

WELCOME



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TOMATO

- ▶ Tomato is one of the most popular vegetables of great commercial value.
- ▶ In India, tomato was introduced by the **Portuguese travellers.**
- ▶ Tomato is grown throughout the year in almost all home gardens and on large scale in market and truck gardening systems.
- ▶ It is native of **Peruvian or Mexican region.**
- ▶ It is an excellent source of **vitamin C** and good source of **vitamins A and B.**
- ▶ Tomato seeds contain **oil(about 24%)** which is used as **salad oil** and in the preparation of margarine

Botanical description:

- ▶ Scientific name : *Solanum lycopersicum*
- ▶ Family : **Solanaceae**
- ▶ Chromosome no. : **2n=24**
- ▶ Origin : **Peruvian or Mexican region**
- ▶ Plant type : **Annual**
- ▶ Other names : **Wolf peach, Wolf fruit**

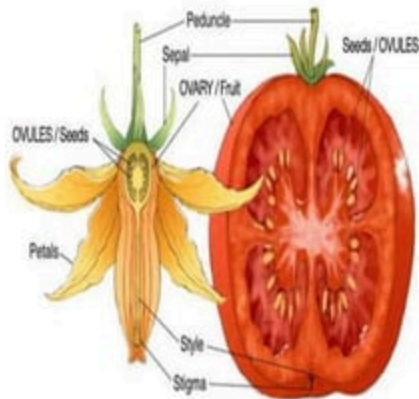


Importance

- 1.It is commonly cooked as vegetable along with other vegetables like Potatoes
- 2.Various products are made from tomatoes are soup, ketchup, sauce, chutney, powder, paste, juice
- 3.Tomato juice is used as an appetizer and beverage.
- 4.Tomato contains important minerals namely potassium, calcium, sodium, magnesium, phosphorous, boron etc.,
- 5.Tomato has medicinal importance. Tomato juice promotes gastric secretion, acts as blood purifier, and works as intestinal antiseptic.

Plant Characteristics:

- ▶ **Habitat** : terrestrial, wetland .
- ▶ **Leaf type** : Leaves are compound (made up of two or more discrete leaflets)
- ▶ **Leaf arrangement** : Alternate, spirally arranged pinnatifid, oval, irregularly lobed.
- ▶ **Inflorescence**: Cymes
- ▶ **Flower**: Pendent, perfect and hypogynous, pale yellow to yellow in colour. Stamens are 5 in number. Ovary 6 celled.
- ▶ **Fruit type** : Flesh berry with 2-9 loculi, orange, yellow or red when ripe. Usually round pear shaped, smooth or furrowed.



Important species of tomato

1. *Lycopersicon esculentum*
2. *Lycopersicon cheesmani*
3. *Lycopersicon hirsutum*
4. *Lycopersicon peruvianum*
5. *Lycopersicon pimpinellifolium*



Indian Agricultural Research Institute, New Delhi

Pusa Early Dwarf

Pusa red plum

Pusa ruby

Set 120

Sioux

IIHR, Bangalore

Arka Saurabh

Arka Vikas

Arka Vardhan

Arka Alok

Arka Vishal



Punjab Agricultural University, Ludhiana

Punjab Tropic

S-12

Punjab NR-7

Indo-American Hybrid Seed C0., Bangalore

Mangala

Sheetal

Vaishali

Rupali

Rashmi

Naveen

Floral biology :

- ▶ **Inflorescence** : Cymes- Flowers borne in cluster
- ▶ **Anthesis** : It starts at 6 a.m. with maximum flower opening between 7 to 8 a.m..
- ▶ **Dehiscence** : Peak from 9 to 11 a.m.
- ▶ **Stigma receptivity**: Becomes receptive 16 hours before anthesis and remain the same for 2-3 days after anthesis.
- ▶ The optimum **temperature** for pollination is about 21°C .
- ▶ The pollen remain viable for 7-10 days at 20° C and 70% humidity.

Corolla :

- ▶ Bright yellow
- ▶ 5 petals
- ▶ Gamosepalous

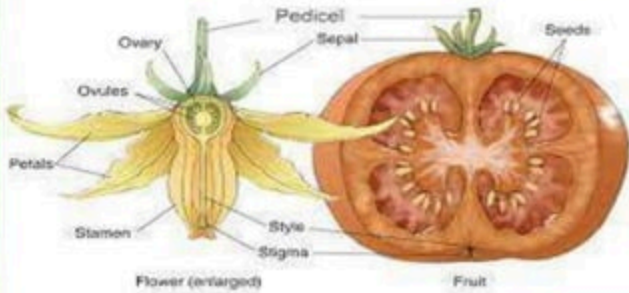
Androecium :

- ▶ 5 stamens
- ▶ Epipetalous
- ▶ Small filaments
- ▶ Large anthers

Gynoecium :

- ▶ Ovary is superior, bicarpellary and syncarpous
- ▶ Style- Single
- ▶ Stigma- bilobed





Climate and soil

- ▶ Tomato is a **warm season** plant. It cannot withstand severe frosts.
- ▶ For plant growth, atmospheric temperature should be in the range of **20°C to 28°C**.
- ▶ Night and day temperature below **15°C** and above **39°C** respectively cause poor germination and develop off shaped fruits.
- ▶ A **warm sunny weather** is most suited for its **ripening, colour, quality and high yields**.

Soil

- ▶ Soil which is well drained fairly light, fertile, organic matter rich with a fair soil water holding capacity is ideal.
- ▶ For early crop, a **sandy loam soil** is the best. Tomato do well in soil reaction from pH 6 to 7.
- ▶ It is moderately tolerant to acid soils (5.5).
- ▶ Application of lime is advisable to improve soil Ph when it is below 5

Propagation

- ▶ Tomato crop is propagated by **seeds**.
- ▶ **Raising of seedlings:** The field for raising nursery should be highly porous and fertile.
- ▶ Raised beds are prepared and the seeds are sown in lines of **5 cm** apart.
- ▶ The seeds are covered with sand. Watering should be done with rose can.
- ▶ Nursery beds may be covered with dry **Saccharum grass** for **3-5** days to induce early germination of seeds because of darkness.
- ▶ The seedlings will be ready for transplanting **25-30** days after sowing.



Seed rate

- ▶ About **500-800 gram** of seed is enough to raise sufficient seedlings for the planting of one hectare area.
- ▶ **One gram** contains about **300 seeds**.

Seed treatment

It is advantageous to treat seeds with **IAA** in talc powder and to sow the seeds after one month of treatment for better plant growth and higher fruits yields.

Nutrition

- ▶ Tomato is a heavy feeder of macronutrients (N,P,K) and therefore these should be applied in right doses in right time and with suitable method so that better growth and development is attained.
- ▶ For Karnataka Irrigated: **250:250:250 kg NPK per hectare**
- ▶ For Karnataka Rainfall: **60:50:30 kg NPK per hectare**
- ▶ Along with NPK, FYM of 35 tons/ha is applied.
- ▶ Micronutrients such as Ca, Boron, Zinc are important. These are applied through foliar sprays.

Method and time of application

- ▶ Organic manures are incorporated in the soil before or at final ploughing.
- ▶ Application of Nitrogen is done in **two splits** doses during **winter** and in **three splits** during **rainy season**.
- ▶ The first application is done 3 weeks after transplanting of seedlings and 2nd application just at the beginning of flowering and 3rd application is done during fruiting stage.
- ▶ Whole quantity of Phosphorus and Potassium is applied on both sides of row and mixed with soil.

Transplanting

- ▶ Tomato seedlings become ready for transplanting when they attain 10-15cm height and are of 3-4 weeks old.
- ▶ Seedlings should be uprooted carefully from the nursery bed.
- ▶ Transplanting is done either in flat bed(in light soils) or on ridges(in heavy soils) at 60×30 cm.
- ▶ Planting on ridges provides good support to plants and less attack of fruit diseases.
- ▶ Planting may be done preferably in the evening.
- ▶ Light irrigation is done immediately after planting.



Irrigation

- ▶ 1st irrigation is given just after transplanting of seedlings .
- ▶ 2nd irrigation should be given on the 3rd day of planting and the subsequent irrigations at 7days interval depending on the soil conditions and prevailing local climate.
- ▶ During hot season, the tomato is irrigated once in a week.
- ▶ During winter season. Whenever there is a danger of frost, the crop must be irrigated as it helps to maintain temperature above freezing.

Interculture and weed control

- ▶ It is an essential for keeping down weeds and maintenance of soil mulch. The 1st hand hoeing and weeding should be attended to on 25th day of planting and earthing up on 45th day.
- ▶ To control weed 2l basin mixed with 600-700 l of water should be sprayed and mixed with soil before transplanting

► **Major Insects - pests in tomato**

1. Fruit borer
2. Jassids
3. Tobacco caterpillar
4. White fly
5. Root knot nematodes

Control:

1. Hand picking of insects and pests.
2. Follow crop rotation.
3. Spray with suitable insecticides.
4. Grow resistant varieties

Major diseases of Tomato

1. Damping off
2. Buckeye rot
3. Fusarium wilt
4. Early Blight
5. Late blight
6. Bacterial canker
7. Leaf curl virus



Early blight



Late blight



Anthracnose

©T.A. Zitter



Severe symptoms of root knot
nematode on tomato roots

Root knot nematode

Physiological disorders of tomato



Blossom end rot



Cat face



Figure 3. Growth cracks of tomato. (Photo courtesy Missouri Botanical Garden)

Fruit cracking

Training and Pruning

- ▶ Individual plant is given support with the help of wooden stick or bamboo stakes.
- ▶ Support prevents plants from bending, fruits do not come in direct contact of soil, insects find comparatively less hiding place, spraying of insecticides becomes easy.

Roguing

- ▶ At least 3 times roughing should be carried out at different stages of crop growth.
- ▶ **1. Pre flowering stage:** The 1st roughing is done for the plants which bears flowers, plants different in their branch and leaves orientation, leaf colour, plants different in general plant type including determinate and indeterminate habit, should be removed if they are different than the grown variety.

- ▶ **2. Flowering stage:** The 2nd roguing should be done at flowering and post flowering stage. The plants which do **not bear flowers** and **plants show different flower colour** than the grown variety should be removed from the field.
- ▶ **3. Fruit stage:** In this roguing, the plants which show different fruit size and shape should be removed. The plants which show unripe fruit colour or ripe fruit colour other than variety grown in the field should also be removed from the field.

Harvesting and seed yield :

- ▶ Tomato fruits are harvested for seed purpose at pink to red ripe stage.
- ▶ Hybrid seed yield is about 40-50 kg/ha .

Seed extraction

- ▶ **1. Fermentation method:** The ripe fruits are crushed wall in a non-metallic container by hand. The entire material is kept as such till it ferment. When fermentation is completed it shows profuse foam formation on the upper surface of material and tomato flesh separated from seeds completely. Seeds are washed at least 8-10 times with clean water. Seeds are spread thinly in the sun for drying.
- ▶ **2. Alkali treatment method:** The extracted material with pulp is treated with an alkali mixture in equal volume. When the alkali mixture is cooled, allow it all to stand overnight in an earthen pot. Next day, all the seeds will settle down at the bottom of the container. The liquid is decanted off. Seeds are washed thoroughly with clean water and allowed to dry in the sun.

- ▶ **3. Acid treatment method:** In the extracted tomato pulp commercial hydrochloric acid at 5-6 ml/kg pulp is thoroughly mixed and stirred and washed thoroughly after 30 min with clean water, and seeds are allowed to dry in the sun.
- ▶ **Washing:**
- ▶ After the extraction the seed are washed with water to remove the pulp.
- ▶ The water is added to containers with the pulp and seed.
- ▶ It is stirred thoroughly and is drained out along with pulp and other mucilaginous substance.
- ▶ This process is repeated until the seeds are clean.

Drying

- ▶ After washing the seeds should be dried as rapidly as possible.
- ▶ Seeds may be spread on screen bottom trays, or cloth and placed in the open where a maximum exposure to sun and dry air is available.
- ▶ The seeds should be dried to 8 per cent moisture before storage.
- ▶ Grading: The seeds are passed through different size of screen preferably above 0.6mm to 0.8mm size.

Grading

- ▶ Whole dry lot of seeds are graded.
- ▶ The seeds are passed through different size of screen preferably above 0.6 mm to 0.8 mm size.
- ▶ However, size of screen or sieve also varies with varieties.
- ▶ Larger seeds are superior to smaller seeds, hence, grading of seeds is absolutely essential to get maximum seed quality.

► **Packing and Storage:**

- The seeds should be treated with captan or thiram 75WDP at 2g/kg seed.
- After treating the seeds should be packed in polythene bags then the seeds should be stored with 8-10 per cent moisture in container of moisture- vapour proof.
- Such seeds will remain viable up to 70-80 per cent at the end of about 25-30 months of storage.

Technique of producing F1 hybrid Tomato seed

- ▶ Hybridization requires the growing of 2 separate male and female parents. The male parent provides pollen and the female parent receives pollen resulting in the fruit bearing, the F1 hybrid seed
- ▶ Ratio of male to female is 1:5.
- ▶ All the flowers of female parents are emasculated during their late bud stage. It is done by removing their anthers with the help of suitable forceps carefully, prior to applying pollen to its stigma.
- ▶ Pollen is collected from the flowers by detaching from the male parent and is applied with a fine brush to each emasculated female flower.
- ▶ Pollination should be followed by bagging of flowers avoiding any chances of cross pollination through bees.
- ▶ Pollinated flowers are marked with tag for ease in identification of fruits containing hybrid seed at harvest time.

Hybrid Seed Production Techniques in Tomato

Emasculation: Can be performed at the start of flowering, about 55-65 days after sowing.



Selection of bud



Split open anther cone



Removal of anther cone



Cutting of petals



*Collection of
pollen*



Dusting of pollen grain on emasculated flower



Bagging of pollinated flower to avoid contamination with foreign pollen

Field standards for Tomato Seed production

Factors	Foundation seeds	Certified seeds
Isolation distance	50m	25m
Off types (maximum)	0.1	0.2
Other crop plants (maximum)	None	None
Objectionable weed seeds(max.)	None	None
Diseased plants	0.1	0.5

Seed Standards for Tomato seed production

Standards	Foundation seeds	Certified seeds
Pure seed (minimum)	98%	98%
Inert matter (maximum)	2%	2%
Other crop seeds (maximum)	5/kg	10/kg
Weed seeds (maximum)	None	None
Germination (minimum)	70%	70%
Moisture (maximum)	8%	8%
For vapour proof container	6%	6%

THANK YOU

