

Apple and Pear Disease - Fire Blight

Fire blight, caused by the bacterium *Erwinia amylovora*, is a destructive disease on apple and pear, as well as can attack some 75 species of plants of the rose family.

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A characteristic symptom of blossom blight on apple caused by *Erwinia amylovora*.

Photo by K. Peter.

Fire blight also occurs frequently on pyracantha, spirea, hawthorn, and mountain ash. In fruit trees, the disease can kill blossoms, fruit, shoots, limbs, and tree trunks. Certain varieties of apples are more susceptible than others. Some susceptible varieties include Braeburn, Crimson Crisp, Fuji, Gala, Granny Smith, Jonathan, Rome, Yellow Transparent, and Idared.

Symptoms

The disease gains entry to the tree through two main points, blossoms and new shoots, and often appears first in spring as blossom, fruit spur, and new shoot blight. Infected blossoms wilt rapidly and turn light to dark brown. Bacteria may move through the pedicel to the fruit spur and out into the leaves. Here they follow the midrib and main veins, which soon darken. The leaves wilt, turning brown on apples and quince and dark brown to black on pear. The blighted flowers and leaves remain attached for much, if not all, of the growing season. Some remain even after normal leaf fall.

Fire blight's two main symptoms are shoot blight and cankers on limbs.

Shoot blight begins with the infection of the young, succulent growing tip. It may occur any time during the season while the shoots are still growing and when environmental conditions are most favorable for the disease. The leaves wilt rapidly, turn dark, and remain attached as in the case of spur blight. A characteristic symptom of shoot blight is the bending of terminal growth into the shape of a shepherd's crook. Pearly or amber-colored droplets of bacterial ooze are often present on diseased blossoms, fruit, and leaf stems, on succulent shoot stems, and on the exterior of infected fruits. Inside these droplets are millions of bacteria, which may cause new infections.

Fire blight bacteria can move from blighted spurs and shoots through the vascular system into larger limbs and tree trunks. Infected branches may be girdled, resulting in loss of the entire branch. Suckers at the base of trees are often invaded and may blight back to the trunk or rootstock, causing the loss of the entire tree in one season. This is true of susceptible pears, especially Bartlett, Bosc, and Red Clapp's, and certain apple rootstocks, especially M.26 and M.9.

Cankers, slightly sunken areas of various sizes surrounded by irregular cracks, occur on small to large limbs, trunks, and even roots. They often begin at the bases of blighted spurs, shoots, and suckers. Active blight cankers are characterized by an amber or brown exudate on their surfaces or on the bark below. If previous season cankers remain in the tree, shoot blight will arise from these cankers year to year. During the growing season, the bacteria continue to replicate and move through the vascular system. They will ultimately move from the cankered regions to growing tissue, thereby causing shoot blight. This is also referred to as "canker blight."

The bacteria may also invade fruit, which becomes water-soaked. Droplets of bacterial ooze appear on the surface. Later the fruit becomes leathery, turns brown (apples) and black (pears and quince), shrivels, and usually remains attached to the fruit spur.

Disease cycle

Bacteria overwinter in the margins of cankers on branches and trunks. Once the temperature reaches about 65°F, bacteria begin to multiply and appear on the outsides of the cankers in drops of clear to amber-colored ooze. The bacteria are spread to blossoms primarily by wind and rain with some transmission by pollinators. Blossom-to-blossom transmission is carried out mainly by bees and other insects that visit

the flowers. The bacteria reside on the flower stigma where they do not cause disease, but replicate to high numbers when temperatures are favorable. Insects also transmit bacteria to growing shoots. If the average temperature is 60°F or above and relative humidity is 60 percent or more, or there is rain, new infections can occur. Infections occur when the bacteria are washed off from the stigmas and move down into the nectarthodes of the blossom. Bacteria need this natural opening to enter the plant; they cannot directly penetrate plant tissue. Shoots become infected through natural wounds, such as broken leaf hairs. At 75°F, blossom blight and shoot blight will be evident in four to five days. Bacterial ooze appears on the new infections soon after the symptoms, providing additional sources of bacteria for new infections. In early to midsummer, during prolonged periods of muggy weather, blighted shoots and spurs, infected fruit, and new branch cankers all may have droplets of ooze on them.

Wounds are also important entry points to leaves, shoots, and fruit. Aphids, leafhoppers, lygus bugs, and other insects with piercing mouthparts may transfer fire blight bacteria directly into susceptible tissues. Wounds from hail often lead to a severe outbreak of fire blight. Any fresh wound can serve as an entry point.

Disease management

Temperatures just before and during bloom will determine if fire blight becomes serious in early spring. Daily temperatures must average 60°F or above during pink through petal fall for bacterial populations to grow enough to cause severe disease. The disease also occurs later in the season when bacteria enter late opening blossoms or growing tips of new shoots.

Where this disease was present the previous year, we suggest the following management program:

- During dormancy, prune out all cankers. Cut apple limbs at least 8 to 12 inches below external evidence of the canker. Pruning tools do not need to be disinfected.
- At green tip, apply a copper spray aiming to have 2 pounds per acre of metallic copper equivalent to kill bacteria on tree surfaces.
- When daily temperatures average 60°F or higher during bloom through petal fall, make at least two complete applications of a streptomycin formulation. Apply the first streptomycin spray after first blossoms open when daily average temperatures are above

60°F and a wetting event is anticipated within 24 hours. Repeat sprays at five- to seven-day intervals through late bloom if disease conditions persist. A minimum of two applications is necessary to provide control.

- For semi-dwarf trees and older dwarf trees that have filled their tree space, applications of prohexadione calcium (Apogee, Kudos) beginning at bloom are effective for mitigating shoot blight that may occur during the season, be it from infected blossoms or leftover cankers. Shoots harden off 10 to 14 days after application and are no longer susceptible to infection. Several applications are typically recommended.
- For newly planted or young dwarf trees, combining streptomycin with a product that stimulates the plant's immune system at bloom will help mitigate blossom blight and will offer some protection for growing shoots shortly after bloom (Example: Actigard). Plant defense elicitors need 48 hours to activate the plant defenses and the first application should be made during early bloom. Another option to mitigate shoot blight on young dwarf trees is low-rate copper applications. To prevent fruit injury, use every other spray and be mindful of slow-drying conditions and the pH of the spray solution since acidic conditions increase copper phytotoxicity. (Example: Cueva)
- When it comes to pruning decisions when fire blight occurs, use the following guidelines to prioritize:
 - Young orchards three to eight years old with just a few strikes are highest priority.
 - Young orchards three to eight years old with severe strikes.
 - Orchards with a few strikes.
 - The "walk away" group: orchards with so many strikes that most of the tree would need to be removed; severe pruning can stimulate new growth that can become infected (lowest priority).
 - If fire blight is to be pruned, use the "ugly stub" method by cutting branches between nodes and several inches away from the central leader or other branch union:
 - Two-year-old wood (and older) is more resistant to fire blight and can stop infection movement into the tree. Since the bacteria can travel inside the tree well ahead of the visible infection (up to several feet), make cuts 8 to 12 inches below the last signs of browning, leaving a 4- to 6-inch naked stub in two-year-old or older wood.
 - A canker will form in the stub, which can be cut off with the canker during the next winter.

- Disinfecting pruning tools is ineffective for minimizing spread of the disease since the bacteria often are present internally in mature bark well in advance of symptom margins.
- o When terminal growth stops, the spread of fire blight should also stop. The most important thing to do to control fire blight during the summer is to control sucking insects like aphids and leafhoppers. Applying streptomycin sprays within 24 hours after hail or a storm with severe winds to prevent new infections is also a good practice.

Authors

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Expertise

- Apple and pear diseases
 - Peach, cherry, other stone fruit diseases
 - Tree fruit disease management
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