



Growing Tomatoes

in the Home Garden

South Dakota Extension Fact Sheet 915

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Few vegetables inspire gardeners more than home-grown tomatoes, bursting with vine-ripe flavor. Tomatoes are the most widely used vegetable in the world, and U.S. annual consumption of them is over 90 lbs per person, including both fresh and processed products. Nutritionally, they are excellent sources of vitamins A and C, as well as cancer-fighting lycopenes.

Tomatoes originated in South America and slowly spread northward. The native peoples of Mexico, who have grown the plant for food since prehistoric times, named the fruit “tomati.” Tomatoes were carried back to Europe in the 1500s by Spanish and Portuguese explorers, who used them for food. However, English settlers in North America grew tomatoes solely as ornamentals, because they considered the fruit (known to them as “love apples”) poisonous. Not until the mid-1800s did Americans overcome this misconception and embrace tomatoes as a food source.

GARDENING IN SOUTH DAKOTA

by Rhoda Burrows and David Graper,
Extension horticulturists,
SDSU Horticulture, Forestry, Landscape,
and Parks Department

Types of Tomatoes

Although we are most familiar with varieties that produce deep red fruit, tomatoes may be red, yellow, pink, purplish-black, white, or even green at maturity, depending on the variety. Fruit shape varies from pear to long and rectangular to almost flat or round. Size can range from that of a grape to a grapefruit.

Determinate vs. indeterminate Tomatoes are classified by their growth habit. Shoot growth of *determinate* types is ended by the formation of flower clusters at the shoot tips. This results in a flush of fruit forming and ripening all at once; an advantage if you plan to preserve the produce but not if you want a steady supply of fresh fruit over a long time. Determinate plants tend to be smaller, so they work well for containerized plants (some are even called “patio” hybrids). The flower clusters of *indeterminate* plants are formed along the sides of the shoots, so that vegetative growth and flowering continue until frost. Indeterminate types ideally should be staked or caged for support, although they can be left to sprawl. Most tomato types send out shoots in the leaf axils as they develop, so this is not a distinguishing feature between the two types. Some varieties are called *semi-determinate*; as the name suggests, growth habit is intermediate between determinate and indeterminate types.

Variety selection The number of varieties available to home gardeners can be overwhelming, especially if gardeners are willing to start their own plants from seed. Varieties fall into several fruit types, based on size (e.g., grape, cherry, or beefsteak), use (paste, slicer), or even shape (pear). Tomatoes may also be classified by their time to harvest 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..



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Older varieties are often known as “heirlooms,” passed down through generations (of both plants and people) often because of their superior flavor. “Brandywine” is perhaps the most well known heirloom type. Seed catalogues are beginning to carry more of these heirloom varieties. At the same time, they offer newer varieties bred for disease resistance, shape, and resistance to cracking and catfacing.

Culture

Temperature

Tomatoes are warm-season plants. Maximum production requires clear and dry weather with uniformly 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. They are not frost-tolerant.

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. No new fruit will set, and existing fruit will not redden properly if the night temperatures stay above 85° F. At temperatures above 95° F, the fruit does not increase in size and will not color properly.

Claims for a number of products on the market are that they can increase fruit set. These products contain cytokinin and mimic natural plant hormones. They may increase blossom *retention*, but they do not affect pollen *formation* and *pollination*. Thus, treated plants may set some fruit but lack proper seed formation, resulting in misshapen fruit that is also uncharacteristically pasty in texture.

Soil

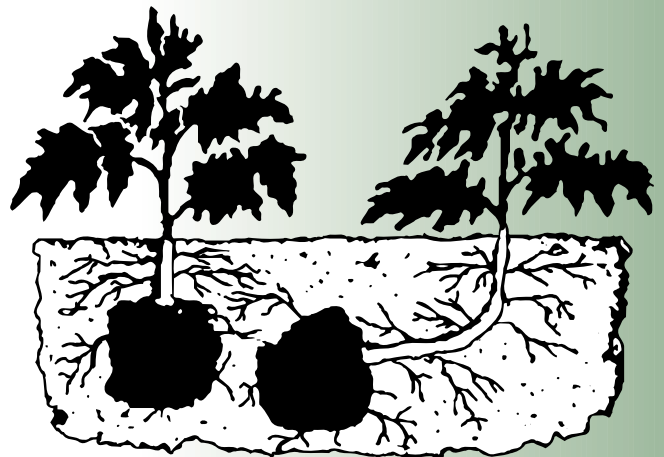
Tomatoes will grow in nearly all types of soils. A light, well-drained, fertile soil high in organic matter is best for producing early, high quality fruit. Tomatoes grow well in a soil pH of 5.5 to 7.8.

Planting

Because of our relatively short growing season, successful tomato production in South Dakota requires the use of transplants. Transplant tomatoes after the last frost date in your area, unless you are using one of the protective devices discussed later. 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 good foliage color. 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 be significantly reduced.

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. If temperatures drop to near freezing, bring the plants indoors for the night. 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 in a 5-6 inch deep furrow, cover 1/2 to 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. You can use diluted starter fertilizer solution for this purpose.



Place the plants deep enough so that the bottom leaf is no more than 2-3 inches from the soil. Leggy plants can be placed at a angle to allow roots to form along the lower portion of the stem (lower leaves should be removed if that portion of the stem is placed under the 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. Most home gardeners plant tomatoes in 3-foot rows with plants 2-3 feet apart within the row. Generous spacing will help decrease foliar and fruit diseases.

Frost Protection

If you try to get a jump on spring by planting your tomatoes before the last spring frost 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, usually old coffee cans or plastic milk jugs. However, if a container is left over the plant during the day, it may collect so much heat that the plant will be damaged. The container also may restrict growth as the plant becomes larger. Heavy, fruit laden branches may break if they are growing over the edge of a container. 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.

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 reduce acidity levels to a point where the canned fruit is easily contaminated by bacteria that may survive the canning process.

If frost is expected in your area, it is better to pick all fruit, including mature green fruit. Covering plants with a blanket or sheet will protect only from a light frost. Fruit left on a frosted plant will develop very slowly and may not ripen.

Fertilizing

It is best to have soil tested in the spring before adding fertilizer. Lacking a soil test, broadcast 1-1.5 lb of a complete fertilizer (5-10-5, 6-12-6 or similar composition) per 100 sq ft in the spring before planting.

Watch for nitrogen deficiency symptoms when plants are 10-15 inches tall. Nitrogen deficiency is possible even though you applied fertilizer because nitrogen can leach out of soil with heavy rain or excessive watering. If the plants are light green or if the lower leaves become yellow, they are probably deficient, and a small amount of a nitrogen 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 that does not contain a weed killer. Apply the fertilizer around the plant but about 6 inches away and water to move it into the soil.

If the tomato plants are very dark, almost black green, it means there is too much nitrogen in the soil. Excess nitrogen will encourage vegetative growth and flowering but little fruit. This results in reduced yield and delayed crop maturity, and the fruit that does ripen will often not develop the desired sweetness and flavor.

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 per plant (as described above) when the first fruits begin to redden. Repeat two weeks later. This extra nitrogen may increase fruit size at harvest.

Generally, phosphorus and potassium levels do not change in the soil from year to year since these minerals are held tightly in soil and do not leach out with water. Because they are not lost from soil they can build to very high levels with annual fertilization. A soil test is the only way of determining excessive phosphorus and potassium levels.

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 of packaged manure or compost annually per 100 square feet will help to increase organic matter levels, improve soil structure and water holding capacity, and supply a slow-release source of nutrients.

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 one to two 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 fly 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 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 is said to repel certain aphids and thrips and to attract spiders that eat other troublesome insect pests.

Sometimes people spread grass clippings as mulch. If the lawn has been sprayed with a weed killer, wait until after the fourth mowing to collect clippings for mulch.

Most organic mulch should be about 2 1/2 to 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 1/2" to 1" deep. At the end of the growing season, turn the mulch into the garden to provide organic matter to the soil.

Staking

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 (ground spot) or damage from slugs. Staking or caging reduces ground rot and also decreases incidence of leaf blights. When plants are raised, the fruits are generally larger, ripen earlier, and are easier to spray, pick, and clean.

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 (see figure) up to the one immediately below the first flower cluster. (Removing suckers above the first flower cluster may result in severe stunting and leaf curling.) It is easiest to remove suckers when they are 2 to 4 inches long.

An alternative to staking is the use of tomato cages, 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 tomato?

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 plants. Staking or caging, pruning, and/or mulching can reduce various leaf diseases like Septoria leaf spot and early blight, and can possibly reduce fruit cracking as well.

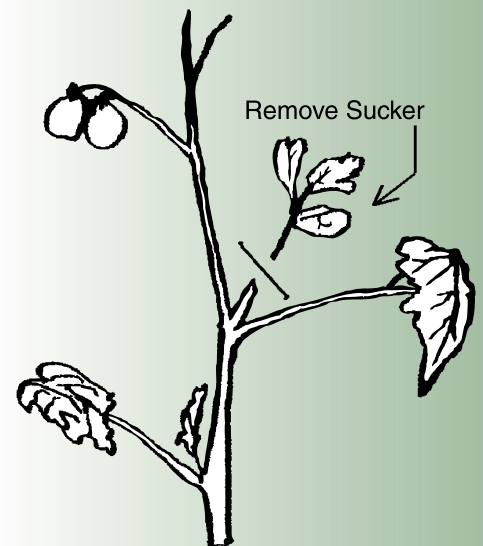
Cultivating and Controlling Weeds

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 weeds or mulching 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.



Tomatoes are often set into plastic mulch. Keep the plastic from direct contact with the stem, as burning can result on a hot day.



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

Watering

You will need to adequately moisten the entire root zone of fully grown tomato plants with at least one inch of water each week (depending on local soil and climate). Check to see that the water is penetrating deep 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 the blossom end of the fruit. This is known as blossom end rot, caused 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 the fruit. Adding calcium to the soil will not help, since it is not usually deficient in South Dakota soils; rather, the problem is that roots are unable to uptake it quickly enough or distribute it uniformly. Often only early fruit will show the symptoms, since 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.

*See South Dakota Extension publication FS909
"Blossom End Rot of Tomatoes and Other Vegetables"
for further information.*

*FS909 is also available online at:
<http://agbiopubs.sdstate.edu/articles/FS909.pdf>*

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.
- Rotate to a new planting area each 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 above ground.
- Keep the plant off the ground for good air circulation.
- Use mulch to form a barrier between the above-ground plant parts and the soil, which can harbor disease-causing organisms.
- Do not overcrowd the plants.
- Keep the planting area and the surrounding area weed free.
- Avoid heavy nitrogen applications. Instead, promote good growth by proper cultural methods.
- Avoid wetting the leaves when watering. If possible, 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, attempt to 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.

The three most common tomato diseases are early blight, Septoria leaf spot, and late blight. The first two are similar in appearance: both cause leaf spots to form on the lowest, oldest leaves and progress upward. Infected leaves yellow, shrivel, and die. Septoria leaf spots are small, numerous, dark spots that frequently have white or gray centers (thus the disease is sometimes also known as gray leaf spot). Early blight leaf spots are larger, darker, and may exhibit a target pattern, formed of concentric rings of dried tissue. Septoria will become noticeable around the time of fruit set, while early blight may be present during all stages. Tomato leaves with late blight develop irregular greasy-appearing grayish or dark areas, which expand rapidly in cool wet weather. The fruit may also be infected. (Despite the name, late blight usually appears earlier in the season than early blight.)

These three diseases can be controlled, or at least slowed, by timely applications of fungicides. 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. There is at least one tomato variety, "Mountain Fresh," that is said to have some resistance to early blight; but for the most part growers will have to rely on cultural and chemical controls for these leaf 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, or nematodes, respectively.

Contact your local county Extension office for further assistance with disease or insect control.

Other problems

Herbicide damage: Damage by 2,4-D and similar growth regulator herbicides such as MCPP, dicamba, MCAA, etc., is quite common. Symptoms include distorted thickened leaves and stems. The fruit may also be misshapen (see below). Damaged plants should be destroyed, as the fruit could 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. And if you use grass clippings from a recently treated lawn to mulch tomatoes, you could end up with herbicide damage. To avoid this problem, wait until after fourth mowing after herbicide treatment before using the clippings for mulch in the garden.

Catfacing and cracking: Catfacing 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 exacerbate the problem. Varieties differ in their susceptibility, with large-fruited 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.

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.



Exposure to herbicides can cause thick rubbery, misshapened leaves.

Harvest and storage

From bloom until the fruit is full-sized and begins to ripen is about 30 days. 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 3 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.



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.

For more information, see:

ExEx 8021 Garden Insect Control,

<http://agbiopubs.sdstate.edu/articles/ExEx8021.pdf>

EC 668 Vegetable Gardening,

<http://agbiopubs.sdstate.edu/articles/EC668.pdf>

FS909 Blossom End Rot of Tomatoes and Other Vegetables,

<http://agbiopubs.sdstate.edu/articles/FS909.pdf>



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