

# TOMATO

## SEASON

The crop requires a warm growing season with abundant sunshine and adequate moisture. It is a warm season vegetable but is extensively grown in cooler regions as well. The plant, however, cannot stand severe frost. It can be grown at temperatures ranging between 15–27 °C. It performs well under an average monthly temperature of 21–23° C. It can be cultivated under irrigated conditions in arid tropics, but under very high temperatures the quality of fruits is poor and there is a high incidence of sunscald. High humidity and high temperature makes the plant susceptible to foliage diseases. Excessive rain causes flower drop and adversely affects fruit set. For proper pigmentation of fruits, warm sunny days with moderately cool nights are preferable.

In India, the crop can be grown throughout the year. In the northern plains, the crop can be cultivated during autumn and spring as well as summer. In south India, there are three growing seasons: June–July, October– November and January–February.

The crop can be grown under varied soils ranging from sandy loam to clay, black soil or red soil having good drainage. However, sandy loam rich in organic matter with a little sand in the upper layer and good clay content in the subsoil and a fairly good capacity to hold moisture is best suited for the crop. A pH between 6 and 8.5 is ideal. The crop can tolerate moderate acidity and salinity.

## SEED VARIETIES

Select depending up on local conditions and adoptability

## SEED QUANTITY AND TREATMENT

Seed Rate - The seed rate for commercial tomato varieties is around 200 to 250 gm/acre.

Seed Treatment - The seeds can be mixed with *Trichoderma viride* and (@ 5 gm/100 gm of seeds). This will help in the control of early blight and other pathogens or go for Beejamrutham if the above material are not available

## NURSERY MANAGEMENT

Seeds are sown in well-prepared, raised nursery beds. For raising seedlings for one hectare about six cents of nursery area is required. Raised beds of dimensions 7.5x1.2 x0.1m are prepared. They are covered with a layer of farm yard manure and sand in equal proportion. Addition of farmyard manure should be @ 4 kg/m<sup>2</sup>. During the summer and rainy season there may be heavy incidence of damping off. Field solarisation and seed treatment are helpful in minimising disease infection. Neem cake and groundnut cake (@ 2 kg/cent) can also be added to enrich nursery soil.

The soil can be disinfected further by cultivating it well and then covering it with a clear plastic sheet so that it gets heated up thoroughly under the mid-day sun. This technique can be used for varieties that are highly susceptible to disease. Soil solarisation of nursery plots by covering them with mulch.

### MAIN FIELD PREPARATION

A well prepared seed bed with 4–5 ploughings is necessary for transplanting tomato. The seedlings are transplanted on flat beds, on the sides of raised beds or ridges. The latter is preferred since it prevents the fruits appearing on the lower branches from making direct contact with the soil.

### TRANSPLANTATION – PLANT DENSITY AND POPULATION

Transplanting can be done on small flat beds in light soils where irrigation is available and on shoulders in shallow furrows where irrigation water is scanty. On heavy soils, the seedlings are normally transplanted on ridges. The seedlings are transplanted in rows 60–75 cm apart. The planting distance within a row is 30 cm for determinate varieties and 60 cm for indeterminate varieties. For hybrids, the distance can be increased, based on types. It was reported from certain trials that planting in a double row system (30 cm x 30 cm x 1m) on raised beds can generate high yields with healthy fruits. Raised bed methods need less water and the incidence of pests and disease is also low. For mechanical harvesting and for varieties suited for processing, a closer spacing should be adopted. For hybrids, the row spacing should be wide whereas a close spacing should be adopted between plants. Spacing differs for varieties and hybrids. It ranges between 60–120 cm between rows and 30 to 60 cm between plants.

Direct Sowing - The tomato is also cultivated by direct seeding. This results in early flowering, early fruiting and less incidence of pest and disease. Close spacing in direct seeding has the advantage of higher yields as well. Seeding of 3–5 seeds in a clump at 25–30 cm ensures 2–3 plants per clump. After the plants have established, thinning should be done to maintain only 1–2 seedlings per hill.

### SOIL FERTILITY MANAGEMENT

- The soil can be treated with Azatobacter or Azospirillum @1-1.25
- NADEP compost 2.5 Tons( if available ) 400 kgs of Ghanajeevamrutham 120 kg of Neem cake can be added per acre.
- 1<sup>st</sup> apply 200 liters of Dhrajeevamrutham 10days after transplantation
- 2<sup>nd</sup> apply 200 liters of Dhrajeevamrutham 20 days after transplantation
- Repeat same procedure at every 10 days interval
- Spray Panchagavya at the time of flowering and continue at every 15 days interval.

## PEST AND DISEASE MANAGEMENT

### GRAM POD BORER: *HELICOVERPA ARMIGERA*

The larvae are extremely polyphagous and feed on different plant structures including stems, leaves, flower heads and fruits. The high reproductive potential and mobility of the adult moths are further challenges for the control of this pest.



#### Control Measures

- Field sanitation and rouging
- Growing inter crops such as cowpea, onion, maize, coriander, urd bean in 5 or 4:1 ratio
- Raise Maize 4 lines as border crop
- Erecting of bird perches (15 per acre) for encouraging predatory birds such as king crow, mynah, and drongo etc.
- Install pheromone traps @ 5/acre for monitoring adult moths activity. Replace the lures with fresh lures after every 2-3 weeks
- marigold @ 200 plants (marigold seedling of 45 days should be planted along with chilli transplanting)
- Release of egg parasitoid *Trichogramma pretiosum* @ 50,000 adults (in the form of parasitized card) /acre /week commenced right from the start of flower initiation to till end of the crop, tie the egg cards on the stick placed throughout the field at 4-5 m apart, in the evening, a day prior to the emergence of adult.
- First spray 5% neem seed kernel extract, after 7 days spray Brahmastram (3.5 liters extract in 100 liters of water)
- Spray HNPV ( 200 LE) in 100 liters of water per acre

### TOBACCO CATERPILLAR: *SPODOPTERA LITURA FABRICIUS*

#### Symptoms

- Young larva scrap leaves on ventral surface
- Grownups defoliate crops



### Control Measures

- Field sanitation and roguing
- Castor can be grown as a trap crop along the field border to attract the egg laying female adult moths (collect and destroy the laid egg masses and gregarious neonates)
- Raise maize or jowar as a border crop
- Setting up light traps for collecting adults @ 1/acre
- Erecting of bird perches (15) for encouraging predatory birds such as king crow, mynah etc.
- Install pheromone traps@5/acre for monitoring adult moth activity. Replace the lures with fresh lures after every 2-3 weeks
- Spray NSKE 5 % against eggs and first instar larva.
- Dip gunny bags into jaggery solution and torn into small pieces and keep them in field in the evening all caterpillars will be attracted there and kill them in the morning.
- Spray garlic chilli extract in the evening.
- Spray SNPV (200 LE) in 100 liters of water per acre

### WHITEFLY: *BEMISIA TABACI* (LEAF CURL)

Affected plants show numerous chlorotic spots on leaves/ yellowing and sometimes, sooty mould. Yellowing along veins, leaf curling, mosaics, etc. on affected plants probably indicate whitefly-transmitted viral diseases. Damage may be more severe when plants are under water stress.

#### Control Measures

Cultivation of most preferred alternate host crops like brinjal, bhendi, tomato, tobacco and sunflower may be avoided.

- Adopting crop rotation with non-preferred hosts of white fly such as Sorghum, Ragi , Maize to check pest build up.
- Install 15 yellow sticky traps per acre
- Nirgundi leaf extract followed by neem seed kernel extract.



Leaf curl caused by whiteflies



uneven ripening in white fly effect  
crop



white fly

### SERPENTINE LEAF MINER



Adult



Larva



Leaf mined by leaf miner

Larvae mine in the mesophyll of leaves and make irregular, papery mines. The larvae also mine apical buds and stems. In cases of heavy infestation, both green and red fruits are attacked and infested fruits show small holes



Stem damage



Fruit damage

on the surface and the larvae tunnel/mine below the surface. Pupation takes place in soil or on plant parts such as leaves and stem. Adult moths are silvery brown with mottled wings.

#### Control Measures:

- Avoid excess use of nitrogen.
- Ecological engineering of tomato with beans as inter crop reduces leaf miner attack.
- garlic chilli extract



## RED SPIDER MITE: TETRANYCHUS

Symptoms of damage:

- Affected leaves become reddish brown and bronzy
- Severe infestation larvae silken webbing on the leaves, wither and dry
- Flower and fruit formation affected



Redspider mite

### Control Measures

- dung urine and hing extract



Fruit damage

## DAMPING OFF: PYTHIUM APHANIDERMATUM

### Symptoms

- The disease is caused by a fungus which is common in wet soils and may survive for several seasons. Overcrowding, poor drainage, compacted soil and inadequate air flow increase the chances of seedlings getting infected.
- Damping off of tomato occurs in two stages, i.e. the pre-emergence and the post-emergence phase.
- In the pre-emergence the phase 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 of the collar at the ground level.
- The infected tissues become soft and water soaked. The seedlings topple over or collapse.



Damping off

Control Measures:

- Excessive watering and poorly drained areas of field should be avoided
- Use raised beds: 15cm height is better for water drainage or use pro-trays for raising seedlings
- Seed treatment with *Trichoderma viride* 1 % WP @ 9 g/Kg of seed



Wilted plants due to attack of damping-off disease.

## TOMATO LEAF CURL DISEASE: TOMATO LEAF CURL VIRUS

### Symptom

- The new growth of plants with tomato yellow leaf curl has reduced internodes, giving the plant a stunted appearance
- The new leaves are also greatly reduced in size and wrinkled, are yellowed between the veins, and have margins that curl upward, giving them a cup-like appearance
- Flowers may appear but usually will drop before fruit is set



### Control Measures:

- Spray (NSKE) 5% or azadirachtin 5% W/W neem extract concentrate @ 80g in 160 l of water/ac
- spray neem leaf+nirgundi leaf extract

## BACTERIAL WILT: *RALSTONIA SOLANACEARUM*

### Symptom

- 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 up plants.
- Lower leaves may drop before wilting. Pathogen is mostly confined to vascular region; in advantage cases, it may invade the cortex and pith and cause yellow brown discolouration of tissues.
- Infected plant parts when cut and immersed in clear water, a white streak of bacterial ooze is seen coming out from cut ends.
- The spreads through wounds, soil and implements.



Bacterial Wilt

### Control Measures:

- Rotate with non-host crops, particularly with paddy
- Restriction of irrigation water flowing from affected field to healthy field
- neem seed kernel extract

## FUSARIUM WILT: *FUSARIUM OXYSPORUM*

### Symptom

- The first symptom of the disease is clearing of the veinlets and chlorosis of the leaves.



Fusarium Wilt

- 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.
- In young plants, symptom consists of clearing of veinlet and dropping of petioles. In field, yellowing of the lower leaves first and affected leaflets wilt and die.
- The symptoms continue in subsequent leaves. At later stage, browning of vascular system occurs. Plants become stunted and die.

#### Control Measures

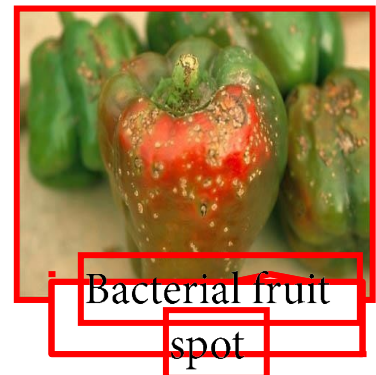
- Mix 2 kg of *Trichoderma viridi* in 200 liters of water and spray or pour at the base of the plant.

Root zone application: Mix thoroughly 2.5 Kg of the *T. viride* 1% WP

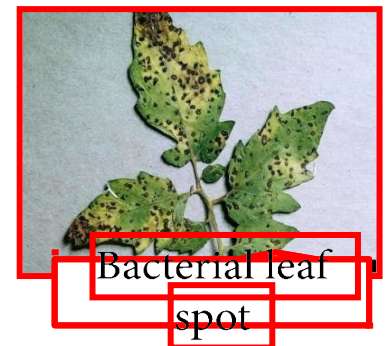
### BACTERIAL FRUITS AND LEAF SPOTS: *XANTHOMONAS CAMPESTRIS*

#### Symptom

- Moist weather and splattering rains are conducive to disease development. Most outbreaks of the disease can be traced back to heavy rainstorms that occur in the area.
- Infected leaves show small, brown, water soaked, circular spots surrounded with yellowish halo.
- On older plants the leaflet infection is mostly on older leaves and may cause serious defoliation.
- The most striking symptoms are on the green fruit. Small, water-soaked spots first appear which later become raised and enlarge until they are one-eighth to one-fourth inch in diameter.
- Centers of these lesions become irregular, light brown and slightly sunken with a rough, scabby surface.
- Ripe fruits are not susceptible to the disease. Surface of the seed becomes contaminated with the bacteria, remaining on the seed surface for some time.
- The organism survives in alternate hosts, on volunteer tomato plants and on infected plant debris.



Bacterial fruit spot



Bacterial leaf spot

#### Control Measures

- neem seed kernal extract



## TOMATO SPOTTED WILT DISEASE: PEANUT BUD NECROSIS VIRUS

### Symptom

- It causes streaking of the leaves, stems and fruits. Numerous small, dark, circular spots appear on younger leaves.
- Leaves may have a bronzed appearance and later turn dark brown and wither.
- Fruits show numerous spots about one-half inch in diameter with concentric, circular markings. On ripe fruit, these markings are alternate bands of red and yellow.
- The spotted wilt virus is transmitted through thrips (*Thrips tabaci*, *Frankliniella schultzi* and *F. occidentalis*).

### Control measures

- trichoderma viridi



Infected Leaves



Infected fruit

Extracted from:

**Manual Prepared by Rythu Sadhikara Samstha (RySS), Andhra Pradesh**