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Hybrid Seed Production in Tomato

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Introduction:-

Tomato is one of the most popular and widely grown vegetable in world.Tomatoes contribute to a healthy well balanced diet. They are rich in minerals, vitamins,essential amino acids, sugars and dietary fibres. Tomato contains much vitamin B and C,iron and phosphorus. In the present days, it is gaining more medicinal importance because of the antioxidant property of ascorbic acid and lycopene content. It is also an important source of carotene and valued for their colour and flavour. Thus, today it is one of the important raw materials for multi-million food industries. Tomato are also called as poor man's Apple. Tomato is consumed either fresh, cooked or processed into various product like juice, ketchup, sauce,puree. Tomato has its origin in the South America. Tomato belongs to the solanaceae family. This family also included other well known species, such as a potato, tobacco, peppers and eggplant. Tomato fruits are consumed fresh in salads or cooked in sauce soup and meat or fish dishes. Tomato is an annual plant which can reach a height of over 2 metres. The colour range from yellow to red. The pulp and Juice are digestible,mild apparent a promoter of gastric secretion and blood pressure. Tomato is one of the versatile crop in the world because of its fast and wide climate adoption and it is universally treated as protective food.

Botanical Description:-

Tomato is self-pollinated crop. Self-fertilization is favoured by the position of respective stigma within the cone anthers and the normal pendant position of the flower. Anthesisstarts at 6.30 a.m. and continues upto to 11.00 a.m. Anther dehiscence occurs 1-2 days after opening of corolla. Tomato is a typical day neutral plant. It requires temperature of 15 - 20 °C for fruit setting.

Botanical Classification:-

Cultivated tomato according to the fruits shape and plant spread by Bailey (1949).

1) L. esculentum. Var. Commune (Common round fruited tomato)
2) L. esculentum. Var. grandifolium (Potato leaves type)
3) L. esculentum. Var. cerasiformae (Small fruited cherry tomato)
4) L. esculentum. Var. validum (Upright tomato)
5) L. esculentum. Var. pyriformae (Pear shaped tomato)

Tomato plant is characterized by two types of plant:-

1. **Determinate type:** Inflorescence occurs more frequently in almost every internode until terminal ones are formed and elongation ceases at this point. In other words, it may be defined as self- topping and the main axis terminates with a flower cluster.

2. Indeterminate type: Inflorescence cluster occurs at every third internode and the main axis continues growing indefinitely.

Land Requirement - Selection of suitable land for tomato seed production is important where the previous crop should not be the same variety to avoid the contamination due to volunteer plants. For seed production of tomato, varieties require minimum of 50 M for foundation seed and 25 M for certified seed. For hybrid seed production, it requires minimum of 200 M for foundation [parental line increase] and 100 M for certified hybrid seed.

Soil and Climate:-

Tomato seed production is highly influenced by environmental factor, particularly temperature which has significant effect on all stages of plant growth and development. Day and night temperature and the variation between the two has pronounced effect on growth , flowering, fruiting and yield of fruits and seeds in tomato, but the night temperature is a critical factor for fruit set in tomato . It is reported that plants could set fruits abundantly when the night "temperature is between 15^0C and 20^0C and the day temperature is about 25 ^{0}C. Various experiments have revealed that temperature above 32°C leads to reduction in fruit set. Fruit set is also reduced at a temperature below 15.5°C due to poor pollen dehiscence. Tomato can be grown on a rather wide range of soils from sandy. The optimum soil pH is 6.5 - 7.8.

Method of Seed Production:- Seed to Seed

Varieties:-

Breeder seed - Foundation seed - Certificate seed
Breeder seed - Foundation seed - Multiplication of parent lines - Certified seed(Production of F1 hybrids)
Inderterminate variety:-AngurLata,ArkaVikas, ArkaSaurbh,Pusa Ruby, Sioux, Naveen,Marglobe.
Determinate Varieties:- Pusa Early Dwarf, PusaSheetal, Arkameghali, Roma, Rupali, HS 101, 102, 110, Pkm1, Co 1,2,3.

Hybrids:-Arkavardan, Pant Hybrid 10,Arka Abhijit ,Rupali, Sonali, Arkashrestha, hybrid2.

Seed Treatment: - Seed is treated with fungicide like Captan or Thiram2g\kg of seed.

Seed Rate - F1 hybrid

a. Male parent 25 g / ha
b. Female parent 100 g / ha
c. Varietal seed production - 300-400 g\ha

Time of Planting:-

Tomato can be grown in any season as it is a day neutral plant. Three crops are taken in areas which are not affected by frost.
Kharif Crop - July
Rabi Crop - November months.

Nursery bed Preparation:-

The land is first ploughed with soil turning plough followed by 4-5 ploughing with country plough or harrow. Labelling should be done after ploughing and bring the soil into fine tilth and also provide better drainage facilities. Show the seeds in raised nursery bed of 20 cm height in row of 5 cm gap and covered with sand. Eight and ten nursery beds will be sufficient to transplant in one acre. Applied to 2 kg of DAP 10 days before pulling out of seedling.

Spacing–

1. Hybrid seed production Female Parent; 90×60cm
2. Hybrid seed production Male Parent - 60×45 cm

Planting ratio:- Female and Male Parents ratio - 12: 1or 12: 2

Transplanting:-

Seedlings are ready for transplanting between 4-5 weeks after seeding in nursery beds. Seedlings should be hardened before transplanting. This is done by withholding watering 4-5 days so as to reduce available moisture to 20%.

Rouging:-

The rouging should be done based on the plant characters, leaf, branching and spreading characters and also based on fruit size shape and colour. The plant affected by early blight, leaf spot and tomato mosaic virus disease should be removed from the seed production field.

Specific field requirements –

S/N	Factors	Foundation	Certified
1.	Off type	0.1%	0.2%
2.	Hybrid	0.01%	0.05%

3.	Plant Affected by Seed borne Disease	0.1%	0.5%

Manure and fertilizer:-

I. Fym - 25 tonne / ha
II. Nitrogen - 100 kg/ ha
III. Phosphorus - 80 kg/ ha
IV. Potassium - 100 kg / ha

Crossing techniques:-

1. **Emasculation:**- In tomato the hybrid seed production is normally done by emasculation and hand pollination'. Emasculation is done before the anthers are mature and the stigma has become receptive to minimize accidental self-pollination. Thus emasculation is generally done in the evening between 4 p.m. and 6 p.m, one day before the anthers are expected to dehisce or mature and the stigma is likely to become fully receptive. Emasculated the bud by hand with the help of needle and forceps. Sterilize the forceps, scissors and hands by dipping them in 95% alcohol before emasculation is started. If gloves are used these should also be dipped in 95% alcohol to prevent Pollen contamination. Use sharp pointed force to force open the selected buds. Then, split open the anther cone. Carefully remove the anther cone out of the bud, leaving the calyx, Corolla and pistil. To help identify the hybrid fruits from selfed fruits at the time of harvest, cut a few of the sepals using a scissors. Collect flowers from the male parent to extract pollen. The best time of pollen collection during an early morning before the pollen has been shed. Remove the anther cones from the flowers and put them in glassine envelopes. Dry the anther container by placing those 30cm below 100 watt lamp for 24 hours. The lamp creates a drying temperature of about 30^0C. Pollen can also be sun dried. Put the dried anther cones in a plastic cup. Shake the cup about 10- 20 times so that the pollen is collected in the lid cup. Transfer the pollen into small convenient to handle container for pollination .Fresh pollen is best for good fruit set.

2. **Pollination:** Emasculated flowers are generally pollinated two days later. Expose the stigma to facilitate pollination. Dip the stigma into pool of Pollen in the pollen and container or pollinated by touching the stigma with the tip of the index finger dipped in the pollen pool. Is usually done three times weekly over a 3-5 week period .After breeding operations are completed, any non-crossed flowers on the female plants are removed to lessen the change of contamination from selfed seeds before harvest.

Pest and DiseaseManagement:-

PestManagement:-

1. White Fly: Bemisiatabaci

Symptoms: Effect the leaves and causes their shriveling and curling up.

Management: Uproot and destroy the disease leaf curl plants .Use nitrogen and irrigation judiciously. Use yellow sticky traps at 12/ha to attract and kill insects. Spray of dimethoate 30% EC @ 1 ml / litre.

2. Thrips: Thripstabaci

Symptoms: Nymphs and adults lacerate leaves. Leaves may become pale and silver shines appear on affected leaves.

Management: Spray methyl demeton 25 EC @ 1 litre per hectare. Use yellow sticky traps at the rate 15 per hectare.

3. Fruit Borer: Helicoverpaarmigera

Symptoms: Damage starts from flowering. Eggs and laid on young leaves which are damaged by young larvae. Later they migrate to developing fruits. They bore the fruits

with half of the body outside food. The caterpillars are greenish to variable colours with dark broken grey lines along the side of the body

Management: Use of tolerant varieties like Punjab chubara,Pant bahar, Pusa hybrid -4 ,. Deep summer ploughing to expose the larvae and pupae to sunlight and predation by birds. Planting of marigold attract the pest. Collection and destruction of larvae from marigold flowers. Use of pheromone traps for early pest detection.

Disease Management:-

1. **Bacterial Spot:**Xanthomonasvesicatoria

Symptoms: Spot appears on leaves as small, sometimes water - soaked circular areas. Spots may initially be yellow green, but draken to brownish - red as they age. On green fruit, spots are typically small, raised and blister like, and may have a yellowish halo.

Management: Soak seeds in water at 122 F for 25 min. before sowing. To keep leaves dry and to prevent the spread of the pathogens, avoid overhead watering and instead use a drip - tape or soaker - hose.

2. **Early Blight :**Alternariasolani

Symptoms: Foliar symptoms generally occurs on the oldest leaves and start a small,brownish to black lesions. This leaf spots enlarge up to 1.4 cm in diameter in a concentric fashion .Under favorable conditions,significant defoliation of lower leaves may occur leading to sunscald of fruit. Stem lesions are dark, slightly sunken and enlarge concentrically, Basal girdling and death of seedlings may occur.

Control: Use pathogen free seeds and resistant cultivars Arkarakshak and Arkasamrat. Use crop rotation eradicate weeds. Hot water treatment of seeds for 25 minutes at 50° C.

3. **Leaf Curl of Tomato:**

Symptoms: the leaf curl is characterised by severe stunting of the plants with downward rolling and crinkling of the leaves. Partial or complete sterility of the plant is also common. Plant are stunted due to shortening the internodes. The disease is transmitted by the whitefly.

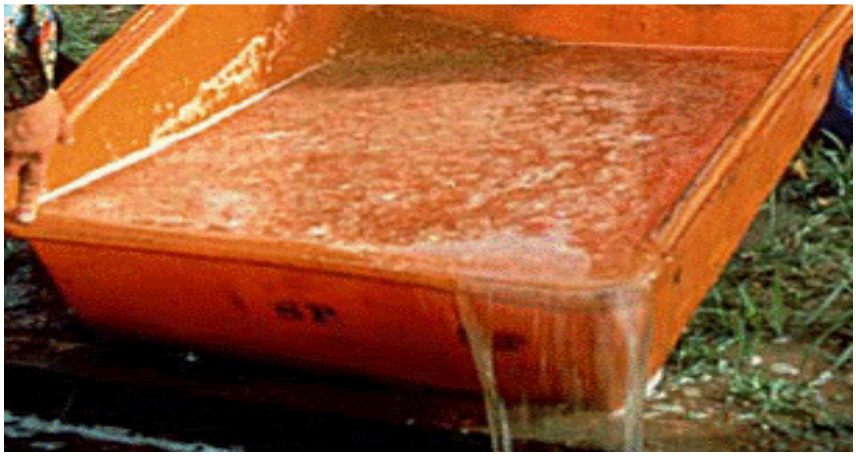
Management: Use resistant variety lycopersiconperuvianum,AkaraAnanya, AkaraRakshak. Use of systemic insecticide such as Dimethoate (0.05%) as spray or carbofuran (50 kg /ha) as soil application are useful in vector control and reducing the disease.

Harvesting:

Seed fruit are allowed to ripen to maturity on the plant. Only completely colored and matured seed fruits are harvested.

Seed Extraction:-

The fruits in between 6-7 harvest should be used for seed extraction. Before seed extraction, the fruits are to be graded for true to type and selection of medium to large size fruits for getting higher recovery of quality seeds.



Acid Method:-

The acid method of seed extraction is the best method for tomato seed extraction. In this method, the fruits are to be crushed into pulp and taken in a plastic containers. And then add 30 ml of commercial hydrochloric acid per kg of pulp, stir well and allow it for 1/2 hour. In between this duration the pulp may be stirred well for one or two times. This facilitates the separation of seed and pulp. After 1/2 hour, the Seeds will settle down at the bottom and then the floating fraction is to be removed. The collected seeds should be washed with water for three or four times.

Drying, Grading and Storage:-

Drying and grading seeds are to be dried in the shade. It should never be dried in hot sun. The safe moisture content of the seed for grading is 8 to 9% .Storage the seeds dried to safe moisture content after treating either with captan of thiram @2 gram/kg can be stored for 15 month in moisture vapour previous containers, while it can be stored in moisture vapour proof container for 30 months.

Seed Standards (variety and hybrid):-

S/N	Factors	Foundation	Certified
1.	Pure Seed(Mini)	98%.	98%
2.	Inert Matter (Maxi)	2%.	2%.
3.	CropSeedsNo/kg (Maxi)	5/kg	10/kg

Seed Yield:- 100-120kg/ha