Managing Fire blight in New Apple Plantings

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Over the past decade, many growers have experienced serious tree losses in new and young apple plantings due to fire blight, losing as many as 25-50% of the trees. According to the 2006 New York Fruit Tree and Vineyard Survey, 43% of the apples planted in NY are at a density of 350 or more trees per acre. More than 51% of the trees reported in NY are varieties that are susceptible to fire blight. Although the numbers are not available from the survey, it is likely that most of the trees planted at 350+ trees per acre are on dwarfing rootstocks, likely M.9 or M.26. These rootstocks are very susceptible to fire blight infection, which will kill the infected trees if the disease is not managed. The 2006 survey also shows that 57% of acres of trees planted in 2005-06 are in varieties susceptible to fire blight.

> **"Fire blight infections in newly planted apple orchards can originate from infections in the nursery or from blossom infections soon after planting. Inspections of new trees and applications of copper soon after planting and removal of all blossoms are essential practices to prevent significant tree loses due to fire blight."**

Select Resistant Rootstocks

Growers can minimize the risk of tree loss by choosing a rootstock that is not susceptible to fire blight infection if a scion infection occurs. An alternative to M.9 and M.26, which are very susceptible to rootstock blight, is B.9 which is susceptible to direct inoculation in the stoolbed, but is resistant to infection through the scion. The CG rootstocks, G.16, G.30, G.65, G.41, G.202, and G.935 are resistant to fire blight; G.11 is tolerant. So in a fire blight-prone area with susceptible varieties, growers can prevent serious losses by using B.9 or the CG rootstocks.

When Are Rootstocks Most Susceptible to Rootstock Blight?

Research done by Dr. Jay Norelli showed that the susceptibility of M.26 rootstocks to infection in the third leaf is significantly higher (20%) than the susceptibility in the first and second leaf (1-2%). This study was begun with inoculating shoots in mid-June. Dr. Nicole Russo (2006) showed that B.9 is also susceptible to infection dependent on age of the tissue; first year shoots were susceptible but the infection was walled off when it reached the two-year old root tissue. This prevents scion infections from resulting in rootstock blight in B.9 plantings; consequently, there is no tree loss if blossom or shoot blight strikes are established unless on the main trunk of the susceptible cultivar.

Plant Clean Nursery Stock

After you have made your decisions concerning rootstock and variety and ordered your trees for the new planting, examine nursery stock when it arrives. Most nurseries rogue infected and neighboring trees if infections occur and do not try to cut out infections in the nursery. The risk in buying trees previously infected is the potential for the bacteria to be present in the tree without evidence of infection. When the conditions are right for the bacteria to multiply, the symptoms of infection become apparent.

Nursery outbreaks have been recorded as potential sources for establishment of fire blight. (Russo, et al, 2008). In 2002, we found resistant isolates of *Erwina amylovora* in newly planted trees in Western New York while conducting our annual survey for streptomycin resistance of fire blight infections in the state. There were two related plantings where streptomycin-resistant bacteria were identified. Resistance developed due to the plasmid transfer of the strA-strB gene cluster, previously characterized in populations of streptomycin-resistant *E. amylovora* found in Michigan. The nursery stock of the two infected plantings was from Michigan. There were several cankers on the new trees, indicating a problem in the nursery (Figure 1). When the growers were informed of the presence of streptomycin-resistant *E. amylovora* in these plantings, they agreed it would be best to remove and burn the trees. All other survey results for NY through 2007 have shown all fire blight bacteria were sensitive to streptomycin.

Figure 1. Canker from possible FB infection in nursery.

Tim Smith (2002) reported a situation in 1999 when infected, but asymptomatic budwood was used to bud nursery trees resulting in very high tree loss numbers in the orchard after planting. This experience has raised awareness of the importance of the quality of budwood collected for propagating nursery stock. Symptoms of nursery infections in new plantings are usually manifested by cankers on the trunks. If new plantings have blossoms the first season, and only blossom blight is found, the source of bacteria for infections is likely from the local area.

As a precaution, we recommend that growers apply copper after planting. Nursery stock is generally clean from fire blight but there is no way of knowing if the bacteria are present upon arrival. One precaution which will reduce the risk of bringing streptomycin-resistant bacteria into the region is to assume there may be some bacteria present on the nursery stock and apply a registered copper formulation at planting before budbreak. You can extend the protection by applying low-labeled rates of copper to prevent

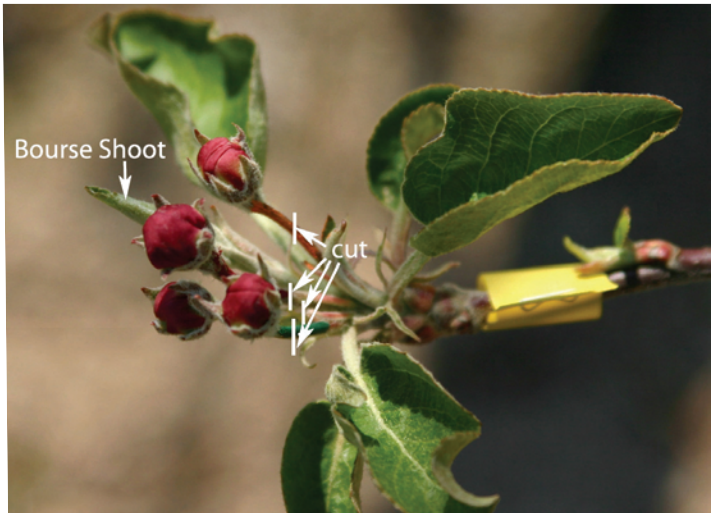

Figure 2. Blossom cluster on newly planted tree showing where to remove flowers but leaving the bourse shoot intact. (Megan Dewdney)

Figure 3. FB ooze in newly planted orchard.

shoot blight infections in new plantings when nearby orchards are infected. If the new planting is nearby a commercial orchard where you are still managing apple scab, these sprays will also help prevent establishment of scab in the new planting.

What About the Blossoms?

The biggest challenge growers face in managing fire blight in a new planting is keeping up with blossom blight protection while they are busy assessing and applying thinning sprays in established orchards. The nursery stock available to growers usually have some flower buds that will open the year of planting but weeks after blossoming is completed in adjacent established orchards. This typically occurs when we get warm weather with high temperatures in the high 70's and 80's. This provides the "perfect storm" for fire blight blossom infections in these new plantings if left unmanaged.

One way to prevent blossom blight infections in new orchards is to assign someone to walk the new planting when it comes into tight cluster or early pink and look for flower buds that have expanded but not yet opened; pinch out the flowers without pinching the shoot that will grow out of this flower bud, the bourse shoot (Figure 2). The bourse shoot is a shoot that elongates from a bud in the axil of the top leaf on the flowering/fruiting spur. This must be done on a dry day, not a rainy or humid day! Figure 2 shows where to pinch out the blossoms and leave the bourse shoot to grow. Many varieties like Gala will produce a second flush of blossoms on one-year-old wood that will need to be removed as well.

The alternative to removing flower buds is to apply streptomycin during high risk infection periods. Growers must identify "high" and "extreme" risk for blossom blight using prediction models like Maryblyt and Cougarblight. The critical components to monitor for applying antibiotics are the presence of blossoms and the average daily temperatures. These criteria need to be monitored as long as there is bloom in the planting and realize that a streptomycin application will only be good for three days and a second application will be necessary if warm weather continues and new blossoms continue to open. Rainfall is the most common, but not the only source of blossom wetting necessary for an infection; a heavy morning dew that may dry before being noticed or a spray applied in poor drying conditions have taken more than one grower by surprise (Figure 3). The Cougarblight risk model is now available at http://nysaes.cornell.edu/pp/extension/tfabp/cougarblight.htm#newa

If we have an extended bloom period and several infection periods, the models may recommend more than three streptomycin applications per season. Our experience from areas with streptomycin resistance implies that the risk of resistance development is higher if streptomycin is applied more than three times per season, or if growers use lower than recommended rates. Usually in late spring our average temperatures are more conducive for blossom blight infections than in the normal bloom time. In the long run, spraying the trees and running models requires as much time removing blossoms with equal results if done properly. However, the timing of antibiotic application is much more critical to protect blossoms that are one to four days old; in varieties like Gala with extended bloom periods, it is more likely growers will miss a critical spray. Prevention of infection is the key!

Alternatives to streptomycin in new plantings include copper and Serenade®. Copper is a biocide and kills the on contact. Most fixed copper formulations registered in NY include an application rate for silver tip to green tip, but a much lower rate for half-inch green to first cover at five-seven day intervals or during bloom at 20% and 75 % bloom. Since copper formulations have various levels of metallic copper equivalent, it is critical to look at the label for the proper rate. Copper applied to apples and pears during bloom can result in fruit russeting. Phytotoxicity can be reduced with the addition of hydrated lime to the mix. Do not apply copper in a spray solution with a pH of less than 6.5 due to faster release of free ions of copper that kill the bacteria but also cause phytotoxicity. Phytotoxicity of copper can also be reduced when it is applied in good drying conditions (less than 20 minute drying time). Copper applied for blossom blight does not require the precise timing of application as that of streptomycin, but in replicated trials, copper does not perform quite as well as streptomycin.

Serenade® is a biological control formulation of the bacterium, *Bacillus subtilis.* These bacteria release cell contents that interfere with the growth of competing bacteria such as *Erwina amylovora.* It has no systemic activity like streptomycin, and must be used as a preventive spray with no post-infection activity. Serenade® provides moderate control under high disease pressure, and should be used in an integrated program with streptomycin. This material is probably not the best choice for new plantings if high disease pressure exists.

After infection the *E. amylovora* bacteria move into the vascular system of the trees which protect the bacteria from applications of copper or streptomycin (Figure 4). Applying copper or streptomycin once the bacteria are in the vascular system will not prevent movement of the bacteria within the trees and new infections could continue to develop. Furthermore, applying streptomycin over an infected orchard increases the risk of development of resistance to streptomycin in the bacterial population and is not recommended. Applying copper over a rampant infection in the orchard is preferred; however, it will only protect new shoot tips from infection, but will not stop the internal spread of the bacteria. If a new planting is near an older established orchard which is a reservoir of fire blight infections, low label rates of copper can reduce shoot infections in the new plantings. These applications are not recommended in bearing blocks of fresh fruit orchards due to the potential for fruit russet.

To Cut Or Not To Cut?

And what if all of the above measures do not come together and you find fire blight in your new planting. Do you cut or not? Do you spray streptomycin? Do you spray copper? Norelli et al. (2000), found that in young nursery stock inoculated with *E. amylovora,* the bacteria were detected in the rootstock within three weeks after inoculation. Although the bacteria are not always going to result in disease symptoms in the rootstocks the first season, this is an important consideration since it usually takes 7-10 days for symptoms to show after an infection has occurred. It also indicates that the bacteria are often beyond the brown visible infected area by the time growers notice them and prune them away.

If you have had conditions during bloom that may result in blossom blight infections, monitor the orchard for symptoms of infection about a week after the infection date. The Maryblyt model predicts the first signs of infection to be visible at 103 degree days (base 55F) after the infection period. Such orchard monitoring could correspond to tree training activities. However, do not do "pinching" and "leader selection" while removing fire blight. If you only have a few infections and the symptoms are new, i.e. just wilting but not yet brown, it should be worth the time and effort to walk the new planting and cut at least 12 inches below the visible water-soaked symptoms in the bark. There is no magic number for how far below the symptoms to cut, since the movement of the bacteria within the tree depends on weather conditions, time of year of infection, tree vigor, water relations in the tree, and variety.

Pruning out fire blight in a new tree should be a combination of disease removal and horticultural pruning. In order to protect the main trunk of the tree, it is often advisable to remove the entire scaffold if infected using a "Dutch" cut. It will be necessary to walk the orchards weekly, looking for new infections and removing them as early as possible. In highly susceptible varieties, the infections will continue to spread into new shoots, but with resistant varieties, the infections tend to stop at the two-year-old wood. There is no clear advantage to disinfecting shears between cuts as long as cuts are not made through infection symptoms. Prune out FB infections under dry, low humidity conditions.

The plant growth retardant Apogee® is an excellent tool to manage fire blight in established orchards that have filled their space, but its use in new plantings will sacrifice desired shoot growth and must be applied long before there is an infection.

Figure 4 Blossom blight infection which resulted in shoot dieback in a newly planted orchard.

Summary

Controlling fire blight in new apple plantings requires vigilance. The following steps will help limit fire blight problems in new plantings:

- Inspect nursery stock for any cankers before planting.
- Apply copper at budbreak in new planting.
- Monitor plantings for blossom clusters.
- Remove blossoms at pink or
- Monitor weather conditions and apply streptomycin as recommended by blossom blight models when blossoms are open.
- Monitor planting for signs of infection a week after infection conditions.
- Promptly cut out infections at least 12" below infection.

Completing all of these steps will help prevent FB infections in new plantings. The risk of fire blight in new plantings is low if the planting is isolated from established orchards and fire blight inoculum. Nevertheless, we recommend that growers be vigilant during bloom in all new plantings and either remove blossoms or spray streptomycin.

References

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