



## Department of Horticulture

Purdue University Cooperative Extension Service • West Lafayette, IN

# Tomatoes

*B. Rosie Lerner*

The tomato is the most popular vegetable in today's home gardens, but it was not always so popular. Native to South America, the tomato was introduced by early explorers to Europe, where it became known as the "Apple of Love" in France and Italy. Thomas Jefferson raised tomatoes for his guests in 1781. However, it was not generally cultivated in the United States until 1835 because, until then, it was widely believed to be poisonous.

Tomatoes are nutritious and low in calories. One medium-sized tomato provides 57% of the recommended daily allotment (RDA) of vitamin C, 25% RDA vitamin A, and 8% RDA iron, yet it has only 35 calories. Besides being eaten fresh, the versatile tomato can be baked, stewed, fried, juiced, or pickled and can be used in soups, salads, and sauces.

## Cultivars

Tomatoes are available in a wide variety of shapes, sizes, and colors. While red tomatoes are the most common, yellow, orange, and pink tomatoes are sometimes grown. Tomatoes may be round, slightly flattened, or pear-like in shape. Sizes range from the bite-size cherry types to the giant beefsteak tomatoes.

New cultivars appear on the market each year, expanding selection and improving disease resistance. The choice for your garden depends on how you will use the fruit. Most tomatoes can be used for fresh eating and cooking. However, the paste or Roma type tomatoes are best suited for cooking down into sauces and ketchup due to their lower water content.

Some gardeners strive to produce the largest tomato on the block. Cultivars such as Beefsteak, Beefmaster, Ponderosa, and Oxheart are noted for their large fruit. However, these larger fruited types often are more susceptible to diseases and skin cracking.

Others choose early-maturing cultivars to try to produce the first tomato of the season. Cultivars such as Early Girl, Early Boy, Fantastic, and Jetstar may be slightly less

flavorful but will produce fruit 2-3 weeks earlier than mid- or late-season cultivars.

Tomato cultivars can be classified according to their growth habit. Determinate tomatoes are plants that grow to a height determined by their genetic makeup. When they reach their pre-determined height, they produce a cluster of flowers at the growing tip. The flowers along the stem of the plant tend to both open and set fruit within a couple of weeks time. Thus, determinate tomatoes are good choices for canning and sauce-making.

Indeterminate tomatoes increase in height throughout the growing season because the terminal of the stem continues to produce foliar growth rather than set flowers. The flowers and thus fruits on these plants are produced continually through the season along the side shoots of the plant. Indeterminate tomatoes are the choice if you want to spread out the harvest over a longer period of time.

Choose disease-resistant cultivars whenever possible. Many modern cultivars have resistance to Verticillium wilt, Fusarium wilt, and root knot nematodes. Cultivars with such resistance are denoted as such by the letters V, F, and N following the cultivar name. Consult your county office of the Purdue University Cooperative Extension Service for current cultivar recommendations.

## Soil Preparation

Tomatoes will grow in many different soil types, but a deep, loamy, well-drained soil is ideal. Tomatoes grow best in a slightly acid soil with a pH of 6.2-6.8.

Thoroughly prepare the soil by tilling or spading by hand. A soil test will indicate the proper level of fertilizer to apply to establish a healthy planting. In the absence of soil test recommendations, apply 2-3 pounds of a complete fertilizer such as 5-10-5, 10-10-10, or 6-10-4 per 100 square feet of garden area. Work the fertilizer in as you till or spade. Do not apply high nitrogen fertilizers such as those recommended for lawns. Excessive

nitrogen will promote luxurious foliage but will delay flowering and fruiting.

## Planting

Tomatoes are most commonly transplanted rather than direct-seeded into the garden. You can grow your own transplants by starting the seed indoors. One advantage of growing your own transplants is the wider selection of cultivars available as seed through garden centers and mail-order houses. However, most homes do not provide good growing conditions for production of healthy transplants.

Most gardeners purchase their transplants from local sources. Look for short, stocky plants with dark green color and straight, sturdy stems about the size of a pencil or thicker. Avoid plants with yellowing leaves, spots, or other indications of insect, disease, or stress damage. Also avoid plants with flowers or fruits, because they will be slower to adapt to the garden environment. Early-forming flowers should be removed to allow the plant to concentrate on foliage production first.

Tomatoes are warm-season plants which do not tolerate frost or cold temperatures. Transplant to the garden after danger of frost is past and the soil has warmed: mid-late April in southern Indiana and mid-late May in northern Indiana. Cover plants if late frosts are forecast after tomatoes have been planted.

Give the plants as much sunshine as possible (a minimum of 6 hours direct sunlight) for optimum fruit production. Do not plant near black walnut trees, because their roots produce a substance, juglone, which is toxic to tomatoes and some other plants.

Space the plants 1-1/2 to 2 feet apart for small bush-type plants or larger plants that will be staked. Space larger plants 3 to 4 feet apart if unstaked. Allow 4 feet between the rows.

Since tomatoes will root along the stem where in contact with soil, transplants can be set deeper in the garden than they were in the pot. However, the deeper the roots are planted, the less air is available, so it is best to plant as close to the original level as possible.

Be sure to water the transplant thoroughly to establish good root/soil contact and prevent wilting. Watering in with a starter fertilizer solution will help get the roots off to a good start. Make your own starter solution by dissolving 2 tablespoons of a high phosphorus fertilizer such as 6-10-4 or 5-10-5. Newly set transplants may need to be shaded for the first week or so to prevent excessive drying of the leaves.

## Training

Training tomatoes to grow upwards along a stake or in a cage has several advantages. Plants will have better air circulation to keep the leaves less susceptible to disease attack. Fruits will be held off of the soil, which helps prevent diseases. Plants can be spaced more closely to allow greater production.

## Caging

Tomato plants can be supported on all sides by enclosing them in a wire cage. Caged tomatoes tend to be more productive, since suckers do not need to be removed. Caged tomatoes are also less prone to sunscalding injury because of greater foliage cover.

Tomato cages can be purchased in several different sizes. Keep in mind the mature size of the tomato cultivar you are growing. The plants may start out small but will soon outgrow a small cage. As with stakes, it is best to set the cage in place at planting time.

You can also construct your own cage using wire mesh such as concrete reinforcement wire. A cage which is 4-1/2 feet in diameter and 4-5 feet tall will support most tomato cultivars. Make sure that the mesh is wide enough to allow your hand to reach in and harvest the fruit, preferably 6 x 6 inches. Hook the two cut ends of the mesh together to form a cylinder. Remove the bottom rung to form prongs that can be pushed into the ground for support. For additional protection from falling over, weave a stake in and out of the cage vertically until the stake reaches and sinks into the ground to a depth of about 1 foot. (See Figure 1.)

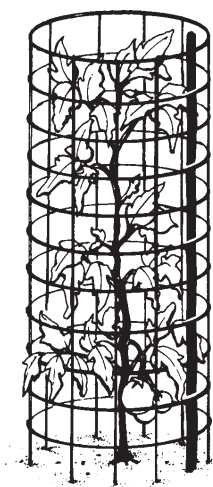


Figure 1. A properly caged tomato plant.

## Staking

Stakes should be set in place at planting time to avoid later injury to roots. Use a sturdy pole at least 8 feet tall and 1 inch in diameter. Set the pole 1-2 feet deep and about 4 inches out from the plant. Use soft cord, strips of cloth, or strips of old nylon stockings to secure the tomato to the stake. To prevent injury to the plant's stem from rubbing against the stake, tie the strips in a "figure 8," with one loop loose around the stem and the other loop tight around the stake.

To keep your tomato plant trained to the stake, it will be necessary to remove the suckers. These are the side branches that form in the axils of the plant, the points where the leaves join the stem. Check the plants weekly for sucker development, and pinch out the growing tip of the sucker just beyond the first two leaves on that branch. Allowing the first two leaves to remain will give the plant better foliage cover, which helps protect the fruits from sunscald. (See Figure 2.)

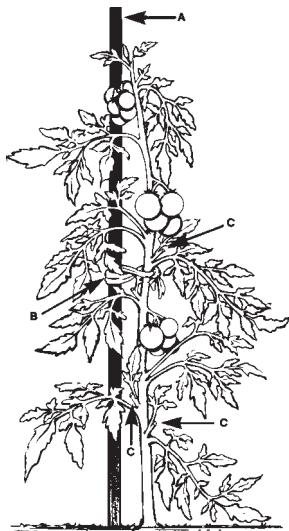


Figure 2. A properly staked tomato plant.

- A. A sturdy pole at least 8 feet tall should be placed 1-2 feet deep and 4 inches out from the plant at the time of planting.
- B. The tomato plant should be tied to the stake by fastening a soft cloth in a "figure 8," one loop around the stake and the other around the stem.
- C. Suckers should be removed by pinching just beyond the first two leaves.

## Summer Care

Tomatoes need 1 to 1-1/2 inches of water per week to maintain plant health and good quality fruit. Applying a mulch will help conserve soil moisture by preventing evaporation and will help prevent extremes in the moisture supply.

Mulching will also help prevent weeds from germinating. Apply 2-4 inches of organic mulch such as straw, hay, or bark chips after the soil has had a chance to warm up, usually by June. Or apply black plastic mulch just prior to planting.

Where no mulch is used, cultivate shallowly to remove weeds while they are still small. Herbicides can be used in large tomato plantings but are not practical in the small garden with only a few plants of many different crops.

A sidedressing of nitrogen fertilizer will help see the plants through the growing season. Apply 1 pound of ammonium nitrate (33-0-0) per 100 foot row at each of the following times:

- 1-2 weeks after first fruits are set,
- 2 weeks after picking first ripe fruit, and
- 6 weeks after picking first ripe fruit.

## Harvesting

Both temperature and genetic makeup regulate the ripening and color development of tomatoes. The red color typical of most tomato cultivars does not form when temperatures are above 86°F, but yellow pigment continues to develop. Thus, tomatoes which ripen during hot weather are often yellowish-orange.

Most gardeners like to wait until their tomatoes are "vine-ripe" before they pick them. Unfortunately, ripe tomatoes are more susceptible to sunscald and skin cracking, so it may be best to pick the fruits on the pink side and allow them to fully ripen off the plant. Place your harvest in a warm, shaded location or even in the dark to ripen them. Light is not necessary to further ripening.

Pick off all remaining tomatoes, including the green ones, in the fall if a killing frost is forecast. The green tomatoes can be pickled or fried in the green stage. Most picked green tomatoes will ripen to a red color if placed in a dark, warm, 65-70°F location. Clean and dry the green tomatoes, and carefully remove the fruit stems. Place the tomatoes in single layers between sheets of newspaper. For longer storage, place in a cooler location but not under 55°F. Check the tomatoes periodically and remove any soft or decaying fruit.

Another method is to leave the green tomatoes on the vine and pull up the vine itself, hanging it upside down in a cool area. Fruits can then be removed from the vine as they ripen.

## Problems

Tomatoes are plagued by numerous problems which can often be prevented or controlled with proper cultural practices.

### Environmental Stress Disorders

Blossom-end Rot appears as a dry, black, leathery scar on the blossom-end of the fruit. Caused by calcium deficiency, it is most often brought on by extremes in soil moisture and is most serious during hot dry spells. Mulching and irrigating during drought will help prevent moisture extremes. Staked and heavily pruned plants appear to be most susceptible.

Blossom Drop is caused by temperature extremes. Fruit set occurs only when night temperatures are between 55 and 75°F. When fruits are not set, blossoms fall off. Hormone sprays such as "Blossom-Set" may prevent some blossom drop due to low temperatures, but the resulting fruit is likely to be misshapen. These sprays are not effective when temperatures are too high.

Fruit Cracks usually occur during hot rainy periods (above 90°F), especially when preceded by a long dry period. Fruits exposed to the sun are most susceptible. Radial cracking is most common, but concentric cracks also occur on some cultivars.

Sunscald appears first as a yellow or white patch on the side of the fruit facing the sun. The spot may blister and dry, forming a paper-like surface. Poor foliage cover allows exposure to sun such as on pruned, staked tomatoes, sprawling plants, or unhealthy plants. Caging offers the best protection.

Blotchy Ripening, the uneven development of color, may be due to temperatures below 60°F, root stress from compacted or soggy soil, or low levels of potassium in the soil. The fruits can still be used, simply cut away the poorly-colored areas.

Poor Fruit Set is caused by extreme temperatures, dry soil, shading, or excessive nitrogen applications.

Leaf Roll is characteristic of some cultivars and is nothing to be concerned about. Lower leaves roll up at the margins and take on a leathery texture.

Catfacing is puckering and scarring at the blossom end of the fruit. Cavities may penetrate deep into the fruit. Cool and cloudy weather at blooming time may cause the

blossom to stick to the young, developing fruit, resulting in the malformation. Damage from the herbicide 2, 4-D also will cause distortion.

Puffiness occurs most frequently on early harvests. The outer walls of the fruit are normal, but the inside is hollow. Usually only one of the seed cavities will be empty. Extreme high or low temperatures which interfere with pollination, low light, excessive nitrogen, and heavy rainfall all contribute to this problem. No controls are known to be effective.

Deformed Leaves, a weed killer injury, can be caused by even slight amounts of hormone-type herbicides such as 2, 4-D. The injury results in curled, twisted leaves with light green, parallel veins on new growth. If severe, fruits may also be deformed. Plants usually return to normal after a period, but overall yield may be reduced.

Cloudy Spots are irregular whitish spots just under the skin and are the result of stink bugs feeding. Controlling stink bugs will control the problem.

### Diseases

Anthracnose, Early Blight, and Septoria Leaf Spot are the most commonly occurring diseases in Indiana gardens. They often begin as spots on either the leaves or fruits.

Fusarium and Verticillium wilts are also quite common. The first symptom of wilt disease is a yellowing of the lower leaves, which then progresses upward through the plant. These two wilt diseases are very difficult to distinguish from each other and from walnut wilt.

Choose resistant cultivars whenever possible to help prevent diseases from starting. Many fungicides are available to aid in preventing infection and controlling the spread of diseases if they do occur. Consult your county office of the Purdue Cooperative Extension Service.

### Insects

Cutworms often cut off plants close to the soil surface, particularly early in the season. Setting a cardboard collar around the transplants at planting time will help prevent cutworm damage.

Hornworms are large, 4-inch worms with a horn on one end, that eat foliage and fruit. Hand picking gives good control when numbers are small.

Fruitworms eat holes in fruits and buds. Sprays are usually needed to prevent their injury.

Stalk Borers tunnel in the stem, causing the plant to wilt and die. Removing nearby weeds will help destroy their breeding sites.

Flea Beetles are tiny, black jumping bugs which eat many tiny holes in the leaves.

Leaf Miners tunnel inside the leaves, leaving tell-tale white, curly trails behind.

Stink Bugs suck juices from the plant and often cause whitish spots to develop just below the skin of the fruit.

Spider Mites are tiny, barely visible, and cause yellowish speckling on the foliage and very fine webbing.

Many insecticides are available for control of insect pests. The choice of which chemical depends on the particular insect and crop. Consult your county office of the Purdue University Cooperative Extension Service.

## Canning

Fear of botulism poisoning has been associated with home-canned tomatoes for many years, particularly with the new, so-called low-acid tomatoes. The acidity of a tomato does vary depending on location in the garden and degree of ripeness. However, the low-acid tomatoes are just as acidic as other tomatoes. They just have a higher sugar content, which makes them taste less acidic. Tests on numerous cultivars have shown that the acid content of the tested cultivars was high enough to prevent botulism when fruits are ripe. Use only firm, ripe tomatoes, and follow recommended procedures for safe canning. Do not use damaged, overripe fruits or those that have been stored at high temperatures. Consult your county office of the Purdue University Cooperative Extension Service for current canning recommendations.

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For more information on the subject discussed in this publication, consult your local office of the Purdue University Cooperative Extension Service.

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