FACULTY OF AGRICULTURAL SCIENCES

AND ALLIED INDUSTRIES

MAINTENANCE OF NUCLEUS AND BREEDER'S SEEDS

1. The sampling for nucleus seed may be restricted to 15 new varieties of any crop, obtaining about 200 plants from the central portion of seed field of border rows of replicates.
2. Discarding poor plants and those with few tillers, the plants should be harvested 4-5 days before full maturity (or) at physiological maturity stage to avoid shattering.
3. The plants are then threshed separately and the seed examined in piles on the table, discarding off types or diseased seeds.
4. The seed is now ready to be sown in a purification nursery called a nucleus.
5. The nucleus seed is grown on clean, fertile land at an experiment station having grown no crop of the same kind in the previous year.
6. The 200 progenies of nucleus seed should be sown in a block of 200 double row plots in four series, with a plot to plot distance of at least 45 cm. The plot must be isolated properly to prevent contamination by natural crossing and spread of diseases.
7. The nucleus seed plot should be examined critically for removal of off types through out the growth phases.
8. At least 180 out of 200 original plants should be harvested individually and threshed, avoiding mixing of one nucleus seed with any other.
9. The seed is then cleaned and examined for uniformly (180 or more piles). Off types appearing be discarded.
10. Uniform seed should be massed together and treated with fungicide and insecticide, bagged, labelled and stored as "breeder's stock seed" for use of the next year.

BREEDER SEED PRODUCTION

1. The breeder's stock seed from the nucleus is sown on clean, fertile land, having grown no crop of the same kind during the previous year.
2. The area required for planting breeder's seed stock is about 1.2 ha for wheat and 3 ha in the case of transplanted rice.
3. The field should be properly isolated.
4. Adopting standard agronomic practices of sowing, intercultural and harvesting, the seed should be produced at the experiment station in the area where the new variety has been bred.
5. Row spacing should be sufficient to permit examination of plants in rows for possible mixtures or off types.
6. Plants not typical of the variety should be pulled and removed (roguing) before flowering as was done for nucleus / breeder's seed stock.
7. Where plants are removed after flowering and pollen has escaped all surroundings plants within one meter should be discarded.
8. The breeder's stock is harvested, threshed with clean equipment, and bagged and labelled.
9. The seed should be about 100 % pure to its variety. This breeder's seed is now ready for multiplication as foundation seed.
10. The breeder's stock should be continued each year to furnish a fresh stock of seeds to the growers of foundation stock until the variety is replaced by newer ones.
11. The genetic purity of the breeder's seed of the established varieties of crops can be maintained by growing the crop in isolation and by rigorous roguing during different phases of crop growth.
12. The purity can be further enhanced by bulk selection, where in 2000-2500 plants typical of the variety are selected, harvested and threshed separately.
13. The seeds are critically examined, discarding off types, if any. The uniform seeds are bulked to constitute breeder's seed.

14. This process may be continued until deterioration sets in, changing plant characteristics of economic importance. Breeder's seed, therefore, needs to be included in yield tests.
15. The breeder must carry over at least enough seed to safeguard against the loss of variety due to complete failure of crop during the multiplication of foundation seed.
16. The production of breeder's seed is an expensive process, with the associated risks of contamination by repeated multiplication and loss due to adverse growing conditions. Such risks of contamination by repeated multiplication and loss due to adverse growing conditions. Such risks can be minimized and the continuity of seed programme better assured by producing sufficient breeder's seed at one time to meet the requirements of two the three productions of foundation seed (carryover of breeder's seed)
17. The carryover seed must be stored under optimum conditions in order to maintain its vigor and viability.

GENETIC PURITY MAINTENANCE IN HYBRID SEEDS

1. Maintenance of the genetic purity of hybrid seeds is complicated, requiring elaborate procedures
2. The nucleus seed of inbred lines can be maintained by self pollination, sib-pollination, or a combination of the two procedures (hand pollination).
3. Some breeders prefer 'sibbing" because it maintains vigor. "Selfing" is used to stabilize inbred lines if a change in breeding behavior is noticed.
4. Some parental material is preferably maintained by alternate selfing and sibbing from one generation to other.
5. 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).
6. The uniform ears are then threshed separately and planted ear to row to easily detect and discard off types from individual ears if any.
7. Alternatively all of the ears from an individual inbred line may be compostited for bulk planting in the next season.
8. 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).
9. 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.

10. 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.
11. Maintenance of genetic purity in inbred lines through hand pollination and adequate isolation alone is not enough to achieve perfection.
12. The isolated fields must also be critically rogued for off types and other impure types prior to the shading the pollen.
13. The nucleus seed crop is harvested after physiological maturity if artificial drying facilities exist.
14. 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.
15. If the overall percentage of off types exceeds 0.1%, hand pollination should be repeated to produce the second year's breeders seed.
16. The uniform ears are bulked, dried in a clean dry bin at temperatures not exceeding 43^{o}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 the high genetic purity of the seed.

GENETIC PURITY MAINTENANCE OF THE NUCLEUS SEED OF NON-INBRED LINES

1. 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 make up of the variety, narrowing the genetic base by sibbing only a few plants (about 5000 plants or more).
2. The sibbed ears are examined critically, discarding of colour, textured, or diseased ones.
3. Uniform ears are bulked, dried, shelled, cleaned, treated and stored as usual.
4. Other practices of seeding sibbed nucleus seed are similar to those described earlier for inbred lines.
5. Roguing however, needs to be observed more critically by individuals with good knowledge of the material.
6. 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.
7. 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.
8. It is often purified by mass selection.
9. 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.
10. This constitutes the breeder's stock seed. The seed may be carried over to ensure against possible failures or unforeseen shortages.

CLASSES OF SEED

The four generally recognized classes of seeds are: Breeder's seed, foundation seed, registered seed and certified seed. The Association of Official Seed Certifying Agencies (AOSCA) has defined these seed classes as follows:

a) Breeder's seed: The seed or vegetatively propagated material directly controlled by the originating or the sponsoring breeder or institution, providing for the initial and recurring increase of foundation seed.

b) Foundation seed: The seed stock handled to maintain specific identity and genetic purity, which may be designated or distributed and produced under careful supervision of an agricultural experiment station. This seed is the source of all other certified seed classes either directly or through registered seed.

c) Registered seed: The progeny of the foundation seed so handled as to maintain its genetic identity and purity and approved and certified by a certifying agency. It should be of quality suitable to produce certified seed.

d) Certified seed: The progeny of foundation, registered or certified seed that is handled so as to maintain satisfactorily genetic identity and purity and that has been approved and certified by the certifying agency.

CERTIFIED SEED

1. Shall be the progeny of the foundation seed
2. Its production is so handled to maintain genetical identity and physical purity according to standards specified for the crop being certified
3. It should have the minimum genetical purity of 99%
4. Certified seed may be the progeny of certified seed , provided this reproduction does not exceed two generations beyond foundation seed and provided that if certification agency determines the genetic and physical purity, if not be significantly altered
5. In case of highly self pollinated crops certification of one further generation may be permitted

6. Certified seed produced from certified seed ,shall be eligible for further seed increase under certification, except in case of highly self pollinated crops, where certification of one further generation may be permitted
7. Certification tags issued once for certified seed not eligible for further seed increase under certification
8. For paddy and wheat, certified seed produced from certified seed is eligible for certification by NSC up to two generations from foundation seed

DIFFERENCES BETWEEN CERTIFIED SEED AND TRUTH FUL SEED

Certified seed	**Truthful labelled seed**
Certification is voluntary	Truthful labelling is compulsory for notified kind of varieties
Applicable to notified kinds only	Applicable to both notified and released varieties
It should satisfy minimum field and seed standards	Tested for physical purity and germination
Seed certification officer ,seed inspectors can take samples for inspection	Seed inspectors alone can take samples for checking

IMPORTANT QUESTIONS:

1. Explain varietal deterioration and the factors affecting it.
2. What are the ways to maintain genetic purity of cultivars?
3. How the genetic purity of nucleus seed and breeder seed is maintained?
4. Write down the ways by which genetic purity of hybrids can be maintained.
5. Describe truthful seed.
6. Briefly explain different classes of seed and their tag colours.