

# TOMATO



**Designed by:**  
**Crop Manager Team**

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## **Varieties**

Choice of variety is based on Fruit Quality, Adaptability and Reliability, Susceptibility to diseases and pests, and market demand. Tomatoes can be classified into two types Determinate and Indeterminate with over 10,000 varieties those most common in Uganda include - Money maker, Bonny Best, Marglobe, Rio Grande, Tengeru 97, Amateur Rodade, Heinz, New fortune maker F1

## **Soil Requirement**

Tomatoes grow on practically all soils from light sandy to heavy clay. Light soils are good for an early crop, while clay loam and silt-loam soils are well suited for heavy yields. Tomatoes do best in a soil that has a soil reaction from pH 6.0 to 7.0. If the soil is acidic liming is required.

## **Climatic conditions**

Tomatoes are a warm-season crop. The crop does well under an average monthly temperature of 21 to 23degrees Celsius. Temperature and light intensity affect the fruit-set, pigmentation and nutritive value of the fruit. Long dry spell and heavy rainfall both shows detrimental effect on growth and fruiting.

## **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 carbo-furan granules or 200 kg neem cake has to be applied.

## **Planting**

Seedlings should be raised in a nursery bed 300 - 400 g/ha seeds are required, make a square portion of a raised site meant for a bed, and then make a fine tilth. Broadcast the seeds on the bed and lightly cover with soil also add manure to enhance the nutrients. Cover the nursery bed with fine nylon net to escape the damage by virus transmitting insects.

After sowing the seeds, mulch with green leaves and irrigate with a rose-can daily in the morning until seedlings reach a height of 5 to 7 cm. Remove the mulch immediately after germination of the seeds. Restrict irrigation one week before transplanting and irrigate heavily on the previous day of transplanting. Seedlings are

usually ready for transplanting 3-4 weeks after sowing, and they should be transplanted on moist soil.

Recommended spacing between plants is 24-36 inches.

### **Weed control**

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

# Disease management

## Tomato Damping off



### Symptoms

- Damping off of tomato occurs in two stages, i.e. the pre-emergence and the post-emergence phase.
- In the pre-emergence 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.

### 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.
- Spray 0.2% Metalaxyl when there is cloudy weather

## Early Blight



### Symptoms

- This is a common disease of tomato occurring on the foliage at any stage of the growth.
- The fungus attacks the foliage causing characteristic leaf spots and blight. Early blight is first observed on the plants as small, black lesions mostly on the older foliage.
- Spots enlarge, and by the time they are one-fourth inch in diameter or larger, concentric rings in a bull's eye pattern can be seen in the center of the diseased area.
- Tissue surrounding the spots may turn yellow. If high temperature and humidity occur at this time, much of the foliage is killed.
- Lesions on the stems are similar to those on leaves, sometimes girdling the plant if they occur near the soil line.
- Transplants showing infection by the late blight fungus often die when set in the field. The fungus also infects the fruit, generally through the calyx or stem attachment.
- Lesions attain considerable size, usually involving nearly the entire fruit; concentric rings are also present on the fruit.

### Management

- Removal and destruction of crop debris.
- Practicing crop rotation helps to minimize the disease incidence.
- Spray the crop with Mancozeb 0.2 % for effective disease control.



### Symptoms

- Clearing of the vein-lets and yellowing 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.
- Dropping of petioles. In field, yellowing of the lower leaves first and affected leaflets wilt and die.
- At later stage, browning of vascular system occurs. Plants become stunted and die.

### 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.





### Symptoms

The plant may be attacked at any stage of its growth. The disease is characterized by numerous, small, grey, circular leaf spots having dark border.

### Management

- Removal and destruction of the affected plant parts.
- Seed treatment with Thiram or Dithane M-45 (2 g/kg seed) is useful in checking seed borne infection.
- In the field spraying with Mancozeb 0.2 % effectively controls the disease.



### Symptoms

- 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 discolorations 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. This spreads through wounds, soil and implements.

### Management

- 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.
- Damage to seedling while transplanting
- Apply bleaching powder @ 10kg/ha and inrate.



### Symptoms

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.

### Management

- Disease-free seed and seedlings should always be used and the crop should be rotated with non-host crops so as to avoid last years crop residue.
- Seed treatment with mercuric chloride (1:1000) is also recommended for control of disease.
- Spraying with a combination of copper and organic fungicides in a regular preventative spray program at 5 to 10 day intervals or Spraying with Agrimycin-100 (100 ppm) thrice at 10 days intervals effectively controls the disease.



### Symptoms

- The disease is characterized by light and dark green mottling on the leaves often accompanied by wilting of young leaves in sunny days when plants first become infected.
- The leaflets of affected leaves are usually distorted, puckered and smaller than normal. Sometimes the leaflets become indented resulting in "fern leaf" symptoms.
- The affected plant appears stunted, pale green and spindly.
- The virus is spread by contact with clothes, touching of infected plants with healthy ones, plant debris and implements.

### Management

- Seeds from disease free healthy plants should be selected for sowing. Soaking of the seeds in a solution of Trisodium Phosphate (90 g/litre of water) a day before sowing helps to reduce the disease incidence. The seeds should be thoroughly rinsed and dried in shade.
- In the nursery all the infected plants should be removed carefully and destroyed. Seedlings with infected with the viral disease should not be used for transplanting.
- Crop rotation with crops other than tobacco, potato, chilli, capsicum, brinjal, etc. should be undertaken.



### Symptoms

- 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
- Foliar symptom
- Yellowing between veins and an upward curling of their margins and Adult and nymph of Bemisia whitefly

### 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.





### Symptoms

- 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 (*Thripstabaci*, *Frankliniellaschultzi* and *F. occidentalis*).

### Management

- The affected plants should be removed and destroyed.
- Alternate or collateral hosts harboring the virus have to be removed.
- Raise barrier crops – Sorghum, Maize, Bajra 5-6 rows around the field before planting tomato.
- Spray Imidachloprid 0.05% or any systemic insecticide to control the vector.

# Nutrient Deficiencies

## Nitrogen Deficiency



### Symptoms

- Restricted shoot growth and spindly appearance of plants.
- Older leaves at first turn yellowish green; under severe deficiency, the whole plant becomes pale green.
- The leaflets are small, erect and with pink veins which are more clearly noticeable on the underside.
- Leaves die prematurely. Flowers buds turn yellow and fall off. Fruits when formed, remain small.

### Management

Foliar spray of urea 1% twice at weekly interval.

## Phosphorous Deficiency



### Symptoms

- Plants look lush blue-green or purplish in colour.
- The stems very thin and stunted while the roots are brown with restricted development of lateral branches.
- Mature leaves to be small with down curled leaflets.
- The oldest leaves, having initially purplish tints and scorched areas, later become yellow with purple veins and died prematurely.

### Management

Foliar spray DAP 1% twice at fortnightly interval.





### Symptoms

- Yellowish spots in the margins of new leaves which later spread over the leaf surface and subsequently turn brown, starting with the older leaves.
- Plants are stunted, hard and chlorotic. Leaves first become grey at the margin and later interveinally. The tips and margins undergo scorching and turn upwards K deficiency symptoms appear first in the oldest leaves.
- Leaves remain small and plant growth restricted. Chlorosis and necrosis then spread to younger leaves with defoliation of yellowed and curled older leaves.

### Correction Measure

Foliar spray of potassium sulphate 1% thrice at weekly interval.



### Symptoms

- The plants became flaccid; dead spots appeared on the upper stems and the growing apex died. Upper leaf coloration initially is darker green, but later turns yellow at the edges and dies.
- Scorching and die back of the main stem, strong curling of the leaves inwards and downwards. Fruits showing blossom end rot ripen less rapidly. Blossom end rot is closely associated with Ca deficiency of the fruit. Sunken region of few millimeters in width, near distal end of youngest fruit.

### Management

- Soil application of Calcium sulphate 1 to 2 kg/m<sup>2</sup> or Foliar spray of Calcium chloride 0.5% thrice at fortnightly interval.



### Symptoms

- Yellowing of foliage.
- Interveinal areas became yellow or greenish yellow while leaf margins remained green. Magnesium deficiency starts as interveinal yellowing at the leaf margins on older leaves, which later becomes brown and withers interveinal yellowing and necrosis. Sunken necrotic spots appears shiny, from the back of the leaf appears the first symptoms of Magnesium deficiency as discoloration of the margins.
- Yellowing progresses from base to the top of the plant.

### Management

Foliar spraying of 2% Magnesium sulphate twice at fortnightly interval or soil application of dolomite at 2 ton/ha or magnesium sulphate at 20 kg/ha.



### Symptoms

- Deficiency appears first on older leaves in the form of interveinal chlorosis (yellowing).
- Inhibit both vegetative growth and fruit production.
- Shortened internodes, diminutive leaves with undercurling of leaflets, epinastic curvature of leaves and chlorosis.
- Oozing out of cell contents as a brown fluid from the leaves.

### Management

Foliar spray of Zinc Sulphate 1% twice at fortnightly interval



### Symptoms

- Symptoms are somewhat similar to nitrogen deficiency. Younger leaves are affected. Lower leaves yellowish green while stems were hard and woody.
- Older leaves developed necrosis at tips and margins with development of small purple spots between the veins. Young leaves stiff and curled downward.

### Management

- Foliar spray of  $\text{CaSO}_4$  1% twice at fortnightly interval or gypsum @ 50 kg/ha.

### Fruit Borer *Helicoverpa armigera*

#### Larval feeding



#### Symptom of damage

- Young larvae feed on tender foliage
- Mature larvae bore circular holes
- Thrust only a part of its body into fruit and eat the inner content

#### 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.
- For *Helicoverpa armigera*: HaNPV  $1.5 \times 10^{12}$  POBs/ha i.e. NPV of *H. armigera* 0.43% AS @ 3.0 ml/lit or 2 % AS @ 1.0 ml per lit
- For *Spodopteralitura*: Sl NPV  $1.5 \times 10^{12}$  POBs/ha
- Provide poison bait with carbaryl 50 WP 1.25 kg, rice bran 12.5 kg, jaggery 1.25 kg and water 7.5 lit/ha
- Spray *Bacillus thuringiensis* 2g/lit or any one of the following insecticides.

## Serpentine leaf miner

### Leaf mining on leaves



### Symptom of damage

- Leaves with serpentine mines.
- Mining symptom on leaf.
- Drying and dropping of leaves.

### Management

- Collect and destroy mined leaves
- Spray NSKE 5%



## Leaf eating caterpillar

Foliar Damage



Flower damage



### Symptom of damage

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

### Management

- Plough the soil to expose and kill the pupae
- Grow castor along border and irrigation channel as trap crop
- Flood the field to drive out the hibernating larvae
- Set up light trap @ 1/ha
- Pheromone traps (Pherodin SL) @ 15/ ha to attract male moths
- Collect and destroy egg masses in castor and tomato
- Hand pick grown up larvae and kill them
- Spray SI NPV @  $1.5 \times 10^{12}$  POBs / ha + 2.5 Kg crude sugar + 0.1 % teepol
- Poison bait
- Rice bran 5 Kg + Molasses or Brown sugar 500g + Carbaryl 50 WP 500g+ 3lit of water/ha
- Mix the ingredients well – Kept around the field in the evening hours
- Spray chlorpyrifos 20 EC 2lit/ha or dichlorvos 76 WSC 1 lit/ha



Fruit damage



Silvery damage



### Symptom

- Chlorotic spots
- Yellowing Downward curling and drying of leaves.
- Vector of tomato leaf curl diseases

### Management

- Uproot and destroy the diseased leaf curl plants
- Use nitrogen and irrigation judiciously.
- Remove alternate weed host *Abutilon indicum*
- Use yellow sticky traps at 12/ha to attract and kill insects.
- Apply carbofuran 3% G @ 40 kg /ha or spray any one of the following Insecticides.



### Symptom of damage

- Silvery streaks on leaf surface
- Pre-mature dropping of flowers
- Bud necrosis.
- Vector of tomato spotted wilt virus.

### Management

- Mechanically uproot the diseased plants and destroy them
- Use yellow sticky traps @ 15/ ha
- Release larvae of *Chrysoperla cornea* @ 10,000/ ha
- Spray methyl demeton 25 EC @ 1lit/ha or dimethoate 30 EC @ 1lit/ha



### Symptom of damage

- Presence of white, cottony mealy bugs on the leaves and twigs
- Stunted growth

### Management

- Spray FORS 25g/lit or neem oil 0.5% along with teepol 1 ml/lit
- Spray any following insecticides
  - Phosphomidon 40 SL 2ml/lit
  - Imidacloprid 80.5 SC 0.6 ml/lit
  - Chlorpriphos 20 EC 2ml/lit
  - Thiamethoxam 25 WSG 0.6 mg/lit
  - Profenophos 2ml/lit



### Symptom of damage

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

### Management

- Spray dicofol 18.5 EC 2.5 ml/lit or wettable sulphur 50 WP  
20/lit

## Harvesting

Tomato harvesting is mainly done by hand. The activity is dependent to the end use of the produce and distance to the market. Pick fruits meant for transportation to long distances when they are at a less mature stage, and those meant for the local market at a mature ripe stage.