

Tomato Cultivation Guide

Introduction

Tomato/Tamatar : *Lycopersicon esculentum Mill.*

Family : *Solanaceae*

Tomato is one of the most popular and widely grown vegetables in the world ranking second in importance to potato in many countries. The fruits are eaten raw or cooked. Tomato in large quantities is used to produce soup, juice ketchup, puree, paste and powder.

Among vegetables, tomato occupies 4th position in area and 2nd position in production in India.

Nutritional Values

Tomato occupies prime position in list of protective foods since it is rich source of minerals, vitamins. The attractive red colour of fruit is due to lycopene and yellow colour is due to carotenes.

Tomato is warm season crop. Grows well in those regions that are free from frost. It can't be grown successfully in places of higher rainfall. Temperature after tomato crops in following ways.

1. Optimum temperature for seed germination is 26 to 32°C.
2. The optimum temperature required for its cultivation is 15 - 27°C. At higher temperature its blossoms drop off. The damage is great when high temp is combined with dry wind. It will result in the failure of fruit set due to drying of stigmatic liquid.

3. Colour development: In tomato red colour is due to the pigment Lycopene. Lycopene is highest at 18 to 26°C while production of this pigment drops off rapidly above 30°C and 'nil' above 40°C.

4. Carotene is developed rapidly at high temperature.

5. If fruits exposed to direct sunlight, their tops may turn whitish yellow & become leathery in texture. This is common in late varieties during summer season. This condition is known as sun - scald.

6. A warm, sunny weather is most suited for proper ripening, colour, quality & high yield.

Soil & Land Preparation

Soil

1. Soil pH should be between 5.5 to 6.5 or it should be maintained within this range to get maximum efficiency in absorption of nutrients
2. The salinity level of soil should not be more than 1 mS/cm.
3. Soil should be highly porous and well drained to have better root growth and penetration. Therefore, before cultivation soil should be analyzed to decide on the further reclamation.

Sandy loam soil with a well drained clay sub soil is best suited. Light soils are good for early variety. While clay loam or silt loam soils are well suited for heavy yield (Late variety), grows at pH 6.0 to 7.0 satisfactorily. The soil should be well prepared & leveled by ploughing the land 4 - 5 times.

Land Preparation

Land is prepared to a fine tilth by thorough ploughing or digging 2 - 3 times. At the last ploughing organic manure and 10 kg carbofuran granules or 200 kg neem cake has to be applied. Form ridges & furrow at spacing 75-90 cm.

Mulching

Mulch with black LDPE sheets of 25 micron thickness and bury both the ends into the soil to a depth of 10 cm

Season & Transplanting

Season	Time of sowing	Time of transplanting
Kharif	2 nd week of June	July-August
Rabi	End of September	October-November
Summer	2 nd week of January	February

Seedrate: 200-250 g / ha

Nursery bed preparation

Apply FYM 10 kg, neem cake 1 kg, VAM 50 g, enriched super phosphate 100 g and furadon 10 g per square metre before sowing. Area required for raising seedling for planting 1.0 ha is 100 sq.m.

Protected nursery

- Prepare the nursery area of 3 cents with slanting slope of 2 % for the seedling production to cover 1 ha.
- Cover the nursery area with 50 % shade net and cover the sides using 40 / 50 mesh insect proof nylon net.
- Form raised beds of 1 m width and convenient length and place HDPV pipes at 2m interval for further protection with polythene sheets during rainy months.
- Mix sterilized cocopeat @ 300 kg with neem cake 5 kg along with Azospirillum and phosphobacteria each @ 1 kg. Approximately 1.2 kg of cocopeat is required for filling one protray. 200 protrays are required for the production of 18,700 seedlings, which is required for one hectare adopting a spacing of 90 x 60 x 75 cm in paired row system.
- Sow the treated seeds in protrays @ 1 seed per cell.
- Cover the seed with cocopeat and keep the trays one above the other and cover with a polythene sheet till germination starts.
- After 6 days, place the protrays with germinated seeds individually on the raised beds inside the shade net.
- Water with rose-can everyday and drench with 19:19:19 @ 0.5% (5g/l) at 18 days after sowing.

Transplanting

- The transplanting is done in small flat beds or in shallow furrow depending upon the availability of irrigation.
- In heavy soil it is usually transplanted on ridges and during the rains also it is advantageous to plant the seedlings on ridges.
- For indeterminate varieties/hybrids, the seedlings have to be staked using bamboo sticks of two meter length or planted in broad ridge of 90 cm width and 15 cm height. The seedlings are planted in the furrows at a spacing of 30 cm and the plant is allowed to spread on the broad ridge.

Layout and planting for drip irrigation & fertigation

- Apply FYM @ 25 t / ha as basal before last ploughing.
- Apply 2 kg/ha of Azospirillum and 2 kg/ha Phosphobacteria by mixing with 50 kg of FYM.
- Apply 75 % total recommended dose of superphosphate ie 1172 kg / ha as basal.
- Install the drip irrigation with main and sub main pipes and place lateral tubes at an interval of 1.5 m.
- Place the drippers in lateral tubes at an interval of 60 cm and 50 cm spacing with 4 LPH and 3.5 LPH capacities respectively.
- Form raised beds of 120 cm width at an interval of 30 cm and place the laterals at the centre of each bed.
- Before planting, wet the beds using drip system for 8-12 hrs.
- Planting to be done at a spacing of 90 x 60 x 60 cm in the paired row system, using ropes marked at 60 cm spacing.
- Gap filling has to be done at 7th day after transplanting.

Spacing

75-90 x 45 cm OR

75-90 x 60 cm

Nutrient Management

Basal dose : FYM 25 t/ha, NPK 50:250:100 kg/ha. Borax 10 Kg and Zinc Sulphate 50 Kg/ha

Top dressing : N & K each 150 Kg/ha in 3 equal splits at 30,45 and 60 days after planting

Fertigation schedule for hybrids : Recommended dose: 200:250: 250 kg / ha

Stage	Crop stage	Duration in days	Fertilizer grade	Total Fertilizer (kg/ha)	Nutrient applied			% of requirement		
					N	P	K	N	P	K
1	Transplanting to plant establishment stage	10	19:19:19 13:0:45 Urea (46%N)	65.78 27.77 8.44	12.50	12.50	12.50	10.00	5.00	10.00
					3.61	-	12.50			
					3.88	-	-			
2	Flower initiation to flowering	30	12:61:0 13:0:45 Urea (46%N)	40.98 222.22 100.27	19.99	12.50	25.00			
					4.92	25.00	-	40.00	10.00	40.00
					28.89	-	100.00			
3	Flowering to fruit set	30	19:19:19 13:0:45 Urea (46%N)	65.78 138.88 63.90	46.12	-	-			
					79.93	25.00	100.00			
					59.94	12.50	75.00			
4	Alternate day from picking	80	12:61:0 13:0:45 Urea (46%N)	20.49 111.11 50.14	2.46	12.50	-	20.00	5.00	20.00
					14.44	-	50.00			
					23.06	-	-			
					39.96	12.50	50.00			
					199.82 or 200.00	62.50	250.00	100	25	100

75% of RD of P applied as superphosphate as basal application= 1172 kg/ha

1. 19:19:19 = 132 kg / ha

2. 12:61:0 = 62 kg / ha

3. 13:0:45 = 500 kg / ha

4. Urea = 223 kg / ha

Growth regulators

Spray 1.25 ppm (625 ml in 500 litres of water) Triaccontanol at 15 days after transplanting and at full bloom stage to increase the yield.

Micronutrient spray

- Foliar spray of ZnSO₄ @ 0.5 per cent thrice at 10 days interval from 40 days after planting.
- Spray 19:19:19 + Mn @ 1 % at 60 days after planting.

Irrigation Water Quality

Both irrigation water quality and proper irrigation management are critical to successful crop production. The quality of the irrigation water may affect both crop yields and soil physical conditions, even if all other conditions and cultural practices are favorable/optimal. In addition, different crops require different irrigation water qualities.

Therefore, testing the irrigation water prior to selecting the site and the crops to be grown is critical. The quality of some water sources may change significantly with time or during certain periods (such as in dry/rainy seasons), so it is recommended to have more than one sample taken, in different time periods.

The parameters which determine the irrigation water quality are divided to three categories: chemical, physical and biological. In this review, the chemical properties of the irrigation water are discussed.

The chemical characteristics of irrigation water refer to the content of salts in the water as well as to parameters derived from the composition of salts in the water; parameters such as EC/TDS (Electrical Conductivity/ Total Dissolved Solids), SAR (Sodium Adsorption Ratio) alkalinity and hardness.

The most common parameters used for determining the irrigation water quality, in relation with its salinity, are EC and TDS.

TDS ppm or mg/L	EC dS/m	Salinity hazard
<500	<0.8	Low
500 – 1000	0.8 - 1.6	Medium
1000 – 2000	1.6 - 3	High
> 2000	> 3	Very high

Irrigation Management

- It should be so arranged that the soil remains continuously moderately moist.
- Avoid excessive irrigation as it induces the plants to run to vines and drop the blossoms off
- There is no need of irrigation during rainy season if, there is a proper distribution of rainfall. When the rainy season is over, the crop may be irrigated twice or thrice in a month.
- The crop planted during the winter season will need irrigation once in about 20 day.
- While the crop transplanted during spring season will need irrigation more frequently, say, one in ten days in the beginning, and later on during the hot season, the tomato crop is irrigated once a week.
- During the winter season, whenever there is a danger of frost, the crop must be irrigated so that the temperature may not go down too low and damage the plants.
- Tomatoes, that have been growing when moisture is low, may split severely after a rain or even after a heavy-dew to an influx of water into the fruit through roots, stems or through the cracks in the skin near the calyx. Therefore, the crop should be irrigated carefully during the fruit ripening stage.

Intercultural Operations

Weed Management

- There is need of light hoeing during first four weeks in the field which encourage the growth but also remove the weeds from the field. The surface soil is loosened by hand hoeing as soon as it is dry enough after every irrigation or shower. All weeds should also be removed in this process.
- Mulching with straw, black polythene and many other materials has been found beneficial in moisture conservation, in controlling weeds and some diseases.

Training, Pruning & Staking

- Though pruning and staking in the tomato crop increase cost of cultivation, these operations make a tomato-plant grow more better and larger tomatoes resulting in a higher yield per hectare. But both of these operations depend on the time that is at the disposal of the grower and the availability and cost of the staking material.
- Through pruning tomato plant may be made single-stem in the following ways:
- All the side shoots are removed so that plant may use all its food and energy to develop its fruits and very little of it is left for the foliage. These are then staked. In this way the plants get a 1.2 meter square area and bear more fruits.

The following are the advantages of pruning to single stem and staking:

- 1) They produce more fruits per hectare per plant an average.
- 2) They yield earlier and give rise to more cluster.
- 3) They make picking more rapid and cultivation and spraying easier.
- 4) They give cleaner more uniform and larger fruits.

Disadvantages of this method:

- i) Cost of cultivation increases considerably.
- ii) There are more changes of sun scalding in the excessively warm weather due to fruits being exposed to sun.

Pest & Disease Management

Pest/Disease	Name	Content	Dose	Application
Fruit & Shoot Borer	SERVIN	THIODIOCARB	2 GM/L	Spray
	LANET,DUNET	METHOMYLE	1 GM/L	Spray
	FURADON,FURAN	CARBOFURAN	20 KG/HA	Soil
	THIMATE	PHORATE	20 KG/HA	Soil
	CRUSH,EKALAX	QUINALPHOS	2 ML/L	Spray
Cut Worm	SERVIN	THIODIOCARB	2 GM/L	Spray
	LANET,DUNET	METHOMYLE	1 GM/L	Spray
	FURADON,FURAN	CARBOFURAN	20 KG/HA	Soil
White Fly	ASATAF,LANCER	ACEPHATE	2 GM/L	Spray
	MARSHAL	CARBOSULFAN	1.5 ML/L	Spray
	POLYTRIN C	PROFENOPHOS 40% + CYPER 4%	1 ML/L	Spray
	HOSTATHION	TRIAZOPHOS	1 ML/L	Spray
	METASISTOK	OXYDEMETON METHYL	1 ML/L	Spray
Jassids and Aphids	CONFIDOR,IMIDAGOLD,TATAMIDA,GAUCHO	IMIDACHLOPRID	0.5 ML/L	Spray
	ACTRA,CRUZER	THIOMETHOXAM	0.25 GM/L	Spray
	TATA MANIK,PRIDE	ACETAMIPRID	1.5 GM/L	Spray
Fusarium Wilt	BLUE COPPER, BLITOX	COC	2 GM/L	Drench
	TOPGUN	COC	2 GM/L	Drench
Damping off	KAVACH	CHLOROTHALONIL	1.5-2 GM/L	Drenching
	KOCIDE	COPPER HYDROXIDE	2 GM/L	Drenching
	BLUE COPPER, BLITOX	COC	2 GM/L	Drenching
Alternaria Leaf Spots	SCORE	DIFENCONAZOLE	1 ML/L	Spray
	RIDOMIL	METALAXYL+MANCOZEB	5 GM/L	Spray
	BAVISTIN	CARBENDAZIUM	0.5 GM/L	Spray
Powdery Mildew	SYSTHANE	MYCLOBUTANIL	04 GM/L	Spray
	TOPAZ	PENCONAZOL	0.5 ML/L	Spray
	CONTAF	HEXACONAZOL	1 ML/L	Spray
Anthracnose	ANTHRACOL	PROPINAB	3 GM/L	Spray
	CAPTAF	CAPTAN	3 GM/L	Spray
	SCORE	DIFENCONAZOLE	1 ML/L	Spray
Yellow Vein Mosaic Virus	The virus is transmitted by the whitely, control white fly			

Harvesting

Tomato fruits are picked up from the plants by grasping them by the hand and dislodging them from the vine by twisting keeping the thumb pressed against the vine.

According to the Use of Fruits, they are Harvested in Following Stages:

1) Green Stage:

About a fortnight before turning (development of a trace of redness at the stem end of the fruit), the fruits will develop normal colour of the vine though they are still green yet they may be fully developed. These fruits are picked and sent to distant markets.

2) Pink Stage:

At this stage red or pink colour on the fruits varies from a trace at the blossom end to a considerable extent covering the surface. Though at this stage most of the fruits are red, yet they are not fully ripe. They are picked for local markets.

3) Ripe Stage:

At this stage the surface of most of the fruits is red and the softening of the fruits begins. They may be picked for home or table use.

4) Full Ripe Stage:

At this stage the fruits have approached maximum colour development and may feel soft to the touch. Now the starch is changed into sugar. They are ordinarily used within 24 hours of picking and are consumed or used for canning and pickling.

Disclaimer : These are the general crop management guidelines. Company denies responsibility for the profit or losses arising out of following these guidelines. Grower may follow practices recommended by respective state agricultural universities or local practices in growing a good crop.