APRIL 2021

THE PRODUCE PAGES

Serving the fruit and vegetable growers of Eastern New York

Vineyard in Middletown, NY.
Photo: J. Meyers

Cornell Cooperative Extension
Eastern NY Commercial Horticulture Program

Feature Farm Story

5 Good Things from the Pandemic

Elizabeth Higgins, CCE ENYCHP

I am sure that most readers of *Produce Pages* are experiencing "COVID Fatigue", I know I am.

But as they say, "it's an ill wind that blows no good". Here are 5 good things that have come out of the adaptations that many farms in NYS and Cornell Cooperative Extension have had to make to adjust to social distancing and safety that I think will have lasting benefits to our region.

Winery sales

Like many others, I was apprehensive about what COVID-19 restrictions would do to winery sales in our region. But anecdotal reports from area vineyards as well as some research from Cornell indicates that some of the restrictions due to COVID may have improved winery sales at wineries with tasting rooms! Prior to the pandemic, there were no restrictions on numbers of people in a winery. No reservations were required at most wineries, and people typically stood at a tasting bar, often with people they did not know. A tasting often lasted 15 to 30 minutes, and in many places were limited to pre-determined flights of wine. Some wineries did not charge for tastings, others charged $10 to $15. During the pandemic, capacity has been limited to 50% or less, reservations are often required, customers are frequently seated at tables with only members of their party, and they may be able to pick exactly which wines they want to taste. The experience potentially is longer, between 45 minutes and an hour, and may be more expensive. Wineries have seen that those reservations are making

(Continued on page 3)

The Produce Pages

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In this Issue:

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Serving the Educational and Research Needs of the Commercial Small Fruit, Vegetable and Tree Fruit Industries in Albany, Clinton, Columbia, Dutchess, Essex, Fulton, Greene, Montgomery, Orange, Putnam, Rensselaer, Saratoga, Schoharie, Schenectady, Ulster, Warren and Washington Counties.

(Continued from cover)

a plan to visit, and the winery can reward them with a better, more informative, authentic experience. It also is an opportunity to talk to those customers about the winery's wine club or how to buy wine online. The end result may well be that those customers will spend more money, buy higher quality wine and become on-line customers. Preliminary research by Dr. Miguel Gomez and Trent Davis of Cornell's Dyson School supported this conclusion. https://www.winebusiness.com/news/?go=getArticle&dataId=242445

CSA and local food sales

Local foods were also a bright light in 2020. CSA share prices increased last year for the first time in many years. Based on price data I have collected on CSA farms in the Eastern NY region since 2017, the average CSA share price, for a weekly, large/full-sized, vegetable share, increased by 10.3 percent. We also found that over half of the CSAs in our database indicated on their website in July 2020 that they had sold out their shares for 2020. We saw an increase in the number of CSA farms. In 2019 there were 102 farms offering vegetable CSA shares in the ENYCH region, but we identified 117 farms in 2020. Some of these were farms that had been selling to restaurants or wholesale but pivoted back into CSAs – I am seeing more of these in 2021. If the CSA farms are able to retain their customers in 2021, we may see a reversal of what had been a downward trend in direct to consumer marketing.

Farm websites moved into the 21st Century

At the 2019 fruit school I did a presentation on apple varieties for agritourism, which meant looking at the websites of 55 PYO farms in the ENYCH region. I also have spent the past 4 years looking at over 100 CSA websites. There were a lot of outdated farm websites in our region. This year I am looking at websites again and WOW you guys have really taken it up a level! A lot of farms clearly realized that they needed to be able to reach their customers on-line this year and finally bit the bullet and upped their game.

We got better at on-line learning

This year most of Cornell Cooperative Extension's educational programming moved on-line. Having to move on-line forced many of us to upgrade our systems and get better at teaching online. Being online allowed people to attend programs that otherwise would have been too far away. And we did not need to cancel a single program this year due to weather! While I miss the face to face interaction with people at programs, the feedback that I have received is that many farms are finding on-line education to be a time-effective and cost-effective way learn. What do you think? We are actively seeking feedback from your experience at our on-line fruit and vegetable schools this winter. Please respond to the evaluation survey that you will receive!!!

Windfall COVID $$$

Federal COVID relief funding, the PPP program and CFAP, in particular, made grant dollars accessible to fruit and vegetable farms at levels that are unprecedented.

If you have not taken advantage of PPP, you have until March 31st to apply. Changes were made to the program that makes it even more attractive. The PPP funds are not taxable at either the federal or state level, expenses paid for with PPP funds can still be deducted from your income taxes as an expense and you can now use PPP funding to cover COVID worker protection expenses. The other change, for sole proprietors (or farms that file the schedule F) is that the income used to calculate the owner's salary is now the gross income, not net income. This helps to make the program more attractive to farms with fewer employees.

The deadline for Value Added Producer Grant has been extended to May and an additional $35 million in COVID relief funding has been added to the program ($76 million total is available this year) making it much more likely that farms that apply will receive funding. If you have been considering this program, this would be a very good year to apply! Other changes have been made to make the program more accessible. For example, the match this year is only 10% not 50%!

Despite all of these good things, I know that some farms in our region have struggled and we are not completely out of the woods yet. Remember to keep your safety practices in place, get you and your employees immunized as soon as you can and hopefully 2021 will be an even better season than 2020.

NEW Crop Rotation Recommendations for Swede Midge: Make Plans Now for 2021 Growing Season

Christy Hoepting, CCE Cornell Vegetable Program

As planting time approaches and last-minute changes to cropping plans are made, consider our colleague Christy's new recommendations for planning where to grow your brassicas to minimize swede midge damage. Swede midge is a small invasive fly that is becoming increasingly prevalent in New York and elsewhere in the Northeast. Midge maggots feed on the growing point and cause distorted plant parts. Because the midge overwinters in the soil and has somewhat limited mobility, crop rotation is a useful tool in your management plan for this pest. For more information on swede midge, see the Swede Midge Information Center for the U.S. website and our Organic Management of Swede Midge factsheet.
– Elisabeth Hodgdon, ENYCHP.

PLANNING AHEAD

We all know that the best-laid plans can easily go awry in a cold wet spring, but it is still always a good idea to start with the best-laid plan. Swede midge can be a persistent pest of brassicas whose feeding damage can reduce marketable yield dramatically, especially

(Continued from page 3)

in organic broccoli production (Fig. 1). Several organic growers have had to abandon growing broccoli, because of swede midge. If you have a pesky swede midge problem on your farm that seems to be progressively getting worse, you may want to consider implementing a crop rotation plan that will prevent swede midge from ever reaching economically damaging levels.

Swede midge is difficult to control on small (especially organic) farms

Swede midge have 4-5 overlapping generations that are active from mid-May to late-October. On small farms where season-long production of brassica crops in close proximity is common, this continuous supply of host plants allows swede midge populations to explode. Fortunately, new research shows that economic damage to crops can be avoided by "crashing" the swede midge population using crop rotation.

FAR AND LONG CROP ROTATION OPTIONS

Preliminary crop rotation recommendations

Preliminary crop rotation recommendations advised growers to rotate away from brassica crops by **at least 3,000 feet for a minimum of 3 years.** This was a conservative recommendation based on the knowledge that swede midge are weak fliers and can persist in soil for at least 2 years. Implementing such far and long spatiotemporal rotations is impractical for most small farms. To examine whether a reduced spatiotemporal rotation scheme could effectively mitigate swede midge damage, Cornell Vegetable Program researchers conducted an extensive project, which monitored swede midge populations and crop damage on seven small-scale organic farms in New York from 2015 to 2017. **This work resulted in new, less restrictive crop rotation recommendations** that center on reducing economic damage by depriving adult swede midge of susceptible host plants during peak periods of activity.

New spatial (far) crop rotation recommendations

In the monitoring project, **~500 feet between secluded fields was enough** to prevent swede midge that emerged from an infested field from finding brassicas in an uninfested field. Swede midge generally cannot fly long distances or cross over large physical barriers, so it is important that fields are separated by barriers such as wooded strips. Hedgerows and fences are not an adequate physical barrier. Note that in an open field (e.g. 8-12 acre), 500 feet between an infested site and a new brassica planting is not enough to prevent infestation of the new planting.

New temporal (long) crop rotation recommendations

In New York, peak emergence of adult swede midge (flies) from overwintered pupae occurs from mid-May to late June. Population monitoring indicates that there are usually two emergence peaks, after which only very low levels of overwintering adults will continue to emerge. Therefore, a **minimum 2.5 to 3 month gap in brassica crop production from May through July can be highly effective**. This means that the same field may be cropped to brassicas in consecutive years, but enough time must be given to crash the swede midge population in the spring. **Wait until mid-July when swede midge spring emergence has subsided before planting a brassica crop in such a field.**

Fig 1: Swede midge feeding damage causes growing point death and lack of head formation in broccoli. Photo: E. Hodgdon

Largest spring emergence of swede midge adults is expected following a brassica crop that was infested with swede midge during the previous fall. Heavy spring emergence may also occur following a brassica planting that was infested with swede midge during the previous summer. Extent of spring emergence following an infested planting during the previous spring is unknown, but it is expected to be minimal, because swede midge would likely have left the site in search of another brassica crop.

The new crop rotation recommendations will not eliminate swede midge from your farm, but can prevent swede midge populations from building up to economically damaging levels.

Conditions for new crop rotation recommendations

- Have multiple secluded fields, ideally separated by wooded areas. 500 feet is not far enough in an open area (e.g. 8-12 acre field).
- Ensure brassica transplants are free from swede midge infestation before planting.
- Combine crop rotation with timely post-harvest crop destruction to prevent swede midge populations from building.
- Avoid brassica cover crops such as mustard when rotating away from brassicas.

WHEN CROP ROTATION IS NOT AN OPTION

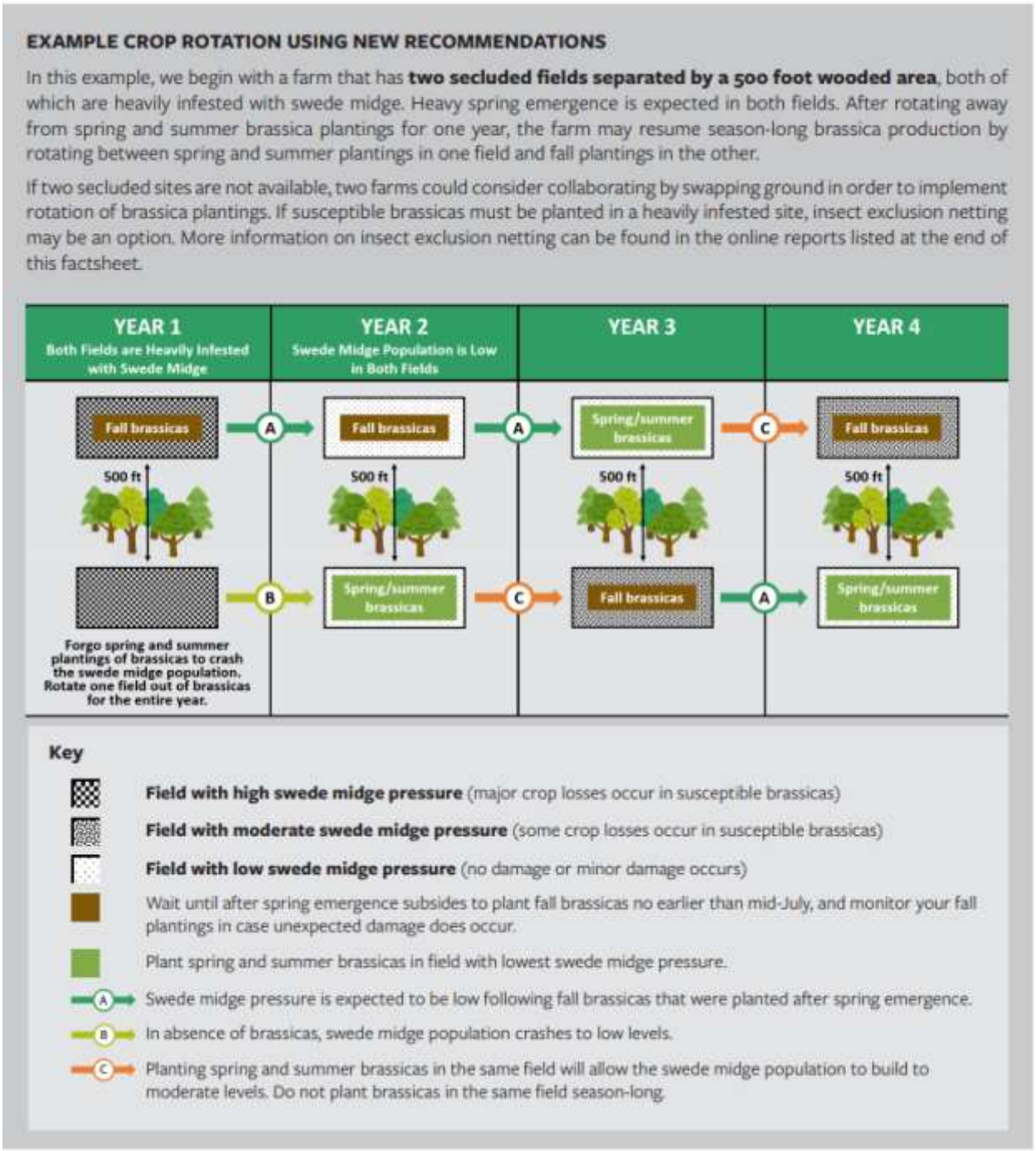
The new crop rotation recommendations will not work for every farm. However, there are still other management strategies to consider. Even if you do not have secluded fields separated by 500 feet, **growing only fall brassicas** on your farm can reduce pest pressure by disrupting the swede midge population cycle (see crop rotation example). **Insect exclusion netting** is extremely effective and economically viable when swede midge pressure is high in a high-

value brassica crop. Additionally, swede midge has relative preferences among brassica crops, and less-preferred crops consistently suffer lower levels of damage.

After three years of monitoring swede midge populations on small organic farms, it became obvious that **broccoli and Red Russian kale are the most preferred hosts**. Repeatedly, swede midge sought out these crops over all other brassica crops within a contiguous 4 to 12 acre area. Also, swede midge tended to remain in broccoli and Red Russian kale as long as these crops were producing new growing points. Therefore, know that **if you plant broccoli or Red Russian kale under moderate or high swede midge pressure, these crops will very likely suffer economic levels of damage.**

Alternatively, **Chinese cabbage, savoy cabbage, and Bok choy consistently were not damaged in fields with high swede midge pressure.** Curly kales, Lacinato kales, turnips, radishes and rutabagas also appeared to be less preferred by swede midge, but could be infested when a more preferred crop was unavailable. More tolerant crops could potentially withstand higher levels of swede midge pressure than susceptible crops, reducing economic losses. In general, red or purple varieties, such as red cabbage or purple kale, are more preferred by swede midge than green varieties. Also, once the growing points become inaccessible, such as when cabbage is heading, these crops become least preferred by swede midge. If crop rotation is not an option, strategically plant more tolerant brassicas where/when swede midge pressure is predicted to be high.

Available Now! New Fact Sheet on New Crop Rotation Recommendations for Swede Midge (including relative crop preference chart).



Mesotunnels: Next Best Tool for Organic Cucurbit Growers in the Northeastern US

Kellie Damann and Sarah Pethybridge, Cornell AgriTech

Let us talk about crop protection! We know the first thing on growers' minds throughout the summer is keeping their plants healthy and green, so they are able to have a good harvest at the end of the season. For many organic growers, the worry of losing your plants to insects, diseases, or weeds offers the potential for nightmares! For organic growers, there are simply not as many tools in the box as one would like. Iowa State University and the University of Kentucky have been researching a new mesotunnel row cover system for a few years now and this year in collaboration, Cornell University has begun research with the same system to evaluate the potential for New York growers.

The mesotunnel system offers some great advantages, as noted in last month's newsletter, and at the same time allows the grower to not worry as much about their crops within the tunnel. This system has been shown to keep the plants inside healthy all season long and provide protection against pests such as cucumber beetles, and the elements.

This is the first year that the mesotunnel system has been observed in New York and it is already demonstrating positive impacts on cucurbit production. We are trialing mesotunnels at four locations around the state including three on-farm trials with our collaborators. Most noticeable is the exclusion of insect pests and diseases.

Typically, around early to mid-July, growers across New York see an influx of Striped Cucumber Beetles, *Acalymma vittatum* (pictured below). The insect itself is more of a nuisance than anything, but the bacteria carried in their gut can spread into the plant via feces, causing severe wilting and dieback in the field after feeding. The bacterium, *Erwinia tracheiphila* causes Bacterial Wilt, for which currently there are no treatments after an infection has occurred. Another common pest of cucurbits is the Squash Bug, *Anasa tristis* (pictured below) which spreads Cucumber Yellow Vine Disease (CYVD), caused by the bacterium *Serratia marcescens*. There are currently no methods to cure plants with Bacterial Wilt or CYVD, so prevention is key.

Striped Cucumber Beetle mating on netting. Photo: K. Damann

In our first year with the mesotunnel system, we noticed a substantial decrease in incidence of Bacterial Wilt and CYVD in our covered plots. To date, the system has proven to reduce and/or prevent the insects from getting through the netting. We will be sure to follow up in a future post letting you know just how much of a difference there has been!

Squash Bug laying eggs on uncovered squash. Photo: K. Damann

Another positive benefit observed with this system is the protection from abiotic factors including high winds and hail. New York can get fairly windy and every so often those high winds can bring hail. When you are growing crops such as squash or pumpkin that grow a few feet tall, wind damage can become a serious threat to the plant's health. Generally, a plant can bounce back from these events even if stems break or leaves get punctured from hail. However, plant damage can often provide an entry way for fungal and/or bacterial pathogens, which then may cause disease in plants that are already stressed. By having this extra layer of protection, you are not only protecting your crop from biotic threats, but also abiotic. The netting used for this system is breathable, so in the event of high winds the air flows right through causing minimal damage to the tunnel and the plants inside.

Wind damage on uncovered squash plant. Photo: K. Damann

This form of a season-long row cover has the potential to protect crops from both abiotic and biotic stresses, and allows plants to grow stronger, larger, produce better yields, and increase quality. The magnitude of these benefits along with a cost-benefit analysis will be determined in New York to better understand the true advantages and trade-offs of this system. We will also be listening to our on-farm collaborators to hear their thoughts and suggestions for making this system practical for organic grower.

This research is funded through the USDA-NIFA Organic Research

and Extension Initiative led by Iowa State University. Sarah Pethybridge and Kellie Damann (Cornell AgriTech, Geneva) are the New York collaborators on this project. More details on the New York research can be found by contacting Sarah (sjp277@cornell.edu); (315)744-5359 [cell] or Kellie (kcd48@cornell.edu); (585)233-6779 [cell].

Please visit our project's website and follow us on Twitter to stay up to date on all the latest mesotunnel news.

The Current Cucurbit Project: https://www.cucurbit.plantpath.iastate.edu/

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EVADE Lab Website (NY): https://blogs.cornell.edu/pethybridgelab/

Twitter (NY): @Cornell_EVADE

Reflecting on the 2020 Preliminary Results of the Mesotunnel System in NY

Kellie Damann and Sarah Pethybridge, Cornell AgriTech

Finding new methods and developing innovative systems for growers is a top priority for many agricultural researchers. We want to find ways to help growers produce the best quality produce and stress less about crop protection. That is why the EVADE lab at Cornell AgriTech was excited to test out the mesotunnel system in 2020 and understand the benefits for organic cucurbit growers in NY. If you have been following the last few articles, then you are familiar with some of the benefits this system can provide growers. In this article we would like to share the preliminary results from the season, so you can see first-hand the impacts this could have on your cucurbit crop. Due to COVID-19 restrictions our trials had to be adjusted but we were still able to gain some valuable insight on the potential for this system.

Mesotunnel trial on the Cornell AgriTech Gates West certified organic research farm. The front is the acorn squash crop (mesotunnel and uncovered). In back is the muskmelon crop with the same treatments . Photo: K. Damann

The trial was located on certified organic land at Cornell AgriTech, Geneva. The information collected was focused on determining the impact of the mesotunnel on the insect pests and diseases of cucurbits. This included Cucumber Beetles and Squash Bugs along with the diseases they vector: Bacterial Wilt and Cucurbit Yellow Vine Disease (CYVD), respectively. We also monitored the incidence and severity of two commonly encountered fungal diseases, powdery mildew and downy mildew. Along with this we observed the behavior of pollinators within and outside the mesotunnel. At the end of the season, we collected yield data which compared the numbers of marketable fruit to unmarketable fruit and noted the factors that contributed to the unmarketable category. Two crops were included in the study: muskmelon (var. Athena) and acorn squash (var. Honey Bear). Each crop was grown in a single three-row plot either within the mesotunnel or uncovered.

So, what happened? Findings indicated that the mesotunnel system prevented insect pests from getting into the tunnel and causing damage. There was also a noticeable decrease in the incidence of plants affected by bacterial wilt and CYVD.

Squash. In the squash plots, cucumber beetles and squash bugs were present in the uncovered plot, but only a few cucumber beetles sneaked into the tunnel. This was late enough in the season, so no damage resulted. The squash bug infestation led to 41% of the plants in the uncovered plot to be affected by CYVD. None of the plants in the mesotunnel had symptoms of CYVD. Although the netting was highly effective at preventing most of the insect pests from entering, towards the end of the season there was a large spike of aphids that formed within the tunnel. Fortunately, most of the fruit on the vines were at or near maturity so it did not impact the yield. Over the next few seasons, we are planning on observing if this is a trend and determining the best methods to control aphid populations. The uncovered squash plot had a slightly higher marketable yield than the covered. This variety produced a large amount of vegetative growth which could explain the slight reduction in yield due to the restricted space for fruit development to occur. This upcoming season we are testing a different variety to see how well it compares in this system.

Both pictures are from within the mesotunnel showing misshapen and not mature fruit due to the growth under the main stem. Photo: K. Damann

(Continued on page 8)

(Continued from page 7)

Muskmelon. In the muskmelon plots, cucumber beetle populations increased significantly from the middle of July through to the end of August. The influx in cucumber beetles lead to 65% of the muskmelon plants in the uncovered plot showing symptoms of bacterial wilt leading to plant death. On the other hand, only 29% of the plants in the tunnel showed symptoms of bacterial wilt. Symptoms of bacterial wilt were not observed until mid-August within the tunnel, so these plants already had produced fruit which were close to maturity.

At harvest, some significant differences appeared between the mesotunnel and uncovered plots. Eighty-eight fruit were harvested from the mesotunnel while only 65 from the uncovered plot. Of the total number harvested, 70 fruit were deemed marketable in the mesotunnel plot, while only 24 were marketable in the uncovered plot. In the uncovered plot most of the damage was due to insect damage, cracking, soft spots, and poor netting. In the tunnels unmarketable fruit was mainly due to overripe fruits that had soft spots. Fruit within the mesotunnel also ripened about a week earlier than in the uncovered plot.

Looking forward to 2021. Trials in 2020 therefore showed significant promise at excluding pest insects and were especially effective in muskmelon. This year we will be conducting larger replicated trials to gain an even better understanding on how this system works in organic cucurbit production. We will also be including a trial to investigate weed suppression options for their compatibility in a mesotunnel system.

This research is funded through the USDA-NIFA Organic Research and Extension Initiative led by Iowa State University. Sarah Pethybridge and Kellie Damann (Cornell AgriTech, Geneva) are the New York collaborators on this project. More details on the New York research can be found by contacting Sarah (sjp277@cornell.edu); (315)744-5359 [cell] or Kellie (kcd48@cornell.edu); (585)233-6779 [cell].

Left: Melon grown in the uncovered plot with significant damage to the skin; Right: Melon grown within the mesotunnel. Photo: K. Damann

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Early Season Garlic Fertility

Crystal Stewart Courtens, CCE Eastern NY Commercial Horticulture

The snow has receded in many locations, and soon the garlic will resume its growth. The first thing on many growers' minds as this happens is fertility management. Let's start by discussing the latest research about just how much nitrogen the garlic crop needs and how to know if you have enough, and then we can talk about ways to get that amount of nitrogen to your plants.

The good news is that garlic actually requires quite a bit less nitrogen than had been recommended prior to the last couple years. Early garlic fertility recommendations were based on onion recommendations rather than on fertility work with garlic specifically. Our nitrogen studies over the past 3 years (as well as studies coming out of Canada) have clearly shown that garlic only utilizes about 50 lbs of N per season, and research conducted over the last two decades consistently shows that all of this N is taken up by the end of May at the latest. From that point onward the plant moves from developing leaf tissue to developing bulb tissue.

A key point to note is that not all nitrogen forms become available on the same timeline. Organic growers who rely primarily on fall applied, manure-based fertilizers, cover crops, and feather-meal find that they have to apply 75 to 100 lbs of N in order for the needed 50 lbs to become available in time for the garlic to utilize it. The speed of mineralization depends on a combination of the biological activity of the soil and the soil temperature. Warmer and more active soils mineralize N faster. Any nitrogen that mineralizes after the garlic has completed its N uptake is consumed by whatever follows the garlic crop—another good reason to plant either a cash or cover crop after garlic! Some organic growers choose to apply a small percentage (10-25%) of the crop's total N as a more soluble form in the spring, such as Chilean nitrate (note application limits of your certifier) or fish emulsion. These forms may be more available, but they are also much more costly. Foliar applications of N are not recommended, since they do not easily pass through the waxy leaves of garlic plants.

Conventional growers can apply all of the needed 50 lbs of N in the spring in readily available forms. Bare ground growers can do a

(Continued on page 9)

sidedress application as soon as the ground can be worked, and plasticulture growers can apply the N through their drip system over the course of a couple of weeks in the early spring. The earlier these applications can happen the better, as garlic is one of the earliest plants to start active growth.

It is key to note that the plant is able to utilize nitrogen from the seed clove as well as anything taken up by the plant in the fall for its earliest nitrogen needs. This is one of the reasons it's so important to plant healthy, medium-large cloves. Garlic, like all overwintering bulbs, may show some discoloration early, but this is not cause for alarm. As the soil warms and the plant resumes normal growth, you should see normal green coloring return as well.

If you want to know whether your garlic actually has enough nitrogen you can conduct foliar tests. To do this, remove about 15 of the most recently fully expanded leaves from garlic plants throughout the field, place them in a paper bag, and send them off to the lab. For our research trials we have used Waters Ag Lab, which has submission forms on their website. But you can use a lab of your choice. If the results indicate that the leaves contain 3.5% N or more, your N levels are adequate.

If you have questions about getting your garlic crop off to a good start, don't hesitate to reach out! My email is cls263@cornell.edu, and you can call or text me at 518-775-0018.

How Important are Grapevine Trunk Diseases in New York?

Janet van Zoeren and Tim Martinson, Cornell University

Originally published in Appellation Cornell, Issue 37, May 2019

Ed. Note: Professor José Ramón Úrbez-Torres of Agriculture and Agri-Food Canada, an expert in grapevine trunk diseases, recently presented a Northern Grapes Webinar entitled "Grapevine trunk diseases: The fungi that cause them, how they develop and spread, and how they are managed". The following article is based largely on his presentation. We would also like to thank Professor Úrbez-Torres for all of the photographs in this article.

While New York growers spend a great deal of time thinking about and managing the five major fungal pathogens (Powdery Mildew, Downy Mildew, Black Rot, Phomopsis, and Botrytis), those associated with trunk diseases have received less consistent attention. The reason for this is simple: the 'big five' foliar and fruit pathogens can destroy, reduce or render unmarketable a crop rapidly in one growing season.

Trunk diseases, on the other hand, spread slowly, are sometimes difficult to detect and result in general, non-specific symptoms like blind buds, dead cordons or 'dead arm' – or ultimately, missing vines. They do not pose an immediate threat, but over time their presence can gradually expand to rob a vineyard of its productivity.

Although grapevine trunk diseases (GTD) have been around for a long time, there has been a recent surge in the number of vineyards reported to be affected by these diseases, and a corresponding increase in research and understanding of their complexity. In 2000, 15 species of fungi from 10 genera were known to be associated with GTDs, but by 2019, researchers had identified 133 different species from 34 genera.

In the Northeast, two surveys (Stewart 2004, Rolshausen & Kiyomoto 2007) identified several trunk pathogens in Pennsylvania, New York and New England vineyards. However, the extent of diseased vines and relative economic impact of GTDs in the northeast is not well understood.

Figure 1: "Dead arm" is a common symptom of some trunk diseases. Photo: José Ramón Úrbez-Torres

Figure 2: Grapevine trunk disease symptoms include 'dead arm' and cankers. Photo: José Ramón Úrbez-Torres

(Continued on page 10)

(Continued from page 9)

Symptoms

GTDs consist of several disease complexes, each of which is caused by several to many fungal species. They affect the mature wood and vascular tissues of the vine, and often the first visual symptom is foliar die-back and general decline in vine vigor. They often form cankers within trunks and cordons that discolor discrete 'pie-shaped' sections in permanent wood. The most common GTDs found in New York include Eutypa dieback, Phomopsis canker and Botryosphaeria canker.

Eutypa dieback is the GTD most commonly recognized in New York state, and among the most commonly detected in the limited surveys that have been conducted. It's caused by the fungal pathogen *Eutypa lata*, along with other closely related species. Although the rate of Eutypa infection in NY is not known, in British Columbia around 10% of vines are infected. Furthermore, vineyards in Washington state with the worst severity of Eutypa had over 90% yield loss (Johnson and Lunden 1987).

Figure 3: Eutypa foliar symptoms include yellowing and cupping leaves and short internodes. Photo: José Ramón Úrbez-Torres

Externally visible symptoms of Eutypa include leaf cupping and chlorosis (yellowing of leaf tissue), stunted deformed shoots looking somewhat like those with Roundup injury, berries ripening slowly or unevenly, dead nodes, and/or dead arms. These shoot symptoms (caused by a toxin produced by the Eutypa fungi) are diagnostic for this disease, as they are not produced by any of the other canker-forming fungi. Internally, symptoms include a wedge-shaped dark staining in areas of the wood, which is found with all of the other trunk canker diseases as well. As the disease progresses, there may be flattened cankers with no bark. See the NY state fruit IPM factsheet: "Eutypa dieback" for more information.

Phomopsis dieback (caused by the fungus *Phomopsis viticola*) was identified at Cornell in the early 1900s, and was called "dead arm" at that time. By the 1970's, research indicated that this "dead arm" disease was actually caused by the Eutypa fungi, with symptoms as described above. In contrast, symptoms caused by the Phomopsis fungus were then thought to be confined to lesions on current-year shoots and leaves ("cane and leaf spot", which most growers are familiar with), and in severe cases infections of cluster stems and berries, which are seen most commonly in native grape plantings. In recent years, it has been determined that the same Phomopsis fungus can also cause the collection of symptoms typical of all the canker diseases: wedge-shaped cankers and wood staining, dead canes, and dead ("blind") nodes with no growth arising from them. Not surprisingly, these Phomopsis dieback symptoms are often seen on vines with Phomopsis cane and leaf spot. See the NY state fruit IPM factsheet: "Phomopsis Cane and Leaf Spot of Grape" for more information on that phase of the disease.

Botryosphaeria dieback was distinguished as being caused by different pathogens than Phomopsis or Eutypa in the 1960s, although its widespread scope of occurrence has only been recognized more recently. This single name is now given to a disease complex caused by a number of fungi in the Botryosphaeriaceae family, which are common throughout the viticultural world, including NY and surrounding regions. General symptoms are very similar to those of Phomopsis dieback, including cankers and wood staining, dead canes and missing nodes. Spore-containing fruiting bodies may emerge from infected wood.

Figure 4: Phomopsis pycnidia. Photo: José Ramón Úrbez-Torres

Other Pathogens. Other diseases caused by trunk pathogens include young vine decline, Black Foot, Petri disease, and Esca.

Pathogen Biology

GTDs infect plants through any opening (most commonly through

pruning wounds). Avoiding these wounds is not possible, so prevention mainly focuses on sanitation and the timing and methods of pruning.

Inoculum sources are difficult to remove altogether, since many of the GTD species are also found in nearby woody hosts (for example, Eutypa is found in over 80 plant species). Some of these pathogens can also be present but asymptomatic in grape vines in a vineyard, and only exhibit symptoms following stress events, such as drought, winter injury, trunk splitting, etc. Nevertheless, removal—and ideally, destruction—of dead and diseased wood is a practical means of limiting the levels of inoculum available to spread these diseases within a vineyard.

The timing of spore dispersal and how long wounds remain open to infection after pruning have been the focus of recent research. Spore dispersal and tissue infections generally happen when there is high humidity or rainfall and temperatures are above freezing. In general, wounds are most susceptible to inoculation at the time of pruning, with susceptibility decreasing over the weeks/months that follow. Both of these factors are region and climate dependent.

For example, research in California has shown that most spores in that state are released by midwinter, with peak periods associated with winter rainfall. Late pruning can decrease infection rates by opening the wounds during the dry period in the spring and summer, when Botrysphaeria and Eutypa are unlikely to spread inoculum. Conversely, in British Columbia, early pruning decreases infection because wounds heal before spores are released in the spring.

Management

Prevention

Pruning practices. Dead tissue on cordons and trunks is a source of new inoculum, so eliminating dead tissue from cordons and trunks before they release new spores will provide some control. This is admittedly a challenge in mechanically-pruned bulk varieties. Regular, systematic trunk renewal to replace weak or diseased trunks also will limit the spread of the disease while also reducing their economic impact, by increasing the supply of healthy fruiting wood.

In our humid, cool-climate region, delayed pruning (as recommended in arid California production regions) may not be the best choice for preventing new infections. Research in Michigan's similar climate suggested that Eutypa spores are generally released in March through May during periods when the temperatures are above 40°F. Mid-winter pruning might provide more time for pruning wounds to heal and resist new infections.

Sanitation includes burning, burying, mulching, or composting all infected wood and pruning materials. Because even symptomless prunings can harbor the pathogens, removing and burning or composting them will prevent them from releasing spores in the vineyard. But even chopping brush and allowing it to decompose in row middles is preferable to having dead wood within the canopy.

Pruning protectants, such as paints and pastes, are manually applied to pruning wounds at the time of dormant pruning. They can be effective, especially when combined with a fungicide. However, they are also time- and labor-intensive, and multiple applications may be required to provide control throughout the entire period of susceptibility.

More recently, pruning protectant sprays applied with standard sprayers have been shown in California and Australia to be effective against some of the pathogens responsible for GTDs. No trials have been conducted in New York, but there is currently a New York DEC-approved special local need label for the use of thiophanate-methyl (Topsin-M) for pruning paints/pastes or sprays to control Eutypa and Botryosphaeria. Mettle (tetraconaole, a Group 3 DMI fungicide) also has an EPA registration approved in most states (including NY) for post-pruning spray applications to control these diseases.

Figure 5: Internal wood staining. Photo: José Ramón Úrbez-Torres

Post-infection

Trunk renewal can completely remove the infected tissue. To be effective, all wood showing any staining must be removed, including an extra 5-10 inches of apparently healthy wood below the canker. In Australia, a study suggested that removing all trunks in an entire vineyard block 10-15 inches above the graft union provided the most consistent long-term results.

Some factors specific to Northern climates

- Re-training due to winter injury may decrease GTD prevalence, as vines are often replaced before cankers have time to affect vine health.
- Due to the huge array of potential pathogens, ALL cultivars are susceptible to at least some of them. In our growing region, there is no cultivar that is known to be completely resistant to all trunk diseases.
- Freezing injury may make it easier for GTD pathogens to cause symptomatic infections. For example, in a study done in peaches, Cytospora (which also can be pathogenic in grapes) incidence was higher following tissue freezing. A hypothesis is that the cell destruction due to freezing allows greater pathogen colonization.
- There is a need for more studies on how winter injury interacts with GTD development, efficacy and economics of using pruning

(Continued on page 12)

(Continued from page 11)

protectants, timing of infection, and on the best time to prune in our region.

The Takeaway

GTD fungal species and life cycles are complex and variable. Management options are region and climate specific – and largely untested in the northeast. It's likely that many growers – particularly those with older vineyards – are losing significant amounts of yield to dead arms and trunks associated with GTDs. Younger vineyards are less likely to be severely affected, but may see an increase in symptoms and economic impact as they age. Beyond removal of infected wood, management options are limited or prohibitively expensive (manual pruning wound painting). More research is needed to define the relative importance and economic impact of these pathogens, and to test and validate improved management options for growers.

Further reading:

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Organic Management of Spotted Wing Drosophila—Update on Research

Laura McDermott, CCE Eastern NY Commercial Horticulture

On March 9th, 2021, eOrganic sponsored a webinar summarizing research into organic management methods for *Drosophila suzukii*, or Spotted Wing Drosophila (SWD). As most berry and cherry growers know, SWD is a devastating pest of these fruits. Losses due to SWD can be as high as 100% and have been valued at more than $718 million annually in the U.S. In an effort to control this insect growers have resorted to preventative insecticide applications as fruit ripens. Organic growers are at a severe disadvantage as there are very few effective OMRI-approved materials available. The USDA -NIFA grant program funded a multi-region team from 11 Universities and the USDA to improve understanding of SWD biology that could translate into the use of non-chemical management tactics. Below is a brief summary of that webinar. For the full recording of the webinar, visit: https://eorganic.org/node/34578.

Objective 1 – Behavioral control

This objective is looking at two main approaches to controlling the flies through behavior. The first is an 'attract and kill' approach. They are looking at four different attractants or "hooks". Some of them are mixed with Entrust (spinosad), Venerate, Pyganic, Grandevo and Neem which supplies the "kill". The scientists are measuring emergence of larvae from berries where adults that fed on the "hook" would have laid eggs. Using chemical attractants that influenced feeding, the results look promising, at least in the lab, with adult mortality rates ranging from 80% in 24 hours to 90% over 3 days. Larval emergence was also decreased. Field testing will be ongoing in 2021.

The second approach involves using a food-grade gum substance that is a smelly concoction of a plant-based powder containing materials like agar gel, cellulose, pectins, along with fructose and glucose sugars, all of which is mixed with water into a jelly. The gum doesn't trap the flies, but rather the odor disrupts the flies' behavior so that they spend all of their time exploring the gum instead of attacking the fruit. The effective range of this gum seems to be about 30 feet from the source, meaning that the gum bait stations (Figure 1) would need to be deployed frequently through the planting. Studies are focusing on field placement and it seems that placement along the edges of the field may do the trick in reducing infestation. More field work will continue in 2021.

Objective 2 – Cultural Control

This portion of the research concentrates on how temperature and humidity impact SWD and how growers can manipulate the microclimate in a commercial planting to reduce the negative impact of this pest. SWD is susceptible to high temperatures and low humidity, so using in-row mulches like sawdust or weed mats could prove to be management tools for SWD along with other fruit production benefits like weed control and soil moisture stabilization. The studies compared the effects of different mulches (black polypropylene fabric weedmats, sawdust, and wood chips) on temperature and relative humidity and on adult emergence of SWD from larvae in blueberries and pupae, both above and below the ground, in blueberry plantings.

The results showed that lower larval survival and longer periods with

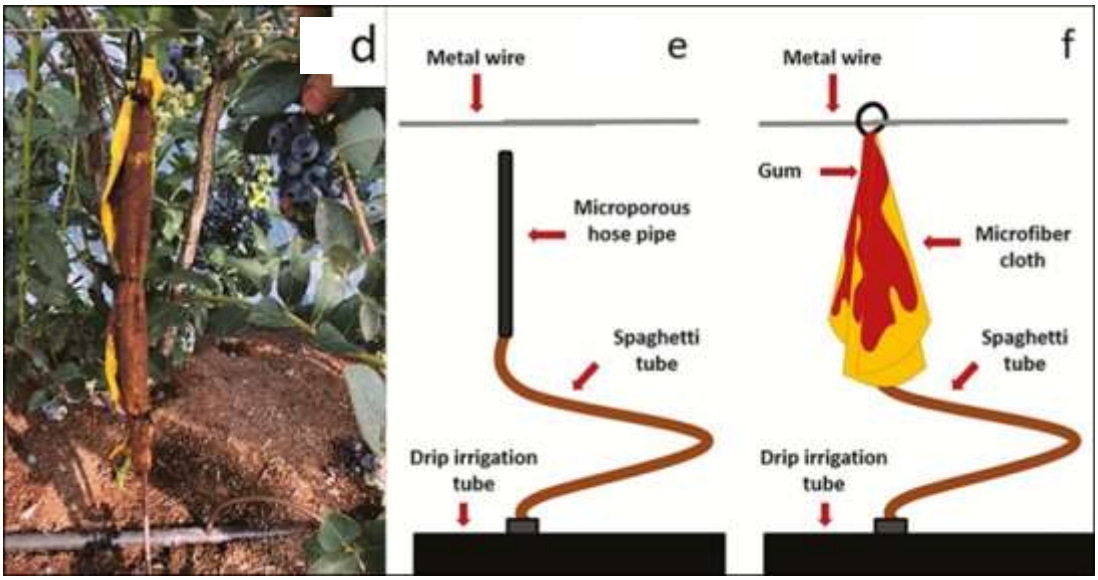

Figure 1. The photo on left and diagram on right illustrates the method for delivery of food grade gum used to disorient SWD adults. The gum is smeared on microfiber cloth then hung in the lower canopy. The gum is activated by moisture from a drip irrigation system. (Images from Stacconi et al 2020, Journal of Economic Entomology)

high suboptimal temperatures occurred above the ground in comparison to buried below the ground, regardless of mulch type, but weedmats may have more impact by providing a barrier that prevents larvae from pupating underground.

Exclusion Netting was not discussed in this webinar, but has been shown to be effective in New York.

Objective 3 – Biological Control

The use of parasitoids is seen by many as the holy grail of biological control. This portion of the webinar discussed two techniques that are being explored. The first is a type of biocontrol called augmentation. Augmentation works somewhat like pesticide control. You release the biocontrol parasitoid several times in preparation for the increased population of the pest and you continue to apply as the pest is problematic. The parasitoid doesn't reproduce enough to become established in the environment. This type of augmentation would work well if the paristioids were aggressive, but in the case of the two most notable insects being investigated, both of these insects have a fairly wide host range and don't focus as predictably on SWD. It's still not clear if the parasitism rates are high enough to be economically important. This predator behavior is typical as these insects are native to many areas of the US so they have already found their food sources. More research into the timing of releases may improve the augmentation strategy.

Classic biocontrol is different from augmentation as this involves importing a predator that will be introduced to fields at low numbers, then will increase in population while decreasing SWD numbers as it preys on them. Then the predator and SWD remain in a low level oscillating population over time. This is a much longer strategy as the predators need to be identified in the Asian wild, then caught, approved for entry into the US, quarantined and then built into colonies. Classic biocontrol predators may be ready for field introduction in 2022.

Objective #4 – Integrate new OMRI approved products into IPM program

Sterilants – Researchers looked at materials peroxyacetic acid (PAA) and hydrogen peroxide (HP). These are the active ingredients found in materials like Jet Ag, Rendition, SporeQuell and Oxidate 2.0. All of these materials are active against microbes. PAA and HP do reduce yeasts on the fruit which are an important food supply for SWD, but there is no residual effect. Studies have been done in the lab or in small field plots, and the research has shown that when sterilants are applied on ripening berries SWD populations decreased. The question remains as to whether the decrease is enough to be economically important.

Skin Thickeners – OsmoPro, Profuze, Sil-Matrix, Sil-Cal are commercial skin thickeners that are normally applied to light green fruit to prevent fruit cracking. In this work, the researchers applied them later than normal when fruit is ripe and did see some reduction in egg laying and thus a reduction in SWD population, but work still hasn't been done in field setting.

Additionally, work is being done to understand how spinosad resistance can be prevented. Resistance to spinosad has been documented in California and is suspected in Oregon. Scientists are looking for more discriminating doses of spinosad that would be effective and would delay resistance. Many sites across the country were tested.

Data about the combined impact of cultural controls like caneberry pruning and the interaction with insecticide sprays is currently being examined.

Objective #5 – Economic Analysis of SWD Management Practices for Organic Berry Growers

The cost of management techniques being studied will be used to develop a decision making tool to help growers understand the best options for them in the future.

Resources:

Gumming Up The Works: Field Tests of a New Food-Grade Gum as Behavioral Disruptor for Drosophila suzukii (Diptera: Drosophilidae), M V Rossi Stacconi, et al.. Journal of Economic Entomology, Volume 113, Issue 4, August 2020, Pages 1872–1880. https://doi.org/10.1093/jee/toaa072

Mulching as a cultural control strategy for Drosophila suzukii in blueberry, Dalila Rendon et al., Pest Management Science, 17 June 2019, ps.5512 https://onlinelibrary.wiley.com/doi/abs/10.1002/ps.5512

Branching Young Apple Trees with Plant Growth Regulators

Win Cowgill, Rutgers University and Jon Clements & Wes Autio, University of Massachusetts Amherst

Two-year-old Ruby Mac/M.9 Pajam 2 trees at UMass Cold Spring Orchard, Belchertown, MA as part of a branching trial conducted by Jon Clements. Untreated (left) and MaxCel treatment (right), one year after application. Treatment (MaxCel at 400 ppm) was applied in early July 2016, with a backpack sprayer. This was considered a late application; spur leaves were almost fully leafed out and starting to form a fruit bud. MaxCel treatment for branching is recommended once the buds break and green leaf tissue is visible.

Applications where PGR's can be used to increase branching on apple.

1. **First-leaf apple trees where the leader with no buds broken but just prior to bud swell. For example, newly planted nursery tree "whips."**

A) If dormant buds are present on one-year-old wood: Apply a high rate (5,000 ppm) of MaxCel® or Promalin® mixed in latex paint BEFORE buds break. See product labels for more details and instructions.

B) B) If buds have broken, and the leaf tissue is showing on one-year-old wood: Mix 400 PPM MaxCel with water, NO SURFACTANT, or 400 PPM Promalin plus a non-ionic surfactant (NIS). Apply by spraying with a back-pack sprayer. Works best when temperatures are warm and there is enough tissue to absorb the PGR. Note: Never add surfactant to a solution of MaxCel as it is already included in the formulated product. Promalin should be combined with a NIS following the label instructions.

Notching blindwood in the spring before significant bud growth.

2. **Second-leaf apple trees where leaders have "blind wood" with no visible buds or branches.**

A) Make a notch with a hacksaw blade (narrow, fine-toothed saw, usually used for cutting metal) just above the existing bud scar on the leader then on nonbearing trees, immediately spray the cut with a 1500 PPM solution of MaxCel.

Second-leaf Cortland trees at the end of the season after receiving MaxCel at 200 ppm with an air-blast sprayer during bloom. Apex Orchards, Shelburne, Massachusetts.

3. **Existing young tall-spindle or vertical-axis apple orchards with limited branching in the tops of the trees: an airblast sprayer application should be considered.**

A) If spraying non-bearing trees in second or third leaf, to increase overall branching, apply MaxCel at 200-300 PPM using an airblast sprayer. It is best if lower nozzles are turned off and the spray is targeted to the top 1/3 to 2/3 of the tree where more branching is desired.

B) If spraying bearing trees in second or third leaf to increase overall branching, apply MaxCel at 200 PPM using an air-blast sprayer. It is best if lower nozzles are turned off and the spray is targeted to the top 1/3 to 2/3 of the tree where more branching is desired. Time the application to apply at bloom to petal fall to cover green tissue. This rate will help remove fruit

Two-year-old non-bearing Granny Smith trees with no visible buds (blind wood). Trees were notched with a hacksaw blade (narrow, fine-toothed saw, usually used for cutting metal) just above the existing bud scar on the leader, and then the cut was sprayed immediately with a 1500 PPM solution of MaxCel. Photos: Dr. Steve McCarthy, Valent BioSciences.

Second-leaf Macoun trees at the end of the season after receiving MaxCel at 200 ppm with an air-blast sprayer during bloom. Apex Orchards, Shelburne, Massachusetts.

TeeJet ConeJet Nozzle, pressure regulator, swivel head applying 4ML of PGR solution to apple growing tip.

Feathers starting in treated trees at Adams County Nursery, Delaware. Trees are Macoun/M.9 NAKBT337 and received four applications of Promalin at 500 ppm to the growing tips every 7-10 days.

Applying MaxCel/Promalin for branching to apple trees at Adams County Nursery, Ellendale, DE.

MaxCel and Promalin mixing rates

200 PPM	400 PPM	1500 PPM
128 ounces/100 gallons	256 ounces/100 gallons	960 ounces /100 gallons
1.3 ounces/1 gallon	2.6 ounces /1 gallon	9.6 ounces /1 gallon
10 mL /Liter	20 mL/Liter	75 mL/Liter

Generic formulations of the active ingredients in MaxCel and Promalin are available as Exilis Plus® and Perlan®, respectively (both from Fine Chemical). Please note that Perlan rates are the same as those used for Promalin, but Exilis Plus has a slightly higher percent active ingredient, so the rate is about 5% lower (always check the label to be sure).

Feathers on Macoun/M.9 NAKBT337 trees with four applications of Promalin at 500 ppm to the growing tips. Adams County Nurser, Delaware.

in the top 1/3 of tree, where you do not want to allow the canopy to fill out.

4. **Nursery Trees**

A) Apples in a nursery or planted in place can be branched with applications of MaxCel or Promalin at 400 PPM (400 mg. L-1) when leader growth reaches approximately 70 cm. or 28 inches above ground. i.e., the height at which the start of branching is desired. This treatment should be repeated at 7-14 day intervals or every 5-6'' of leader growth for a total of 4 -5 applications. This rate of terminal growth on the leader will depend on temperature. On the first application date, the central leader shoot tips should be 28 inches above ground. We suggest applying PGR'S to tree leaders with a backpack sprayer. Use a single nozzle (cone jet hollow cone spray tip), calibrated to apply 4 ml of solution per application, and directed over the tip of the leader of each tree. Any hand pump manually operated back pack sprayer can be used but should have the boom modified to have a pressure regulator, and a swivel head attachment for the nozzle head (See Photo) so that the desired amount of spray can be applied to each tree. Parts are available from TeeJet Corporation and Gate Technologies.

Note: A complete parts list and instructions can be obtained from the author: Win Cowgill, P.O. Box 143, Baptistown, NJ 08803 USA (wincowgill@mac.com).

Acknowledgements

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Literature Cited

Terence Robinson, Brent Black, and Win Cowgill. 2014. Use of multiple applications of MaxCel and Promalin to produce feathered trees. *Compact Fruit Tree* 47(1):23-28.

Duane Greene. 1983. Use of Promalin to increase branching of young trees. *Fruit Notes* 48(2):20-22.

Win Cowgill, Mike Beese, Rebecca Magron, Wes Autio, Jon Clements, and Terence Robinson. 2014. Studies and recommendations for branching young apple trees. *Horticultural News* 94(3):1-9.

Upcoming Events & Important Information

Shining Ultra Violet Light on Plant Pathogen Management podcast

If you're interested in learning more about UV technology for crop protection and mobile UV array units, you'll want to check out our latest podcast "Shining Ultra Violet light on Plant Pathogen Management". ENYCHP vegetable production specialist Teresa Rusinek is joined by Nick Skinner, UV researcher at the Rensselaer Polytechnic Institute; grower Larry Eckhart from Kinderhook Creek Farm and vegetable specialist Charles Bornt to discuss the development and implementation of ultra violet light dosing as a tool to manage some of the most challenging diseases in cucurbit crop production. This podcast can be found at https://soundcloud.com/easternnewyorkvegnews/shining-uv-light-on-plant-pathogen-management

A transcript of this episode is available at the following link: https://enych.cce.cornell.edu/podcast_transcript.php

For more information on UV technology for plant pathogen management, check out the website: http://lightandplanthealth.org/

Survey Participants Needed

Researchers at the University of Rhode Island are currently distributing an online survey about fresh market sweet corn. Your participation and feedback are extremely valuable to the success of this research. The survey will gather information on growers bird damage levels to sweet corn and prevention methods used to deter bird damage. Click on the following link to take the survey: https://uri.co1.qualtrics.com/jfe/form/SV_8qBBeU2HAIwcKYl

Invasive Species in Agriculture
June 8, 2021—3:30pm-5:00pm

A free webinar on invasive species that impact agriculture in New York State. This will give an overview of some of the established, newly detected, and potential invasive species, as well as discuss the impacts to vineyards, orchards, and other crops.

Register here: https://www.capitalregionprism.org/event-calendar.html

Online Farm Financial Management Tuesdays: Farm Business Education in April, 2021

April 13, 12:30-1:30pm: Assessing Farm Capital Investment Decisions
https://caahp.ccext.net/civicrm/event/info?reset=1&id=122

April 20, 12:30-1:30pm: Farm Business Transfer Planning
https://caahp.ccext.net/civicrm/event/info?reset=1&id=123

April 27, 12:30-1:30pm: Insurance and Liability Protection
https://caahp.ccext.net/civicrm/event/info?reset=1&id=124

The New England Vegetable & Fruit Conference is Going Virtual
December 13-17, 2021

We have made the difficult decision not to hold an in-person New England Vegetable and Fruit Conference in December 2021 as originally planned, due to the ongoing COVID-19 pandemic. We will plan a simple online conference this coming December, during the week of Dec 13-17 2021, in order to provide education, professional development, and pesticide credits to growers and service providers across New England and New York. Stay tuned for details as we develop our plan for the December 2021 meeting by checking our conference website or by following us on Facebook, Instagram, and Twitter.

Cornell Cooperative Extension
Eastern NY Commercial Horticulture Program