



# Crop Management Practices

An Agricultural Extension Initiative of **INDORAMA**

## Tomato



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## Introduction

Nigeria is ranked the second largest producer of tomato in Africa and 13th in the world with a total production estimated at 1 million hectares of land producing 1.701 million tonnes per annum with average of 20-30 tons/hectare.

Tomato is no doubt one of the world's highly consumed vegetables as it is found in a lot of meals across the globe. In Nigeria, particularly with a population of over 160 million, tomatoes command a huge demand especially in the urban areas where it is sought after by households to prepare their favourite meals.

Currently, most of the tomatoes supplied to the country's markets come from the Northern parts of the country where it is grown, as well as from neighbouring countries, including Ghana and Benin Republic. **Nigeria imports 65,809 tonnes of processed Tomato annually worth over N11.7 Billion** despite its massive local production (RMRDC 2012). The trend may continue if adequate processing and Storage mechanism is not developed and put in place.

## Soil

Tomato is grown in many types of soils from sand to heavy clay. A well-drained, fairly light fertile loam with a fair moisture holding capacity is ideal for growing a good crop of Tomato. Good texture of the soil is of primary importance, although poor or medium quality land produces good early crop if managed properly. Tomato crop prefers a soil reaction ranging from pH 6.0 to 7.0. In acidic soils, liming is beneficial for pH balance.

## Climate

Tomato, being a warm season Crop requires a long season to produce a profitable Crop. It is tender and will not withstand a hard freeze. In regions having less than 3½ months frost-free period, Tomato is not likely to be profitable. High humidity with high temperature favors the development of foliage diseases. On the other hand, hot drying winds often result in the dropping of the blossoms. The Tomato plant produces large yields under irrigation in semi-arid and arid regions.

## Seed Treatment

Seed treatment with hydrogen peroxide (0.2 to 0.6 percent) for 2 to 4 days at 21°C gives an early emergent of seedlings by 7 to 8 days and also yields 22.8% higher yield. Heat treatment at 60°C for 6 hours also proves effective in increasing the yield by 33.3%.

**Raising of seedlings:** About 400 to 500g seeds are normally needed for raising Crops in one hectare. The seed quantity varies with season and region of cultivation.

**Hardening of seedlings:** For better survival in the field, hardening of the seedlings is suggested. The hardened plants withstand extreme temperatures. Jemakinde and Onuveme (1980) studied the heat hardening (40°C for 6 hours daily for 5 to 12 days) for drought conditions. Plants were allowed to nearly wilt for 2 to 3 days before watering and this practice was repeated 2-3 times. The percentage of seedling survival in field under stress condition increased by the hardening treatment. Seedlings are ready for transplanting within 4 to 5 weeks. Harbaoni and Yellodt (1980) observed that seedlings 5mm in diameter were better for yield setting. The plants of about 15cm in height were more suitable for transplanting.

## Soil Preparation and Transplanting

Tomato is planted in well pulverized and leveled field. Tomato is normally planted in raised beds of 60 to 75 cm width. Sharma and Tiwari (1996)

studied the performance of cv. *Pusa Ruby* under subtropical conditions and found that individual fruit weight, diameter and the total marketable yields were the greatest (48.94 g, 5.45 cm and 62.89 kg/21.6m<sup>2</sup> plot and 56.81 kg/plot, respectively) when transplanting was done on 5th March; the number of days from sowing to harvesting was the least (143 days) when transplanting was done on 25th March. Under arid tropical climate, the highest yield of 0.911 kg/plant in cv. *Pusa Ruby* was obtained when planting was done on 15th November and the fruit size declined as planting was delayed while the fruit size increased on staked plants (Kadam and Deore, 1990).

Transplanting is usually done during late afternoon and the seedlings are placed on side of the beds. This provides ample moisture for the plants to survive.

Seedlings are raised in seedbeds and transplanted to the field. Transplanting is preferable if hybrid seed is used for early planting and when producing for the retail market. Direct seeding is usually done if the crop is going to be mechanically harvested or processed. The seedlings are broadcasted on the beds lightly covered with soil. Seedlings are usually ready for transplanting three to four weeks after sowing and they should be transplanted on moist soil. The seedbeds should be irrigated after sowing and it should be done regularly until the seedlings reach a height of 5 to 7 cm.



## Manures and Fertilizers

**Macronutrients:** Tomato is a heavy feeder of plant nutrients including Nitrogen, Phosphorus and Potassium and it responds well to organic Fertilizers. The amount of Fertilizer applied is influenced by fertility status of the soil, season and the cultivar. The plants have a moderately high requirement of Nitrogen. Nitrogen promotes better growth and better flower and fruit set. **A minimum of 200-250 kg per hectare of nitrogen (440 to 550 Kg Indorama Granular Urea) is recommended in high rainfall areas or for high production.**

Approximately a quarter of Nitrogen is applied at planting while the remainder is applied in the first six to eight weeks of growth at two to three week intervals. Further light dressings are applied over the next six or more weeks.

Tomato also requires high levels of Potassium. Adequate levels of Potassium result in improved colour, taste, firmness, sugars, acids and solids of the fruit. Plant cells are also strengthened. A minimum of 100 kg of potassium should be applied per hectare. Phosphorus promotes root development, early flowering and fruit set and ensures more vigorous growth. A total of 40 to 60 kg of phosphorus per hectare is suggested in soils with a built-up of the nutrient. It is recommended that phosphorus be banded in acid soils.

Tomatoes also require micronutrients for growth and development. Deficiencies of Magnesium, Calcium, and Molybdenum are common in acid soils while Boron and Copper deficiencies are not often found in Tomatoes. However, Boron deficiency, if it occurs, results in fruit cracking, pitted and corky areas, deformed shape, malformation and uneven fruit ripening. Iron has been found to be deficient on calcareous, alkaline soils or after heavy applications of lime. Manganese deficiencies are mainly found in calcareous soils.

**Biofertilizers:** Biofertilizers not only play an important role in maintaining good health of the plants, but also serve as a natural source of plant nutrient to increase productivity. The beneficial effects of Biofertilizers are manifold. Sasai (1991) reported that VAM fungi promoted Phosphate uptake in low Phosphate soils during the early stages of plant growth, According to Terry et al. (1995) Azospirillum brasilense strain UAP-154 + 30 kg N/ha applied to the seedbed + 45 kg N/ha at transplanting resulted in a higher fruit yield, and a Fertilizer saving of 45 kg N/ha.

## Disease Management

**Fungal diseases:** Damping off and Root rot: These diseases are caused by Pythium spp., Rhizoctonia solani, Phytophthora parasitica and a few other organisms. These are very serious diseases affecting plants at the nursery stage. Pre-emergence damping off consist of killing the seedlings at initial stages of seed germination and emergence.

Control measures consist of soil treatment with Formaldehyde 2 weeks before sowing and seed treatment with 1% mercuric chloride. Spraying of seedlings with Fytolan or Captan is effective. Hot water seed treatment at 52°C for 30 minutes is recommended along with 5 year crop rotation.

**Late blight:** The disease appear on the foliage at any stage of growth. Brown to purple black lesions begin at any point on the leaflet, rachis, petiole or stem and advance rapidly to cause a severe blight when conditions were favourable.

Fungicide sprays of Dithane Z-78 and Partate are effective for controlling the disease. Other fungicides found effective are Dithane M-45, Difolatan, Daconil 2787 (Gupta, 1988) and metalaxyl (Barrantes, 1989).



**Buckeye rot (Fruit rot):** It is caused by *Phytophthora parasitica* and the disease appear on lower fruits. The pathogens does not affect the foliage and thus the disease is distinct from late blight. The disease appear as a brownish spot, often at the point of contact between the fruit and the soil.

In susceptible conditions, ascorbic acid content range from 17 to 22 mg/100g. Spraying of Difolatan 4 times at 10 day intervals is effective. Two sprays of copper Oxychloride 50 at 0.25% prove effective in reducing the incidence of Buckeye rot (*P. nicotiana* var. *nicotiana*). Staking also reduce the incidence of the disease (Bhardwaj et al., 1995).

**Fusarium wilt:** In young plants, symptoms like clearing of veinlets and drooping of petioles occur. In the field, yellowing of the lower leaves appear first and the affected leaflets wilt and die.

Control measures include seed treatment with fungicides like Agrocit 50 SD and Chinoin-fundozol 50 WP (Iloba and Achor, 1989). Mladenov et al. (1989) recommended the use of Methyl bromide and Ditrax (dichloropropane with 1, 3- dichloropropene) as soil infectant for controlling *F. oxysporum* f. sp. *lycopersici* and other *Fusarium* spp. under polythene cover.

## Pest Management

Tomato crop is attacked by a number of insect pests, some important insect pests of tomato are:

### Tomato fruit worm (*Heliothis armigera*)

Immediately after hatching, the caterpillar crawls over the leaves and feeds on vegetative parts. It eventually finds its way to the fruit into which it cuts holes and burrows. The life cycle is completed in 28-60 days. Best results are achieved by alternate sprays with Malathion and Carbaryl at 10 day intervals starting from leaf perforation. It is found that frequent spraying of insecticides gives better control of *H. zea*.

### Epilachna beetles (*Epilachna vigintioctopunctata*)

Both larvae and adult feed on the leaves. Feeding is irregular and gives the plant a characteristic lace-like appearance. Spraying of Endosulfan or Dichlorophos or Chlorophyriphos at 0.1% controls this pest.

### Jassids (*Empoasca devastans*)

Jassids suck the sap from the leaves causing curling of the leaves. Use of any contact insecticides like Malathion 0.05% effectively control this pest.

### Tobacco caterpillar (*Spodoptera littoralis*)

The pest is generally confined to nursery beds and is classed as Cutworm. Their life cycle is completed in 32 to 49 days. It could be controlled by spraying 1ml Nuvan-100 mixed in 2 litres of water at the rate of about 800 l/ha. Spraying of 0.05% Endosulfan is also effective.

### White fly (*Bemesia tabaci*)

Chemical control of white fly include spraying of different pesticides and pyrethroids. Spraying (with pyrethroids) and cooling of greenhouse (with fans which forced outside air into the greenhouse) result in reduction of population of white fly (Zipori et al., 1988).

### Thrips (*Thrips tabaci* and *Frankliniella intonsa*)

Sprays of 36% DMTP wetttable powder (methionine) and 50% MEP emulsifiable concentrate or soil treatment with granular formulation of 5% Acephate and 5% monocrotophos effectively controls the insect.

### Nematodes

Tomato is attacked by various nematodes although the root-knot nematode is the most prevalent. Attack by nematodes is more likely in sandy soils and during warm conditions. They attack roots causing galls to develop and reduce the size and efficiency of the root system.

## Weed Control

Tillam 6E is recommended for monocot weeds and Tok E 25 for dicot weeds. Lasso at 1.0 kg per hectare is the most effective in controlling weeds. Orobranche ramose, a notorious saprophytic dicot weed of Tomato can be controlled by the application of Chlorsulfuron (pendimethalin) at 2.44 g a.i when thoroughly mixed with the soil prior to transplanting (Qasem, 1998). Sandyan and Banerjee (1981) observed Basalin at the rate of 1.25 l/ha as most effective in controlling weds. Metribuzin at the rate of 1.0 kg/ha was found effective in transplanted crop of tomato. About 0.56 kg was applied as preplant incorporation and rest of the quantity was applied as post-planting treatment (Sanok et al., 1981, Kalia et al., 1980).

## Harvesting

The stage of maturity for harvest of tomato depends upon the purpose for which they are used and distance covered to each the market. The following stages of maturity for harvesting are recognized.

**Immature:** Before the seeds fully developed and before the jelly-like substances surrounding the seeds were formed.

**Mature green:** The fully grown fruit with a brownish ring at stemscar. Removal of calyx, light green colour at blossom end changed yellowish green and seeds surrounded by jelly-like substances filling the seed cavity. Turning:  $\frac{1}{4}$  of the surface at blossom end shows pink (breaker stage). Pink:  $\frac{3}{4}$  of the surface shows pink

**Hard ripe:** Nearly all red or pink with firm flesh,

**Over ripe:** Fully colored and soft.

Fruits harvested at immature green stage are usually tough leathery and develop poor colour when ripened artificially. Fruits picked in mature green stage develop good colour when ripened under favourable conditions.

Tomato grown for processing is harvested when fully ripe to ensure desired quality and red colour of the product. Quality characteristics such as flavour, texture and colour in fruits are superior to those harvested at earlier stage of maturity.

Greenhouse grown tomato fruits harvested at the breaker to turning stage (80-143 days after planting) and held at 21°C up to 8 days.

**Yield:** The yield depends upon various agro climatic factors, including soil fertility, and cultivar and cultural practices. On an average field conditions, a normal tomato crop produces 16-25 t/ha. The hybrids often produced 60-80 t/ha.

