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Organic Production of Tomato

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Scientific Name: *Lycopersicon esculentum*
Chromosome no.: 2n=24

Origin: The crop's name, "tomato," is derived from the Aztec word "tomato," and it originated in Peru in South America. The tomato was first mentioned in writing in 1544, yet it is a relatively new crop. The crop is now cultivated all over the world thanks to its rapid after expansion.

Introduction: In addition to degrading soil fertility and increasing environmental degradation, pollution potential, and health risks, many traditional pesticides and fertilizers also remain in the soil and damage important soil microorganisms, such as earthworms. Under such circumstances, the agricultural sector is transitioning from chemical to organic farming, and the demand for vegetables grown organically is rising daily. Tomato farmers have a problem in cultivating resistant tomatoes that are free from pests and illnesses through organic farming. The goal of organic farming is to minimize the usage of chemical pesticides and fertilizers. Fruits that are healthful, nutrient-dense, and residue-free are produced by organic tomato cultivation. Organic tomatoes are constantly in great demand in whole-sale and local markets. Farmers need them for their low production costs, and customers want them for their health benefits.

Climate Requirements: The tomato is a warm-season, day-neutral crop that is not frost-tolerant. The crop prefers cool, dry weather, with daytime temperatures of 21–28°C and nighttime temperatures of 15-20°C. Temperature at night is more important than during the day. High temperatures cause limited pollination and fruit set due to exerted stigma, dry stigma, scorching of the anther tip, poor pollen dehiscence, reduced pollen viability, and sluggish expansion of the pollen tube. Viral illnesses will also be more common in warm weather. The ideal temperature range for fruit color development is 21–24°C. Lycopene, a coloring pigment, will not develop as well over 27°C. Below 10°C has an unfavorable effect on both pollen and seed germination. Tomato cultivars are categorized into three groups based on the minimum nighttime temperature needed for fruit set:

a) Normal set varieties: Set fruits at 15-20°C.
b) Hot set varieties: Set fruits above 20°C. eg : Philipine, Punjab Tropic, Pusa hybrid 1.
c) Cold set varieties: Set fruits below 15°C. eg : Pusa Sheetal, Avilanche.

Soil Condition: Tomatoes are susceptible to water logging. Soil that is reasonably fertile, well-drained, and rich in organic matter is ideal. When the pH of the soil reaches 5.5, it may tolerate acidic conditions somewhat; a pH of 6-7 is excellent.

Sowing time: Three crops can be grown in a year in regions with moderate climates and little risk of frost. Seeds are often planted on the hills between March and April. It is cultivated on plains from June to November.

Seed rate

- Open pollinated variety: 400-500 g / ha
- Indeterminate F2 hybrid: 125-175 g / ha

Seeds sown in an area of 4-5% (200-240 m^2) will be enough to cover one hectare. For transplanting, seedlings that are four to five weeks old are utilized. In order for seedlings to establish themselves in the main field, they must be hardened, which is accomplished by removing irrigation for a week prior to transplantation.

Main field preparation and transplanting: Raised beds and ridge-side surfaces are used for transplanting seedlings. After preparing ridges and furrows or elevated beds with a width of 80–90 cm, the field is plowed four or five times. The growth habits of the variety-determinate, indeterminate or semi-determinate determine the spacing, which can be as little as 60 x 30-45 cm, 75 x 60 cm, or 75 x 75 cm. Although tighter spacing often yields bigger and earlier yields, it can also affect fruit size.

Nutrient Management: Organic matter needs to be introduced to the soil on a regular basis to keep it productive. To further improve the soil, add compost or farmyard manures. Applying organic manure is crucial to the growth of tomatoes. Applying vermicompost at 1–1.5 t/acre or FYM at 10 t/acre is recommended. FYM can be treated with Trichoderma @ 500g/tractor load of manure to avoid contamination. For optimal culture, the manure should be left in a mound covered with moist gunny bags after the necessary amount of Trichoderma has been mixed.

Table 1. Nutrient content (N, P2 O5, K2 O) of manures collected from animal's residue

Manure	Nutrient content (%)		
	N	P_2O_5	K_2O
Blood meal	10-12	1-2	1.0
Fish meal	4-10	3-9	0.3-1.5
Meat meal	10.5	2.5	0.5
Bone meal	3-4	20-25	-
Horn and hoof meal	13	-	-
Dairy	13	25	40
Beef	9	9	13
Swine (finisher wet-dry feeder)	17	40	24
Layer	20	51	33
Boiler	60	27	33
Laying hen	40-70	-	-
Rabit	20-40	-	-
Dry stack	20-40	-	-
Horse	0-20	-	-

Table 2. Nutrient content (N, P2 O5, K2 O) of oil cake collected from oil seeds

Oil cake	Nutrient content (%)		
	N	P2O5	K2 O
Castor cake	4.3	1.8	1.3
Cotton seed cake	6.4	2.9	2.2
Karanj cake	3.9	0.9	1.2
Mahua cake	2.5	0.8	1.2
Safflower cake	7.9	2.2	1.9
Coconut cake	3.0	1.9	1.8
Rape seed cake	5.2	1.8	1.2
Groundnut cake	7.3	1.5	1.3
Sesamum cake	6.2	2.0	1.2
Linseed cake	4.9	1.4	1.3
Niger cake	4.7	1.8	1.3

Irrigation: Tomatoes are most commonly irrigated via furrow irrigation, and they require sufficient moisture for growth. Irrigation frequency is influenced by soil and climate factors. Crops should receive irrigation every three to four days throughout the summer. Water stress during the blooming stage will have a negative impact on production and fruiting. Fruits break after a protracted dry season and intense watering. Similar to how blossom end rot is caused by a dry time following frequent irrigation. In regions where there is a water scarcity, sprinkler and drip irrigation are becoming increasingly popular.

Weed Management: It is important to regularly weed, hoe, and clean up fields to keep them clear of weeds. With the Pusa Ruby tomato variety, weeds may be controlled with a single hand hoeing 45 days after transplantation. In organic farming, crop rotation is another weed-controlling tactic. It disrupts the lifecycles of insects and illnesses in the field, reduces the development of weeds, and improves crop-plant competitiveness. Straw or plastic mulching works well for controlling weeds and controlling soil temperature.

Training and Pruning: To avoid fruit lodging and loss due to soil contact, all indeterminate types are trained using wires, strings, or stacks. To stretch wire, it is either possible to provide individual stacks or to create 2-2.5 m long poles on either side of ridges. Plants support their branches using poles or twine threads. For indeterminate cultivars, pruning is also typically done to enhance fruit quality, size, and form. To increase the vitality of plants, undesirable branches are removed.

Pest Management

- The life cycles of insect pests are broken in part by crop rotation. It is therefore a conventional method of pest management. Biological control and cultural techniques must be integrated with close observation to achieve control. There are several bio-pesticides available to control pests below ETL. Compared to tomatoes cultivated organically, conventionally farmed tomatoes contain more pests.
- Trap crops are also beneficial for pest management. One of the main threats to tomato crops is fruit borer. Marigold should be planted on the adjacent plot to deflect fruit borer interest and stop this harm. Trichocard can be used if insect eggs are discovered on the leaves. If the infestation becomes more intense, plants can be sprayed with a 4% NSE solution every 15 days to keep the pest at bay.

- One of the most appropriate and promising methods of managing pests is the use of biopesticides. In tomato, Ha NPV is used to combat *Helicoverpa armigera*. One common kind of fungal biopesticide is trichoderma. It works well for treating seeds and is also used against root fungus. *Trichogramma* is helpful against lepidopteran pests and is a member of a wide group of egg parasitoids. Fruit borers are combated using Tricho cards. Neem-based insecticides, such as neem oil, neem cake, NSKE, neem leaf extract, etc., work as fruit borer deterrents and as ant repellents.

Disease Management: Tomatoes are susceptible to pathogenic illnesses produced by fungus and bacteria, as well as physiological problems such as cat facing and blossom end rot induced by environmental/abiotic stress. Infections from above and below ground, as well as occasionally from insects feeding on them, are the ways that pathogenic illnesses occur. Some of the most common tomato diseases are those that affect the above-ground stems and leaves (bacterial canker, late blight, bacterial wilt, rhizoctonia, fusarium wilt, verticilium wilt, bacterial wilt), fruit (bacterial spot, bacterial speck, anthracnose), and root system. The resistant types can be used to stop bacterial diseases, and frequent crop rotation with non-solanaceous crops can also be used as a preventive approach.

Harvesting: Crop starts yielding by 70 days after planting. Usually fruits are harvested with hand by a gentle twist so that the stalk is retained on plant. Intervals of harvests depend on season and it is twice in a week during summer and weekly during winter and rainy days. Harvesting maturity depends on the purpose whether for fresh market, processing, long distance transport etc. Following maturity standards are recognized in tomato:

- **Mature green:** Fruits fully grown, fruit colour changes from green to yellowish and cavity filled with seeds surrounded by gelly like substance. Harvested for long distance market.
- **Turning or breaker stage:** Fruits firm, 1/4th portion of fruit changes to pink in colour, but the shoulder still yellowish green. Harvested for long distance market.
- **Pink stage**: 3/4th of whole fruit surface turns pink
- **Light red:** Entire fruit surface is red or pink but the flesh is firm. Harvested for local market.
- **Red ripe or hand ripe:** Fully ripened and coloured. Flesh becomes soft. Harvested for processing and for seed extraction.

Yield : The yield of irrigated tomato varies from 15-20 t/acre.