COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY • COLLEGE OF AGRICULTURE

FIRE BLIGHT

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Importance

Fire blight, caused by the bacterium *Erwinia amylovora*, concerns orchardists as a serious disease of apple and pear. However, it also occurs on many landscape trees and shrubs in the rose family. Besides attacking apple and pear trees, including flowering crabapple (*Malus* spp.) and callery pear (*Pyrus callaryana*), fire blight appears commonly on several species of cotoneaster (*Cotoneaster* spp.), hawthorn (*Crataegus* spp.), and mountain ash (*Sorbus* spp.). It also occurs on firethorn (*Pyracantha coccinea*), and less commonly on serviceberry (*Amelanchier canadensis*), flowering quince (*Chaenomeles japonica*), cultivated quince (*Cydonia vulgaris*), Christmas berry (*Photinia villosa*), flowering plum (*Prunus triloba* var. *plena*), spirea (*Spirea vanhouttei*), rose (*Rosa* spp.), *Stransvaesia davidiana*, and on *Rubus* species such as red and black raspberry and thornless blackberry.

Fire blight is a highly destructive disease that has aggravated fruit growers since the 1700s. One reason it is so harmful is that its epidemics are extremely erratic in nature and nearly impossible to accurately predict. Also, a great amount of damage can be done in a very short time. Severe epidemics of fire blight have largely caused the decline in pear production in certain parts of the United States and have caused gradual elimination of the more blight susceptible cultivars of apple, pear, cotoneaster, and other plants.

Disease Symptoms

The earliest symptoms in the flowers can be seen only by careful examination of infected spurs, which reveals dark and wilted individual flower bases or pedicels. As the infected bloom collapses, the infection spreads rapidly into the other flowers in the spur, causing the entire spur to wilt suddenly and die. Thus, growers often first notice that blossoms and leaves of infected terminals and spurs wilt suddenly and then turn dark brown to black as if scorched by fire. Diseased tissue usually remains firmly attached to the tree (Fig. 1). From there, infections frequently spread to the supporting spurs and branches to form cankers. These cankers continue to increase in size as long as conditions remain favorable for disease development. The cankers have a shrunken surface and appear dark brown to purple in color. If a canker girdles a stem, the whole stem can die.

Figure 1. Blighted pear shoot.

Figure 2. Characteristic bend or "shepherd's crook" of a blight-affected terminal.

In the "shoot blight" phase of the disease, infected, rapidly-growing shoots wilt from the tip and develop a crook or bend at the growing point (Fig. 2). At first the tissues appear

water-soaked and dark green; soon, however, they become brown to black in color. Twig infections can spread back into their supporting limbs and cause cankers. Infections of basal sprouts (suckers) can rapidly kill a tree when the infection moves into the root collar area and restricts the vital flow of nutrients and water into the crown. Symptoms can develop rapidly.

Disease Cycle

The bacteria overwinter in cankers formed during the previous years' infections and as "resident" bacteria on plant surfaces. As numbers of bacteria grow, they can be identified as droplets of bacterial ooze produced in the margins of cankers. Bacterial growth is generally favored by an adequate food base supplied by the host plant, poor internal defense mechanisms of the host, high humidity, and temperatures between 65 and 70°F. When conditions become favorable for bacteria to grow, populations can build rapidly. At 70°F, bacterial numbers double every 20 minutes; one cell becomes billions overnight, each capable of causing an infection. Given the right conditions, thousands of infections can occur within minutes; thus fire blight epidemics are explosive.

The first new tissues to become infected in spring are the flowers, and, once infected, they serve as the source of inoculum for shoot infections. With warm spring weather during bloom, bacteria reach sufficient numbers on the flowers to be able to cause infections in the flowers. If bacteria can move into the flowers through natural openings such as nectaries at the base of the flowers or through wounds, infection can occur. A rain or heavy dew event provides the infection opportunity by washing the bacteria to the nectaries. If temperatures are suitable for infection, the disease becomes established and symptoms of flower blight appear suddenly and usually simultaneously in many clusters in a week or two. Because precise conditions are needed for infection (open flowers, warm temperatures, rain or dew), disease appearance is erratic from year to year.

As fire blight progresses and disease symptoms develop, bacterial populations continue to build and are spread to other susceptible, but as yet unaffected, tissues. Note that bacteria not already in susceptible tissue can only gain access to it by entering wound sites or natural openings such as flower nectaries or leaf and shoot stomata and hydathodes. As a result, rain (especially wind driven), wind carrying abrasive materials, hail, frost damage, and significant insect feeding all have a tendency to increase disease. Secondary spread can also be accomplished by movement of the bacteria within the plant itself. Further, humans can spread the disease through pruning and general cultural activities. Disease then continues until the environment becomes unfavorable for it and/or the host tissues become less susceptible to infection. At this point, fire blight cankers become dormant.

In most years, fire blight begins during the bloom period and continues through petal fall and/or until shoot elongation stops. Generally, the disease is favored by long frost-free periods before bloom, humid weather with 65 to 70°F temperatures during and after bloom, and occasional rains during those periods. These conditions affect bacterial multiplication, bacterial spread, and host susceptibility. Windy, stormy weather, especially hailstorms, after first infections have occurred favors secondary spread of fire blight.

Control

The adequate control of fire blight in a severe disease year is difficult, if not impossible, to attain. However, most years are not severe disease years and adequate disease control can be achieved with some effort. It is very important to prevent infection of the flowers because once they become infected, they serve as a source of inoculum for the rest of the tree. Control measures are outlined below:

1) Take extra care during the dormant season to prune trees according to sound horticultural principles. Trees properly thinned and shaped are generally less susceptible to fire blight. In addition, while trees are dormant, blighted twigs should be pruned just below the infected areas and *destroyed*. This practice, which should be done every year, eliminates an important potential source of inoculum for subsequent epidemics. The pruning must be done carefully, so that all infected branches are removed. This care is especially important in young plantings where unchecked canker development could easily kill the tree. It is not necessary to sterilize pruning tools for dormant pruning. Remove badly infected trees and old, neglected pear trees that could be sources of inoculum.

2) While trees are breaking dormancy, just at first green tip, apply fixed copper to the twigs and branches to help reduce overwintering bacterial inoculum. Avoid spraying copper after 1/2-inch green tip so that fruits do not become russetted. Thoroughly wash the spray tank following use, since the chemical can be corrosive. This spray also will reduce the overwintering populations of the fungi that cause black rot, blotch, and other canker diseases. (See Cooperative Extension publication, ID-92, "Fruit Tree Spray Guide" for additional information.)

3) For growers who can only guess whether fire blight is likely to be a problem in a given year, their only choice is to try to protect the orchard from fire blight by spraying with the antibiotic streptomycin at four- to five-day intervals during bloom. When weather conditions are favorable for disease and extremely susceptible cultivars are grown, spray schedules may need to be tightened to three-day intervals during bloom time. Streptomycin is best applied by itself early or late in the day when the air is still and when the rapid breakdown of the material due to high light intensity is unlikely. Repeated application and slow drying conditions generally enhance streptomycin's absorption into plant tissues and, therefore, enhance its effectiveness. Streptomycin sprays should be stopped at petal fall. Be sure to check the chemical label to determine that legal registration is indicated for the kind of plant being treated. If streptomycin needs to be applied more than four times during bloom, it is probably being overused and fire blight bacteria resistance to the chemical can occur.

Many commercial growers use a computer program, MARYBLYT, to effectively time their streptomycin applications. The computer calculates the risk of infection, and, using

weather forecasts, growers make informed spray decisions. Streptomycin is more effective when the applications are properly timed. The computer program takes some of the guesswork out of knowing when this erratic disease will occur. (For more information about using MARYBLYT to control apple fire blight, consult Cooperative Extension publication PPFS-FR-T-5.)

For organic production, fixed copper can be used instead of streptomycin; however, it is less effective and could cause injury to the fruit. Use of streptomycin in urban landscapes is discouraged because *E. amylovora* resistance transfer to human pathogens, though highly unlikely, is possible.

4) Apply insecticides as needed just after petal fall to reduce levels of leafhoppers, plant bugs, and psylla which have been implicated as vectors of fire blight.

5) Avoid any cultural practices which stimulate rapid tree growth and excess branch proliferation. As noted earlier, these conditions (often brought on by excess nitrogen, abnormally low fruit load, and/or poor pruning techniques) increase a tree's susceptibility to fire blight. Avoid tree stresses as well, because stressed trees, once infected, are less able to slow the spread of infection within the tree.

6) Pruning can play an important role in the total fire blight control program, and when done properly, should reduce inoculum and tree damage. This reduction is especially important when the structural integrity of young trees or of high density plantings is at stake. Inspect the plantings frequently during the growing season and remove newly infected spurs and terminals by breaking them out. Prune or break out twigs several inches below the active fire blight strike. If infections cannot be detected early, it may be best just to let the disease run its course. Growers using the MARYBLYT computer program can anticipate the appearance of symptoms and begin breaking infected tissues before the symptoms become obvious. The objectives of this pruning are to eliminate tissues with high bacterial populations and to stop the progress of infective cankers.

If pruning is begun after obvious symptoms appear, cut back to an internode of at least two-year-old wood, leaving a stub several inches long. The tree's natural defenses are then relied upon to prevent further movement into the branch. This stub can be safely removed in the winter. Do not prune infected branches back to a spur or crotch in summer because it will not be noticed in winter and would be overlooked.

Pruning may not be effective during severe fire blight outbreaks. Through poor sterilization techniques, fire blight can inadvertently be spread to previously unaffected areas. Also, pruning can sometimes stimulate additional shoot growth which could become diseased. Pruning of large trees may be impractical because of the difficulty of doing a thorough job of blight removal. In these instances, the best alternative is to leave the task until the dormant season when more effort can be devoted to completing the job.

7) Use fire blight resistant plants, if available. Few cultivars of apple, pear, or the various blight-susceptible ornamental species and cultivars are immune to fire blight. Nonetheless, some cultivars of these plants are more resistant to or tolerant of the disease than others. Planting less susceptible species or cultivars might be beneficial where practical. Avoid the interplanting of susceptible and resistant cultivars of the same species or different species at a single location. A common mistake is to plant susceptible pear trees in the apple orchard. Interplanting often serves as a source of additional bacteria from which an epidemic could develop.

For more information on fire blight tolerant cultivars, consult ID-93 "Midwest Tree Fruit Handbook."

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