



TOMATO PRODUCTION



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Tomato: An Introduction

Tomato plants are suited for growing in a wide range of climates. It can be grown in greenhouses throughout the year. Tomato plants are suitable for hydroponic growing also. Tomato is the one of the most popular and largest cultivated vegetables with variations in size, colour and shape. Size varies from small (tiny tomatoes) to large (plum tomatoes) while shape varies from round, oblong and globe. Tomatoes are available in many colours also such as green, pink, red, yellow, and orange. Tomatoes are also one of the largest canned vegetables. Tomatoes are also known for its highest nutritional value. Tomato is counted among the top 50 nutrient-dense, plant-based foods.

Taxonomy

Kingdom	Plantae
Order	Solanales
Family	Solanaceae
Genus	Lycopersicon
Species	esculentum

Origin and Distribution

Tomatoes are believed to be originated in South America. Major producers of tomatoes are China, Europe, India, and the USA.

Plant Description

Tomato plants are grown for its fruits, i.e. tomatoes. Tomatoes are botanically fruits called 'berries' but considered as culinary vegetables as they are used as vegetables rather than as fruits. Two types of tomato plants are widely grown. These are Determinate (bush type) tomato plants and Indeterminate (vine type) tomato plants. Bush-type plants are annuals that stop growing at a certain height presenting a bush-like appearance; their stems are strong and they produce only one crop, all at once. Determinate bush tomato plants are suitable for container gardening. Indeterminate tomato plants grow up to 3 meters in height; stem is tender and vine-like and often needs support; these plants are perennials but cultivated as annuals; fruits are available throughout the year and therefore preferred for commercial cultivation.

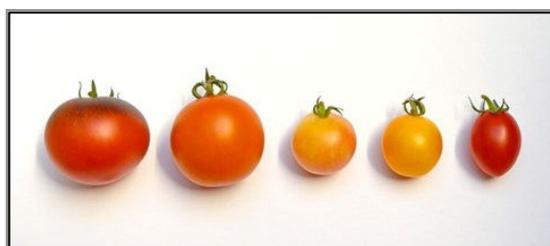
Varieties of Tomato

Based on the size of the fruits, tomatoes are classified into 7 groups such as beefsteak tomatoes, plum tomatoes, cherry tomatoes, grape tomatoes, Campari tomatoes, Tomberries, and globe tomatoes.

- *Beefsteak tomatoes*: Large tomatoes having 4 inches or more diameter, round shaped with thin skin and are used for sandwiches
- *Plum tomatoes*: Thick and fleshy, oblong-shaped tomatoes having 3-4 inches length and 2 inches diameter with high TSS (total soluble solids); suitable for canning, sauce and paste
- *Cherry tomatoes*: Small, round tomatoes of cherry-size; they are with less than one inch in diameter and sweet in taste
- *Grape tomatoes*: Small, round tomatoes of grape-size; they look like tiny variations of plum tomatoes
- *Campari tomatoes*: Bigger than cherry tomatoes, but smaller than plum tomatoes
- *Tomberries*: They are very tiny tomatoes having about 5 mm in diameter
- *Globe tomatoes*: Tomatoes of average size, globe-shaped and having a diameter between 2 and 2.5 cm and commercially cultivated for processing and fresh consumption purposes

Growing Tomato

Climate and Soil: Tomato is a warm season crop and is prone to frost. Tomatoes may be grown at temperatures ranging from 18 OC to 27 OC. Tomatoes favour direct sunlight. Variations in temperature and light intensity may affect the fruit-set, pigmentation and nutritive value of the fruit. The best soil for tomato cultivation is well-drained, rich, fertile loamy soils. Optimum soil pH is 6.0 to 7.0.



Sowing and Planting: Seeds are sown in well-prepared nursery beds. For winter crop in tropics, seeds may be sown in June-July and for the spring-summer crop, seed are sown in November. Two to three sowings/year can be done in regions with mild climate; in the hills the seeds are sown in March-April. There are about 300 seeds in one gram. About 400 to 500 grams of seed are needed for one hectare area. Nursery-raised seedlings may be transplanted when they reach 10-15 cm in height. Spacing for the winter crop is 75x60 cm and for the spring-summer crop is 75x45 cm.

Manures and Fertilizers: 20 to 25 tons FYM (farmyard manure)/compost per hectare should be incorporated in the soil at the time of land preparation. 275 kg of ammonium sulphate/ha is applied as top dressing one month after planting. Foliar application of 35 kg of nitrogen and 45 kg phosphate per hectare in four or five sprays may be beneficial for the crop. Concentration of foliar spray should be less than 1%; concentrations higher than 1% may scorch the leaves.

Irrigation: Need-based watering is done for tomato plants; however, both overwatering and insufficient irrigation should be avoided. Young plants need frequent watering until they get established. During summers, irrigation is needed at weekly intervals. During winters, irrigation may be done at fortnightly intervals. Mulching is a good practice to conserve soil moisture. Mulching also suppresses weed growth. Tomato plants can successfully be grown as companion plants along with Carrots, Parsley, Dill, Mints, Dandelions, Asparagus, and Marigolds.

Aftercare: Tomato plants may need training and pruning in some cases. In case of training, single stem training is practiced where all young shoots are removed from the main stem. Weed control is an important practice; generally manual weed control is practiced. Some growers use hybrid seeds for growing tomatoes; however, cost of growing is higher in such cases.



Diseases Management

Tomato plants are affected by a number of diseases. A list of these diseases is given below:

1. **Damping off:** A fungal disease caused by *Phytophthora* spp. and *Pythium* spp. and the disease affects nursery raised seedlings; affected plants rot and die
2. **Fusarium Wilt:** A fungal disease caused by *Fusarium oxysporum*; affected plants start wilting
3. **Early Blight:** A fungal disease caused by *Alternaria solani*; it affects the foliage and causes brown spots on immature fruits
4. **Late Blight:** A fungal disease caused by *Phytophthora* spp. ; it attacks the leaves and stems as well as the fruits
5. **Leaf Mould:** It is caused by the fungus *Cladosporium fulvum*; there will be yellowish green blotches on the upper surface of the leaves accompanied by grey or greenish brown mouldy spots
6. **Bacterial Canker:** This is a bacterial disease caused by *Corynebacterium* spp.; there will be cankers/light brown or dark streaks inside stems
7. **Bacterial Wilt:** A serious bacterial disease caused by *Pseudomonas solanacearum*
8. **Leaf Curl:** A serious viral disease spread by white flies; leaves of affected plants start curling
9. **Mosaic:** Another viral disease of tomatoes; commonly known as tobacco mosaic virus ; there will be chlorotic areas on the leaves of the affected plants
10. **Root-knot Nematodes:** They are small microscopic worms that penetrate the roots and cause swollen root nodes

Insect-Pests of Tomatoes: Major insect-pests of tomato plants are tomato fruit worms/fruit caterpillars that eat the leaves and feeds on the vegetative parts of the plants and the *Epilachna* beetles, both larvae and adults of which feed on the young leaves and tender shoots. Other insect-pests of the plants include aphids, white flies, spiders, thrips, jassids, and red mites.

Pest and Disease Management: IPM, integrated pest management may be practiced for pest management. IPM comprises of cultural control such as crop rotation, hand picking of caterpillars and beetles, and using trap crops; mechanical control such as using yellow colour cards and pheromone traps as insect baits; biological control such as using ladybugs for controlling aphids; and if necessary, chemical control by using recommended chemicals.

IDM, integrated disease management may be used for controlling diseases; this is similar to IPM.

IDM uses a combination of cultural, mechanical, biological, and chemical control measures for managing crop diseases.



Harvesting and Yield: Tomatoes

can be harvested at different maturity stages depending upon the purpose of uses. Immature green and mature green tomatoes are harvested for raw uses. Half-ripe and red ripe tomatoes are harvested for culinary and processing purposes. For shipping and export purposes, firm mature green fruits are harvested. Tomatoes for canning are harvested when they are fully ripe. Yield varies from 15 to 25 tons per hectare.

Storage: Optimum storage temperature is from 12OC to 15OC. When stored at freezing-point, the fruits show chilling injury. Mature green tomatoes can be kept for as long as 30 days at 10OC to 15OC. Ripe tomatoes can be kept for 10 days at 4.5OC. Optimum relative humidity is 85-90%.

Food Uses

Raw tomatoes are used in salads. Cooked tomatoes are used in preparing many kinds of vegetable dishes. Tomatoes are used for making purees, paste, sauces, jams and chutneys. Tomatoes are canned for using in various processed products. A detailed account of nutrients present in 100g of edible portion of raw tomatoes is given below:

Nutrient		Unit	Green Tomato	Orange Tomato	Yellow Tomato
Value/100g					
1	Protein	g	1.2	1.16	0.98
2	Fiber	g	1.1	0.9	0.7
3	Calcium	mg	13	5	11
4	Iron	mg	0.51	0.47	0.49
5	Potassium	mg	204	212	258
6	Zinc	mg	0.07	0.14	0.28
7	Vitamin C	mg	23.4	16	9
8	Thiamin	mg	0.06	0.046	0.041
9	Riboflavin	mg	0.04	0.034	0.047
10	Niacin	mg	0.5	0.593	1.179
11	Vitamin B-6	mg	0.081	0.06	0.056
12	Vitamin B-12	mg	0	0	0
13	Folate	Âµg	9	29	30
14	Vitamin A	IU	642	1496	n/a
15	Vitamin E	mg	0.38	n/a	n/a
16	Vitamin K	Âµg	10.1	n/a	n/a
17	Vitamin D	Âµg	0	0	0

Processing of Tomatoes

A number of processed foods are prepared from tomatoes. Major among the tomato-based processed foods are such as tomato juice, tomato puree and paste, tomato sauce/ketchup, tomato chutney, tomato cocktail, tomato soup, canned tomatoes, and tomato pickles.

Tomato Juice: Plant-ripened, red, fleshy fruits are selected for juice preparation.

Cleaned and dried tomatoes are then crushed by using suitable equipment. A pulper or a spiral press is normally used for juice extraction. Juice is sieved by using a strainer to remove seeds and other particles. A good quality juice should be of deep red colour and must contain about 0.4 per cent acid; it should be uniform in appearance and should have high nutritive value.



Tomato Puree and Paste: Tomato puree is the concentrated, tomato fruit pulp without skin or seeds and without added salt, and containing not less than 9% of salt-free tomato solids. Tomato fruit pulp is extracted from ripe tomatoes by using a pulper. Tomato pulp is then concentrated by cooking in an open cooker or in a vacuum pan.



Tomato Sauce/Ketchup: Ripe tomatoes are cleaned and crushed to extract juice. Juice is then sieved to remove all seeds and other materials to get a clear juice. Then, spices, salt, sugar and vinegar are added to the juice, with or without onion and garlic depending upon the consumer preferences. Good quality, tomato sauce should contain not less than 12% tomato solids and 25% TSS (total soluble solids).



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