

Hybrid Seed Production Techniques in Maize

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Maize is monoecious in nature with male flower (tassel) present on the top of the plant and female flowers (spadix) in the middle part of the plant. **Hybrid maize seed** is produced by using designated female and male parents, removing the tassels from the female plants before silk emergence and allowing male plants to provide the pollen for fertilizing the silks.

Seed Production: Hybrid seed production in maize involved two parents to produce following types of hybrids.

Single cross: Hybrid seed produced by controlled crossing between two selected inbreds (A x B).

Double cross: Hybrid seed produced by crossing between two Certified single crosses [(A x B) x (C x D)].

Three way cross: Hybrid seed produced by crossing between an inbred used as male and a Certified single cross hybrid [(A x B) x C] as female parent.

Top cross: Hybrid seed produced by crossing of inbred line with a Certified open pollinated variety.

Double top cross: Hybrid seed produced by the crossing between a certified single cross and a certified open pollinated variety.

Nucleus and Breeder's seed production programmes : Nucleus and Breeder's seed of male and female parents are produced by selfing. Isolation of 400 meters from the field of other varieties is required.

Foundation seed production programme: Inbred lines and single cross hybrids are produced as Foundation seed.

Certified seed production programme: Production of single, double, three ways top and double top cross hybrid is known as certified seed. Foundation and Certified seed production programme are taken at recommended isolation distance.

Table 1: Recommended isolation distance for seed production programme of hybrid and its parents

Contaminants	Isolation distance (m)		
	FS	CS	
	Inbred	Single	Hybrid
Maize with same kernel colour and Texture	400	400	200
Maize with different kernel colour and texture	600	600	300
Field of same inbred/hybrid seed production not confirming MSCS	400	400	200
Field of other hybrid having common male parent confirming MSCS	-	5	5
Field of other hybrid having common male parent not confirming MSCS	-	400	200
Field of other hybrid having different parent	-	400	200
Teosinte	600	600	300

Planting Ratio:

Optimum planting ratio of seed and pollinator parent for production of hybrid and male sterile seed is 2:6 (female).

Seed Rate:

Twelve kg seeds of seed parent and 5 kg seed of pollinator to be sown in one hectare field with 70 cm row to row and 22.5 cm plant to plant spacing.

Staggering:

Normally both the parents flowered at same time but in some hybrids staggering for 7 days is required for synchronization of flowering.

Detasseling:

Detasseling is the removal of tassel from female parent. Detasseling is done when the tassel emerged out of the boot leaf, but before anthesis has shed pollen. Anthers take 2-4 days to dehisce after complete emergence. Only in few cases, the anthers start dehisces before its

complete emergence. In such case detasseling should be done earlier. Detasseling is done daily till all the seed parents get detasselled.

Method

- Hold the stem below the boot leaf in left hand and the base of the basal in right hand and pull it out in a single pull.
- Grasp entire tassel so that all the pollen parts are fully removed.
- Do not break or remove leaves as removal will reduce yields and will result in lower quality of seed.

Roguing:

Roguing should be done periodically based on position of cob, colour of silk, arrangements of seeds in cob, leaves etc. Shedding tassels to be removed. It refers to the tassels in female parent rows, shedding pollen or that has shed pollen in hybrid maize plots. During field inspection a tassel whose main spike or any side branch or both have shed pollen or shedding pollen in more than 5 cm of branch length is counted as a shedding tassel during inspection the shedding tassels are taken into count for acceptance or rejection of production plot.

Field standard (%)

	FS	CS
Off types	0.2	0.5
Shedding tassel	0.5	1.0 (when receptive silk is 5% or more)

Field standards –specific

Specific factors	Certified stage (%)
Off types shedding pollen when 5 % or more of seed parent in receptive silk	0.5
Seed parent shedding pollen when 5 % of the seed parent is having receptive silk	1.0
Total of pollen shedding tassel including tassel that had shed pollen for all 3 inspections conducted during flowering on different dates	2.0

Off types in seed parent at final inspection

0.5

Number of inspection: Four (Seed certification officers). First before flowering and remaining three during flowering

Harvest

Harvest when the moisture content falls to 20-25%. Harvest male first and remove from the field and then harvest female

Threshing

- a. **Dehusking-** The husks are removed manually.
- b. **Cob sorting-** Remove ill filled, diseased cobs and cobs have kernel colour variation.

Xenia

- The direct/visible effects of pollen on endosperm and related tissues in the formation of a seed colour. **e.g.** seed colour.
- In maize, the gene present in sperm cell contributes in the expression of colour of hybrid seeds.
- The **Xenia Effect** refers to the **effect** of foreign pollen on kernel characteristics. Cross- pollination occurs in corn because it is monoecious, which means that it has both male (the tassel) and female (the ear) flowers on a single plant
- The Xenia effect occurs when pollen from the tassel of one corn variety moves from one field to another, landing on the silks of another variety which fertilizes and produces.
- The cross-pollination exhibited by the Xenia Effect can influence testing procedures and production of specialty corn crops.

Metaxenia

- The effect of a pollen parent on the developing maternal tissues of a seed or fruit outside the embryo and endosperm due to hormones produced by the embryo and endosperm after double fertilization
- Is the effect of pollen on the maternal tissues of fruit.

Shelling

- Cob sorting should be the first operation it is a post harvest, evaluation for genetic purity.

- The sheath is removed and checked for kernel colour, shank colour, diseased cobs, and kernel arrangement.
- The cobs are shelled either mechanically or manually at 15-18% moisture content. Improper shelling leads to 48% damage to kernel growth of storage fungal results in Pericarp damage.
- Crack on pericarp can be identified by FeCl₃ or Tz test.
- Shelling is done mechanically using cob sheller and manually by rubbing with stones.

Drying

Dry the seeds to 12% moisture content.

Grading

Grade the seeds using 18/64" (7.28 mm) sieve.

Seed treatment

Slurry treat the seeds with 8% moisture content either with captan or thiram 75% W.P. @ 70 g/100 kg with 0.5 litre of water. Treated seeds can be stored for 1 year in cloth bag.

Seed yield: 2.5-3.6 t/ha

Seed standard inbred, varieties and hybrids

Sr. No.	Parameters	Inbreds	FS	CS
1.	Physical purity (%) (min)	98	98	98
2.	Inert matter (%) (max)	2	2	2
3.	Other crop seed (max)	5 kg ⁻¹	5 kg ⁻¹	10 kg ⁻¹
4.	ODV seeds (max)	5 kg ⁻¹	5 kg ⁻¹	10 kg ⁻¹
5.	Germination % (min)	80	80	90
6.	Moisture content (%) (max)			
a.	Moisture pervious	12	12	12
b.	Moisture vapour proof	8	8	8