Massachusetts Fruit IPM Report for 2019

Jaime C. Piñero, Daniel Cooley, Jon Clements, Sonia Schloemann, and Elizabeth Garofalo
University of Massachusetts Amherst

Weather

Low winter temperature(s) recorded at the UMass Cold Spring Orchard was -6°F. on January 21, January 31, and February 1, 2019. January 31 through February 2 marked three nights of sub-zero temperatures between -5°F. and -6°F. While there was some consternation about stone fruit flower bud damage, in the end, with some exceptions, the stone fruit crop was very good in 2019. Continuing a recent trend, green tip on apple was about on time if a little early (April 12). However, a cool May (Figure 1) delayed apple bloom somewhat (May 12) and then we were in for a prolonged bloom period. Pollination weather and bee flight appeared to be so-so, however, a heavy crop was generally set (except where a heavy crop was observed in 2018, then for example, some Honeycrisp blocks were very light set). Again, continuing a recent trend, the summer was hot (mostly July, Figure 2), but with adequate precipitation season-long (Figure 3). The peach crop enjoyed this weather and was one of the best in terms of quantity and quality in years. August was not particularly hot, with some low temperatures in the 50's beginning early in the month. Apple red color benefitted. Unlike in recent years, September was also not hot, but it was dry. All which generally favored the harvest of a nice crop of apples.

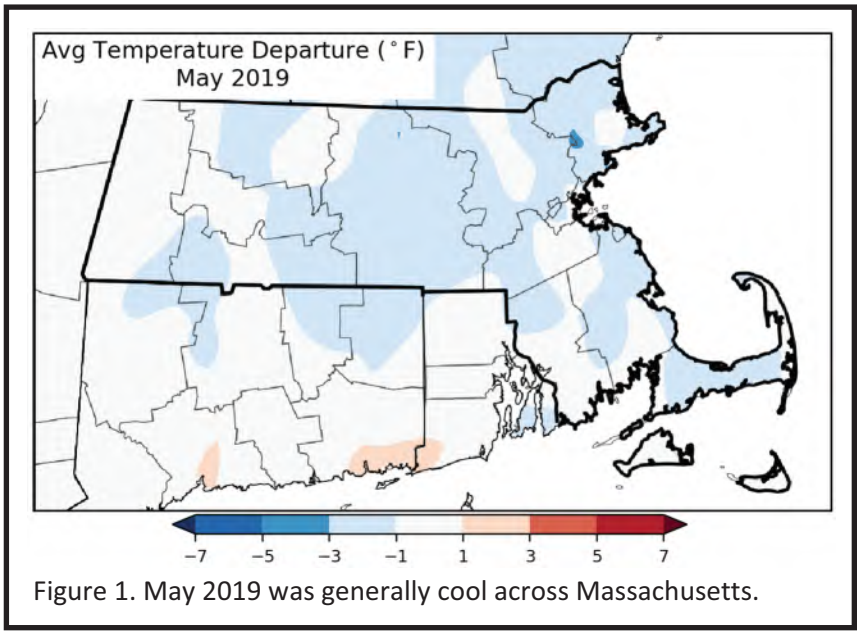

Figure 1. May 2019 was generally cool across Massachusetts.

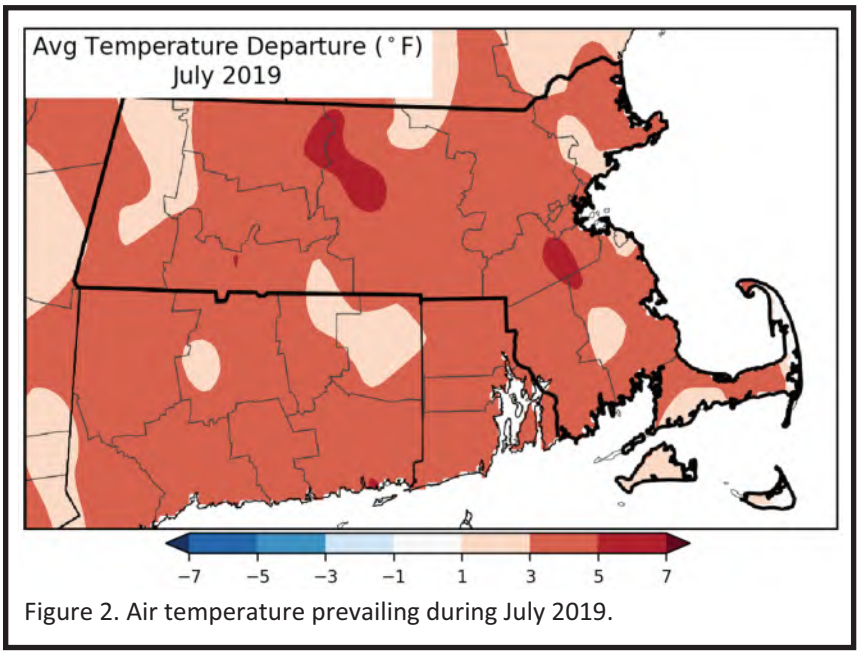

Figure 2. Air temperature prevailing during July 2019.

Diseases

The spring started off wet, making orchard access difficult. These conditions exacerbated last fall's rainy weather leading to a few,

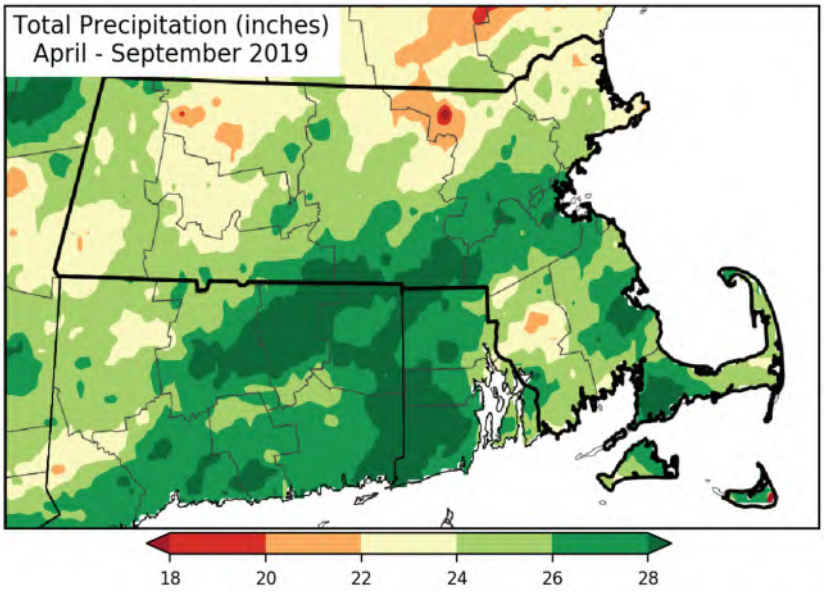

Figure 3. Rain was generally adequate during the 2019 growing season. However, not the same state-wide.

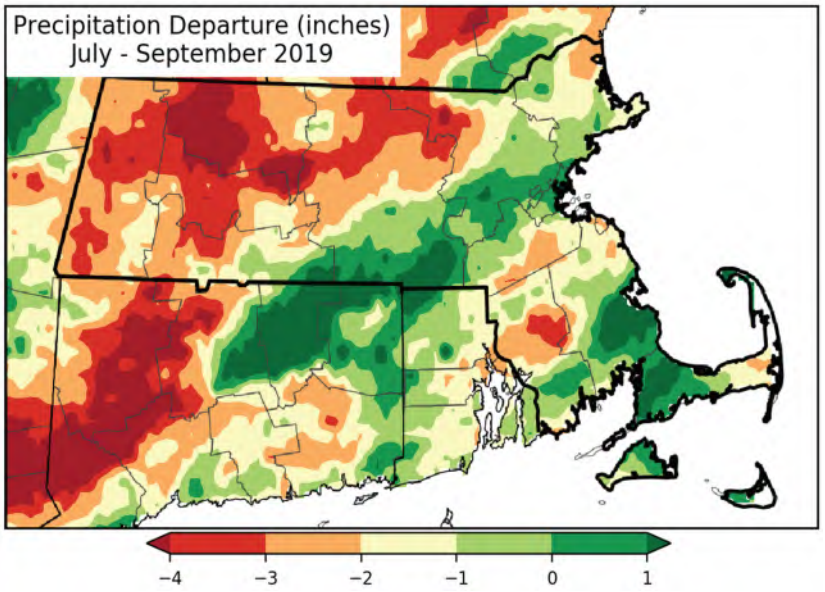

Figure 4. Summer precipitation during the summer of 2019 was normal to dry in most of the state.

isolated, **Phomopsis** outbreaks. While these may have looked bad (and caused a fair amount of panic), they did not seem to progress once pruned out.

Muddy orchard conditions also made early season disease management difficult, in general. Some **apple scab** cropped up, especially in blocks where inoculum has been historically high. While the better part of primary scab was fairly readily managed, enough infections were established to lead to some fruit damage. At the UMass Cold Spring Research Orchard, we had both RIMpro and NEWA running for Decision Support Systems. Between April 12 (GT) and June 10, RIMpro estimated 6, multi day, infection events with RIMs exceeding the 100 level. NEWA estimated 16 separate infection events over the same time frame.

As shown in Figure 5, only about 2% of the fruit sampled at harvest had scab lesions. Fly speck was a complete no show and sooty blotch barely present. Similarly, the fruit rots that were so prevalent last year did not appear this year. The precipitation during the summer was drier than normal to normal over the state (Figure 4) accounting for less summer disease pressure. Growers were prepared to spray fungicides for summer rots and diseases this year, given last year's problems.

Insects

In 2019, the most challenging insect pests in Massachusetts in several orchards seem to have been, in this order: codling moth and other Lepidoptera, plum curculio, stink bugs, and mites. The least damaging or almost non-existent pests were leafminers and European sawfly.

Brown marmorated stink bug (BMSB). In 2019, 12 BMSB monitoring sites were established in MA orchards, in cooperation with private consultants. Four of these sites were used to assess the potential of the ghost trap as a means of managing late season BMSB damage, especially in PYO blocks where insecticide residues are not permissible. Fruit in blocks adjacent to the ghost traps were evaluated to determine if the proximity of the traps to the blocks increased stink bug damage. After last year's big (big for Massachusetts, anyway) trap captures, we were all geared up for even higher numbers

Table 1. Summary of precipitation and scab infection events by date, recorded at the UMass Cold Spring Orchard (Belchertown, MA).

2019 Apple Scab Summary UMass Cold Spring Research Orchard				
Precipitation			Infection Event (date initiated)	
Date	# Days with Rain	Total Rainfall (inches[a])	RIMpro- RIM value[b]	NEWA Y/N
4-12	4	1.36	2 (4-15)	Y (4-12) (4-14)
4-18	7	2.03	1770 (4-20)	Y (4-19) (4-21) (4-24)
4-26	5	2.69	182 (4-26)	Y (4-26) (4-28)
5-2	6	0.61	2246 (5-3)	Y (5-2) (5-7)
5-12	3	1.14	1507 (5-10)	Y (5-12)
5-17	1	0.19	1 (5-17)	Y (5-17)[c]
5-23	4	0.75	1 (5-23)	Y (5-23)
5-28	1	0.44	857 (5-28)	Y (5-28)
6-2	2	0.30	0	N
6-10	7	1.62	133 (6-11)[d]	Y (6-10) (6-14) (6-16)

[a]Precipitation events with less than .10 inches of rain are not recorded here as they are not considered sufficient to trigger an infection event.
[b]RIM values less than 100 are not considered "significant" infection events, for practical management purposes. RIM values represented here are the total value for a combined infection event, not each day's discreet RIM value.
[c]NEWA estimated essentially all ascospores were released May 17.
[d]The final primary scab even estimated by RIMpro was 6-10 and exceeded the 100 RIM necessary to make it a "significant" infection event.

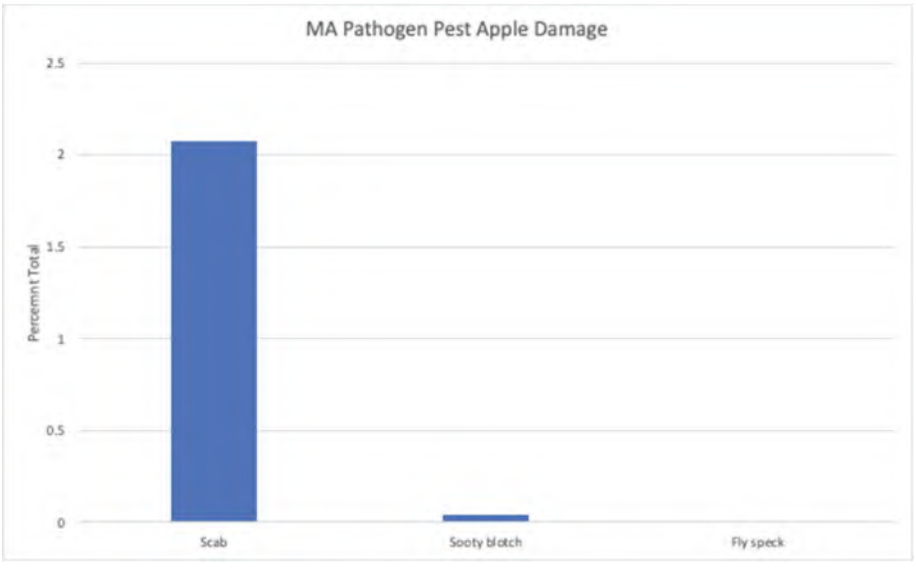

Figure 5. Percent fruit damage from the three most common fungal pathogens. A total of 2,650 apples were sampled from five orchards in Massachusetts.

this year. Not all that much actually showed up though. Neither ghost traps, nor pyramid traps caught anything like what we had expected. The cool weather for the first part of the summer might have slowed down stink bug development. While stink bug damage was documented in several apple blocks, whether or not that damage was from invasive or native stink bugs has yet to be determined.

Codling moth (CM). Reports indicate that for about 5-6 years, we've gone from CM being an occasional pest to posing a serious problem –particularly for the last 2 years. A couple of MA orchards reported injury by this pest.

Oriental fruit moth (OFM) still seems to hang mainly in peaches but occasionally in apples -- a couple of people that were using mating disruption in small stone fruit plots had significant activity from (presumably) mated females flying in and laying eggs.

Plum curculio (PC). We monitored the early-season PC activity using black pyramid traps baited with benzaldehyde (BEN) and grandisoic acid (GA), the PC aggregation pheromone. The first overwintered PCs (4 adults in 3 odor-baited traps) were captured on April 24th. These first captures took place at 214.1 DD (base 43F, accumulated since January 1st). This is very close to the 7-year average of 224 DD (base 43F).

PC adults seemed to come and go in a fairly 'normal' pattern, although the cold, wet spring got

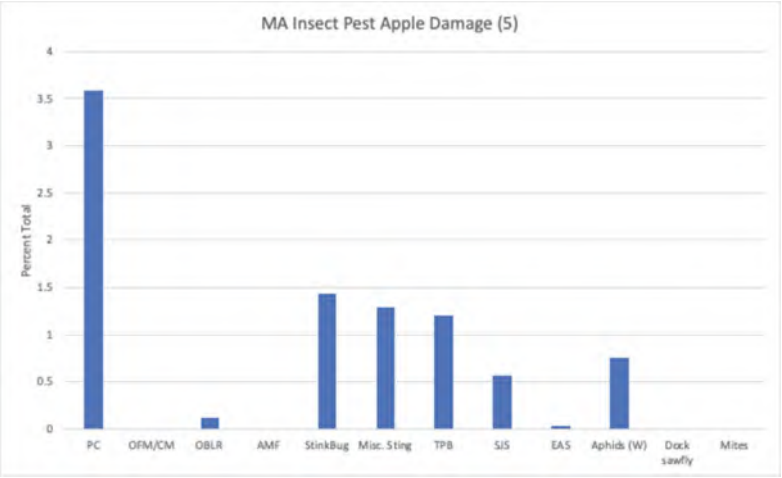

Figure 6. Percent fruit damage from the 13 most common insect pests of apple. A total of 2,650 apples were sampled at five orchards in Massachusetts.

them to a slow start. Such a weather pattern also resulted in an extended period of PC activity which, for the first time in several years, was difficult to monitor using odor-baited traps. Table 2 shows that 2019 had the lowest average air temperature for the month of May, when compared to the three preceding years. For example, in 2018 the average temperature during May was about 7 degrees higher, with more comparatively 'warm' days. It seems that the 2019 May weather was similar to 2017 in terms of temperature (both years were similarly cool), although in 2017 the amount of precipitation during May was nearly twice as much the amount received in 2019.

Overall, even though populations didn't seem to have been greater than usual, greater-than-expected damage took place in a couple of orchards that likely missed the timing or didn't have enough coverage due to rainy, cool weather that prevailed during the PC season.

Apple maggot fly (AMF). AMF populations appeared and peaked later than usual. There was high variability in AMF pressure across orchard blocks, but in general populations were not high. The final insecticide in August usually seems to take care of late-appearing AMF. Preliminary research was initiated to determine whether perimeter-row sprays in association with semiochemicals would result in adequate levels of AMF protection. See Fruit Notes article reporting on the main 2019 findings of that research.

Tarnished plant bug (TPB). On April 14, 2019, the first TPB adults were captured in white sticky cards (two TPB adults in six traps) deployed at the UMass Cold Spring Orchard. It seems that TPB was well controlled in most orchards.

Oblique-banded Leaf Roller (OBLR). Current control strategies implemented by growers seem to be working well.

Mites were, generally speaking, not a big problem. When they cropped up, it was often in limited areas in some cases limited to single limbs. It is possible that such spotty presence may due to uneven coverage with oil since application conditions were so challenging.

Red-banded leaf rollers presence was documented in a couple of orchards, but fruit injury was not evident.

Wooly apple aphid continues to crop up in more places where it was not previously seen, both in old standard type trees as well as high density plantings.

Fruit injury at harvest. The level of fruit sampled at harvest showing insect damage (expressed as percentages) is presented in the Table below (from two MA orchards) - data are presented separately for perimeter rows and for block interior, and also in Fig. 6 (from five MA orchards).

Table 3 shows infestation data collected at harvest in two MA commercial orchards. Note the comparatively high percentage of fruit with PC scars in the perimeter of one block. Injury by AMF was confirmed via incubation of individual fruit sampled from trees, which were kept in individual containers with sand (pupation substrate) for 5 weeks. Fruits were dissected and a determination was made of whether injury was caused by AMF (presence of larvae / pupae) or by stink bugs (presence of feeding tube).

As shown in Figure 6, Oriental fruit moth (OFM) and codling moth (CM) (here, considered together as

Table 2. Air temperature and rainfall recorded during the month of May over a 4-year period (2016-2019) at the UMass Cold Spring Orchard (Belchertown, MA).

	Avg. temperature (May)	# of days with max. temp ≥ 70°F	# of days with max. temp ≥ 80°F	Total rainfall (inches)
2019	55.5	9	1	3.3
2018	62.0	20	9	1.6
2017	56.3	9	3	6.7
2016	59.0	16	6	2.5

internal lepidoptera), and plum curculio (PC) caused the greatest amount of damage while European apple sawfly (EAS) caused relatively minimal damage. Miscellaneous sting is considered any damage where the cause is indeterminable.

Horticulture

Chemical fruit thinning remains one of the most challenging AND most important spray(s) of the year. Some of my "adventures" in apple chemical thinning in 2019 follow.

The nibble fruit thinning approach as espoused by Dr. Duane Greene was advisable. This includes using NAA (Fruitone, PoMaxa), carbaryl (Sevin), and 6-BA (Maxcel, Exilis) at the appropriate timing (beginning at bloom and continuing through 10-12 mm fruitlet size) and during good weather (warm, partly cloudy, neither of which occurred together at a particularly good time).

Still, this approach generally resulted in inadequate thinning. Apple trees were rarely under considerable carbohydrate stress during most of the chemical thinning window (Fig. 7) for chemical thinners to be particularly effective. But, it (nibble approach) definitely did some thinning. Some might argue the results were acceptable. But I am tired of too many small, clustered-up apples, particularly when it comes to crop-load sensitive varieties like Honeycrisp wherein fruit quality (size, red color, and flavor) suffers.

Table 3. Level of perimeter-row and interior-row injury caused by insect pests recorded at harvest in two Massachusetts orchards.

Insect pest	MA orchard 1		MA orchard 2	
	Perimeter row	Interior	Perimeter row	Interior
PC	8%	0.45%	1.76%	0.63%
PC feeding or similar type of damage	0%	0	1.47%	2.5%
Late-season stink bug	0.33%	0	1.18%	0.63%
Early-season Hemiptera	1.67%	1.36%	2.35%	1.88%
AMF	0.33%	0	0.88%	0.63%
Rollers	0	0	0.29%	0
OFM	0	0	0.58%	0
CM	0	0	0	0
EAS	0.33%	0.45%	0.29%	0

The Pollen-tube-growth Model. New this year, I followed it (the PTGM, https://ptgm.newa.cornell.

Figure 7. Carbohydrate balance at UMass Orchard. Note carbohydrate deficit was minimal during most of the chemical thinning window from app. May 15 through May 25.

fur application, all other trees received the standard UMass chemical thinner application(s), whatever that was. I won't bore you with all the details, you will have to wait for an upcoming jmcextman blog or *Fruit Notes* article, but suffice it to say, in the end, still too many apples at harvest. Too many.

edu/) closely, fully intending to apply lime sulfur to a block of Honeycrisp. Which I did. The result, it smoked the flower petals (see picture below) at a high rate! I was pleased. I was so pleased — and a bit scared! — that I did not follow-up with another application of lime sulfur, which is advised to get that last cohort of flowers, including lateral bloom, that was pollinated. Kind of a mistake, as although the lime sulfur spray at bloom definitely resulted in king fruit set only (mostly?), at the end there was still too many apples on these trees! Hand thinning followed in the summer. Note to self, don't be gun shy, follow the recommendation of the PTGM. Of course, if I do it again next year, and apply lime sulfur twice, I will probably strip the trees. (Would not be the first time, see below.) So, who out there is willing to give bloom thinning with caustic thinners a go in 2020?

Malusim app and the fruitlet growth rate model. I used the Malusim app (https://malusim.org/) in its first year of general release to help measure apple fruitlets and predict fruit set (using the fruitlet growth rate model.) Four varieties — Pazazz, Gala, Fuji, and Honeycrisp. Two sets of trees — five trees per variety, five (only) flower clusters per tree. Only 25 flower clusters per variety. Suppose to do 75. (Trying to see how little I can get away with, yup, I'm lazy, I'll admit it. The result, well, interesting. Seems like things were pretty much on track, with the exception of the lime sulfur application, all other trees received the standard UMass chemical thinner application(s), whatever that was. I won't bore you with all the details, you will have to wait for an upcoming jmcextman blog or *Fruit Notes* article, but suffice it to say, in the end, still too many apples at harvest. Too many.

Yes, you can, strip trees of apples that is. Using ethephon. And 6-BA. And Vydate. Yup, I did it, Golden Delicious, really sick of hand thinning in the past, so a tank mix of above did it. And fruits were about 1-inch diameter! Bottom two-thirds of trees, all apples fell off beginning about a week after application. Interestingly, top one-third of trees had a nicely thinned crop. Shows you where the spray hits and where spurs are weaker (more shaded). Also, there was a pretty good carbohydrate deficit around application. Good thing I don't make a living doing this.

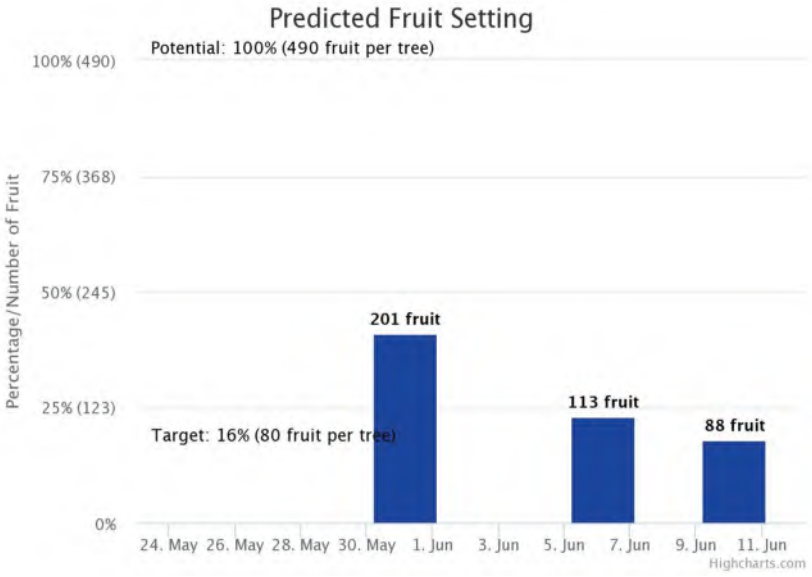

Figure 9. Malusim app output for Gala at the UMass Orchard. Although it appeared the target was being approached, in the end at harvest there were still too many apples on these trees to achieve optimum fruit sizes and profitability.

Figure 8. Honeycrisp flowers on May 17, 2019 after application of 4% lime-sulfur.

Multiple applications of ReTain, again using Duane Greene's recommendation, did a nice job of holding Honeycrisp on trees and they took on real nice color in October. (Wish I had taken a picture!) Anecdote from another PYO orchard confirms this approach. For more information: http://umassfruitnotes.com/v83n3/a1.pdf.

Small Fruit IPM

Winter Moth (WM). WM egg hatch occurred this year on or around April 10th in the Southeastern Counties of the state. Egg hatch was spread over a fairly long period of time due to cool temperatures, but populations were very low and little significant damage occurred. This is widely thought to be the result of Cyzenis albicans parasitoid releases from prior years. There was some evidence of WM migration to more westerly counties in the state in 2019 where they have not previously been thought to overwinter. Dr. Joe Elkinton is monitoring this migration and feels that it may be the result of hybridization with Bruce Spanworm rather than because of any climate change effects. There does not seem to be a reason to worry about this leading to WM outbreaks in either forest trees or fruit crops (blueberry or apple), but his lab is monitoring to verify that.

Gypsy Moth (GM). We have reported on this pest in past years when the drought in 2016 set off an outbreak of GM in 2017 and some residual pockets of high damage in 2018. The Small fruit crops that were most affected in those years were blueberries and grapes. In 2019 the state did not produce an aerial survey map of GM damage due, most likely, to low populations. There were some reports of light infestation on fruit farms but growers were aware of what to look for and control was easily accomplished.

Spotted Wing Drosophila (SWD). The UMass statewide monitoring network was not implemented in 2019. Instead, our efforts were focused on (1) field trials for monitoring and possibly mass trapping, (2) bait/lure evaluations, and (3) laboratory investigations of the feeding behavior and physiology of this invasive pest. Piñero et al (2019) reported on the high attractiveness of Concord grape juice, a low-cost and readily available material, to male and female SWD. When diluted at a ratio of 1 part of grape juice and three parts of water, diluted grape juice showed to be 3 times more attractive to male and female SWD than one commercial lure under field conditions. Grape juice diluted at the 1:3 ratio also attracted significantly fewer (about three times less) non-targets than the commercial lure, highlighting the greater selectivity of grape juice.

In 2019, we also compared the SWD-capture efficiency of traps baited with commercial lures against that of traps baited with diluted grape juice early in the season at five MA locations. Diluted grape juice was the only attractant that detected SWD during the month of May. During June, while commercial lures also attracted SWD, the numbers of SWD were greater in the diluted grape juice-baited traps. In addition, traps baited with diluted grape juice captured most (89%) of the females that were trapped over a 6-week period, highlighting the effectiveness of this inexpensive material for SWD monitoring. Cage studies revealed that nearly 90% of the SWD females that were released inside cages were killed by traps baited with diluted grape juice within a 24-hour period, whereas traps baited with commercial lures killed less than 50% of the females over a 24-hour period.

Spotted Lanternfly (SLF). No SLF reports in Massachusetts in 2019 (aside from 1 dead SLF found on imported ornamentals in Boston). On February 7th, 2019, and with support from the Massachusetts Department of Agricultural Resources, a Spotted Lanternfly Preparedness Conference was coordinated by UMass Extension. It was attended by over 240 people. We also did some grower outreach with educational materials and will continue these efforts in 2020.

Massachusetts IPM Berry Blasts/Healthy Fruit

Newsletter Small Fruit section. Fifteen issues of Massachusetts IPM Berry Blast (508 subscribers), were sent out during the 2019 growing season. These covered IPM recommendations for a wide range of pests and disease problems in berry crops. A condensed version of this information was also included in 16 issues of the Healthy Fruit newsletter (165 subscribers).

Special Projects

Northeast Cider Apple Project (NECAP). This 3-year project funded by NESARE is being led by the University of Vermont with collaborators from UMass and UMaine. At UMass, D. Cooley, J.C. Piñero, J. Clements, and E. Garofalo will evaluate at least five cider orchards throughout Massachusetts for insect and disease incidence on cider apples, and will also evaluate horticultural and fruit quality characteristics to develop fact sheets and recommendations for both established and new growers of cider apples. And video! https://www.youtube.com/channel/UCWrmWfBqbcK8FgjV-TuRT0Gw.

MyIPM app. This work continued by Cooley, Clements, and Garofalo on the MyIPM including adding pear insects, cherry insects, and updating apple and pear diseases. MyIPM is designed to provide mobile access to pest management information for many fruit crops with an emphasis on resistance management. For more information on the app: https://apps.bugwood.org/apps/myipmseries/

Publications

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Piñero, J.C. 2019. Regenerating Orchard IPM: Managing key apple pests with ecologically-based IPM approaches. *Proceedings of the 2019 Empire State Producers Expo,* Onondaga County Community College SRC Arena, Syracuse, NY, January 14-17, 2019.

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Zeng, Q., Cooley, D.R. and Schultes, N. 2019. Use of biological controls and sterilants as alternatives to streptomycin against fire blight blossom infections in apples. *Fruit Notes* 84 Summer 1-6.

Research/Extension grants received

Piñero, J.C., Wallingford, A., and collaborators. Multicultivar grafting: a novel low-cost, grower-friendly Attract-and-Kill approach to manage key apple pests in New England. NIFA Crop Protection and Pest Management program (9/1/19 – 8/31/2023). $324,246.

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