



## Fire Blight of Rosaceous Plants Caused by *Erwinia amylovora*

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### Introduction

Fire blight is one of the most damaging bacterial diseases affecting major pome fruit trees, causing significant economic losses. It was first observed in the Hudson Valley, upstate New York, in 1780 and has since spread across the entire North American continent. It is endemic to Virginia, consistently threatening apple and pear orchards across the state. The causal agent of this detrimental disease is a Gram-negative rod-shaped bacterium, *Erwinia amylovora*, which belongs to the Erwiniaceae family, in the order Enterobacterales. The most distinctive symptoms of the disease include wilting and blackening of flowers, shoots, twigs, and foliage that appear as if it has been swept by fire, giving rise to the name ‘fire blight’. The principal pome fruits affected are from the Rosaceae family, such as apple (*Malus × domestica*), pear (*Pyrus communis*), Asian pear (*P. pyrifolia*), quince (*Cydonia oblonga*), and loquat (*Eriobotrya japonica*), including several ornamentals as well as wild species. The fire blight pathogen overwinters primarily within cankers on infected host plants, which are dead, elliptical to irregular patches of bark on perennial wood of branches, central leader, trunk, or rootstock. The bacteria spread from active symptoms on the plant or contaminated flowers through non-pollinating and pollinating insects, birds, wind, and rain during the flowering and shoot growth periods. *E. amylovora* primarily enters host plants through nectarthodes (nectaries) of flowers, with

mechanical openings like pruning wounds, breakage, or abrasions serving as an additional important infection pathway, particularly for shoot and trauma blight. *E. amylovora* can quickly destroy an entire orchard in a single season, especially if the trees are younger than 10 years. This is harmful to grower farms as it significantly devalues the orchard, interrupts fruit production, and/or reduces the crop yield and price, leading to severe economic losses. Therefore, several cultural and chemical management practices have been adopted to manage the pathogen. However, in the last 20 years, managing fire blight has been challenging due to frequently occurring favorable weather conditions during bloom and shoot growth, thus propelling multiple infection periods, which are difficult to prevent.

### Host range and Significance

Fire blight is known as a major disease of apples and pears. Over time, it has adapted to other hosts, ranging from pome fruits such as quince to ornamentals such as crabapple, hawthorn, mountain ash, firethorn, and Cotoneaster. Other Rosaceous plants, including loquat, plum, cherry, raspberry, rose, Amelanchier, and Spirea, are also affected or serve as alternate hosts of *E. amylovora* in the landscape. The pathogen primarily infects young flowers, fruitlets, and shoots on these plants, ultimately invading wood and forming dark patches of

bark called fire blight cankers. Annual losses and management costs in the United States exceed \$100 million, including tree mortality and yield loss. In the past, fire blight caused trade disruption due to phytosanitary restrictions and a ban on importing infected plant material. The infection rate is directly proportional to the weather conditions. With warmer and wetter springs in the mid-Atlantic U.S., leading to a further increase in disease pressure and exceeding losses of up to \$22 million per year. In New York, a regional outbreak in 2016 resulted in more than \$16 million in losses, leading to the death of half the trees in young orchards. Similarly, in Washington State, several outbreaks from 2017 to 2019 resulted in a \$9 million annual loss, including yield losses and management and tree removal costs. Fire blight is a global disease, affecting pome fruit production in more than 60 countries worldwide. For example, the fire blight epidemic in Korla, China, resulted in a 30–50% loss of pear yield, followed by the destruction of approximately 1 million trees in 2017. The financial damage was valued at over 1 billion CNY, equivalent to around \$140 million USD. This led to a disastrous decline in the ‘Korla’ fragrant pear industry.

## Distribution

The first written report of fire blight disease was in New York in 1780, and as orchards grew in number and proximity, it progressively extended westward across the Mississippi River Valley. By 1840, fire blight had spread to Illinois, Indiana, and Ohio. It grew into one of the most severe and extensive epidemics by 1844, completely ruining pome fruit orchards. The EPPO Global Database (2020) confirmed the presence of *E. amylovora* in more than 60 countries, with ongoing surveillance in high-risk regions. Virginia has had several fire blight breakouts over the last 15 years, which have caused fruit and tree losses. Over the last 10 years in the Eastern U.S., there has been a trend of very warm, rainy weather during apple bloom in spring, with few to multiple wetting events triggering extreme risk of fire blight infections.

Such conditions require a higher number of protective antibiotic spray applications than what growers are used to. In the northeastern U.S. alone, costs ranged from \$8M – \$16 million in 2016, including efforts to control fire blight, in-season treatments, tree replacement, and longer-term revenue impacts. in damages (Farm Progress, 2021).

## Signs and Symptoms

While there may be some differences between hosts, fire blight symptoms are often distinctive and easily identifiable on any pome fruit tree. Symptoms and disease progression described below will be modeled on apples but can be applied to pears, quince, loquat, or other pome fruits. Symptoms often progress more quickly and become more visible in warm, humid weather.

### Blossom Blight

Fire blight infection often begins on open flowers, then progresses to the entire spur. Infected flowers initially appear with water-soaked lesions, but soon take on a withered, darkened appearance as if fire burned them (Fig. 1).



Figure 1. Apple blossom cluster and spur leaves infected with fire blight (Photo by Aćimović S. G. 2017).

White, yellow-to-orange droplets of bacterial ooze emerge first from infected and wilted flowers, before they turn dark, and blight becomes readily visible from afar. Dead

blossoms (Fig. 1) remain attached to the tree and may continue to exude a creamy-white, orange-to-brown ooze during humid conditions.

## Shoot and Fruit Blight

Shoot blight often follows blossom blight as the disease invades internally from infected flower clusters to infected spurs, fruitlets, and shoots as the current year's growth. The infection can also spread externally from fire blight cankers or infected flowers to nearby and distant uninfected flowers, shoot tips, and fruitlets, infecting them through natural or mechanical injury openings caused by hail, deer browsing, wind abrasion, piercing-sucking insects, or burrowing insects. Fire blight can also directly spread from fire blight cankers to infect shoots and/or fruitlets, bypassing the flower infection stage (Fig. 2 and 3). Once infection begins, bacteria have been shown to move through the shoot at an average rate of 4.2 cm per day (1.7 inches) in susceptible cultivars such as 'Gala'. Development may be slower in more resistant cultivars, such as 'Honeycrisp'. The development of shoot blight at this stage is not slowed by the bud scar, but populations grow more slowly once bacteria reach second-year wood (Dougherty et al. 2025). Shoot blight is initially characterized by the blackening of leaf veins before their complete browning. Infected shoots usually remain attached to the branch. Shoot tips bend downward, i.e., wilt as infection progresses, creating a characteristic 'shepherd's crook' shape (Fig. 2).



Figure 2. Top: shoot leaf vein necrosis typical for fire blight infection with shoot tip wilt and initial tip bending, Bottom: an infected apple shoot displaying the characteristic 'shepherd's crook' shape typical for fire blight (Photo by Aćimović S. G. 2009 and 2025).



Figure 3. Top: discolored and shriveling apple fruitlets with orange bacterial ooze. Bottom: immature apple fruit with white bacterial ooze. Ooze facilitates *Erwinia amylovora* spread to uninfected plant organs and allows new infections (Photo by Aćimović S. G. 2017).

## Fire Blight Cankers

After pathogen invasion of spurs and wood from infected flowers and/or shoots, fruit-bearing branches may develop cankers, which are dark black, flat, or sunken lesions on the branch surface (Fig. 4). Fire blight cankers can expand to girdle the branch stem and cause branch death, leaving it as if it were “scorched by fire”. Trunk or rootstock infections visible as cankers occur as residual cells of fire blight bacteria spread internally from infected branches in the tree crown and reach the trunk, often indicating systemic infection. Trunk or rootstock infection can also be initiated from infected scion strikes or rootstock suckers, leading to the formation of

cankers. Large branches, central leader or main trunk, develop cankers that are larger in size, dark, flat or sunken, with cracked or diffused edges, and rarely have water-soaked appearances. Cankers are important infection sites on wood that often exude large quantities of orange-to-brown ooze in humid conditions. The pathogen survives over the winter in cankers, which serve as reservoirs and thus are the primary source of inoculum in spring and during summer. Fire blight canker is the most terminal form of fire blight symptoms. On younger trees (1 – 10 years old), fire blight cankers can girdle the rootstock, trunk, or central leader and cause tree top or whole tree death, leading to severe losses in the number of trees.

## Disease Cycle

In Virginia and other temperate apple- and pear-growing regions, the fire blight bacterium, *Erwinia amylovora*, most commonly overwinters in cankers on branches, limbs, and trunks of infected trees. During late winter and early spring, when temperatures rise above approximately 50°F (10°C), the bacterium resumes metabolic activity within cankers. At optimum temperatures of 65°–85°F (18°–29°C) and during periods of moisture, bacteria multiply rapidly and ooze from canker margins as sticky, amber-colored bacterial exudates that serve as the primary inoculum for new infections.

Primary infections typically begin during bloom, which is the most critical and susceptible phase of the fire blight disease cycle. Bacteria are disseminated from cankers to open blossoms by rain splash, wind-driven rain, insects, and contaminated tools. Once deposited on flowers, *E. amylovora* multiplies epiphytically on floral stigmas and can be carried by pollinators to other flowers. Bacterial populations increase rapidly at temperatures above 60°F (16°C), with optimal growth occurring between 70° and 85°F (21°–29°C). Infection occurs when moisture from rain, dew, or high humidity washes bacteria into the floral nectarthodes.



Figure 4. Top: fire blight ooze and water-soaked bark around the newly forming canker margin. Bottom: sunken canker on a central leader of a young 'Gala' apple tree.

Flower infections can occur over a broad temperature range (55°–90°F), but the highest risk occurs when warm temperatures coincide with wetting events. Blossom blight is a concern even when disease incidence is low and insufficient to cause major yield loss. Infected blossoms often serve as entry points for the bacterium into adjacent spur and shoot tissues, leading to shoot blight, which can increase ooze production and spread to other shoots. Once inside young, actively growing shoots, the bacterium moves systemically through the vascular tissue. Rapid shoot growth and succulent tissues, favored by warm temperatures (75°–85°F) and high nitrogen availability, greatly increase susceptibility to shoot blight.

As the season progresses, bacteria spread from infected flower clusters and shoots into woody tissues, where cankers form at their base. Cankers are a critical part of the disease cycle, acting as both survival structures and sources of inoculum for future seasons. If cankers do not girdle the limb or trunk, the bacterium can persist within them for multiple years, producing inoculum each spring, when favorable weather conditions return.

Fire blight can also occur as trauma blight, when bacteria infect trees through wounds caused by hail, wind damage, or mechanical injury. Trauma blight infections can occur at almost any time during the growing season when temperatures exceed 60°F, with optimal infection occurring between 70° and 85°F in the presence of free moisture. Unlike flower infections, trauma blight does not require flowers and can lead to rapid disease spread following severe weather events.

Green fruit of apples and pears are generally not susceptible to infection; however, fruit may become infected at late stages of petal fall and when injured by insects, hail, or mechanical damage, particularly under warm and wet conditions. Fruit infections are less important epidemiologically than blossom and shoot infections but may contribute to localized inoculum production (Fig. 3).

Spread of *E. amylovora* to new infection sites occurs primarily through rain splash, wind-driven rain, insects (including bees, flies, and ants), and contaminated pruning or thinning tools. Under warm, wet conditions that favor rapid bacterial multiplication and repeated infection cycles, especially during extended bloom periods, fire blight epidemics can develop quickly, resulting in severe shoot blight, canker formation, tree decline, and tree death.

## Apple Cultivar Susceptibility

Due to the inherent difficulties in treating fire blight, the best control strategy is prevention, including planting fire blight-resistant cultivars. However, due to the variability in susceptibility across cultivars by tree organ, it is important to approach management differently in some cultivars than in others. While flower susceptibility is broadly similar among cultivars, fire blight disease severity differs from cultivar to cultivar due to differences in shoot and wood colonization. Shoots, spurs, and perennial wood are organs that most reflect a cultivar's susceptibility or resistance rating to fire blight, as described in the nursery catalogue. For example, 'Red Delicious' is rated moderately susceptible to susceptible because flower and shoot infections can occur under highly favorable conditions, which include high inoculum pressure and warm, humid conditions, leading to fruit, spur, and shoot losses. Wood of 'Red Delicious' is also rated as moderately susceptible and is not prone to large fire blight canker expansion, although small cankers form and overwinter effectively, providing inoculum for the next season. This response of the wood in preventing large canker development is genetically determined in 'Red Delicious' and allows the tree to survive fire blight infection without severe losses of perennial wood. In combination with pruning for removal of fire blight cankers, blossom blight, and shoot blight, the moderate susceptibility of 'Red Delicious' means that the majority of the trees in an

orchard can survive a severe disease outbreak, although fruit yield can be lost.

In another example, the apple cultivar 'Gala' is rated highly susceptible to fire blight because after infection of flowers and shoots, the fire blight bacterium quickly invades the perennial wood and forms large cankers that can lead to severe bearing wood losses. Large cankers on these cultivars girdle the branches or central leader, killing the branch or the tree top, and even the whole tree. Therefore, 'Gala' has no genetic wood resistance to fire blight and cannot survive fire blight infection, succumbing to severe losses in perennial wood and number of trees. This means that the majority of the trees in an orchard will not survive a severe disease outbreak. The younger the orchard is, the more likely tree death can occur. Finally, when a resistant apple cultivar is paired with a susceptible rootstock (e.g., M.9, M.26, M.111), fire blight risk increases for tree death due to cankers killing the rootstock by girdling. Tolerant or resistant Bud-9 or Geneva rootstocks (e.g., G.41, G.11, G.935, G.210), respectively, markedly reduce tree mortality, though flowers, shoots, and wood of the grafted cultivar remain susceptible.

While the majority of pear cultivars are highly susceptible, many apple cultivars show different levels of susceptibility, though no fully resistant varieties exist. The more susceptible an apple cultivar is, the more likely it is to become infected, show rapid and severe disease progression, and ultimately die in comparison to less susceptible cultivars. While fire blight poses a risk to all apple varieties, understanding which varieties in an orchard are more susceptible can help prevent sudden, severe crop loss by dedicating increased care.

**Table 1. Susceptibility to fire blight of apple cultivars commonly grown in Virginia. Sources: Kostick, Sarah. 2019. Fire blight susceptibility of apple cultivars & Khan, Awais. 2014. Fire Blight Susceptibility of Common Apple Varieties.**

Cultivar	Fire Blight Susceptibility
Ginger Gold	Very High
Lodi	Very High
York Imperial	Very High
Evercrisp	High
Black Twig	High
Gala	High
Granny Smith	High
Jonagold	High
Cortland	Moderate
Honey Crisp	Moderate
Rome Beauty	Moderate
Stayman Winesap	Moderate
CrimsonCrisp	Moderate-Low
Fuji	Moderate-Low
Gold Rush	Moderate-Low
Hewes Crab	Moderate-Low
Golden Delicious	Low
Harrison	Low
Red Delicious	Low

Among the apple varieties commonly grown in Virginia, highly susceptible apple varieties include ‘Gala’, ‘Ginger Gold’, ‘Lodi’, and ‘York Imperial’. Some of the least susceptible apple varieties common in the state are ‘Red Delicious’, ‘Golden Delicious’, ‘Honeycrisp’, and ‘Harrison’. Table 1 lists other commonly grown varieties and their corresponding susceptibility to fire blight infection. It is

important to note that while varieties show general trends in resistance, fire blight severity is contingent on many variables, including time of infection, temperature, humidity, tree age, physical damage, and age-related resistance (also known as ontogenic resistance). Due to this unpredictability, these ratings are only meant to serve as a reference point, as even trees that generally show low susceptibility may still experience severe infection in high infection pressure years.

## Ontogenic Resistance of Host

Ontogenic resistance in pome fruit trees refers to the natural, age- or development-dependent change in a plant’s susceptibility to pathogens. In simple terms, young apple tissues (such as rapidly growing shoots, leaves, flowers, and young fruit) are usually much more susceptible to infection, whereas older, more mature tissues become increasingly resistant. This resistance is not due to prior exposure to a pathogen, but rather to normal developmental changes in the plant. As apple tissues mature, they undergo structural and physiological shifts, such as thicker cuticles, increased cell wall lignification, altered nutrient availability, reduced stomatal activity, and changes in defense-related metabolites—that make it harder for pathogens to penetrate, colonize, or spread. Ontogenic resistance plays a major role in infection because the fire blight pathogen is most severe when tissues are young and actively growing, while the same pathogen often fails to infect or cause limited damage later in the season. This is especially true for shoots, which become less susceptible to fire blight after terminal bud formation due to significant metabolic changes. Understanding ontogenic resistance is critical for disease management, as it helps explain why infection risk is highest during specific growth stages and why well-timed protective measures are more effective than season-long susceptibility assumptions.

# Control and Management Practices

Once fire blight infects an orchard it is difficult to eradicate it. Therefore, the best control is to apply preventive control practices. There are a variety of preventive practices available to help prevent disease outbreaks, but timely application is necessary for maximum efficiency. Creating an integrated approach that combines cultural and chemical control options best suited to your orchard can be effective in preventing significant loss. Below is a breakdown of the most widely used treatments for fire blight that growers should consider when preparing to manage it.

## Cultural Control

Cultural control through modification of the growing environment is an important aspect of fire blight control. When selecting plant material, consider choosing more resistant cultivars over more susceptible varieties. Always aim to select a resistant rootstock, as rootstock infections are difficult to detect and can lead to the death of the tree. Consider rootstocks such as tolerant B.9, or resistant G.11, G.16, G.41, G.214, G.935, or G.969 for apples. New shoot growth is highly susceptible to fire blight, so avoid excessive nitrogen fertilization and over pruning in the winter to limit excessive new green growth in the spring.

Reducing inoculum in orchards is critical for preventing infections. During winter, identify and remove all fire blight cankers and other infected tissue(s). During tree flowering periods, avoid mechanical flower thinning, as this can contribute to inoculum spread, and trees are most susceptible to fire blight infection. If fire blight symptoms are visible, prune out any infected branches or blossoms. Current research recommends pruning 30 – 45 cm (~12 – 18 inches) below the visible symptom margin for the removal of fire blight. Further pruning beyond this point has not demonstrated significant reductions in new canker symptoms (DuPont 2023). Prune during dry weather.

Sanitizing tools with 10% bleach is recommended, but current research demonstrates that this treatment did not result in fewer cankers than pruned trees without sanitation. Breaking off cankers by hand without the use of proper pruning equipment may leave cankers behind at the end of the season. Cuttings which leave a 13 cm (~5 inches) stub on structural wood can reduce cankers on structural wood compared to flush cuts or 4 cm (~1.5 inches) stubs. Pruned-off infected material should be left on the ground until dry, then removed from the property, either disposed of in a ground pit or burned off-site. Take care to prevent contact with infected pruning wood with clothes and other trees.

## Chemical Control

### Blossom Blight Management

There are a handful of treatments that manage fire blight preventively, either by directly killing the bacteria on flowers (antibiotics) or by altering the tree's defenses (plant immunity or growth regulators). Once a pathogen enters the tissue, there is no cure, and the most effective treatments are preventive. Application of copper spray to dormant trees late in the winter is the most prevalent method in both conventional and organic orchards to disinfect the bark surface and the unfolding green tissues. Copper products are applied at a high rate once in late winter, and exact timing is dependent on the product label. However, the application of delayed dormant copper is prohibited after the ¼- to ½-inch green bud growth stage, as copper can be phytotoxic to green bud tissues. Only low concentrations of copper are allowed after these stages and are specified on each product label. Copper spray applications will kill bacteria exuded early in spring from cankers and other infection sites upon contact, but are not enough to protect pome fruit trees as they develop into bloom and shoot growth stages. This is because copper is a contact bactericide and is easily washed away from tree surfaces by late winter and spring rains. Thus, the protective copper residues are often significantly

diminished to depleted before bloom starts. Copper is only one component of the overall integrated approach to manage fire blight, which aims to reduce primary pathogen inoculum emerging from cankers and cannot kill it entirely.

During bloom, when fire blight infection prediction models like MaryBlyt, RIMpro Erwinia, and/or CougarBlight, using weather forecasts, report oncoming wetting events that can trigger infection, antibiotics are applied before these predicted infection events. The MaryBlyt version EIP in Network for Environment and Weather Applications and the latest CougarBlight models can be accessed online at <https://newa.cornell.edu/fire-blight>, while RIMpro Erwinia is accessible at <https://rimpro.eu/>. The CougarBlight model is also available as a standalone Microsoft Excel file CougarBlight2019ver8.xlsx. Maryblyt model was developed on the East Coast by Paul Steiner, University of Maryland, and Gary Lightner, USDA-ARS AFRS. CougarBlight was developed by Tim Smith, Washington State University, while RIMpro Erwinia was developed by Marc Trapman, RIMpro B.V. The first two models are available free, while RIMpro Erwinia access is paid for through a subscription (250 Euro per year for an account with one weather station, and 250 Euro per year for every extra weather station). The best accuracy of all these models is dependent on the installation of on-farm weather stations, which collect local weather data (e.g., KestrelMet by RainWise or HOBO) and use the location-specific National Weather Service weather forecast. More on suitable weather stations can be found here: <https://newa.cornell.edu/about-weather-stations/>

The antibiotic streptomycin is a strong tool for preventing fire blight infection when applied before infection and when fire blight bacterium resistance is not reported. If applied in tank mix with Regulaid or LI700 surfactant, up to 24 h after the model reported infection event, lower efficacy of streptomycin can occur, and this application is only recommended if preventive

measures have not been done in a timely manner for various reasons. Streptomycin is usually combined with a surfactant, such as Regulaid or LI700, to increase the penetration of the active ingredient into the green tissues, thereby improving efficacy. Application of streptomycin is recommended only to control the blossom blight phase of fire blight to mitigate antibiotic resistance risks.

Oxytetracycline is another antibiotic with lower efficacy against fire blight because it does not have a direct kill action on the bacteria. Oxytetracycline-based products rely on oxytetracycline's ability to slow or halt bacterial growth and development. We call oxytetracycline a “bacteriostatic” for this reason. Streptomycin is a bactericide, which implies a direct killing action of the antibiotic. Oxytetracycline is susceptible to UV light-induced degradation and is generally less effective when applied during high-UV-index conditions. We recommend applying oxytetracycline in the early morning or late at night when the spring UV index is lower. In locations where streptomycin-resistant strains of fire blight bacterium have been reported, oxytetracycline is applied in combination with streptomycin to broaden the spectrum of efficacy.

Kasugamycin is the third antibiotic labeled for fire blight prevention, but due to the cost, is principally used in regions where streptomycin resistance has been detected. Kasugamycin is almost as effective as streptomycin but can be sensitive to UV degradation. Wider adoption of this antibiotic is limited by the high cost of its formulation.

In organic apple production, low rates of copper and the biological control product Blossom Protect can be used to manage blossom blight. Although both materials can provide good control, they require frequent applications and are prone to causing fruit skin russeting, particularly under slow drying conditions. Blossom Protect is also sensitive to certain fungicides commonly applied during bloom, and

its efficacy may be reduced if applied too close to or when tank-mixed with incompatible pesticides.

## Antibiotic Resistance

### Antibiotic Use and Streptomycin Resistance History

Application of antibiotics must be reserved exclusively for blossom blight prevention and applied only when infection risk is predicted by validated fire blight forecasting models. Historically, repeated and calendar-based use of streptomycin has led to the development of streptomycin-resistant populations of *Erwinia amylovora* in several apple-producing regions (New York, California, Oregon, Washington), resulting in partial or complete loss of antibiotic efficacy. Resistance emergence has been strongly associated with unnecessary applications, poor timing, and repeated use in nurseries or during periods of low infection risk. Consequently, antibiotic stewardship is critical to preserving the long-term effectiveness of streptomycin and other antibiotics for fire blight management.

### Importance of Disease Forecasting

Fire blight prediction model-based decision support systems are essential for accurately timing antibiotic applications during bloom and minimizing resistance risk. Fire blight prediction models identify short infection windows during bloom when environmental conditions favor bacterial multiplication and infection through floral nectarthodes. Applying antibiotics only during these high-risk periods maximizes efficacy while reducing the total number of applications. In contrast, routine calendar-based applications made without regard to infection risk increase selection pressure for resistant strains without improving disease control.

## Avoidance of Shoot-Phase Antibiotic Applications

Antibiotics should not be used to control the shoot blight phase of fire blight. Once shoot blight symptoms develop, systemic infection has already occurred, and antibiotic applications are ineffective. The only exception for post-bloom streptomycin use is after hail event(s), when applications may be warranted to protect wounded tissues from infection, a disease phase known as trauma blight. Outside of this narrowly defined scenario, post-bloom antibiotic use is strongly discouraged due to limited efficacy and the increased risk of selecting resistance in high epiphytic pathogen populations present as ooze.

## Shoot Blight Management

Management of shoot blight relies on non-antibiotic strategies, primarily applications of the plant growth regulator prohexadione-calcium (Kudos<sup>®</sup>) and low rates of copper. Prohexadione-calcium suppresses excessive shoot growth, reducing host susceptibility and slowing pathogen invasion, thereby limiting canker development and tree loss. Applications typically begin at petal fall, followed by two additional spray applications at 14-day intervals, with higher rates required for canker prevention. To prevent new shoot infections, low rates of copper can be applied throughout the summer. Copper application should be limited to days with fast-drying conditions, as copper ions lead to fruit skin russeting under slow-drying conditions, thereby impairing fruit quality. Plant resistance activators Actigard (acibenzolar-*S*-methyl) and Regalia (plant extract of giant knotweed) have also shown some potential for shoot blight management; however, data indicate their effects depend on the pome fruit host (pear vs. apple), tree age, and weather conditions. Actigard has high efficacy on young apple trees. A combination of reduced-rate mixtures of prohexadione calcium and acibenzolar-*S*-methyl can significantly reduce shoot blight incidence and severity. Acibenzolar-*S*-methyl can also help reduce the

incidence and size of cankers. Always check the pesticide label for proper application guidelines.

## Summary

The lowest risk of fire blight is achieved by combining resistant plant material, strict sanitation, model-based decision-making, and disease-phase-specific management. Growers should start with fire blight-tolerant rootstocks (e.g., B.9, G.11, G.41, G.935) and avoid excessive nitrogen fertilization and aggressive winter pruning that stimulate highly susceptible shoot growth. Inoculum should be minimized by removing overwintering cankers during dry winter weather, pruning at least 30 – 45 cm (12 – 18 inches) below visible symptoms, leaving short stubs on structural wood, and removing infected material from the orchard after it is dry.

During bloom, antibiotics should be used only preventively and only when fire blight infection models predict risk, using well-maintained on-farm weather stations and tools such as Maryblyt, CougarBlight, or RIMpro *Erwinia* models. Calendar-based spray applications should be avoided to preserve antibiotic efficacy and prevent resistance. Antibiotics should never be used for shoot blight, except for a single post-hail application to prevent trauma blight. After bloom, shoot blight should be managed using growth control (prohexadione-calcium), low-rate copper under fast-drying conditions, and plant defense activators (acibenzolar-S-methyl) when appropriate, rather than antibiotics. When these cultural, chemical, and decision-support strategies are applied together and timed correctly, growers can achieve effective fire blight control while minimizing tree loss, resistance development, and negative impacts on fruit quality.

## Disclaimer

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