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HOME & GARDEN INFORMATION CENTER

Tomato Diseases & Disorders

Tomatoes (*Solanum lycopersicum*) can be grown on almost any moderately well-drained soil type. A good supply of organic matter can increase yield and reduce production problems. Tomatoes and related vegetables, such as potatoes, peppers and eggplants, should not be planted on the same land more than once in three years. Ideally, any cover crop or crop preceding tomatoes should be members of the grass family. Corn, an excellent rotation crop with tomatoes, supplies large amounts of organic matter and does not promote the growth of disease organisms that attack tomatoes. Certified seeds and plants are recommended and should be used whenever possible.

Bacterial Wilt

Bacterial wilt or Southern bacterial blight is a serious disease caused by *Ralstonia solanacearum* (formerly *Pseudomonas solanacearum*). This bacterium survives in the soil for extended periods and enters the roots through wounds made by transplanting, cultivation or insects and through natural wounds where secondary roots emerge.

Bacterial wilt (*Ralstonia solanacearum*) causing a rapid wilting of tomato plants.
Zachary Boone Snipes, ©2015 Clemson Extension

Disease development is favored by high temperatures and high moisture. The bacteria multiply rapidly inside the water-conducting tissue of the plant, filling it with slime. This results in a rapid wilt of the plant, while the leaves stay green. If an infected stem is cut crosswise, it will look brown and tiny drops of yellowish ooze may be visible.

Prevention & Treatment: Control of bacterial wilt of plants grown in infested soil is difficult. Rotation with non-susceptible plants, such as corn, beans and cabbage, for at least three years provides some control. Do not use pepper, eggplant, potato, sunflower or cosmos in this rotation. Remove and destroy all infected plant material. Plant only certified disease-free plants. The cultivar Kewalo is partially resistant to bacterial wilt, but is an uncommon cultivar. Chemical control is not available for this disease.

Early Blight

This disease is caused by the fungi *Alternaria tomatophila* and *A. solani* and is first observed on the plants as small, brown lesions mostly on the older foliage. Spots enlarge and concentric rings in a bull's-eye pattern may be seen in the center of the diseased area. Tissue surrounding the spots may turn yellow. If high temperature and humidity occur at this time, much of the foliage is killed. Lesions on the stems are similar to those on leaves and sometimes girdle the plant if they occur near the soil line (collar rot). On the fruits, lesions attain considerable size, usually involving nearly the entire fruit. Concentric rings are also present on the fruit. Infected fruit frequently drops.

Early blight (*Alternaria solani*) on tomato foliage.
Joey Williamson, ©2012 HGIC, Clemson Extension

The fungus survives on infected debris in the soil, on seed, on volunteer tomato plants and other solanaceous hosts, such as Irish potato, eggplant, and black nightshade.

Prevention & Treatment: Use resistant or tolerant tomato cultivars. Use pathogen-free seed and do not set diseased plants in the field. Use crop rotation, eradicate weeds and volunteer tomato plants, space plants to not touch, mulch plants, fertilize properly, don't wet tomato plants with irrigation water, and keep the plants growing vigorously. Trim off and dispose of infected lower branches and leaves.

To reduce disease severity, test the garden soil annually and maintain a sufficient level of potassium. Side dress tomato plants monthly with calcium nitrate for adequate growth.

If disease is severe enough to warrant chemical control, select one of the following fungicides: mancozeb (very good); chlorothalonil or copper fungicides (good). Follow the directions on the label. See Table 1 for examples of fungicide products for home garden use. See Table 2 for tomato cultivars with resistance or tolerance to early blight.

Late Blight

Late blight is a potentially serious disease of potato and tomato, caused by the fungus *Phytophthora infestans*. Late blight is especially damaging during cool, wet weather. The fungus can affect all plant parts. Young leaf lesions are small and appear as dark, water-soaked spots. These leaf spots will quickly enlarge and a white mold will appear at the margins of the affected area on the lower surface of leaves. Complete defoliation (browning and shriveling of leaves and stems) can occur within 14 days from the first symptoms. Infected tomato fruits develop shiny, dark or olive-colored lesions, which may cover large areas. Fungal spores are spread between plants and gardens by rain and wind. A combination of daytime temperatures in the upper 70s °F with high humidity is ideal for infection.

Prevention & Treatment: The following guidelines should be followed to minimize late blight problems:

- Keep foliage dry. Locate your garden where it will receive morning sun.
- Allow extra room between the plants, and avoid overhead watering, especially late in the day.
- Purchase certified disease-free seeds and plants.
- Destroy volunteer tomato and potato plants and nightshade family weeds, which may harbor the fungus.
- Do not compost rotten, store-bought potatoes.
- Pull out and destroy diseased plants.
- If disease is severe enough to warrant chemical control, select one of the following fungicides: chlorothalonil (very good); copper fungicide, or mancozeb (good). See Table 1 for examples of fungicide products for home garden use. Follow the directions on the label.
- Plant resistant cultivars. See Table 3 for tomato cultivars with resistance to late blight.

Septoria Leaf Spot

This destructive disease of tomato foliage, petioles and stems (fruit is not infected) is caused by the fungus *Septoria lycopersici*. Infection usually occurs on the lower leaves near the ground, after plants begin to set fruit. Numerous small, circular spots with dark borders surrounding a beige-colored center appear on the older leaves. Tiny black specks, which are spore-producing bodies, can be seen in the center of the spots. Severely spotted leaves turn yellow, die and fall off the plant. The fungus is most active when temperatures range from 68 to 77° F, the humidity is high, and rainfall or over-head irrigation wets the plants. Defoliation weakens the plant, reduces the size and quality of

the fruit, and exposes the fruit to sunscald (see below). The fungus is not soil-borne, but can overwinter on crop residue from previous crops, decaying vegetation and some wild hosts related to tomato.

Septoria leaf spot (*Septoria lycopersici*) on tomato.
Joey Williamson, ©2013 HGIC, Clemson Extension

Prevention & Treatment: Currently grown tomato cultivars are susceptible to Septoria leaf spot. Crop rotation of 3 years and sanitation (removal of crop debris) will reduce the amount of inoculum. Do not use over-head irrigation. Repeated fungicide applications with chlorothalonil (very good) or copper fungicide, or mancozeb (good) will keep the disease in check. See Table 1 for examples of fungicide products for home garden use.

Leaf Mold

The fungus *Passalora fulva* causes leaf mold. It is first observed on older leaves near the soil where air movement is poor and humidity is high. The initial symptoms are pale green or yellowish spots on the upper leaf surface, which enlarge and turn a distinctive yellow.

Leaf mold (*Passalora fulva*) on tomato foliage.
Joey Williamson, ©2012 HGIC, Clemson Extension

Under humid conditions the spots on the lower leaf surfaces become covered with a gray, velvety growth of the spores produced by the fungus. When infection is severe, the spots coalesce, and the foliage is killed. Occasionally, the fungus attacks stems, blossoms and fruits. Green and mature fruit can have a black, leathery rot on the stem end.

Leaf mold (*Passalora fulva*) on lower leaf surface.
Joey Williamson, ©2012 HGIC, Clemson Extension

The fungus survives on crop residue and in the soil. Spores are spread by rain, wind or tools. Seeds can be contaminated. The fungus is dependent on high relative humidity and high temperature for disease development.

Prevention & Treatment: Crop residue should be removed from the field. Staking and pruning to increase air circulation helps to control the disease. Avoid wetting leaves when watering. Rotate with vegetables other than tomatoes. Using a preventative fungicide program with chlorothalonil, mancozeb or copper fungicide, can control the disease. See Table 1 for fungicide products for home garden use.

Bacterial Spot

This disease is caused by the bacterium *Xanthomonas vesicatoria*, which attacks green but not red tomatoes. Peppers are also attacked. The disease is more prevalent during wet seasons. Damage to the plants includes leaf and fruit spots, which result in reduced yields, defoliation and sun-scalded fruit. The symptoms consist of numerous small, angular to irregular, water-soaked spots on the leaves and slightly raised to scabby spots on the fruits. The leaf spots may have a yellow halo. The centers dry out and frequently tear.

Bacterial Spot (*Xanthomonas vesicatoria*) symptoms on tomato leaves.
Zachary Boone Snipes, ©2015 Clemson Extension

The bacteria survive the winter on volunteer tomato plants and on infected plant debris. Moist weather is conducive to disease development. Most outbreaks of the disease can be traced back to heavy rainstorms that occurred in the area. Infection of leaves occurs through natural openings. Infection of fruits must occur through insect punctures or other mechanical injury.

Bacterial spot is difficult to control once it appears in the field. Any water movement from one leaf or plant to another, such as splashing rain drops, overhead irrigation, and touching or handling wet plants, may spread the bacteria from diseased to healthy plants.

Prevention & Treatment: Only use certified disease-free seed and plants. Avoid areas that were planted with peppers or tomatoes during the previous year. Avoid overhead watering by using drip or furrow irrigation. Remove all diseased plant material. Prune plants to promote air circulation. Spraying with a copper fungicide will give fairly good control the bacterial disease. Follow the instructions on the label. See Table 1 for fungicide products for home garden use.

Buckeye Rot

Buckeye rot is a disease of the fruit caused by the fungus *Phytophthora parasitica*. The first fruit symptoms appear as brownish spots, often at the point of contact between the fruit and the soil. As the spots enlarge, dark, concentric rings can be seen. Lesions of buckeye rot resemble those of late blight, except that the former remain firm and smooth, whereas late blight lesions become rough and are slightly sunken at the margins. Under moist conditions, a white, cottony fungal growth appears on the buckeye rot lesions. With time, the entire fruit will rot. The fungus does not affect the foliage. The disease is most common during periods of prolonged warm, wet weather and in poorly drained soils. The fungus survives in the soil and is spread by surface water and rain. Peppers are also susceptible to this disease.

Prevention & Treatment: Avoid compacted, poorly drained soils (grow plants in raised beds). Rotation, sanitation, staking and mulching will help reduce the disease. Fungicide sprays with chlorothalonil, mancozeb, or copper fungicides will give fairly good control of buckeye rot. See Table 1 for examples of fungicide products for home garden use.

Anthracnose

Anthracnose on tomatoes is caused by the fungus *Colletotrichum coccoides,* which is primarily a pathogen of the tomato fruit. As the fruit are ripening, the symptoms first become noticeable as small, circular indented areas, which later develop darkened centers. The diseased spots continue to grow larger with time as each infection site also spreads deeper into the fruit. With warm, moist and humid weather (from rainfall or over-head irrigation) the fungus produces salmon-colored spores that are exuded from the black fungal material in the center of the spots. These spores are spread by splashing water.

Anthracnose (*Colletotrichum coccoides*) on tomato fruit.
Joey Williamson, ©2013 HGIC, Clemson Extension

Prevention & Treatment: Purchase disease free seed, as the fungus that causes anthracnose of tomato may be within the seed. Tomato seed may be treated by soaking them in hot water (122 ºF) for 25 minutes to destroy the fungus. Some varieties of tomatoes have resistance to anthracnose, such as Chef's Choice Orange Hybrid.

Do not over-head irrigate tomatoes, as splashing water aids in the spread of fungal spores. Plant the garden in a sunny site and stake or cage tomato plants to provide better air movement and leaf drying conditions. Keep the garden weed free, as the presence of weeds may raise humidity levels around plants and slow drying conditions.

Because this disease affects other plants in the tomato family (Solanaceae), such as eggplants and peppers, the site for the tomatoes should not be planted again with solanaceous plants for at least a year. Some weeds that infest the garden are also in the same family, which is another reason to keep the garden free of weeds. Fungal spores can remain in the soil to infect plants the following year. Mulching the garden helps create a barrier between the soil surface and the fruit to reduce infections.

Some insects feed on ripe fruit, such as leaf-footed plant bugs and stink bugs. Their feeding punctures the skin of the fruit and allows the fungus to infect. Harvest tomato fruit daily as soon as they are ripe. Remove and destroy crop debris as soon as the crop has finished bearing. Do not add debris to compost.

Fungicide sprays can help reduce disease. Products containing chlorothalonil can be sprayed weekly to reduce infection. Follow label directions. There is a one day waiting period between spraying and picking. See Table 1 for examples of products containing this active ingredient.

Fusarium Wilt

This is a warm-weather disease caused by the fungus *Fusarium oxysporum*. The first indication of disease in small plants is a drooping and wilting of lower leaves with a loss of green color followed by wilting and death of the plant. Often leaves on only one side of the stem turn golden yellow at first. The stem of wilted plants shows no soft decay, but when cut lengthwise, the lower stem will have a dark brown discoloration of the water-conducting vessels. The fungus is soil-borne and passes upward from the roots into the water-conducting system of the stem. Blocking of the water-conducting vessels is the main reason for wilting. Invasion occurs through wounds in roots growing through infested soil. Long-distance spread is through seed and transplants.

Prevention & Treatment: Control can be obtained by growing plants in pathogen-free soil, using disease-free transplants and growing only cultivars at least resistant to races 1 and 2 of Fusarium wilt (indicated by FF following the tomato cultivar name). Some newer cultivars are resistant to races 1, 2 and 3, and can be found listed in Table 4. Raising the soil pH to 6.5 - 7.0 and using nitrate nitrogen (such as in calcium nitrate) rather than ammoniacal nitrogen (as in 5-10-10, 10-10-10, or 34-0-0) will retard disease development. No chemical control is available.

Southern Blight

The fungus *Sclerotium rolfsii* causes this disease. The first symptom is drooping of leaves suggestive of other wilts. On the stems, a brown, dry rot develops near the soil line. White fungal growth with brown mustard seed-sized sclerotia may be visible. The stem lesion develops rapidly, girdling the stem and resulting in a sudden and permanent wilt of all aboveground parts. Frequently, a white fungal mat covers the lesions. The fungus can also attack fruits where they touch the soil.

The fungus can survive for years in soil and plant debris. It is favored by moist conditions and high temperatures.

Sclerotia and mycelium of (*Sclerotium rolfsii*) on the base of a tomato plant.
Zachary Boone Snipes, ©2015 Clemson Extension

Prevention & Treatment: Crop rotation with non-susceptible grass crops and removal of plant debris immediately after harvest will help to control the disease. Do not plant tomatoes after beans, pepper or eggplant. Calcium nitrate may be applied at transplanting.

Seedling Disease (Damping-off)

The fungi *Pythium* and *Rhizoctonia* cause damping-off of tomato seedlings. Seedlings fail to emerge in the greenhouse or small seedlings wilt and die soon after emergence or transplanting. Surviving plants have water-soaked areas on the stem close to the soil line.

Prevention & Treatment: Damping-off is often a problem in plants that are planted too early in the spring. The fungi are more active in cool, wet, rich soils. To prevent damping-off, take these precautions:

- Start seeds indoors in sterilized potting mix.
- Do not start seeds in soil that has a high nitrogen level. Add nitrogen fertilizer after the seedlings have produced their first true leaves.
- Allow the surface of the soil to dry between waterings.

Tomato Spotted Wilt Virus (TSWV)

TSWV is spread by a tiny insect called thrips, which acquires the virus by feeding on one of many infected weed or ornamental hosts, and then spreads it to the developing tomato plants. Several weeks after transplanting the tomato plants into the garden, random plants may appear stunted, and younger leaves may be marked with bronze or dark spots, or have prominent purple veins. Often the upper foliage will become twisted and cupped as the bronze areas expand. Fruits may have yellow spots. Younger plants may wilt and die, but older plants may survive and bear discolored fruit that may not fully ripen.

Prevention & Treatment: Eliminating weeds in the garden is the first step in reducing the chance of acquiring TSWV. Keeping the grass and weeds mowed in areas surrounding the garden may reduce the spread of thrips onto susceptible garden plants. Weeds in the garden area during the winter may harbor both the thrips and the virus. So, remove the old crop debris, till and mulch the garden for the winter to keep weeds and thrips down for the next year.

TSWV symptoms on tomato foliage.
Meg Williamson, ©2012 Plant Problem Clinic, Clemson University.

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TSWV symptoms on tomato fruit.
Meg Williamson, ©2012 Plant Problem Clinic, Clemson University.

Reflective (aluminum or silver-colored) mulch beneath the tomato plants may reduce the number of thrips that arrive and feed upon the plants. If reflective mulch is not available, paint black plastic mulch silver before transplanting the tomatoes.

There is no cure for a plant with TSWV. Roguing or removing infective plants immediately from the garden may help reduce the incidence of disease on additional plants. However, feeding by thrips can transmit the virus to plants within minutes. Because of this rapid infection time, insecticidal sprays may be of no use for the home gardener.

Seeds of several TSWV-resistant cultivars of tomatoes are available from mail-order seed companies. These cultivars are resistant, but not totally immune. They may acquire the virus, but yields and fruit quality may remain acceptable. Look for cultivars with resistance if this has been a problem in the past. See Table 5 below for recommended TSWV-resistant cultivars.

Tomato Yellow Leaf Curl Virus (TYLCV)

TYLCV is not seed-borne, but is transmitted by whiteflies. This disease is extremely damaging to fruit yield in both tomato and pepper crops. Whiteflies may bring the disease into the garden from infected weeds nearby, such as various nightshades and jimsonweed. After infection, tomato plants may be symptomless for as long as 2 - 3 weeks.

Tomato plant with *Tomato Yellow Leaf Curl Virus.*
Zachary Boone Snipes, ©2015 Clemson Extension

Symptoms in tomato plants are the upward curling of leaves, yellow (chlorotic) leaf margins, smaller leaves than normal, plant stunting, and flower drop. If tomato plants are infected early in their growth, there may be no fruit formed. Infected plants may appear randomly throughout the garden. Pepper plants may also become infected, but will show no symptoms.

Prevention & Treatment: Removal of plants with initial symptoms may slow the spread of the disease. Rogued (pulled out) infected plants should be immediately bagged to prevent the spread of the whiteflies feeding on those plants. Keep weeds controlled within and around the garden site, as these may be alternate hosts for whiteflies. Reflective mulches (aluminum or silver-colored) can be used in the rows to reduce whitefly feeding.

Low concentration sprays of a horticultural oil or canola oil will act as a whitefly repellent, reduce feeding and possibly transmission of the virus. Use a 0.25 to 0.5% oil spray (2 to 4 teaspoons horticultural or canola oil & a few drops of dish soap per gallon of water) weekly. Examples of products containing horticultural oil are Ferti-lome Horticultural Oil Spray and Bonide All Seasons Spray Oil. Example of products containing canola oil is Lilly Miller Vegol Year-round Pesticide Oil Concentrate and Espoma Earth-tone Horticultural Oil Ready to Spray.

At the end of the season, remove all susceptible plants and burn or dispose of them. See Table 6 for tomato cultivars with resistance to *Tomato yellow leaf curl virus.*

Other Viruses

Different viruses cause different symptoms on tomato. Symptoms of virus infection may appear as light and dark green mottling of the leaves. *Tobacco mosaic virus* (TMV) causes mottling of older leaves and may cause malformation of leaflets, which may become shoestring-like in shape.

Viruses are highly infectious and readily transmitted by any means that introduces even a minute amount of sap from infected into healthy plants.

Prevention & Treatment: There are no chemical controls for viruses. Remove and destroy infected plants promptly. Wash hands thoroughly after smoking (the *Tobacco mosaic virus* may be present in certain types of tobacco) and before working in the garden. Eliminate weeds in and near the garden. Control insects (thrips and whiteflies) that carry viruses (see HGIC 2218, *Tomato Insect Pests*).

Rotate tomatoes with crucifers (such as cabbage, broccoli and turnips). Use reflective mulches. Use virus resistant tomato cultivars. Many cultivars have *Tobacco mosaic virus* (TMV) resistance (the letter T follows the cultivar name), such as: Bush

Celebrity, Bush Early Girl, Jetsetter, Big Beef, Celebrity, Sweet Cluster, Sweet Million (cherry), and Super Marzano (paste).

Root-knot Nematodes

Root-knot nematodes (*meloidogyne* species) are microscopic worms that live in the soil and in plant roots. Affected plants are usually stunted, discolored and may die. Knots or galls develop on the roots.

Galled tomato roots caused by root-knot nematodes (*meloidogyne* species).
Zachary Boone Snipes, ©2015 Clemson Extension

Prevention & Treatment: When nematodes are not yet present, move the garden location every year, purchase disease-free plants, pull up and dispose of roots immediately after harvest, and use resistant cultivars (indicated by N following tomato cultivar name). See Table 7 for cultivars resistant to root-knot nematodes.

When root-knot nematodes are present, relocate the garden to a nematode-free area. Use nematode resistant tomato cultivars. Establish a rotation system using marigold cultivars Tangerine, Petite Gold or Petite Harmony, which reduce root-knot nematode populations in soils. For more information see HGIC 2216, *Root-Knot Nematodes in the Vegetable Garden*.

Disorders

Blossom End Rot: Blossom end rot is a physiological disorder of tomato. Symptoms are water-soaked spots on the blossom end of the fruit. These spots enlarge and become black. Secondary infection by decay-causing organisms usually follows.

The cause of this disorder is a calcium deficiency in the developing fruit. Extreme fluctuations in moisture, insufficient soil calcium, root pruning from nearby cultivation, and excessive ammoniacal (NH_4^+) nitrogen, potassium, or magnesium fertilization can also increase the chances of blossom end rot, especially early in the season.

Prevention & Treatment: Late spring planting of tomatoes should be at the recommended date for your area. The soil should be limed according to recommendations of a soil analysis report to bring the soil pH to 6.5, and to provide adequate calcium levels in the soil. Limestone is best applied 3 to 6 months in advance and tilled into the garden soil. Follow the soil report for recommendations for pre-plant nutrient (fertilizer) applications. If calcium levels are not sufficient but the soil pH is correct, then gypsum (calcium sulfate) is best tilled into the soil before planting at 1 to 2 pounds per 100 square feet.

Blossom end rot symptoms on tomato fruit.
Joey Williamson, ©2009 HGIC, Clemson Extension

Avoid excessive potassium or magnesium fertilization as these nutrients will compete with calcium for uptake by the plants. Epsom salts is an example of a magnesium source, so do not apply to garden soil unless a recent soil report indicates a magnesium deficiency.

Avoid ammoniacal nitrogen fertilizers for side dress applications (beside or around the plants), as ammoniacal nitrogen also will compete with calcium for uptake. Examples of fertilizers with ammoniacal nitrogen are ammonium sulfate,

ammonium nitrate and most complete fertilizers, such as 10-10-10. A calcium nitrate (15.5-0-0) side dress fertilizer is usually the best choice, and is applied monthly at 2 pounds per 100 feet of row.

Maintain a uniform supply of moisture through irrigation and adequate soil mulches. Mulches will not only keep the soil cooler and more evenly moist, but will suppress weeds, thus reducing the need for nearby cultivation that may damage tomato roots. Remove fruit with blossom end rot symptoms from the plants.

However, if the soil was not tested lime or gypsum was not applied pre-plant, and blossom end rot occurs, then applying gypsum at 1 to 2 pounds per 100 square feet as a side dress supplement has proven beneficial. See Table 8 for tomato cultivars with resistance to blossom end rot.

Sunscald: Sunscald occurs when tomatoes are exposed to the direct rays of the sun during hot weather. It is most common on green fruit. Decay causing fungi frequently invade the damaged tissue.

Prevention: Cover exposed fruits. Control leaf diseases.

Growth Cracks: Tomatoes crack when environmental conditions (drought followed by heavy rain or watering) encourage rapid growth during ripening. Some cracks may be deep, allowing decay organisms to enter the fruit and cause fruit rot.

Growth cracks on tomato fruit.
Joey Williamson, ©2014 HGIC, Clemson Extension

Prevention: Maintain even soil moisture with regular watering. Some tomato cultivars are crack-tolerant; see Table 9 for suggested cultivars.

Poor Fruit Set: Poor fruit set occurs for several reasons:

- Extreme temperatures: The blossoms drop off without setting fruit when temperatures are below 55 °F or above 90 °F for extended periods. Try Arkansas Traveler, Talladaga Hybrid, Homestead 24, Bella Rosa Hybrid, Top Gun Hybrid, Solar Fire Hybrid, Florida 91 Hybrid, Sioux or Costoluto Genovese for heat-tolerance.
- Dry soil: Blossoms dry and fall when the plants do not receive enough water.
- Shading: Few blossoms are produced when the plants receive less than six hours of sun a day.
- Excessive nitrogen. High nitrogen levels in the soil promote leaf growth at the expense of blossom and fruit formation. Correct the nitrogen imbalance with superphosphate or 0-20-20 fertilizer.

Catfacing: This is a disorder caused by cold temperatures during fruit set. The fruit is extremely malformed and scarred, usually at the blossom end. Fruits that develop later in the season will not be affected. The cultivar Homestead 24 is resistant to catfacing.

Leaf Roll: Leaf roll of tomatoes may be caused by high temperatures, prolonged periods of wet soil conditions, and drought. It may also occur when tomatoes are pruned severely. The symptom is mostly on older leaves, with an upward curling of the leaflets, but may progress to affect up to 75 percent of the foliage. The rolled leaves may feel leathery and stiff. Often the condition of leaf roll occurs once the plants are under the stress of a heavy fruit set. Some cultivars are more prone to leaf roll than others.

Tomato foliage exhibiting leaf roll – the upward curing of lower leaves during high temperatures and drought.
Joey Williamson, ©2014 HGIC, Clemson Extension

Prevention & Treatment: The symptom of leaf roll does not significantly damage the crop. To help prevent this disorder, tomatoes should be planted on well-drained soil and be irrigated during periods of drought.

Herbicide Injury: Drift from nearby sprays of broadleaf weedkillers used on turfgrass, such as 2,4-D and dicamba, and non-specific herbicides, such as glyphosate, may severely damage tomato plants.

Distortion of tomato stems and foliage due to exposure to spray drift of 2,4-D herbicide.
Joey Williamson, ©2014 HGIC, Clemson Extension

Initial symptoms of glyphosate injury on tomatoes are characteristically seen as white/yellow discoloration at the base of the leaflets.
Joey Williamson, HGIC, Clemson Extension

Caution: Pollinating insects, such as honey bees and bumblebees, can be adversely affected by the use of pesticides. Avoid the use of spray pesticides (both insecticides and fungicides), as well as soil-applied, systemic insecticides unless absolutely necessary. If spraying is required, always spray late in the evening to reduce the direct impact on pollinating insects. Always try less toxic alternative sprays first for the control of insect pests and diseases. For example, sprays with insecticidal soap, horticultural oil, neem oil extract, spinosad, *Bacillus thuringiensis (B.t.)*, or botanical oils can help control many small insect pests and mites that affect garden and landscape plants. Neem oil extract or botanical oil sprays may also reduce plant damage by repelling many insect pests. Practice cultural techniques to prevent or reduce the incidence of plant diseases, including pre-plant soil improvement, proper plant spacing, crop rotation, applying mulch, applying lime and fertilizer based on soil test results, and avoiding over-head irrigation and frequent watering of established plants. Additionally, there are less toxic spray fungicides that contain sulfur or copper soap, and biological control sprays for plant diseases that contain *Bacillus subtilis.* However, it is very important to always read and follow the label directions on each product. For more information, contact the Clemson Extension Home & Garden Information Center.

Table 1. Fungicide Products for Home Garden Disease Control on Tomatoes

Fungicide Active Ingredient	Examples of Products Containing the Active Ingredient
Chlorothalonil	Bonide Fungonil Concentrate 29.6% Ferti-lome Broad Spectrum Landscape & Garden Fungicide Conc. 12.5% GardenTech Daconil Fungicide Concentrate 29.6% Hi-Yield Vegetable, Flower, Fruit & Ornamental Fungicide Conc. 12.5% Monterey Fruit Tree, Vegetable & Ornamental Fungicide Conc. 29.6% Ortho MAX Garden Disease Control Concentrate 29.6% Southern Ag Liquid Ornamental & Vegetable Fungicide Conc. 12.5% Tiger Brand Daconil Concentrate 12.5%
Maneb	Hi-Yield Maneb Garden Fungicide
Mancozeb	Bonide Mancozeb Flowable with Zinc Concentrate Southern Ag Dithane M-45
Copper Fungicide[2]	Natural Guard Copper Soap Liquid Fungicide Concentrate (1.8%) Bonide Liquid Copper Concentrate (a copper soap) (1.8%) Camelot Fungicide/ Bactericide Concentrate (a copper soap) (1.8%) Bonide Copper Fungicide (7%) Dexol Bordeaux Powder (spray) (8%) Lilly Miller Kop-R-Spray Concentrate (8%) Monterey Liqui-Cop Fungicide Concentrate (8%) Southern Ag Liquid Copper Fungicide (8%)

[1]RTU products are pre-mixed fungicides in a spray bottle.
[2]For copper fungicides, the greater the metallic copper content, the better the control of bacterial & fungal diseases.

Table 2. Tomato Cultivars with Resistance to Early Blight

Tomato Cultivar	Other Disease Resistance*	Plant Growth Habit**	Days to Ripeness
Mountain Supreme Hybrid	VF	D	69-70
Mountain Fresh Hybrid	VFF	D	77
Mountain Magic Hybrid	VFF	ISI	72
Plum Regal Hybrid	VFF	D	72
Plum Dandy Hybrid	VF	ISI	82
Cabernet Hybrid	VFF	I	60
Manalucie	FSt	I	82
Merlot Hybrid	VFF	I	59
Tommy Toe (cherry)	none	I	70
Mountain Merit Hybrid (moderate EB resist.)	VFFFN TSWV LB	D	75
Jasper Hybrid (cherry)	FF LB S	D	60
Iron Lady Hybrid	LB S	D	77
Matt's Wild Cherry (moderate EB resistance)	LB (moderate)	I	60
Juliet Hybrid (mini-roma) (moderate EB resist)	none	I	60
Defiant PhR Hybrid (moderate EB resistance)	VFF LB	D	70
Legend (moderate EB resistance)	LB	D	68
Old Brooks (moderate EB resistance)	LB	I	78

Table 3. Tomato Cultivars with Resistance to Late Blight

Tomato Cultivar	Other Disease Resistance*	Plant Growth Habit**	Days to Ripeness
Legend	EB (moderate)	D	68
Mountain Magic Hybrid	VFF EB	ISI	72
Plum Regal Hybrid	VFF EB	D	72
Mountain Merit Hybrid	VFFFN TSWV EB (Moderate)	D	75
Jasper Hybrid (cherry)	FF EB S	B	60
Iron Lady Hybrid	EB (moderate) S	D	77
Defiant PhR Hybrid	VFF EB (moderate)	D	70
Matt's Wild Cherry	EB (moderate)	I	60

Table 4. Tomato Cultivars with Resistance to All 3 Races of Fusarium Wilt

Tomato Cultivar	Disease Resistance*	Plant Growth Habit**	Days to Ripeness
BHN 640 Hybrid	VFFF TSWV	D	75
Charger Hybrid	VFFFASt	D	76
Crista Hybrid	VFFF TSWV	D	73
Floralina Hybrid	VFFFA	D	72
Tasti-Lee Hybrid	VFFF	D	75
Solar Fire Hybrid	VFFF	D	72
Top Gun Hybrid	VFFFSt TSWV	D	75
Mountain Merit Hybrid	VFFFN TSWV EB (moderate)	D	75

Table 5. Tomato Cultivars with Resistance to *Tomato Spotted Wilt Virus* (TSWV)

Tomato Cultivar	Disease Resistance*	Plant Growth Habit**	Days to Ripeness
Bella Rosa Hybrid	VFFASt TSWV	D	75
BHN 444 Hybrid	VFF TSWV	D	75
BHN 640 Hybrid	VFFF TSWV	D	75
Capaya Hybrid	VFASt TSWV	D	70
Crista Hybrid	VFFF TSWV	D	73
Fletcher Hybrid	VN TSWV	D	74
Health Kick Hybrid	VFFA TSWV	D	74
Plum Regal Hybrid	VFF TSWV	D	72
Sophya Hybrid	VFFSt TSWV	I	75
Talladaga Hybrid	VFF TSWV	D	60-67
Top Gun Hybrid	VFFFSt TSWV	D	75
Mountain Merit hybrid	VFFFN TSWV EB (partial)	D	75

Table 6. Tomato Cultivars with Resistance to *Tomato Yellow Leaf Curl Virus* (TYLCV)

Tomato Cultivar	Other Disease Resistance*	Plant Growth Habit**	Days to Ripeness
Champion II Hybrid	VFFNTA	I	62-65
Charger Hybrid	VFFFASt	D	76
Margo Hybrid	VFFT	D	70

Table 7. Tomato Cultivars with Resistance to Root-Knot Nematodes

Tomato Cultivar	Disease Resistance*	Plant Growth Habit**	Days to Ripeness
Beefmaster Hybrid	VFNASt	I	80
Bella Rosa Hybrid	VFFNA	D	75
Better Boy Hybrid	VFNASt	I	75
Better Bush Hybrid	VFN	ISI	68
Big Beef Hybrid	VFFNTASt	I	73
Burpee's Supersteak Hybrid	VFN	I	80
Bush Early Girl II Hybrid	VFFNT	ISI	54
Bush Goliath Hybrid	VFN	ISI	68
Celebrity Hybrid	VFFNTASt	ISI	70
Champion II Hybrid	VFNTA	I	65-70
Empire Hybrid	VFFNASt	D	72
First Prize Hybrid	VFFNT	I	75
Fletcher Hybrid	VN TSWV	D	74
Goliath Hybrid	VFFNT	I	70
Grandma's Pick Hybrid	VFN	I	78-80
Jetsetter Hybrid	VFFNASt	I	64
Laroma III Hybrid	VFFNA	D	76
MiRoma Hybrid	VFFN	D	70
Park's Whopper CR Improved Hybrid	VFFNT	I	65
Royesta Hybrid	FFNT	I	70
Super Fantastic Hybrid	VFN	I	70
Super Marzano Hybrid	VFNTA	I	90
Tiffany Hybrid	VFNT	I	70
Tomande Hybrid	VFFNT	I	68
Tough Boy Hybrid	VFN	I	75
Viva Italia Hybrid	VFFNASt	D	72
Mountain Merit Hybrid	VFFFN TSWV EB (moderate)	D	75

Table 8. Tomato Cultivars with Resistance to Blossom End Rot of Fruit

Tomato Cultivar	Disease Resistance*	Plant Growth Habit**	Days to Ripeness
Manalucie	FSt EB	I	82
Mountain Spring Hybrid	VFF	D	72
Mountain Fresh Hybrid	VFF EB	D	77
New Yorker	VA	D	66
Ravello Hybrid	VFT	I	60-65
Wins All	none	I	80

Table 9. Tomato Cultivars with Resistance to Cracking

Tomato Cultivar	Disease Resistance*	Plant Growth Habit**	Days to Ripeness
Abraham Lincoln Original	none	I	87
Aunt Ginny's Purple	none	I	75-85
Box Car Willie	none	I	80
Campbell's 33 Hybrid	VFA	D	69
Celebrity Hybrid	VFFNTASt	ISI	70
Charger Hybrid	VFFFASt	D	76
Delicious	none	I	77
Fantastic Hybrid	VF	I	65
Gardener's Delight	none	I	65
German Head	none	I	80-90
Heinz 1439 Hybrid	VFA	D	70
Juliet Hybrid	LB	I	60
Mountain Spring Hybrid	VFF	D	72
New Yorker	VA	D	66
Pilgrim Hybrid	VFFASt	D	68
Pink Girl Hybrid	VFT	I	76
Plum Regal Hybrid	VFF TSWV	D	80
Porter's Pride	none	I	70
Rutgers	VFA	D	75
Super Sioux	none	ISI	70
Supersonic Hybrid	VF	I	75-79
Thessaloniki	none	I	75-80
Tough Boy Hybrid	VFN	I	75
Chef's Choice Orange Hybrid	T Anthracnose	I	75

Table 10. Tomato Cultivars with Resistance to Bacterial Speck

Tomato Cultivar	Other Disease Resistance*	Plant Growth Habit**	Days to Ripeness
Super Marzano Hybrid	VFNT	I	70-90
Health Kick Hybrid	VFFA TSWV	D	74
Viva Italia Hybrid	VFFNA	D	75
Charger Hybrid	VFFFASt	D	76
Mountain Pride Hybrid	VFFASt	D	77
Marcellino Hybrid	none	I	75-80
Ravello Hybrid	VFT	I	60-65
Tomatoberry Garden Hybrid	none	I	60-70

***Disease Resistance Codes:**	
V	Verticillium wilt resistance
F	Fusarium wilt race 1 resistance
FF	Fusarium wilt races 1 & 2 resistance
FFF	Fusarium wilt races 1, 2 & 3 resistance
A	Alternaria resistance
St	Stemphylium or gray leaf spot resistance
N	Root-knot nematode (RKN) resistance
T	Tobacco mosaic virus (TMV) resistance
EB	Early Blight resistance
LB	Late Blight resistance
S	Septoria Leaf Spot resistance
****Plant Growth Habit Codes:**	
D	Determinate plant growth habit (concentrated fruit set)
I	Indeterminate plant growth habit (fruit set throughout the summer)
ISI	Indeterminate short internode (a compact growth habit with longer fruit set)

Pesticides updated by Joey Williamson, HGIC Horticulture Extension Agent, 06/15. Revised by Joey Williamson, HGIC Horticulture Extension Agent, Clemson University, 02/16. Images added by Joey Williamson, HGIC Horticulture Extension Agent, Clemson University, 07/15. Originally Prepared by Marjan Kluepfel, HGIC Information Specialist, James H. Blake and Anthony P. Keinath, Extension Plant Pathologists, Clemson University. New 09/00. Images added by Zachary Boone Snipes, Horticulture Extension Agent, Clemson University, 7/15.

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