TOMATOES – Information from websites and books compiled by Marisa Earnst.

BURY THEM.
Remove bottom leaves and bury tomato plants deeper than they come in the pot, all the way up to a few top leaves. Tomatoes are able to develop roots all along their stems. You can either dig a deeper hole or simply dig a shallow tunnel and lay the plant sideways. It will straighten up and grow toward the sun. Be careful not to drive your pole or cage into the stem.
An old trick when planting is to add Epsom salts (this works for peppers, too). One or two tablespoons in the planting hole add magnesium, an important nutrient for plants.
Tomatoes need a well drained site.

STAKE THEM
Staking is to drive a 6-foot stake into the soil 3 to 4 inches from each plant, preferably before the plant is set. As the plant grows, tie it to the stake with string 4 to 6 times during the season. Make the ties just below the fruit clusters. Old stockings make great ties. Tomato cages are quite popular, and last a long time.

MULCH - MULCH - MULCH
Mulch after the ground has had a chance to warm up. Mulching does conserve water and prevents the soil and soil born diseases from splashing up on the plants, but if you put it down too early it will also shade and therefore cool the soil. Try using plastic mulch for heat lovers like tomatoes and peppers. A 2-3" layer of mulching(like dry grass clippings) also helps to keep weeds down, so you don't risk disturbing the roots while weeding. 3" of perlite also works to deter fungus gnats. If fungus gnats are a problem, use Gnatrol.

REMOVE BOTTOM LEAVES.
Once the tomato plants are about 3' tall, remove the leaves from the bottom 1' of stem. These are usually the first leaves to develop fungus problems. They get the least amount of sun and soil born pathogens can be unintentionally splashed up onto them. Spraying weekly with compost tea also seems to be effective at warding off fungus diseases.

PINCH & PRUNE.
Pinch and remove suckers that develop in the crotch joint of two branches. They will take energy away from the rest of the plant. But go easy on pruning the rest of the plant. You can thin leaves to allow the sun to reach the ripening fruit, but it's the leaves that are photosynthesizing and creating the sugars that give flavor to your tomatoes. Leaves also protect the fruit from scorching sun and prevent "green shoulders". Do not prune all the leaves below the blossoms. Leave one ft. below lowest fruit-bearing stem clear of branches. You can cut either a whole leaf or just part of the leaf as necessary, so you can see what is going on with the stem.

WATER REGULARLY.
Tomatoes need about 1-2 inches of water per week. Don't water the leaves, just the base of the plant. If rainfall is not enough, water plants thoroughly once a week. Heavy soakings once a week are better than many light sprinklings. Include a lot of organics in your soil to help absorb and hold water. Water deeply and regularly while the plants are developing. Tomatoes in containers need to be watered every day.

Irregular watering (missing a week and trying to make up for it), leads to blossom end rot and cracking. Once the fruit begins to ripen, lessening the water will coax the plant into concentrating its sugars. Don't withhold water so much that the plants wilt and become stressed or they will drop their blossoms and possibly their fruit. Also water with egg shell water about 4-5 times after the fruits start developing. This provides calcium which our soil is low on.

Tomatoes tend to crack when they receive irregular water. If your tomatoes have gone through a dry spell and you try to make up for it with frequent watering, the inside of the tomato will plump up faster than the outside can stretch and grow. As a result the outer skin of the tomato splits open or cracks. Tomatoes that crack are still edible. They just won't keep as long. You can prevent future tomatoes cracking by making sure that they receive water regularly, whether or not it rains. Mulching the area around the tomatoes will also help maintain ground moisture levels.

SWEET TOMATOES
When fruits begin showing color, add a spoonful of sugar to their water. This will make your tomatoes sweeter and juicier.

FERTILIZER
Feed the plants by using dry fertilizer, or Osmocote, or solution culture method. No one nutrient solution is superior. Either buy a ready prepared highly soluble fertilizer and follow directions, or make your own solutions. One suggested nutrient solution may be made by dissolving 2 cups of either a 6-6-6, 6-8-6, 6-8-8, or 8-8-8 analysis common fertilizer, 6 tablespoons of Epsom salts, and ½ teaspoon iron chelate in 1 gallon of tap water. This is your base solution. From this you will make your Growing Solution.

For young plants, use 2 tablespoons of base solution mixed in 1 gallon of water. Apply once every 3 days, or depending on plant needs. Apply enough solution to wet to the bottom of the container at every application.

Other good choices are fish fertilizer, liquid kelp, or any tomato food. Adding Epsom salts to the planting hole, mixed with the dirt, helps with the plant's health.

TOMATO TONIC
3 cups compost;
½ cup Epsom salts
1 TBSP baking soda
1/2 cup powdered milk
Combine the first 3 ingredients in a bucket and add a handfulof the mix to the planting hole. After planting, sprinkle a bit of the dry milk on the soil. Repeat every few weeks for the most terrific tomatoes in town.

If the growing season is just about over and your tomato plants still have a crop of green tomatoes on them, don't rush to harvest them green and then let them ripen indoors. To encourage the green tomatoes on your vines to ripen before frost, remove any remaining flowers. The flowers won't have time to mature into fruits anyway and removing them will signal the plant to finish setting seed by ripening the existing tomatoes.

If frost threatens and the tomatoes are still a stubborn green, lift the whole plant and hang it in a dry spot in the garage or basement. The tomatoes should take the hint that their mother plant's days are numbered and begin to ripen (still on the vine). If you prefer, pick the green tomatoes and wrap each in newspaper. Then pack them in a cardboard box and store in a cool, dry place. They will continue to ripen, so check them often.

When the stem end of a tomato remains green or yellowish, it is called green shoulders. The green area is also noticeably harder than the ripened fruit. This can occur when temperatures remain high for a prolonged period or when the fruit receives too much direct sun exposure. The chlorophyll in the fruit that would normally break down as the fruit ripens, doesn't or does so too slowly. This problem is more prevalent in heirloom varieties, since many hybrid tomatoes have been bred not to do this. If you find this happening to your tomatoes, make sure the fruits have good foliage cover. If the problem persists, try picking the tomatoes while they are still green and allowing them to ripen away from the sun. As with tomatoes that crack, tomatoes with green shoulders are still edible.

Bottom of tomatoes turns black and soft. This is called Blossom End Rot. It is thought to be caused by insufficient calcium. However, don't rush out to by a calcium supplement for your soil. This calcium deficiency is probably caused by irregular watering and a fluctuation in water levels. Water carries calcium throughout the tomato plant. Without enough water, the calcium, which is being used first for foliage growth, doesn't make its way to the fruits. Other factors may include: too much nitrogen fertilizer (manure), too much salt in the soil, root damage and a soil pH that is too high or too far below the optimum 6.5. If needed, adding crushed egg shells to the soil will add calcium.
There's no saving the rotting fruits. Remove the affected fruits, make sure the plants are getting at least and inch of water per week, correct any other problems, mulch under the plants and you should see improvement. The key is to keep the plants evenly moist, and the best way to do this is to lay down a thick layer of mulch once the ground warms up.

You can also make a calcium booster by soaking dry(dry in the microwave or oven) eggshells in water for 24 hours and watering your tomato plants with it.

LEAF PROBLEMS

Early Blight. Early Blight can affect the foliage, stems and fruit of tomatoes. Symptoms: Dark spots with concentric rings develop on older leaves first. The surrounding leaf area may turn yellow. Affected leaves may die prematurely, exposing the fruits to sun scald. Management: Early Blight fungus over-winters in plant residue and is soil-borne. It can also come in on transplants. Remove affected plants and thoroughly clean fall garden debris. Wet weather and stressed plants increase likelihood of attack. Copper and/or sulfur sprays can prevent further development of the fungus.

Credit: Clemson Univ.-USDA Cooperative

Gray Leaf Spot. (Stemphyllium) Gray Leaf Spot affects only the leaves of tomatoes, starting with the oldest leaves. Symptoms: Small, dark spots that can be seen on both the top and bottom surfaces of the leaves. The spots enlarge and turn a grayish brown. Eventually, the centers of the spots crack and fall out. Surrounding leaf areas will turn yellow and the leaves will dry and drop. Fruit production is inhibited. Management: Warm, moist conditions worsen gray leaf spot problems. Remove all affected plants and fall garden debris.

Gray Leaf Spot

Late Blight Late blight affects both the leaves and fruit of tomatoes. Late Blight is the disease responsible for the Irish Potato Famine. Late Blight spreads rapidly. Symptoms: Greasy looking irregularly shaped gray spots appear on leaves. A ring of white mold can develop around the spots, especially in wet weather. The spots eventually turn dry and papery. Blackened areas may appear on the stems. The fruit also develop large, irregularly shaped, greasy gray spots. Management: The Late Blight fungus can over-winter in frost free areas. Since it spreads to

potatoes, it also over-winters in potato debris and seed, even in colder areas. The fungus develops during periods of cool wet weather. Fungicide sprays as a preventative measure during these periods may be needed if the crop is being grown near large areas of tomato relatives (Solanaceous weeds, potatoes).

Late Blight

Septoria Leaf Spot is sometimes mistaken for Late Blight. With septoria leaf spot, the papery patches on the leaves develop tiny, dark specks inside them. Older leaves are affected first. Management: Copper sprays are somewhat effective at halting the spread of symptoms.

Septoria leaf spot appearance on tomato can vary in size and coloration on tomato foliage.

Septoria lycopersici

Sometimes, Septoria lesions can be quite large and have tan or whitish centers.

Mature lesions of Septoria leaf spot showing black, speck-like pycnidial fruit bodies.

Verticillium Wilt. This name can be misleading, as sometimes the leaves will turn yellow, dry up and never appear to wilt. Verticillium wilt is caused by a soil-borne fungus and it can affect many different vegetables. The fungus can persist in the soil for many years, so crop rotation and selection of resistant varieties is crucial. Symptoms include: wilting during the hottest part of the day and recovering at night, yellowing and eventually browning between the leaf veins starting with the older, lower leaves and discoloration inside the stems. Verticillium wilt inhibits the plants ability to take in water and nutrients and will eventually kill the plant. Verticillium wilt is more pronounced in cool weather. Management: Remove affected plants.

By far the most feasible and economic control is the use of *Verticillium*-tolerant tomato cultivars of which there are many with varying maturities and excellent horticultural qualities. These include the following:

New Yorker (V)	Earlirouge	Basket Vee
Springset	Supersteak	Campbell 17
Pic Red	Campbell 1327	Big Set
Jet Star	Fireball (V)	Setmore
Supersonic	Beefmaster	Small Fry
Heinz 1350	Better Boy	Terrific
Heinz 1439	Bonus	Big Girl
Westover	Gardener (V)	Mainpak
Royal Flush	Monte Carlo	Early Cascade
Floramerica	Nova (Paste)	Jumbo
Veebrite	Crimson Vee (Paste)	Wonder Boy
Veemore	Veeroma (Paste)	Rutgers 39
Veegan	Veepick (Paste)	Ultra Boy
Veeset	Ramapo	Ultra Girl
Burpee VF Hyb.	Moreton Hyb.	Rushmore
Starshot	Spring Giant	Jetfire

Verticillium Wilt of Tomato

Verticillium wilt of tomato does not cause outright wilting of plants, but causes yellow blotches on the lower leaves.

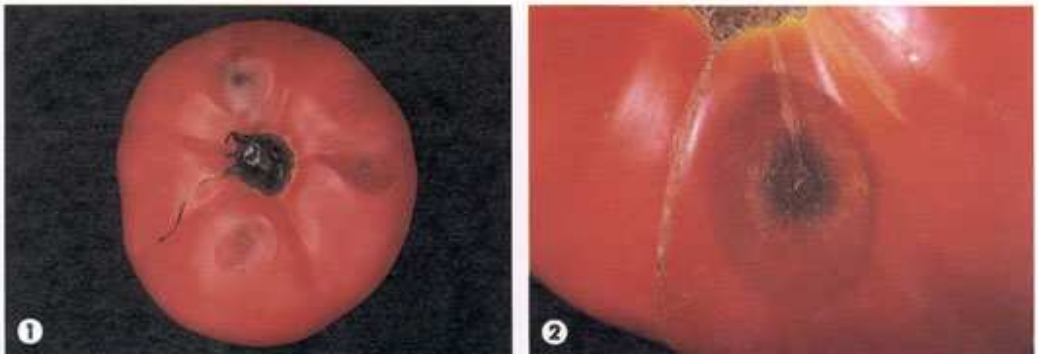
Southern Blight Southern Blight manifests as a white mold growing on the stem near the soil line. Dark, round spots will appear on the lower stem and both the outer and inner stem will become discolored. Southern Blight fungus girdles the tomato stem and prevents the plant from taking up water and nutrients. Young plants may collapse at the soil line. Management: Crop rotation seems to help. There has also been some evidence that extra calcium and the use of fertilizers containing ammonium offer some protection.

Southern blight

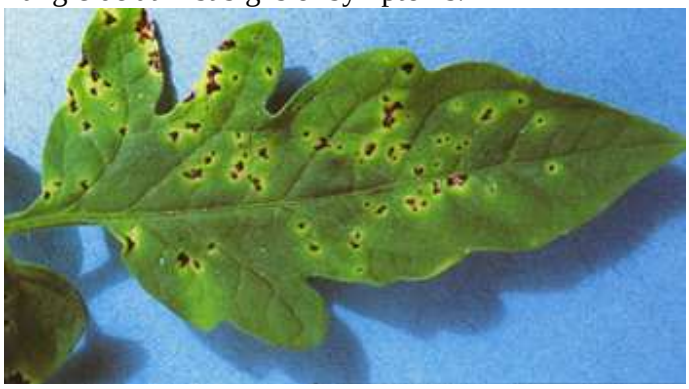
FRUIT DISEASES

ANTHRACNOSE Anthracnose is a very common fungus that causes tomato fruit to rot. Symptoms: Small, round, sunken spots appear on the fruit. The spots will increase in size and

darken in the center. Several spots may merge as they enlarge. The fungus is often splashed onto the fruit from the soil. It can also take hold on Early Blight spots or dying leaves. Wet weather encourages the development of Anthracnose. Overripe tomatoes that come in contact with wet soil are especially susceptible. Management: Copper sprays offer some resistance. Remove the lower 12" of leaves, to avoid contact with the soil. Don't water the leaves, just the base of the plant.



BACTERIAL SPECK There are several bacterial problems that affect tomatoes including Bacterial Speck. Symptoms: Tiny, raised, dark spots, usually with a white border. Management: Copper fungicide at first signs of symptoms.



BUCKEYE ROT Buckeye Rot is more common in Southern states, especially during wet periods. Symptoms: Buckeye Rot is similar to Blossom End Rot, except on green fruit. On ripened fruit the rotting area will appear water soaked, but not dark in color. The rot develops on the area of the fruit that touches the soil. The spot will enlarge and develop concentric rings that resemble a buckeye. The affected area is smooth, distinguishing it from Late Blight, which has a rough surface. Management: Remove affected fruit and keep future fruits from contact with the soil.

GRAY WALL Gray Wall is essentially a ripening problem. Symptoms: The green fruits may have a gray cast or gray blotches. Ripe fruit will have green or brown areas on the inside of the fruit. Management: Good growing conditions will prevent gray wall. Make sure plants aren't heavily shaded, are receiving even watering and fertilizer and that the soil is not compacted around the roots. Cool temperatures and stressed or unhealthy plants also contribute to the problem.

Common Tomato Fruit Disorders

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Blossom-End Rot (BER) - Characterized by a large, leathery brown or black spot on the bottom of the fruit. **(Fig. 1). ** In some cases, internal BER can occur within fruit. It generally occurs on the first fruit cluster. BER is caused by a lack of calcium in the fruit which causes the fruit to die back creating the characteristic spot. What can you do to prevent it? Have your soil tested to make sure calcium is present in adequate amounts. Chances are the calcium level will be fine but if it is not, add limestone (for acid soils with a pH below 6), or gypsum when the soil pH is in the 6 to 7 range. If calcium levels are okay, the next most important control is to maintain optimum soil moisture. When tomatoes experience the slightest bit of drought, BER may result. Using mulches will usually significantly decrease BER as excessive evaporation from soil is reduced. If growing on bare ground, avoid cultivating too close to plants to prevent root damage and the need to maintain deep root development. Varieties will vary in their susceptibility so if you have a problem with a particular variety, choose a new one next year. When side-dressing plants, using a nitrate type fertilizer like calcium nitrate is preferable to ammonium based ones like urea. Finally, don't bother to use calcium sprays. They are worthless in combating the problem. The same problem can occur on pepper and eggplant.

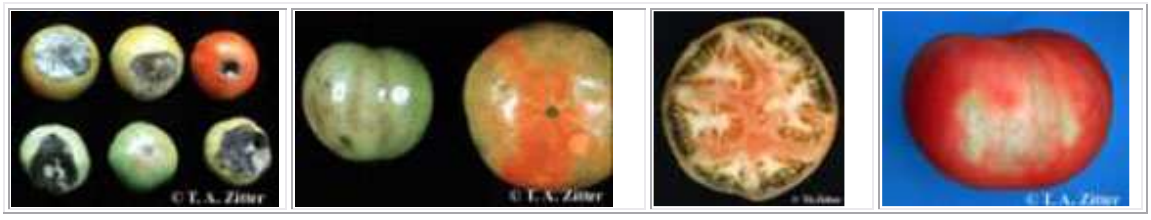


Fig. 1 Blossom-end rot	Fig. 2 Graywall, external symptoms	Fig. 3 Graywall, internal	Fig. 4 Blotchy ripening

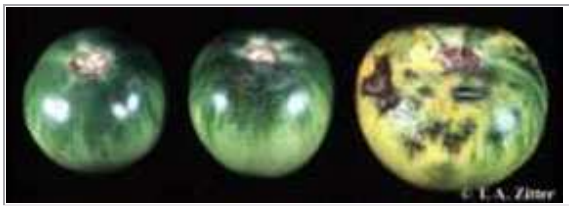
Internal Browning (IB), Graywall (GW) or Blotchy Ripening (BR) - A complex of disorders, hence the various common names applied, that result in irregular ripening, yellowing or internal browning of fruit. Tobacco or tomato mosaic viruses (TobMV, TomMV) have been implicated in some cases of GW, but plants free of virus and those resistant to virus also develop GW. GW typically develops on green fruit prior to harvest. It appears as black to dark brown necrotic tissue in the walls of the fruit. **(Fig. 2).** The outer walls are most frequently affected as seen when fruit are cut. **(Fig. 3).** Blotchy ripening. **(Fig. 4)**. gets its name because the fruit ripens unevenly, with the patches that don't ripen or do so after the rest of the fruit is over-ripe. Symptoms often develop in the interior of dense plants with lots of foliage. Cloudy, wet and cool conditions, high nitrogen, low potassium and compacted soils will increase the severity.

Catface. - Seen as severe scarring on the blossom end of the fruit, usually more severe on the first fruit harvested in the summer and on very large fruited varieties. **(Fig. 5).** Extended periods with temperatures of 60-65F during the day and 50-60F at night cause the problem. The temperatures do not directly affect the fruit but instead the flowers when they are very small. Protection of some kind (row covers, wall of waters, hot caps, etc.) will minimize the problem as will changing varieties. Although we normally think of the early fruit being affected, cool nights extended over the mid-season could cause the problem in later plantings.

Fruit Cracking - This is due to rapid uptake of water by the fruit, as a result of heavy rain or heavy watering. The water can move to the fruit through the roots and also directly into the fruit around the stem scar. Cracks may be concentric (around the stem). **(Fig. 6 a, b)** , or radial (radiating out from the stem). **(Fig. 7)**. To overcome the problem, choose crack resistant varieties like Mountain Pride or Mountain Delight and maintain uniform soil moisture by mulching and steady watering.

			
Fig. 5 Catface on variety Celebrity	Fig. 6a Concentric crack	Fig. 6b Concentric crack	Fig. 7 Radial cracking

Fruit Russeting or Shoulder Checking - Also known as weather checking, this malady is due to the presence of water (irrigation, rain, dew) on the surface of the fruit for extended periods. **(Figs. 8, and 9)**. Cool mornings later in the summer are ideal conditions for russeting to develop. Good air circulation around plants by growing on trellises can help.



Figs. 8 and 9. Fruit russeting (skin checking or weather checking) on Count II

Fig. 10 Zippering

Zippering - A thin longitudinal scar extends from the stem scar to the blossom end. **(Fig. 10)**. The longitudinal scar has a series of transverse scars which resemble a zipper. Sometimes a hole opens to the locule as shown in this picture. This defect happens when the flower anthers fuse to the ovary wall of developing fruit and occurs most commonly when fruit set takes place in cool weather. Varieties can vary in their susceptibility to this malady.

Yellow Shoulders - The tops of the fruit never ripen completely, especially on fruit that are exposed to direct sunlight. **(Fig. 11)**. The area under the yellow shoulders will be corky as well as discolored. This is partly a genetic problem that can be lessened by growing plants with the uniform ripening gene. Maintaining good foliage cover so fruit are shaded will also help. Remember, tomatoes do not need direct sunlight on the fruit to ripen!.

Fig. 11. Yellow shoulders

Fig. 12. Sunscald

Fig. 13. Excessive heat in the greenhouse or high tunnel

Sunscald. and Excessive Heat - Symptoms appear as a yellowish to white water soaked area on the side of the fruit exposed to the sun. **(Fig. 12)**. It is more severe on fruit that have been heavily shaded and then suddenly exposed to the direct rays of the sun. Secondary bacterial or fungal infections can invade the sunscald area. To avoid this problem, ensure your plants are adequately fertilized so healthy foliage shades fruit. Also, don't prune plants later in the season after fruit have formed. Excessive heating can buildup dramatically in greenhouses and high tunnels on sunny days, particularly if no ventilation is provided. This can lead to direct death of young tissues on the fruit surface and may extend deeply into the fruit wall. **(Fig. 13)**.

Stink Bug and Tarnish Plant Bug Feeding - Pale, yellow, cloudy spots on the fruit surface with shallow, white pithy areas in the flesh are caused by stink bug feeding. Stink bugs range in size from 3/8 to 5/8 inches (mean ½ inch), and are brown or green in color. **(Fig. 14)**. Such feeding will result in tomatoes showing cloudy spot. **(Fig. 15)**. Adult tarnished plant bugs are about ¼ inch long and are brown, tan or greenish with darker markings on their wings and back. TPB will feed on newly formed fruits that are succulent, and secrete a toxic substance from their salivary glands which kills the cells surrounding the feeding sites. **(Fig. 16)**. As the fruit enlarges, healthy tissue will expand while the dead tissue does not, which results in distorted and

malformed fruit. Such fruit may also be invaded by common fungi such as *Alternaria alternate*. **(Fig. 17)**. Alfalfa is a preferred host, and when alfalfa is harvested, this stimulates lygus migrations into tomatoes that are unprotected when the sides of high tunnels are raised. Control bugs to minimize the problem.

Fig.14. Stink bug leading to Fig. 15. Cloudy spot

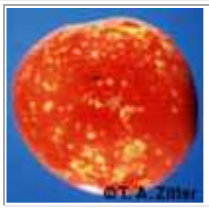


Fig. 16. Tarnish plant bug injury leading to Fig. 17. *Alternaria alternata*.