Cornell Cooperative Extension
Eastern NY Commercial Horticulture Program

Tree Fruit News

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Apple PGRs—Promoting Return Bloom

Dr. James Schupp, Penn State University

A return bloom program should begin after the current year's crop becomes unresponsive to chemical thinning but before the crop becomes sensitive to the ripening effects of NAA or ethephon.

The first step in an effective return bloom program is an effective chemical thinning program. Chemical thinning removes a portion of the fruit crop, reduces competition, and can increase return bloom. When NAA or ethephon are used in a chemical thinning program, these chemistries can directly promote return bloom, in addition to the beneficial effect from the actual thinning. For some annual bearing, or mildly alternating varieties, a good chemical thinning job can promote adequate return bloom for next year. For alternate bearing varieties, additional action is needed. Here is a concise review of how to improve return bloom.

What to Use

NAA or ethephon. Both are effective for promoting RB when used in a multi-spray program such as that described below. Ethephon is the stronger promoter of the two.

Return bloom of 8th leaf Honeycrisp/M.26 apple trees at FREC, May 1, 2015. Row on the left received no return bloom sprays. Row on the right received 3 'sides' of RB sprays—one spray of NAA and 2 sprays of ethephon—June/July, 2014.

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When to Use

Spray every 7 to 10 days, starting after June Drop, and when fruits are larger than 30 mm in diameter. Return bloom sprays should be started after the current year's crop becomes unresponsive to chemical thinning, but before the crop becomes sensitive to the ripening effects of these plant growth regulators. Return bloom sprays later in July, particularly ethephon, can promote premature ripening and accelerate preharvest fruit drop. This is a greater concern for early ripening varieties such as Honeycrisp and McIntosh types. In most seasons, the effective window is early June to early July. For later ripening varieties, such as Delicious, York and Fuji, the sprays can go on until mid-July.

Rates

Low rates of either NAA or ethephon are effective. Two oz per acre of NAA or 8 oz of ethephon per acre per spray are adequate. **There is little benefit from higher rates, and use of lower rates minimizes the risk of unwanted side effects. Increasing the number of low rate return bloom sprays is more effective than one or two heavy shots. For consistent results, 3 to 4 is recommended.**

Can I Add to a Tank Mix?

Return bloom promoters can be applied as stand-alone sprays or tank-mixed with other crop protectants. Return bloom can be applied as part of regular cover sprays, either complete or alternate-row-middle. As with all chemical applications, good coverage is necessary.

Spray Adjuvants

While additives may increase uptake and activity of return bloom promoters, be careful with adding these to your tank mix. As Dr. Dave Rosenberger once said to me "Captan on the surface of a leaf is a wonderful thing. Captan under the surface of a leaf is terrible." If applying return bloom sprays as part of a tank mix, it is probably better to skip the adjuvants.

Some years ago, Dr. Ross Byers at Virginia Tech recommended using an ammonium form of nitrogen in combination with return bloom sprays to increase their activity. I have not been able to demonstrate a benefit from this practice, but some growers continue to add foliar N to return bloom sprays.

Do Return Bloom Sprays Work?

See the photo on page 1 showing rows of Honeycrisp trees. Row 2 received no return bloom sprays. The adjacent rows were treated once with NAA and 2 times with ethephon from one side. The results speak for themselves.

What Can Go Wrong?

Return bloom spray applied too early

Return bloom sprays applied too early increase the potential for unwanted additional thinning of the current season's crop. This risk is greater with ethephon than with NAA, and higher rates (>12 oz ethephon, or > 3 oz NAA per acre) can increase the risk of unwanted thinning. This is particularly the case with varieties that are sensitive to late thinning, such as Macoun, Golden Delicious, and Rome.

Return bloom sprays applied too late

Return bloom sprays applied too late increase the potential risk of premature ripening of early maturity varieties such as Honeycrisp. This risk is also made greater from use of higher rates, and is more acute when using ethephon. Avoid return bloom sprays when daytime highs are in excess of 85° F for the same reason.

Disappointing Results

Many factors influence return bloom. Excessively over-cropped trees, weak trees, excessively vigorous trees, unpruned/heavily shaded trees, water stress and/or heat stress, can all contribute to poor results.

What about Post-harvest Return Bloom Sprays?

Researchers at Michigan State University discovered that stop-drop sprays of NAA could, in some cases, increase return bloom. This has led some consultants to recommend post-harvest return bloom sprays. In 2014, a post-harvest spray of ethephon had no effect on return bloom of Honeycrisp/M.26 trees at the Penn State Fruit Research and Extension Center (FREC). A 2014 stop-drop NAA spray did not increase return bloom of York Imperial/Bud. 9 trees.

Several horticultural techniques (ringing, scoring, root pruning, pinching) have been documented to promote return bloom. With all of these techniques, the period shortly after bloom is the most effective timing, and this appears to be the best timing for return bloom sprays as well. Post-harvest return bloom may prove to be useful in certain circumstances, but even if this timing proves to be worthwhile, it is unlikely to replace the post-thinning timing.

This original article appears on the Penn State Extension website, and can be accessed at the following link: https://extension.psu.edu/apple-pgrs-promoting-return-bloom.

How Do They Work? Bioinsecticide Edition

Dr. Amara Dunn, New York State Integrated Pest Management

A post in the blog 'Biocontrol Bytes' from last February (https://blogs.cornell.edu/biocontrolbytes/2018/02/) described modes of action for biopesticides that target plant diseases…as well as the difference between a biopesticide and a biostimulant. January's post (https://blogs.cornell.edu/biocontrolbytes/2019/01/) described the modes of action of five biofungicides in an ongoing vegetable trial. But there are plenty of insect and mite pests out there, too. You can attract or release predatory or parasitic insects and mites or beneficial nematodes to deal with these arthropod (insect and mite) pests. But you can also use bioinsecticides that control insects and mites. The active ingredients include microorganisms (bacteria, fungi, viruses), plant extracts, or other naturally-occurring substances. Want to know how they work? Keep reading.

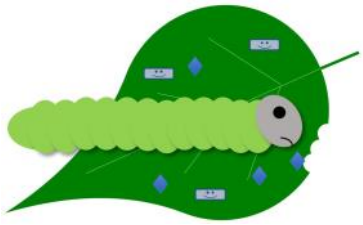

Figure 1: Bioinsecticides include microorganisms and other naturally-derived compounds that control insect pests.

Bioinsecticides can have one (or more) of the following modes of action:

1. Kill on contact
2. Kill after ingestion
3. Repel
4. Inhibit feeding
5. Inhibit growth
6. Inhibit reproduction

The examples included in the following descriptions are reported either on the bioinsecticide labels or in promotional materials produced by the manufacturers. And these are just examples, not meant to be an exhaustive list of bioinsecticides with each mode of action.

Killing on Contact

Some bioinsecticides need to directly contact the body of the insect or mite in order to kill it. Bioinsecticides that contain living fungi work this way. The tiny fungal spores land on the insect or mite pest, germinate (like a seed), and infect the body of the pest. The fungus grows throughout the pest's body, eventually killing it. If the relative humidity is high enough, you might even see insects that look like they are covered with powder or fuzz (but this is not necessary for the pest to die). This powdery or fuzzy stuff growing on the pest is the fungus producing more spores. Bioinsecticides that contain the fungi Beauveria bassiana (e.g., BotaniGard, Mycotrol), Metarhizium anisopliae or brunneum (e.g., Met52), or Isaria fumosorosea (NoFly) are examples of fungal bioinsecticides with contact activity.

Figure 2: If the relative humidity is high enough, insects infected with a fungus may start growing new fungus on the outside of their bodies, appearing fuzzy or like they are covered in powder.
Photo: Louis Tedders, USDA ARS, Bugwood.org

Bioinsecticides that contain spinosad (including Entrust, SpinTor, and others) work because the active ingredient affects the nervous and muscular systems of the insect or mite, paralyzing and eventually killing it. It can kill the pest either through contact, or through ingestion (more on that in a moment). The bioinsecticide Venerate contains dead *Burkholderia* bacteria (strain A396) and compounds produced while growing the bacteria. One mode of action of Venerate is that it contains enzymes that degrade the exoskeleton (outer shell) of insects and mites on contact.

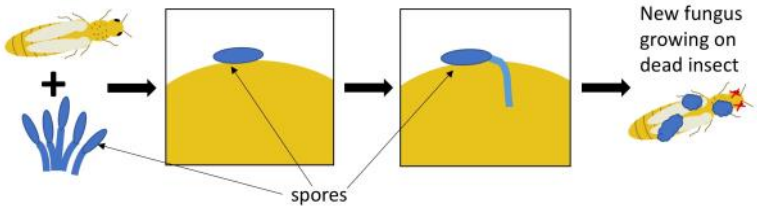

Figure 3: Some bioinsecticides contain living spores of a fungus. These spores need to land on the insect. Then they germinate (like a seed), invade and grow throughout the body of the insect, and eventually kill it. If the humidity is high enough, the fungus may even produce more spores on the body of the dead insect.

Killing by Ingestion

Some bioinsecticides need to be eaten (ingested) in order to kill. Pesticides that contain the bacteria Bacillus thuringiensis (often called Bt for short) as the active ingredient are a good example. Proteins that were made by Bt while the bioinsecticide was being manufactured are eaten by insects and destroy their digestive systems. Several different subspecies of Bt are available as bioinsecticides, and the subspecies determines which insect pest it will be effective against. There are many bioinsecticides registered in NY that contain Bt as an active ingredient. Check NYSPAD for labels, and make sure you choose the right pesticide for the pest and setting where you need control. Bt products do not work on mites, aphids, or whiteflies.

Insect viruses are another example of a bioinsecticide active ingredient that kills

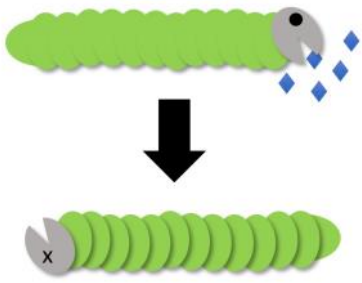

Figure 4: Some bioinsecticides (blue diamonds in this diagram) will only kill pests if they are eaten first. Pesticides that contain Bacillus thuringiensis (Bt) bacteria or insect viruses are examples of this mode of action.

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through ingestion. For example, Gemstar contains parts of a virus that infects corn earworms and tobacco budworms. Once these caterpillars eat the Gemstar, the virus replicates inside the pest, eventually killing it.

Repel

Some bioinsecticides repel insects from the plants you want to protect. However, this mode of action may only work on certain pest species, or certain life stages of the pest. Read and follow the label. Bioinsecticides containing azadirachtin or neem oil, and Grandevo are reported to have repellent activity for some pests. Grandevo contains dead bacteria (Chromobacterium substugae strain PrAA4-1) and compounds produced by the bacteria while they were alive and growing.

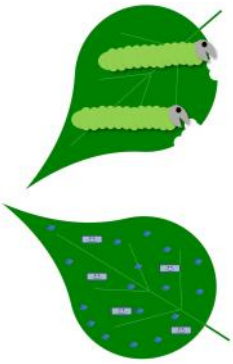


Figure 5: Some bioinsecticides (blue diamonds and happy microbes in this diagram) protect plants because they repel insect and mite pests. This protects treated plants from pest damage.

Inhibit Feeding

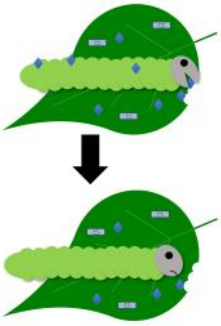


Figure 6: Some bioinsecticides (blue diamonds and happy microbes in this diagram) cause insect and mite pests to lose their appetites. Depending on the bioinsecticide, it either needs to contact the pest or be eaten by it.

If you want insect and mite pests dead as soon as possible, I understand the sentiment. But in many cases stopping the pests from eating your plants would be just as good, right? Some bioinsecticides cause pests to lose their appetite days before they actually die. Like bioinsecticides that kill pests outright, some bioinsecticides that inhibit feeding require ingestion, while others work on contact. And these bioinsecticides may work this way for only certain pest species of certain ages. Read and follow those labels! Bioinsecticides containing Bt require ingestion and some can stop pest feeding before actually killing the pest. The same goes for Gemstar (corn earworm virus). This is another mode of action of azadirachtin products against some pests.

Inhibit Growth

Many insects and mites need to molt (shed their skin as they go from one life stage to another). Bioinsecticides that interfere with molting prevent pests from completing their life cycle. Like feeding inhibitors, these bioinsecticides won't directly kill the pests you have, but they can prevent them from multiplying. This is another mode of action (again, for certain pests at certain stages of development) listed for azadirachtin products and Venerate (Burkholderia spp. strain A396).

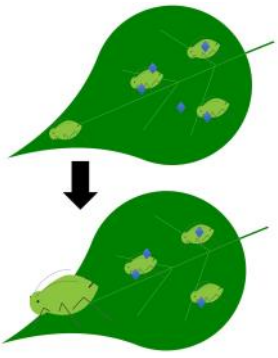


Figure 7: Some bioinsecticides (blue diamonds in this diagram) don't kill insects and mites outright, but they can prevent them from molting and growing into the next life stage. Pests that can't move on to the next life stage will eventually die without completing their life cycle.

Inhibit Reproduction

There are two main types of bioinsecticides that prevent or slow insect reproduction. Pheromones are compounds that confuse insects that are looking for mates. If males and females can't find each other, there won't be a next generation of the pest. Pheromones can be especially useful when the adults who are looking for mates don't feed (e.g., moths). Isomate and Checkmate are two examples of pheromones available for certain fruit pests. Other bioinsecticides actually reduce the number of offspring produced by a pest. This is one of the modes of action of Grandevo (Chromobacterium substugae strain PRAA4-1) against certain pests.

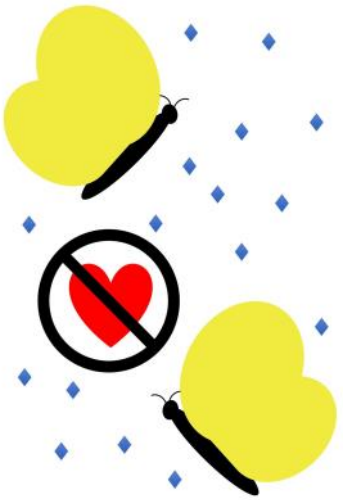


Figure 8: Pheromones (represented here by blue diamonds) are a type of bioinsecticide that confuses insects looking for a mate. As a result, males and females can't find each other, don't mate, and don't lay eggs.

Why Do I Care?

Do you mean besides the fact that you are a curious person and you want to know how biopesticides work? Knowing the mode of action for the pesticide you use (among other things) allows you to maximize its efficacy. Does the bioinsecticide need to contact the pest, or be eaten by it? This determines where, when, and how you apply it. Do you want to use a bioinsecticide that inhibits growth of the pest? Make sure you use it when pests are young. (Sidenote: Like all biopesticides, bioinsecticides generally work best on smaller populations of younger pests.) Is the first generation of the pest the one that causes the most damage? Don't rely on a bioinsecticide that inhibits reproduction. Although if the pest overwinters in your field and doesn't migrate in, maybe you could reduce the population for the next season.

Now is a great time of year to consider the insect and mite pests you are likely to encounter this season, then learn which bioinsecticides include these pests (and your crop and setting) on the label. Always read and follow the label of any pesticide (bio or not) you plan to apply. How do you know whether these bioinsecticides are likely to work on the pests they are labeled for in NY? That's a topic for another post. In the meantime, the Organic Production Guides for fruit and vegetables from NYS IPM are a great place to start. When available, they report efficacy of OMRI-listed insecticides (including some bioinsecticides). Your local extension staff are another great resource.

On-Farm Readiness Reviews and FSMA Inspections Start this Spring

Elisabeth Hodgdon, Eastern New York Commercial Horticulture, Cornell Cooperative Extension

Spring 2019 marks the start of federal food safety regulation compliance and inspections. The Produce Safety Rule within the Food Safety Modernization Act (FSMA), signed into law by President Obama in 2011, attempts to minimize the incidence of food borne pathogens in the food system by preventing contamination during the growing, storing, and handling of fresh produce on farms. The rule imposes standards for activities such as manure application, worker hygiene, record keeping, water testing, and more.

Compliance dates are tiered according to farm size. The largest operations, with produce sales over $500,000, are due for inspection this year, with smaller farms scheduled in the following years. Farms selling less than $25,000 worth of fruits and vegetables are exempt.

With inspections on the horizon, what can you do to prepare?

If you haven't already, the best first step towards FSMA compliance is to sign up for a FSMA grower training course designed by Cornell's Produce Safety Alliance. This required course covers all aspects of the Produce Safety Rule and what is expected of farms. For a list of upcoming courses, see "Additional Resources."

On-Farm Readiness Reviews (OFRRs) are 2-3 hour voluntary educational inspections performed jointly by the New York State Department of Agriculture and Markets (NYSDAM) and Cornell Cooperative Extension (CCE) educators to help you prepare for FSMA compliance. During the visit, NYSDAM and CCE representatives will walk with you around the farm and ask you questions relating to food safety practices. For example, "How do you clean your harvest bins?" and "Do you have a farm visitor policy?" The visit is intended to be conversational rather than running through an audit-type checklist and is educational in nature. At the end of the visit, a list of the main three or four food safety improvement priorities will be delivered to you. Any notes that are taken during the OFRR will be returned to the grower and will not leave the farm. After the visit, the extension educator will follow up by providing more specific resources and advice to assist you with making changes.

How does one sign up for an OFRR?

On-Farm Readiness Reviews are scheduled through NYSDAM. This summer, NYSDAM is prioritizing scheduling OFRRs for the largest farms (>$500,000 produce sales) that may be inspected this year. If you'd like an OFRR, contact Steve Schirmer directly at (315) 487-0852 or steve.schirmer@agriculture.ny.gov. Before the visit is scheduled, you'll be asked to fill out a farm information form, where you will list your business's contact information and answer questions relating to your farm's products and total produce sales. Then, NYSDAM will reach out to you and the nearest trained CCE county or regional educator to schedule the OFRR time.

After the OFRR, what's next?

Large farms interested in OFRRs this year will be placed at the bottom of the list for inspections to allow more time for the OFRRs and education to occur. Large farms that do not want OFRRs will be inspected first. Keep in mind though that the first NYSDAM inspections, although more formal than OFRRs, are also intended to be educational this year, in line with NYSDAM's motto of "educate before we regulate." This means that growers could potentially receive two educational food safety visits to assist them in FSMA compliance this year.

Additional Resources

The ENYCHP's goal is to help growers comply with FSMA requirements by providing resources and advice on practices that are both logistically and economically feasible for individual farms. If you have questions, please contact Elisabeth Hodgdon at eh528@cornell.edu or (518) 650-5323.

Upcoming FSMA courses in New York:

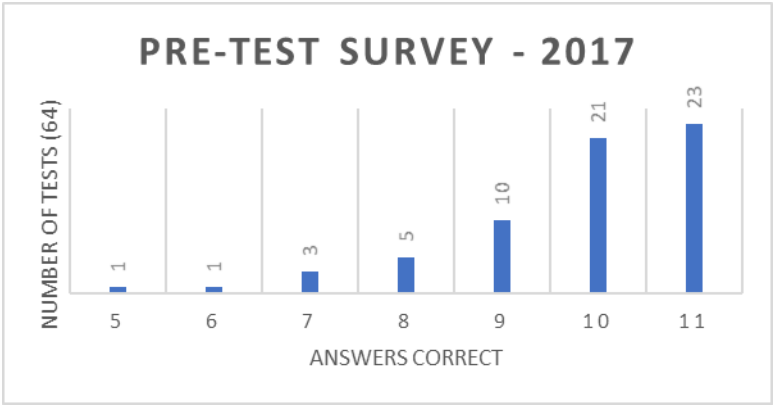
July 15, 2019 in Warrensburg: Register at http://bit.ly/JulyFSMA

Results from Fire Blight Education Efforts in Eastern NY (2017-2019)

Elizabeth Higgins, Eastern New York Commercial Horticulture, Cornell Cooperative Extension

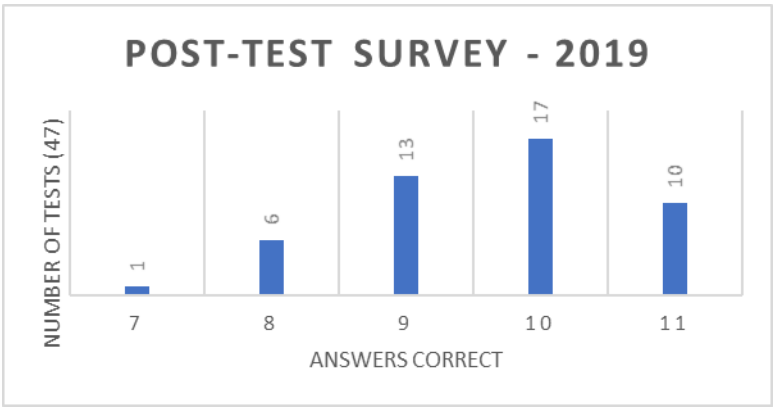
At the 2017 and 2019 petal fall meetings many of you were surveyed about your knowledge of fire blight and treatment options. One goal of this survey was to see if the intensive education and outreach about fire blight conducted by Cornell's HV Lab and CCE ENYCH Educators over the two-year time period had any impact on grower knowledge and actions. 64 growers completed the 2017 survey and 47 completed the 2019 survey. Thanks to all of you who participated! We learned that overall folks were pretty knowledgeable about Fire Blight to begin with, but that education efforts around using predictive models and reducing plant vigor – post infection had been effective.

In the 2017 survey, the folks completing the survey got most of the 11 general knowledge questions about fire blight correct. 14% got more than three questions wrong. The 2 questions where more than 10% of folks taking the survey chose the wrong answer were (in the order of most commonly missed):



- The same antibiotics used to treat human diseases are used to treat fire blight (true) – Streptomycin is a common antibiotic used for human diseases like tuberculosis. Other antibiotics used for fire blight control are not currently used on human diseases, but concern about the future availability of antibiotics for human diseases makes their use in agriculture more scrutinized.
- Vigorous trees, supplied with nitrogen to promote vegetative growth, are better able to fight off fire blight infection than trees with lower vigor (false) New growth is more susceptible to fire blight. Growth regulators, like Apogee, are therefore recommended as a treatment to reduce a tree's susceptibility to fire blight.

In the 2019 survey, there is much less variance in the responses, no-one got more than four answers wrong, but 14% still missed 3 or more questions. The 3 most commonly missed questions, questions where more than 10% of respondents missed the answer, were (in the order of more frequently missed to least frequently missed):



- The same antibiotics used to treat human diseases are used to treat fire blight (true)
- The root stocks you choose do not make a difference for fire blight susceptibility in apples. (false) Although the rootstock will not change the grafted variety's resistance to fire blight, it will affect the vulnerability of the tree should the fire blight pathogen infect the rootstock. A list of highly susceptible rootstocks is available at http://newa.cornell.edu/index.php?page=fire-blight-susceptible-cultivars-and-rootstocks.
- Young trees (1-3 years old) are much less likely to be killed by fire blight than old trees. (false). Young trees are susceptible to fire blight death because of their vigor and because the pathogen is more likely to move into the trunk or rootstock and kill the tree. Protecting young and newly planted orchards is a priority in fire blight management.

We were also concerned about management changes as a result of outreach efforts. There had been two key educational messages during the 2016-2019 period:

1) Use Fire Blight prediction models to inform treatment, and
2) Apogee (and other growth regulators) can be an effective treatment post-infection.

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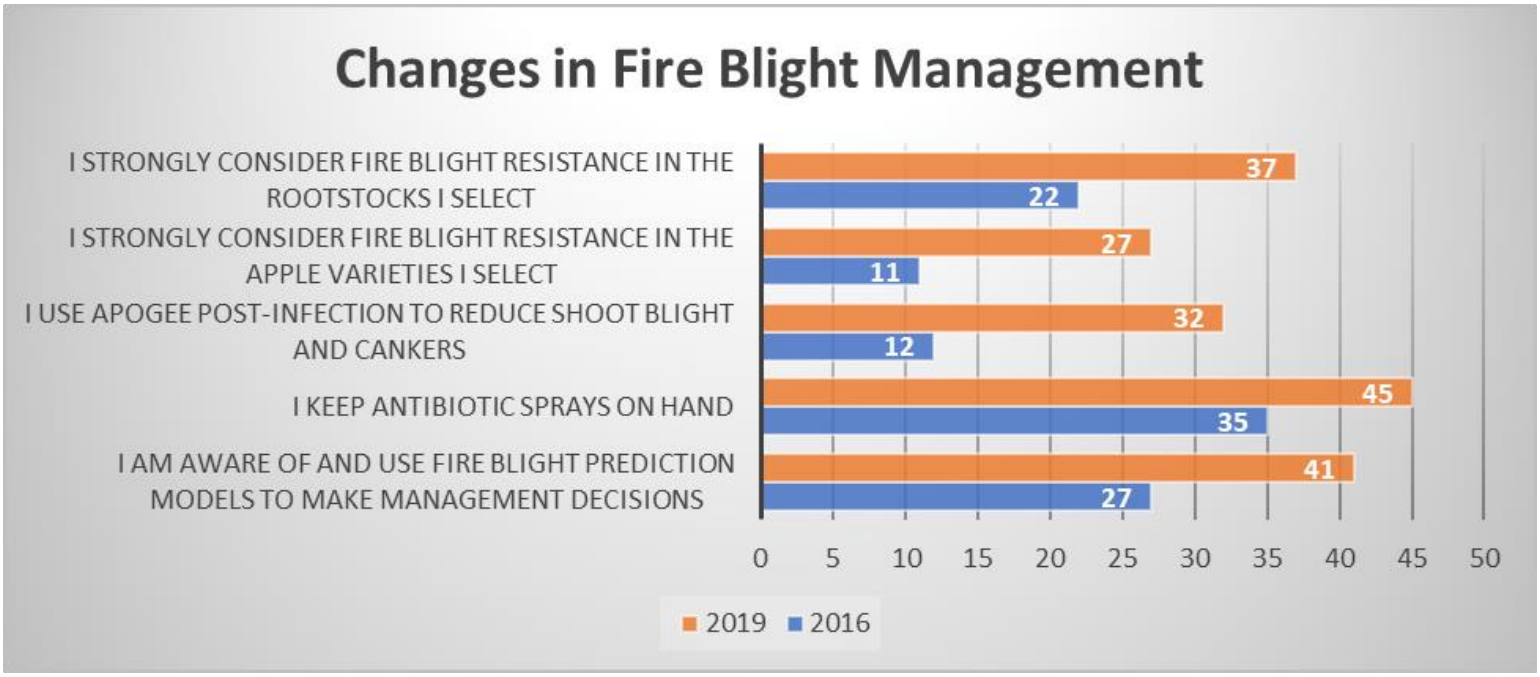


In 2019 we asked growers what fire blight management changes they had made between 2016 and 2019. 45 completed this section of the survey. In all categories, farms had increased their adoption of recommended fire blight management practices from 2016-2019. For the two of primary concern, use of Apogee and use of models, the impact was large. There was a 44% increase in use of Apogee and a 31% increase in use of prediction models.

Thanks again to everyone who participated!

Fire Blight Survey 2019

Kerik Cox's lab will be conducting a fire blight survey again this year, investigating streptomycin resistance and strain distribution across NY State and New England. **In the event fire blight does show up in your orchard, please send a sample to our lab! For a submission form, visit: bit.ly/2019FireBlightSample**

You may take a sample yourself, or you may wish to contact Dan Donahue or Mike Basedow to come and help you collect the sample. Samples submitted without the form will not be processed!

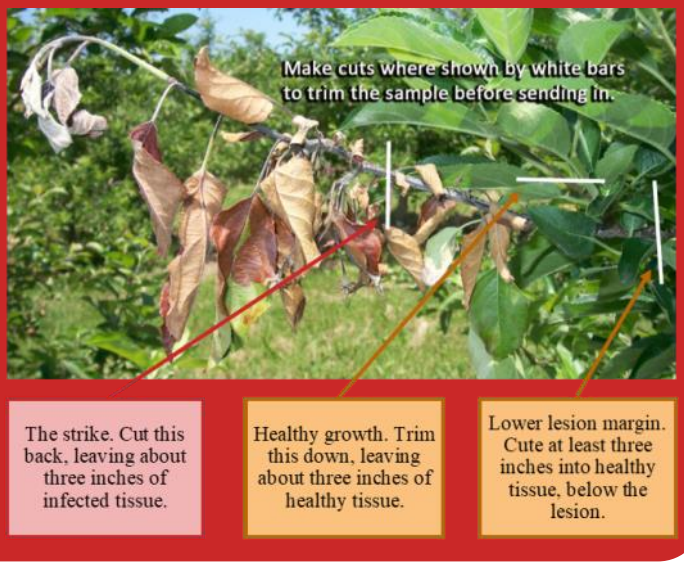
It is imperative that we receive living (green) cambium tissue from the canker margin (i.e. where the necrotic and healthy tissue meet). Otherwise, the pathogen cannot be isolated. Samples should be sent as soon as possible after being removed from the tree, and kept cool if possible.

Instructions for sampling

It is only possible to isolate the bacteria (Erwinia amylovora) from fresh, active lesions, where healthy tissue meets the diseased tissue, i.e. the lesion margin. It is impossible to isolate fire blight bacteria from dead, dried out tissue.

The Lesion Margin

Collect samples that include about 3 inches of healthy tissue beyond the infected tissue, and include about 3 inches of infected tissue. Do not submit all the dead branch of the strike, this is often too long and can be cut back, as described, to 3 inches of infected tissue above 3 inches of healthy tissue. If possible, refrigerate infected trees and strikes. Protect samples from drying out prior to submitting them. Do not collect entire branches or trees unless symptoms are unusual.



Upcoming Events

Summer Pesticide Certification Exam Trainings
July 2, July 9, July 16, July 23, 2019 - 1:30pm-4:30pm
CCE Clinton County, 6064 Route 22, Suite 5, Plattsburgh

CCE ENYCHP Horticulture Specialists Mike Basedow and Elisabeth Hodgodon will be offering four afternoons of training to review key concepts and study tips in preparation for the exam.

FSMA/PSA Grower Food Safety Training Course
July 15, 2019 - 8:00am-5:30pm
CCE Warren County, 377 Schroon River Rd, Warrensburg, NY

A grower training course developed by the Produce Safety Alliance (PSA) that meets the regulatory requirements of the Food Safety Modernization Act (FSMA) Produce Safety Rule. At least one person per farm producing more than $25,000 worth of fruits and vegetables must attend this course once. Participants will receive a certificate of course completion by the Association of Food and Drug Officials. To register, visit: bit.ly/JulyFSMA

Lake Ontario Summer Fruit Tour
July 18, 2019 - All day, free lunch
Niagara County

Check back for more details on this tour of cutting edge fruit in Western New York.

Hudson Valley Tour
July 26, 2019

Half-day tour of the Hudson Valley Research Lab and CCE research projects at Hudson Valley grower sites. More details to follow.

Organic Apple Field Day
August 1, 2019 - 3:00pm-7:00pm
Cornell Orchards, Ithaca

Details coming soon.

2019 Young Fruit Growers of WNY Study Trip to the Hudson Valley
August 5-7, 2019

Lake Ontario Fruit Program is excited to be partnering with the Young Fruit Growers of Western NY to offer the 2019 Young Grower Study Trip to the Hudson Valley. The tour will include innovative grower orchards and packinghouses in the Hudson Valley. The study trip is focused on helping next generation growers develop the knowledge and skills needed to take their family farms into the future. To register, visit: https://lof.cce.cornell.edu/event.php?id=1209

2019 Cornell Storage Workshop
August 8, 2019
Stocking Hall, Cornell University, Ithaca

Topics will include issues such as DCA and food safety, and review of storage recommendations, and varieties such as Gala and Honeycrisp, especially in relation to disorders and quality control. To register, visit: https://hort.cals.cornell.edu/content/2019-storage-workshop/

Long Island Field Tours
August 13-14, 2019

Details coming soon.

Hard Cider PWT Tour in the Catskills

Registration and details coming soon.

The Eastern New York Commercial Horticulture Program is a Cornell Cooperative Extension partnership between Cornell University and the CCE Associations in these seventeen counties: Albany, Clinton, Columbia, Dutchess, Essex, Fulton, Greene, Orange, Montgomery, Putnam, Rensselaer, Saratoga, Schenectady, Schoharie, Ulster, Warren & Washington.

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