

# The Tomato Apocalypse

## Reference

### Physiological

<b><i>Fruit Won't Set; Won't Ripen</i></b>	
	<p><b>Cause</b></p> <ul style="list-style-type: none"> <li>• High temperatures, above 70° at night, 85°- 95° during the day, combined with low humidity and hot, drying winds. Or too low temperatures at night, about 55° or lower. Unfavorable temperatures interfere with pollination, and/or can cause blossom drop.</li> <li>• Too much nitrogen fertilizer, which causes excess foliage growth at expense of fruit production.</li> <li>• Drought, which causes blossom drop before fruits can be set.</li> </ul>
	<p><b>Management</b></p> <ul style="list-style-type: none"> <li>• Provide shade during the hottest daytime hours, either through use of shade cloths that provide 20% to 40% shade or by planting in locations naturally shaded in late afternoon.</li> <li>• Provide “balanced” fertilization, with a content of phosphorous and potassium each equal to, or exceeding, the content in nitrogen.</li> <li>• Maintain stable moisture levels in soil.</li> <li>• Plant tomatoes in an area that receives at least 6 hours of sunlight a day</li> </ul>
<b><i>Fruit Cracking</i></b>	
<p>Development of cracks in skin of tomatoes, generally at stem ends of fruit, in radial or concentric patterns. Sometimes they heal into rough, unsightly scar tissue; sometimes they become avenues for disease infections and/or insect predation.</p>	
	<p><b>Cause</b></p> <ul style="list-style-type: none"> <li>• Genetic predisposition in some tomato varieties, particularly heirloom varieties.</li> <li>• Wide variations in moisture availability – abundant irrigation, for example, after several days of too little soil moisture. Stable soil moisture levels can be difficult to manage during summer monsoon.</li> </ul> <p><b>Management</b></p> <ul style="list-style-type: none"> <li>• Keep soil moisture levels uniform.</li> <li>• Plant varieties that are less prone to cracking; some hybrid varieties are especially resistant to cracking.</li> </ul>

## ***Blossom End Rot***

Tan to black lesion at blossom end of the fruit that grows larger as fruit matures; fruits with blossom end rot will not ripen well.



### **Cause**

- Moisture stress
- Excessive availability of nitrogen, magnesium, potassium, or salt (NaCl)
- Lack of calcium (not a problem in Arizona soils, which are generally rich in calcium).

### **Management**

- Maintain uniform level in soil moisture
- Avoid over-fertilization
- Do nothing. Blossom end rot in Arizona, if it appears at all, is often seen only on the first tomatoes of the season, for reasons still not well-understood; subsequent fruits are unaffected.

## ***Sunscald***

White or yellow blisters form on green fruit on the sunwards side, becoming flattened, white to gray areas with papery skin as fruit matures; often leads to black mold infection and rotting of fruit.



### **Cause**

- Basically, it's sunburn – usually occurring because the plant has insufficient foliage to shade its fruit, either because the plant is still young and not well-filled out with leaves, or because the plant has some other problem limiting its canopy development.

### **Management**

- Provide shade to young, developing plants.
- Or do nothing. The problem will solve itself as the plant develops and leafy growth proliferates to shade subsequent fruits.
- Diagnose and treat other underlying problems that may be inhibiting canopy development.
- Do not excessively prune foliage.

# Insects

## ***Tomato Hornworms***

Caterpillar of the Five-spotted Hawkmoth (*Manduca quinquemaculata*); begins as small caterpillar, but grows rapidly to large length and girth, about the size of a finger. Tobacco hornworms are the closely-related larva of the Carolina Sphinx Moth (*Manduca sexta*) that also feed on tomato plants. Both species will attack eggplant and pepper plants as well.



### **Damage**

- Quickly defoliates the leafy canopy of tomato plants.
- May attack green fruits, although leafy canopy appears to be preferred.

### **Management**

- Most effective is removal by hand. Look for caterpillars in areas of defoliation; they have good color camouflage, so even at their largest size they can be hard to see; grasp them firmly (they do not sting or bite) and pull (hard, they have a good grip) away from plant. Dispose of by squashing under foot, by immersing in a bucket of soapy water, or by feeding them to poultry if you have any.
- Also highly effective, but relatively benign environmentally, are spray applications of Bt (*Bacillus thuringiensis*), a parasitic bacterium, or of Spinosad, an organic insecticide derived from soil bacteria found predominately in Caribbean rum distilleries.

## ***Tomato Fruit Worms***

These are the same as Corn Earworms, which prefer to feed on sweet corn but will also attack tomatoes opportunistically. They are the caterpillar of the Corn Earworm Moth (*Helicoverpa zea*).



### **Damage**

- Tomato Fruit Worms bore into both green and ripe fruits, rendering them unpalatable and rotten.

### **Management**

- Treatment with either Bt (*Bacillus Thuringiensis* var. *Kurstaki*) or Spinosad is effective for tomato infestations. Use of either material is certified as meeting requirements for organic gardening.

## ***Stink Bugs***

Green or brown shield-shaped insects that feed on garden crops by piercing tissues with sucking mouthparts and extracting plant sap and juices. The resulting wounds give fruits and vegetables an unappetizing appearance but, for the most part, do not compromise edibility. Some stink bug varieties do carry and transmit diseases, however, that can seriously weaken or kill affected plants.



### **Damage**

- Locations of piercings on tomato fruits show up as white (on immature fruit) or yellow (mature fruit) spots on and in fruit flesh.
- Stink bug feeding on young, not-yet-productive plants often leads to reduced growth and vigor and delayed on-set of fruiting.

### **Management**

- Mature stink bugs are resistant to insecticides. Immature stink bugs can be treated during their five instar stages of growth with insecticidal soaps, pyrethrum, or neem oil. Intense infestations have been treated with some success with carbaryl, but this should be considered a last resort due to this chemical's broad-spectrum toxicity.
- Mature stink bugs can be picked off garden plants by hand and squashed or deposited in a bucket of soapy water. Their distinctive egg masses, laid in lattice-like patterns on the undersides of leaves, can also be picked off and disposed of.
- Stink bugs seek shelter at night; sheets of cardboard placed next to infested plants will accumulate populations of stink bugs beneath them overnight that can be removed efficiently with a shop vac at dawn.
- Stink bugs overwinter in garden debris, so it is important to practice good sanitation in the garden at the end of the gardening season. Clean up all plant debris and dispose of it, or till it under.

# Diseases

## Viral Diseases

There are several viral diseases that affect tomato plants, none of which has any effective cure other than removing the infected plant from the garden. Curly Top Virus is relatively common in the Verde area of Yavapai County, but not in higher elevations, like the Prescott area. Weeds such as Russian Thistle, Mustard, and Kochia (among others) provide an effectively inexhaustible reservoir for the Curly Top Virus, vectored by the Beet leafhopper. Many of the tomato viruses, including Curly Top, are not limited to tomatoes alone, but are infectious for other garden crops as well.

### Damage

- **Mosaic viruses** produce, as the name implies, mosaic patterns of leaf discolorations, as well as overall stunted growth and poor-quality fruits.
- Some “**wilts**” are viral in origin, although most are caused by fungi. As the name implies, wilt infections are characterized by drooping foliage and dramatic loss of overall plant vigor.
- **Curly Top Virus** can be recognized by a generalized fading of color, leaves rolling upwards along the margins while tips curl downwards, and leaf veins discoloring towards purple.
- Fruits on plants with viral infections may ripen color-wise but have poor to objectionable flavor.

### Management

- For **Curly Top** infections, remove and replace the entire plant. Curly Top is transmitted by a tiny insect, the Beet Leafhopper; it is not infectious from plant to plant by any other means. Infected plants should be removed from the garden immediately and disposed of. No infectious materials will remain in the soil. In large tomato plantings, the prudent Verde Valley gardener will keep a small supply of replants specifically to alleviate Curly Top losses. Control weeds, if you can, in areas adjacent to your garden.
- Because insects are the sole vector for many viral diseases in tomatoes, overhead cover with shade cloth or fine mesh fabric can limit losses, if it is possible to maintain coverage in place. The Beet Leafhopper, the vector for Curly Top, flies in a high, arcing trajectory from feeding to feeding, always approaching its next feeding station from high above such that it can be effectively blocked by a top cover.
- Plant disease-resistant varieties. There are resistant hybrid tomato varieties for several mosaic viruses, as well as for some wilt and leaf curl viruses. There are even a few varieties that are advertised as resistant to Curly Top Virus, although their fruits are said to be of low quality and for that reason, no doubt, they are not widely available. Look for code letters on seed packets that indicate resistances to specific viruses (like, “TMV” for Tobacco Mosaic Virus).



## ***Fungal Diseases***

Fungal diseases are the most common tomato disease problems in Yavapai County, apart from the Curly Top Virus in the Verde Valley. These include various mildews, blights, wilts, rots, and spots. Fungal diseases are spread by, and are largely maintained by, moist conditions, which is why they tend to appear more robustly after the onset of the Monsoon Season.

### **Damage**

- Fungal diseases generally progress towards the complete destruction of the plant. Infection is spread easily between adjacent plants, usually by splashing water during rainstorms or overhead watering.
- Once fungal infections are apparent, it is generally too late to do anything about them, other than to try to limit their spread.

### **Management**

- Always use clean, robust, disease-free transplants from reputable sources to start your tomato garden.
- Fungal organisms persist in soil and organic materials left over from previous years' crops. Maintain good sanitation by removing all plant debris from the garden at the end of each season. Rotate crop types within the garden: do not plant the same varieties, types, and families in the same place over successive seasons. Tomatoes are in the same family (Solanaceae) as peppers, potatoes, and eggplants: do not plant these types in rotation with each other. Observe 2- to 3-year (5 years if infections were significant in prior plantings) intervals between Solanaceae plantings in the same area.
- Where you know you have had fungal infections in the past, apply appropriate fungicides proactively, before fungal infections are apparent on your plants. Fungal infections cannot be cured, only limited. Application immediately after a heavy monsoon rain is advisable. Try to use the least toxic fungicide that is effective for your problem: read and obey label instructions on commercial formulations.
- Space tomato plants far enough apart to insure free air flow around them, which will aid in drying out after rain storms and maximize leaf exposure to sunshine.
- Always apply water in morning hours, never evening, so that plants have a chance to dry off quickly. If possible, try to avoid wetting leaves at all during watering.
- If you have a persistent problem with fungal infections, select hybrid tomato varieties with built-in resistance to specific fungal organisms. Look for code letters to determine which varieties are best for your garden situation ("F" for resistance to Fusarium Wilt, "V" for Verticillium Wilt, "EB" for Early Blight, etc.)



## **Bacterial Diseases**

These infections, including bacterial spot and bacterial speck, are caused by bacteria. Infections appear as necrotic spots, specks, or cankers on leaves, stems, and/or fruit. They are easier to prevent than they are to control or cure after they appear.



### **Damage**

- Fruit quality, in both taste and appearance, is severely diminished.
- Uncontrolled, bacterial infections can eventually kill the entire plant, as well as spread to adjacent plants, with similar results.

### **Management**

- Pick and destroy all infected green fruit. Do not save seeds from infected fruit.
- All the recommendations for treating fungal infections also apply to bacterial infections, with the exception that (see next point).
- Treatment options are limited in the home garden once bacterial infections become apparent. Copper-based fungicides have proven to have some effectiveness in limiting the spread of infections but cannot “cure” them. Commercial growers have access to some additional, somewhat more effective chemical formulations that can limit bacterial infection damage, but these are generally unavailable to the home gardener.

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