



Organic
TOMATO
Production



INTRODUCTION



Tomato or 'kamatis' is the most popular fruit vegetable in the world. It originated from South America then spread around the world after the Spanish colonization. Its many varieties are now widely grown throughout the world, often in greenhouses, in cooler climates. It belongs to the solanaceous or nightshade family. Its scientific name is *Lycopersicon esculentum*. The Aztecs called the fruit 'xitomatl', meaning plump thing with navel. Other Mesoamericans including the Nahuas, called it *tomatl*, which later became tomato.

USES AND TYPES OF TOMATO

The tomato is consumed in many ways, as raw fruit or as salad, as an ingredient in many dishes, and as drinks. It is also processed into paste for sauces, dried or canned whole. Tomatoes contain the carotene lycopene, one of the most powerful natural

antioxidants. Lycopene is known to improve the skin's ability to protect itself against harmful ultraviolet (UV) rays.

The table type tomato variety is used for cooking, preparing salad and processing. An example of this is the cherry tomato. Most of the varieties commercially grown today are hybrids leading to the genetic erosion of the landraces and open-pollinated varieties are still available including the farmer-saved cultivars, Apollo, and Del Monte. Among the varieties developed for organic conditions are 10162 and 10170.



SOIL AND CLIMATE REQUIREMENTS

Tomato can grow well in wide range soil types but sandy loam soil with good drainage is best. A pH from 6 to 6.8 is ideal. Tomato requires cool and dry conditions for better growth. Fruit setting is adversely affected by high temperature. The incidence of foliar diseases is a big problem under wet and humid conditions.

In areas with low elevation, particularly in Luzon, tomato is planted from October to March to take advantage of the dry and cool weather conditions. In areas with medium elevation such as

in Laguna, Quezon, and Nueva Viscaya, planting is done from January to February and July. May to September is the planting schedule in Bukidnon. This is to take advantage of the low supply of tomato during the wet season.

PRODUCTION MANAGEMENT

Seedbed Preparation

The nursery should be in an open area and near a sufficient water supply. The soil is preferably loam to assure good drainage. Form raised bed 20-30 cm high and 90 cm wide. The length will vary from one area to another depending on the shape and orientation of the land. For a seeding rate of 400 g/ha, maintain a net area of 260 m² nursery. For small areas, sow seeds in clay pots or seed boxes and prick later to nursery trays or 'lukong' (rolled banana leaves).

A good soil medium for seeding production is mixture of vermicompost/compost, coir dust, and carbonized rice hull or 'kuntan'. To protect the seedlings from heavy rains, place plastic roofing over the seedbeds.

Sowing

Water thoroughly the seedbed before sowing; either with tap water or vermitea. Make small furrows across the bed, 2-4 cm deep, depending on soil type, and 15 cm between furrows. Sow the seeds at a distance of 2.5 cm (1 inch) along the furrows then cover with thin layer of compost. Cover the seedbed with paper, coconut coir or rice straw mulch. If rice straw hull is used, maintain 1.0 cm thickness. For rice straw, thickness should be just enough to cover the surface to free the emerging seedling and remove after 4-5 days upon emergence. Water the seedbed daily.

Care of Seedlings

Seedling start to emerge 5-6 days after sowing, they fully emerge after 10 days. Practice thinning to have uniform, vigorous seedlings. Start thinning as the first true leaves appear by leaving

only one seedling for every 2.5 cm distance. For seed boxes, after germination, prick the seedlings by transferring them into a tray or seed box to allow more space between seedlings and prevent damping-off. In the absence of seedling tray or seed box, use rolled paper pots or rolled banana leaves.

Water the seedlings in the morning or mid-afternoon. Watering late afternoon or evening favors development of damping-off. Harden seedlings by reducing watering and exposure to sunlight one week before transplanting. Spray oriental herbal nutrient (OHM) and vermitea, if necessary.

Land preparation

Plow two to three times with an animal-drawn plow at 20-30 cm deep, then after harrow after each plowing. Make furrows at 0.75-1.0 m apart for determinate and semi-determinate varieties and 1.5 m for indeterminate varieties. Place a handful of vermicompost or compost per hill at transplanting. For home gardens, 0.75 m wide raised beds may be used.

Transplanting

Select healthy seedlings with 3-5 leaves, three to four weeks after seedling emergence. Transplant one to two seedlings per hill spaced 30-40 cm apart. Press the soil gently around the base of the seedlings. Water immediately after transplanting. Tomato can also be planted in plastic bags or clay pots, if the area is limited. Replant missing hills 5-7 days after transplanting. Mulch seedlings with rice straw or use plastic.

Fertilization

Organic vegetable farming uses organic fertilizers and plant food supplements prepared from natural sources.

The total nutrient requirement of tomato per hectare is 100 kg N, 150 kg P₂O₅, and 150 kg K₂O. To meet this requirement, apply vermicompost, compost or well decomposed animal manure at 3-5 t/ha or around a handful per hill. Spray foliar fertilizers such as vermitea, fermented plant juice (FPJ), fermented fruit juice (FFJ), fish amino acid (FAA), and water soluble calcium at

1-2 weeks interval depending on the plant's vigor. Vermicompost maybe side-dressed 1-1 1/2 months after transplanting.

To prepare manure tea, soak 3/4 sack (30 kg) of dried cow or horse manure in a plastic drum with 180 L of water. Soak for 5-7 days with frequent stirring. To prepare FPJ, mix three parts of chopped plant shoots or banana trunk with one part of raw sugar or molasses. Ferment the mixture for 5-7 days. Dilute the FPJ or manure tea at one part tea to 20-40 parts water, then drench the plots or use as foliar fertilizer. The rate and frequency of fertilization depend on the plants' vigor. To prepare FFJ, mix overripe fruits and peelings with 1/3 part raw sugar and molasses and ferment for 7 days. For FAA, mix fish trashes with equal part molasses. Ferment the mixture for around 2 weeks.

Vermitea is prepared by brewing a kilogram of vermicompost in 30 L water with 1/2 of sugar for 24 hours. Continuous aeration and agitation is required to maintain aerobic condition and extraction of microorganisms.

Trellising



Trellising is recommend in growing semi-determinate and indeterminate varieties. Use available materials such as bamboo or ipil-ipil poles as posts. Tie the branches to the posts and train the vines using plastic straw. An 'A' type trellis is best.

Irrigation

Depending on the weather and soil conditions, water the plants regularly or as needed. Mulching can help conserve soil moisture.

Weeding

Remove the weeds near the base of the plants to minimize competition. Mulching with rice straw can help minimize weeds. For larger areas, use black plastic mulching film. Trim weeds along the rows but do not remove them completely to protect the soil and to encourage natural enemies of tomato pests.

PEST AND DISEASE MANAGEMENT

Practice crop rotation to prevent build-up of pests and disease. Do this by planting non-solanaceous vegetables after the tomato cropping cycle. Grow cosmos, marigold, zinnia, lemongrass, as well as basil around the area to attract natural enemies (e.g., ladybird beetles, lacewings. Syrphids flies, and *Trichogramma* wasps) of crop pests need shelter, pollen, nectar, and food prey to survive.

Pest and disease management options in tomato.

Pests	
Aphids	Spray with hot pepper extract (100 g macerated hot pepper/16 L water) and soap soluble (4 tbsp soap/16 L water). Use commercially available neem soap.
Fruit fly	Use fruit fly attractant such as methyl eugenol, basil or 'tuba' (coconut wine) with molasses (two parts tuba and one part molasses).
Fruit worm (<i>Helicoverpa armigera</i>)	Grow repellant crops such as basil, onion, and marigold. Clip off the affected shoots along with the larva inside. Use pheromone traps to attract males, thereby reducing

	fertilization and consequently, insect pest population. <i>Trichogramma</i> is also effective in parasitizing the eggs of its host, thereby preventing the growth of the insect pest. Also, spray with commercial preparations of <i>Bacillus thuringiensis</i> (Bt) or Nuclear Polyhedrosis Virus (NPV). Collect NPV-infected larvae and store in the freezer for later use. These can be macerated then diluted at 12 infected larvae/6 L water.
Leaf miner	Conserve natural enemies like spiders, lacewings, and syrphid flies. Intercrop with okra, eggplant, tomato or other suitable vegetables. Maintain low weed population along alleys to minimize pest.
White fly (<i>Bemisia tabaci</i>)	Spray "Perla" soap solution (4 tbsp soap/16 L water or oriental herbal nutrient (OHN)) preparations. OHN is made from plants and herbs such as garlic, ginger, chili (siling labuyo), and neem seeds. For crop production, garlic and ginger have anti-fungal and anti-bacterial properties. Neem controls insects.

Disease

Bacterial wilt (<i>Ralstonia solanacearum</i>)	Use resistant varieties. Avoid planting after other solanaceous crop such as potato, eggplant, and pepper. Use compost and vermicompost can help minimize the disease.
Blossom-end rot	Avoid fluctuation in soil moisture. Spray water-soluble calcium at flowering stage.
Late blight	This disease is severe in mid and high elevation areas especially during wet season. Vermicompost tea spray and wood vinegar can help minimize the disease if applied early in the season.
Tomato leaf curl virus	Use resistant varieties.

HARVESTING

Tomato is best harvested when red-ripe for best quality. However, for long distance transport, harvest the mature green or pink-blushed fruits early in the morning. Place the harvest in plastic crates or bamboo crates lined with banana leaves or used newspaper to prevent mechanical damage to the fruits. Avoid over or under packing. Remove bruised and damaged fruits. Pack together fruits with similar maturity in one container.



SEED PRODUCTION

Tomato is self-pollinated and is easy to seed-produce. Grow the crop as in fresh tomato production but with stricter measures on the control of seed borne diseases and removal of off-types through rouging.

After rouging at fruitage stage, select the best plants (30-50) as source of stock seeds. Separate the fruits and seeds harvested from these plants for the next cycle of seed and fresh fruit production.

Harvest the fruits when fully mature. Do not include the disease fruits. Allow the fruits to ripen further before seed extraction. For larger seed extraction, place the fruits inside net bag or sacks. Trample on the bag to squeeze off the seeds from the fruits. Place in plastic containers and ferment for 12-48 hours to degrade the gel on the seeds. For smaller volumes, cut the fruits and scoop out the seeds and ferment. Do not add water.

After fermentation, wash the seeds thoroughly in clean water to remove the debris and other clinging matters. Air-dry

in a cheese cloth or net bag or spin-dry for several minutes in a spin dryer to hasten air-drying. Sun-dry for several days to about 8-10% moisture. Store in airtight and moisture-proof container. Label properly with variety/cultivar name, date of processing, and lot numbers, if any.

Cost and return analysis for one season production of organic tomato.

Items	Total Amount (P/ha)
A. Labor (P250/MD;P500/MAD)	
Plowing (5 MAD)	2,500
Harrowing (3 MAD)	1,500
Bed preparation (5 MAD)	2,500
Seedling production (15 MD)	3,750
Mulching film application (20 MD)	2,500
Planting (10 MD)	2,500
Organic fertilization application (10 MD)	2,500
Irrigation (20 MD)	5,000
Fertilization: spraying with FPFS and Bio-pesticide (10 MD)	2,500
Weeding (10 MD)	2,500
Vine training (8 MD)	2,000
Harvesting (24 MD)	6,000
Miscellaneous (20 MD)	5,000
Sub-total	40,750
B. Materials	
Seeds (200 g/ha)	2,000
Trellis	30,000
Organic fertilizer (3 t)	15,000
FPFS	2,500
Bio-pesticides	500
Mulching film (1.2 x 400 m)	12,500
Net bags, crates, and knives	5,000
miscellaneous	5,000
Sub-total	72,500

SUB-TOTAL (A+B)	113,250
C. Contingencies (15%)	16,987
Grand Total Cost (A+B+C)	130,237
Gross Income (range)^a	200,000 – 300,000
Net Income (range)	69,762.50 – 169,672
% ROI (range)	53.57/130.35%

^a With marketable yield of 10-15 t/ha at farm gate price of P20/kg; Cost are based on 2013 prices; FPFS – ferment plant food supplement; MAD – man-animal days; MD - man-days.

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