College of Agriculture, Food and Environment
Cooperative Extension Service

Plant Pathology Fact Sheet **PPFS-FR-T-12**

Fire Blight

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Introduction

Fire blight is a highly destructive disease of apple and pear that can occur in commercial orchards and residential plantings. Many landscape trees and shrubs in the rose family are also susceptible to fire blight (Table 1). Because precise conditions are needed for infection, disease appearance may seem erratic from year to year. However, when conditions are favorable, fire blight can quickly cause severe damage.

Symptoms & Signs

Blossom & Spur Blight

The earliest disease symptoms are evident when blossoms are infected and become water-soaked, wilted, and darkened. As blooms collapse, infection spreads rapidly into other blossoms in the cluster, causing the entire spur to wilt suddenly and die (Figure 1). Small creamy white to amber droplets of bacterial ooze may be present on infected blossoms during periods of rain or high humidity. Diseased tissues usually remain attached to trees.

Cankers

Infections frequently spread from blossoms to supporting spurs and branches, resulting in stem lesions or cankers (Figure 2). Fire blight cankers eventually become sunken with a dark brown to purple color. As cankers increase in size, they girdle branches, and tissues above these infection sites die.

Shoot Blight

Bacterial cells can build up during the blossom and spur blight phases of fire blight and subsequently infect rapidly growing shoots. Leaves on infected shoots initially blacken along the midrib and veins before completely turning brown. Blighted leaves remain attached to shoots, which gives trees a 'scorched by fire' appearance (Figure 3). Infected shoots wilt from the tip and develop a crook or bend at the growing point, commonly referred to as a 'shepherd's crook' (Figures 4 & 6), a characteristic symptom of fire blight. Droplets of bacterial ooze may be present during warm, humid weather.

Rootstock/Trunk Blight

Trunk infections can develop near the rootstock graft union from internal movement of the pathogen within water conducting-tissue or via infected water sprouts. The bark at these infection sites becomes water-soaked, discolored, and cracked (Figure 5); the wood beneath develops a reddish-brown discoloration. Rapid tree death follows.

Figure 1. Blossoms serve as the primary source of inoculum for fire blight infections. Spur blight results when bacterial infections spread from blossoms down to the spurs.

Figure 2. Canker formation often begins at the base of an infected spur.
Figure 3. Fire blight symptoms are most apparent during the shoot blight phase, which can result in significant damage. Blighted shoots give trees the appearance of being scorched by fire.
Figure 4. The 'shepherd's crook' symptom of the shoot blight phase occurs when bacteria infect shoot tips.
Figure 5. Trunk infections near the rootstock graft result in rapid tree death.

Cause & Disease Development

The fire blight bacterium, *Erwinia amylovora*, survives from one year to the next at the margins of previously formed branch and trunk cankers. Surviving bacteria multiply and ooze from canker margins in spring. Insects attracted to the bacterial ooze, along with wind-driven rain, are the primary means for dispersal from overwintering cankers to blossoms.

Primary Infections

Blossom infections serve as the source of inoculum for primary infections. The pathogen quickly multiplies in these nutrient-rich tissues and spreads via splashing rain and insects to other blossoms and to susceptible shoots.

Secondary Infections

As fire blight progresses and disease symptoms develop, bacterial populations multiply. New infections continue through petal fall and/or until shoot elongation stops, as long as environmental conditions are conducive.

Trauma Blight

High impact events, such as wind-driven rain and hail, can result in an increase in disease incidence. These events result in wounds that serve as portals of entry for the fire blight bacterium. Symptoms may appear within 1 to 2 weeks of the event.

Conditions Favoring Disease

Fire blight is generally favored by:

- High relative humidity or rainy conditions.
- Temperatures between 65°F and 70°F, although disease may develop at temperatures outside of this optimal range.

Under these conditions, bacterial populations can build-up rapidly. At 70°F, numbers of bacterial cells double every 20 minutes; one cell can become one billion cells overnight, each capable of causing a new infection.

Figure 6. Fire blight symptoms on cotoneaster resemble the distinctive symptoms found in apple and pear.

Disease Management

The key to fire blight management is preventing blossom infections; once infected, blossoms serve as a source of inoculum for the rest of the tree, as well as other trees in the planting or orchard. Disease management requires an integrated approach that relies primarily on cultural practices and is supported by the judicious use of bactericides.

Resistant Cultivars

While few cultivars of apple, pear, or the various ornamental host species are immune to fire blight, some cultivars are more resistant or tolerant than others. Whenever possible, plant tolerant cultivars and cultivar/rootstock combinations. For information on cultivars and rootstocks with fire blight resistance, refer to the publications listed under Disease Resistant Cultivars in Additional Resources.

Cultural Practices

Implementing cultural practices is important in managing fire blight:

- Avoid production practices that stimulate rapid tree growth; young succulent tissue is susceptible to infection.
  - Avoid excess fertilization. Apply fertilizers (especially nitrogen applications) that are adequate for tree health without promoting rapid growth and prolonged succulence.
  - Avoid aggressive pruning that will stimulate tissue growth. Selectively prune trees to improve air circulation and to promote rapid drying of foliage.
- Do not plant new trees downwind from or near already infected trees.
- Remove and/or destroy prunings; do not leave them in the orchard.

Table 1. Common and scientific names of some fire blight hosts identified in Kentucky.

Common Hosts	
Apple	*Malus domestica*
Cotoneaster	*Cotoneaster* spp.
Crabapple, flowering	*Malus* spp.
Hawthorn	*Crataegus* spp.
Mountain ash	*Sorbus* spp.
Pear	*Pyrus* spp.
Pear, callery	*Pyrus callaryana*

Additional Hosts	
Blackberry, thornless	*Rubus* spp.
Christmas berry	*Photinia villosa*
Firethorn	*Pyracantha coccinea*
Plum, flowering	*Prunus triloba* var. *plena*
Quince, cultivated	*Cydonia vulgaris*
Quince, flowering	*Chaenomeles japonica*
Rasberry, red & black	*Rubus* spp.
Rose	*Rosa* spp.
Serviceberry	*Amelanchier canadensis*
Spirea	*Spirea vanhouttei*
Stransvaesia	*Stransvaesia davidiana*

Pruning Infected Tissue

Pruning can play an important role in a comprehensive fire blight management program, and when done properly, should reduce inoculum and tree damage. However, while removal of sources of the pathogen is desirable, pruning when the bacterium is active can further spread the pathogen. Thus, removal of fire blight strikes during the growing season is a controversial issue. Due to the high risk of bacterial spread, UK currently recommends that pruning blighted twigs and cankered branches be delayed until winter.

Pruning during dormancy

Diseased limbs may be flagged or painted during the growing season so they can be easily identified during winter. During late winter or early spring:

- Prune carefully so that ALL infected branches are removed.
- Blighted twigs should be pruned at least 6 to 8 inches below cankers and infected areas, preferably down to the branch union.
- Remove and destroy pruned material to eliminate potential sources of inoculum for subsequent growing seasons. Do not leave prunings on the orchard floor.

Pruning during the growing season

If, knowing the risk, growers still choose to prune actively growing trees, only young vigorous trees should be considered. Additionally, several precautions should be taken:

- Prune or break out twigs at least 6 to 12 inches below visible symptoms.
- Always disinfest cutting blades between cuts with a commercial sanitizer, 10% Lysol disinfectant, 10% bleach, or rubbing alcohol. Fire blight can inadvertently be spread to previously unaffected areas by tools, such as pruners. Refer to *Cleaning & Sanitizing Commercial Greenhouse Surfaces* (PPFS-GH-07) for information on sanitizing tools.
- If large, dead limbs are to be removed for aesthetic reasons, growers may temporarily leave stubs several inches long so that pruned branches are easier to identify in the winter when stubs can be properly removed.
- Never prune when trees are wet, as bacterial cells are easily carried through films of water.
- Immediately remove and burn, bury, or otherwise dispose of diseased material.

Bactericides & Growth Regulators

Timely chemical sprays may be used as preventative measures to control fire blight during spring when the pathogen is on the surface of cankers and on blossoms. After the bacterium has invaded tissues, bactericides are not effective. Fungicides will not control fire blight. Commercial growers should consult the *Midwest Fruit Pest Management Guide* (ID-232) for application rates and other details, while residential growers should refer to *Disease and Insect Control Programs for Homegrown Fruit in Kentucky* (ID-21)

Sprays include:

- Copper sulfate: applied during late dormancy to active cankers, twigs, and branches to help reduce bacterial cells that exude from overwintering sites. Copper applications are highly recommended during silver tip to reduce inoculum during bloom. Copper does not directly affect the infected tissue or cure the canker.
- Streptomycin: effective in preventing infection of flower and stem tissues and thereby controlling the blossom blight and shoot blight stages of fire blight in commercial orchards. Streptomycin is used as a preventative, not a curative treatment. Streptomycin can also be combined with spreader-activator Regulaid for improved efficacy. The use of streptomycin in urban landscapes is discouraged due to the high risk for the development of pathogen resistance.
- Oxytetracycline: often used in rotations with streptomycin to help discourage pathogen resistance development; it is not as effective as streptomycin. Oxytetracycline is used as a preventative for protecting susceptible plant tissue.
- Apogee (prohexadione calcium): growth hormone that reduces terminal growth, thereby making plants less succulent and less susceptible to infection. Apply between king bloom (center bloom within the cluster) and petal fall for reducing the shoot blight phase of fire blight. Some apple cultivars are sensitive to Apogee. Refer to the *Midwest Fruit Pest Management Guide* (ID-232).

Disease Forecasting

Disease prediction models utilize local weather data during bloom to determine the risk for fire blight infections. Because sprays are applied only during periods of high risk, bactericide applications can be eliminated when conditions are unfavorable for disease development (e.g. cold or dry weather) based on the predictive model.

Most universities have predictive systems in place; Kentucky growers should refer to the UK Ag Weather Center site. The publication *Using Prediction Models to Manage Diseases in Fruit* (PPFS-FR-T-07) provides step-by-step directions for using disease prediction models.

Additional Resources

Disease Management

- Disease and Insect Control Programs for Homegrown Fruit in Kentucky (ID-21)
http://www.ca.uky.edu/agc/pubs/id/id21/id21.pdf
- Fungicides for Management of Landscape Woody Ornamental Diseases (PPFS-OR-W-14)
https://plantpathology.ca.uky.edu/files/ppfs-or-w-14.pdf
- Homeowner's Guide to Fungicides (PPFS-GEN-07)
https://plantpathology.ca.uky.edu/files/ppfs-gen-07.pdf
- Midwest Fruit Pest Management Guide (for commercial growers) (ID-232)
https://plantpathology.ca.uky.edu/files/id-232.pdf
- Woody Plant Disease Management Guide for Nurseries and Landscapes (PPFS-OR-W-29)
https://plantpathology.ca.uky.edu/files/ppfs-or-w-29.pdf

Disease Prediction

- Ag Weather Center Disease Prediction Models (University of Kentucky)
http://wwwagwx.ca.uky.edu/plant_disease.html
- Using Prediction Models to Manage Diseases in Fruit (PPFS-FR-T-07)
https://plantpathology.ca.uky.edu/files/ppfs-fr-t-07.pdf

Disease Resistant Cultivars

- Disease Susceptibility & Resistance of Common Apple Cultivars (PPFS-FR-T-28)
https://plantpathology.ca.uky.edu/files/ppfs-fr-t-28.pdf
- Disease Susceptibility Ranking of Apples (Cornell University)
https://blogs.cornell.edu/applevarietydatabase/disease-susceptibility-of-common-apples/
- Rootstocks for Kentucky Fruit Trees (HO-82)
https://simpson.ca.uky.edu/files/rootstocks_for_ky_fruit_trees.pdf

Sanitation

- Cleaning & Sanitizing Commercial Greenhouse Surfaces (PPFS-GH-07)
https://plantpathology.ca.uky.edu/files/ppfs-gh-07.pdf
- Fruit, Orchard, and Vineyard Sanitation (PPFS-GEN-05)
https://plantpathology.ca.uky.edu/files/ppfs-gen-05.pdf

Scouting & IPM Manuals

- IPM for Select Deciduous Trees in Southeastern US Nursery Production (Southern Nursery IPM Working Group)
http://wiki.bugwood.org/IPM_book
- IPM Scouting Guide for Common Problems of Apple (ID-219)
http://www2.ca.uky.edu/agc/pubs/ID/ID219/ID219.pdf
- IPM Scouting Guide for Common Problems of Apple (mobile website)
http://applescout.ca.uky.edu/
- Kentucky Apple Crop Management Scout Manual
http://ipm.ca.uky.edu/files/kentucky_apple_crop_management_scout_manual2020.pdf

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