🍅 **Tomato — Complete Practical Guide**

Common names: Tomato, Table tomato

Scientific name: **Solanum lycopersicum L.**

Use: Fresh vegetable, salad, culinary use, processing (sauce, paste, puree, ketchup), dehydration, pickles, juice

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1. Vegetable classification

- **Category:** Fruit vegetable (botanically a berry, grown as a vegetable)
- **Type:** Annual/warm-season vegetable crop used for fresh market and processing
- **Quality class:** High-value crop; quality depends on cultivar, harvesting stage, and post-harvest handling

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2. Origin and history

- **Origin:** Native to Western South America (Peru–Ecuador region)
- **Domestication:** First domesticated in Mexico by early civilizations
- **Introduction:** Introduced to Europe in the 16th century; then spread globally
- **Adoption:** Now cultivated worldwide as a major horticultural crop, essential for both fresh use and processing
- **Improvement:** Modern hybrids developed for yield, disease resistance (TLCV, wilt), transportability, and processing quality

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3. Nutritive value and medicinal use

Typical composition (fresh fruit):

- Moisture: **93–95%**
- Dry matter (DM): **5–7%**
- Vitamin C: **20–30 mg/100 g**
- Vitamin A (β-carotene): good source
- Lycopene: **3–8 mg/100 g** (powerful antioxidant)
- Fiber: **1–1.5 g**
- Minerals: K, Ca, Mg, P
- Energy: **18–22 kcal/100 g**

Feeding/Use:

- Consumed fresh in salads, cooked in curries, soups, sauces, juices, chutneys
- Used for processing (paste, puree, ketchup)

Medicinal/traditional uses:

- Lycopene reduces oxidative stress
- Supports heart health
- Anti-cancer properties (especially prostate health)
- Boosts immunity due to Vitamin C
- Assists digestion and improves skin health

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4. Taxonomy

- **Kingdom:** Plantae
- **Family:** Solanaceae
- **Genus:** Solanum
- **Species:** *Solanum lycopersicum L.*

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5. Botany (morphology & growth habit)

- **Growth form:** Annual/biennial herbaceous plant; determinate (bushy) or indeterminate (vining)
- **Roots:** Deep taproot with extensive lateral branching
- **Stem:** Weak, succulent, hairy; prone to lodging
- **Leaves:** Compound, alternate, lobed, hairy
- **Flowers:** Yellow, perfect, mostly self-pollinated (vibration promotes pollination)
- **Fruit:** Fleshy berry; round, oval, pear-shaped, oblong depending on variety
- **Seeds:** Small, kidney-shaped, hairy seed coat

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6. Tomato — Scientific name

- **Accepted scientific name:** Solanum lycopersicum L.
- **Synonym:** Lycopersicon esculentum (older classification)

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7. Seed rate

Seed rate requirements:

- Hybrid varieties: **100–150 g/ha**
- Open Pollinated (OP) varieties: **300–350 g/ha**
- Greenhouse/protected cultivation: **20–25 g per 1000 m^2**

Note: Seedling requirement depends on spacing and crop type (determinate vs. indeterminate)

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8. Nursery bed preparation

Purpose: To raise healthy, vigorous seedlings for transplanting

Bed requirements:

- Raised beds **1–1.2 m wide**, convenient length
- Soil: Fine tilth, aerated, disease-free, well-drained
- Add well-decomposed **FYM @ 8–10 kg/bed**
- Add **neem cake 200 g/bed** to reduce soil-borne pests

Sowing method:

- Create small furrows at 5–7 cm spacing
- Sow seeds thinly and uniformly
- Cover lightly with fine soil + compost mixture
- Water using rose can; avoid heavy watering

Nursery protection:

- Use **shade-net (50%)**
- Cover with insect-proof net to avoid virus-transmitting insects

Nursery period:

- **25–30 days**
- Seedling height at transplanting: **12–15 cm**, 4–6 leaf stage

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9. Protected nursery

When needed:

- Areas with high incidence of sucking pests (whitefly, thrips)
- Virus-prone zones (TLCV)
- Rainy season planting
- Greenhouse cultivation

Structure features:

- Polyhouse or shade-net house (50–75%)
- Raised benches
- Plug trays for hygienic rooting
- Misting/fogging for humidity control
- Insect-proof netting

Benefits:

- Higher germination
- Uniform seedlings
- Reduced damping-off disease
- Virus-free healthy plants

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10. Soil

- **Type:** Well-drained sandy loam to clay loam
- **pH:** Ideal 6.0–7.0
- **Organic matter:** Essential for productivity
- Avoid:
    - Heavy clay (root diseases)
    - Waterlogged soils
    - Saline soils

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11. Season of sowing / planting

India (general):

- **Kharif:** June–July
- **Rabi:** September–October
- **Summer:** January–February
- **Protected cultivation:** Year-round

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12. Field preparation

- Deep ploughing: 2–3 passes
- Harrowing to achieve good tilth
- Incorporate FYM **20–25 t/ha**
- Make ridges & furrows or raised beds
- Install drip lines before transplanting for efficient irrigation

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13. Spacing

Open field:

- Determinate varieties: **60 × 45 cm**
- Indeterminate varieties: **90 × 60 cm**

Protected cultivation:

- **40–50 cm** plant spacing
- **1.2–1.5 m** row spacing

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14. Mulching

Benefits:

- Moisture conservation
- Weed suppression
- Reduced soil-borne infections
- Improved fruit quality
- Reduced cracking

Materials:

- Black/Silver plastic mulch (25–30 microns)
- Organic mulch (straw, leaves, grass)

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15. Weed control

- **Manual weeding:** 20–30 days after transplanting
- **Chemical:** Pendimethalin @ 1 L/ha as pre-emergence
- **Cultural:**
    - Mulching
    - Proper spacing
    - Drip irrigation minimizing weed growth between rows

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16. Training and pruning

Determinate varieties:

- Minimal pruning
- Remove damaged lower leaves

Indeterminate varieties:

- **Single-stem** or **double-stem** system
- Remove side suckers regularly
- Provide **stakes, trellising or wires**

- Maintain air flow to reduce fungal infections

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17. Irrigation

- Critical stages:
  - Flowering
  - Fruit set
  - Early fruit development
- **Avoid water stress** and **avoid waterlogging**
- Drip system recommended for uniform moisture

Irrigation schedule:

- Summer: Daily or alternate-day
- Winter: Every 3–4 days

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18. Layout and planting for drip irrigation & fertigation

Drip layout:

- One drip line per row
- Emitter spacing: **30 cm**
- Emitter discharge: **2–4 L/hr**

Operating time:

- 1–1.5 hours daily (soil dependent)

Planting:

- Transplant seedlings near the emitter points
- Maintain uniform moisture during establishment

Fertigation:

- Use water-soluble fertilizers
- Ensure filters and backflow preventers are installed
- Flush lines regularly

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19. Manuring

Organic matter:

- FYM/compost: **20–25 t/ha**

Recommended fertilizer dose:

- **N:** 150–200 kg/ha
- **P_2O_5:** 60–80 kg/ha
- **K_2O:** 60–100 kg/ha

Note: Adjust per soil test

Excess nitrogen can cause excessive vegetative growth and reduce fruit set

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20. Basal dose

Before transplanting:

- 25% Nitrogen

- 50% Phosphorus
- 25% Potassium

Incorporate well into the soil in planting rows

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21. Top dressing

Apply remaining N and K in 2–3 splits:

- 30 days after transplanting
- At flowering
- At early fruit formation

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22. Foliar spray

- 19:19:19 NPK @ 1% during vegetative stage
- $CaNO_3$ @ 1% during fruit development
- Micronutrient mixture @ 0.5%
- Boron @ 0.2% to reduce flower drop and improve fruit set

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23. Fertigation schedule

Suggested weekly schedule:

- Urea: 3–5 kg/acre
- SOP: 3–4 kg/acre
- MAP: 2–3 kg/acre (early)
- Calcium nitrate: 3–4 kg/acre (fruiting)

Frequency:

- Every 3–4 days (soil-dependent)

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24. Growth regulators

- **GA_3 @ 20–30 ppm:** Enhances vegetative growth
- **NAA @ 20 ppm:** Reduces flower drop, improves fruit setting
- **CPPU:** Limited use for fruit enlargement

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25. Harvesting

First picking: 60–80 days after transplanting

Harvesting stage:

- **Turning stage** for long-distance transport
- **Red ripe stage** for local markets

Harvest every **2–3 days**

Avoid rough handling to minimize bruising

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26. Yield

Open field:

- 40–60 t/ha

- Hybrids: 60–80 t/ha

Protected cultivation:

- 150–250 t/ha (indeterminate hybrids)

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27. Grading, storage and marketing

Grading based on:

- Size
- Color
- Firmness
- Shape
- Free from cracks and pest damage

Packaging:

- Ventilated plastic crates
- Avoid stacking too high

Marketing:

- Fresh retail
- Wholesale
- Processing units

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28. Storage conditions

- **Temperature:** 12–15°C
- **Relative humidity:** 85–90%
- **Storage life:** 7–15 days

Avoid:

- Refrigeration below 10°C (causes chilling injury)

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29. Micronutrient spray

- $ZnSO_4$: 0.5%
- $FeSO_4$: 0.25%
- Boron: 0.2%
- Calcium: 1%

Apply during vegetative and early fruiting stages

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30. Physiological disorders

A. Blossom End Rot (BER)

- **Cause:** Calcium deficiency, irregular watering
- **Symptoms:** Dark sunken spot at fruit base
- **Management:**
  - $CaNO_3$ spray
  - Uniform irrigation

B. Fruit Cracking

- **Cause:** Sudden moisture changes
- **Symptoms:** Radial/longitudinal cracks
- **Management:** Mulching, regulated watering

C. Sunscald

- **Cause:** Direct sunlight exposure
- **Management:** Maintain leaf cover

D. Puffiness

- **Cause:** Poor pollination
- **Management:** Boron spray

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31. Plant protection — Pests (common)

A. Fruit Borer (Helicoverpa armigera)

- **Symptoms:** Holes in fruits, internal feeding
- **Biological control:**
  - Trichogramma cards
  - Neem oil 5%
- **Chemical control:**
  - Emamectin benzoate
  - Spinosad
  - Indoxacarb

B. Whitefly

- **Symptoms:** Leaf curling, sooty mold, virus transmission
- **Biological control:** Yellow sticky traps
- **Chemical control:** Imidacloprid, Thiamethoxam

C. Aphids

- **Symptoms:** Curling, sticky honeydew
- **Biological control:** Ladybird beetles
- **Chemical control:** Acephate, Dimethoate

D. Thrips

- **Symptoms:** Silvering of leaves, distorted fruits
- **Biological control:** Blue sticky traps
- **Chemical control:** Fipronil, Spinosad

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32. Plant protection — Diseases (common)

A. Early Blight (Alternaria solani)

- **Symptoms:** Concentric ring spots
- **Biological control:** Trichoderma
- **Chemical control:** Mancozeb, Chlorothalonil

B. Late Blight (Phytophthora infestans)

- **Symptoms:** Water-soaked lesions, rapid spread
- **Control:**

    - Copper fungicides
    - Metalaxyl-M mixtures

C. Tomato Leaf Curl Virus (TLCV)

- **Symptoms:** Curling, stunting, yellowing
- **Biological:** Vector control
- **Chemical:** Imidacloprid for whitefly control

D. Damping-off

- **Symptoms:** Seedling collapse
- **Control:**
    - Trichoderma
    - Captan / Carbendazim

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33. Integrated Pest Management (IPM)

- Use virus-resistant hybrid seeds
- Raise seedlings in **protected nursery**
- Install **yellow and blue sticky traps**
- Regular monitoring and scouting
- Neem-based sprays for early pest control
- Use **Trichoderma** for soil-borne disease management
- Maintain cleanliness around fields
- Avoid monocropping in disease-prone regions
- Use chemicals only when necessary, following label rates