# Breeding Methods in Self Pollinated Crops

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***Abstract*** **- Breeding plays a significant role in agriculture field to meet up the availability of food in the world. Plant breeders are allowed to apply breeding principles and technologies in the field of agriculture to improve crop yield and performance. Various breeding methods are successfully proven in self-pollinated crops. Thus, the main aim of breeder is to produce new varieties with better performance. This review paper aims to discuss about the various breeding methods adopted in self-pollinated species.**

***Index Terms*** **- plant breeding, agriculture, yield, self-pollinated crops.**

## INTRODUCTION

Plant breeding, various applications of genetic principles to develop crop cultivars with improved yield and disease resistance, that are more useful to farmers. This can be achieved by selecting plants which are economically or aesthetically desirable, firstly by maintaining the mating of selected individuals, and then later by selecting desirable individuals among the progeny and this selection process is continued over many generations, and results in changing the hereditary constitute and value of an individual plant. So various breeding methods are used to improve yield and performance of plant population. Breeding methods differ according to self- or cross-pollinated species, some breeding methods are successfully proven in self-pollinated crops. Mutation breeding, polyploidy breeding, heterosis breeding and transgenic breeding are rarely used breeding methods for crop improvement and are referred as special breeding methods. The most commonly used method for selection in self-pollinated species is pure line method. The purpose of breeding method is to improve the genetic potential of plant population and to increase yield.

## BREEDING METHODS IN SELF-POLLINATED CROPS

### Pure line method

Pure line method is most commonly used breeding method in self-pollinated crops. It depends on the concept, that repeated selfing of heterozygous individual or population will increase the homozygosity within the population. It is also called as individual plant selection as it deals with the selection of large number of plants individually and are harvested individually. Later their individual progenies are evaluated in field trails and the superior pure line is notified and released as a pure line variety.

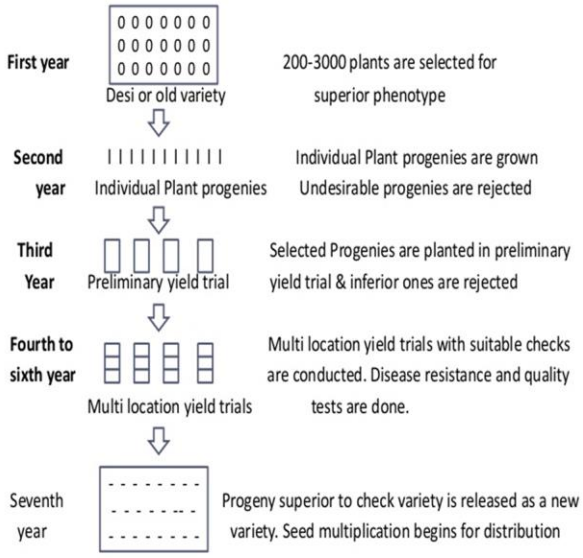
### Applications of pure line method

(a) improvement of native variety or a mixed population of an old variety (b) Development of desirable varieties from introduced varieties (c) The released new variety may be used as parent in hybridization for the development of superior cultivars (d) Improvement of old pure line varieties.

### Procedure for pure line selection method

Pure line selection mainly involves four major steps (1) selection of heterogeneous base population from which pure lines are selected (2) pure lines are isolated by individual plant selection (3) yield trails (4) Release of the best pure line as a variety. Firstly on the basis of phenotypic appearance single individual plants are selected from the heterogeneous population keeping in view the objective of selection. In second year individual plant progenies are planted with wide spacing and inferior individuals are eliminated. In third year, selected individual progenies are used for preliminary yield trails and undesirable ones are eliminated. Replicated yield trails are conducted from fourth to seventh year at several locations and inferior progenies are rejected. The best progenies are selected

and released as new variety in the 8th year. Then foundation or certified seeds are produced and distributed among the farmers in 10th year.




Pedigree method

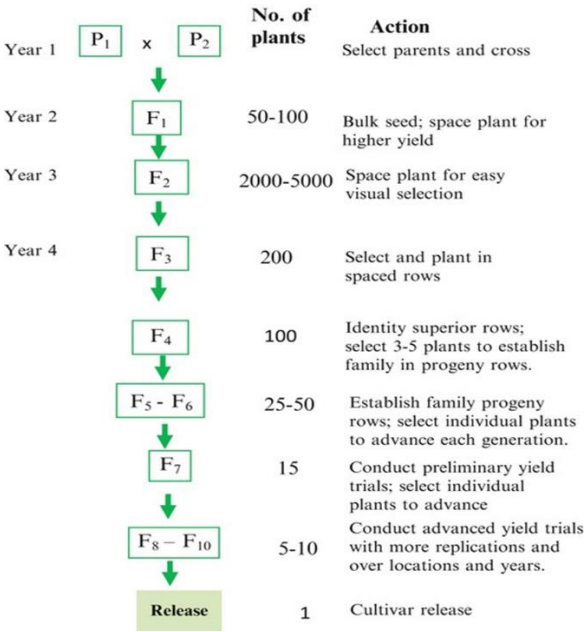
In self pollinated crops, pedigree method is widely used for selection. This method involves crossing between two individual parents, one is superior variety and the other is commercial one. The main aim of breeder is to integrate this variety in a genetic way, that it meets the all characters of commercial variety along with possessing the attributes of the donor parent. In this method selection of individuals is done from segregating generations where single plants are selected from F2 generation or delayed until the F3 or F4 generation. Selected Progenies are tested and evaluated with repeated selection until the F6 or F7 generation, by which time progeny shows no segregation. At this stage when segregation stops, the homozygous progenies which are selected from F6 generation are placed in multi-location yield trails in F7 generation for further selection on the basis of yield performance. The record of entire parent to offspring relationship is kept and this system is known as pedigree record. The pedigree record is simply known as pedigree it is detail record of the relationship between the selected desirable parents and their progeny. This system gives entire information about the ancestors, grand parents and parents of an individual plant.

Applications of pedigree method

In self pollinated crops, this method is more commonly used to improve polygenic characters than oligogenic characters and also used for the development of new varieties. Pedigree method is widely used for the selection of individuals from F2 and subsequent generations. This method is also used to control number of superior recombinants with easy comparative in early segregating generations.

Procedure for pedigree method

Firstly cross is made between selected parents. The F1 material is grown with wide spacing. The dominance behaviour of various characters is observed. In F2 also the material is grown with wide spacings and individual plant selection is practised in F2 generation. The progeny of each selected plant is grown separately which forms the F3 generation. In F3 and f4 generations, selection is practised within and between families. From F5 to F8 between progeny selection is done and superior progenies are identified and isolated in F8. These progeny form strains. These strains are evaluated in replicated multilocation trails for a period of 3-4 years. Based on its superior performance, the strain is released as a new variety.




2. Bulk method

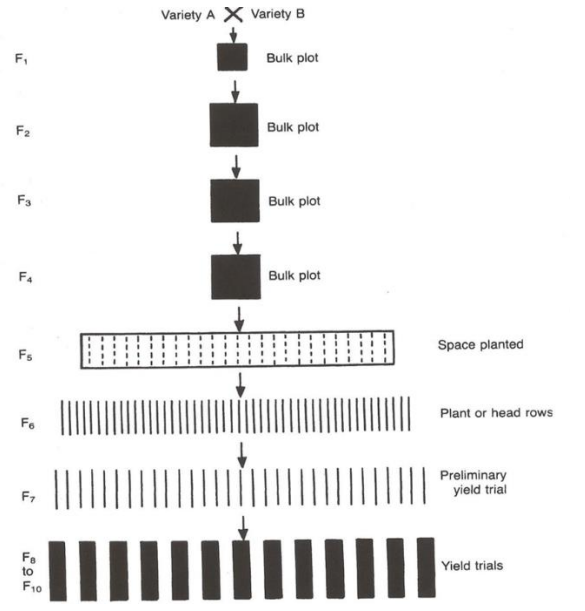
This method involves hybridizing two chosen parents and growing them from segregating generation and subsequent generations until F6 generation in mass as field plots. In this method selection is preferred from F6 generation where a large number of individual

plants are selected on the basis of agronomic production and their progenies are grown in particular rows. At the end of bulking period, individual selected plants which are homozygous in nature are evaluated same as like in pedigree method. The duration of bulk method may vary from 6-7 or 30 generations. This method leads to remarkable evolutionary changes in the gene frequencies in a mass or bulk population. Hence, it is referred as evolutionary method of crop improvement.

Applications of bulk method

This method is mainly used for the genetic improvement of self pollinated species. It is applicable when parents have good agronomic characters, and those characters which are governed by polygenes. Bulk method is also suitable to land segregating generations of cereals, oil seeds and grain legumes. Bulk method is applied in various ways such as 1) For the development of homozygous lines. 2) The selected plants from F6 generation are further handled through pedigree method or pureline method to minimize the effort and expense. 3) natural selection: Bulk populations are maintained up to 15 or 25 generations to create environment for natural selection, to get high yielding genotypes and poor yielding ones are eliminated. superior lines are produced from natural selection; thus this method is used as evolutionary method for crop improvement.

PROCEDURE FOR BULK METHOD




Mass selection method

Mass selection was the first method which was used for crop improvement in field of agriculture. On the basis of phenotypic characters individual plants are selected from heterogeneous population. Later seeds are collected from the selected plants and are bulked to grow for further generations to develop a new variety. Selection is done based on the phenotypic characters which includes Grain size, plant height etc. Varieties produced through mass selection are mixture of pure lines which shows similar genetic variations.

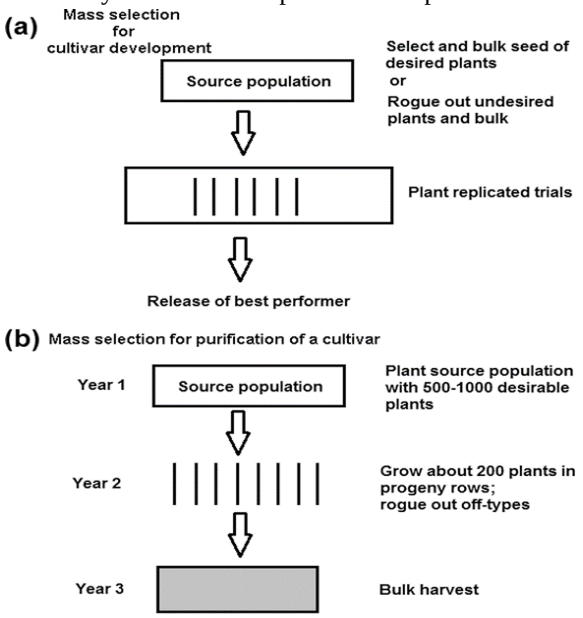
Applications of mass selection method

(1) Improvement of local varieties: The local varieties with inferior types are eliminated by mass selection method which would improve the performance of the local variety and the new variety produced from the land race would be more uniform in appearance than the local variety (2) Maintenance of existing pure line varieties: Due to mechanical mixture, natural hybridization and mutation the pure lines would change with time, so mass selection helps to keep up the purity of the pure line varieties.

Procedure for mass selection method

Steps involved in mass selection 1) Selection of base population 2) based on phenotypic characters desirable plants are selected from the base population and their seeds are collected and mixed to raise next generation 3) selected ones are grown along with standard checks for comparison in field trails for 2-3 years and are evaluated based on their performance and the superior plant is released as a new variety. Firstly land race is used as a base population which is grown in a large plot. Secondly On the basis of phenotypic performance, single individual plants are selected and the inferior or segregating progenies are eliminated. After the elimination of inferior ones the seeds are collected and mixed from the superior plants and are used for next generations. In third year, preliminary yield trial are conducted to compare the bulked seed with standards checks and superior ones are selected, and are included in multilocation yield trials. From Fourth to seventh year multi location yield trials are conducted, and superior one is notified and released as a new variety. The seeds of released variety are multiplied and distributed in the eighth year. Compared to pure line varieties the varieties developed by mass selection method are adopted widely. Number of yield trials are not needed in this

method and retains significant amount of genetic variability thus further improvement is possible.




Back cross method

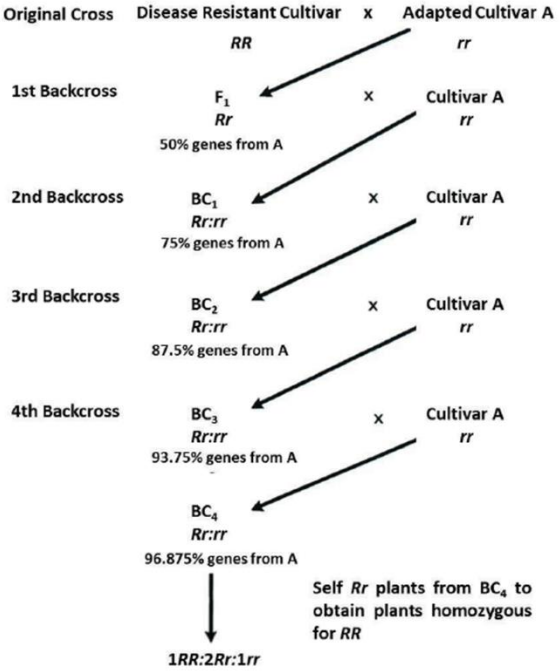
Back cross refers to a cross of a F1 hybrid with either of its parents. Test cross is made between F1 hybrid and homozygous recessive parent. After repeated backcrosses the produced progeny would almost be identical to the parent. The main objective of the back cross method is to improve defects of a well adapted plant variety, by incorporating the characters without any changes in its genotype.

Applications of back cross method

The back cross method of breeding is more effective than the other breeding methods because this method is generally used to improve particular trait of a well-established variety. This method is mainly used for the transfer of oligogenic or monogenic traits only not polygenic ones. Intervarietal transfer of simply inherited traits. In the case of cytoplasmic male sterility, female parent is used as donor for the transfer of cytoplasm and male parent is used as recurrent one. After repeated back crosses, the produced progeny will have the cytoplasm of donor parent.

Procedure for back cross method

The breeding procedure for back cross method depends on weather the trait under transfer is controlled by dominant or recessive gene.




CONCLUSION

Breeding the self-pollinated crops has its own methods. In Mass selection, based on phenotypic characters a large number of plants are selected and their seeds are collected and are mixed and are used for further generations to produce a new variety.

In pure line selection, a large number of pure lines are selected from heterogeneous population and are harvested individually. Therefore, it is known as individual plant selection. In the pedigree method, selection is done from segregating generations, and it includes the information about the ancestors, grandparents and parents of individual plant. In Bulk method, F1 plants are grown and their seeds are collected in bulk to raise next generation. In Back cross method, hybrid (F1) is crossed with either of its parents. After repeated backcrosses the produced progenies are similar to one of its parent.

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