The information offered here is to help gardeners grow vegetables successfully. It focuses on common questions asked as well as conditions, pests, and diseases that occur in St. Tammany Parish home gardens. Every attempt has been made to ensure the accuracy of the information, but references should always be checked, and LSU AgCenter personnel contacted if there are questions.

Tomatoes

By Jerry Ballanco

"It ain't what you don't know that causes trouble...it's what you know that ain't so."

Introduction

TOMATOES ARE FUN TO GROW and most folks who grow any vegetable in St Tammany Parish, grow tomatoes. But they are not a particularly easy fruit to grow. If you are a novice gardener, cherry tomatoes are good to begin with. Once you have a little experience, you might next try hybrids which have resistance to different diseases bred into them. Perhaps the trickiest to grow are medium and large heirlooms. Naturally, the hardest to grow usually taste the best. One exception to that generalization is that some cherry tomatoes are delicious. The longer a tomato takes to mature (between 55-85 days depending on variety), the more opportunity pests and disease will have to operate. Hence, the more difficult it can be to get a successful harvest.

Tomatoes are classified as determinate, semi-determinate (a bushy indeterminate), and indeterminate. The apical meristem (growing tip of the plant) of a determinate tomato is a flower cluster. When that top flower cluster opens, only side shoots of the tomato will continue to grow. The apical meristem of an indeterminate tomato is vegetative which means that plant will continue to grow for as long as environmental factors allow it to do so.

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Growing tomatoes in beds

The Sun and the Fertilizer

See general garden information for bed location, design, and materials.

TOMATOES LOVE MORNING SUN. They sometimes tolerate afternoon sun; other times they complain mightily about the heat. True summer crops (like hot peppers) scoff at the sunlight and heat, provided they get enough water. If there are trees to the west of your garden, those may provide some afternoon shade. If afternoon shade is not present or not sufficient, you might consider creating dappled light or light shade for the tomato plants in the afternoon. Tomatoes are delicate and do not like a great deal of hot afternoon sun but to have good fruit production need eight hours of direct sunlight.

For a bed that is 8' x 3', pre-treat with 1 cup of 8-24-24 (my favorite) or 13-13-13 two weeks or so before transplant time. Do not add additional fertilizer until the first blossom set. Too much nitrogen will lead to excess vegetative growth and poor fruit set. At the first blossom set, give each plant 1 TBS of Calcium Nitrate sprinkled about 4 inches from the stem and worked into the soil. Repeat at the opening of the third blossom set. The calcium helps prevent blossom end rot and the nitrogen supports the growth of the plant. The load of potassium and phosphorus added in the pre-treatment need not be supplemented for tomatoes because the growing season is relatively short. If your cherry tomatoes continue to set fruit through June, 1 TBS of additional 8-24-24 may be alternated with the calcium nitrate every three weeks after fruiting commences.

Water

See general garden information.

TOMATOES WILT EASILY. Excluding disease conditions, they may wilt from too little water, too much water, or, as we humans do, wilt from the heat despite adequate hydration. As mentioned above, shade is sometimes greatly beneficial to the plant as it decreases water loss from transpiration.

Water tomatoes in raised beds every third day to start. If the tomatoes do not wilt in the afternoon, no need to change this schedule. As the plants get larger and the temperatures hotter, more frequent watering might be necessary. During dry spring and summer spells, I usually water my raised beds twice daily. The frequency of watering must be made based on rain and soil conditions.

Tomatoes kept slightly on the dry side are reported to taste better. However, if they then experience one of our summer downpours, they may split. Some cherry tomatoes are infamous for this, but full-size tomatoes are also susceptible.

In ground level or mounded native soil, watering deeply once a week is usually recommended.

Growing tomatoes in containers

The Container

Photo by Jerry Ballanco

SELECT A RELATIVELY LARGE CONTAINER, 5-8 gallons. Some tomatoes grow large and the container may easily become top heavy, so select a container that can be supported. Remember, a support structure for the plant will also be necessary.

Unglazed pottery is attractive, but its porous structure makes maintaining adequate moisture difficult. Securing a support structure for the tomato requires a rod or more elaborate support, depending on the size and pruning strategy. A rigid, thick-walled container may make this especially difficult. Black or colored plastic containers hold moisture better and they can be easily modified to attach a cage or stake. Black containers may get extremely hot if exposed to direct sun and shading them (especially from afternoon sun) may be necessary to keep the soil from becoming too hot.

Soil

IT IS PROBABLY BEST TO purchase potting soil mix initially, then enhance it as time goes on. Any recognized brand will do. Most have fertilizer as part of the mix but require supplementing as the growing season progresses.

After one growing season, the potting soil mix will require a semi-annual addition of quality compost. After one season of growth, monitor the soil quality with a soil test sent to the LSU lab. Try not to continue to grow the same crop (or the same crop family) in the same soil without a three- or four-year gap between the repeat crops. (For example, tomato is a solanaceous crop. Other solanaceous crops to avoid planting in this container for three years are peppers, eggplant, potatoes, and tomatillos. Instead, plant a cucurbit (squash, cucumber, or cantaloupe) in year two; plant beans or peanuts in year three; plant onions in year four; then begin again with tomatoes.

If you prefer to make a soil-less mix, blend three parts coir or peat moss, one-part compost, and 1/2 part each of perlite and vermiculite. Organic or standard fertilizer must be added as "pre-plant" then supplemented as indicated below.

Fertilizer

MOST BAGGED POTTING SOILS INCLUDE fertilizer but not enough to support tomatoes for the full growing season. Add 1 TBS Calcium Nitrate to the potting mix at formation of the first flower cluster. Repeat with 1 TBS Calcium nitrate with the third flower cluster. A mixture of bone and blood meal also provides calcium and nitrogen for organic growers. If your cherry tomatoes continue to set fruit through June, 1 TBS of additional 8-24-24 may be alternated with the calcium nitrate every three weeks after fruiting commences.

Over time, the high wood content of these mixes requires special attention to nitrogen. Because a soil test does not include nitrogen, plant appearance (how green) and growth (slow or vigorous) must be guides. A soil test on the container soil every three or four years is best to monitor essential and trace elements and pH.

High nitrogen fertilizer can cause excessive vegetative growth and/or blossom drop at the expense of fruit set. Alternatively, nitrogen consumed by the first fruit cluster can inhibit mid-level fruit set and size if there is not enough nitrogen to go around. This is generally not a problem but try to avoid high nitrogen fertilizers.

For more information consult The LSU Master Gardener handbook or
https://aces.nmsu.edu/ces/mastergardeners/manual/docs/chap_1/chap1.c.pdf

Water

WHEN TOMATOES PLANTS GET LARGE, they use and transpire a lot of water. Often, in the summer, we see "physiological" leaf curling which is partially due to transpiration water loss that exceeds what the roots can pick up and the vasculature (xylem) can carry.

Plants take up water through the roots. That water is distributed to the different parts of the plant. Some of this water is used in metabolic processes but far more is "transpired" from the leaves into the air. In hot, windy, or low humidity conditions transpirational water loss increases.

Often containerized tomato plants need to be watered twice daily. Containers with a water reservoir are available and work well.

In raised beds with sandy soil, watering twice a day may be necessary.

If your garden has more than one bed, consider installing an irrigation system. It does not have to be fancy and it does a much easier and more consistent job than hand watering. A ground level water system also avoids splashing soil onto the lower leaves, reducing the problem of fungal disease spread.

Peculiar things tomatoes do *(in no particular order)*

Catfacing

CATFACING CAN OCCUR ON THE blossom or stem end...or both. Sometimes when this strange development goes from stem to blossom it is called **zippering**. Others consider zippering as only very superficial changes along this plane.

Catfacing is not contagious and usually does not impact medium size tomatoes nearly as much as big tomatoes. Because it is not a significant problem in commercial growing, little research has been done on this problem. As it tends to be more frequent in the first formed tomatoes, cold weather and/or variable weather may play a role. Insects feeding on the early developing fruit, and almost any process that interferes with development of the early fruit, may cause catfacing. Frequently, on a large variety heirloom tomato plants, several of the tomatoes produced will show catfacing.

Catfacing of blossom end of Mortgage Lifter tomato. Photo by Jerry Ballanco.

Early catfacing of a large heirloom Mortgage Lifter tomato may be mistaken for blossom end rot. The soft and rotten appearing margins along blossom end rot contrast with the firm tissue bordering the catfaced area. Blossom end rot expands over a relatively short time, whereas catfacing seems to get smaller as the tomato grows. Photo by Jerry Ballanco.

This tomato, grown and ripened, required a bit of knife work, but the edible tomato taste and texture were fine. The tomato weighed 14 ounces. Photo by Jerry Ballanco.

https://hortnews.extension.iastate.edu/2001/7-27-2001/cattomatoes.html

https://vric.ucdavis.edu/veg_info/catface.htm

Blossom end rot

Blossom end rot on tomato. Photo by Kappy Goodwin.

Blossom end rot Is something everyone who grows full size tomatoes has seen. It happens without warning and, after it appears, cannot be fixed for that tomato. Other tomatoes on the same plant may be fine. It begins as a water-soaked area on the blossom end of the fruit with surrounding discoloration. As it develops, the entire blossom end of the fruit turns leathery hard with surrounding discolored mush. It is an opportune spot for infection to speed the mush to rot. Blossom end rot may happen to fruit that is ripe or unripe. It happens when that particular fruit is deprived of calcium during a critical developmental period. Basically, it is caused by a localized nutritional deficiency.

Things that are thought to contribute: plants set into too cold ground (early fruit impacted); too much ammonium in fertilizer mix (This causes such rapid growth that calcium delivery to certain areas may be compromised); inconsistent water to plant (calcium must be dissolved in the soil water to be available to the plant for roots to pick up); root damage from cultivation. Though calcium is not particularly plentiful in St Tammany soil, seldom is inadequate soil calcium the problem; the problem is accessibility to each developing tomato at the right time, often because of inconsistent soil moisture.

How to avoid it? Water consistently and mulch. Add 1 TBS of calcium nitrate to each plant after first and third fruit cluster. Minimize ammonium in fertilizer and avoid use of high nitrogen fertilizers. Keep the soil pH 5.5-6.5. Do not damage the roots when weeding. Do not spray foliar calcium (waste of time, money, and risks foliar injury).

https://www.canr.msu.edu/resources/blossom_end_rot_tip_sheet

Extra parts to tomato

Extra growth on a tomato (or two).
Photo by Laura Steffee.

Cat

Catfacing of stem end of Black Krim tomato.
Photo by Jerry Ballanco.

Failed fruit set

Failed fruit set. Photo by Jerry Ballanco.

DAYTIME TEMPERATURES ABOVE 85 DEGREES and nighttime temperatures above 70° cause the pollen to become "tacky" and non-viable. Water stress compounds this temperature effect. High relative humidity (above 75%) causes the pollen to not shed from the stamen properly.

The experience of gardeners in St Tammany indicate that cherry tomatoes set fruit longer than full size tomatoes as the summer progresses. Heat resistant or heat set tomatoes are available and may extend the productive fruit set period.

https://ipm.missouri.edu/MPG/2013/4/Understanding-Tomato-Fruit-Set/

https://swfrec.ifas.ufl.edu/docs/pdf/veg-hort/tomato-institute/presentations/ti2011/ozores.pdf (power point slides)

Yellow or Green Shoulders

Black Krim heirloom tomato showing Green shoulders and catfacing. Photo by Jerry Ballanco.

THE EXACT CAUSES OF THIS green shoulder phenomena are uncertain. Adverse weather, potassium imbalance, and pH have been implicated but these causes are only slightly more than conjectural. The tomato under this unusual color may be hard and inedible. Other times that area of the tomato is fine, but the skin is tough. Heirloom varieties, especially those with dark skin, are more prone to this than hybrids.

http://www.missouribotanicalgarden.org/Portals/0/Gardening/Gardening%20Help/Visual%20Guides/Tomato%20Fruit%20Problems.pdf

Leaf Curl

Physiological leaf curl*

Physiologic leaf curl. Photo by Jerry Ballanco.

*"Many researchers have reported different causes for physiologicalal leaf roll such as: transplant shock, heat, drought, excessive water, root injury, plants severely pruned or pruned during dry soil conditions, high nitrogen, or phosphate deficiency. No matter the cause, symptoms generally remain the same. Managing this problem can be done by following basic cultural methods such as properly hardening off tomato seedlings before planting, planting different cultivars, maintaining a consistent moisture level in the soil, maintaining temperatures below 95 degrees by shading or evaporative cooling, and avoiding over-fertilization, excess pruning, and root damage." ***

NO MATTER THE CAUSE, PLANT health and production are generally unaffected by this condition. However, this curling may be a response to water or heat stress, thus a warning that all is not well. If the stress persists, blossom end rot and susceptibility to disease and insect attack may be increased. Bottom line: do not assume this "physiological" phenomena can be safely ignored.

*Also see Diseases (below) leaf curl, pathological causes

**http://hyg.ipm.illinois.edu/article.php?id=498#:~:text=Symptoms%20of%20physiological%20leaf%20roll,normal%20in%20color%20and%20size.

https://vegcropshotline.org/article/tomato-leaf-curling/#:~:text=Tomato%20leaf%20curling%20which%20is,with%20the%20leaf%20curling%20symptom.

https://ipm.missouri.edu/MEG/2019/7/tomatoLeafCurl/

Pathologic Leaf Curl

Herbicide Injury

Herbicide damage. Photo by Purdue U.

GLYPHOSATE, AND 2,4-D, AND DICAMBA are herbicides that play havoc with tomatoes. Once, unknowingly, I used composed horse manure from a horse farm that treated the fields with 2,4-D. The result was two hundred unmarketable, deformed, tomato seedlings.

"All you have to do is say the word 'Roundup' around a tomato plant and the leaves start to curl. " (That may be a slight exaggeration, but it makes the point). If you use any of these products, use a separate, dedicated sprayer only for that product. Be careful about product drift to tomatoes as a tiny amount is enough to do damage.

Once herbicide damage occurs, there is no remediation strategy and these leaves will not rebound but the plant may survive.

https://vegcropshotline.org/article/tomato-leaf-curling/

Sunscald and water split

TOWARD THE END OF THE productive season, sunscald in often seen in tomatoes. The sun exposure may result from foliar loss due to disease or the tomato may grow in an area that does not have the foliage to properly shade it. Sunscald may appear in unripe and ripe tomatoes and can appear in almost any vegetable exposed to too much sun.

The split that is to the left of the sunscald area in the top photo may happen to any fruit if it gets a sudden burst of water, as happens with a heavy rain after a dry period. Splits tend to be along the long axis of the fruit. Small splits usually heal but watch a split like this one carefully, even after picking, because this injury predisposes to Anthracnose. Some varieties of cherry tomatoes are prone to split and should be avoided in our boom and bust rain pattern. Look for warnings in catalogue.

Sunscald and split in tomato. Photo by Michael Dill.

https://extension.umd.edu/hgic/topics/sunscald-vegetables

Sunscald. Photo by UMD Extension.

Purple leaf on tomato

Purple-tinged tomato leaf. Photo by Art Scott.

ART SCOTT TOOK THIS PHOTO of one of his tomato plants in mid-May. I took the bottom photo of one of my plants on June 15. Each plant has a few purple-tinged leaves. Both tomato bushes are healthy and producing fruit as anticipated. The purple tinge to some of the leaves on both plants has not seemed to spread or cause difficulty of any kind. Thus, nutritional deficiency and purple leaf disorder (a recognized plant disease) are not present here. Only one or two leaves are affected, and the plants are thriving. For now, this is being added to the category of weird things tomatoes sometimes do.

https://edis.ifas.ufl.edu/pp259

Purple leaf on tomato. Photo by Jerry Ballanco.

Chlorosis

CHLOROSIS IS A DESCRIPTION, NOT a diagnosis. It may be caused by inadequate iron uptake because of low pH. Other causes include other nutrient deficiencies, infestation by mites or other juice sucking insects, and some fungal diseases.

What that means is this: if you see this in several leaves on a tomato plant, do not ignore it. Find the cause as it is not likely to go away or lead to a happy outcome.

Chlorosis in tomato leaf. Photo by Missouri Botanical Garden.

Blotchy Ripening

Blotchy tomato ripening. ISU photo.

"Climatic, nutritional, and cultural problems may contribute to blotchy ripening. Low levels of potassium in plants and prolonged cloudy periods or inadequate light intensity have been associated with the disorder. Other possible contributing factors are high soil moisture, high humidity, low temperature, soil compaction, and excessive fertilization. These environmental factors can contribute to nutrient deficiencies or other imbalances that impede development of red pigment in the fruit."

Iowa State University Extension

THIS USUALLY HAPPENS late in the growing season. Adding 1 TBS 8-24-24 three weeks after the third flower cluster forms may help prevent blotchy ripening. This is especially true of large heirlooms with long time to harvest (65 days or more) or extended harvest time from late fruit set.

Diseases

GROWING TOMATOES IS OFTEN CHALLENGING because of the spectrum of diseases that are prevalent in southeast Louisiana's climate. Hybrids have been bred that have resistance to quite a few diseases and some pests, but few hybrids can match the taste or opportunities of color and size that heirloom varieties have. Few heirloom varieties have special resistance to diseases or pests.

High humidity season usually means lots of foliar disease in vegetables and subsequent damage to fruit. The lower leaves on tomatoes are especially vulnerable as most of the disease organisms are present in the soil and get splashed on lower leaves by rain or overhead watering. It then spreads by touch, wind, and tools. Thus, the nearly universal recommendation to not do overhead watering. Working with plants when they are wet significantly increases the chance of spreading any diseases already present. Disinfect tools used to trim diseased plant tissue (10% bleach solution for 5 minutes).

Destroy infected plants and their roots. Do not put them in the compost. Clean what leaf debris you can from the growth site of any infected plant.

Most tomato seed catalogues have a key for diseases or pests against which a particular tomato variety has resistance.

For a brief description and management of common disease problems and disorders seen with tomatoes, see https://hgic.clemson.edu/factsheet/tomato-diseases-disorders/. Though clearly written especially for home gardeners, it does not address pests.

Bacterial Wilt

WILT RESULTS FROM INSUFFICIENT TURGOR in the plant support parts necessary to maintain form (the leaves droop, the stems droop). Because the upright posture of non-woody plants is maintained by internal water pressure, insufficient water in these structures causes wilt. Wilt may result from dry soil or root damage, from disease that prevents adequate moisture uptake from the soil, or from stem injury. Bacterial wilt, though, involves a blockage in the water distribution system of the plant. The water picked up by the roots cannot get up to where it needs to be. The xylem system is blocked with bacteria and cannot move enough water to keep up. This is the equivalent of a plant coronary artery blockage. The inadequate water available to the leaves and stems results in wilt.

Plant Wilt. Photo by Glenda Schmidt.

The plants in the above photo are at the end stage of a wilt disease that is fatal to the plant. Typically, a healthy plant that has already set some un-ripened fruit, will begin to wilt in the afternoon. Perhaps, only part of the plant wilts, but then the wilt begins to appear earlier in the day, involve larger areas, and persist longer. Finally, the lower leaves begin to turn brown and the plant remains wilted all day long. This whole process takes 4-6 days. Bacterial wilt is the most common wilt disease of tomatoes in St. Tammany Parish.

Positive "streaming" test for bacterial wilt. Note the "smoky" stream coming from the bottom edge of the stem and just above the bright light artifact. Photo by Art Scott.

This clinical picture is so characteristic, that further diagnostics may not be necessary, but a quick field confirmation test called streaming can be conclusive. This test requires sacrificing the plant.

The streaming phenomenon may not be easy to elicit. The glass that Art used in the photo is perfect because it allowed the water column to be narrow. Cut the main trunk close to the ground and put the cut end of the stem into a glass of clear water. Allow it to stand for 5-25 minutes to see if the bacteria stream into the water.

This plant stem on the right shows the brown stem material typical of bacterial wilt disorders. The roots of a plant with this kind of wilt are normal in size, in stark distinction from wilt due to root disease. Unfortunately, the responsible organism for serious wilt such as this often lives long in the soil and makes tomato growing in that soil impossible for years. Sterilize tools that have been in contact with this soil and with these plants.

This tomato plant shows the brown stem material typical of bacterial wilt. Photo by Glenda Schmidt.

Southern Bacterial Wilt may affect any solanaceous crop. Most gardeners find that tomatoes are far more susceptible than peppers and eggplant, but any crop in this family supports the continuing presence of the pathogen in the soil.

Do not attempt to grow tomatoes for at least four years if this disease occurs in the bed. Other solanaceous crops may grow successfully in this bed but just their presence promotes the multiplication of the responsible organism. A four-year crop rotation is strongly suggested.

Below are links to articles with excellent pictures and information about tomato wilt diseases.

https://plantpathology.ca.uky.edu/files/ppfs-vg-15.pdf

https://www.lsuagcenter.com/NR/rdonlyres/737450E6-9D20-4D3E-9ED1-B04A2AB3C122/80045/pub3190SouthernBacterialWiltLOWRES.pdf

Fusarium wilt

This section and the one previous are about the two specific diseases that have the word "wilt" in their name.

THE SYMPTOMS OF WILT DISEASES in tomatoes closely resemble each other, which causes confusion. Further confusion exists because wilt is a prominent symptom of other pests and disorders.

The progress of specific wilt diseases in tomatoes is somewhat different. When infected with Fusarium wilt, the lower leaves start to turn yellow, gradually turn brown. The wilt is gradual, perhaps over weeks. It proceeds from bottom to top. Eventually the plant looks like the one in this photo. In Southern Bacterial Wilt, the wilt is the initial and commanding symptom and the progress from initial wilt to desperate appearance is days.

Near end stage Fusarium Wilt disease, Cherokee Purple tomato. Photo by C.W. Lartigue IV.

The vasculature of a healthy tomato (second photo) is white-green. It shows none of the brown striations visible in wilt diseases as shown in the lower photo. Enlarge the photos to see the striking difference. The brown streaks in the vasculature is common to both wilt diseases. In Fusarium wilt, typical foliar changes occur, browning of vasculature is present, and there is a negative streaming test. It is a common tomato disease in Louisiana.

Healthy vasculature in Black Krim tomato. Photo by Jerry Ballanco.

Resistant varieties of tomato, identified in seed catalogues with the letters FW1 and FW2, must be considered if planting tomatoes in the same area. Repeated planting of a crop family in the same bed without a three- to four-year hiatus is discouraged. Repeatedly planting the same crop allows the pathogen load of the soil to steadily increase, whereas the planting of non-susceptible crops causes the population of pathogen to drop.

http://blogs.cornell.edu/livegpath/gallery/tomato/early-blight/

Brown striations in the vasculature of this Cherokee Purple. Photo by C.W. Lartigue IV.

Early Blight, Common Blight

EARLY BLIGHT IS A COMMON FUNGUS infection in tomatoes. It usually starts on lower leaves as small brown spots. Gradually, they enlarge showing the typical concentric ring pattern, often surrounded by yellowing of the surrounding area. If untended, this fungus may infect the entire leaf and/or spread to other leaves, stem, and fruit itself. It is thought to begin from splash from soil, from either rain or overhead watering.

Early Blight. Photo by UMN Extension.

It may be minimized by drip irrigation rather than overhead watering or by selection of less vulnerable cultivars. Avoid working with plants when the leaves are wet as that may help spread disease. Early blight may be controlled by regular application of fungicides. Severely infected leaves may be removed and destroyed.

https://extension.umn.edu/diseases/early-blight-tomato

https://plantpathology.ca.uky.edu/files/ppfs-gen-07.pdf

Anthracnose Tomato

Anthracnose on "Creole" tomato. Photo by Laurette Jacob.

THIS COMMON FUNGUS INFECTION DAMAGES leaves and fruit. It occurs on fruit on the vine but quite often appears on home grown tomatoes after they have been picked. It is not a normal skin resident but is so widespread that, in my opinion, should be considered so.

After a tomato starts to blush, it will ripen off the vine just fine. Keep it out of the sun with adequate ventilation. However, this quiet period offers Anthracnose a chance to grow and often these spots appear as the tomato ripens, especially if the ripening period is prolonged or there is a damaged area. The flesh under the area is soft and best removed before eating. Sometimes, the texture of the entire tomato suffers.

For years, when growing tomatoes commercially, we would put picked tomatoes in a 10% bleach solution for 2-3 minutes, then rinse them thoroughly and allow to dry. Storing them out of sunlight in a ventilated area allowed them to mature safely. This resulted in minimal loss to Anthracnose and did not adversely impact the taste or texture of the tomato. We still do this when anticipating a fairly long ripening period.

Occasionally, Anthracnose impacts other solanaceous crops and cucurbits (squash, melons, cucumber). In fact, just about any fruiting crop is susceptible.

https://marylandgrows.umd.edu/2016/08/24/dont-forget-you-can-pick-tomatoes-ahead-of-full-ripeness/

Septoria Leaf Spot

FUNGAL SPORES OVERWINTER IN soil from dropped, dead leaves of infected plants. It is relatively uncommon in container grown plants with new soilless media. At the end of a season, very few tomatoes, and probably no heirlooms, are disease-free so it is a good idea to remove tomato debris promptly after harvest. Do not plant solanaceous crops in the same soil for three or four years.

Septoria Leaf Spot, Iowa State U Photo. Eventually, these spots develop a grey center. They are often surrounded by yellow, or morph into brown areas that may become holes or just turn into a brown, dried, dead leaf that eventually falls.

As with other soil-originated plant infections, the lesions usually start on lower leaves, from rain splash or overhead watering. Once this disease gets a start, it can spread to the entire plant, especially in wet or high humidity conditions. Eventually, infected leaves will turn yellow, then die and fall to the soil and re-inoculate it. Infected leaves may be removed and destroyed. Fruit is not infected but defoliation may lead to sunscald. Fungicidal sprays offer effective control.

https://www.missouribotanicalgarden.org/gardens-gardening/your-garden/help-for-the-home-gardener/advice-tips-resources/visual-guides/tomato-foliage-problems.aspx a user-friendly visual guide to common tomato problems

https://store.extension.iastate.edu/Product/4618 a compendium of tomato disorders from Iowa State University

https://plantpathology.ca.uky.edu/files/ppfs-gen-07.pdf

Bacterial Leaf Spot or Bacterial Leaf Speck

Bacterial Leaf Speck or Bacterial Leaf Spot. Photo by Maggie McCarty.

BACTERIAL SPECK AND SPOT ARE TWO different but similar diseases that impact both foliage and fruit. The foliar lesions are small, brown, specks that first appear on leaves and then on the green tomatoes before ripening. Bacterial speck and spot spots on the leaves may superficially resemble Septoria leaf spot which is a fungus infection and does not directly damage the fruit. The foliar lesions of bacterial speck do not develop central grey spots as happens with Septoria.

The tomato lesions of bacterial speck and spot are dark pimple-like lesions. Those of bacterial spec are smaller and shallower. Though the organisms are not pathogenic for humans, it is recommended to not eat affected fruit.

Fixed copper products, used regularly, will reduce future damage. Clean debris and destroy after harvest. Rotate crops on three to four-year schedule.

Bacterial Speck or Bacterial Spot on tomato. Photo by Maggie McCarty.

Bacterial Speck or Bacterial Spot on tomato. Photo by NCSU.

http://vegetablemdonline.ppath.cornell.edu/factsheets/Tomato_Bacterial.htm

https://hort.extension.wisc.edu/articles/bacterial-speck-of-tomato/

http://extension.msstate.edu/publications/bacterial-speck-and-bacterial-spot-tomatoes

Pests

Leaf-footed Bug and Stink Bugs

Leaf-Footed Bug, Adult. *Photo by California Agriculture & Natural Resources.*

THE TOP LEFT PHOTO SHOWS an adult leaf-footed bug. Often, they will be seen in mating pairs. The photo below is of a group of juveniles (an instar form), one of which is extracting juice from the tomato. The instar forms may cause as much trouble as the adult.

The instar (nymph, juvenile) very closely resembles the juvenile form of the assassin bug, a garden beneficial. However, assassin bugs are lone travelers, and do not have the prominent two dots seen in the middle photo on the leaf-footed bug instar. More obviously, the juvenile leaf-footed bugs travel in groups of 3-15. There is certain sick joy in smashing a whole family at one time which is how they should be treated. They will not fight back. The assassin bug, however, may deliver a nasty stick. The adult leaf-footed bug offers an offensive odor when smashed or threatened, not so the immature bugs. Removal efforts are best done in the early morning or late afternoon when the bugs tend to be sluggish. Gloves are not essential but make the killing less gross.

A leaf-footed bug instar with proboscis in the green tomato. Photo by Art Scott.

To ingest the vegetable juices, the bug injects digestive enzymes to dissolve the fruit substance (left lower photo). This leaves an area on the fruit or vegetable, just below the skin, which makes it unsightly (see photo below). The fruit is safe to eat.

Leaf-footed bugs are not very discriminating in their preferences and may be found on almost any fruiting vegetable.

The other photos are of the ubiquitous stink bugs, brown and green. They are responsible for the same kind of lesions as the leaf-footed bug and should be given the same reception.

As often as not, if alerted, any of these bugs may fly off or simply drop and get lost in foliage or soil. Trying to kill them in the early morning is most effective as they seem to be sluggish or otherwise distracted. When you kill one of these adults, you will understand how the common name was decided.

The light marks on this cherry tomato are sites of injury cause by leaf footed bugs. Photo by Laura Steffee.

Green Stinkbug. Photo Frank Peairs, Colorado State University, in https://hgic.clemson.edu/factsheet/tomato-insect-pests/

Brown Stink Bug. Photo by Herb Pilcher, USDA Agricultural Research Service, in https://hgic.clemson.edu/factsheet/tomato-insect-pests/

https://www.lsuagcenter.com/topics/crops/fruits_and_vegetables/blueberries/pests/leaffooted-bugs

http://ipm.ucanr.edu/PMG/PESTNOTES/pn74168.html

Tomato Army Worm

THERE ARE QUITE A FEW rules of gardening that command attention. One of them is when you see a hole in a tomato leaf with visible droppings nearby...either find the offending worm and remove or anticipate further damage. Chemical means may not work well on adult caterpillars.

The army worm is a regular visitor to gardens where tomatoes or almost any vegetable grows. Presence is usually noticed by holes in leaves and sometimes, on close inspection, by the tiny worms swarming over a leaf that appears to have been "skinned" from below leaving only a lacy leaf support structure (bottom left photo). Later, the individual adult caterpillars make larger holes in the leaf, often leaving black droppings (frass). Still later, they invade and ruin the fruit.

If caught early, the damage to the plant and crop can be minimized. Physical removal is important and should be done whenever possible. Chemical means may be employed, and these are most effective on the younger caterpillars. Spinosad and BT (extract of Bacillus thuringiensis) and insecticidal soaps are popular organic insecticides used in regular spray cycles to control this and other tomato insect pests

Tomato army worm on damaged leaf. Photo by Jerry Ballanco.

Army worm eggs. UFL.edu. Eggs may be on upper or, more often underside of leaf. The hatch occurs 5-6 days after eggs are laid.

Mature armyworm and typical foliar damage and frass. Photo by Jerry Ballanco.

Army worm in tomato. Photo by Jerry Ballanco.

Newly hatched armyworms on tomato leaf. In appropriate conditions, a new generation may occur every 4-6 weeks. Photo by Susie Andres.

Moth of tomato armyworm, Spodoptera eridania. UFL.edu

https://www.lsuagcenter.com/~/media/system/f/a/2/5/fa25b59d25c9d8ad93142283f4a311be/1902%20tomatoes%20rev%200417pdf.pdf

http://entnemdept.ufl.edu/creatures/veg/leaf/southern_armyworm.htm

Tomato Pinworm

Leaf miner type damage from tomato pinworm. Photo by UFL

eaf

Pinworm damaged tomato. https://www.thedailygarden.us/garden-word-of-the-day/tomato-pinworms for photo credit.

THE FOLIAR DAMAGE CAUSED BY the early larval form of the tomato pinworm is usually minimal, thus it goes undetected. Their presence is usually noted by finding a tomato that is ripening far faster than its mates. Close inspection discloses a tiny pinhole near the stem end that has a small discolored halo around the hole. The pinworm may or may not be present any longer, but that tomato is ruined.

Once pinworm presence is detected, the only realistic solution is regular spraying with a chemical that will kill them. BT will not harm pollinators and us usually effective. Sunlight deactivates BT so best to spray in the evening.

- "Newly hatched larvae spin a shallow web covering where they mine into the leaf and then create narrow straight or serpentine mines as they tunnel through leaves.
- Frass (insect poop) is deposited in a single mass at entrances of mines.
- Older instars make blotch mines next to their leaf fold.
- Most damage occurs when larvae enter fruit near the stem, mining just below the fruit surface or in the core."
  https://extension.umd.edu/hgic/topics/tomato-pinworm-vegetables

https://www.lincolnu.edu/c/document_library/get_file?uuid=690d1bd4-47d6-403d-b4c6-4a5b022c55e2&groupId=145912

https://edis.ifas.ufl.edu/in231

http://entnemdept.ufl.edu/creatures/veg/tomato/tomato_pinworm.htm#:~:text=Damage%20to%20tomatoes%20results%20from,small%20%22pin%22%20size%20hole.

Tomato Fruitworm (aka bollworm, aka corn earworm)

THE TOMATO FRUITWORM IS DIFFICULT to control because it is so sneaky. The egg is laid near the ripe or unripe fruit and the emerging larva quickly begin to feed on the tomato. The caterpillar may take a few bites then move to another tomato, then another. Alternatively, it may live to maturity in one of the tomatoes. It is so hard to find because it does not damage the foliage and the damage to the tomato is usually near the calyx and difficult to see until the tomato is harvested. In contrast, the tomato pinworm causes the invaded fruit to ripen early so it is noticed.

If you do discover Fruitworm damage either on the plant or in the fruit after harvest, spray with BT or Spinosad on a weekly basis for two to three weeks minimum to control that generation. You can anticipate more will come. Adults may not be impacted by sprays as much as younger caterpillars. Do not assume your spraying has been successful. Continue to survey.

Tomato fruitworm holes are typically round, shallow or deep, multiple or single, in ripe or unripe fruit. Photo by Jerry Ballanco.

Tomato Fruitworm. Photo by University of California.

Adult tomato fruitworm in residence in an unripe tomato. Photo by Jerry Ballanco

Tomato Hornworm

Tomato Hornworm: baby. Notice the black horn. Photo by Jerry Ballanco.

IF YOU LOOK CLOSELY, YOU will see the "horn" on this very small hornworm on the edge of the eaten area of the leaf.

This tiny worm, before being found, was on his way to becoming one of the most ravenous caterpillars that eat tomato foliage. An adult, which may reach the diamater of a finger and can be almost two inches long, can devour the leaves on a large branch in a single sitting, overnight. If you find such an attack on a tomato bush, it is imperative that you search until you find the worm or worms. It is unlikely that chemical means will have an effect on an adult worm**.**

The tomato hornworm is a camouflage masterpiece. Finding it is sometimes very difficult, despite its size. Keep at it until you find the beast, usually hiding out on a branch.

This year, in my garden, this youngster was the only one found. The plants were sprayed weekly with Bt to help control this and other lepidopteran pests to good effect.

Tomato Hornworm. Photo by UGA.

https://edis.ifas.ufl.edu/in158

https://extension.umn.edu/yard-and-garden-insects/tomato-hornworms

Leaf Miner

The serpentine "white" tracks trace the path of the larvae as they burrow through the leaf parenchyma.
Photo by Clement Wycliffe Lartigue IV

UNDER NORMAL CIRCUMSTANCES, TYPICAL leaf miners do only cosmetic damage. The leaf continues to photosynthesize so leaf miners need not be vigorously addressed. The leaf in the lower photo, however, shows signs of generalized damage and was appropriately removed.

Preventing leaf miner activity is difficult and, fortunately, not necessary. The moth lays the egg which is nearly impossible to see. The larva hatches and immediately bores to the parenchyma of the leaf where it is virtually immune to harm from chemicals. Best treatment is to enjoy nature's cleverness.

Leaf miner tracks with secondary injury to leaf. Photo by Cindy Hemm

https://www2.ipm.ucanr.edu/agriculture/tomato/Leafminers/

Potato Aphids

Potato aphid infestation (Macrosiphum e uphorbiae). Merle Shepard, Gerald R.Carner, and P.A.C Ooi, Insects and their Natural Enemies Associated with Vegetables and Soybean in Southeast Asia, insectimages.org

2020 IS THE FIRST YEAR THAT I have seen aphids on tomatoes in my garden, so it is unlikely to be a common tomato pest. Aphids should be attended to promptly as they multiply rapidly and can suck enough juice from the plant to severely damage it. This potato aphid has a wide range of hosts including other solanaceous crops, beans, and beyond.

Sometimes, a vigorous jet from a water hose will dislodge them. If they return in a day or two, spray again. If they return after that, another plan is needed. Biological tools, such as the release of aphid predators, requires a sufficient population of aphids to hold them where released. Applying "sticky" (such as Tanglefoot glue or Vaseline) to a material wrapping the stems of the plant will bother the ants that often accompany and even protect aphids. Their natural protectors absent, the aphids may succumb to garden predators. In a healthy garden, predators often keep aphid populations under control so they may not even be noticed.

Aphids may be controlled with a contact chemical such as insecticidal soap or horticultural oil. These cannot safely be used when the temperature approaches 90^{o} F.

If you enjoy being amazed, study the relationship between ants and aphids.

https://hgic.clemson.edu/factsheet/tomato-insect-pests/

http://ipm.ucanr.edu/PMG/PESTNOTES/pn7404.html

Whiteflies

Silverleaf Whitefly

Whiteflies on okra plant leaf. Photo from Nigeria.

WHITEFLIES ARE A NEARLY UBIQUITOUS pest in the heat of summer, bothering fruit trees and vegetable plants, as well as ornamentals. Among vegetables, they seem to especially enjoy okra, squash, and solanaceous crops. Citrus new growth is a delicacy to them. They do damage on several fronts: the adults and young suck juice from the leaves, weakening the plant and leaving honeydew residue, drawing ants, and diminishing photosynthesis. They also spread diseases. In a home garden, it is sometimes hard to know when or how to intervene if they are found.

Organic favorites, neem oil and insecticidal soaps, are effective but may harm the leaves when temperatures get into the high 80's. Use of a handheld vacuum cleaner and/or spray with a strong hose stream are ways to reduce the population without chemicals. Yellow sticky traps are sometimes suggested but are not terribly effective in controlling whiteflies in home gardens.

Although not high on the list of ideal practices, pyrethrin may be the best spray choice. Pyrethrin is often combined with another agent because the knock down dose of pyrethrin is less than the lethal dose. It is a contact spray so must be sprayed on the insects which are **often on the underside of leaves**. Unfortunately, alone or in combination, pyrethrin affects the nervous system of all insects it contacts, so beneficial organisms and pollinators are at risk but only if they are sprayed directly. There is little residual of the spray, so spray after the pollinators have gone to bed. Unfortunately, more than one spray event five days to seven days apart is usually necessary for adequate control.

Imidacloprid works but I wish neonicotinoids would be banned.

https://hgic.clemson.edu/factsheet/tomato-insect-pests/

http://npic.orst.edu/factsheets/pyrethrins.pdf

Two-spotted Spider Mites

Two-spotted spider mites. Photo by Missouri Botanical Gardens.

SPIDER MITES ARE ANOTHER UBIQUITOUS pest in a southern garden. They are undiscriminating feeders and are the creature most responsible when we see tiny white stippling on leaves. Leaves may also curl and otherwise distort when bothered by spider mites and very tiny webs may be visible. If you suspect they are present, put a piece of white paper under a flower or leaf and gently tap. If they are present, you will see what Dr. Fontenot describes as small tan specs that hop or move.

IPM principles again apply when deciding what to do. Control is not easy and absolute control nearly impossible. Multiple generations occur each warm season.

Neem oil is a reasonable choice for treatment in cool weather. Spinosad should be considered when the weather is warm.

This year, I serendipitously discovered that tomatillos make an excellent trap crop for spider mites. Do not forget to treat the trap crop or you will really make a mess.

https://www.missouribotanicalgarden.org/gardens-gardening/your-garden/help-for-the-home-gardener/advice-tips-resources/pests-and-problems/insects/mites/spider-mites-outdoors.aspx

https://hgic.clemson.edu/factsheet/tomato-insect-pests/

Root Knot Nematodes

Root Knot Nematodes on roots of tomato plant. Photo by Jerry Ballanco.

A NEMATODE IS A MICROSCOPIC SOIL dweller that invades the roots of susceptible plants. There are many kinds of nematodes: some very specific, and others a more general nuisance. In some cases, the root knot nematode invasion results in stunting, slow growth, easily wilting plants, yellow leaves, poor production, susceptibility to disease, and a gross-out when you pull the plant to end its misery. In root crops, distortion or gall formation may occur.

Discovery of this nematode pest in your garden is a great disappointment. It will be there for a while and is difficult to get rid of. It is best to not let it get a start. Do this by rotating crops on a three- or four-year schedule. That way the nematode population is not able to build up to a population that is harmful. If that is not possible, resistant varieties of tomatoes have been developed. The letters RKN will appear after the variety name.

Two techniques are available to reduce the population of nematodes in the soil.

French marigolds invite the nematodes into their roots but, when they enter, they can develop no further thus reducing the population by diminishing reproduction.

Another technique involves addition of chitin to the soil. When fungi in the soil try to dissolve the chitin for their use, they secrete an enzyme that ultimately compromises development of young nematodes. In Louisiana, chitin is in crab shells, shrimp shells, and crawfish shells. After a boil, add the shells to the soil, break up as much as possible with the shovel. Wait at least two weeks before planting anything, as the ammonium released in this process may damage young plants.

http://entoweb.okstate.edu/ddd/diseases/rktomato.htm

https://www.lsuagcenter.com/profiles/coverstreet/articles/page1486135407127

Viral Infections

Yellow Leaf Curl Virus

Yellow Leaf Curl virus. Photo by Clemson U.

LEAF CURLING ASSOCIATED WITH POOR growth or other foliar changes may be due to one of several viral diseases, none of which have satisfactory treatment. Should this combination of leaf curl, foliar color change, and poor growth occur in tomato plants in your garden, contact the AgCenter agent for suggestions about management, as other tomato plants may be at risk. Resistant varieties may be available.

https://hgic.clemson.edu/factsheet/tomato-leaves-rolling/

Tomato Spotted Wilt Virus

Tomato Spotted Wilt Virus. Photo by Dr. Don Ferrin.

CUPPING AND ROLLING OF THE upper leaves are typical symptoms of this virus. The infected leaves usually turn purple/brown along the veins.

This infection is transmitted by thrips. A plant infected with TSWV has usually been purchased commercially and brought home before it starts to develop signs of disease. In that case, the plant produces little or no fruit. The tomato in this photo is the result of a late, thrip-acquired infection. Peppers are also susceptible to this infection.

The initial phases of this disease are subtle. Years ago, the late Dr. Don Ferrin, professor of plant pathology at LSU, gave a talk to the Vegucator group on diseases of vegetables. Someone gave him a tomato plant as a thank you gift. He looked at the plant, smiled, and offered a sincere thank you. The plant was a perfect example of early Tomato Spotted Wilt Virus disease.

Tomato Spotted Wilt Virus. Photo by NMSU.

https://www.lsuagcenter.com/topics/lawn_garden/home_gardening/vegetables/disease_pest_management/tomato-spotted-wilt-virus

https://aces.nmsu.edu/ces/plantclinic/tomato-spotted-wilt-viru.html

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