

Package of Practices for Tomato Cultivation

Tomato is one of the most popular vegetables grown all over the world. It is a day neutral plant and can be grown throughout the year depending on the climate. In India, it is grown in an area of 7.89 lakh hectare with a production of 197.59 lakh tonnes. West Bengal occupies an area of 0.57 lakh hectare with production of 12.65 lakh tonnes and productivity of 22.01 t/ha, respectively.



It is universally treated as ‘protective food’ and rich source of minerals like calcium, sodium, copper and vitamin A, B & C. The attractive red colour of fruit is due to lycopene and yellow colour is due to carotenes. Tomato is consumed directly as raw vegetables in sandwiches, salad etc. Several processed item like paste, puree, syrup, juice, ketchup etc. are prepared on a large scale.

Climate

Tomato is a day neutral plant and requires a relatively long growing season with plenty of sunshine and moderate day temperature of 20-28°C. It is sensitive to frost. Under low temperature, the plant growth is restricted and fruit setting is poor. Cool and dry weather is preferred by the crop and optimum temperature is 21-28°C during day and 15-20°C during night. Night temperature is more critical than day temperature. Optimum temperature for colour development of fruit is 21-24°C. Development of lycopene pigment will be hampered above 27°C. Seed germination and pollen germination are adversely affected below 10°C.

Soil

Tomato can be grown in almost all types of soils. However, it cannot withstand water logging. Hence well drained sandy loam soil rich in organic matter is preferred. It is moderately tolerant to acid soil having pH 5.5 and ideal pH requirement is 6-7.

Planting season

Tomato crop can be grown almost throughout the year in the country. The season for cultivation varies from region to region as given below:

Area	Season	Time of nursery sowing	Transplanting
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Northern India	Autumn winter	January	July-August
	Late autumn	July-August	August-September
	Spring summer	late November	January
Hills		March-April	April-May
West Bengal		September	October

Improved varieties/hybrids

A large number of tomato varieties/hybrids are being cultivated in the country. The details of some important varieties suitable for the region are given below:

Kashi Vishesh (H-86): It is Tomato Leaf Curl Virus (TLCV) resistant variety developed at IIVR, Varanasi. It has determinate growth habit, dark green foliage, red spherical medium to large fruits each weighing 80 gm. First harvest can be taken at 70-75 days after transplanting and has yield potential of 430-450 q/ha.

Arka Alok (BWR-5): This determinate variety is resistant to bacterial wilt, developed at IIHR, Bangalore; derived through selection from Taiwan. Fruits of lower clusters are square-round, large (120 g) and fruits of later clusters are oblong, medium (80 g), firm with light green shoulder; suitable for kharif and rabi seasons cultivation; gives an average yield of 300q/ha in 130 days of crop duration.

Arka Samrat: It is a semi-determinate, high yielding F1 hybrid developed at IIHR, Bengaluru. It is triple disease resistance to leaf curl virus, bacterial wilt and early blight. Fruits oblate to high round, large (90-110g), deep red and firm. Suitable for fresh market. Yield:750-800q/ha. in 140 days.

Arka Rakshak: High yielding F1 hybrid with semi-determinate growth habit developed at IIHR, Bengaluru. It is triple disease resistance to TLCV, Bacterial wilt and Early blight. Fruits square round, large (90-100g), deep red colored and firm. Suitable for fresh market and processing. Yield: 750-800 q/ha in 140 days of crop duration. This very popular hybrid attracts the interest of growers throughout the country. Keeping quality is 15-20 days.

Arka Meghali: Open pollinated variety bred for fresh market, fruits medium size (65g),oblate with light green shoulder, turns deep red on ripening, suitable for rainfed cultivation, yield potential 180 q/ha in 125 days.

Seed rate

For open pollinated variety, the seed rate per hectare is 400-500 g. whereas for hybrids, the requirement is less *i.e* 125-175 g/hectare.

Nursery management

For raising healthy seedlings, nursery beds should be 3-5 m long, 1.00 m width and 10-15 cm high. Well decomposed FYM should be properly mixed into nursery bed at the rate of 2 kg per m². Fertilizers should be incorporated @ 100g SSP & 50g MOP per bed. Seeds should be sown at a depth of 0.5-1 cm with a spacing of 10 cm row to row and 5 cm from seed



to seed within row. Drench the seed beds first with water and then with carbendazim (2 g/l of water). Cover the seedbeds with dry paddy straw or any organic mulch. After seed germination, remove the mulch. Cover tomato nursery beds with white nylon nets (40 mesh) for 25-30 days together with the application of one spray of imidacloprid (0.1 %). It reduces incidence of whitefly which transmits leaf curl disease. Damping off in the nursery can be controlled by the application of @0.2% mancozeb + metalaxyl (Ridomil).

Land preparation

Land should be ploughed 4- 5 times before cultivation to bring into fine tilth. The land is leveled evenly and beds are prepared for planting. At the time of land preparation, raising of the planting bed above ground level facilitates drainage during rainy season and if this practice is followed during winter season, it enhances plant growth by conserving the soil heat. Soil solarization using plastic cover reduces disease causing pests and microbes. Sterilization can also be done by drenching the soil with Dithane M-45 or formalin mixed with water in ratio of 1:7 and covered with plastic mulch for 10-15 days.

Manures & Fertilizers

Tomato requires adequate amount of nutrients for its growth and development. Sufficient nitrogen increases fruit quality, fruit size, keeping quality, colour and taste. An optimum level of phosphorus throughout root region is essential for rapid root development and for better utilization of water and other nutrients. For a successful crop, application of about FYM 20t/ha, 90-100 kg N, 60-70kg P₂O₅ and 50-60 kg K₂O per hectare is required. Entire dose of phosphorus and potash should be applied during land preparation. Half of N should be applied after one

week of transplanting and the remaining half of N should be applied at 35-40 days of transplanting. Foliar application of nutrient has been found beneficial. Application of urea as foliar spray (1.25%) produced better plant growth, fruit yield and quality. Deficiency of calcium causes blossom end rot. Application of micronutrient like Zinc High, Boron significantly increased the number of fruits per plant, yield and quality. Application of 20 – 30 kg /ha of Borax and 0.5% High Zinc is beneficial for yield and good quality of fruit.

Transplanting

The seedlings are ready for transplanting 4-5 weeks after sowing in nursery beds. The tomato seedlings are transplanted on flat beds or on the side of ridges. In the initial stage, seedlings are transplanted at the side of the ridge and later earthing up is done to keep plant in the middle of the ridge. Before transplanting, seedling root dip treatment should be done with Plantomycin or Streptomycin @ 0.1 % against bacterial diseases. Spacing depends on the growth habit viz. determinate (60 x 45cm), semi determinate (75 x 60cm) indeterminate (75 x 75 cm). Usually, closer spacing results in early and higher yield, but it may affect size of fruits. A plant population 35000 per ha is considered to be optimum producing fruit yield of 400 q/ha. Two rows of trap crop such as marigold should be planted after every 25 rows of tomato for controlling fruit borer and aphids.

Irrigation

Tomato plants require adequate moisture throughout its growth period. First irrigation should be provided soon after transplanting. Furrow irrigation is the most common method in tomato. Frequency of irrigation depends on the climatic and soil condition. Water stress at flowering stage will adversely affect fruiting and productivity. A long spell of drought followed by heavy irrigation leads to cracking of fruits. Similarly, a dry spell after regular irrigation causes blossom end rot. Drip irrigation and sprinkler irrigation are becoming more common in areas of water shortage.

Integrated Weed Management

Field should be kept weed free by frequent weeding, hoeing and earthing up. Two hand hoeing and earthing up should be done at 15 and 45 days after transplanting. The application of herbicide is economical compared to manual weeding. Application of pre-emergence herbicides like Metribuzin @ 1 kg/ha, Fluchloralin @ 1.25 kg /ha has been found to increase the yield significantly. Application of Pendimethalin @ 1.0 kg/ha as pre-emergence application + one

hand weeding at 45 days after transplanting was found very effective in suppressing the weed with the mean survival of 85% tomato seedlings.

Mulching

Mulches conserve soil moisture, increase the temperature and suppress weed growth. Organic mulches like paddy straw can reduce the soil temperature during summer season. However, plastic mulches are used in commercial production to suppress weed growth, conserve moisture and increase the soil temperature during winter season.

Training and pruning

All indeterminate varieties are trained with wires, strings or stakes to prevent lodging and loss of fruits by coming in contact with soil. It is done by providing individual stake or by erecting 2-2.5 m long poles on either side of ridges for stretching G1 wire. Branches of plants are supported on poles or strings with twine. Pruning is also generally followed in indeterminate varieties to improve size, shape and quality of fruits. It is removal of unwanted shoots to enhance vigor of plants.

Major Insect-pests

White fly (*Bemisia tabaci*)

Whiteflies are small, soft-bodied sucking insects that look like tiny white triangles, less than one-tenth of an inch long, often rest on the undersides of plants. It is responsible for transmitting leaf curl virus. It sucks the sap from leaves and causes deformation.

Management

- Use yellow sticky trap for early attack detection
- After transplanting give need-based sprays of Imidacloprid 20 SL (0.5ml/l) after 15 days of planting.
- If the traps indicate the whitefly activity, spray Dimethoate 30EC at 2ml/liter
- Use nylon net for covering the crop.

Leaf Miner (*Tuta absoluta*)

Maggots of leaf miner feed on leaf and make serpentine mines into leaf. It affects the photosynthesis and fruit formation. The whole plant gets affected if not controlled and in severe infestation the plant may die.

Management

- To control leaf miner, spray with Tafgor/Rogor (Dimethoate) 30EC @ 2ml/Ltr of water.
- Soil application with Cartap Hydrochloride 4 % will kill the pupa.

Thrips (*Thrips tabaci*)

The insect is mostly observed in dry weather. They suck sap from the foliage and results in curling of leaves to cup shaped. The infected plant in severe infestation may die.

Management

- To check severity of thrips incidence, keep blue sticky traps @ 6-8 per acre.
- Spray of Imidacloprid @ 1ml /Ltr water.

Fruit Borer (*Helicoverpa armigera*)

It is a major pest of tomato. Female lay eggs on the flowers. Larvae feed on the leaves and bore the developing fruits by entering a part of its body This pest could damage 40%-50%of fruits production.

Management

- Collect and destroy the infected fruits and grown up larvae
- Grow simultaneously 40 days old American tall marigold and 25 days old tomato seedling at 1:16 rows
- Setup pheromone trap with Helilure at 12/ha
- Collection and destruction of damaged fruits and grown up caterpillars.
- Release *Trichogramma pretiosum* @ 1 lakh nos. /ha/release at an interval of 7 days starting from flower initiation stage based on ETL of 10% damage.
- Spray *Bacillus thuringiensis* 2g/litre of water.

Major Diseases

Damping off (*Pythium aphanidermatum*)

Damping off of tomato occurs in two stages, i.e. the pre-emergence and the post-emergence phase. In the pre-emergence, the seedlings are killed just before they reach the soil surface. The young radical and the plumule are killed and there is complete rotting of the seedlings. The post-

emergence phase is characterized by the infection of the young, juvenile tissues at the collar region. The infected tissues become soft and water soaked. The seedlings topple over or collapse.

Management

- Used raised seed bed. Provide light, but frequent irrigation for better drainage.
- Drench with Copper oxychloride 0.2% or Bordeaux mixture 1%.
- Seed treatment with fungal culture *Trichoderma viride* (4 g/kg of seed) or Thiram (3 g/kg of seed) is the only preventive measure to control the pre-emergence damping off.

Fusarium Wilt (*Fusarium oxysporum*)

The first symptom of the disease is clearing of the vein lets and chlorosis of the leaves. The younger leaves may die in succession and the entire may wilt and die in a course of few days. Soon the petiole and the leaves droop and wilt.

Management

- The affected plants should be removed and destroyed.
- Spot drench with Carbendazim (0.1%). Crop rotation with a non-host crop such as cereals.

Leaf curl (Tomato leaf curl virus)

Leaf curl disease is characterized by severe stunting of the plants with downward rolling and crinkling of the leaves. The newly emerging leaves exhibit slight yellow colouration and later they also show curling symptoms. Older leaves become leathery and brittle. The nodes and internodes are significantly reduced in size. The virus is transmitted by white fly, *Bemisia tabaci* and grafting.

Management

- Keep yellow sticky traps @ 12/ha to monitor the white fly. Raise barrier crops-cereals around the field.
- Removal of weed host. Protected nursery in net house or green house.
- Spray Imidachloprid 0.05 % or Dimethoate 0.05% @ 15, 25, 45 days after transplanting to control vector.

Late blight (*Phytophthora infestans*)

Water-soaked spots appear on margins of leaves which later turn into black patches with whitish fungus growth visible on lower surface in the morning hours. Black patches may extend and kill the foliage in a few days if moist weather prevails.

Management

- Use healthy seedlings for planting.
- Follow high ridge culture to avoid tuber infection.
- Follow crop rotation
- As a prophylactic measure, spray the crop with contact fungicides like mancozeb 75% WP (0.2%), propineb 70% WP (0.2%) or chlorothalonil (0.2%) as soon as the weather conditions become congenial for late blight.

Bacterial wilt (*Burkholderia solanacearum*)

This is one of the most serious diseases of tomato crop. Relatively high soil moisture and soil temperature favour disease development. Characteristic symptoms of bacterial wilt are the rapid and complete wilting of normal grown plants. Lower leaves may drop before wilting. Infected plant parts when cut and immersed in clear water, a white streak of bacterial ooze is seen coming out from cut ends.

Management

- Avoid damage to seedling while transplanting.
- Apply bleaching powder @ 10kg/ha.
- Crop rotations, viz., cowpea-maize-cabbage, okra-cowpea-maize, maize- cowpea-maize and finger millet-egg plant are reported effective in reducing bacterial wilt of tomato.

Harvesting

Tomato fruit maturity starts after 70-100 days after transplanting depending upon the variety. Usually, fruits are harvested with hand by a gentle twist so that the stalk is retained on plant. Fruits are normally picked at the interval of 4-5 days in summer whereas for winter crop picking should be on weekly interval. Harvesting depends on the purpose such as fresh market, processing, long distance transport etc.

Yield and Income

On an average, yield of open pollinated varieties ranges from 200-250 q/ha. Hybrid varieties may yield upto 500 q/ha or more under favourable climatic conditions. The cost of cultivation of tomato is approx. Rs.1,25,671/- per hectare and a farmer can earn a net income is Rs. 1,89,329/-