Chapter: Maintenance of Genetic Purity during Seed Production

The various steps suggested, to maintain varietal purity, are as follows.

a. Use of approved seed only in seed multiplication.
b. Inspection and approval of fields prior to planting.
c. Field inspection and approval of growing crops at critical stages for verification of genetic purity, detection of mixtures, weeds, and for freedom from noxious weeds and seed borne diseases etc.
d. Sampling and sealing of cleaned lots
e. Growing of samples of potentially approved stocks for comparison with authentic stocks.

The various steps suggested for maintaining genetic purity are as follows:

a. Providing adequate isolation to prevent contamination by natural crossing or mechanical mixtures
b. Rouging of seed fields prior to the stage at which they could contaminate the seed crop.
c. Periodic testing of varieties for genetic purity.
d. Avoiding genetic shifts by growing crops in areas in their adaptation only.
e. Certification of seed crops to maintain genetic purity and quality of seed.
f. Adopting the generation system.
g. Grow out tests.

Genetic Purity Maintenance in Hybrid Seeds

Maintenance of the genetic purity of hybrid seeds is a complicated one requiring elaborate procedures.

Nucleus Seed of Inbred Lines

- The nucleus seed of inbred lines can be maintained by self pollination, sib-pollination, or a combination of the two procedures (hand pollination).
- Some breeders prefer 'sibbing" because it maintains vigour. "Selfing" is used to stabilize inbred lines if a change in breeding behavior is noticed.
Some parental material is preferably maintained by alternate selfing and sibbing from one generation to other.

Individually selfed or sibbed ears should be examined critically, discarding off types or inferior characteristics (texture, colour, seed size, chaff color and shape of earhead).

The uniform ears are then threshed separately and planted in ear to row method to easily detect and discard off types from individual ears if any.

Alternatively all of the ears from an individual inbred line may be composited for bulk planting in the next season.

The hand pollination seed is sown on clean, fertile soil having no previous crop of the same kind or variety during the previous year (bearing maize).

It is rather important to ensure that the crop is well isolated, with the requirement varying from crop to crop and depending upon the nature of the material to be protected by isolation, the nature of the contaminant, and the direction of the prevailing wind.

The isolation can be achieved either by distance or by time (maize). The inbred line may be composited for bulk planting in the next season.

Maintenance of genetic purity in inbred lines through hand pollination and adequate isolation alone is not enough to achieve perfection.

The isolated fields must be critically rogued for off types and other impure types prior to the shedding of pollen.

The nucleus seed crop is harvested after physiological maturity if artificial drying facilities exist.

Ear to harvest lines are harvested separately and piled; These are again critically examined for ear characteristics, sorting out of all off-coloured, diseased, or otherwise undesirable ears.

If the overall percentage of off types exceeds 0.1%, hand pollination should be repeated to produce the second year's breeders seed.

The uniform ears are bulked, dried in a clean dry bin at temperatures not exceeding $43^\circ$C, shelled, cleaned, treated with pesticides, and stored under ideal storage conditions as breeder stock seed. This seed may be increased during the following season by paying adequate attention to isolation, roguing, etc., to maintain high genetic purity of the seed.
Nucleus Seed of Non-Inbred Lines

- To maintain in the genetic purity of the nucleus seed of non-inbred lines, the number of plants for hand pollination should be large enough to preserve genetic makeup of the variety, narrowing the genetic base by sibbing only a few plants (about 5000 plants or more).
- The sibbed ears are examined critically, discarding of colour, texture, or diseased ones.
- Uniform ears are bulked, dried, shelled, cleaned, treated and stored as usual.
- Other practices of seeding sibbed nucleus seeds are similar to those described earlier for inbred lines.
- Roguing however, needs to be observed more critically by individuals with good knowledge of the material.
- The breeder's stock seed thus produced from the nucleus seed can be utilized to increase the breeder's stock of non-inbred lines, paying adequate attention to land requirements, isolation, roguing, harvesting and handling of seed to achieve maximum genetic purity.
- The breeder's seed of the established varieties of cross-pollinated crops can be maintained by raising breeder's seed crop in isolation and roguing the crop thoroughly at various stages.
- It is often purified by mass selection.
- The crop is grown in isolation and rogued carefully as described earlier.
- At maturity about 20,000 - 25000 true to type plants are selected, harvested separately, and bulked after careful examination.
- This constitutes the breeder's stock seed. The seed may be carried over to ensure against possible failures or unforeseen shortages