RAMA UNIVERSITY

www.ramauniversity.ac.in

FACULTY OF AGRICULTURAL SCIENCES

AND ALLIED INDUSTRIES

DR. SUHEL MEHANDI

ASSISTANT PROFESSOR

GENRTICS & PLANT BREEDING

SST 221, PRINCIPLES OF SEED TECHNOLOGY

Deterioration of Crop Varieties and Methods to prevent them

Variety: Is a group of plants having clear distinguished characters which when reproduced either sexually or asexually retains these characters.

The main aim of seed production is to produce genetically pure and good quality seed. But why/how the genetic purity of a variety is lost or deteriorated during seed multiplication. The several factors that are responsible for loss of genetic purity during seed production as listed by kadam (1942) are:

1. Developmental Variation
2. Mechanical Mixtures
3. Mutations
4. Natural Crossing
5. Genetic drift
6. Minor Genetic Variation
7. Selective influence of Diseases
8. Techniques of the Breeder
9. Breakdown of male sterility
10. Improper/ defective seed certification System

1. Developmental Variation: When a seed crop is grown in difficult environmental conditions such as different soil and fertility conditions, under saline or alkaline conditions or under different photo-periods or different elevations or different stress conditions for several consecutive generations the developmental variations may arise as differential growth response.

To avoid or minimize such developmental variations the variety should always be grown in adaptable area or in the area for which it has been released. If due to some reasons (for lack of isolation or to avoid soil born diseases) it is grown in nonadaptable areas it should be restricted to

one or two seasons and the basic seed i.e. nucleus and breeder seed should be multiplied in adaptable areas.

2. Mechanical Mixtures: This is the major source of contamination of the variety during seed production. Mechanical mixtures may take place right from sowing to harvesting and processing in different ways such as;

a. Contamination through field – self sown seed or volunteer plants
b. Seed drill – if same seed drill is used for sowing 2 or 3 varieties
c. Carrying 2 different varieties adjacent to each other.
d. Growing 2 different varieties adjacent to each other.
e. Threshing floor
f. Combine or threshers
g. Bags or seed bins
h. During seed processing

To avoid this sort of mechanical contamination it would be necessary to rogue the seed fields at different stages of crop growth and to take utmost during seed production, harvesting, threshing, processing etc.

3. Mutations: It is not of much importance as the occurrence of spontaneous mutations is very low i.e. 10-7. If any visible mutations are observed they should be removed by rouging. In case of vegetatively propagated crops periodic increase of true to type stockwould eliminate the mutants.

4. Natural Crossing: It is an important source of contamination in sexually propagated crops due to introgression of genes from unrelated stocks/genotypes. The extent of contamination depends upon the amount of natural cross-fertilization, which is due to natural crossing with undesirable types, offtypes, and diseased plants.

On the other hand natural crossing is main source of contamination in cross-fertilized

or often cross-fertilized crops. The extent of genetic contamina tion in seed fields is due to natural crossing depends on breeding system of the species, isolation distance, varietal mass and pollinating agent.

To overcome the problem of natural crossing isolation distance has to be maintained. Increase in isolation distance decreases the extent of contamination. The extent of contamination depends on the direction of the wind flow, number of insects presents
and their activity.

5. Genetic drift: When seed is multiplied in large areas only small quantities of seed is taken and preserved for the next years sowing. Because of such sub-sampling all the genotypes will not be represented in the next generation and leads to change in genetic composition. This is called as genetic drift.

6. Minor Genetic variation: It is not of much importance, however some minor genetic changes may occur during production cycles due to difference in environment. Due to these changes the yields may be affected.

To avoid such minor genetic variations periodic testing of the varieties must be done from breeder's seed and nucleus seed in self-pollinated crops Minor genetic variation is a common feature in often cross-pollinated species; therefore care should be taken during maintenance of nucleus and breeder seed.

7. Selective influence of Disease: Proper plant protection measures much be taken against major pests and diseases otherwise the plant as well as the seeds get infected.

a) In case of foliar diseases the size of the seed gets affected due to poor supply of carbohydrates from infected photosynthetic tissue.

b. In case of seed and soil borne diseases like downy mildew and ergot of Jowar, smut of bajra and bunt of wheat, it is dangerous to use seeds for commercial purpose once the crop gets infected.

c. New crop varieties may often become susceptible to new races of diseases are out of seed production programms. Eg. Surekha and Phalguna became susceptible to gall midge biotype

8. Techniques of the Breeder : Instability may occur in a variety due to genetic irregulaeities if it is not properly assessed at the time of release. Premature release of a variety, which has been breed for particular disease, leads to the production of resistant and susceptible plants which may be an important cause of deterioration. When sonalika and kalyansona wheat varieties were released in India for commercial cultivation the genetic variability in both the varieties was still in flowing stage and several secondary selections were made by the breeders.

9. Breakdown of male sterility: Generally in hybrid seed production if there is any breakdown of male sterility in may lead to a mixture of F1 hybrids and selfers.

10. Improper Seed Certification : It is not a factor that deteriorates the crops varieties, but is there is any lacuna in any of the above factors and if it has not been checked it may lead to deterioration of crop varieties.

Maintenance of Genetic Purity during seed Production

Horne (1953) had suggested the following methods for maintenance of genetic purity;

1. Use of approved seed in seed multiplication

2. Inspection of seed fields prior to planting

3. Field inspection and approval of the Crop at critical stages for verification of

genetic purity, detection of mixtures, weeds and seed borne diseases.

4. Sampling and sealing of cleaned lots

5. Growing of samples with authentic stocks or Grow -out test

Various steps suggested by Hartman and Kestar (1968) for maintaining genetic purity are as follows;

1. Providing isolation to prevent cross fertilization or mechanical mixtures

2. Rouging of seed fields prior to planting

3. Periodic testing of varieties for genetic purity

4. Grow in adapted areas only to avoid genetic shifts in the variety

5. Certification of seed crops to maintain genetic purity and quality

6. Adopting generation system

Safe guards for maintenance of genetic purity

The important safe guards for maintaining genetic purity during seed production are;

1. Control of seed source

2. Preceding crop requirement

3. Isolation

4. Rouging of seed fields

5. Seed certification

6. Grow out test

1. Control of Seed Source : The seed used should be of appropriate class from the approved source for raising a seed crop. There are four classes of seed from breeder seed, which are given and defined by Association of Official Seed Certification agency (AOSCA).

a. Nucleus Seed: It is handful of seed maintained by concerned breeder for further multiplication. The nucleus seed will have all the characters that he breeder has placed in it and it is of highest genetic purity. The quantity of nucleus seed is in kilograms.

b. Breeder Seed : It is produced by the concerned breeder or sponsoring institute or and which is used for producing foundation seed. It is of 100% genetic purity. The label/tag issued for B/s is golden yellow in color. The quality of breeder seed is assured by the monitoring team constituted by the govt.

c. Foundation Seed: It is produced from breeder seed and maintained with specific genetic identity and purity. It is produced on govt. farms or by private seed producers. The quality of foundation seed is certified by certification agency. It has genetic purity of above 98%. The certification tag or label issued for F/s is white in color.

2. Preceding Crop requirement : This has been fixed to avoid contamination through volunteer plants and also the soil borne diseases.

3. Isolation : Isolation is required to avoid natural crossing with other undesirable types, off types in the fields and mechanical mixtures at the time of sowing, threshing, processing and contamination due to seed borne diseases from nearby fields.

Protection from these sources of contamination is necessary for maintaining genetic purity and good quality of seed.

4. Rouging of Seed Fields: The existence of off type plants is another source of genetic contamination. Off type plants differing in their characteristics from that of the seed crop are called as off types. Removal of off types is referred to as roughing.

The main sources of off types are

a. Segregation of plants for certain characters or mutations
b. Volunteer plants from previous crops or
c. Accidentally planted seeds of other variety
d. Diseased plants

Off type plants should be rouged out from the seed plots before they shed pollen and pollination occurs. To accomplish this regular supervision of trained personnel is required.

5. Seed Certification: Genetic purity in seed productions maintained through a system of seed certification. The main objective of seed certification is to make available seeds of good quality to farmers. To achieve this qualified and trained personnel from SCA carry out field inspections at appropriate stages of crop growth.

They also make seed inspection by drawing samples from seed lots after processing. The SCA verifies for both filed and seed standards and the seed lot must confirm to get approval as certified seed.

6. Grow-out Test : varieties that are grown for seed production should be periodically tested for genetic purity by conducting GOT to make sure that they are being maintained in true form. GOT test is compulsory for hybrids produced by manual emasculation and pollination and for testing the purity of parental lines used in hybrid seed production.