

Growing Tomatoes in South Dakota

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Photo credit: Mary Roduner

Few vegetables inspire us more than home-grown tomatoes, bursting with vine-ripe flavor. Tomatoes are easy to grow in containers or in the ground, and are excellent sources of vitamins A and C, as well as cancer-fighting lycopenes.

Types of Tomatoes – How do you choose? Color? Size?

Ripe tomatoes may be red, yellow, pink, purplish-black, white, or even green, depending on the variety, and may be as small as blueberries or as large as grapefruit. The number of varieties available can be overwhelming, especially for gardeners willing to start their own plants from seed. **Currant** and **grape** tomatoes are the smallest tomatoes, borne on and usually harvested as a cluster, stem and all. **Cherry** tomatoes are a bit larger, and usually harvested singly. **Beefsteak** are the extra-large tomatoes, usually sliced. **Roma** tomatoes, also known as **Plum** tomatoes, have thicker walls and less juice than other types, so they are excellent for sauces.

Older varieties are often known as “heirlooms,” passed

down through generations (of both plants and people) often because of their superb flavor. ‘Brandywine’ is perhaps the most well-known heirloom type. Seed catalogues are beginning to carry more of these varieties. Keep in mind that heirlooms tend to have “imperfect” appearing fruit, with a tendency towards green shoulders, cracking, and catfacing (see below). Newer varieties are bred to avoid these common problems, as well as many of the common diseases.

Use: Fresh or Preserved?

Determinate tomatoes are great for canning, as they produce all their fruit in a short period of time. These tomatoes, also called “bush” tomatoes, have their flower clusters at the ends of their shoots, so they stop growing once they set fruit. Determinate tomato plants tend to be smaller, so they don’t usually need staking, and they also work well for containers (some are even called “patio” hybrids).

If you are looking for a steady supply of tomatoes all season long, choose **indeterminate** varieties. The flower clusters of these tomatoes are formed along the sides of the shoots, so they continue to produce leaves and fruit until frost. Indeterminate types need to be staked or caged for support. Some varieties are called *semi-determinate*; as the name suggests, their growth habit is intermediate between determinate and indeterminate types. Check the label on your transplant or seed package – it should tell you whether the variety is determinate/bush or indeterminate.

Tomatoes may be categorized by their time to ripen as “early,” “midseason,” or “late.” Very early varieties tend not to have the full flavor of some of the mid- or late-season types, but may be worthwhile just to start the season.

Culture

Temperature

Tomatoes are not frost tolerant, and do best in temperatures above 50°F, so wait to plant them outdoors until late spring or early summer. The best production occurs under clear and dry weather with moderate temperatures, ideally 70–75°F during the day and 65–68°F at night. Although temperatures below 60°F decrease yield, many early determinate varieties will set some fruit between 40–50°F, and some have been bred to withstand higher summer temperatures. Tomatoes often produce more flowers at high temperatures, but above 80°F pollen production is impaired and fruit set is decreased, especially if the high temperatures are accompanied by high humidity. Cooler nighttime temperatures (below 72°F) will help offset hot daytime temperatures. At temperatures above 95°F, the fruit does not increase in size and will not color properly.

A number of products on the market claim that they can increase fruit set. These products mimic natural plant hormones. They may increase blossom *retention*, but they do not affect pollen development or *pollination*. Thus, plants treated with these products may produce fruit that lack proper seed formation, resulting in misshapen fruit that is also uncharacteristically pasty.

Soil

Tomatoes will grow in nearly all types of soils. A light, well drained, fertile soil high in organic matter is best for producing early, high-quality fruit. Tomatoes grow well in a wide range of soil pHs, from 5.5 to 7.8 pH.

Planting

Because of our relatively short growing season, most tomatoes in South Dakota are grown from transplants.

Transplants ideally should be 5–6 weeks old (6–8 inches tall, but not leggy), and, at most, just beginning to flower. Plants should be stocky, disease free, and have dark green leaves. Avoid root-bound plants. If you transplant a plant with fruit already on it, you may be the first one in the neighborhood to get a ripe tomato, but the subsequent yield of that plant will likely be reduced.

Transplant tomatoes after the last frost date in your area, unless you are using one of the protective devices discussed later. Harden off plants for 1–2 weeks before you set them into the garden. Hardening off is done by leaving the plants outside in a shady location at first, then gradually increasing the amount of sunlight

to full sun while decreasing the water supply. It is also helpful to gradually expose them to increasing wind during the hardening process. If temperatures drop to near freezing, bring the plants indoors. When plants are properly hardened and able to handle outdoor conditions, they should not show transplant shock when they are finally set into the garden.

When transplanting, bury the tomato plants up to the first leaf. If the plants get too tall (leggy) before planting, lay them slanted along a 5–6 inch deep furrow, cover $\frac{1}{2}$ to $\frac{3}{4}$ of the stem, and leave the top of the plant exposed. The plants will root all along the stem.

Water well to settle the soil. Using a diluted starter fertilizer (high in phosphorous) solution for this purpose will help their roots to grow quickly in their new soil.

Distance between plants depends on the type of tomato (determinate or indeterminate, see above), method of growing (on the ground, in cages, or staked), fertility of the soil, and the growing season. Many home gardeners plant tomatoes in 3-foot rows with plants 2 to 3 feet apart within the row. Generous spacing will help decrease foliar and fruit diseases.

Frost Protection

If you plant your tomatoes before the average last spring frost date, you're taking a risk, but having early produce may be worth it. Gardeners have devised a number of ways to protect their plants from cold weather. The most common include using some sort of shelter around the plants, such as old coffee cans or plastic milk jugs. Be careful to provide ventilation - if a container is left over the top of the plant during the day, it may collect so much heat that the plant will be damaged. Be cautious - heavy, fruit laden branches may break if they are growing over the thin edge of a container such as a coffee can. Plastic bottles can be carefully cut away once the risk of frost has passed.

Transplant shelters are available from garden catalogs, local garden centers, and nurseries. Some of these use clear or translucent insulating materials. Some surround the plant with a heat-collecting layer of water that acts to keep the plant warm during the night or on cool days. Try various methods on individual plants to see what works best for you.

Frost Damage

Tomatoes, especially young transplants, are very

sensitive to cold weather and can be damaged by cool temperatures (40°F and lower). You will need to replant if the stems of the frosted seedlings are soft and discolored below the lowest leaves. If the lower portion of the stem is still intact, new buds may grow and still produce a new plant, but the delay caused by frost damage and regrowth may be greater than if you were to replant with new seedlings.

Covering plants with a blanket or sheet will protect only from a light frost. In the fall, if frost is expected in your area, it is better to pick all fruit, including mature green fruit. Fruit left on a frosted plant will develop very slowly and may not ripen. Frost-damaged fruits decay quickly. However, fruits may be eaten fresh if used immediately after frosting and if all damaged areas are removed.

Fruit on a frosted plant may be unsafe for canning. Chemical changes occur once the plant has been frosted, even if there are no signs of damage on the fruit. These chemical changes may reduce fruit acidity to a point where harmful bacteria may survive the canning process.

Fertilizing

Tomatoes, like most other vegetables and flowers, do best in fertile soil containing high organic matter. Organic matter levels of at least 4% result in a healthy soil with good structure. Mixing 2 bushels (2½ cubic feet) of packaged manure or compost annually per 100 sq. ft. will help increase organic matter levels, improve soil structure and water holding capacity, and provide a slow release source of nutrients. If your garden soil is high in organic matter (6% or more), you may not need any additional nitrogen beyond a starter fertilizer.

It is best to have soil tested before adding fertilizer, but if you have not been able to get it tested, broadcast 1–1½ lb. of a complete fertilizer (5-10-5, 6-12-6 or similar composition) per 100 sq. ft. in the spring before planting. Have the soil tested after two or three years of adding this fertilizer, to determine if phosphorous and potassium levels are getting too high. They are held tightly in soil, so they can build to very high levels with repeated fertilization, and a soil test is the only way of determining if levels are excessive.

Often, soil tests in South Dakota indicate a need only for nitrogen. If so, a lawn fertilizer such as 26-0-0 (be sure it is not a “weed and feed” product, which also contains herbicide) can be used, at a rate of about ¼ lb. (4 oz.)

per 100 sq. ft. Watch for nitrogen-deficiency symptoms when plants are about one foot tall, and have started to flower. If the plants are light green or the lower leaves become yellow but otherwise seem healthy, they are likely nitrogen deficient, and a small amount of fertilizer will be helpful. Apply about 1 tablespoon of urea (46-0-0) per plant. You can also use a lawn fertilizer such as a 27-3-3 (be sure it contains no herbicide!). Apply the fertilizer around the plant but about 6 inches away and water to move it into the soil. The tomato plant uses extra nitrogen when the fruit is just starting to ripen. Unless you suspect there is already too much nitrogen present, apply one tablespoon of nitrogen fertilizer (as described above) per medium-sized plant when the first fruits begin to redden. This extra nitrogen may increase fruit size at harvest.

Don't apply too much nitrogen! If the tomato leaves are very dark, almost black green, it may mean there is too much nitrogen in the soil. Excess nitrogen can lead to lush vegetative growth, but little fruit. The fruit may take longer to ripen, and the fruit may not have the desired sweetness and flavor. Too much nitrogen may also increase the amount of blossom end rot on the fruit (see below).

Mulching

Mulch may warm or cool the soil, decrease weeds, decrease water loss, and protect the plants from soil-borne diseases. Red or black plastic will increase soil temperatures and inhibit weed growth. Lay it on the ground a few days prior to planting to warm the soil. (For even more-rapid soil warming, clear plastic may be laid down 1 to 2 weeks in advance and removed prior to planting.) The ground should be moist and the surface smooth, so that the plastic makes good contact with the soil. Remember to tuck edges under the soil, so that the plastic doesn't blow away. At the time of planting, make a small “+” or “o” cut in the plastic and plant through it. If the plastic touches a tender seedling on a hot day, it can burn the stem. Some ways to avoid this problem are to use the paper collars suggested below for cutworms or to add organic mulch to shade any plastic touching the stems. Later in the season, the plastic may be covered with an organic mulch or painted with white latex paint to keep the soil from becoming too warm.

If you use an organic mulch (Fig. 1) instead of plastic, wait 4–6 weeks after planting to put it on the soil. Organic mulch applied right after transplanting keeps the

soil too cool and delays crop maturity. If you use a straw mulch, be sure it is free of weed seeds. Straw mulch may help repel certain aphids and thrips and attract spiders that eat troublesome insect pests. Always make sure the soil is thoroughly moistened before applying mulch.



Fig. 1 A good mulch layer can greatly reduce foliar diseases. Photo credit: David Graper, South Dakota State University

Most organic mulch should be about 2 ½–3 inches deep; otherwise, light will penetrate and weeds will come through. If the mulch compacts easily, as fresh lawn clippings do, it should be only ½–1 inch deep. At the end of the growing season, turn the mulch into the soil to provide organic matter.

Grass clippings can work well for mulch, but pay attention to the source. If the lawn was sprayed with a weed killer, the grass clippings may carry herbicide that can damage vegetable plants. Check the herbicide label to see when it is safe to use the clippings for mulch in a garden. Some herbicides will preclude the use of the clippings altogether.

Staking and Pruning

Tomato plants can be left on the ground, caged, or staked up. If left on the ground, some of the fruit may be lost to ground rot or damage from slugs. Staking or caging reduces rot and helps decrease the incidence of leaf blights. When plants are upright, the fruits are generally larger, cleaner, ripen earlier, and are easier to spray and harvest.

Indeterminate types of tomatoes can be pruned to one or two stems and tied directly to stakes or twine strung between stakes. To prune, remove all suckers (Fig. 2) up to the one immediately below the first flower cluster. (Removing suckers above the first flower cluster may

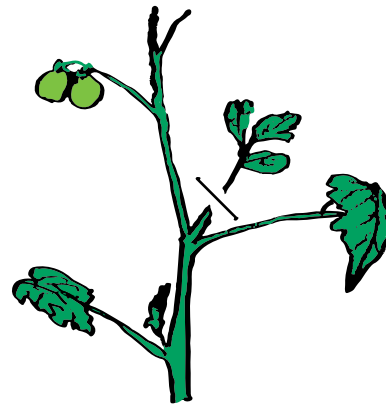


Fig. 2 To prune indeterminate-type tomatoes, remove sucker shoots below the first flower cluster only.

result in severe stunting and leaf curling.) It is easiest to remove suckers when they are 2–4 inches long.

An alternative to staking is the use of tomato cages (Fig. 1), which decrease the need for pruning—an advantage if you have had problems with sunburned fruit in the past, as there will be more leaves to shade the fruit. Cages or stakes must be large enough and sturdy enough to support a heavy plant laden with fruit. If you opt for a cage, check the openings; can you reach through and remove the ripened tomatoes?

Generally, no pruning is needed for determinate types of tomatoes. Depending on the vigor of the variety, they may be grown either without support, staked, or in cages.

Whatever method of plant support you use, the idea is to keep the fruit clean and have good air circulation around the plant, reducing the incidence of leaf diseases such as Septoria leaf spot and early blight, and possibly reducing fruit cracking as well.

Cultivating and Controlling Weeds

Weeds compete with the tomato plant for water, nutrients, and sunlight. Weeds also tend to block air movement and increase humidity around plant leaves, encouraging the risk of leaf diseases.

Early cultivation is a good way to eliminate weeds. Cultivations can be close to the plant for the first 2–3 weeks after planting. As the plant grows and the root system expands, cultivation should become shallower and farther away from the plants. Pulling young weeds or mulching rather than hoeing will avoid damage to the tomato root systems. Pre-emergent herbicides may only be used *if they list garden vegetables and tomatoes on*

the product label and are applied according to the label instructions.

Watering

You will need to adequately moisten the entire root zone of fully grown tomato plants with at least 1 inch of water each week (depending on local soil, temperatures, wind and rainfall). Check to see that the water is penetrating deep (8 to 10 inches) into the soil. A light application of water every day or two may not adequately moisten the root zone and will encourage shallow rooting and increase stress related injuries.

Blossom end rot

One of the most frequent tomato problems home gardeners observe is dry, brown to black, leathery, scale-like blemishes on bottom of the fruit (Fig. 3). This is known as blossom end rot and is caused not by a disease, but by an inability of the plant to supply enough calcium to the developing fruit. The disorder is more common in early fruit, as water containing calcium is directed toward leaf growth rather than fruit. Adding calcium to the soil will not help, as calcium is not usually deficient in South Dakota soils; rather, the problem is that roots are unable to absorb it quickly enough or distribute it uniformly. (An exception to this is plants that are grown in a potting soil in containers; these may need to be supplemented with calcium, since potting soils may not have enough calcium.) Often only early fruit will show the symptoms, as this is when the leaves are most actively competing with the fruit. Varieties differ in their susceptibility; so if you have had problems in the past, you may want to try a different variety. Determinate types tend to be more susceptible, since all the fruit sets at once. Using a mulch around the plant can help even out the moisture levels in the soil and



Fig. 3 Blossom end rot is a dry rot that often affects the first tomatoes borne on a plant.

help facilitate calcium uptake to decrease this problem.

See SDSU Extension publication P-00083 “Blossom End Rot on Tomatoes and Other Vegetables” for further information: <https://extension.sdstate.edu/blossom-end-rot-tomatoes-and-other-vegetables>

Insects and Diseases

Diseases of tomatoes include wilts, leaf spots, blight, fruit spots, rots, viruses, after-harvest diseases, and mechanical or insect damage. The following are recommendations to reduce insect and disease problems:

- Buy healthy, disease-free plants.
- Look for disease-resistant varieties. These are often designated on the label or catalogue description by letters:
 - V – Verticillium wilt
 - F – Fusarium wilt
 - N – Root knot Nematode
 - T – Tobacco mosaic virus
 - TSWV – Tomato Spotted Wilt Virus
- Rotate to a new planting area each year. Don’t plant where tomatoes, potatoes or peppers were last year.
- To prevent cutworm damage, wrap the tomato stem at transplanting with 3-inch-wide wax paper or cardboard. Bury half the paper in the ground and leave the other half aboveground.
- Keep the plant off the ground for good air circulation.
- Use mulch to form a barrier between the aboveground plant parts and the soil, which can harbor disease-causing organisms.
- Do not overcrowd the plants.
- Keep the area weed free.
- Avoid heavy nitrogen applications.
- Avoid wetting the leaves when watering. Use a drip irrigation system or soaker hose. If using a sprinkler, water in the morning so the plant leaves are dry by the time the sun goes down. This will decrease humidity around the plant and will help reduce foliar diseases.
- To avoid blossom end rot, keep the soil evenly moist throughout the root zone.
- At the end of a growing season, remove plant debris from the garden and either compost or discard. If the plants have been diseased, discard them—do not compost them.

Common Leaf Diseases

Does your plant have spots or blotches on the leaves? It may have one of the three most prevalent tomato diseases in South Dakota: early blight, Septoria leaf spot, and late blight. The first two cause leaf spots to form first on the lowest, oldest leaves and progress upward. Infected leaves become yellow around the spots, shrivel, and die. Early and late blight may also infect the fruit, while Septoria does not. Septoria will become noticeable around the time of fruit set, while early blight may begin earlier or later.

Septoria (Fig. 4) has small, numerous, dark leaf spots that frequently have white or gray centers. **Early blight** (Fig. 5) leaf spots are larger, darker, and may exhibit a target pattern, formed of concentric rings of dried tissue. Early blight causes a somewhat leathery fruit rot (Fig. 6), which usually starts at the stem end – thus helping distinguish it from blossom end rot. The fruit rot may or may not have a target pattern. Early blight can also infect potato leaves and tubers.

Tomato leaves with **late blight** develop irregular greasy-appearing grayish or dark areas, which expand rapidly in cool wet weather. The lesion borders are usually less distinct than with Septoria or early blight, and may also be on the stems. (Despite the name, late blight usually appears earlier in the season than early blight, as it thrives in cool moist weather.) The fruit may also be infected, causing dark “greasy” appearing lesions that may spread over the entire fruit, often followed by a soft rot.

These diseases can be controlled, or at least slowed, by timely applications of fungicides. *Make sure that tomatoes are on the label of whatever fungicide you use, and follow the directions carefully.* Removing infected leaves will also help slow progress of the disease, as will keeping the foliage dry (don't sprinkler irrigate). Mulches will help decrease infections initiated from soil splashed on the foliage, and good air circulation will restrain disease progress.

Removing all tomato plant debris at the end of the season will greatly decrease any overwintering source of early blight or Septoria. Early blight and late blight can also infect potatoes and overwinter on tubers left in or on the ground; so be sure to remove these from your garden in the fall.

In the past few years, breeders have worked diligently



Fig. 4 Septoria Leaf Spot is a very common disease on tomatoes. Photo Credit: Michelle Grabowski, Univ. of Minn.



Fig. 5 Early blight on tomatoes. Note the concentric patterns in the spots. Photo Credit: Michelle Grabowski, Univ. of Minn.



Fig. 6 Early blight infection of fruit. Note it tends to be on the stem end. Photo Credit: Michelle Grabowski, Univ. of Minn.

to develop cultivars with resistance to the above diseases, with some success, especially with late blight. Breeders have not been able to develop tomatoes that are resistant to early blight, but they have been able to create some cultivars with “tolerance”, meaning some infection will still be present, though usually reduced in severity. “Iron Lady” is very resistant to late

blight, resistant to Septoria, and tolerant to early blight. "Mountain Merit", "Mountain Magic", "Lemon Drop", "Jasper," "Plum Regal," and "Defiant PHR" all have fairly good resistance to late blight, but of these, only "Jasper" is also resistant to Septoria. "Mr. Stripey" is an heirloom variety with some resistance to late blight. Don't rely on decades-old descriptions of resistance: a number of heirloom types had resistance to older types of these diseases, but not to the races that are currently prevalent in the U.S.

Other diseases

Many varieties are resistant to Fusarium or Verticillium wilts, tobacco mosaic virus, or root-knot nematodes. The most effective means of controlling these diseases is the planting of resistant varieties. Look on the label or in the variety description for "F", "V", "T", or "N," which indicate resistance to Fusarium, Verticillium, tobacco mosaic virus, or nematodes, respectively.

Tomato Spotted Wilt Virus (TSWV) is an occasional problem in South Dakota. Symptoms include concentric circles of color on the fruit (Fig. 7). Leaf symptoms can be more difficult to discern, but leaves may exhibit small brown circle with green centers, as well as a general bronzed tinge to the upper foliage. New shoots may turn brown and shrivel. The virus is transferred by thrips, which thrive in hot dry weather in late spring and early summer. Several resistant tomato varieties have been introduced in recent years; if you have had problems with TSWV in past years, look for them. Removing an infected plant is the only treatment. The affected fruit is not poisonous (the virus infects only plants), but may not be very edible, and should not be used in canning.



Fig. 7 TSWV-infected fruit.

If you are uncertain what disease may be affecting your plant, bring a representative sample to your local Master Gardener. High quality photos can also be useful in diagnosis. The SDSU Plant Diagnostic Clinic can also assist you with a diagnosis on a fee basis.

Other problems

Herbicide damage

Damage by 2,4-D and similar growth regulator herbicides such as dicamba, MCPP, MCAA, etc., is quite common. Symptoms include distorted thickened leaves and stems (Fig. 8). The fruit may also be misshapen. Damaged plants should be destroyed, as the fruit may contain chemical residues. Tomatoes are very sensitive to these chemicals and may be easily damaged by even small amounts drifting in from nearby areas, use of a contaminated sprayer, or even volatilization from a treated area on a hot day. As noted above, if you use grass clippings from a recently treated lawn to mulch tomatoes, you could also end up with herbicide damage. To avoid this problem, check the herbicide label to see when clippings will be safe to use.



Fig. 8 Exposure to herbicides can cause thick, rubbery, misshaped leaves.

Catfacing and cracking

Catfacing (Fig. 9) in tomatoes refers to the crevices, lumps, or scars that sometimes form on the blossom end of tomato fruit, particularly those that first form on a plant. Cool weather during early blossom formation (before flower buds are visible) or 2,4-D herbicide injury are common causes. Excessive nitrogen may make the problem worse. Varieties differ in their susceptibility, with large-fruited heirloom varieties tending to be more susceptible. While commercial value or aesthetic appeal may be decreased, the eating quality is not— affected areas can simply be trimmed away.



Fig. 9 Catfacing can result from herbicides or from cool weather as the blossom are just beginning to be formed. Varieties differ in their susceptibility to this problem. Photo Credit: Michelle Grabowski, Univ. of Minn.

Cracking is a related problem. Both concentric cracks around the stem end and lateral cracks (from the stem to the blossom end) may be caused by severe fluctuations in moisture or temperatures. Loss of foliage due to disease may worsen cracking. Again, some varieties are more susceptible, although even highly resistant cultivars may develop cracks when grown under the right (or wrong) conditions.

Harvest and storage

It takes about 30 days from bloom until the fruit is full-sized and begins to ripen. Tomatoes can be picked when they turn pink or light red, or they can be left on the plant until fully ripe. Picked fruit can be ripened inside the home or in a garage or basement. Place the fruit stem-side down on a layer of newspaper in a cool location. Cover with another layer of paper on top. Do not stack more than three layers of fruit. Store at about 60°F. Tomatoes treated in this manner may ripen faster than they would outdoors during cool weather. It's a good idea to check the fruit on a regular basis and discard any rotting ones before they contaminate other fruit. *Do not place the fruit in a sunny window*—this will shorten shelf life and actually delay ripening, and the fruit will often be damaged by the direct sun.

Do not refrigerate tomatoes! The cold temperature will ruin the flavor and texture of the fruit.

For more information

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