

MANAGING FIRE BLIGHT AND LATE SEASON TREE DECLINE

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Shoot Blight and Tree Decline in the 2014 season

Throughout NY in 2014, there have been numerous instances of shoot blight and whole tree decline in both newly planting and established apple orchards. In many cases the problems weren't shoot or scion blight caused by fire blight. The symptom of a flagged crooked brown or black shoot with wilted dead leaves isn't exclusive to fire blight infections. Such a symptom is physiological response to any rapid wilting and death of tissue, which is why other fungal canker diseases, stem borer infestation, and even "tractor blight" (when farm equipment snaps a shoot) can mimic fire blight symptoms. The fire blight bacterium *Erwinia amylovora* can actually cause necrosis of tissue, which often causes the wilted shoots and affected foliar tissues to look darker than the brown color associated with the death of vascular tissue cases by a slow fungal decay or a cracked shoot. Regardless, of the cause, actions may be warranted to understand and manage all causes of shoot blight and tree decline

While these proceedings are concerned with both fire blight and late season tree decline, the first section will focus on fungal causes of shoot blight tree decline. An integrated copy of the [2015 Guidelines for Fire Blight Management in New York](#) immediately follows the information on fungal blights and tree decline.

Fungal causes of blights and tree decline

Nectria and *Botryosphaeria* (and leader blight on newly planted trees) blights were fairly widespread in the 2014 season. I have seen *Nectria* and *Botryosphaeria* cankers in all of my research orchards from newly planted orchards to 15-year-old blocks. With the exception of my newly planted orchard, fruiting fungal cankers were only found on shoots that were compromised by either physical or chemical damage, deer browsing, or fire blight. In fact, nearly every broken branch or pruning left in my orchard was covered with *Nectria* or *Botryosphaeria* fruiting bodies. In the case of orchards with fire blight, these canker fungi likely arrived after they were compromised by fire blight, hail, or deer browsing.

In the 2014 season, many of the fungal cankers observed were colonized by *Nectria cinnabarina*, which is weakly pathogenic often a secondary colonizer of woody tissue. It often succeeds infection by more aggressive shoot pathogens such as *Botryosphaeria*. Although *N. cinnabarina* is weakly pathogenic, shoots compromised by fire blight, the black stem borer, hailstorms, herbicide application, and heavy thunderstorms would be sufficient to make shoot tissue susceptible to infection by *N. cinnabarina* and other fungal pathogens. With all of the aforementioned problems plaguing orchards this summer it is not surprising to see *Nectria* and *Botryosphaeria* cankers. The question now becomes how to identify and manage infections by these canker fungi.

Identifying fungal canker pathogens: Symptoms and signs:

Apple shoots infected by *Nectria*, *Botryosphaeria*, and other canker fungi will wilt, decline, and turn brown with a crooked tip. However, the color of the leaves and wilted shoot tip is more bronze (not black) and will look nearly identical to a shoot that was broken at the base. Sections of the infected bark may appear light tan with a slight orange tint. In these pale sections and at the attachment point of shoots or fruit spurs one may often find the presence of hard orange, coral (*N. cinnabarina*), or black (*Botryosphaeria* spp.) fruiting bodies (stromata) which are 1mm (about the size of the head of a pin). Such stromata are filled with spores that can cause infections of leaf scars, pruning wounds, and dead fruit spurs or peduncles remaining after thinning. *N. cinnabarina* can occur on shoots infected with *Botryosphaeria* and produce fruiting bodies first. Additionally, it can occur on shoots with fire blight or vice versa, which can greatly confuse the diagnosis.

Epidemiology and management *Nectria* diseases:

Little is known about the pathogenicity of *N. cinnabarina* other than the fact that it is an opportunist and can attack compromised woody perennials from currants to apples and produce stromata with infective spores in mid-summer to early fall. By comparison, a good bit is known about *Neonectria galligena*, the causal agent of European canker and the *Botryosphaeria* spp. that cause cankers in woody perennials worldwide. While I've not seen European canker on apple in NY and New England, it is a fairly important disease of apple in Europe and South America, and is known to be present on apples in California. Although pathogens like *N. galligena* and *Botryosphaeria* are more aggressive than *N. cinnabarina*, the life history of these fungal pathogens is fairly similar. These fungi survive in cankers and old bark, and can even be present in nursery stock. These pathogens can survive on summer prunings that may be present on the orchard floor or still hanging in larger trees. Unless every spur or shoot with stromata (fruiting bodies) is removed from affected trees, it should be assumed that canker fungi are present, able to sporulate, and cause infection of compromised tissues. Typically, infections from canker fungi occur in the late summer early fall by wind-dispersed spores invading leaf scars formed during leaf drop at senescence. However, local infections may also occur during spring and summer by spores produced on the cankers that formed from infections occurred the previous fall. In addition to infection of pruning wounds, the black stem borer, local hailstorms, fire blight, and even winter injury would have been enough to exacerbate spring and summer infection by canker fungi in the summer of 2014.

Managing canker fungi is difficult as the fungi are protected deep inside woody tissues from fungicide residues used to manage apple scab and powdery mildew. While there are a few fairly systemic fungicides, the most effective fungicides are only locally systemic and would never penetrate deeply into woody tissues. Management of *Nectria* canker begins in the fall by protecting leaf scars during leaf fall. At this time, infections are initiated by spores produced in stromata (fruiting bodies) emerging in late summer. It is often recommended to apply copper fungicides at 20% and 80% leaf fall. Leaf fall application timings can be adjusted to better match local fall rains. Bear in mind that summer applications of copper can cause fruit finish disorders, will only protect against new infections, and will not be able to arrest established infections in the woody tissue. Fortunately, many excellent copper products including Kocide 3000 and Badge SC are labeled for European canker, but *Nectria* sp. in NY. Hence, these could be used to protect against fall infections for the 2015 season.

Since infections by canker fungi first occur in the early summer or late spring, it is important to prune out infected shoots before the fungus spreads throughout the scaffold to the main trunk. Moreover, such infections will also serve as a source of inoculum for infections at leaf drop. Pruning shoots infected with canker fungi should occur on cool day following a 24-hr period of dry weather with two days of dry weather forecasted following pruning. If infection has reached the leader or trunk, it is probably worthwhile to remove the tree and replant rather than to remove the leader, retrain the tree, and risk potential development of more inoculum in the orchard in the fall. When pruning is completed, it is imperative to remove cuttings from the orchards and burn them or take them offsite to reduce inoculum pressure in the orchard and infection risk to healthy trees during leaf fall.

In summary, most canker fungi (e.g. *N. cinnabarina*) are fairly weak pathogens and usually only infect shoots compromised by winter injury, the black stem borer, fire blight, hail, and herbicide applications. Copper fungicides are the only means to protect against infection during leaf drop in the fall. Pruning is probably the most important means of managing infection by canker fungi as it reduces inoculum potential and restricts the spread of the fungus into the major scaffolds, the leader, and the crown. Infected prunings should be pushed out of the orchard and burned to reduce inoculum. Finally, while infections by canker fungi seem overly prevalent this season, we may not see them in growing seasons with warmer winters, less rainfall, and fewer cases of fire blight.

References

1. **Cox, K.D.**, and Carroll, J. 2014. That other blight, Blight Blues: Nectria and Late Summer Tree Decline. Scaffolds. 23:4-7.
2. Singer, S.D., and **Cox, K.D.** 2010. The re-emergence and management of currant cane dieback in the Northeastern United States. Plant Dis. 94(11):1283-1289.

2015 Guidelines for Fire Blight Management in New York

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Background

Since the winter of 2011, streptomycin-resistant strains of the fire blight bacterium, *Erwinia amylovora*, (SmR Ea) have been identified in western NY. In some areas of western NY, streptomycin may provide less than adequate control of blossom blight. However, Prohexadione-Calcium (Apogee) will be effective against shoot blight.

We are continuing to screen fire blight samples for streptomycin resistant *Erwinia amylovora*. Information on submitting samples is outlined at the end of the guidelines.

Fortunately, we don't have a state- or region-wide fire blight epidemic with tremendous economic impact. Because of this, it is unlikely EPA will grant and emergency use Section 18 label for Kasumin 2L (active ingredient Kasugamycin) in the near future. However, if you experience significant economic loss from fire blight, please document it and send it to Kerik Cox, email: kdc33@cornell.edu.

Kasugamycin is an effective alternative antibiotic to streptomycin, and provides excellent blossom blight control. Kasumin 2L is in the pipeline for EPA Section 3 registration and may be available in 2015. Because the registration of Kasumin 2L is tenuous, guidelines are provided for control of fire blight without and with use of kasugamycin.

Guidelines for all areas

1. All fire blight cankers should be removed during winter pruning. Remove all trees with central leader or main trunk infections. Infected wood should be removed from the orchard and either burned or placed where it will dry out rapidly.
2. Copper sprays should be applied at green tip.
3. CCE alerts and disease model forecasts for fire blight infection periods should be heeded, and suggested materials sprayed promptly.
4. When blossom infection is forecast, apply a tank mix of either
 - a. oxytetracycline* in combination with streptomycin at highest labeled rates,
 - b. or, the highest labeled rate of streptomycin in combination with a bloom time rate of a registered copper** product,
 - c. or, kasugamycin (Kasumin 2L), if registered.
5. Prohexadione-Calcium (Apogee) applications for shoot blight should be seriously considered, especially on highly-susceptible varieties.
6. Fire blight strikes should be pruned out promptly and destroyed. It is best to prune well back into healthy wood, about 12 inches below the margin with dead tissue.
7. If severe blossom blight occurs regardless of the timing of a streptomycin application, contact CCE for SmR Ea testing, listed under "Sample Submission" below.
8. If you need to interplant apple trees in existing orchards where fire blight was observed; wait until late fall, so the bloom on the new trees will be synchronized with the established trees.
9. If fire blight symptoms appear, collect samples for streptomycin resistance screening so you can plan your management program. Contact CCE for SmR Ea testing, listed under "Sample Submission" below.
10. No quarantine will be imposed if SmR Ea is found in your orchard.

Additional chemical use guidelines for high risk areas (with confirmed SmR Ea)

1. Follow general recommendations (above) ***except for the following differences.***
2. Never apply streptomycin without another active ingredient effective against fire blight. To reiterate, when blossom infection is forecast, apply a tank mix of either
 - a. oxytetracycline* in combination with streptomycin at highest labeled rates,

- b. or, the highest labeled rate of streptomycin in combination with a bloom time rate of a registered copper** product
 - c. or, kasugamycin (Kasumin 2L), if registered.
3. Prohexadione-Calcium (Apogee) sprays should be applied at the highest labeled rate at 1-3 inches shoot growth. Apogee will not be effective if applied after you see fire blight symptoms.

GUIDELINES FOR ON-FARM NURSERY PRODUCTION

1. Collect budwood from orchards where fire blight is not established or from a neighboring farm without fire blight.
2. Limit streptomycin applications to 2-3 per season. These should be timed according to a disease forecast model prediction or CCE alert.
3. When fire blight pressure is high and shoots are actively growing, apply copper at the lowest labeled rate to prevent shoot blight.
4. Before conducting tree management tasks in nursery apply a copper product at the lowest labeled rate and observe the labeled REI.
5. When working in the nursery, field workers must wear clean clothing, and should wash hands and disinfect working tools often.
6. Any pinching, leaf twisting, should be done on dry sunny days with low relative humidity, after the REI of a copper application has expired.
7. If fire blight is found in the nursery, completely remove the infected trees including the root system, and place them in trash bags between rows. Subsequently, remove the culled trees from between the rows and discard them. Under no circumstances should unbagged infected trees be pulled between nursery rows when trees are wet, otherwise fire blight will be spread down the rows.
8. Control potato leafhoppers in nursery using a registered neonicotinoid product.
9. Maintain weed control through cultivation. Apply registered post-emergence herbicides using a shielded boom. There are some residual herbicides registered for use in nurseries.
10. When trees have reached the desired height, consider applying the lowest labeled rate of Apogee to slow growth and reduce susceptibility to shoot blight.
11. Manage nitrogen levels to balance tree growth and fire blight susceptibility.

RECOMMENDATIONS FOR NEW PLANTINGS (1-2 years)

1. If possible, plant varieties grafted on fire blight-resistant rootstocks.
2. Trees should be carefully examined for fire blight infections before planting. Infected trees should be discarded. Samples should be submitted for strep-resistance testing. Contact CCE for SmR Ea testing, listed under “Sample Submission” below.
3. Immediately after planting, and 14 days later, a copper application should be made. Ensure that soil has settled to avoid phytotoxicity to roots.
4. Trees should be scouted at 7-day intervals for fire blight strikes until July 31st. Infected trees should be removed as described above. Plantings also need to be scouted 7-10 days after hail or severe summer storms. The NEWA disease forecasting model for fire blight newa.cornell.edu/index.php?page=apple-diseases can assist by providing an estimate of symptom emergence following a storm or other trauma event. Also scout the planting at the end of the season (mid-September).
5. If possible, remove flowers before they open. New plantings may have considerable numbers of flowers the first year, and blossom removal may not be practical. If practiced,

the blossoms should be removed during dry weather and before there is a high risk of fire blight infection.

6. Trees should receive an application of copper at a stage equivalent to bloom. Observe the labeled REI before blossom removal.
7. To protect any remaining bloom, apply one of the following tank mix options:
 - a. the highest labeled rate of copper** prior to infection,
 - b. or, oxytetracycline* in combination with streptomycin at highest labeled rates,
 - c. or, the highest labeled rate of streptomycin in combination with a bloom time rate of a registered copper** product,
 - d. or, kasugamycin (Kasumin), if registered.
8. Samples of any infections observed after planting should be submitted for strep-resistance testing – see contact information below. Infected trees should be removed entirely in these high density orchards.

SAMPLE SUBMISSION INSTRUCTIONS

If fire blight infected trees and strikes are observed after proper streptomycin application, call or email one of the persons below to provide you with sample submission instructions, and possibly to come and collect samples and take data on the situation.

Debbie Breth, Tel: 585-747-6039, email: dib1@cornell.edu

Juliet Carroll, Tel: 315-787-2430, email: jec3@cornell.edu

Kerik Cox, Tel: 315-787-2401, email: kdc33@cornell.edu

*Oxytetracycline must be applied before infection occurs. Therefore, monitor fire blight forecasts and heed CCE alerts carefully when using oxytetracycline. Data from university field research trials suggest that different formulations of the same antibiotic active ingredient may perform differently in the field. Consult with specialist before choosing the product for your operation.

**Copper must be applied before infection occurs. Therefore, monitor fire blight forecasts and heed CCE alerts carefully when using copper. Copper may cause fruit russet. Hydrated lime may be used to soften copper. An example would be Badge SC at rate of 0.75 to 1.75 pints /acre buffered with 1-3 lbs. of hydrated lime for every 2 pints of Badge to minimize fruit finish damage.