



Role of Selection in Improving Cultivars

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Man has always been practicing selection process consciously or unconsciously since from the time of domestication. Selection is an earliest and oldest tool of crop improvement which consists of selecting individuals on the basis of phenotypic superiority. Since ancient time our fore farmers were inculcating their skill in selection of best planting material from the existing local entries/cultivars for raising the next season crop. This article describes in brief about two major processes of selection i.e. mass selection and pure line selection to impart the knowledge of crop improvement in a simple way.

Introduction

Selection is essentially based on the phenotype of the plants, and the effectiveness of selection primarily depends upon the degrees to which phenotypes reflects the genotype. Selection has two basic characteristics. First, it is effective only for heritable differences, means its effectiveness is greatly affected by heritability of the characters under selection. Second, selection does not create new variation; it only utilizes the variation already present in a population. Thus, two requirement of selection are (a) variation must be present in the population and (b) the variation should be heritable. The purpose of selection is to isolate desirable plant types from the population. Thus, selection is basic to any improvement. Indeed, it is one of most essential and fundamental step of crop improvement.

In this process, man was trying to select and isolate the superior individual

plants/lines on the basis of visible characteristics viz. plant height, no. of pods, pod length, no. of branches, no. of seed per pod, seed colour, seed size, pod yield etc. Such kind of selection strategy has been transformed in a very successful breeding methodology by the breeders and it is further developed and popularized as a very unique breeding method for allogamous crops as well as autogamous crops, known as mass selection.

Mass selection is the method, in which selection is applied for a number of plants phenotypically superior in desired traits, selected from the field population of a variety which has to be improved. Their produce is then harvested and bulked together for sowing the next year crop and this process is repeated till desired improvement is achieved. Hence this kind of selection must have been used by man since ancient times of agriculture to develop present day cultivated crops from their wild

parents. It was also used extensively before pureline selection came into existence and it is still used for improving present day local varieties. Some examples of varieties developed through mass selection are as follows:

Crop	Varieties
Maize	T19, T41, Jaunpur
Pearl millet	Pusa moti, Babapuri, Jamnagar jiant, AF3, S530
Sorghum	R.S. 1
Rice	SLO 13, MTU-15
Groundnut	TMV-1 & TMV-2
Rai	T11, L16
Yellow mustard	T42, T16
Brown mustard	DS1, DS2
Toria	Abohar
Castor	S20, B1, B4
Cotton	C402, C520, C1281, K12, 100F, 216F, A19, Dharwad American Cotton

Procedure for Evolving a Variety by Mass Selection

First year: Large numbers of phenotypically similar plants having desirable characters are selected. The number may vary from few hundred to thousand. The seed from the selected plants are composited to raise the next generation.

Second year: Composited seed are sown for a preliminary yield 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 trial (IET) for one year. If found superior, the variety is promoted to main yield trials for 2 or 3 years.

Seventh year: If the variety is proved to be superior in main yield trials, it is multiplied and released after giving a name.

Advantages of Mass selection:

1. It can be practiced both in cross and self pollinated crops
2. The varieties developed through mass selection are widely adopted.
3. It retains considerable variability and hence further improvement is possible in future by selection
4. Helps in preservation of land races
5. Useful for purification of pure line varieties
6. Improvement of characters governed by few genes with high heritability is possible.
7. Less time consuming and less expensive.

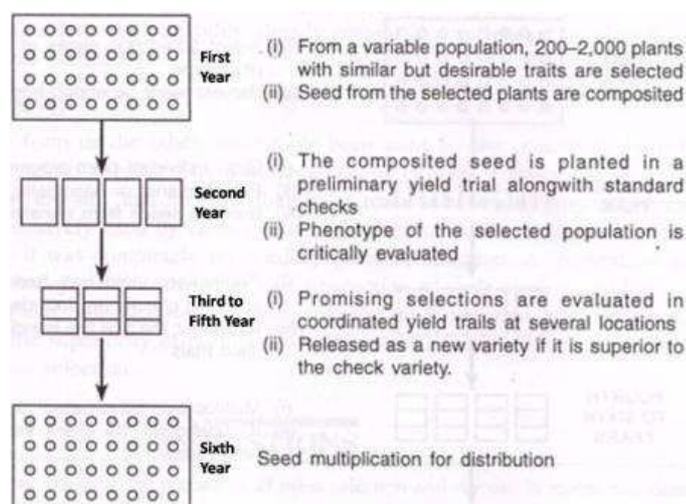


Fig. Schematic presentation of mass selection for developing a new variety (Source: Singh, 2006)

Pureline Selection

Pureline selection has been the most commonly used method of improvement of self pollinated crops. Present day, all varieties of self pollinated crops are purelines. Pureline selection has several applications in improvement of self pollinated crops. It is used to improve

1. Local varieties
2. Old pureline varieties and
3. Introduced varieties

The pureline selection has three steps for evolving a variety i.e.

1. Selection of individual plant from a crop of local variety or mixed population.
2. Visual evaluation of individual plant progenies and
3. Yield trials

Procedure for Evolving a Variety by Pureline Selection

First year: A large number of plants (2000-3000) which are superior to rest of plants are selected from a crop of local variety or mixed population and harvested separately (in some cases individual heads from a single plant may be selected). The number of plants to be selected is a breeder's discretion but also depend on available time, land, funds, labour etc. For observation, it is advisable to select easily observable traits such as flowering, maturity, disease resistance, plant height etc.

Second year: Progenies of individual plants selected in 1st year are grown separately with proper spacing (plant to plant & row to row). The progenies are evaluated by visual characters such as plant height, duration, seed size, ear characters as well as yield. The number of progenies should be reduced as much as possible. Disease epiphytotic may be created to test the progenies for disease resistance. Poor, weak, diseased, insect attacked and segregating progenies are rejected. The superior progenies are harvested separately. If necessary the process may be repeated for 1-2 more years.

Third year: The selected progenies now called as cultures which are grown in replicated trial for critical evaluation of yield etc. The best local variety is used as a check and should be grown at regular intervals

after every 15 or 20 cultures for comparison. This is known as preliminary yield trial. Superior cultures based on observable characters and yields are selected.

Fourth & Fifth years: The superior cultures are tested against the local checks in yield trials. Observations are recorded on many characters like diseases resistance, days to flowering, days to maturity, plant height, ear characters, test weight and yield. The data is subjected to statistical analysis to identify really superior cultures. If necessary the trials may be extended for one more year or season. Inferior culture are rejected and a few (4-5) promising cultures are selected.

Sixth, Seventh and Eighth years: The selected promising cultures are evaluated at several locations along with local checks. One or two promising cultures are selected.

Ninth year: The best selected culture is multiplied, named and released as a variety.

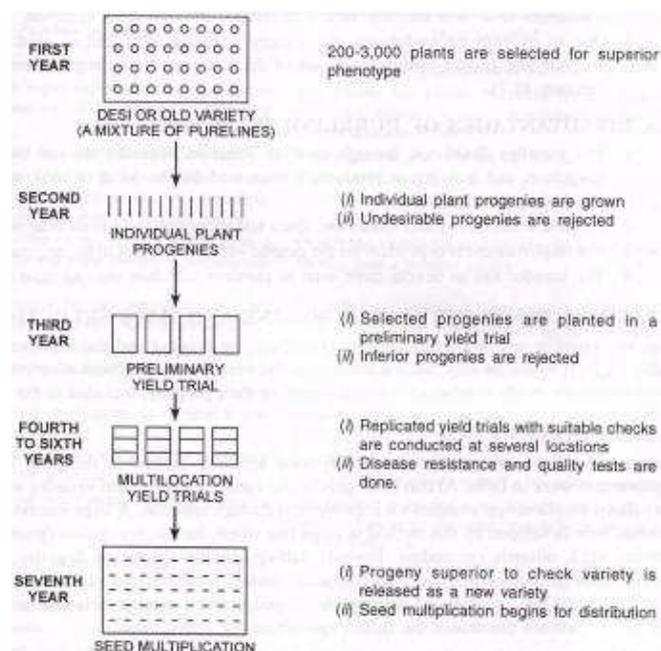


Fig. Schematic presentation of pureline selection (Source: Singh, 2006)

Advantages of Pureline Selection

1. The purelines are extremely uniform since all the plants in the variety will have the same genotype.
2. Purelines are stable for many years.

Some examples of pureline selection are:

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 71-1

Redgram : TM-1, ST-1

Chillies : G1 & G2

Ragi : AKP 1 to 7

Conclusion

Mass and pureline selection being the simple processes, progressive farmers at their own farm can improve their existing local cultivars. They can also attract and motivate other local farmers and produce quality seed from high yielding variety just by applying these selection methodologies.

Reference

Singh BD. 2006. Plant Breeding. Kalyani Publisher, New Delhi