

## *Lecture: - 8*

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### **BREEDING METHODS IN SELF POLLINATED CROPS**

**8.1 Selection:** - It is basic to any crop improvement. Isolation of desirable plant types from the population is known as selection.

- It is one of the two fundamental steps of any breeding programme viz.,
  1. Creation of variation and
  2. Selection.

**8.2 The pure line theory:** - A pureline is a progeny of a single homozygous plant of a self-pollinated species. All the plants of a pureline have the same genotype.

- The phenotypic differences within a pureline are due to environment. Therefore variation within a pureline is not heritable. Hence selection in a pureline is not effective.
- The concept of pureline was proposed by Johannsen in 1903 on the basis of his studies with princess variety of beans (*Phaseolus vulgaris*).
- Johannsen further studied 19 lines, each line was a progeny of a single seed from the original lot. He discovered that each line showed a characteristics mean seed weight, ranging from 640mg in Line No 1 to 350 mg in line No 19.
- The two main conclusions of Johannsen's experiment are
  3. Selection is effective in population since it contains a mixture of several genotypes.
  4. Selection is ineffective in a pureline, since it is a progeny of single, self fertilized homozygous individual.

**8.3 Genetic basis of pureline:** - Self-pollination increases homozygosity with a corresponding decrease in heterozygosity. Proportion of completely homozygous plants in the population.

$$[(2m - 1) / 2m] n$$

m = No. of generations of self-pollination, n = No. of genes segregating

**Key features :-** Homogeneous, Non heritable, Highly uniform, Selection is ineffective, Narrow adaptation, more prone to new diseases, isolation of purelines, sources of variation.

## 8.4 Origin of variation in pure lines:-

- **Mechanical Mixture:-** During cultivation, harvesting threshing and storage, other genotypes may get mixed up.
- **Natural hybridization:-** Through pure lines are produced in self pollinated crops, some amount of natural cross pollination occurs in them also can be avoided by isolation and rouging.
- **Mutation:-** occur spontaneously in nature at random.

## 8.5 Achievements:-

**Wheat:** NP4, NP6, NP12, **Rice:** Mtu-1, Mtu-3, Mtu-7, Bcp-1, Adt-1, 3, 5, and 10 **Sorghum :** G 1 & 2, M 1 & 2, OO 1, 4 & 5, **Groundnut:** TMV 3, 4, 7, 8 and Kadiri 71 **Redgram :** TM-1, ST-1, **Chillies :** G1 & G2 Ragi : AKP 1 to 7.

## 8.6 Advantages of pureline selection:-

- The pureline are extremely uniform since all the plants in the variety will have the same genotype.
- Attractive and liked by the farmers and consumers.
- Pureline are stable and long test for many years.
- Due to its extreme uniformity the variety can be easily identified in seed certification programmes.

## 8.7 Limitations or disadvantages of pureline selection:-

- New genotypes are not created by pureline selection
- Improvement is limited to the isolation of the best genotype present in population. No more improvement is possible after isolation of the best available genotype in the population.
- Selection of pureline requires great skill and familiarity with the crop.
- Difficult to detect small differences that exist between cultures so the breeder has to devote more time.

## 8.8 Mass selection:-

It is the earliest method of selection.

- In its most basic form mass selection consists of selecting individuals on the basis of phenotypic superiority and mixing the seeds for using as planting material for next season.
- Genetic constitution-homozygous and heterogeneous.

## 8.9 Types of mass selection:-

- **Positive mass selection:-** Desirable plants are selected from a mixed population.
  - Base material is old varieties or land races.
- **Negative mass selection:-** Undesirable off type plants are removed from mixed population
  - Used for varietal purification in seed production and certification programs.

## 8.10 Procedure for evolving variety by mass selection:-

- **First year:** Large number of phenotypically similar plants having desirable characters are selected. The number may vary from few hundred to few thousand. The seeds from the selected plants are composited to raise the next generation.
- **Second year:** composited seed planted in a preliminary field trial along with standard checks. The variety from which the selection was made should also be included as check. Phenotypic characteristics of the variety are critically examined and evaluated.
- **Third to sixth year:** The variety is evaluated in coordinated yield trials at several locations. It is evaluated in an initial evaluation (IET) trial for one year. If found superior it is promoted to main yield trials for 2 or 3 years.
- **Seventh year:** if the variety is proved superior in main yield trials it is multiplied and released after giving a suitable name.

## 8.11 Merits of Mass selection:

- Can be practiced both in self and cross pollinated crops.
- The varieties developed through mass selection are more widely adopted than pure lines.
- It retains considerable variability and hence further improvement is possible in future by selection
- Helps in preservation of land races.
- Useful for purification of pureline varieties.
- Improvement of characters governed by few genes with high heritability is possible.
- Less time consuming and less expensive.

## 8.12 Demerits of Mass selection:

- Varieties are not uniform.
- Since no progeny test is done, the genotype of the selected plant is not known.

- Since selection is based on phenotype and no control over pollination the improvement brought about is not permanent. Hence, the process of mass selection has to be repeated not and then.
- Characters which are governed by large number of genes with low heritability can't be improved.
- It can't create any new genotype but utilizes existing genetic variability.