Massachusetts Fruit IPM Report, 2020

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Weather

Other than some late fall 2019 cold and an early December snowstorm, the winter of 2019-20 was characterized by mild temperatures and lack of snow. The minimum (at the UMass Orchard, Belchertown, MA) was 2.4 degrees F. on 15-February, 2020. Given the lack of snow cover and some early March warmth, spring 2020 seemed on the brink of being "early," but April turned cold after early green tip arrived on 1-April. Mid-April temperatures flirted with bud damaging lows, and in fact it is suspected some site-specific bud injury occurred during this time. Full bloom was about 16-May, and it was extended with cool May weather. May and June were fairly dry which was great for controlling scab but initiated drought conditions in MA. July was hot, very hot overall, with a maximum temperature of 94.2 on 19-July.

A quick analysis of 20 years of weather station data from the UMass Orchard makes it pretty clear July has been getting warmer over the period from 2001-2020. (Fig. 1) At the UMass Orchard July and August had 3.90 and 4.77 inches of rain respectively during thunderstorms, which ameliorated our drought situation somewhat. However, many other orchards in MA were extremely dry and without irrigation fruit size suffered, and with irrigation, growers and water supplies were run ragged. Hailstorms were out there this summer, and several orchards had extensive hail damage. Crop insurance is an essential risk management strategy these days. Finally, the weather was generally sunny late summer into early fall, and peach and apple quality was very good as a result.

The fall harvest season in particular was weather-benevolent, and customer turnout at PYO orchards and farm stands could not have been much better on account

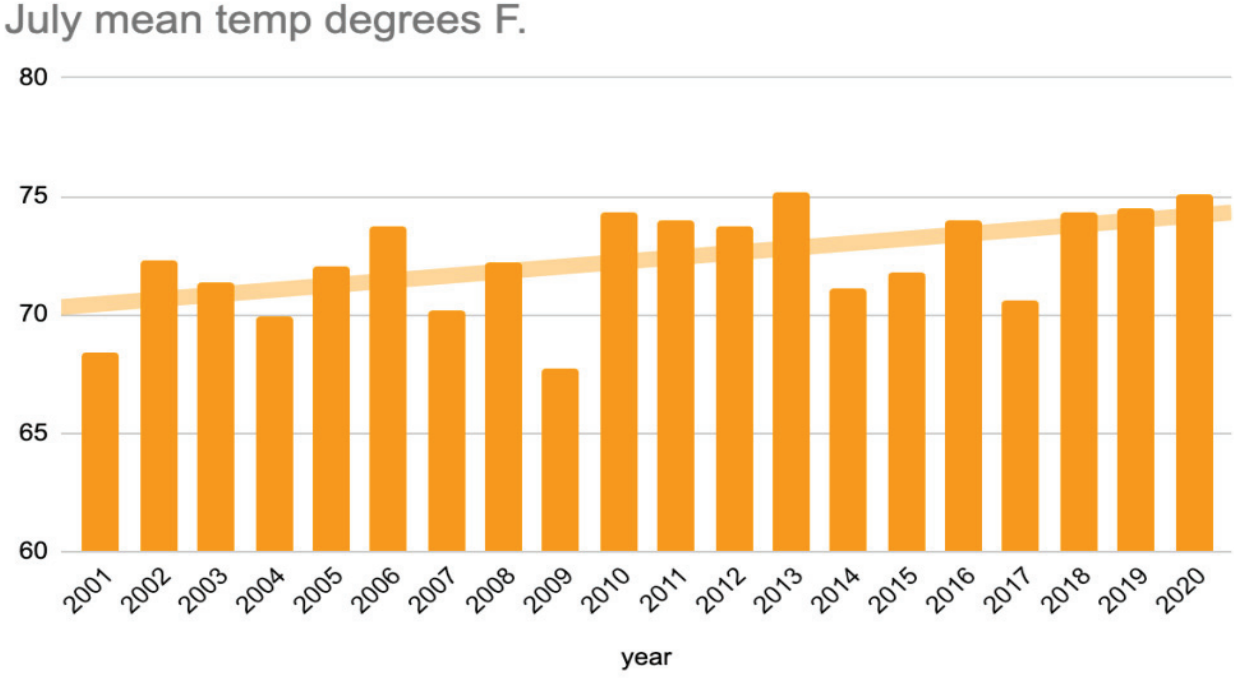

Figure 1. Mean July temperature 2001-2020 at the UMass Orchard Belchertown, MA. (https://orchardwatch.wordpress.com/2020/08/29/july-is-getting-hotter/

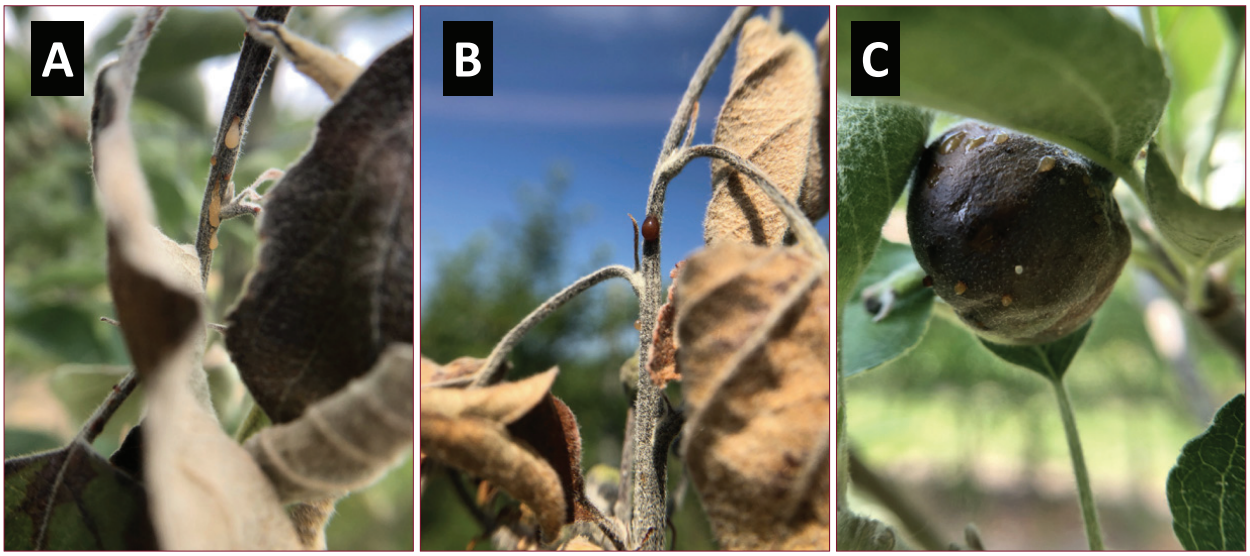

Figure 2. (A) Characteristic fireblight ooze on an infected apple shoot. This infection originated with a blossom infection resulting from late bloom time and. Streptomycin was applied to earlier blooming varieties but this late bloomer was missed, (B) advanced shoot blight with darker ooze droplets, (C) later in the season, fireblight persisted in the cider block and affected developing fruit as well as shoots.

of Covid-weary people wanting to get outside and enjoy a safe experience with their family. But growers had to adapt by adopting significant Covid-19 safety measures (at their expense) such as a customer reservation system, touchless payment, social distancing signage, requiring face masks, and hiring extra staff to manage the situation. Most growers will be extra glad to see the 2020 growing season come to a close, as whereas weather used to be the big worry item, they had an additional worry item with Covid-19 in 2020.

Diseases

Apple scab was largely a no-show as a result of the drought that eventually expanded to engulf the entire state. Final ascospores were observed in the petri plate assay and funnel trap on June 29, 2020. The cool temperatures heading into bloom led us to think we might slip through 2020 with no **fire blight**, but, sudden increases in temps throughout the region led to outbreaks in late blooming varieties. Suspect fire blight samples from five orchards throughout Massachusetts were submitted to Anna Wallis, PhD. student in Kerik Cox lab at Cornell University, for confirmation and streptomycin resistance testing. All were positive for fireblight and negative for resistance to streptomycin.

Sooty blotch (SB) and **flyspeck (FS)** became apparent in the harvest surveys in several blocks. For example, in two blocks located in a single MA orchard having cider apple cultivars, the incidence of SB and FS were 3.7 and 9.6%, respectively for block one, and 0% (SB) and 1.8% (FS) for the second block.

Marssonina leaf blotch continues to creep up in many orchards, cultivar and management practices significantly influence the severity of the disease. However, even in rigorously managed conventional orchards, the disease has been observed. The following photos (Figs. 3 and 4) all were taken in a low spray

Figure 3. Early Marssonina symptoms. On close inspection acervuli (tiny black fruiting fungal bodies) can be seen in the brown-purple spots. Photo taken in Amherst, MA October 9, 2020.

Figure 4. Enterprise (front of photo) versus GoldRush (behind) leaf drop.

organic orchard block (no fungicides this year).

Insects

In 2020, the two most damaging insect pests were **plum curculio (PC)** and **tarnished plant bug (TPB)**. Across 11 commercial orchards located in MA (7), NH (3), and ME (1), 10,560 fruits were inspected for insect injury at harvest. The average level of block-wide injury was 2.8% for PC and 2.6% for TPB. No PC research involving odor-baited trees was conducted this year. Therefore, the incidence of injury by PC being reported here occurred under standard grower management. As shown in Table 1 below, injury by internal Lepidoptera was very low. In 2019, low levels of fruit injury attributable to codling moth (CM), Oriental fruit moth (OFM) and obliquebanded leafrollers (OBLR) in Massachusetts were recorded: 0%, 0.15%, and 0.08%, respectively.

Plum curculio (PC). The timing of the petal fall insecticide spray is critical. 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

Table 1. Insect incidence at harvest in 10,560 apples, sampled from 11 orchards located in MA (7), NH (3), and ME (1).

	PC	Stink bug	TPB	AMF	PC feeding or other damage	Rollers	OFM	CM	EAS	San Jose scale
PERIMETER	4.28	0.17	1.76	0.31	0.11	0.09	0.06	0.20	0.01	0.11
INTERIOR	1.27	0.45	3.52	0.54	0.11	0.06	0.03	0.26	0.31	0.00
Whole orchard block	2.78	0.31	2.64	0.43	0.11	0.07	0.04	0.23	0.16	0.06

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. While both insecticides were equally effective at controlling PC, the timing of application led to higher levels of PC injury in those blocks, compared to other orchard blocks.

Monitoring for PC is key to successful management. A monitoring technique, based solely on observation of fresh PC injury on fruit from odor-baited trees, has proven effective and efficient 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.

Tarnished plant bug (TPB). Injury by this insect pest was recorded at each orchard where we conducted harvest surveys. This year, we initiated a project (led by UMass graduate student Ms. Prabina Regmi) aimed at evaluating plant volatiles for potential use in monitoring systems for TPB. *Findings will be presented in the next Fruit Notes issue.* Research will continue in 2021.

Apple maggot fly (AMF). 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. 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. *A full account of the results will be published in the next issue of Fruit Notes.*

Internal Lepidoptera. 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 three mating disruption (MD) and the three 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. *More detailed results will be published in the next issue of Fruit Notes.*

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

Brown Marmorated Stink Bug. 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.

San Jose scale was detected in only a couple of orchards, and the level of injury was low.

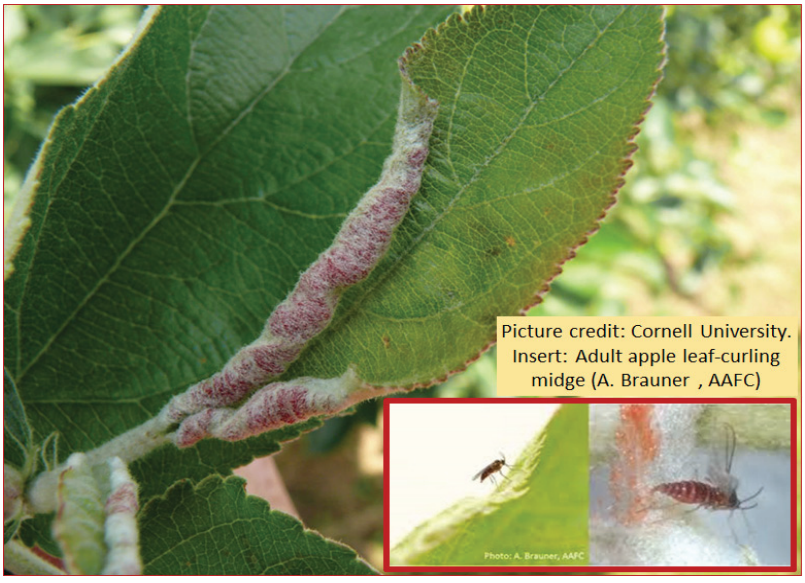

Figure 5. Injury by apple leaf midge and midge adults (insert).

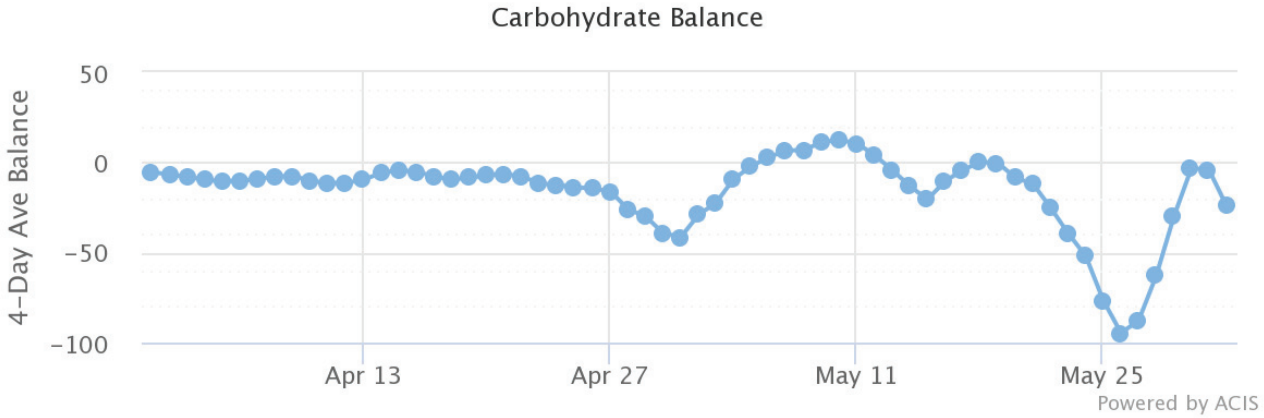

Figure 6. Carbohydrate balance at UMass Orchard culminating in a deficit of nearly 100 g/day on 26-May.

Injury by **European apple sawfly (EAS)** was recorded in a couple of orchards, at low levels.

Apple leaf curl midge. The apple leaf midge (also known as apple leaf curling midge and apple leaf gall midge) is an exotic foliar pest of apple trees. It was found in a few MA orchards. Minor injury potentially caused by this insect pest was suspected in one orchard.

Horticulture

Two things stand out in 2020. First, the weather, or should I say the carbohydrate deficit during the 10 mm apple fruitlet chemical thinning stage, and second, wind during Tropical Storm Isaias which wreaked havoc on some apple trees at the UMass Orchard.

2020 Thinning weather — suffice it to say a rather massive carbohydrate deficit on account of warm day and night temperatures and cloud cover made chemical thinning in 2020 rather dubious. More and more we encourage growers to thin aggressively using a "nibble" approach of multiple chemical thinning applications beginning at bloom. But still, the single best time to accomplish chemical thinning is when apple fruitlets are about 10 mm. This year, a large carbohydrate deficit occurred about this time, culminating in a 4-day average carbohydrate balance of -95 on 26-May. (Fig. 6) This is a huge deficit and could easily result in over-thinning if a chemical thinner was applied. The deficit was short-lived, but there was much hollering by growers who did apply a chemical thinner just prior to this deficit. After the fact a resounding "oh my goodness, I think I thinned all my fruit off!" was heard. We have not experienced this situation in several years. Some varieties did turn out light, however, later blooming apples had a nice crop. Mac type apples were generally good, but Honeycrisp turned out rather light across the board. Lesson learned? Pay attention to the carbohydrate deficit during that time period when apple fruitlets are about 10 mm, adjust your chemical thinning response (time, rate, combinations) accordingly, and direct 2/3 of the thinning spray in the tops of trees (always).

Wind and G.41 are a mismatch — Tropical storm Isaias blasted through the Hudson Valley of NY on 04-August with heavy rain there, but ALL we got at the UMass Orchard in Belchertown was WIND, with a recorded on-site gust of 50 mph. ALL was enough to break off many (100 or so, I did not count exactly, it was too depressing) young apple trees at the Orchard. The consistent factor was all the broken apple trees were on G.41 rootstock, they were snapped right off at the graft union. (Fig. 7) It appeared to me that this was a result of several factors: moderate-heavy crop loads, long branches, and a marginal support system with failure to fully keep the trees from twisting or moving too much from vertical along with what is commonly known as a weak graft union when mated with G.41 rootstock. Some varieties, but not all are known, may exacerbate the problem. Young trees are also more prone to breakage. Lesson learned? Apple trees planted on G.41 rootstock cannot be allowed to twist or rock in the wind, period. Keep branches short. Build a proper support system. Use extra fasteners (or wires) when attaching trees to wire. G.41 is a good rootstock because it is fire blight resistant, but it has this one fatal flaw that needs extra attention if planting an apple orchard on this rootstock. I have a YouTube video here if you

Figure 7. Apple tree on G.41 rootstock snapped right off at the graft union in high wind.

want to see the carnage up-front and personal: https://youtu.be/XLXvrBFY6H4.

Small Fruit IPM

Winter Moth (WM). Based on the success of biocontrols of Winter Moth in recent years and the resulting lower population levels, we did not directly monitor WM in 2020. Information on WM emergence predictions based on observations in RI and on Degree Day models were disseminated in the IPM Berry Blast and Healthy Fruit Newsletters early in the season.

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.

Spotted Wing Drosophila. In 2020, we continued to emphasize to implement the 1-2-3 IPM approach to spotted wing Drosophila (SWD) management. The three components are (1) monitoring, (2) cultural control methods, and (3) insecticide sprays. In 2020, 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. Diluted grape juice was used to monitor SWD for the entire season. The season-long pattern of SWD captured by diluted grape juice is presented in Fig. 8, below. *The results of this study are presented in the next article of this Fruit Notes issue.*

Massachusetts IPM Berry Blasts/Healthy Fruit Newsletter Small Fruit section. Nineteen issues of Massachusetts IPM Berry Blast (515 subscribers), were sent out during the 2020 growing season. These covered IPM recommendations for a wide range of pests and disease problems in berry crops. A con-

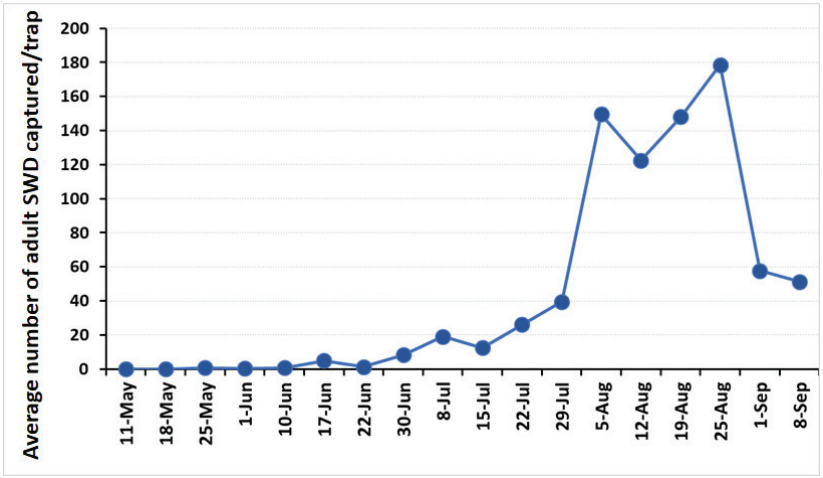

Figure 8. Season-long captures of adult spotted wing drosophila in traps baited with diluted concord grape juice (n= 4 orchards).

densed version of this information was also included in 20 issues of the Healthy Fruit newsletter (165 subscribers).

Special Projects

NEW Fruit IPM Fact Sheets and Videos! We have revamped the **Fruit IPM Fact Sheet series** (apple, blueberry, strawberry). If you are reading a PDF copy of this report, then the Fact Sheets are available (https://ag.umass.edu/fruit/fact-sheets). Otherwise, you can Google "UMass Fruit IPM Fact Sheets". Educational **videos** relating to fruit production and pest management are available (https://www.youtube.com/channel/UCKCU0_6fvuSPLtWvsmDhfwg/videos?view=0&sort=p&flow=grid) or Google "UMass Extension fruit program YouTube channel".

Northeast Cider Apple Project (NECAP) -- Beginning in Fall 2019, this 3-year Project funded by NESARE is led by University of Vermont with collaborators from UMass and UMaine. At UMass Cooley, Pinero, Clements, and Garofalo are evaluating at least five cider orchards throughout Massachusetts for insect and disease incidence on cider apples. We are also evaluating horticultural and fruit quality characteristics to develop fact sheets and recommendations for both established and new growers of cider apples (https://www.youtube.com/channel/UCWrmWfBqbcK8FgjVTuRT0Gw).

MyIPM app -- 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/

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Research and Extension Grants

Supporting IPM on diverse Massachusetts farms through the integration of applied research and Extension. 09/01/2017 - 08/31/2021. USDA NIFA Award Number 2017-7006-27137. H. Sandler (PI) and J. Clements (Co-PI). $1,156,009.00.

Cooley, D. R. and J. M. Clements. Using Computer Vision to Improve Data Input for Precision Thinning Models in Apples. USDA/NIFA and NSF CPS: Medium: Collaborative Research. 6/1/2020 – 5/31/2023. $430,762. In collaboration with Carnegie Mellon University. Total Award both Institutions $1,100,000.

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