UMass Extension

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Introduction (J. Piñero)

We are pleased to bring you the 29th edition of the March Message. 2020 was likely the most challenging in living memory with the complications brought on by COVID-19 and the drought throughout the region. Nevertheless, we have been inspired to see the resiliency of farms throughout New England and have been proud to continue serving our commercial growers this past year. During 2020, the Extension fruit team adjusted its Extension programming for online delivery. Unfortunately, we had to cancel dozens of educational events, some staff took furloughs, extended grants and canceled projects because we could not hire the people to do them.

We sincerely hope 2021 will be a great year for all of you!

Publications, videos, and other IPM resources

Starting this year, we will include one section that combines the most important educational resources produced by the UMass fruit team, by other Universities in New England, and by Cornell University. You only need to click on the hyperlinks to access this information. This way the March Message has become the one-stop place to access useful research-based information!

- **UMass Fact sheets.** A new series of IPM Fact Sheets (focus on insects and diseases) have been developed. For example, in terms of insects, currently there are 18 Fact sheets on apple pests, 8 on blueberry pests, and 9 on strawberry/raspberry pests.

- **Healthy Fruit** is a timely newsletter that includes information on tree-fruit horticulture, pest management, and related topics. The primary reader is the commercial grower, but anyone growing fruit trees will benefit. Healthy Fruit is published weekly or biweekly from April through September and periodically throughout the rest of the year.

  The cost for a subscription to Healthy Fruit is $65 per year for the email version (available for purchase at the UMass Extension Bookstore or download the 2021 Fruit Publications Order Form and mail it in with your payment.

- **UMass IPM Fruit Loop Podcast.** Another way to get information presented in the Healthy Fruit Newsletter. Freely accessible HERE.

- **UMass Extension Fruit Team YouTube Channel**: It currently has 55 videos! It also serves as an archive of Zoom twilight meetings and other presentations.

- **Fruit Notes** is distributed to growers and researchers in 35 states in the U.S. and 14 other countries. Most reports are from current research at the University of Massachusetts and other universities. Electronic versions are available for purchase at the UMass Extension Bookstore. or download the 2021 Fruit Publications Order Form and mail it in with your payment. 4 issues per year. Cost: Paper copy: $50, Electronic copy: $25.

  Results of IPM research conducted by the UMass fruit team are now regularly published in this journal. For example, the winter 2021 issue includes the following articles:

  - ➔ Evaluation of a Grower-friendly Attract-and-kill Strategy for Apple Maggot Control in New England Apple Orchards: Research Results for Year Two.
  - ➔ Evaluation of Novel Kairomone-based Lures for Attracting Male and Female Tortricid Moths in Apple Orchards.
  - ➔ Response of Tarnished Plant Bug to Synthetic Aromatic Plant Volatiles.
  - ➔ Does the Red Color Enhance Spotted Wing Drosophila Response to Traps Baited with Diluted Concord Grape Juice?
  - ➔ Does the Presence of Trap-crop Plants Enhance the Response of the Invasive Brown Marmorated Stink Bug to Its Synthetic Pheromone?
  - ➔ Evaluating the Efficacy of Multi-cultivar Grafted Apple Trees as Perennial Trap Crops for Multiple Pests: Research Results Year One.

- Cornell University Acimovic Lab blog. Available HERE
- Cornell University Jentsch Lab Blog. Available HERE
- New England Tree Fruit Management Guide. Available HERE
- New England Small Fruit Management Guide. Available HERE
- University of Vermont Extension - Tree Fruit production. Available HERE
- University of Rhode Island IPM program (by Heather Faubert). Available HERE
- University of Connecticut IPM program - Fruit Pest Messages (by Mary Conklin). Click HERE

Massachusetts Horticulture Overview

The way I see it (Jon Clements)

NEWA 3.0 update

I am hesitant to announce this prematurely, but the long-promised NEWA website upgrade has gone live and is available at dev.newa.cornell.edu. We will probably have more training on this later once we get used to the changes. BUT, unfortunately a couple key apple models, including scab and fire blight will NOT be immediately available on the new NEWA site. You will be redirected to the old NEWA site at newa.cornell.edu to run those models, likely into May. So just be aware of that. We will have more coming on NEWA 3.0 in Healthy Fruit and during twilight meetings, but you are welcome to use it starting anytime now with the caveat about the apple scab and fire blight models running only on the old NEWA site for the time being.

Precision thinning "recipe" using the fruitlet growth rate model

I am working on a cookbook, aka a "dummies recipe" for using the fruitlet growth rate model to predict fruit set of apples during the chemical thinning window. I won't go into much detail here, as you can read the recipe here. Suffice it to say this is a necessary practice for you to know what is the efficacy and need for chemical thinning sprays. It would be too much to ask you to do this on numerous varieties and blocks, but I absolutely encourage you to try it on one high value variety (hint Honeycrisp). By adequately adjusting crop load during the chemical thinning window, you can improve fruit size and quality, reduce hand thinning costs, and equalize cropload from year to year (prevent biennial bearing). Feel free to contact me with questions or guidance.

PACMAN

New in 2021 through 2023 I am part of the Precision Apple Cropload MANagement (PACMAN) team lead by Terence Robinson at Cornell. The team is a NIFA-funded SCRI project, the objectives being:

- Develop science based guidelines to precisely manage crop load precisely and maximize crop value for important high-value apple varieties being planted and specific guidelines for western, southeastern, northeastern and midwestern apple growers and extend the information nationally
- Develop and extend information on the large economic impacts and opportunities when crop load is managed precisely and extend the information nationally
- And, develop computer vision and robotic tools to collect the necessary data to guide human workers or robots to precisely manage crop load.

My main role is to coordinate Extension activities to let you know about PACMAN team activities and outputs. To that end we have a website: pacman.extension.org. Hope you take a minute to check it out, leave comments, or feel free to message me directly. I also intend to do a little research locally on Precision Apple Cropload MANagement.

Accede® EUP

Valent USA has received an Experimental Use Permit (EUP) for use of Accede® on apples in 2021. The product will be applied under supervision by myself and Pat Kriksceonaitis (Nutrien) in nine Massachusetts orchards including the UMass Orchard in Belchertown. Accede is used for thinning apples, and has shown to be most effective when fruitlets are in the 12-15 mm size range. It is kind of like "Oh-oh! I am not sure I did enough thinning previously, and I need to apply a thinner now again even though the fruit is getting too large for traditional chemical thinners! What do I do NOW?" Thus, the applications will be made on a case by case basis, most likely when a thinning spray has been missed or extra thinning is desired. One side-effect can be some phytotoxicity post-application, but that has not been a longer-term concern. How it works on different varieties and what to expect in terms of phytotoxicity are part of the EUP process. The bad news for you is Accede will not be available for general use this year, but most certainly will be an addition to your chemical thinner recipe in 2022. But the good news, it will be labeled for THINNING PEACHES, where it has proven to be quite effective (depending on variety), most likely available in 2022. Yee Haw!!!

Frost and Freeze worries?

It's that time of the year, frost and freeze risk to our tree fruit flower/fruit buds. To that end, a couple useful websites to either make you worry more or less?:

> Climate Smart Farming - Apple Frost Risk "The Kill Probability map compares the hardiness temperature at each phenological stage to the observed daily air temperature. Crop damage occurs when the observed temperature falls below the hardiness value. These maps are produced from mid-September through the end of June and are updated three times a day around 11am, 1pm, and 3pm."
>
> Critical Spring Temperatures for Tree Fruit Bud Stages - print and hang up in the office or spray shed!

And don't forget Promalin® has on the label To Increase Fruit Set After Frost (apple only) - "Apply 1-2 pints per acre within 24 hours after a frost event when the majority of the crop is between early bloom and full bloom. Apply in 75-150 gallons of water per acre."

Plant Growth Regulator (PGR) Updates (Duane Greene)

Accede®

Accede (ACC) is a new chemical thinner that has been granted an Experiment Use Permit (EUP) for 2021. It will be available in a number of states including Massachusetts. It will be tested in several orchards in Massachusetts including at the UMass Cold Spring Orchard. ACC is a naturally occurring compound that is found in all plants. It is the last step in the biosynthetic pathway for ethylene production.

ACC is converted to ethylene by the enzyme ACC oxidase. There is an ample amount of this enzyme in the plant to convert any ACAC to ethylene. Therefore, the rate-limiting step in ethylene production is the amount of ACC available and this may now be supplied to the tree by spray application.

Both ethephon and ACC bring about ethylene production although by different mechanisms. When ethephon is sprayed on a plant it is absorbed and move to the cytoplasm where it is broken down by a chemical reaction caused by high pH in the cytoplasm. ACC is safer to use when applied at high temperatures because there appears to be no large spike in ethylene production due to elevated temperature as is true with ethephon.

ACC has been tested as a thinner for many years. One of the thinning characteristics that separates Accede from other thinners available today is that it appears to thin preferentially at the 16 to 20 mm fruit size, a thinning window that other thinners are far less effective in. Undoubtedly, this is the fruit size range where Accede will be used most frequently. The concentration range that is suggested to be used at is 200 o 400 ppm. Accede may cause some phytotoxicity, leaf yellowing and leaf drop. The severity of this varies from year to year and some cultivars are more sensitive than others. Often no phytotoxicity is seen. When it occurs leaf yellowing and drop is generally restricted to the smallest 1 to 3 leaves in a spur. These represent a very small percent of the total leaf area of a spur. Any effect on the tree should be minimal. Phytotoxicity is more pronounced when applied at the higher concentration at the 7-12 mm fruit size.

There appears to be no fruit effects at harvest that can be attributed to its application during the thinning season. In the trials that I have run with Accede, return bloom appears to be related to the degree of thinning achieved. Even though it does result in increased ethylene production in the tree, there appears to be no additional promotion of flower bud formation beyond that attributed to the thinning effect.

Accede also has an EUP to be used to thin peaches. (But not in Massachusetts.) Presently there is no compound registered for use to thin peaches. The goal with Accede to thin peaches is to reduce hand thinning, but not necessarily eliminate it. The suggested times of application are at pink and again at petal fall. The suggested rates to use are 300 to 600 ppm. The advantage of using Accede in addition to reduction in hand thinning is that it can increase fruit size. By the time hand thinning is usually started when fruit are about 1 inch, some reduction in fruit size

has already occurred. Starting thinning nearer bloom reduces competition among fruit early, thus allowing the remaining fruit to grow larger.

Label Change for Prohexadione-calcium Products (Kudos and Apogee)

Last year the Kudos label was changed to allow this formulation of prohexadione-calcium (Pro-Ca) to be applied at the Pink stage. The amount that could be applied at this time was restricted to 6 oz/100 gal. This year the Apogee label was changed with a supplement (FIFRA Section 2(ee), user must have this supplemental label in possession) to allow application at the pink stage as well. Restriction of the amount that can be applied was not changed from the Apogee label.

There are two advantages related to early application of Pro-Ca. The first is for enhanced fire blight control. It should be pointed out that Pro-Ca has no direct effect on the fire blight bacteria. What it does do is to thicken the cells in the emerging shoot and possibly the flower pedicel which then provides a more formidable barrier for infection. The major advantage of pink application for fire blight control is that with this early timing shoot blight protection will begin much earlier, in most cases up to two weeks earlier. Second, the early application will allow growers to achieve much earlier and greater shoot control. The shoot growth inhibition from Pro-Ca is not very concentration dependent. Therefore, the best way to achieve greater growth control from Pro-Ca is to apply it early. Pro-Ca requires 10-14 days to establish growth inhibition. Shoot growth from before bloom until at least 14 days after bloom is rapid and can be as much as 25% of total growth for the year therefore, initiating growth inhibition early allows up to additional growth control as opposed to waiting to make the first application at petal fall. An additional vegetative growth control advantage is that lateral shoots are suppressed early, which makes trees that have been treated with the petal fall timing appear more “open” due to the suppression of these lateral shoots. Trees treated with a pink application of Pro-Ca will have greater light penetration into the tree. The best way to achieve greater growth control with Pro-Ca is to apply the first application at pink rather than increasing the amount applied. The 6 oz/100 gal rate is a good place to start.

Following initial application of Pro-Ca, it is up to the individual grower to design a strategy for the blocks for the remainder of the year. If the intent of early application is for early fire blight control, no additional Pro-Ca should be applied. This will allow some shoot fire blight control early but will allow the tree to resume growth later in the season if more growth is desired. If fire blight control is desired further into the season then additional application(s) will be necessary. As the season progresses less Kudos/Apogee will be needed to achieve good growth control. The frequency of these applications and the amount applied will depend on vigor of the block, variety, rootstock, soil, rain (irrigation) and the weather.

Inhibition of Flower Bud Formation with Arrange™ (GA7) to help Regulate Biennial Bearing in Apples.

Fine Americas Inc. was granted label clearance in Massachusetts (and NY, NJ, PA) for the use of Arrange (Gibberellin A7) to inhibit flower bud formation in apple. Apples are biennial bearing fruit and thus they naturally tend to produce a heavy crop one year that results in few flower buds initiated for the following year. With many resting spurs in the "off" year, flower bud formation occurs readily resulting in a "snowball" bloom the following year. Up until now the only option available to growers was to thin in the "on" year. This strategy is made difficult because some varieties are extremely difficult to thin. If trees are not thinned adequately in the "on" year tree will fall into a biennial bearing cycle. The registration of Arrange will provide another tool to orchardists to help control biennial bearing. Arrange should be applied in the "off" year. It then partially inhibits flower bud formation so that during the next year, fewer flowers bud will be present, which should then result in lower fruit set and a condition where it will be easier to more easily thin the trees. The timing of Arrange application should be between petal fall and the 10 mm fruit size stage. The suggested use rate of Arrange is 100 ppm (128 fl. oz per 100 gal.). I would suggest that you should start with this rate in your first trial.

If you have some blocks or varieties of trees that are difficult to thin and keep producing annually, you may wish to try Arrange this year.

Ed. note: Arrange is also OMRI approved for use in organic production.

A Review of Thinning Last Year and Thinning This Spring

It is a good idea to review results from last year to see what we learned and see if we can apply this new information to aid in thinning this season. In general, thinning was very successful last year with the consensus that in a number of blocks there was over-thinning. The culprit that resulted in over-thinning was the extremely warm/hot weather that occurred during the prime thinning period. NEWA was extremely useful in providing pertinent information to aid in making thinning decisions and providing insight. The carbon balance during much of this period was above -50 g/tree and in some instances it was over -100 g/tree. These are dangerous situations that can result in over-thinning if adjustments are not made. In recent years we have experienced more frequent and severe weather conditions. They could occur again this year. If these occur during the thinning season. it is very difficult if not impossible to craft a safe thinning strategy. My suggested strategy this year is exactly what I wrote last year.

> *"The most challenging thinning time is near the traditional thinning time, 7 to 14 mm stage. This period of time is when fruit are most susceptible to chemical thinners. If weather is not favorable for thinning during this time, the chances of over-thinning or under-thinning is enhanced. Assuming that there are no weather disasters that severely damage flower buds on trees I am going to recommend a very aggressive thinning program early, especially at bloom and petal fall. Although the word aggressive may concern you, in my estimation it may be the safest way to approach the coming season."*

I would like to add that I have never over-thinned an apple tree at bloom or petal fall. As the thinning season approaches I will hopefully provide more details.

Massachusetts Pests Overview

Diseases (D. Cooley, J. Clements, E. Garofalo)

Fire blight 2020

Probably the major lesson we learned last year about fire blight is that the rule of thumb that we need rain, or at least a heavy dew, for infections may not be entirely true. As with many things, there appears to be an exception to that rule. That exception appears to be when the bacterial populations of *Erwinia amylovora* are off the chart.

There were a few serious fire blight outbreaks in orchards in Massachusetts and other parts of New England last year. These outbreaks happened even when growers used streptomycin. The question was why, in spite of strep sprays, did some growers have fire blight?

When we reviewed the timing of streptomycin sprays, there were no apparent mistakes. The infection periods indicated by NEWA and other decision support systems were sprayed. An early suspicion was that fire blight strains that were resistant to strep had arrived in Massachusetts. Samples from six MA orchards were sent to Cornell-Geneva for testing, and the tests all came back negative - no resistance.

Apparently something out of the ordinary must have happened. The extremely high risk levels on NEWA stood out. At the end of bloom, the EIP in many areas stayed over 100 for several days, and went well over 200 for many of them. Similarly, Cougarbight DH values exceeded 1,000, and risk is 'extreme'. The NEWA output below, at the end of bloom and into petal-fall in an area where two orchards had fire blight, is a good example.

Bloom last year was extremely dry in most places. Notice that relative humidity never exceeds 84% at the site below. At the same time, temperatures are relatively high. This is what's driving the high fire blight risk numbers. But there doesn't appear to be any moisture around - even the relative humidity is low. It's dry.

There is one thing in particular about this NEWA output that is strange. On May 23 to 25, with no rain or dew, there are some leaf wetness hours. In addition, more leaf wetness is predicted for the next four days, but no rain or dew. I'm not sure why there's a difference, but ultimately there were infections, indicating that the leaf wetness information is right - there was some moisture around. NEWA, in the Infection Potential/EIP value, says there will be an infection every day May 26 to May 30.

However, the weather is dry, and if someone weren't checking NEWA, then they could easily conclude the risk was low, especially as petal fall had started. But apparently there was enough moisture in the canopies of trees to allow the very high levels of bacteria to infect. Even though there were few flowers, there were enough, and there were plenty of bacteria. The infections quickly took off, spreading into shoots.

	Past	Past	Current	Ensuing 5 Days				
Date	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30
Cougarblight 4-Day DH	Extreme 553	Extreme 544	High 411	High 414	Extreme 688	Extreme 969	Extreme 1281	Extreme 1308
Infection Potential EIP value	High 133	Moderate 89	Moderate 100	Infection 157	Infection 205	Infection 266	Infection 275	Infection 258
Wetness Events								
Rain Amount	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
Dew	No	No	No	No	No	No	No	No
Leaf Wetness (hours)	5	4	13	8	9	3	3	4
Hours >90% RH	0	0	0	0	0	0	0	0
RH max/min	69/49	64/52	75/58	81/58	78/53	75/62	84/75	84/54
Temp avg F	55	52	58	68	72	70	73	69

While there are some strange things in this example of NEWA output, it clearly shows that bacterial populations are extremely high and that the risk of infection is very high. NEWA, RIMpro and other DSSs can tell us a lot about how well fire blight bacteria are growing, and since we can't see bacteria, that's the only way we can estimate the size of the population.

I think the take-home lesson from last year is that if we have very high bacteria populations, that is, high EIP values and high CougarBlight risk, it's best to be very conservative, and apply streptomycin even in dry weather without rain or dew predictions. This is particularly important in cider blocks and young blocks with susceptible cultivars and/or rootstocks, and areas where there has been fire blight in previous years.

Drought and Disease

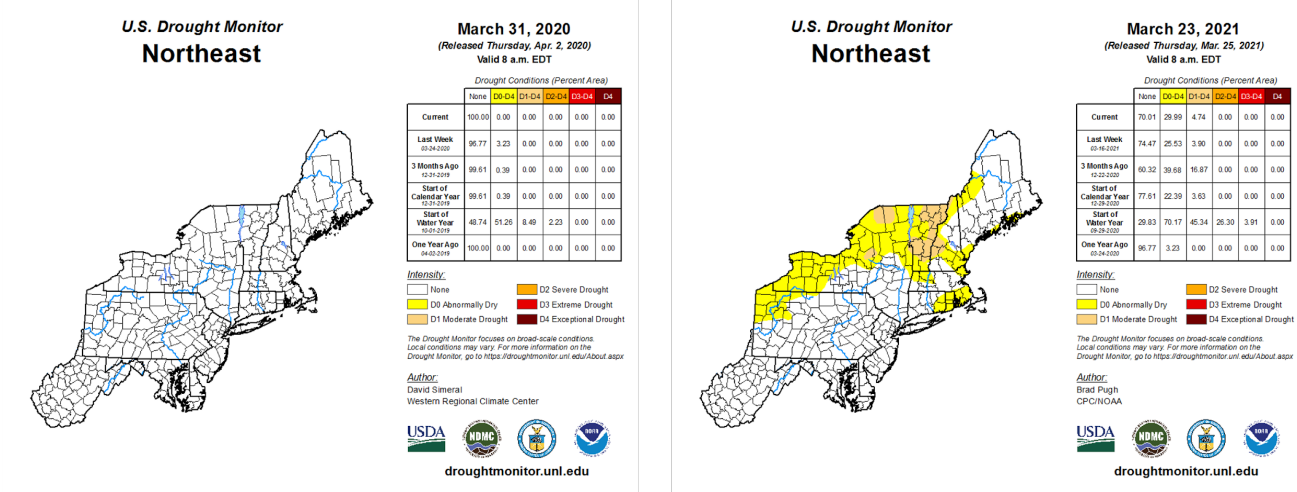
2020 began with normal precipitation levels right up until the week of March 17 when parts of NY, PA, CT, MA and all of RI began to see "abnormally dry" (as defined by the U.S. Drought monitor) conditions creep into fields. At this point, only 6% of the Northeast had been impacted. Conditions continued to worsen. By the time September 29, 2020 arrived 70.17% of the Northeast was experiencing a water deficit. ~45% of that area was experiencing "moderate

drought" conditions, ~26% severe drought and ~3% of the region saw extreme drought conditions. The worst of these conditions were concentrated in New England states.

Precipitation Accumulation Comparisons				
Location	**Normal**	**2021[a]**	**'21 Difference[b]**	**'20 Difference[c]**
Belchertown, MA	10.17"	6.96"	-3.21"	-1.88"
North Adams	8.65"	5.46"	-3.19"	-2.3"
Lowell	10.51"	5.39"	-5.12"	-1.88"
Middleborough	13.37"	6.65"	-6.72"	-5.36"

Precipitation accumulations above represent normal and current accumulations, in inches, for the time frame of Jan. 1 through Mar. 30. [a] Current actual precipitation accumulation totals for the year 2021. [b] Precipitation deficit as of Mar. 30, 2021 compared to normal precipitation accumulations between the current year and the normal precipitation. [c] Precipitation deficit in 2020 at this time compared to the normal accumulation.

In spite of recent rains across the state, we are still seeing greater water deficits now than we were this time last year. The Climate Center's seasonal drought outlook indicates that the April May June period (climatological spring)should see "...wetter-than-average forecast for much of the Midwest and Northeast, indicating drought removal (D1) is likely for those regions."



Left: Map showing state of water in the Northeast as of Mar. 31, 2020. Right: Map showing state of water in the Northeast as of Mar. 23, 2021. This time last year, we were still seeing relatively normal precipitation amounts. This year we are already seeing drought conditions occurring.

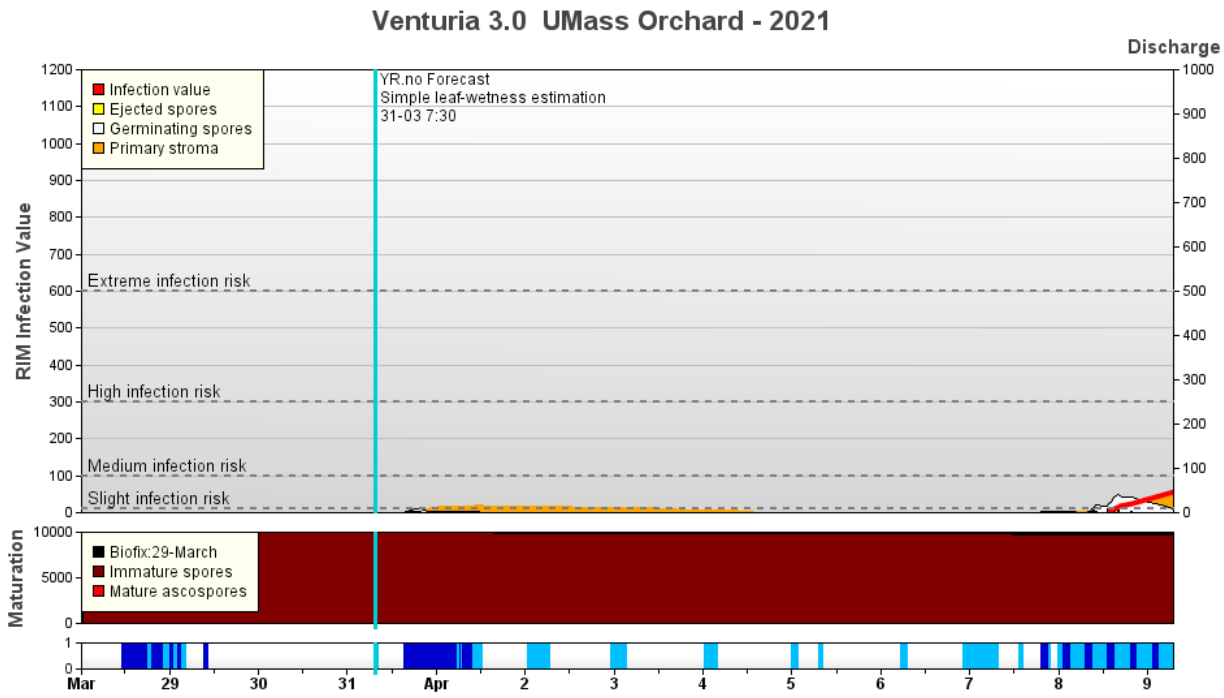
In relation to 2020 disease management, this should have given us a relatively easy year. For **apple scab** this seems to have held true with very little scab incidence. There were, however, two notable disease exceptions; fireblight (covered above) and **Marssonina.**

Marssonina apple leaf blotch; left: yellowed leaf, later in infection phase, top right: mid-infection phase, bottom right, early infection phase- many discrete lesions

Marssonina leaf blotch is the fly in the ointment of any reduced input management system (think stretched out summer programs, cider blocks and organic). We are still in the early stages of getting a handle on how this disease works. Based on casual observation (in other words, while frantically counting apple scab ascospores, wee tiny Marssonina conidia can be observed) over the last three years, Marssonina conidia show up around when peak scab ascospore production and discharge is underway. This confluence of spore events makes understanding what is happening with Marssonina as it first becomes available for infection difficult. The scab ascospore density obscures the first available Marssonina conidia. In order to focus more effectively on Marssonina spore release, leaves from infected scab resistant cultivars were collected in the fall of 2020 and overwintered for analysis of first available spore in the 2021 growing season. By using scab resistant varieties for these assessments, we should be able to confidently determine the first available Marssonina conidia release. Those of you who signed up for your own RIMpro account this year will be able to use the Marssonina model included there.

Apple scab 2021. We all know better than to believe a dry year past means no scab for this year. We still have some room to breathe, though. Maybe a few days. Green tip has just occurred over these last few days- Mar. 29-31- and no ascospores have been observed in the

lab yet. They are expected soon as temperatures begin to climb back up. If you haven't already, it's time to get sanitation accomplished and dormant to early green copper applications on.



Current scab forecast for the UMass Cold Spring Orchard(CSO) in Belchertown, MA according to RIMpro. The Biofix in the system represents green tip at CSO. There is an infection event forecast for Apr. 1 showing up with a RIM value of about one (if even that high). Remember in a "clean" orchard the RIM value to look for is 100. The next projected infection event for CSO according to RIMpro is on Apr. 8. This event is estimated to be closer to the 100 RIM we are looking out for, but at ~50 RIM, still below critical.

If you have had problem blocks in the past, last year's dry weather coupled with a solid sanitation program, good air flow (well pruned) and a good prevention program using a scab forecast model to help with timing will get that old scabby block back in hand.

Insects (J. Piñero, K. Leahy).

In 2020, we conducted IPM studies in 24 commercial orchards in Massachusetts. These studies focused on plum curculio, tarnished plant bug, tortricid moths (female trapping and mating disruption), brown marmorated stink bug (trap cropping, ghost trap, monitoring), apple maggot fly, and spotted-wing drosophila (lure comparison, performance of diluted Concord grape juice).

Coleoptera

Plum Curculio (PC). In 2020, the average level of block-wide fruit injury by PC across 11 commercial orchards in MA, Nh, and ME was 2.8%. No PC research involving odor-baited trap trees was conducted this year. Therefore, such an incidence of injury by PC occurred under standard grower management. We continue to learn that the timing of the petal fall insecticide spray is critical. In 2020, there were at least 3 orchards where the petal fall spray was applied later than growers intended. This was likely due to the presence of mixed cultivars in those blocks or to rainy weather conditions that may have prevented them from entering the blocks to spray. In one block located in the UMass Cold Spring Orchard that was used to compare the level of control achieved with Verdepryn (a.i. Cyclaniliprole) versus that of Avaunt (a.i. Indoxacarb), the insecticides were sprayed a couple of days after the optimal time. Both insecticides were equally effective at controlling PCs. This result, when combined with additional reports from other regions, indicates that Verdepryn can be considered an effective insecticide against PC.

A monitoring technique, based solely on observation of fresh PC injury on fruit from odor-baited trap trees, has proven effective at determining the need for and appropriate timing of perimeter-row insecticide sprays against PC after the whole-block petal fall spray. A Fact Sheet is available here.

Research update: In 2020 we did not conduct trap tree or entomopathogenic nematode research, except at the UMass Cold Spring Orchard. In 2020, we published a research article that presents results from research aimed at comparing the efficacy of the odor-baited trap tree approach with grower-prescribed (=grower standard) sprays to manage *PC* populations **over a six-year period in seven commercial apple orchards in New England**. We also assessed the performance of the EPN *Steinernema riobrave* at suppressing ground-dwelling stages of PC. In addition, the performance of *S. riobrave* was compared against that of *S. carpocapsae* and *S. feltiae* in one year. Across the six years, percent fruit injury on trap tree plots averaged 11.3% on odor-baited trap trees (an expected result, since trap trees congregate adult PCS and injury) and 1.4% on unbaited trees in grower standard plots. Mean percentage injury on fruit sampled from interior trees, the strongest measure of treatment performance, in trap tree plots did not differ significantly from that recorded on interior trees in grower standard spray plots (0.95 vs. 0.68%, respectively). *Steinernema riobrave* consistently reduced PC populations as indicated by the significantly lower number of adult PCs that emerged from the soil, when compared to water control. *Steinernema carpocapsae* and *S. riobrave* performed similarly well. Our combined findings indicate that an IPM approach that targets multiple life stages of PC has the potential to manage this pest more sustainably in a reduced-spray environment. If you are interested in reading the entire article, click HERE.

Diptera

Apple Maggot Fly (AMF). In 2020, across 11 commercial orchards in MA, NH, and ME, the average level of fruit injury by AMF was 0.13% in the perimeter of attract-and-kill blocks, 0% in the block interior, and only 0.055 in the perimeter of grower standard blocks, and 0% in the

block interior. Infestation levels were confirmed by incubating fruit suspected to have AMF oviposition stings inside individual plastic containers with moist sand (as a pupation substrate) at 20-25°C for six weeks. Then, each fruit was dissected for signs of tunneling and/or pupae in the sand. The 2020 levels of AMF infestation were lower than those reported in 2019.

Research update. In 2020, we conducted a study that started in 2019 in collaboration with the Univ. of New Hampshire and the Univ. of Maine. This investigation, led by a UMass graduate student (Ms. Dorna Saadat) evaluated the efficiency of an attract-and-kill strategy involving the use of attractive lures and insecticide sprays in combination with sugar added as phagostimulants, applied to perimeter-row trees. In 2020 we increased the number of orchards from 6 (number used in 2019) to 11. Two treatments were compared: (1) attract-and-kill and (2) grower control. The attract-and-kill block involved the use of lures deployed on the perimeter of the block plus red spheres as a monitoring tool. In these blocks, perimeter-row trees were sprayed with insecticide mixed with 3% sugar added to the tank mix. In the grower control blocks, two or three insecticides were applied to the entire block by the grower. Unbaited red spheres deployed in the block interiors were used to monitor the level of AMF penetration. Data on the number of AMF captured by the red spheres were recorded weekly until harvest. At harvest, fruits were sampled from the interior and perimeter of the two treatments to record AMF injury. Our results show that the attract-and-kill strategy is effective at controlling AMF and can be validated in additional orchards in 2021

Apple leaf curling midge. This exotic fly species was first found in Western Washington in 1991. It is now found in Canada, New England, New York, and in other regions. In 2020, it was found in two MA orchards at very low levels. The larvae attack leaves and flowers of apple trees, which can particularly impair the growth of young or grafted trees. Larvae spend most of their life within a rolled leaf, and then usually drop to the ground to pupate. Major symptoms of infestation are tightly rolled leaves, caused by early instar larval feeding. Leaves subsequently become brown and brittle and drop from the tree. Insecticide sprays are not recommended because generally this insect is not a problem in orchards receiving insecticide sprays for other pests.

Hymenoptera

European Apple Sawfly. Injury by EAS was at very low levels (average of 0.16% across 11 orchards in MA, NH, and ME) in 2020.

Research update. In 2020, one UMass graduate student (Ms. Prabina Regmi) conducted field research aimed at evaluating selected plant volatiles to determine the level of response by EAS. While not many EAS were captured by white sticky traps in the field experiments that were conducted, results suggest some level of EAS response to the plant volatiles that are being evaluated. Studies will continue in 2021.

Hemiptera

San Jose Scale. was detected in only a couple of orchards, and the level of injury was low (average incidence of injury was 0.06%).

Tarnished Plant Bug (TPB). In 2020, TPB became active in mid-April. Most activity took place between May 7 and 15. No orchard had more than a couple of bugs on a few traps, even in traditional 'hot spots'. In 2020, injury by this insect pest was recorded at each orchard where we conducted harvest surveys. Injury levels recorded in 2020 were 2.64%, although most of the injury was shallow and was not expected to result in rejection by customers.

Research update. In 2020, we initiated a project (executed by UMass graduate student Ms. Prabina Regmi) aimed at evaluating plant volatiles for potential use in monitoring systems for TPB. Research results are promising; this information can be found in the winter 2020 issue of Fruit Notes. Research will continue in 2021.

Lepidoptera

Codling moth (CM), Oriental fruit moth (OFM) and obliquebanded leafrollers (OBLR). In 2019, low levels of fruit injury attributable to CM, OFM, and OBLR in Massachusetts were recorded: 0%, 0.15%, and 0.08%, respectively.

Research update. In 2020, we conducted a study aimed at assessing the efficacy of mating disruption using dual pheromone lure dispensers targeting obliquebanded leafroller (OBLR) and codling moth (CM). This work was led by a UMass graduate student, Mr. Ajay Giri. The mating disruption dispensers were deployed at a low rate (32 dispensers/acre). At harvest, we quantified the level of injury by CM and OBLR in the mating disruption and in the grower control blocks. The average level of fruit injury by CM recorded in the 3 mating disruption (MD) and the 3 grower control (GC) blocks was 0.02% and 0.03% respectively. Injury by OBLR was similarly low: 0.08% and 0.15% in MD and GC blocks, respectively.

Winter Moth (WM). No monitoring of WM is taking place in MA. Heather Faubert, from Univ. of RI indicated that WM caterpillars "were mostly not a problem. A few blueberry growers probably should have sprayed, but there was not too much damage". Heather will be monitoring eggs in 3 locations this year. She commented: "*All three locations have different*

results. One location has about the same number of eggs this year as last year. One location has slightly fewer eggs, and one location has many fewer eggs than last year. At least the number of eggs didn't increase in my 3 locations".

Heather added: "*Tree wraps were set up in early November, 2020, to monitor eggs at 3 locations in RI – Charlestown, Kingston, and Portsmouth. In November and December, as female winter moths climbed trees and encountered tree wraps, female moths deposited eggs below the wraps, aggregating eggs, and making it easier to monitor eggs hatching. Winter moth eggs are orange now, but turn blue a couple of days before hatching. This trait makes it very handy for monitoring egg hatch!".*

Gypsy Moth (GM). Based on low levels of Gypsy Moth egg masses in the winter of 2019/2020, the UMass Fruit Extension team did not do any direct systematic monitoring of GM populations during the 2020 growing season. Information on damage potential in hot spots was disseminated in IPM Berry Blast and Healthy Fruit Newsletters as needed.

With the drought that lasted throughout the growing season in 2020, and the abnormally dry weather in parts of MA and other parts of New England, it is possible we will see sporadic GM moving into orchards and other fruit crops. Egg masses are being monitored for emergence and ballooning.

Mites

Mites were not reported by growers as being a problem despite the lack of rain.

Invasive Pests Update (J. Piñero, E. Garofalo).

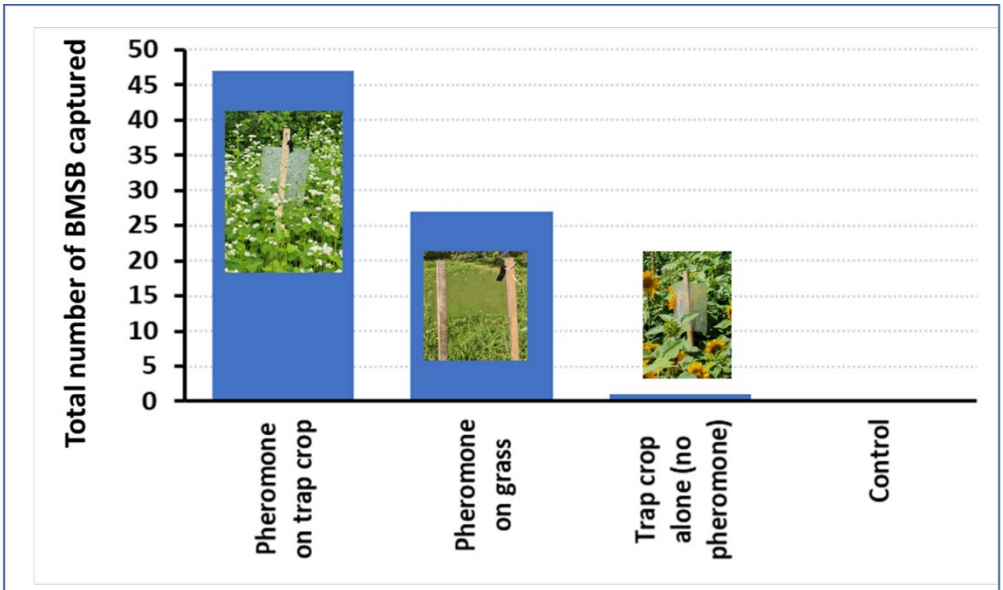
Brown Marmorated Stink Bug (BMSB), *Halyomorpha halys*.

The BMSB has become established throughout MA. In 2020, monitoring of BMSB was done in 10 commercial orchards starting in mid-August, 2020. Six of those locations had not been monitored for BMSB before. BMSB was detected at every single orchard that was monitored, indicating the presence of established populations state-wide. Ghost traps (insecticide-treated netting deployed in association with the BMSB pheromone lure) were deployed at selected orchards. In one orchard, two ghost traps killed 636 BMSB in 3 weeks. We can conclude that BMSB populations continue to be on the rise, and injury by this invasive pest was reported in at least 3 Massachusetts orchards.

In early July 2020, a Google Docs survey specifically prepared for this project was distributed among fruit growers by J. Piñero with support from an Extension faculty from UConn. Twenty-nine surveys were completed. Survey results showed: **(1)** 66% of growers are very concerned about the presence of BMSB in their area, **(2)** 89.7% expressed that research on BMSB needs to

be conducted in MA and other New England states, **(3)** 96.4% indicated that the type of research proposed involving 'ghost traps (= insecticide-treated netting in association with the BMSB pheromone)' and 'trap cropping' for BMSB management is relevant and needed, **(4)** 75.9% expressed willingness to conduct on-farm research if the project receives funding (additionally, 24.1% indicated 'maybe'), and **(5)** 100% of the respondents indicated that more Extension and outreach on BMSB (biology, management, biological control, effective insecticides, etc.) are needed. The full BMSB survey results can be accessed **HERE**.

In 2020 we conducted a preliminary study aimed at comparing the attractiveness of dwarf sunflower, buckwheat, sorghum, and pearl millet, either alone or in combination with the BMSB, at attracting this pest to clear sticky cards. All trap crop species were evaluated singly. The study was conducted at the UMass Cold Spring Orchard in Belchertown, MA. As shown in the figure below, clear sticky cards deployed in association with trap cropping and the BMSB pheromone lure captured nearly twice as many BMSB as did pheromone-baited cards deployed on a grassy area (control for trap crop). These results suggest that the presence of trap crop plants may actually increase the BMSB response to the pheromone. Sunflower and buckwheat were the most effective trap crop species.



Total captures of BMSB (adults and nymphs combined) in clear sticky cards deployed in four 20 m^2 plots at the UMass Cold Spring Orchard (Belchertown, MA). Trap crop plants were seeded on 06.01.20; pheromone lures and clear sticky cards were deployed on 7.7.20. Cards were inspected once or twice a week until 9.21.20.

New research project funded, to be initiated in the 2021 growing season. This project seeks to evaluate trap cropping in association with the (BMSB pheromone and insecticide-treated netting (ghost trap) as a potential IPM tool to manage this invasive pest,

particularly near crop harvest at 8 grower cooperator farms. Our main research goal is to pull stink bugs to the trap crop areas where they can be killed, away from the cash crop.

In year 1, we will quantify BMSB response to sunflower and buckwheat combinations either, alone or in association with the BMSB pheromone. We will compare the following treatments: (1) trap cropping mix (buckwheat 40%; dwarf sunflower 60%) alone i.e., no BMSB pheromone, (2) sunflower alone i.e., no pheromone, (3) buckwheat alone, (4) trap cropping mix (buckwheat 40%; dwarf sunflower 60%) in combination with pheromone, (5) sunflower with pheromone, (6) buckwheat with pheromone, and (7) pheromone alone (on a grassy area).

In year 2, we will assess the effectiveness of the best performing trap crop / pheromone combination at managing BMSB over the summer and through harvest time, when growers have the fewest options available to combat BMSB due to PHIs that limit pesticide use. Two treatments will be evaluated: (1) Best treatment from year 1 (expected to include the pheromone, and (2) grower control, where BMBS will be managed according to the grower decisions.

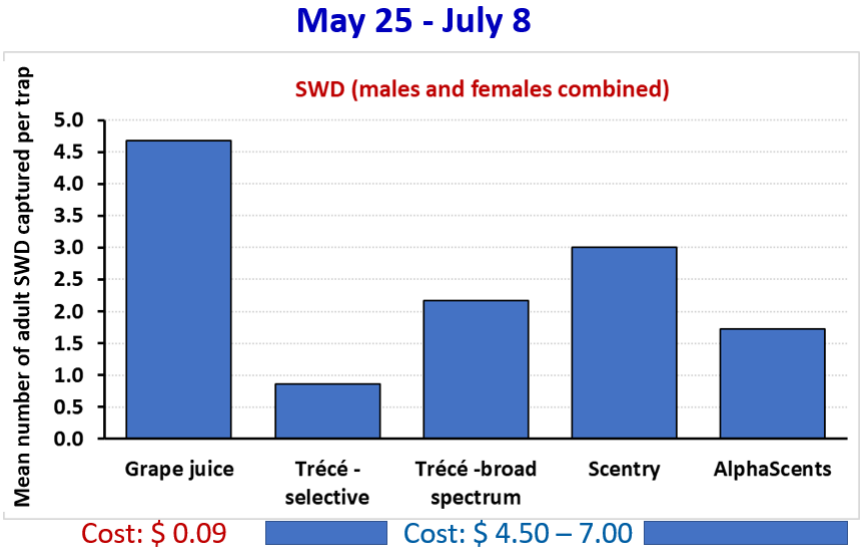
Research updates on the Samurai wasp, an egg parasitoid of BMSB. Substantial research has been done for the past 5 years on the Samurai wasp. Here are the most important findings. For additional readings, click on the hyperlinks:

- The Samurai wasp can kill up to 70% of BMSB eggs in the insects' native range but in the USA parasitism rates are still low. Most parasitoid species feed on floral nectar which improve parasitoid longevity or fecundity in the field. Researchers from WI and OR evaluated the impact of eight flowering plant species on Samurai wasp survival in the lab by exposing unfed wasps to flowers inside vials.. Buckwheat, cilantro, and dill provided the best nectar sources for *T. japonicus* by improving median survival by 15, 3.5, and 17.5 days compared to water. These findings suggest that buckwheat may represent an insectary plant that enhances parasitoid longevity and fecundity, in support of biocontrol. The full article is accessible here: https://www.mdpi.com/2075-4450/11/7/413/htm.
- In one study conducted in West Virginia, adult Samurai wasp survivorship and subsequent adult emergence in orchards was greatest in untreated refugia created by IPM tactics such as border or alternate row middle sprays. The insecticide bifenthrin had consistent negative impacts on the wasp. Insecticide applications did not significantly impair Samurai wasp emergence from egg masses parasitized prior to spray applications. The researchers concluded that management of BMSB in apple orchards is amenable to adjustments that support the incorporation of the Samurai wasp. The full article is accessible here: https://www.mdpi.com/2075-4450/11/12/833/htm.
- Researchers reported that captures of Samurai wasp in Virginia were much higher than those of any other parasitoid species. The community of native parasitoids observed

was similar in composition to that reported previously. The Samurai wasp attacked more BMSB eggs than native stink bug eggs in field choice trials, suggesting that, the Samurai wasp prefers BMSB eggs to native stink bug species and therefore the wasp may be able to successfully coexist with native species in the biological control of BMSB. The full article is accessible here: https://www.mdpi.com/2075-4450/12/2/118/htm.

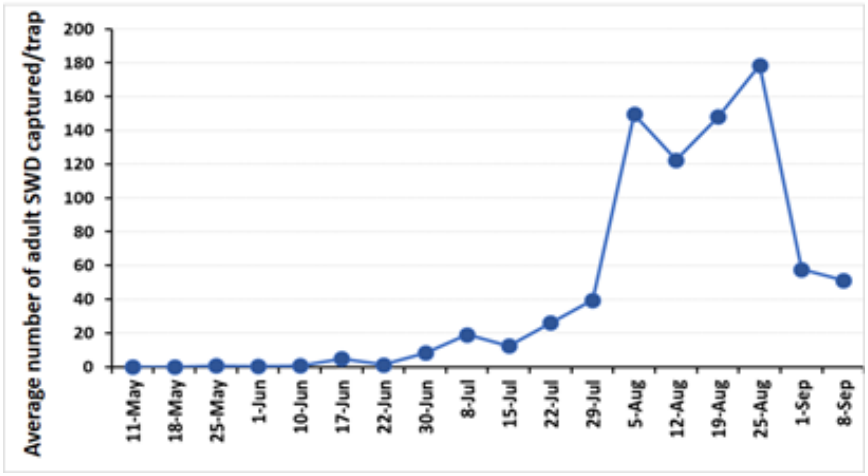
Spotted-wing drosophila (SWD), *Drosophila suzukii.*

In 2020, the first SWD were captured in MA on May 25th. We compared the performance of diluted Concord grape juice (1:3 juice:water) at capturing SWD against that of four commercial lures, at four MA locations. Below is a summary of our findings. Diluted grape juice showed to be a very attractive material to adult SWD. It is important to note that the diluted grape juice was replaced every week whereas the commercial lures were not replaced throughout the study. The expected lure longevity is 4-6 weeks for the two Trécé lures and for the Scentry lure, and 8 weeks for AlphaScents.



Average captures of adult SWD in traps baited with diluted concord grape juice and with commercial lures, early in the 2020 season

The season-long pattern of SWD captured by diluted grape juice is presented in the figure below. The period of greatest SWD captures was late August.

1. 

Season-long captures of adult SWD in traps baited with diluted concord grape juice (n= 4 orchards).

Can hummingbirds be used for biological control of SWD? In NY, Juliet Carroll and Grace Marshall, NYS IPM Program, with advice and guidance from Courtney Weber (Horticulture) and Greg Loeb (Entomology) conducted studies aimed at answering this question. In western NY, one raspberry farm and one blueberry farm are actively utilizing hummingbird feeders in their operations (25 feeders/acre) as a management tactic for SWD. In 2020, plots on these farms were compared to plots on two other farms that did not use feeders. Hummingbirds were seen at all observation time points from June through August in the berry plantings using feeders. None were seen in the plantings without feeders. Assessments for SWD were conducted in three of the four rows, one on the edge and two in the interior of the planting. Adult fly abundance was assessed weekly with Scentry SWD traps and lures. Samples of marketable fruits collected from each plot were assessed for fruit infestation.

Main results: In 8 of 11 weeks, the raspberry plot with hummingbird feeders had statistically fewer SWD than the plot without feeders, especially in the latter half of the growing season. Differences were seen in the fruit infestation levels in the raspberry plots with lower infestation in the plot with feeders.

Spotted Lanternfly (SLF), *Lycorma delicatula* (contributor: Tawny Simisky)

The Problem: The spotted lanternfly (*Lycorma delicatula*) is an invasive, non-native Hemipteran (true bugs, cicadas, hoppers, aphids, etc.) in the family Fulgoridae (the planthoppers). This insect uses piercing-sucking mouthparts to remove plant fluids from over 103 different host plants (Barringer and Ciafré, 2020), including tree of heaven (TOH; *Ailanthus altissima*), apple (*Malus spp.*), plum, cherry, peach, apricot (*Prunus spp.*), grape (*Vitis spp.*), American beech (*Fagus grandifolia*), American linden (*Tilia americana*), American sycamore (*Platanus occidentalis*), big-toothed aspen (*Populus grandidentata*), black birch (*Betula lenta*), black cherry (*Prunus serotina*), black gum (*Nyssa sylvatica*), black walnut (*Juglans nigra*), dogwood

(*Cornus* spp.), Japanese snowbell (*Styrax japonicus*), maple (*Acer* spp.), oak (*Quercus* spp.), paper birch (*Betula papyrifera*), pignut hickory (*Carya glabra*), sassafras (*Sassafras albidum*), serviceberry (*Amelanchier canadensis*), slippery elm (*Ulmus rubra*), tulip poplar (*Liriodendron tulipifera*), white ash (*Fraxinus americana*), willow (*Salix* spp.), and many others.

While tree of heaven is considered a preferred host, spotted lanternfly will feed on other susceptible hosts and lay its eggs on just about any flat surface. Because of this, it is very easy to accidentally move spotted lanternfly egg masses, in addition to adults and nymphs (immatures).

The Massachusetts Department of Agricultural Resources reports that single, dead individual spotted lanternflies have been detected in Middlesex, Norfolk, and Worcester Counties, and that in each case, SLF that were detected were traced back to infested areas in Pennsylvania. **Spotted lanternfly is <u>not</u> currently thought to be established and reproducing in Massachusetts.** However, we need to remain vigilant because it is clear that this insect is an excellent hitchhiker and capable of moving great distances with our accidental help.

Spotted lanternfly feeding has caused mortality (perhaps in addition to abiotic factors) and losses of grape crops in Pennsylvania. Additionally, flagging and branch dieback has been observed in that state on some host trees. However, the long-term impacts of spotted lanternfly feeding are not yet completely understood on all susceptible hosts. That said, this invasive insect has become a significant nuisance in the areas of the US where it has become established. Spotted lanternfly adults and nymphs produce a sugary, liquid excrement known as honeydew, which can coat leaves, plants, and other objects (such as outdoor furniture, cars, etc.) that are found beneath infested host plants. This honeydew can promote the growth of black sooty mold and also attract stinging insects, such as wasps. Adults can gather in very large numbers in managed and agricultural landscapes. In summary, we do not want the spotted lanternfly to become established in Massachusetts!

Timing and Identification of Life Stages:

Eggs: Overwinter and are **laid starting in September** and **hatch in May** in Pennsylvania. Freshly laid egg masses appear as if coated with a white substance. As they age, the egg masses look as if they are coated with gray mud, which eventually takes on a dry/cracked appearance. Very old egg masses may look like rows of 30-50 brown seed-like structures aligned vertically in

columns. As shown in this image, courtesy of Gregory Hoover, do not confuse spotted lanternfly egg masses for those of the gypsy moth (tan/brown egg mass pictured on the right of this photo).

Nymphs:

1st – 3rd Instars: Present following egg hatch from **May through roughly June** in PA. Early instars (immature stages; 1st, 2nd, and 3rd instar) are black with white spots. (Image courtesy of Gregory Hoover.)

4th Instar: Present in **July** in PA. SLF develop red patches in addition to the black color with white spots. This is the last immature stage before they mature into an adult. (Image courtesy of Gregory Hoover.)

Adults: Present from **July until frost kills them**, usually in November and December in PA. Adults are 1 inch long and ½ inch wide at rest. The forewing is gray with black spots of varying sizes and the wing tips have black spots outlined in gray. Hind wings have contrasting patches of red and black with a white band. The legs and head are black, and the abdomen is yellow with black bands. (Image courtesy of Gregory Hoover.)

How You Can Help:

Keep your eyes open! Be on the lookout for any of the aforementioned life stages of this insect in Massachusetts and **report anything suspicious immediately** to the MA Department of Agricultural Resources, here: https://massnrc.org/pests/slfreport.aspx

MDAR has also recently released some **Best Management Practices for Nurseries and Landscapers**, which can be found here: https://massnrc.org/pests/linkeddocuments/MANurseryBMPs.pdf

These BMP's include tips for inspecting materials that may be likely to accidentally transport SLF, including but not limited to: vehicles, trailers, shipping/storage containers, bulk/crushed stone, pallets, firewood, hand trucks and landscaping supplies, lawn furniture/decorations,

nursery stock and potted plants, storage sheds and other outdoor structures, trash cans, wheel barrows, and virtually any flat surface. It is recommended that nursery owners and operators, landscapers, garden centers, and property owners in Massachusetts inspect these items and report anything suspicious.

MDAR has also released some **Best Management Practices for Moving Companies and the Moving Industry**, which can be found here: https://massnrc.org/pests/linkeddocuments/SLFChecklistMovingIndustryMA.pdf

These BMP's include a checklist for inspecting further materials that might accidentally transport this insect, as well as an excellent photo guide depicting some of the interesting items spotted lanternflies may lay their egg masses on! While BMP's specific to fruit production are not yet available, these resources provide helpful information for anyone living or working in the Commonwealth who is on the lookout for the lanternfly!

Research and Extension Update on SLF:

UMass Extension is teaming up with UMass Amherst's Department of Environmental Conservation, the USDA APHIS, and the Massachusetts Department of Agricultural Resources to monitor for the spotted lanternfly in Massachusetts. A team including members of UMass Extension's Landscape, Nursery, and Urban Forestry Program, Extension's Fruit Program, Stockbridge School of Agriculture, and the Department of Environmental Conservation at UMass, Amherst are undertaking a nine-month integrated research and extension project to develop effective tools to detect the spotted lanternfly.

The researchers associated with this project (Dr. Joseph Elkinton, Dr. Jeremy Andersen and Dr. Jaime Pinero) will be working with Dr. Miriam Cooperband of the USDA APHIS lab on Cape Cod to identify and evaluate airborne attractants that can improve the ability to detect SLF in traps. Dr. Cooperband has identified several attractant lures released from host plants of SLF. She is currently working on pheromones produced by SLF that may be much more attractive. The UMass team will help her conduct field tests of these new lures, while also assisting the Massachusetts Department of Agricultural Resources (MDAR) in monitoring for SLF in Massachusetts. UMass Extension Entomologist, Tawny Simisky, will periodically report on progress made during the course of this project. **For more information, please visit:** https://ag.umass.edu/cafe/news/looking-for-spotted-lanternfly-recent-invasive-arrival

For more information about spotted lanternfly, visit:

UMass Extension's Fact Sheet: https://ag.umass.edu/landscape/fact-sheets/spotted-lanternfly

MDAR's Massachusetts Introduced Pests Outreach Blog: https://massnrc.org/pests/blog/

MDAR's Spotted Lanternfly Mini Poster: https://massnrc.org/pests/linkeddocuments/SLFminiposter.pdf

Order Spotted Lanternfly Materials from MDAR: http://bit.ly/FPOMOrder

MDAR's Spotted Lanternfly Fact Sheet: https://massnrc.org/pests/pestFAQsheets/spottedlanternfly.html

A Map of Known SLF Infestations in the US: https://nysipm.cornell.edu/environment/invasive-species-exotic-pests/spotted-lanternfly/

Pesticides Update (J. Piñero, D. Cooley, M. Concklin)

Fungicides

Overview. There aren't many new materials for disease control this year, and no new types of chemistry. The most interesting new fungicide is Cevya, a new DMI (FRAC 3) from BASF. Why do we need another DMI, you may ask, or at least I did. It turns out that it may have an edge on the current fungicides in this group, which have lost some efficacy due to resistance. In his trials at Cornell, Kerik Cox has found it to be exceptional against apple scab, even strains with DMI-resistance. Also interesting, it has done well for him against late-season bitter rot on fruit, though it isn't labelled for bitter rot. It is, however, labelled for sooty blotch/flyspeck and white rot, so could be applied for those diseases late in the season, and it has a 0 PHI. It is limited to three applications per season.

Excalia is a new SDHI (FRAC 7) fungicide from Valent. Like two other SDHI fungicides, Fontelis and Aprovia, Excalia is not pre-mixed. This is a good thing. Like the other SDHIs, it is excellent against scab and powdery mildew, ok on cedar apple rust. So it fits into the window around tight-cluster through bloom.

LifeGard is a bacterial-based resistance activator from Certis. It is like Actigard, though there's a difference: LifeGard is a biological, bacteria, and OMRI-approved, while Actigard is a chemical and not OMRI-approved. It is most useful as a pink to early-bloom treatment against fire blight. While listed for other diseases, its efficacy is less consistent than other options.

There's a new phosphite for diseases, pHorcepHite from Omex Agrifluids. Where do the chemical companies come up with these product names? As with many other phosphite options, this product is labelled for use on collar rot and related root rots, fire blight and blister spot. While there have been good trial results for phosphites against blister spot, efficacy against fire bight is generally moderate at best, unless combined with other materials.

Omex also has a mix of a phosphite and sulfur new this year, SulfoMEX, labelled for use against powdery mildew. Period.

APPLE

Product	Code	Targets	Rate/A	PHI (day)	REI (hr)	Comments
Cevya	3	Alternaria Blotch, apple scab, powdery mildew, black rot/frogeye leaf spot, cedar apple rust, flyspeck, sooty blotch, white rot, quince rust (suppression)	3-5 fl oz; 5 fl oz for scab	0	12	Limited to 3 applications per year, no more than 15 fl oz per year.
Excalia	7	Scab, powdery mildew, rust	3-4 fl oz/A	Not > PF	12	Do not apply after petal fall; 8 fl oz/A max per season. P and PF recommended. Excellent scab. Currently registered in NH, RI, and VT have approved. It is pending in ME, MA, CT. We expect those soon. Limited to 2 applications per year, 8 fl oz per year.
LifeGard WG	44	Fire blight, powdery mildew, rust, flyspeck, sooty blotch, fruit rots	4.5 oz/100 gal	0	4	Moderate-good (scab); good-exc (Powdery mildew, rust, fruit rots); good (flyspeck, sooty blotch). OMRI-listed
pHorcepHite	NA	Phytophthora, Pythium, fireblight, blister spot	2-4 qt	0	4	Suppression only for fireblight, Blister spot
SulfoMEX	NA	Powdery mildew	3-6 qt	Terminal bud set	24	TC- terminal bud set. Do not apply with or within 14 days of oil application

PEAR

Product	Code	Targets	Rate/A	PHI (day)	REI (hr)	Comments
Cevya	3	Alternaria blotch, apple scab, powdery mildew, black rot/frogeye leaf spot, cedar apple rust, flyspeck, pear scab, sooty blotch, white rot, quince rust (suppression)	3-5 fl oz	0	12	
pHorcepHite	NA	Phytophthora, Pythium, fireblight, blister spot	2-4 qt	0	4	Suppression only for fireblight, blister spot

STONE FRUIT

Product	Code	Targets	Rate/A	PHI (day)	REI (hr)	Comments
Cevya	3	Nectarine, Peach, Plum: Alternaria leaf spot, blossom blight, brown rot, beaf spot, ripe fruit rot, rust, scab, shothole, powdery mildew (suppression); Cherry: Alternaria leaf spot, blossom blight, brown rot, leaf spot, ripe fruit rot, rust, scab, shothole	4-5 fl oz	0	12	
RootShield PLUS+ WP	NC	Phytophthora root rot	In-furrow spray or transplant starter solution: 16 – 32 oz	0	4	
pHorcepHite	NA	Bacterial diseases	2-4 qt	0	4	Suppression only
SulfoMEX	NA	Powdery mildew	3-6 qt	?	24	Do not apply with or within 14 days of oil application; do not apply with copper

Insecticides and miticides

APPLE

Type	Product	Code	Targets	Rate/A	PHI (day)	REI (hr)	Comments
Insecticide	Senstar	23, 7C	Aphids, WAA, Mealybugs, Pear psylla, whiteflies	12-18 fl oz/A	45	24	Do not apply until after petal fall
Insecticide	SuffOil-X®	NC	Aphids, Bugs (including Apple Red Bug), Fruit Tree Leaf Roller, Mites (including European Red Mite), Powdery Mildew, Scales (Hard, Soft, Scurfy), Whiteflies	1-2% by volume	0	4	TC- terminal bud set. Do not apply with or within 14 days of oil application. OMRI-listed.
Miticide	Magister SC	21A	spider, rust mites	32-36 oz	7	12	Very effective on mites (all motile stages)
Miticide	Nealta Miticide	25	European red mite, two-spotted spider mite	13.7 fl oz/A	7	12	For small non-bearing trees, apply in at least 50 gallons of spray solution per acre. For knockdown and residual control of miles apply at first sign of infestation. Limit 2 applications/year
Miticide	Nexter SC	21A	spider mites, rust mites	11-17oz	7	12	All motile stages. Replaces Nexter 75WP
Miticide	Onager OPTEK	10A	spider mites	12-24 oz	28	12	Targets eggs and immature motile mites

PEAR

Type	Product	Code	Targets	Rate/A	PHI (day)	REI (hr)	Comments
Insecticide	Senstar	23, 7C	Aphids, WAA, Mealybugs, Pear psylla, whiteflies	12-18 fl oz	45	24	Do not apply until after petal fall
Insecticide	SuffOil-X®	NC	Aphids, Fruit Tree Leaf Roller, Mites (including Pear leaf Blister Mite), Pear Psylla, Powdery Mildew, Scales, Whiteflies	1-2% by volume	0	4	OMRI-listed.
Miticide	Magister SC	21A	spider, rust mites; pear psylla	32-36 oz	7	12	Very effective on mites (all motile stages) and psylla
Miticide	Nealta Miticide	25	European red mite, two-spotted spider mite	13.7 fl oz	7	12	For small non-bearing trees apply in at least 50 gallons of spray solution per acre. For knockdown and residual control of miles apply at first sign of infestation. Limit 2 applications/yr
Miticide	Nexter SC	21A	spider mites, rust mites	11-17oz	7	12	All motile stages. Replaces Nexter 75WP
Miticide	Onager OPTEK	10A	spider mites	12-24 oz	28	12	Targets eggs and immature motile mites

STONE FRUIT

Type	Product	Code	Crop	Targets	Rate/A	PHI (day)	REI (hrs)	Comments
Insecticide	Imidan 70W	1 B	Cherry: Sour	SWD	2.12 lbs	14	3 day	very effective in tart cherry for SWD (not for use on sweet cherry)
Insecticide	Senstar	23, 7C	Stone	Aphids, Lecanium scale, mealybugs, San Jose Scale, White peach scale, whiteflies	12-18 fl oz	14	24	Do not apply until after petal fall
Insecticide	SuffOil-X®	NC	Stone	Aphids, Fruit Tree Leaf Roller, Mites, Scales, Whiteflies	1-2% by volume	0	4	OMRI-listed
Miticide	Magister SC	21A	Cherries	spider, rust mites, powdery mildew	24-36 oz	3	12	Miticide and fungicide activity
Miticide	Magister SC	21A	Stone other than Cherry	spider, rust mites	32-36 oz	3	12	Very effective on mites (all motile stages).
Miticide	Nealta Miticide	25	NEW for 2021: Stone Fruit supplemental label	European red mite, two-spotted spider mite	13.7 fl oz/A	7	12	For small non-bearing trees, apply in at least 50 gal. of spray solution per acre. For knockdown and residual control of miles apply at first sign of infestation. Do not use any adjuvants other than NIS, at a rate not to exceed 1pt/100 gal. (0.125% v/v). Limit 2 applications/year
Miticide	Nexter SC	21A	Stone	spider mites, rust mites	7.5-17 oz	7	12	All motile stages. Replaces Nexter 75WP
Miticide	Onager OPTEK	10A	Stone	spider mites	12-24 oz	7	12	Targets eggs and immature motile mites

IPM and other News Around the Country (J. Piñero)

Pest Activity and Protection Practices: Four Decades of Transformation in Quebec Apple Orchards

A group of Canadian researchers led by Drs. Gérald Chouinard, Francine Pelletier, and Charles Vincent just published a peer-reviewed article reporting on results from 40 years of tracking patterns of activity of major fruit pests, fruit damage and impacts (environmental and financial) of pesticide applications in commercial orchards in Quebec.

ABSTRACT: A group of commercial orchards from Quebec (Canada) was followed from 1977 to 2019 as part of a project to implement Integrated Pest Management (IPM) practices. Collected data comprised activity of major fruit pests (from monitoring traps), fruit damage at harvest and pesticide applications, from which the annual costs and impacts of protection programs over 42 years were calculated. Activity and fruit damage in commercial orchards were compared to patterns observed in a reference insecticide-free orchard. Some insects (European apple sawfly, codling moth, apple maggot) were more prevalent in the insecticide-free orchard than in commercial orchards, while others were more prevalent in commercial orchards (oblique-banded leafroller) or as prevalent in both orchard types (tarnished plant bug). Annual fruit damage in the insecticide-free orchard was mostly from the apple maggot (up to 98%), the plum curculio (up to 90%) and the codling moth (up to 58%). The average situation was different in commercial orchards, whose damage was mostly from the plum curculio (up to 7.6%), the tarnished plant bug (up to 7.5%) and the oblique-banded leafroller (up to 1.7%). While the number of registered pesticides, the number of applications and the total cost of pesticides gradually increased from 2002 to 2019, the risks incurred, as measured by indicators of environmental and health impacts, followed a downward trend for insecticides and acaricides and varied slightly for fungicides.

The full article is accessible here: https://www.mdpi.com/2075-4450/12/3/197

IPM Around the World (J. Piñero)

2021 -World Apple and Pear Association (WAPA) presents annual Southern Hemisphere production forecast

The World Apple and Pear Association (WAPA) has released the Southern Hemisphere apple and pear crop production forecast for the upcoming season. According to the forecast, which consolidates the data from Argentina, Australia, Brazil, Chile, New Zealand, and South Africa, apple production is estimated to increase by 6 % in 2021 compared to the previous year, while pear production is projected to stabilize.

Regarding apples, the aggregate Southern Hemisphere 2021 crop forecast suggests an increase of 6 % (5.090.000 T) compared to last year (4.818.000 T), with increases in Australia, Brazil, and South Africa of 23 %, 20 % and 6 % respectively, a decrease in New Zealand of 5 %, and stable figures in Argentina and Chile. The aggregate increased by 2 % compared to the average of crops between 2018 and 2020. Chile remains the largest Southern Hemisphere apple producer in 2021 with 1.512 million T, with Brazil in second place (1.130 million T), followed by South Africa (1.013 million T), Argentina (617 million T), New Zealand (547 million T), and Australia (271 million T). Gala remains the main variety (39 %), followed by Fuji (14 %) and Red Delicious (13 %). Export figures are estimated to stabilize at 1.691.562 T, with stable figures for Chile (650.773 T), a 4 % increase for South Africa (476.000 T), and a 7 % decrease for New Zealand (372.000 T).

Source: https://www.fruit-processing.com/2021/02/world-apple-and-pear-association-wapa-presents-annual-southern-hemisphere-production-forecast-3/

https://apps.fas.usda.gov/psdonline/circulars/fruit.pdf

Impact of Exclusion Netting Row Covers on 'Honeycrisp' Apple Trees Grown under Northeastern North American Conditions: Effects on Photosynthesis and Fruit Quality

Nets are commonly used as an anti-hail device in tree fruit production. Considering the various advantages nets can provide to the grower (bird, insect, disease and mammal control and protection against hail, wind, frost and sunburn), they are also referred to as “multitask nets”.

Researchers evaluated a complete exclusion system—in which the soil is also excluded—to grow 'Honeycrisp' apples for six years in southern Quebec, Canada. Abiotic conditions, as well as plant photosynthesis and fruit quality characteristics (color, firmness, size, sugar content, number of seeds, ripeness and skin integrity) and yield were estimated yearly and compared in netted (either with or without a rainproof top) and unnetted row units. Although annual variations were high and results showed little or no difference between netted and unnetted rows for all measured variables, with the following exceptions; color (increased red surface on fruits from unnetted rows some years), size (fruits from unnetted rows were smaller) and maturity (fruits from unnetted rows matured slightly faster). Fruits produced under nets had fewer microcracks at the surface than fruits produced without nets. Reduced cracking possibly helped decrease sooty blotch and flyspeck incidence and severity. These findings pave the way for using this exclusion system as an effective alternative, or addition, to IPM programs for orchards.

The full article is accessible here: https://www.mdpi.com/2075-4450/10/7/214.

The potential for wildflower interventions to enhance natural enemies and pollinators in commercial apple orchards is limited by other management practices

This study was conducted in England. **Summary**: Modern fruit production has successfully increased yields and fruit quality to meet market demands mainly through intensification and the use of Plant Protection Products (PPPs). Due to the associated environmental impacts and consumers increasingly demanding food produced more sustainably, the tree fruit sector is seeking to reduce its reliance on PPPs. Despite intensification, apple production is still highly dependent on ecosystem services, including pest regulation and pollination. The aim of this study was to investigate the response of natural enemies and pollinators in commercial apple orchards to the provision of a wildflower habitat. It was hypothesized that the abundance and diversity of beneficial invertebrate species would be enhanced leading to an increased control of apple pests and enhanced pollination of apple blossom. We also investigated the effect of orchard pesticide toxicity on natural enemies and pest regulation services and how responses varied between apple cultivars (Jazz and Braeburn).

The study was carried out in five orchards of each apple variety across Kent (UK), using a split-plot experimental design. At each site, a one-hectare orchard plot was established with wildflower strips in alleyways between rows of trees and compared with a one-hectare control plot where alleyways were managed conventionally with regular cutting. Responses of natural enemies and pollinators were recorded over a period of three and four years, respectively.

The presence of wildflower strips did not contribute significantly towards the delivery of natural pest regulation or pollination services. However, hoverfly diversity and species richness were greater in orchards with wildflower strips, and whilst this was not associated with increased rates of pest regulation, such a response could potentially provide more resilient pest regulation and pollination services. Braeburn orchards had higher bee abundance, and pest predation rates, which were associated with a greater abundance of earwigs, compared to Jazz orchards. Of key significance for growers is that high values of cumulative pesticide toxicity negatively affected natural enemy populations, especially earwigs. If growers want to support natural enemies and wild pollinators in modern apple orchards following the principles of ecological intensification, they need to consider both the types and frequency of pesticide sprays used, in conjunction with interventions aimed at promoting beneficial invertebrates.

The full article is accessible HERE.