successful commercial plant breeding concerns began to be founded from the late 19th century. Gartons Agricultural Plant Breeders in England was established in the 1890s by John Garton, who was one of the first to cross-pollinate agricultural plants and commercialize the newly created varieties. He began experimenting with the artificial cross pollination firstly of cereal plants, then herbage species and root crops and developed far reaching techniques in plant breeding.

William Farrer revolutionized wheat farming in Australia with the widespread release in 1903 of the fungus resistant "Federation" strain of wheat, which was developed as a result of his plant breeding work over a period of twenty years using Mendel's theories.

From 1904 to World War II in [Italy](#), [Nazareno Strampelli](#) created a number of wheat hybrids. His work allowed Italy to increase crop production during the so-called "[Battle for Grain](#)" (1925–1940) and some varieties were exported to foreign countries, such as Argentina, Mexico, and China. Strampelli's work laid the foundations for [Norman Borlaug](#) and the [Green Revolution](#).

## **Green revolution**

In 1908, [George Harrison Shull](#) described [heterosis](#), also known as hybrid vigor. Heterosis describes the tendency of the progeny of a specific cross to outperform both parents. The detection of the usefulness of heterosis for plant breeding has led to the development of inbred lines that reveal a heterotic yield advantage when they are crossed. [Maize](#) was the first species where heterosis was widely used to produce hybrids.

By the 1920s, [statistical](#) methods were developed to analyze gene action and distinguish heritable variation from variation caused by environment. In 1933 another important breeding technique, [cytoplasmic male sterility](#) (CMS), developed in maize, was described by [Marcus Morton Rhoades](#). CMS is a maternally inherited trait that makes the plant produce sterile [pollen](#). This enables the production of hybrids without the need for labor-intensive [detasseling](#).

These early breeding techniques resulted in large yield increase in the [United States](#) in the early 20th century. Similar yield increases were not produced elsewhere until after [World War II](#), the [Green Revolution](#) increased crop production in the developing world in the 1960s. This remarkable improvement was based on three essential crops. First came the development of hybrid [maize](#), then high-yielding and input-responsive "[semi-dwarf wheat](#)" (for which the [CIMMYT](#) breeder N.E. [Borlaug](#) received the [Nobel prize for peace](#) in 1970), and third came high-yielding "short statured rice" cultivars.<sup>[4]</sup> Similarly notable improvements were achieved in other crops like [sorghum](#) and [alfalfa](#).

## **Molecular genetics and bio-revolution**

Intensive research in [molecular genetics](#) has led to the development of recombinant [DNA](#) technology (popularly called [genetic engineering](#)). Advancement in biotechnological techniques has opened many possibilities for [breeding](#) crops. Thus, while mendelian genetics allowed plant breeders to perform genetic transformations in a few crops, molecular genetics has provided the key to both the manipulation of the internal genetic structure, and the "crafting" of new cultivars according to a pre-determined plan.

## Breeding Objectives:

The important breeding objectives should be following

**1. High Yield:** The high yield depends on:

- A) The number of heads/unit area
- B) The number of grain /head
- C) The average weight of 100 grain

While breeding for high yielding varieties all the above three components must be looked into. Omitting any one of them may not yield results.

- 2.** Resistance breeding for lodging and shattering
- 3.** Breeding for disease resistance
- 4.** Breeding for insect resistance
- 5.** Breeding for quality

**Breeding Methods:** The major wheat breeding procedures are follows:

- i) **Introduction**
- ii) **Pure line selection in land races**
- iii) **Hybridization**
  - a) Pedigree selection method
  - b) Bulk method
  - c) Single seed descent method
  - d) Back cross methods
  - e) Multipule breeding methods
  - f) Hybrid
- iv) Mutation Breeding
- v) Alien gene transfer
- vi) Biotechnology

## Books Reference:

- 1. Choudhary R.C. (2017) Introductory principles of Plant Breeding ,India
- 2. Allard, R.W.(1960), Principles of Plant breeding. New Yark
- 3. Sharma. J.R , Principles and Practices of Plant Breeding. New Delhi
- 4. Singh, B.D. Principles of Plant breeding,