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Method of Plant Breeding in Self Pollinated Plants

Pedigree Methods

Mass selection and pure line selection cannot be applied to segregating population. Eg F2, F3 etc. The method is generally used for handling segregation generation may be grouped into three categories.

i) Pedigree Method

ii) Bulk Method

iii) Back Cross Method

The objectives of all these methods are to develop pure line varieties. In pedigree method, individual plants are selected from F2 and the subsequent generation and their progenies are tested. During the entire operation, a record of the entire parent's offspring relationship is kept, is known as pedigree record. The selection of individual plant is continued till the progenies show no segregation. At this stage, selection is done among the progenies, because there would be no genetic variation within progenies.

Pedigree Record: In Pedigree method, a detailed record of the relationship between the selected plants and their progenies is maintained as a result of this each progeny in every generation can be traced back to the F2 plant from which it originated, such record is known as pedigree record or pedigree. The pedigree may be defined as a description of the ancestors of an individual and it generally goes back to some distant ancestors. Thus, it describes the parents grandparents, great grandparents so on of an individual. Maintenance of Pedigree Record: Pedigree record may be kept in several ways, but it should be simple and accurate. Generally, each cross is given a number. The first two digits of this number refer to the year in which the cross was made, and the remaining digits denote the serial number of the cross in that year. For example, the number 7911, denotes the cross number 11 of the year 79.

In the segregating generation one of the two systems of designation may be followed.

I) System: In this system, the individual plant progenies in each generation are assigned row number, corresponding to their location in the plot. In addition each progeny in F4 and the subsequent generation is assigned the row number of the progeny in the preveious generation from which it was derived.

Generation Number Description F3 7911-7 Progeny in the 7 th row in the F3 plot. F4 7911-7-4 Progeny in the 4 th row in the F4 plot, selected from the progeny in the 7 th row of the F3 plot. F5 7911-4-14 Progeny in the 14 th row in the F5 plot selected from the progeny in the 4 th row of the F4 plot. F6 7911-14-3 Progeny in the 3 rd row in the F6 plot selected from the progeny in the 14 th row of the F5 plot. Thus each progeny can be traced back to the F3 progeny or F2 plants, from which it originated. But for determining the pedigree of a progeny the breeder has to consult the records of the previous year.

II) System-II: In this system, in each generation the selected plants are assigned serial numbers within individual progenies. Each progeny or selected plant bear the serial number of all the plants in the previous generation, related to it by direct descent. Thus, the plants selected in F2 are given serial numbers of their parents (F2 plants). The plants selected from a progeny in F3 are given the number of that progeny and in each generation the selected plant also given a serial number.

Generation Number Description F3 7911-7 Progeny obtained from plant number 7 selected in F2 F4 7911-7-4 Progeny from plant No.4 selected from F3 progeny , derived from the plant No.7 selected in F2 F5 7911-7-4-2 Progeny from plant No.2 selected from the F4 progeny derived from plant no.4 , selected from the F3 progeny, obtained from the plant No.7 selected in F2. F6 7911-7-4-2-8 Progeny from plant No 8, selected from the F5 progeny, derived from the plant N0.2 selected from the F4 progeny of the plant No.4 selected from F3 progeny of the Plant No.7 selected in F2. In this system, the pedigree of a progeny is immediately known and one done not have to refer to the previous year record. But there are greater chances of error, since more number are to be recorded. In both the systems, the progenies are assigned a different serial number, when they become homozygous and are included in preliminary yield trials. This number is given to those homozygous lines that are included in preliminary yield trials.

For keeping a pedigree records following point are important.

1) Only important characteristics should be recorded.
2) Only the promising should be included in the record. Poor progenies may be simply marked discard.
3) The pedigree record must be accurate.

Application of Pedigree Method:

1) Selection of desirable plants from the segregating population in self- pollinated crops.
2) This method is commonly used to correct some specific weaknesses of an established variety (Combination breeding).
3) It is also used in the selection of new superior recombinant type's i.e Transgressive breeding.
4) This method is suitable for improving specific characteristics such as disease resistant, plant height, maturity etc.

Procedure of Pedigree Method Hybridization: The selection of parents to be used in a cross is the most important step in a breeding programme based on hybridization. The selected parents are crossed to produce a simple or a complex cross.

F1 Generation: F1 seeds are space planted so that each F1 plant produces the maximum F2 seed. Generally, 15- 30 F1 plants should produce enough seed for a good F2 population size.

F2 Generation: In F2, 2000-10000 plants are space planted to facilitate selection. About 100-500 plants are selected and their seeds are harvested separately.

F3 Generation: Individual plant progenies are space planted; each progeny should have about 30 or more plants. Individual plants with desirable characteristics are selected from superior progeny. The number of plants selected in F3 should be preferably less than the number of F3 progenies. If the number of superior progenies is small the whole cross may be rejected.

F4 Generation: Individual plant progenies are space planted; again desirable plants are slected mainly from superior progenies. The no of plants selected in F4 is generally less than that of the F4 progenies.

F5 Generation: Individual plant progenies are planted according to the recommended commercial seed rate. Often three or more rows are grown for each progeny to facilitate comparison among progenies. The number of progenies must be reduced to manage the size in preliminary yield trials which is usually 25- 100 progenies.

F6 Generation: Individual plant progenies are planted in multi row plot and evaluated visually. Progenies are harvested in bulk since they would have become almost homozygous. The

progenies which are reasonably homozygous and have enough seed may be planted in a preliminary yield trial and inferior progenies are eliminated.

F7 Generation: Preliminary yield trials with three or more replications are conducted to identify few superior lines. The progenies are evaluated for plant height, lodging and disease resistance, maturity, etc. Standard commercial varieties must be included as check for comparison. Two to five outstanding lines if found superior to check would be advanced to the coordinated yield trials.

F8 – F10 Generation: The superior lines are tested in replicated yield trials at several locations for desirable characters. During these trial lines are evaluated for yield, disease resistance, maturity, etc. a line that is superior to the best commercial variety for yield and other characteristics would be released as a new variety.

F11 Generation: In F11 generation released var. is multiplies for distribution to the farmers. The breeder is responsible to supply the breeder seed to the N.S.C for production of foundation seed.

Merits of Pedigree Method:

1) This method gives maximum opportunity for breeder to use his skill and judgement for the selection of plants.
2) It is well suited for the improvement of characters, which can be easily identified and simply inherited.
3) Unpromising material is rejected in earlier generation hence only superior plants are promoted.
4) Homozygous is rapidly achieved.
5) Transgressive segregation for yield and other quantitative characters may be recovered.
6) It takes less time than the bulk method to develop a new variety.

Demerits of Pedigree Method:

1) This method is more time consuming, laborious and expensive for maintaining pedigree record.

2) Extra attention is required for selection among and within a large number of progenies.

3) The success of this method is largely depends upon the skill of the breeder.

4) Selection for yield in F2 and F3 is ineffective. If care is not taken to retain a sufficient number of progenies.

Achievements of Pedigree Method:

1) Wheat: NP-52, NP120, NP125, etc.

2) Rice: Jaya, and Padma (TN-1 X T-141)

3) Cotton: Laxmi (Gadag-1 X CC2)

4) Tomato: Pusa early dwarf (Meeruti X Red cloud)

5) Chickpea: T1, T2, T3, T5, Radhey.