K-STATE Research and Extension

Tomatoes

MF312

Tomatoes are the most popular home garden vegetable. They are easy to grow and thrive under a variety of growing conditions. Sales of tomato transplants have skyrocketed in recent years with tomato plants being an important part of the spring bedding-plant industry.

Tomatoes are a native South American crop but were taken to Europe by early explorers. Although some Europeans accepted the tomato immediately, others thought it to be poisonous. Even after the plant was brought to America, most Americans were afraid of tomatoes until the 1830s.

Nutritive Value

Tomatoes are an excellent source of vitamin C. One and a half small tomatoes contain more vitamin C than half a grapefruit. Tomato juice rivals orange juice in vitamin C content. One small tomato provides nearly 20 percent of the daily minimum requirement for vitamin A, and newer varieties with more vitamin A are being developed. Tomatoes also contain high amounts of magnesium, calcium, phosphorus, copper, iron, and cobalt.

Varieties

Consider plant characteristics when selecting tomatoes. Some vines are relatively compact and less sprawling compared to large-vined types that require pruning and staking, tying, or "cage" culture. See the table on page 3 for descriptions of tomato varieties popular with Kansas gardeners.

Transplants

Most gardeners prefer to buy transplants from local greenhouses, nurseries, garden dealers, and other suppliers. Tomatoes can be purchased in flats, market packs, or individual pots. Plants sold in individual pots are more expensive, but they suffer less transplant shock because the roots do not have to be disturbed when planting.

Choose plants that are dark green, short, and compact, with sturdy stems about the size of a pencil. Look for a balance between the size of the plant and container. Avoid large plants growing in small containers.

Seeding or Growing Transplants

Tomatoes can be seeded directly into the garden. Canning types are best suited for this. Seed thickly, and thin to about one plant per foot later in the season.

All types of tomatoes can be started indoors if you want to experiment rather than buying transplants. Use clay, plastic, or peat pots, milk cartons, paper or plastic coffee cups, or similar containers, but make sure they have drain holes in the bottom. It is best to use potting soil from a greenhouse or garden center, which is free of weed seeds and harmful disease organisms. Plant several seeds into soil that has been well-firmed in the pots. Thin later, leaving one seedling per container.

Optimum growing temperature for tomatoes is 70 to 75°F, with night temperatures of 60 to 65°F. Give plants as much natural light as possible or grow them under artificial light. Plants grown without enough light are spindly.

A week or so before tomatoes are ready to be set in the garden, decrease watering and toughen or "harden" the plants by gradually increasing exposure to outside conditions. This makes transplanting shock less severe.

Planting

Plant tomatoes where they will receive full sun for a half day or more. Plants grown in shade will be spindly and unproductive.

Tomatoes are sensitive to frost and will not thrive in cold garden soils. In extreme southeastern Kansas, tomatoes can be transplanted in early to mid-April. Late April to May is the suggested transplanting date for most of eastern and central Kansas. If there is a danger of frost after plants are set, be prepared to provide temporary cover.

Tomatoes will grow in many different soil types, but they prefer a deep, loamy soil with a pH of 6.2 to 6.8. If topsoil is shallow, improve the growing area by mixing in a 2- to 3-inch layer of peat moss or compost to a depth of at least 6 inches. Otherwise, till the soil thoroughly with a spade or rototiller.

Ask your local extension agent for specific recommendations on fertilizing tomatoes. If you choose not to do a

Set tomato plants mostly below the soil surface and cover to the first set of leaves.

soil test, add 1 to 2 pounds of complete garden fertilizer per 100 square feet. Avoid fertilizers with too much nitrogen. Excessive nitrogen fertilization leads to spindly plants and few fruits. Fertilizers with 5-10-10, 6-12-12, 5-10-5 ratios, or about half as much nitrogen as phosphate, are the most desirable.

Spacing depends on plant size and whether plants will be staked. Small-vined types should be spaced 15 to 18 inches apart, and staked vines 18 to 24 inches. Unstaked plants should have 30 inches of space between them. If planting several rows, place them about 4 feet apart.

Tomato plants should be set in the ground slightly deeper than they grew in the original flat or pot. Place the stem of tall, spindly plants mostly below the soil surface and cover to the first leaf to keep them from breaking in spring winds.

You do not have to remove peat containers, but tear off the top edge or place pots well below the soil surface. An exposed edge acts like a wick, drawing water from the soil around the plant.

After planting, water well with a starter fertilizer solution. This can be purchased from your local garden center, or you can mix 3 to 4 tablespoons of ordinary garden fertilizer in a gallon of water. Pour about 1 cup of starter solution around each plant.

Protect plants for a few days by shielding them with boards, shingles, or light-penetrating coverings such as plastic milk jugs, glass, or hotcaps.

Staking

Tomatoes can be staked to conserve space in small gardens. This practice usually produces earlier tomatoes because vines are pruned, which promotes fruit growth. In extremely hot weather, staked plants may lack adequate foliage to prevent sunburning fruit.

Choose stakes 6 to 7 feet tall. Drive them about 2 feet into the ground, 3 to 4 inches from the plant. Tie the plant to the stake with twine, cloth, or soft plastic strips about every 12 inches up the stake, tying first tightly around the stake, and then loosely. Tie again loosely around the plant, leaving the stem room to expand.

As plants develop, prune "suckers" or shoots that develop in the angle between the stem and leaves. Remove suckers every few days before they are 1 to 2 inches long, leaving one stem to grow up the stake. Some gardeners let the sucker at the bottom of the plant develop, forming two main stems.

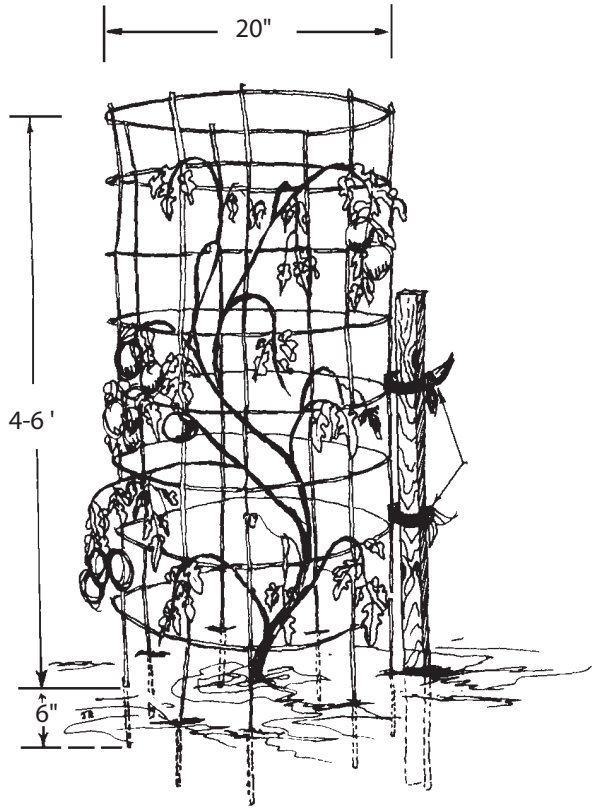

Figure 1. Cut off bottom horizontal wire and stick resulting prongs into the ground approximately 6 inches.

A cultural approach preferred by many Kansas gardeners is to "cage" or trellis individual plants. This method conserves garden space and keeps tomatoes and foliage off the ground, while offering foliage protection during the hot summer months.

A tomato cage can be constructed from concrete reinforcing wire or similar material with spaces large enough for fruits to be removed. A 6-foot length of wire will form a cylinder about 18 to 20 inches in diameter. Remove the horizontal wire at the bottom of the cylinder, leaving the vertical wires or prongs. Place the cage over the transplant and secure it by pressing the vertical wires into the ground (Figure 1). If necessary, stake the cage to keep it from blowing over.

Caging allows the plant to grow normally without having to remove the suckers. The plant does not have to be tied to the cage, but protruding stems should be pushed back inside the cage. Using this method, you should have ripe tomatoes until frost. Compact-type plants do not have to be pruned.

Mulching

Mulch benefits growing tomatoes by retaining soil moisture, reducing soil compaction, and helping to control weeds. Plastic mulches can be used early in the season before planting to warm the soil and encourage early growth. Apply straw, compost, leaves, and grass clippings in mid-June at the base of each plant.

Caring for Plants

Tomatoes need about 1 inch of water per week, which can be supplied with sprinklers, soaker hoses, drip irrigation, or furrow irrigation when rainfall is insufficient.

Control weeds when they are small by hoeing. Use shallow scraping and avoid deep cultivation. Mulch to smother small weeds, reduce moisture loss, and decrease fruit rotting and foliage diseases. Mulch with 2 to 3 inches of compost, peat moss, leaves, or grass clippings, or 4 inches of coarser mulch such as wheat straw or old prairie hay.

In extreme summer heat, blossom drop is common. At temperatures above 90°F and with low humidity, poor pollination causes blossom drop and poor fruit set. Blossom-set type hormone sprays have not proven effective in reducing blossom drop under these conditions.

Table 1. Popular Tomato Varieties

Variety	Disease Resistance*	Vine Size	Fruit Size	Comments
Garden Tomatoes				
Big Beef	V1, F1,2 , N, TMV	Large	Large	Hybrid
Carolina Gold	V, F1,2	Determinate	Large	Yellow
Celebrity	V, F1,2, N, TMV	Medium	Medium	High yield
Chef's Choice Orange	V, F	Large	Very large	Good flavor
Dixie Red	V, F1,2,3	Small-Medium	Large	Good flavor
Florida	91 V, F1,2	Medium	Large	Sets in heat
Jet Star	V, F1	Large	Large	Crack resistant
Mt Spring	V, F1,2	Small-Medium	Medium	Crack resistant
Mt Fresh	V, F1,2	Medium	Large	Crack resistant
Primo Red	V, F1,2	Small	Large	Large crop early
Scarlet Red	V, F1,2	Medium	Large	High yield
Cherry				
Cherry Grande	VF1	Medium	1 oz	
Mountain Belle	V, F1	Medium	1 oz	
SunSugar	F, TMV	Large	½ to ¾ oz	Yellow, very sweet
Sweet Chelsea	V, F1,2, TMV	Large	1 oz	
Paste/Roma				
Roma	VF1,2	Medium		
Plum Dandy	VF1, EB	Small-Medium		
Super Marzano	VF1,2, TMV, N	Large		
Heirloom				
Amana Orange		Large	Large	Orange fruit
Black Krim		Large	Large	Partly black interior
Cherokee Purple		Large	Large	
Mortgage Lifter		Large	Large	

*Disease resistance: V = verticillium wilt; F = fusarium wilt races 1,2 or 3; TMV = tobacco mosaic virus; N = nematodes

Most newer tomato varieties have a more compact vine with a uniform ripening genetic trait (fruit ripens uniformly from top to bottom), multiple disease resistance and a fairly meaty, firm fruit. Two races of strains of Fusarium wilt, the most serious disease, can be found in Kansas. A third race may move to the state in a few years, but it is not currently a threat. Fusarium persists in the soil for eight to 12 years, and there is no known control other than resistant varieties. Nematodes are a problem in parts of Kansas that are south of Interstate 70.

Fertilizing

Tomatoes benefit from additional applications (sidedressings) of nitrogen fertilizer at the following times:

- when the tomato fruits reach full size but are still green;
- two weeks after the first fruit is harvested; and
- one month after the second sidedressing.

Fertilizing more often than this can encourage leaf growth at the expense of the fruit and is not recommended. An exception would be plants grown on sandy soil, which benefit from monthly sidedressings of fertilizer. Use a fertilizer composed primarily of nitrogen, such as nitrate of soda (16-0-0). This fertilizer can be applied at the rate of 2 pounds (equals 2 pints) per 100 feet of row. High-nitrogen lawn fertilizers, 27-3-3, 30-3-4, 29-5-4 or similar, should be applied at a rate of 1 pound (1 pint) per 100 feet of row. Do not use lawn fertilizers that contain weed killers or weed preventers.

Harvest

Tomato fruits do not turn red when temperatures are above 95°F. In extreme summer heat, fruits allowed to ripen on the vine may turn yellowish-orange. For optimum color development, pick tomatoes in the pink stage and allow them to ripen indoors. About 70°F is ideal, and light is not required. After tomatoes have ripened, they can be stored in the refrigerator for several weeks.

Just before frost, remove green tomatoes from the vines, detach stems, and wipe with a soft cloth. Wrap each tomato in newspaper or waxed paper. Store in a cool, dark place at 55 to 60°F, checking frequently to remove decaying or damaged fruit. Remove fruits as they begin to turn, and continue ripening at 70°F. You should have ripe tomatoes until Thanksgiving or Christmas using this technique.

Common Tomato Problems

Leaf curl. This curling or rolling of the leaves occurs in hot weather or after cultivation or severe pruning and does not affect yield or quality. Keep plants well watered, and do not hoe deeply around plants.

Blossom end rot. Appearing as a dry leathery patch at the bottom of tomato fruit, this disorder is caused by fluctuations in the soil's moisture supply or by a quick transition from cool to hot weather. Provide uniform watering, use a mulch, and do not overfertilize with nitrogen.

Blossom drop. At temperatures below 60°F or above 90°F, blooms may fall off plants. Avoid excessive nitrogen fertilization, which encourages blossom drop.

Cracking. Sudden summer rains or watering after drought may cause fruit cracking. Varieties differ in their tendency to crack, so choose one recommended for Kansas such as Jet Star. Pick fruits in the pink stage and allow them to ripen indoors.

Weed spray damage. Phenoxy herbicides such as 2,4-D in small quantities may cause twisting and distortion of tomato stems and leaves. Avoid using these sprays close to your garden and on days the wind can direct vapors or spray onto your plants. Plants usually return to normal in a few weeks.

Wilts. Sudden wilting and death can occur as a result of this serious tomato disease. Choose tomato varieties that are resistant to wilt.

Blight and other foliage diseases. Several fungus diseases cause spots or lesions on tomato leaves and fruit. Lower leaves may yellow, die, and fall off the plant. These diseases worsen in warm, humid weather. Planting tomatoes in a different area each year can help. Apply a fungicide spray containing chlorothalonil, mancozeb, or fixed copper applied at weekly intervals to control this problem. Your local garden center can suggest products containing these fungicides. Mulching also helps.

Aphids. These small green, yellow, or dark-colored insects are often present on tomato plants. Spray plants thoroughly with malathion, cyfluthrin or permethrin. Sevin will not control this pest. Large numbers of lady bugs, lacewings, and other predator insects may control aphids.

Cutworms. Worms cut young tomato plants off at ground level. A paper or aluminum foil collar around each plant should prevent damage.

Spider mites. The first indication of these tiny, difficult-to-see insects is a pale stipple or small white spots on leaves. Later, leaves shrivel and turn brown, and a fine webbing often appears on the undersides of leaves. Early treatment is crucial. Use a strong jet of water from a hose twice a week to dislodge mites. Be sure to hit the undersides of the leaves.

Fruitworms. These green or brown worms with light-colored heads bore into tomato fruits. Use cyfluthrin, spinosad (organic), or permethrin.

Tomato hornworms. These are large green worms with a horn or tail that eat large amounts of tomato foliage. Remove by hand picking. Use *Bacillus thuringiensis* (BT), cyfluthrin, spinosad (organic), or permethrin for control.

Stink bugs. These green or brown shield-shaped insects suck juices from fruits, leaving white "cloudy spots" beneath the skin. The fruit is safe to eat fresh or to can. If control is desired, cyfluthrin can be applied to the fruit.

Additional Resources

To learn more about pest management, visit the Horticulture Information Center. Contact your local K-State Research and Extension office for related publications:

- *Vegetable Garden Planting Guide*, MF315
- *Recommended Vegetable Varieties*, L41
- *Kansas Garden Guide*, S51

Ward Upham, Horticulturist

From original by Charles W. Marr, Extension specialist, horticulture, retired.

Kansas State University Agricultural Experiment Station and Cooperative Extension Service
K-State Research and Extension is an equal opportunity provider and employer. Issued in furtherance of Cooperative Extension Work, Acts of May 8 and June 30, 1914, as amended. Kansas State University, County Extension Councils, Extension Districts, and United States Department of Agriculture Cooperating, John D. Floros, Director.

MF312 March 2018