

Hybrid Seed Production in Maize through Single Cross Technique

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Introduction:

The simplest method among the various methods of making variety in maize by scientific method is single cross method. Single cross has the highest yield potential and is sensitive to fertilizer, water and other inputs. In the cultivation of maize, farmers give more preference to hybrid varieties than native varieties because hybrid varieties have more genetic purity, higher production and higher productivity than native varieties.

The most important thing is to choose a good place to produce hybrid seeds of maize. We should choose such a place, around which no variety or hybrid variety of maize has grown. The ratio of male to female depends on the ability of male plants to produce pollen and the maturity of female plants. The eclecticism or harmony in male and female flowering is done by sowing on different days.

Advantages of single cross hybrid:

- ✓ Good acceptability by farmer
- ✓ Requires only two inbred
- ✓ Production and maintenance of two parental lines is easier

- ✓ Cost of production is low
- ✓ Its uniformity in characteristics and high productivity
- ✓ Single cross hybrids represent almost 90% of hybrid maize seed market



Fig. 1: Maize crop

Condition of single cross hybrid seed production:

- Good productive and uniformity
- Good genetically diverse parents
- Maintain isolation distance
- Technically experienced manpower
- Good irrigated soil and fertile

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Fig. 2: Maize plant bearing cob

Good characteristics of parents:

Female	Male
Good productivity	Capacity of long duration of pollen shedding
Good strong root system and	Good color of grain
Strong Resistant or tolerant agence biotic and abiotic stresses	Resistant or tolerant against biotic and abiotic stresses
Good cobs	Better root system
Shorter Anthesis and Silking Interval	High yield potential
Nutrient responsive	Resistance to lodging

Crossing Technique:

Manual emasculation is done by detasseling process. The maize plant has a male part is known as tassel and a female part is known ear. Removal of (male inflorescence) tassel from female parent is known as detasseling. Detasseling is done when the tassel visible among the last leaves of the

plant, 7 to 10 days before the styles of the female inflorescence appear. Anthers take 2 – 4 days to dehisce after complete emergence. Only in few cases, the anthers start dehisces before its complete emergence.

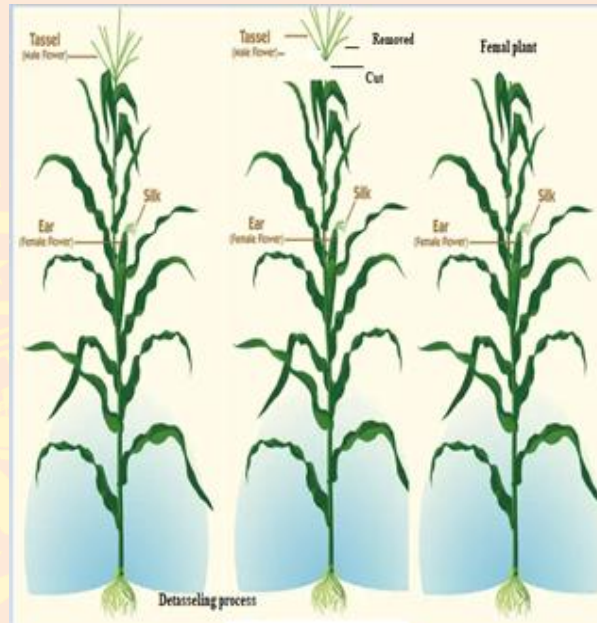


Fig. 3: Maize plant bearing cob

Time for detasseling:

- ❖ It must be done in 7 – 10 days between when tassel is ready to emerge and pollination.
- ❖ At morning time.



Fig. 4: Maize detasseled plot

Method:

Holding the stalk with left hand and remove entire tassel by the right hand. Remove tassel by a steady upward pull and put down tassel on ground. No part should be left on the plant as it causes contamination. Do not break or remove leaves will be reduce yields and will also result in lower quality of seed produced.



Fig. 5: Detasseling method

Necessary precautions in detasseling:

- ❖ Hold the below the boot leaf in left hand and the base of the tassel in right hand and pull it in a single pull with slight jerk
- ❖ No part should be left on the plant as it causes contamination.
- ❖ It should be uniform process done daily in the morning in a particular direction.
- ❖ Immature detasselling should be avoided. It may cause a few spikelets being left, which may emerge and shed pollen.

- ❖ Do not break the top leaves as the yield may be reduced and attack of disease.
- ❖ It should be uniform process done daily in the morning in a particular direction.
- ❖ Mark the male rows with marker to avoid mistake in detasseling.
- ❖ Do not carry the tassel through the field as any fall of pollen may lead to contamination.

System of Hybrid seed production:

Method of inbred development:

- ❖ The pedigree Method is most widely used to develop inbred lines initially pedigree selection was practiced in adopted land race op cultivars. However, this method is referred to as ‘Standard method when an OP population was sampled.
- ❖ The back cross method is another important method the importance of some population developed by back cross is inset next to single crosses. It is easy and effective method to handle one or two genes and has been widely used to incorporate resistance to disease and insect pest.
- ❖ Anther culture and haploid was used inbred line production.

Maintenance of inbred line:

Inbred lines are generally maintained by a system of self-pollinated and growing progenies in ear-to-rows so as to observe change for various traits. One purpose of

developing inbred lines is to obtain genotypes whose genetic constitution will be maintained without change.

Single cross hybrid: Cross between two inbred. A x B. A genotype will be detasseled (male) and crossed with B genotypes (female).

Double cross hybrid: Cross between two single cross (A x B) x (C x D).

Three way cross hybrid: Cross between a single cross and an inbred parent (A x B) x C.

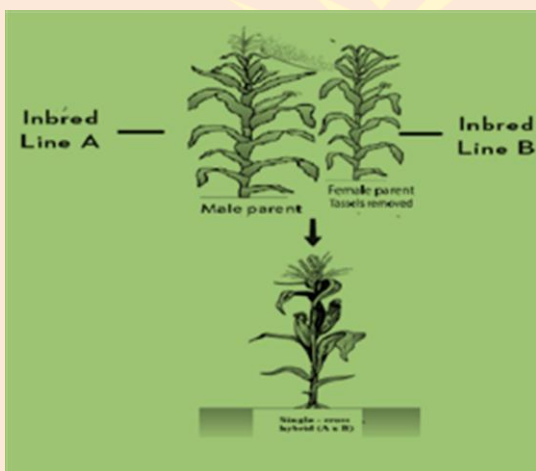


Fig. 6: Hybrid production using inbreds

Seed production technology:

Season: Maize can be grown in all seasons:-

Kharif - last week of June to first fortnight July

Rabi - last week of October

Spring - first week of February

Isolation distance:

Isolation distance is the minimum separation required between two or more varieties of the same species for the purpose of keeping pure seeds. A foundation single cross production field must be isolated by not less than 400 metres and 200 metres for certified seed.

Male and female ratio: The male and female ratio depends on:-

- ✓ Pollen shedding potential and duration of male parent.
- ✓ Male : female synchrony for better seed setting flowering of female should be earlier than male or male pollen dehiscence should coincide with female silking
- ✓ In general the male and female ratio should be 1: 2 or 1:3 or : 4.

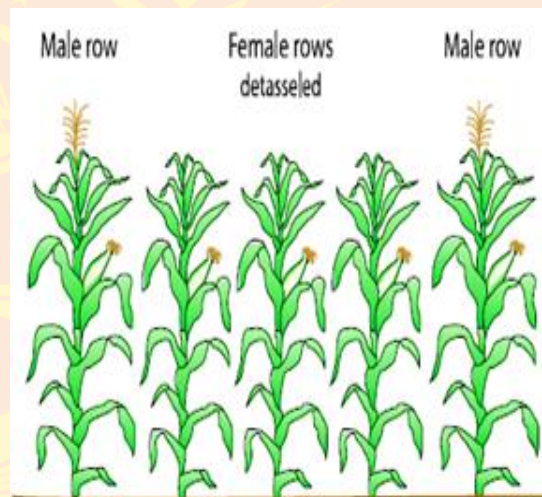


Fig. 7: Diagrammatic representation of Male & Female rows in maize hybrid seed production field

Spacing:

- ✓ Row to row 60 to 75 cm.
- ✓ Plant to plant 20 to 22.5 cm.

Sowing Depth:

- ✓ Seed should be sown at depth of 3-4 cm.
- ✓ For sweet corn cultivation, keep depth of sowing to 2.5 cm.

Method of sowing: Seed are sown in ridges and furrows.

Seed rate:

Female: - 7 – 10 kg ha⁻¹

Male: - 3 – 5 kg ha⁻¹

Seed treatment:

Seed treatment is necessary from soil borne diseases and insect pest. Seed treated with Carbendazim or thiram@2 gm/kg for protection of downy mildew.

Nutrient management:

Inbreds require high fertility as compare to hybrid. It is desirable to apply FYM@15t/ha days prior to seeding. The fertilizer nutrients required N- 180-200 kg., P₂O₅ – 80 kg., K₂O – 80 kg., and ZnSO₄ – 25 kg/ha. Total amount of phosphorus, potash, zinc and 10% nitrogen should be applied as basal. The remaining dose of nitrogen applied four time given below

- ✓ 20% at 4 leaf stage
- ✓ 30% at 8 leaf stage
- ✓ 30% at flowering stage
- ✓ 10% at grain filling

Water management:

Light and frequent irrigations are desirable for parents. Young seedlings, knee high stage, flowering, grain filling and 10 days after grain filling is the most sensitive stages for water.

Rouging:

Removal off – type plants is known as rouging. Inbred lines are relatively true breeding strains. At pre-flowering stage, rogue

out off-type plants which are easily distinguishable on the basis of plant characteristics such as leaf shape, size, plant height, etc.

Harvesting:

Maize cob can be harvested at relatively optimum moisture content 20 - 25 % in grain. The male parent harvested after pollination and used in feed but female parent are use in quality seeds production.

Threshing:

Remove the husk from the cobs and then dry them is sun for 7 – 8 days. There after grains are removed either by beating the cobs by sticks or with the help of maize shellers.

Drying:

Drying is a vital operation that involves moisture from the cobs. High moisture cobs will deteriorate firstly because respiration and heating, germination of grains and increase insect multiplication and damage. Seeds are dried to 12-13% optimum moisture content.



Fig. 8: Maize seed and cob drying

Shelling:

Shelling should not be done at high moisture level as it may damage the seeds. The process of shelling is done by hand or power driven maize Sheller.

Seed processing:

This process maintains the seed quality by separating the seeds from their small size, broken or damaged, different colour, texture, diseased cob and other deformed by the processing plant.

Warehousing and marketing:

Separate the grain from the corn and dry the grain until the moisture in it is about 8%. Then fill them in airy jute bags or small packets and send them to the market.

References:

1. <https://excellenceinbreeding.org/sites/default/files/manual/98078.pdf>
2. <https://www.google.com/search>
3. MacRobert J. F., Setimela P., Gethi J. and Regasa M. W. (2014) Maize Hybrid Seed Production Manual.