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Editors: Winfred P. Cowgill, Jr. & Jaime C. Piñero

The New Jersey State Horticultural Society was organized on August 17, 1875 at Geological Hall, Rutgers College, New Brunswick, NJ. It remains the oldest Horticultural organization in New Jersey.

Horticultural News began as the *The New Jersey State Horticultural Society News*, in October of 1920. The Society began "collecting paid membership in order to obtain funds to promote new features of the society and extend the usefulness of the society. The Horticultural Society News was started to be the official society publication." Published M. A. Blake, Professor at Rutgers College was the first president and chair of the publication committee.

Editors served as follows:

MA Blake	1920 - 1947
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June 2010: Horticultural News has moved to an online web-based format. The New Jersey State Horticultural Society has partnered with the University of Massachusetts Fruit Notes.

October 2021: Jaime Piñero became the editor from UMass upon the reitrement of Wes Autio. Cowgill and Piñero are the new editors of Horticultural News and Fruit Notes.

Horticultural News is distributed to growers, extension personnel and researchers and libraries across North America. Horticultural News focuses primarily on tree-fruit culture, but addresses small-fruit cultural issues as well. Most reports are from current research at Rutgers University, University of Massachusetts, and other universities.

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Cover: Cover: Cortland Apple Block/M.26- Southern Vermont Orchard in bloom- Bennington, VT. Photo Credit- Win Cowgilll

Influence of Naphthaleneacetic Acid (NAA) and Abscisic Acid (ABA) on the Development of Bitter Pit on Honeycrisp Apples.

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Bitter pit is a physiological disorder that affects many apple cultivars. It is characterized by dark circular lesions that develop just below the skin surface of an afflicted apple. Honeycrisp is one of the most susceptible apple cultivars grown in the United States. Thus, economic losses due to this disorder can be great. There are management strategies that are presently used to help reduce the losses due to bitter pit. These include the use of calcium sprays throughout the summer, careful control of vegetative growth by judicious use of fertilizer, especially nitrogen, and less aggressive dormant pruning. The use of these preventatives' practices can be helpful, but in many years fruit losses due to bitter pit may be unacceptably high. Recent reports by Todd Einhorn and other scientists at Michigan State University have shown that post-bloom applications of naphthaleneacetic acid and abscisic acid (ABA, Protone) could reduce the incidence of bitter pit on Honeycrisp apples. This investigation was undertaken to determine if multiple post-bloom applications of NAA, ABA, or the combinations of NAA and ABA on Honeycrisp apples growing in Massachusetts could reduce the incidence of bitter pit at harvest and/or following regular air storage.

Materials and Methods

A block of mature Honeycrisp/M.9 apples was selected at the University of Massachusetts Cold Spring Orchard. Trees in this block have consistently had a high level of bitter pit at harvest. Trees in this block were selected and treatments were assigned after a severe frost occurred on the night of May 18 when fruit size averaged about 5 mm. Due to fruit damage, the decision was made to apply no thinners. Even if we did decide to thin, what to put in the spray tank would have been a guess. Tree rows ran down a slight slope and damage to fruit became progressively more severe going from the top of the row to the bottom. Replications were established by tree position in the row to ensure that all trees had similar cold damage. There were six replications and four treatments: an untreated control, NAA at 10 ppm, ABA at 100 ppm, and a treatment with both 10 ppm NAA and 100 ppm ABA that were applied together in the same spray tank.

Regulaid surfactant at 1 pt/100 gal. was included in the ABA sprays. Treatments were applied at a tree row volume dilute rate of 100 gal/acre at 30, 44 and 60 days after bloom. There was a guard tree on each side of the treatment trees. Fruit set was surprisingly good, making hand thinning necessary. No drop control compounds were used in this block in 2023.

High temperature during the first two weeks of September did not permit development of good, characteristic red color. The first Honeycrisp harvest was made on September 8, and it was based primarily on the starch rating (Table 2.). The second harvest was made on September 13. Good red color still had not developed. However, since there were no drop control chemicals on these trees and hot weather was forecast to continue, we decided to make the second and last harvest on that date. All remaining harvestable fruit were harvested at that time. In total, about 125 fruits were harvested from each tree and evaluated for bitter pit. During the first part of each harvest day, fruit quality assessment was assessed to document fruit maturity at each harvest date. This was followed later in the day by harvesting fruit to evaluate for bitter pit.

All fruits were evaluated for bitter pit in three different ways. First, fruits were rated for bitter pit using a 0 to 3 scale (0= no bitter pit, 1=low, 2=moderate and 3=high amount of bitter pit). Bitter pit was also quantified by counting the number of pits present on each apple and recording that number. The third method to quantify bitter pit was by expressing the percentage of fruit evaluated that had bitter pit. Following bitter pit evaluation at harvest, fruits were kept at room temperature for five days and then they were placed in regular air storage at 32° F for 12 weeks. Fruits judged to have bitter pit were eliminated. Following the cold storage period, fruits were removed and evaluated for bitter pit again, similar to the evaluation done at harvest.

Results

The incidence of bitter pit in harvested fruit is shown in Table 1. When the incidence of bitter pit on fruit harvested is expressed as the percentage of fruit with bitter pit, only fruit that received both NAA and ABA had less bitter pit. This was true for both fruit evaluated at harvest and fruit that were evaluated following 12 weeks in cold storage. When bitter pit was quantified either by using a rating system or by counting the actual number of pits on a fruit, there were no statistical differences among treatments. Fruit quality was evaluated on each harvest date. Red color was not evaluated because of the very warm temperatures leading up to and through the first two weeks in September which was substantially high that typical color did not develop. Starch rating (which was taken) and ground color (not taken) were in the range that we considered fruit ready for as part of a normal commercial harvest.

Although soft scald was not rated, the incidence of

Table 1. Influence of post-bloom applications of naphthaleneacetic acid (NAA) and abscisic acid (ABA) to Honeycrisp/M.9 apples on the amount and severity of bitter pit at harvest and following 3 months of air storage at 32˚F. Belchertown, MA, in 2023.

Treatment[1]	Fruit with bitter pit (%)		Pits per fruit (No.)		Bitter pit rating (0-3)	
	Harvest	Storage	Harvest	Storage	Harvest	Storage
Control	11.1 a	24.7 ab	9.5 a	12.7 a	1.8 a	2.1 a
NAA	10.2 ab	24.5 ab	11.7 a	14.5 a	1.9 a	2.1 a
ABA	8.3 ab	28.7 a	11.8 a	13.1 a	2.2 a	2.1 a
NAA + ABA	5.0 b	11.5 b	8.0 a	13.3 a	1.8 a	1.9 a
Significance						
NAA	NS	NS	NS	NS	NS	NS
ABA	NS	NS	NS	NS	NS	NS
NAA x ABA	*	*	NS	NS	NS	NS

[1]Treatments were applied as a dilute TRV spray at 30, 44 and 60 days after bloom.
*= Statistical differences among treatments were detected at odds 19:1.
NS= Non-significant differences among treatments.

Table 2. Apple maturity parameter at harvest of Honeycrisp/M.9 apples treated with post-bloom spray applications of naphthaleneacetic acid (NAA) and abscisic acid (ABA). Belchertown, MA in 2023.

Treatment[1]	Fruit weight (g)	Flesh firmness (lb)	Soluble solids (%)	Starch rating (1-8)
		------------ Harvest 1 - September 8 ------------		
Control	203	14.1	11.1	5.9
NAA	203	14.4	11.1	6.2
ABA	204	14.6	10.9	6.3
NAA + ABA	200	14.4	10.6	6.2
Significance	NS	NS	NS	NS
		------------ Harvest 2 - September 13 ------------		
Control	216	13.7	10.8	6.0
NAA	219	13.5	10.7	6.5
ABA	218	13.9	10.8	6.1
NAA + ABA	213	13.4	10.7	6.6
Significance	NS	NS	NS	NS

[1]Treatments were applied as a dilute TRV spray at 30, 44 and 60 days after bloom.

this storage disorder was minimal. We surmise that the five-day pretreatment at room temperature prior to placing the fruit into cold storage was sufficient and essentially eliminated fruit losses due to this disorder.

Discussion

The incidence of bitter pit in Massachusetts apple orchards in the 2023 growing season was uncharacteristically low. The reason for this is unclear, although the severity of bitter pit does vary from year to year. The 2023 growing season was abnormally wet with record amounts of rain falling during the season which favored root growth. With abundant soil moisture, we suggest that roots were able to grow into and explore a larger volume of soil; thus, they were able to absorb more calcium from a larger volume of soil.

Bitter pit was quantified using three different methods: percentage of the harvested fruit that had or developed bitter pit, the average number of pits on affected fruit, or by a severity rating system. Only fruit that received three sprays of NAA and ABA showed a reduction in the incidence of bitter pit at harvest and following storage. However, this was true only when bitter pit severity was expressed as percent of fruit with bitter pit but not when severity was expressed as either the number of pits per fruit or when expressed as a severity rating.

It is legitimate to ask if the reduction in bitter pit is real since only one of the methods of assessing bitter pit severity was significant. Only one rate of NAA and ABA was used. Since a standard curve was not run prior to doing the experiment, we cannot say for certain that the best rates for NAA and ABA were selected. Furthermore, one can ask if both NAA and ABA are required to get the maximum response, as suggested from these data? Other questions that need to be answered are whether there are additional benefits of applying these growth regulators at this stage of fruit development. Since flower bud formation in Honeycrisp occurs relatively early, are these sprays applied early enough to enhance flower bud formation?

Effective Monitoring Tools for Tortricid Moths in Apple Orchards

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Commercial apple orchards in eastern North America face persistent threats from various insect pests, particularly those belonging to the Tortricidae family. Common pests include the codling moth (*Cydia pomonella*) (CM), oriental fruit moth (*Grapholita molesta*) (OFM), redbanded leafroller (*Argyrotaenia velutinana*) (RBLR), and obliquebanded leafroller (*Choristoneura rosaceana*) (OBLR) (Figure 1). Tortricid moth larvae are particularly destructive, feeding on leaves, shoots, buds, and fruits. Most tortricid larvae feed on the fruit epidermis, causing deep gouges or tunneling to the core, leaving behind frass on the fruit's surface. Codling moth larvae are notorious for tunneling into the core to feed on seeds, while leafrollers use silk to curl leaves as a defense mechanism against predators and insecticides. The number of generations per year varies across populations due to factors like latitude and weather, resulting in damage throughout the growing season.

Figure 1: Pictures showing OFM (A) (Source: Giligan and Epstein), CM (B) (Source: growing produce.com), RBLR (C) (Source: Jerry Armstrong) and OBLR (D) (Source: Mark Dreiling)

Sex pheromone lures in traps are used to monitor seasonal populations of CM, OFM, RBLR and OBLR in conventional and mating disruption orchards. Monitoring female moth populations is crucial for refining predictive models and establishing precise action thresholds. Augmenting sex pheromone lures with plant volatiles, or kairomones, has shown promise in enhancing moth monitoring and mating disruption systems.

Tortricid moth dynamics in Massachusetts orchards

The line graph (Figure 2) illustrates four years of tortricid moth capture data (2020, 2021, 2022, and 2023) collected across nine orchards in Massachusetts. Among the three moth species studied, OFM exhibited the earliest emergence around last week of April, with its first peak occurring around the second week of May, followed by two subsequent peaks throughout the season. Optimal deployment of OFM pheromone traps (Figure 3) is recommended around mid-April, coinciding with the silver tip or half-inch stage of apple bud development. Following OFM, CM emerged as the second moth species, with initial captures observed during the first to second week of May, maintaining consistent captures throughout the season. This pattern is likely due to the synchronous emergence of the overwintering generation in spring, followed by one to two slightly overlapping emergence peaks later in the season. The CM moth's life cycle is known to be influenced by temperature and day

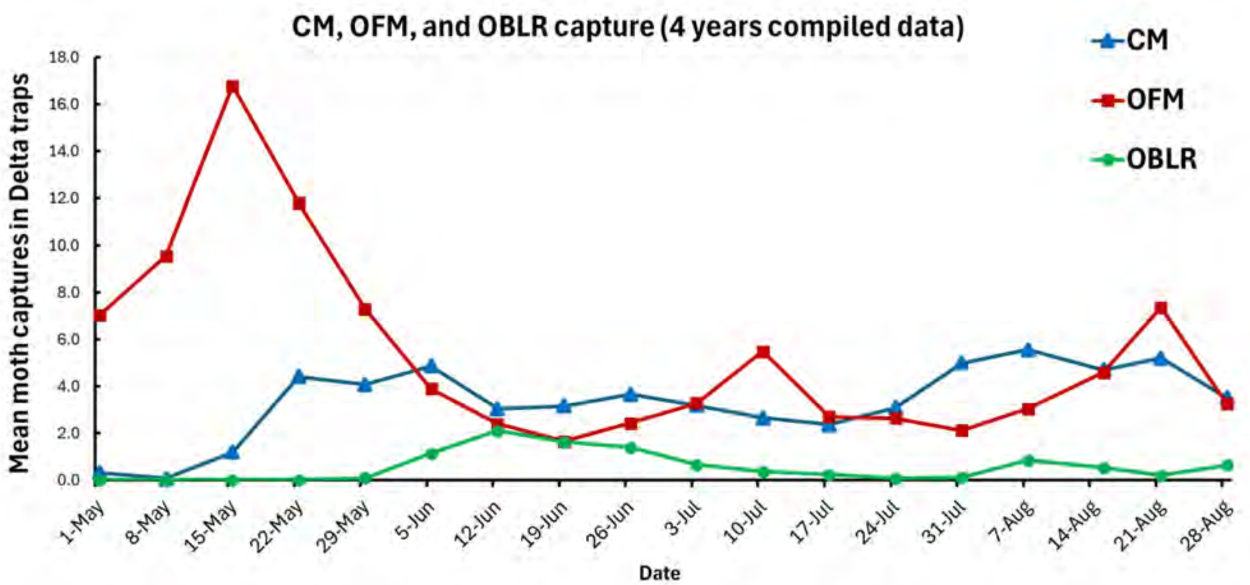


Figure 2: Population dynamics of three moth species (CM, OFM and OBLR) collected and averaged over a span of four years using delta traps deployed across nine orchards in Massachusetts.

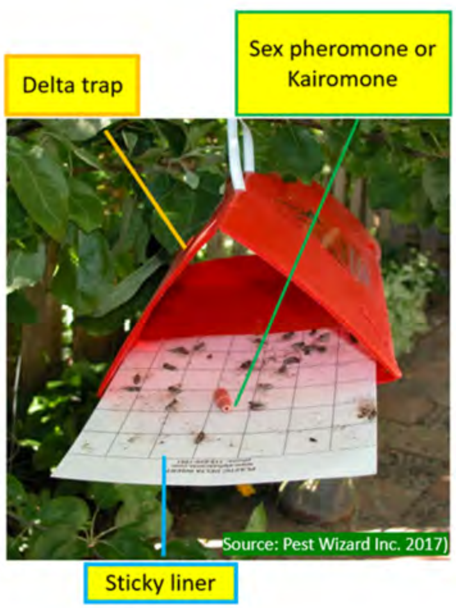


Figure 3: Delta trap baited with lure and sticky liner.

length, resulting in diverse emergence patterns. The third species to emerge was OBLR, with trap captures typically observed at the end of May. However, trap captures of OBLR remained low across all orchards, with some orchards reporting no captures. For effective monitoring of CM and OBLR populations, deploying pheromone traps during the last week of April, coinciding with the half-inch green to tight cluster stage of apple bud development, is recommended.

Commercially available lures for codling moth, Oriental fruit moth, and oblique-banded leafroller

Numerous commercially available lures serve as effective tools for monitoring populations of CM, OFM, OBLR, and other moth species. These lures primarily utilize sex pheromones to attract male moths from the targeted populations. However, enhancing female moth captures can be achieved by incorporating plant volatiles or kairomones alongside the sex pheromones. For instance, traps baited with CM sex pheromone can be augmented with pear ester (ethyl (E,Z)-2,4-decadienoate) and acetic acid, resulting in increased attraction of female CM (Knight et al., 2019). Moreover, a synergistic blend of plant volatiles, known as "Megalure CM 4K dual," has been developed, which, even without sex pheromones, can effectively lure females of both CM and OFM.

Table 1 provides a comprehensive list of commercially available lures designed for monitoring CM, OFM, and OBLR populations. These lures typically utilize a rubber septum as the standard method for dispensing the sex pheromone, offering a longevity of 4 to 6 weeks in the field. Alternatively, a gray halo butyl rubber septum, referred to as OFM L2 or CM L2 in trade names, can extend this longevity to up to 8 weeks. Notably, Trécé has recently introduced a proprietary

PVC matrix as a delivery medium, capable of sustaining the release of sex pheromones or kairomones for up to 12 weeks in field conditions. Combo lures, commonly packaged with two components—sex pheromone and a kairomone—typically feature the sex pheromone loaded in either a rubber septum or PVC matrix, while the kairomone is housed in a membrane cup.

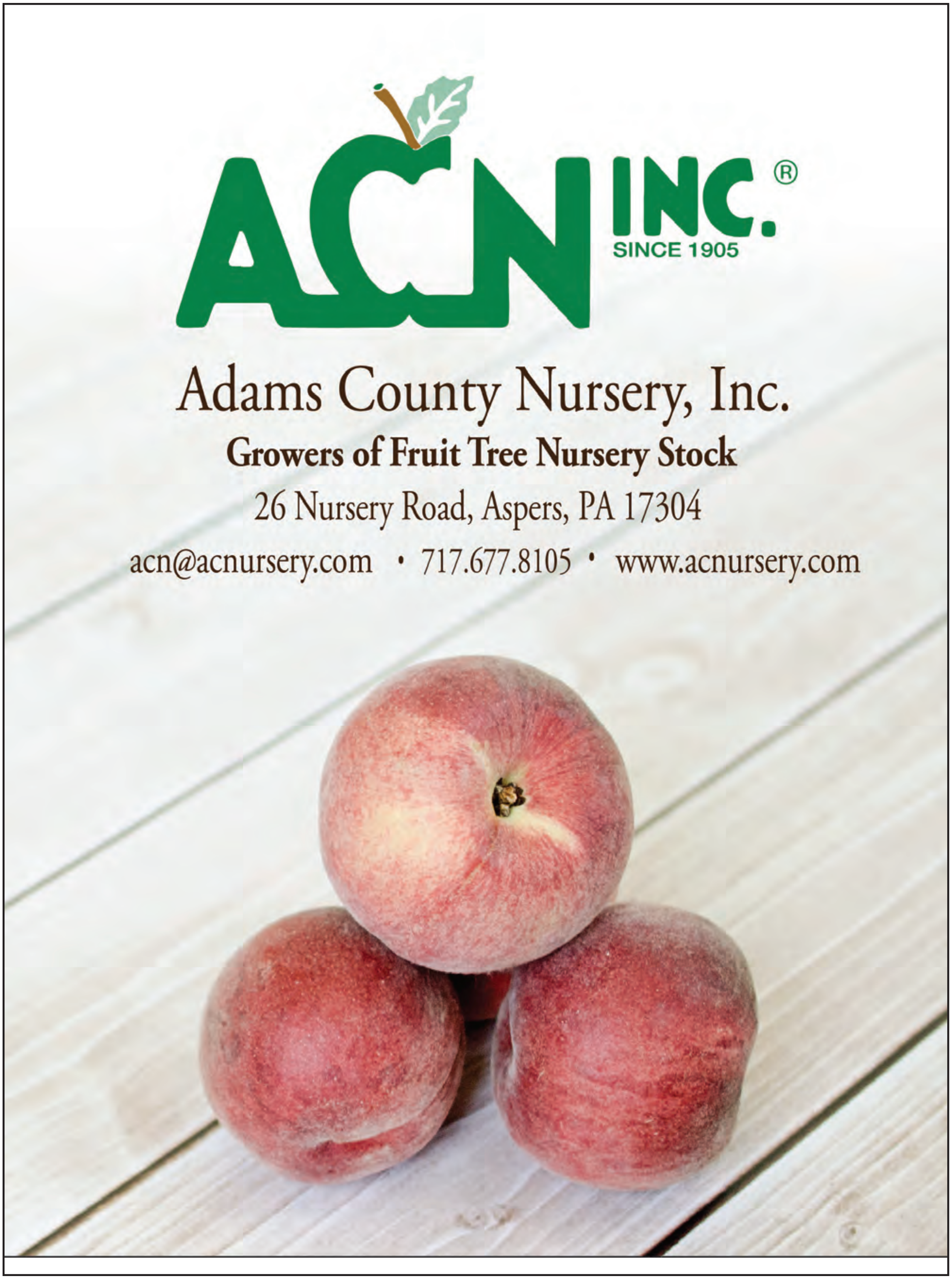
Acknowledgements

We thank all the participating apple growers for allowing us to conduct study in their orchard. Thanks to Heriberto Godoy-Hernandez, Prabina Regmi, Matthew Bley, Mateo Rull Garza, Jaelyn Kassoy and Hayat Junejo for providing field support.

Table 1: List of lures for monitoring selected tortricid moths.

Moth species	Trade name	Attractant type	Replacement	Notes	Pictures
Oriental fruit moth	Trécé Pherocon OFM lure	Male only	4 weeks	Red rubber septa	
	Trécé Pherocon OFM L2 lure	Male only	8 weeks	Gray halo butyl rubber. L2 stands for long lasting. Can be loaded with higher rate of pheromone.	
	Trécé Pherocon OFM Combo Dual	Male and female	8 weeks	Comes with kairomone combo in a peelable membrane cup.	
	Scentry OFM lure	Male only	4-6 weeks	Black rubber septa	
Codling moth	Trécé Pherocon CM Standard 1X	Male only	4 weeks	Red rubber septa for standard monitoring	
	Trécé Pherocon CM Standard 10X	Male only	2-3 weeks	10X higher dose than standard for use in mating disrupted orchard	
	Trécé Pherocon CM L2	Male only	8 weeks	Gray halo butyl rubber. L2 stands for long lasting. Can be loaded with higher rate of pheromone.	
	Trécé Pherocon CM L2-P	Male only	12 weeks	Pheromone loaded in PVC material. L2 stands for Long lasting, and P stands for PVC.	
	Trécé Pherocon CMDA Combo-P	Male and Female.	12 weeks	The DA in CMDA is pear ester (a plant volatile/kairomone). The combo is Acetic acid (AA).	
	Trécé Pherocon CMDA Combo-S	Male and Female.	8 weeks	The DA in CMDA is pear ester (a plant volatile/kairomone). The combo is Acetic acid (AA). S stands for Rubber Septa.	
	Trécé Pherocon Megalure CM Dual 4K	Male and Female.	8 weeks	4K stands for 4 different Kairomones. Studies carried out in Massachusetts also showed its attraction to both sex of OFM.	
	Scentry CM Lure	Male only	4-6 weeks	Red rubber septa for standard monitoring	
Oblique banded leafroller	Trécé Pherocon OBLR lure	Male only	4 weeks	Red rubber septa. Due to overlapping of sex pheromone component in OBLR and RBLR, trap baited with OBLR lure can also attract significant number of RBLR.	
	Scentry OBLR lure	Male only	4-6 weeks	Red rubber septa. Also attractive to RBLR.	

Note: Information generated from Trécé Inc. and Scentry Biologicals Inc.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Challenges and Successes in the Management of Three Key Insect Pests of Highbush Blueberries in New Jersey

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Highbush blueberry, *Vaccinium corymbosum* L., production in New Jersey (USA) is predominantly in the southern portion of the state, in an area referred to as the Pinelands or Pine Barrens. New Jersey highbush blueberry production brings in an estimated $85 million annually for the state and it is ranked regularly among the top six producers in the United States (NASS 2019). Of the approximately 16 insect pests of highbush blueberries in New Jersey (Figure 1), plum curculio (*Conotrachelus nenuphar* (Herbst)), aphids (multiple species), and spotted-wing drosophila (SWD, *Drosophila suzukii* (Matsumura)) are of important concern. These insect pests are present from late flowering (plum curculio and aphids), during fruit maturity (plum curculio, aphids, and SWD), and at harvest (SWD) (Figure 1). Both plum curculio and SWD directly damage the fruit (Tewari et al. 2014; Michel et al. 2015), whereas aphids act as vectors of viruses such as blueberry scorch virus (Morimoto and Ramsdell 1985; Martin and Tzanetakis 2018). As a result, there is little-to-no tolerance for these insect pests in blueberries.

Integrated pest management (IPM) strategies for these insect pests have their own unique challenges. Currently management for all three is reliant on insecticide applications (Van Timmeren and Isaacs 2013; Tewari et al. 2014; Rodriguez-Saona et al. 2019). Here, we describe the biology, damage, and management strategies for plum curculio, aphids, and SWD, and identify challenges and successes associated with their control.

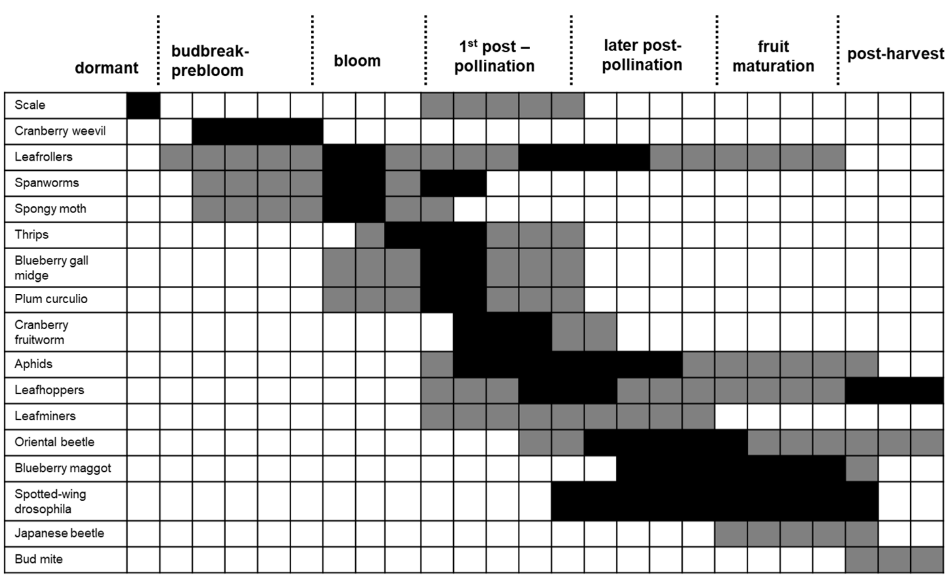

Figure 1. Seasonal activity period of blueberry insect and mite pests in New Jersey. Bars show period when scouting (grey color) and management (black color) of the pest is most important.

Plum curculio

Biology. Plum curculio, *C. nenuphar* (Figure 2), is a native pest of blueberries in North America (Chapman 1938; Lampasona et al. 2020). It is predominantly univoltine (Chapman 1938),

Figure 2. Plum curculio adult and oviposition scar (Photo Credit: Dean Polk).

although some mid-Atlantic states exhibit evidence of multivoltine populations (Leskey 2008). In New Jersey, adults overwinter in leaf litter and become active in April–May when they move to blueberry fields and mate. Peak activity is typically observed at the end of flowering and beginning of fruit set. Females lay eggs on the fruit and create a crescent-shaped scar at the oviposition site. One larva develops inside the fruit until they are ready to pupate at which time they drop to the soil and emerge as adults in July and August (Crandall 1905; Lampasona et al. 2020). Newly emerged adults may feed on mature fruit before moving to overwintering sites.

Damage. Adults feed on both the flowers and developing fruits (immediately following petal fall). Fruit damage is both cosmetic when the adult female oviposits and leaves a scar (Figure 2), as well as internal as the larvae feed inside the fruit. The larval feeding also causes fruit to develop prematurely and drop to the ground (Antonelli et al. 1992). In early-maturing varieties, fruit may be harvested prior to drop and result in rejections as there is a zero-tolerance for plum curculio in blueberries.

Management. Insecticides targeting the adults are applied as soon as commercial honeybees have been moved off blueberries. In New Jersey, the primary insecticides recommended for plum curculio control in blueberries are indoxacarb (Avaunt®) or phosmet (Imidan®) (Besançon et al. 2022).

Challenges and Successes in Management. Plum curculio can be challenging to manage because it is active during bloom when insecticides are not possible because of the presence of honeybees (Deutsch and Guédot 2018). This is especially a challenge in early maturing varieties.

Behavioral and biological control alternatives have recently been tested to target the adult and immature stages of plum curculio, respectively. An odor-baited "trap bush" approach has been evaluated to aggregate plum curculio adult injury (Rodriguez-Saona et al. 2019). This approach consists of using attractive baits such as the aggregation pheromone grandisoic acid and benzaldehyde to lure plum curculio adults to specific sections of the field (i.e., bushes along the perimeter) and then apply control measures only to these sections. Thus, under this "trap bush" approach, insecticides could be targeted only at a few (perimeter-row) bushes within fields rather than entire fields.

Entomopathogenic nematodes (EPNs) are a group of nematodes that cause death to insects and infect many types of insects living in the soil. In addition to broad infection, they are found in diverse habitats and can be readily used in blueberry fields. Four commercially available EPNs were recently tested against plum curculio: *Steinernema feltiae*, *S. carpacapsae*, *S. riobrave*, and *S. scarabaei* at a rate of 50 infected juveniles (IJs)/cm^2. Emergence traps baited with plum curculio infested berries indicated that *S. riobrave* was the most successful at reducing adult emergence and that it was able to persist in the soil for 21 days in the field (Sousa et al. 2021). Further testing of *S. riobrave* at a high rate of 50 IJs/cm^2 and low rate of 25 IJs/cm^2 demonstrated significant reduction from an untreated control and similar rates of suppression (Sousa et al. 2021). Future studies will evaluate the persistence and efficacy of *S. riobrave* against plum curculio in commercial blueberry farms.

Aphids

Biology. Adult aphids (Figure 3) are about 2 mm in length and, for species attacking blueberries, range in color from light to dark green. Nymphs are similar in color and appearance to adults but are smaller in size and wingless. Several aphid species attack highbush blueberries in New Jersey, including *Illinoia azaleae* (Mason), *Aphis fabae* Scopoli, *Ericaphis fimbriata* (Richards), and *Myzus persicae* (Sulzer), with *I. azaleae* being the most abundant. Aphids generally overwinter as eggs that hatch in the spring and populations begin to build in June. Immature aphids feed using a stylet (piercing-sucking mouthparts) on new growth, often on the undersides of leaves at the top or bottom of blueberry bushes. Adults reproduce through parthenogenesis for most of the growing season where females produce offspring clonally. In the fall, males and egg-

Figure 3. Aphids on a blueberry leaf (Photo Credit: Dean Polk).

laying females are produced. Aphids have multiple generations each growing season.

Damage. Aphids excrete a sugary liquid, called honeydew, that can form a sticky layer on leaves. This can promote the development of sooty mold when there are high levels of aphid populations. This is, however, a minor concern for blueberry growers because aphid populations are generally controlled so as not to reach high levels. A primary concern is the ability of aphids to act as vectors of viruses, such as the blueberry scorch virus (Schloemann and Piñero 2020).

Management. Aphids can appear during bloom, but insecticide application should not occur until after honeybees are removed (Schloemann and Piñero 2020). In New Jersey, treatment is recommended if greater than 10% of terminals are infested with live aphids. Insecticides typically used for aphid control in blueberries are predominantly neonicotinoids, such as acetamiprid (Assail®), imidacloprid (Admire® Pro), and thiamethoxam (Actara®) (Besançon et al. 2022).

Challenges and Successes in Management. There are concerns on the use of neonicotinoids because of the possibility of non-target effects (Hladik et al. 2018), causing restrictions on their usage. New insecticides with different modes of action have been registered in blueberries including: Movento® (spirotetramat), Sivanto® (flupyradifurone), and Senstar® (pyriproxyfen + spirotetramat). These new insecticides were tested alongside Assail® (acetamiprid) as well as an untreated control. Aphid mortality after 5 days of exposure to these insecticides indicated significant reductions in live aphids (Rodriguez-Saona and Holdcraft 2022). Limited commercial use has shown that spirotetramat and flupyradifurone can yield improved aphid control compared to standard neonicotinoids (Polk and Mansue, unpublished IPM field data).

Spotted-wing drosophila

Figure 4. A male spotted-wing drosophila (SWD) (Photo Credit: Elvira de Lange).

Biology. Spotted-wing drosophila (SWD), *D. suzukii* (Figure 4), is an invasive pest first found in New Jersey in 2011 (Michel et al. 2015). The adults attack a wide range of thin-skinned fruits including blueberries, strawberries, raspberries, and cherries (Kanzawa 1935; Kanzawa 1939). This pest overwinters as an adult. Eggs are laid into ripening berries and multiple larvae can be present in each berry. Larvae take 5–7 days to develop and pupation an additional 4–15 days either inside or outside of the fruit. SWD populations in New Jersey become active in June and increase as the season progresses, so later ripening varieties are more susceptible to damage. There are several generations per growing season (Michel et al. 2015).

Damage. SWD causes direct damage to the berry through feeding by the larvae (Michel et al. 2015). Berries infested by larvae originally have no apparent damage but begin to shrink and become less sound and misshapen as the larvae develop.

Current Management. SWD is primarily controlled through calendar-based insecticide sprays that occur almost weekly during fruit ripening (Tait et al. 2021; Besançon et al. 2022). Several modes of action are present in registered insecticides, and it is recommended to rotate IRAC classes to avoid resistance. Resistance to insecticides is of concern as it has been observed on populations in California (Gress and Zalom 2018). Sanitation is also recommended because, although SWD females prefer to oviposit in ripe fruit, they will also use rotting fruit as an oviposition site. Keeping rows clean, covering fallen berries, and completely harvesting rows are all cultural control tactics recommended to reduce SWD populations in blueberry fields (Michel et al. 2015; Leach et al. 2018).

Challenges and Successes in Management. Because of its wide host range, rapid development, and multiple generations it is difficult to control and suppress SWD populations. In addition, biological control agents in the invaded regions not effective at controlling this pest. Efforts are current underway to develop effective behavioral control and biological control strategies.

Two behavior-based products under evaluation to manage SWD are ACTTRA SWD and Combi-protec. ACTTRA SWD (ISCA Technologies Inc., California, USA) combines an attractive volatile blend (chemical cues) with visual cues and a phagostimulant in a formulation that can be mixed with an insecticide to attract and kill SWD flies and thus reduce fruit infestation. A recent study showed that ACTTRA SWD is effective at controlling SWD under laboratory conditions, but its efficacy is influenced by internal (i.e., the insect's physiological status) and external (i.e., the availability of host fruits) factors (Babu et al. 2022). Like ACTTRA SWD, Combi-protec (Andermatt Group AG, New Jersey, USA) is an adjuvant feeding stimulant that can be mixed with an insecticide, but it does not contain an attractant (Noble et al. 2021). Combi-protec has been tested under laboratory and semi-field conditions in New Jersey and other US states. When compared with an untreated control, adult mortality was comparable to full-rate insecticide applications without the feeding stimulant. Additionally, insecticide with Combi-protec applied at half-rate performed at similar levels to the full-rate insecticide (unpublished data). As of this writing, ACTTRA SWD and Combi-protec are in the process of registration in the USA.

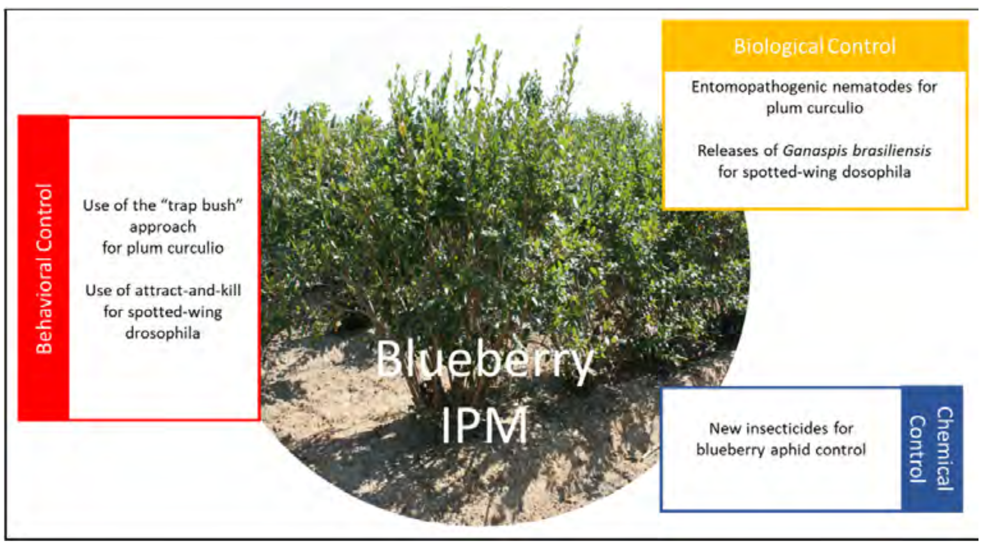

Figure 5. Research advances in blueberry integrated pest management (IPM).

A permit to release *Ganaspis brasiliensis* (Ihering), a parasitoid of SWD native to Asia, was recently approved in the United States. Unlike parasitoids already present in the USA, *G. brasiliensis* is well adapted to attack SWD larvae. In 2022, releases of *G. brasiliensis* wasps were conducted in wooded areas adjacent to blueberry fields in New Jersey, with the expectation that it will establish and successfully parasitize SWD in these areas. Research on *G. brasiliensis* overwintering biology and additional releases and monitoring of its establishment will be conducted in New Jersey.

Conclusions

New chemical, behavioral, and biological control tools are being evaluated to manage three key insect pests of highbush blueberries in New Jersey – plum curculio, aphids, and SWD (Figure 5). The EPN *S. riobrave* has shown to be effective against plum curculio larvae and future research will focus in combining this EPN with the "trap bush" approach to develop a multi-stage management program for plum curculio. New classes of insecticides show efficacy against aphids and can thus be used in rotation with neonicotinoid insecticides. Two behavior-based strategies, ACTTRA SWD and Combi-protec, show promise in reducing SWD infestation. The parasitoid *G. brasiliensis* is being released in New Jersey and other US states; whether this biological control agent and behavioral control strategies are compatible in managing SWD will be the subject of future research.

Acknowledgments

We thank the support of the New Jersey Blueberry Research Council, chemical companies, the USDA Specialty Crop Research Initiative (SCRI) program (Grant No. 2020-51181-32140), USDA Sustainable Agriculture Research and Education (SARE) program (Grant No. LNE22-455R), and IR-4.

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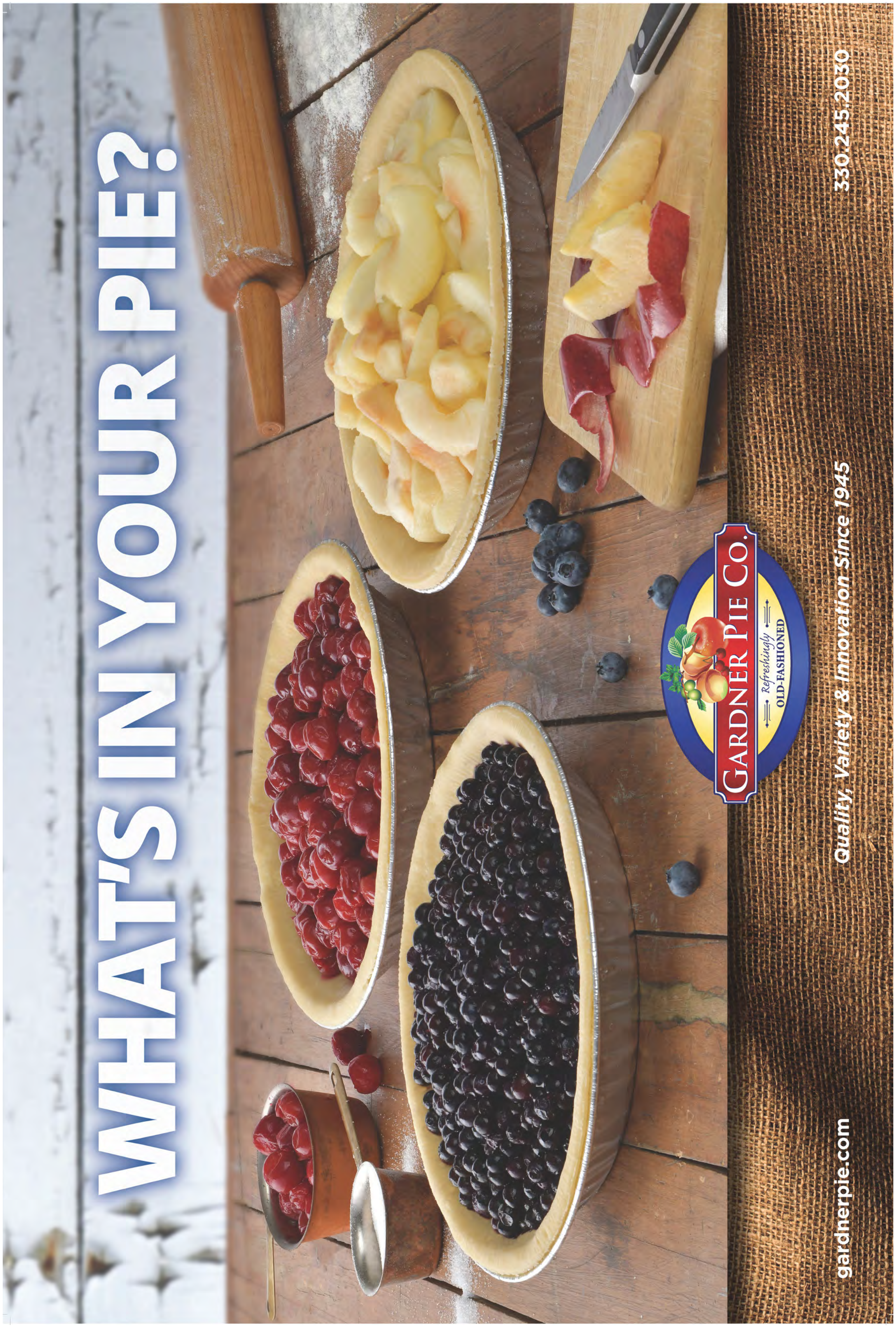
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The 2023 Apple Thinning Season was Difficult!

Duane W. Greene and Jacob Aliengena
Stockbridge School of Agriculture, University of Massachusetts Amherst

The 2023 growing season was probably the most challenging thinning season that we have ever experienced. April and early May were seasonably cool and breezy. The bloom and pollination periods were long and protracted and there appeared to be adequate pollination. On the night of May 18, nearly all orchards in the northeast experienced a freeze where temperature dipped down to the middle and upper 20's when fruit on the trees ranged in size from 3 to 5 mm in diameter. This event caused variable degrees of freeze damage. It was also common to have fruit severely damaged in the bottoms of trees while on the top of the same tree, less damage was sustained. The location in the orchard played an important role in determining the degree of freeze damage as well. The second factor that made thinning difficult was the generally cool sunny conditions that prevailed for nearly 3 weeks resulting in a carbon excess over the thinning season (5-18 mm).

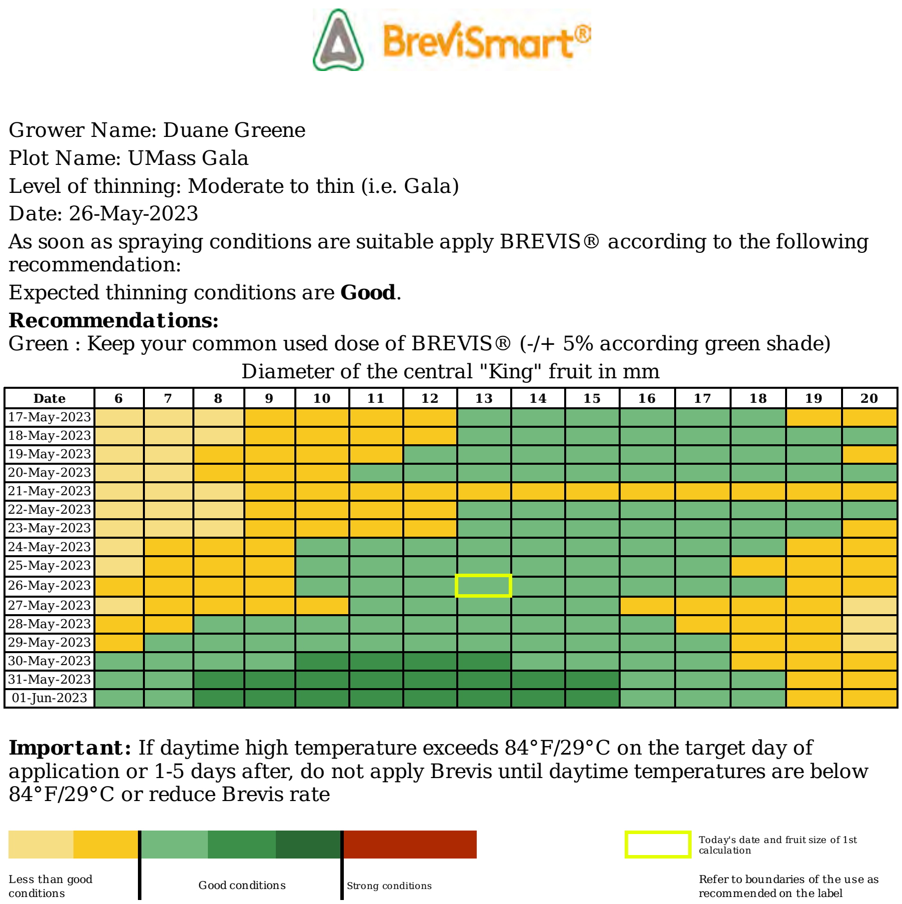
Metamitron is a thinner that we have been evaluating for over 10 years. Initially there was a steep learning curve but in recent years it has performed very well especially when compared to the thinning caused by thinners such as NAA, carbaryl and benzyladenine. As metamitron nears registration for apple thinning in the United States, we wanted to continue to evaluate metamitron and compare its thinning capability with the thinners currently in general use.

Materials and Methods

In a block of mature Summerland McIntosh/ M.9 apples, 42 trees were selected leaving an untreated tree between each treatment tree. At the pink stage of flower development, three uniform limbs on each tree were tagged and the limbs' circumference was measured and recorded. The number of blossom clusters on each tree were counted and the blossom cluster density was calculated. The trees were grouped into six groups (replications) of seven trees based on the blossom cluster density. Weather data from the Cornell NEWA Thinning Model collected at the orchard is shown in Table 1. from one day before the first thinner applications were made (May 12) to four days after the last thinner application (May 26). BreviSmart is a thinner prediction model that was developed by Adama for use with metamitron. BreviSmart outputs were checked periodically over this period. Two of these printouts are shown for May 12 (fruit size 5 mm) and May 26 (fruit size 14.1 mm), the two dates

Table 1. Weather data prior to, on the date of, and for several days following thinner applications on Summerland McIntosh, Belchertown, MA, in 2023.

Date	Temp max	Temp min	CHO balance	Degree day accumulation	Comments
May 11	79	47	-10	89	Increase by 30%
May 12	81	51	-30	104	Increase by 30%
May 13	78	58	-20	120	Increase by 30%
May 14	66	46	30	129	Increase by 30%
May 15	71	38	33	138	Increase by 30%
May 16	78	52	-9	152	Increase by 30%
May 17	64	41	53	158	Increase by 30%
May 18	64	28	70	162	Increase by 30%
May 19	67	41	36	170	Increase by 30%
May 20	64	48	-36	179	Increase by 30%
May 21	70	52	19	191	Increase by 30%
May 22	75	47	22	203	Increase by 30%
May 23	74	45	30	214	Increase by 30%
May 24	75	46	32	226	Increase by 30%
May 25	64	44	71	234	Increase by 30%
May 26	71	37	77	243	Increase by 30%
May 27	79	41	58	255	Increase by 30%
May 28	83	50	30	271	Increase by 30%
May 29	76	53	41	284	Increase by 30%
May 30	75	42	67	296	Increase by 30%
May 31	82	43	52	308	Increase by 30%



when thinners were applied. Disregard the printout label indicating Gala, since both printouts are for the Summerland McIntosh block.

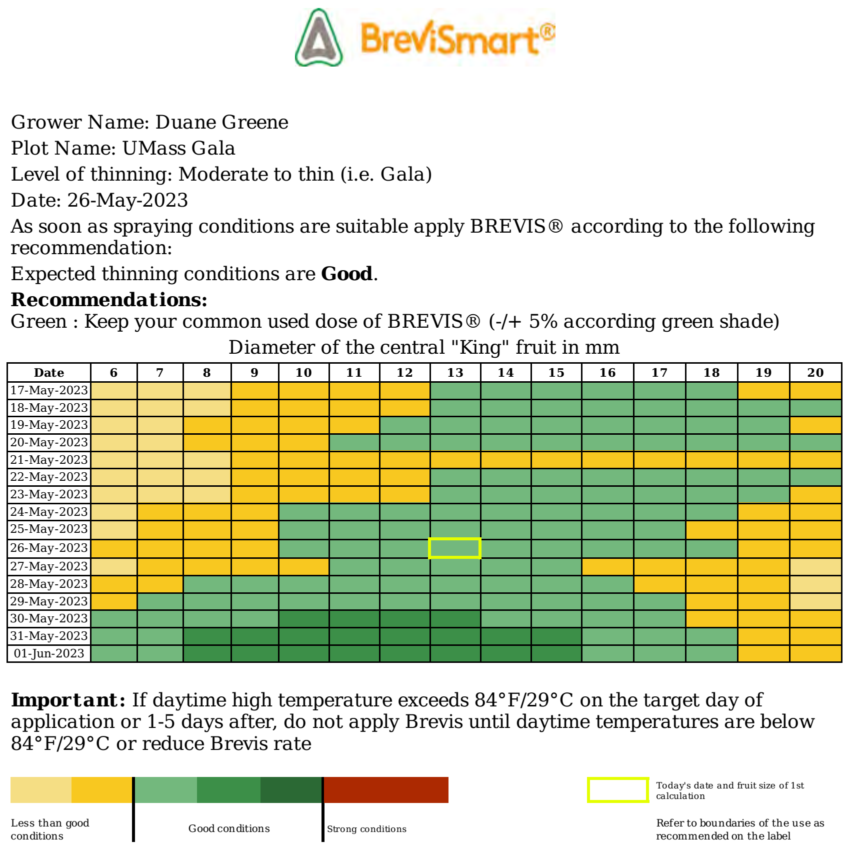
There were two grower thinner controls used in this experiment. Details of the treatments applied are shown in Table 2. Treatments were applied using a tractor-mounted speed sprayer at a TRV dilute rate of 100 gal/acre.

The bloom period was generally cool and protracted but there appeared to be adequate pollination and initial set. The first few days in May were cool and relatively sunny. On May 12, when fruit size was about 5 mm, the NEWA model indicated that there was a positive carbon balance in the trees and the NEWA model recommended increasing thinner applications by 30%. The Brevis model indicated that the conditions were less than ideal and suggested that the rate of Brevis should be increased by 25%. Our normal rate of metamitron for this block of apple trees would be 1.5 pt/acre so we opted to apply metamiatron at 2 pt/100 gal. Following the application, the weather remained cool and very unfavorable for thinners to work (Table 1.).

On the night of May 18, New England and New York orchards were hit by a hard freeze which resulted in extensive damage to trees and fruit. This was an extremely difficult situation to try to assess and even more challenging to try to decide if thinners were needed, and if so, how aggressive these applications should be. The area of the orchard where this experiment was conducted was less damaged than others, however, there was leaf and fruit damage. It was unclear how this frost damage would influence the thinner response. The BreviSmart model suggested that the thinning conditions were "Good," whereas the NEWA model suggested increasing thinner strength by 30%. Given the freeze damage to the trees, we decided

Table 2. Treatments and times of application used in the Metatron experiment on Summerland McIntosh, Belchertown MA, in 2023.

	Treatments	Applied May 12 Fruit size 5.5 mm	Applied May 26 Fruit size 14.1 mm
1	Untreated Control	------	------
2	Metamitron no Surfactant	Metamitron 2 pt/acre	Metamitron 1.25 pt/acre
3	Metamitron plus Surfactant	Metamitron 2 pt/acre Regulaid 1pt/100 gal	Metamitron 1.25 pt/acre Legal aid 1 pt/100 gal
4	Grower Standard #1 no Carbaryl	NAA 10 ppm	NAA 7.5 ppm
5	Grower Standard #1 plus Carbaryl	NAA 10 ppm + Carbaryl 1 qt/100 gal	NAA 7.5 ppm Carbaryl 1 qt/100 gal
6	Grower Standard #2 no Carbaryl	Amid-Thin 8 oz/100 gal Regulaid 1 pt/100 gal	MaxCel 75 ppm
7	Grower Standard #2 plus Carbaryl	Amid-Thin 8 oz/100 gal Regulaid 1 pt/100 gal Carbaryl 1 qt/100 gal	MaxCel 75 ppm Carbaryl 1 qt/100 gal



to apply 1.25 pt/acre metamitron. Eight days after trees were injured by cold temperatures, it was difficult to accurately assess the damage and then extrapolate this to how trees would respond to thinner application. In retrospect, we should have applied a higher rate of all thinners.

At the end of the June drop period in July, all fruit on tagged limbs were counted and recorded. The fruit set was calculated in two ways. First, as fruit per cm limb cross-sectional area and the second as the percentage of fruit set on the spurs with flowers that set. At the normal harvest time on September 12, twenty-five apple samples were randomly harvested from each tree. These were transported to the lab where the total weight was determined. The percent red color on each fruit was estimated to the nearest 10%. Flesh firmness was measured on ten fruits using a penetrometer by making two punctures per apple. A composite juice sample was collected during the pressure test and the soluble solids were measured in this sample using a temperature compensating refractometer. These ten fruits were cut in half at the equator, dipped in an iodine solution, and the residual starch in the apple was then estimated on a scale of 1-8 using the Cornell Generic Starch Chart.

Results and Discussion

No chemical thinning treatment caused thinning in this experiment (Table 3.). The lack of a response to thinner treatments can be directly linked to the weather. First, there were only four days where the carbon balance was negative and only twice did it drop below -20 grams. For thinners to work acceptably, a larger carbon deficit must exist, and the negative periods should last for at least three days to aid in the thinning process. Second, day temperatures were not high enough to allow for thinners to work effectively and to allow for the buildup of a negative carbon balance. Third, night temperatures were also too low to allow for the development of a carbon deficit. No thinner could thin under the weather conditions that the trees were exposed to. We applied metamitron at the 2 pt/acre rate and it did not have any influence on thinner efficacy. It is our understanding that the proposed label for the east coast is limited to 2.5 pt/acre per application.

The frost/freeze that occurred on the night of May 18 caused substantial damage. Most of us have never experienced a low temperature event of this magnitude on trees at this advanced stage of fruit development. Visual damage was apparent, and most growers chose to be conservative in their thinner application. Furthermore, thinners were applied on May 26, when fruit size averaged 14 mm. It would have been desirable to wait longer to assess tissue damage more accurately, but thinners would probably not have worked as well. We used both the Cornell NEWA Thinning Model and BreviSmart model in conducting this experiment. The NEWA Model was useful to summarize weather data and to calculate the carbon balance in the tree.

However, the thinning recommendations were not useful. The NEWA Model suggested that the thinner strength should be increased by 30% during the entire thinner period of the experiment. It is our opinion that the BreviSmart model gave a more realistic guidance for the rates to use, especially for the second thinner application.

Fruit quality parameters were measured on fruit in this experiment (Table 4.). In no circumstance did treatments influence any of the parameters. If thinning treatments, including metamitron, influence fruit ripening parameters it is always due to a secondary effect caused by differences in crop load due to thinning. We would be surprised if any thinning treatment affected any fruit parameters in this experiment this year.

Table 3. Influence of metamitron and grower thinner checks applied at petal fall (5 mm) and at 14 mm on fruit set of Summerland McIntosh/M.9 in Massachusetts, in 2023.

Treatment[1]	Thinner and rate May 12	Time of application May 26	Bloom/cm LCSA	Fruit/cm LCSA	Percent set
1 Untreated Control	------	------	12.2 a	13.2 a	117
2 Metamitron no Surfactant	Metamitron 2 pt/acre	Metamitron 1.25 pt/acre	12.1 a	9.8 a	84
3 Metamitron plus Surfactant	Metamitron 2 pt/acre Regulaid 1pt/100 gal	Metamitron 1.25 pt/acre Legal aid 1 pt/100 gal	11.9 a	10.3 a	87
4 Grower Standard #1 no Carbaryl	NAA 10 ppm	NAA 7.5 ppm	12.1 a	11.5 a	102
5 Grower Standard #1 plus Carbaryl	NAA 10 ppm + Carbaryl 1 qt/100 gal	NAA 7.5 ppm Carbaryl 1 qt/100 gal	11.9 a	9.8 a	82
6 Grower Standard #2 no Carbaryl	Amid-Thin 8 oz/100 gal Regulaid 1 pt/100 gal	MaxCel 75 ppm	12.0 a	12.0 a	101
7 Grower Standard #2 plus Carbaryl	Amid-Thin 8 oz/100 gal Regulaid 1 pt/100 gal Carbaryl 1 qt/100 gal	MaxCel 75 ppm Carbaryl 1 qt/100 gal	12.1 a	10.6 a	86
Significance			NS	NS	NS

[1]Spray applications made on May 12 (5 mm) and on May 26 (14 mm).

Table 4. Influence of metamitron and grower thinner checks when applied on May 12 (5 mm) and May 26 (14 mm) on fruit quality parameters of Summerland McIntosh/M.9 in Massachusetts, in 2023.

Treatment[1]	Thinner and rate May 12	Time of application May 26	Fruit weight (g)	Flesh firmness (lb)	Soluble solids (%)	Red color (%)	Starch rating (1-8)
1 Untreated Control	------	------	159 a	14.1 a	10.8 a	54 a	5.4 a
2 Metamitron no Surfactant	Metamitron 2 pt/acre	Metamitron 1.25 pt/acre	162 a	14.1 a	10.9 a	54 a	5.4 a
3 Metamitron plus Surfactant	Metamitron 2 pt/acre Regulaid 1pt/100 gal	Metamitron 1.25 pt/acre Legal aid 1 pt/100 gal	172 a	14.1 a	11.2 a	51 a	5.1 a
4 Grower Standard #1 no Carbaryl	NAA 10 ppm	NAA 7.5 ppm	169 a	14.2 a	11.2 a	5.6 a	5.6 a
5 Grower Standard #1 plus Carbaryl	NAA 10 ppm + Carbaryl 1 qt/100 gal	NAA 7.5 ppm Carbaryl 1 qt/100 gal	160 a	14.3 a	11.1 a	5.8 a	5.5 a
6 Grower Standard #2 no Carbaryl	Amid-Thin 8 oz/100 gal Regulaid 1 pt/100 gal	MaxCel 75 ppm	162 a	14.0 a	11.0 a	5.9 a	5.3 a
7 Grower Standard #2 plus Carbaryl	Amid-Thin 8 oz/100 gal Regulaid 1 pt/100 gal Carbaryl 1 qt/100 gal	MaxCel 75 ppm Carbaryl 1 qt/100 gal	177 a	14.1 a	11.2 a	5.8 a	5.3 a
Significance			NS	NS	NS	NS	NS

[1]Spray applications made on May 12 (5 mm) and on May 26 (14 mm).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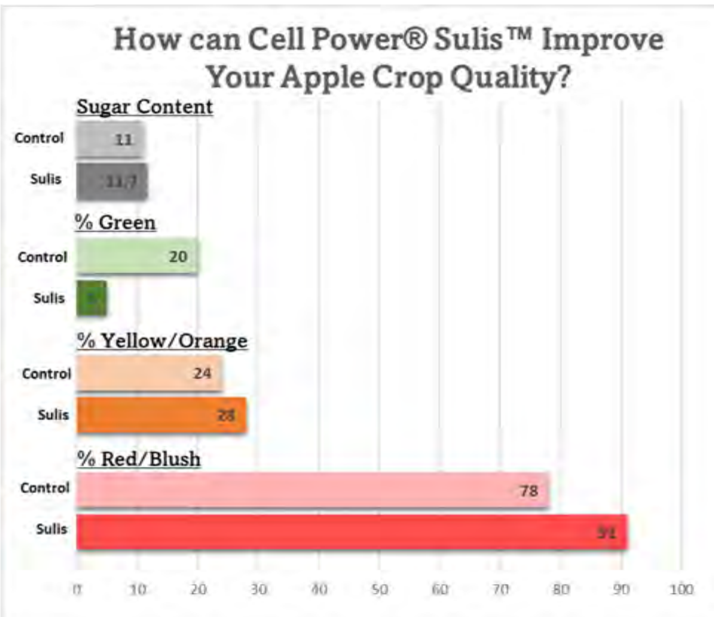

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Feeding Preferences of Rosy Apple Aphids for Six Apple Cultivars

Samina Mian, Mateo Rull-Garza, Jaime C. Piñero
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Rosy apple aphid (RAA), *Dysaphis plantaginea*, is one of the most widespread insect pests that cause fruit deformation, leaf curling, and significant crop yield losses when left uncontrolled. Prolonged leaf curling may lead to leaf abscission, fruit deformation, and stunting in young trees. Furthermore, RAA reaches adulthood in 7-8 days and each female can produce up to 80 offspring in one week. Thus, managing RAA populations during the early stages of fruit growth is important to prevent outbreaks. It is known that RAA prefers some apple cultivars over others. Examples of attractive cultivars include Cortland and Gala. Some studies published by researchers from other states (e.g., West Virginia) have reported that Ginger Gold is attractive to RAA.

In 2018, a long-term IPM project aimed at developing a permanent trap cropping system that is lure-free, inexpensive, grower-friendly, and works for the growers for the entire season was developed. The approach consisted of grafting six pest-attractive apple cultivars onto a handful of apple trees on the orchard perimeter and using them as perennial trap trees. The six cultivars that were chosen are Liberty, Ginger Gold, Red Astrachan, Wickson, Yellow Transparent, and Dabinett. By 2023, more than 150 trees have been grafted in 19 orchards in Massachusetts, New Hampshire, and Maine. Originally the two target insect pests targeted in that project were plum curculio and apple maggot fly, and research data have been collected for a 3-year period.

The main objective of the present study was to assess the feeding preferences of RAA for the six cultivars that are represented in the multi-cultivar grafted trees. We also determined the occurrence of natural enemies attacking RAA in the grafted branches.

Materials and Methods

Study Site. We quantified RAA populations at three different apple tree blocks located at the University of Massachusetts Amherst CSO in Belchertown throughout the month of June 2023. The experimental trees were grafted with six apple cultivars (Liberty, Red Astrachan, Ginger Gold, Dabinett, Wickson, and Yellow Transparent) (Figure 1) in 2018 and 2019.

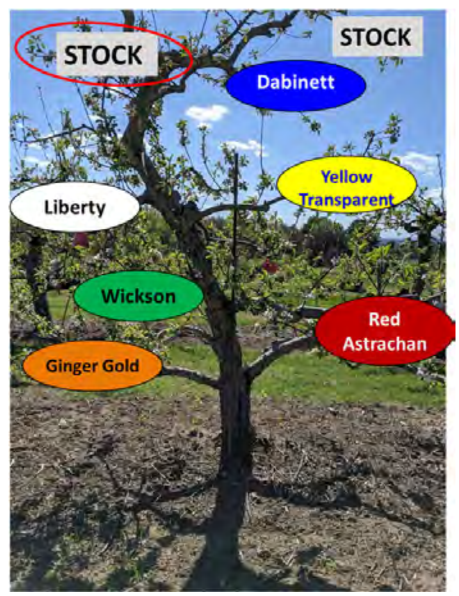

Figure 1. Representative example of an apple tree grafted with 6 cultivars. Rootstock represents the original branches.

Leaf cluster inspection. RAA sampling was conducted twice, on June 5-6 and June 21-23, 2023. Data from the second sampling coincided when most of the RAA had begun to migrate to their secondary hosts. Within each block, four grafted, four non-grafted, and four trees in a different block located about 100 meters away from the grafted block were sampled. Ten fruit clusters with foliage were inspected on each of the 6 grafted branches and 1 stock branch. For the non-grafted and control trees, 20 clusters were randomly sampled. All samples were chosen at random by walking around the entire perimeter of the tree and selecting leaves and shoots generally at stomach and chest height.

Aphid counting. For each block, the number of fruit clusters with RAA incidence were recorded in a sample of 10 fruit clusters per tree. Leaf samples (one cluster from each cultivar and two clusters from each non-grafted and control tree) were collected and wrapped in a damp paper towel to retain moisture. Afterwards, the samples were taken back to the laboratory at UMass Amherst. Each of the infested clusters was inspected under a light microscope to quantify the severity of the infestation, evaluated as the number of mobile RAAs present per apple cultivar. Since each fruit cluster contained an upwards of five leaves, only the ones with the highest counts of aphids (maximum two per cultivar, per sample) were analyzed under the microscope. Samples that were not observed analyzed the day of were kept inside an ice pack-filled cooler to avoid decomposition until the samples could be analyzed (which occurred within four days of the initial collection date).

Natural enemy estimates. In addition to aphid counting, natural enemies (parasitic and predatory insects and spiders) were recorded and identified at the order level to determine differences in biological control potential across treatments. Whenever possible, we also took pictures of the encountered insects to identify later. Parasitized aphid mummies were counted per leaf under the light microscope on all the grafted cultivars, non-grafted, and control trees to estimate parasitism rates.

Results

Incidence of RAA injury. For week one, results from the Rock Mountain block (Figure 2A) show the highest RAA infestation in Ginger Gold. Across blocks, the least-infested cultivars were Liberty and Dabinett (Figure 2A-C). In the case of Yellow Transparent, there were either no grafted branches present on the trees or no RAA infestations in the branches sampled for two blocks. For the Empire block, data were highly variable and no differences in RAA infestation were noted (Figure 2B). Tree branches grafted with Wickson and Liberty had zero RAA infestation; thus, they are not represented on the graph. For X block (Figure 2C), RAA infestations were too low for any interpretation of results. Results for the second sampling (on June 23) followed similar patterns but RAA numbers were too low given that they were migrating to perennial weeds. Therefore, those results are not presented.

RAA abundance. Statistical analyses for abundance were only conducted for the Rock Mountain block during week one due to insufficient sample sizes in the Empire and X blocks. In Rock Mountain, Red Astrachan, ginger Gold, Dabinett, and Wickson had the highest number of RAA in a 2-leaf sample (Figure 3). Liberty had the lowest counts of RAA. By the second week of data collection, RAA had migrated from the apple trees onto their pe-

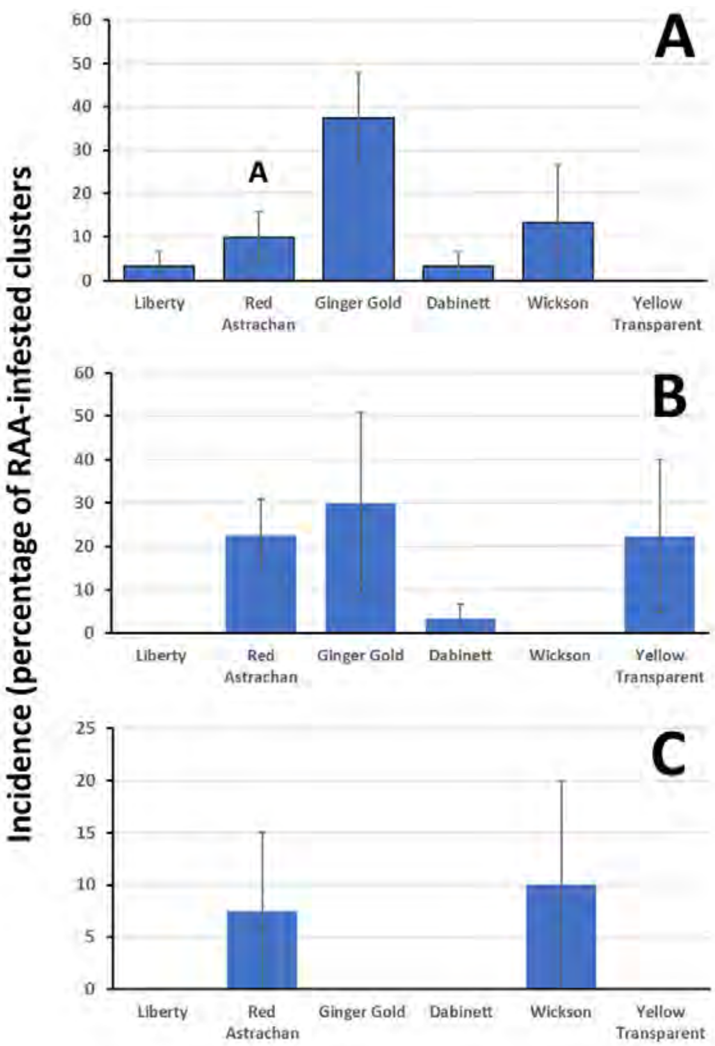

Figure 2. Rosy apple aphid incidence at the UMass Amherst Cold Spring Orchard on June 8th, 2023. (A) Rock Mountain, (B) Empire block, (C) X block

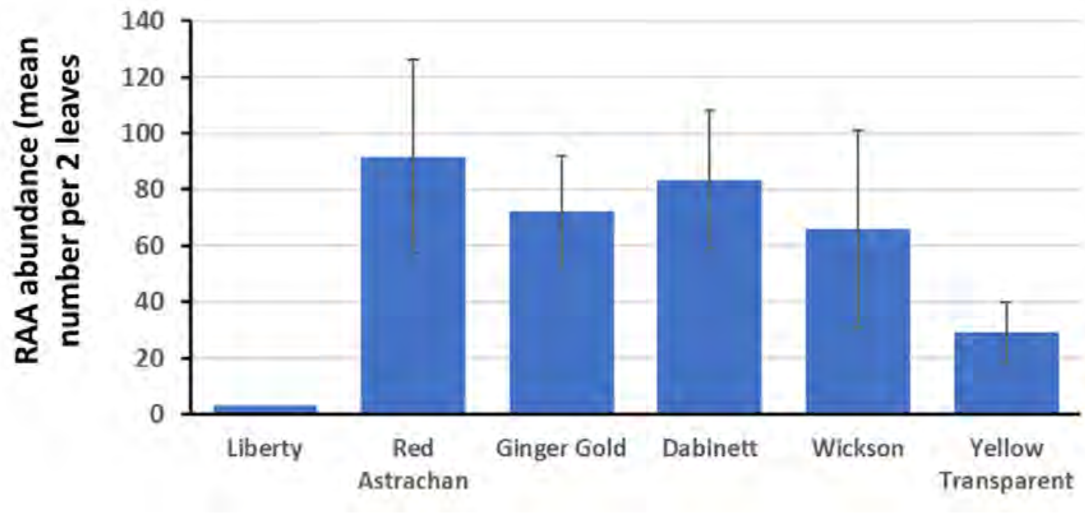

Figure 3. Rosy apple aphid abundance in the June 8th sampling at the UMass Cold Spring Orchard Rock Mountain block.

rennial hosts and numbers were too low to show any meaningful results.

Parasitism of RAA. Parasitism was averaged across all three blocks at CSO for week one only. Numerically higher rates of parasitism were recorded in Red Astrachan and Ginger Gold, with similar results found in Yellow Transparent (Figure 4). The lowest parasitism levels were recorded in Dabinett and Wickson. Liberty was excluded due to only one sample being recorded.

Presence of beneficial arthropods. As shown in Figure 5, the most abundant beneficial insects and arachnids found on the leaves on the June 8th collection date were aphid predatory midges (15 total), followed by spiders (8 total counts including egg masses). These counts were totaled from all sampled trees, across all three blocks (Rock Mountain, Empire, and X).

Conclusion

The combined results from this study suggest that Ginger Gold and Red Astrachan seem to be more attractive to RAA than other cultivars (e.g., Liberty, Dabinett). The highest levels of RAA parasitism were recorded in Ginger Gold and Red Astrachan, followed by Yellow Transparent. The most abundant predatory arthropods were midge larvae, spiders, and earwigs, highlighting the potential impact of biological control agents attacking RAA. Because this study was initiated relatively late in the apple growing season,

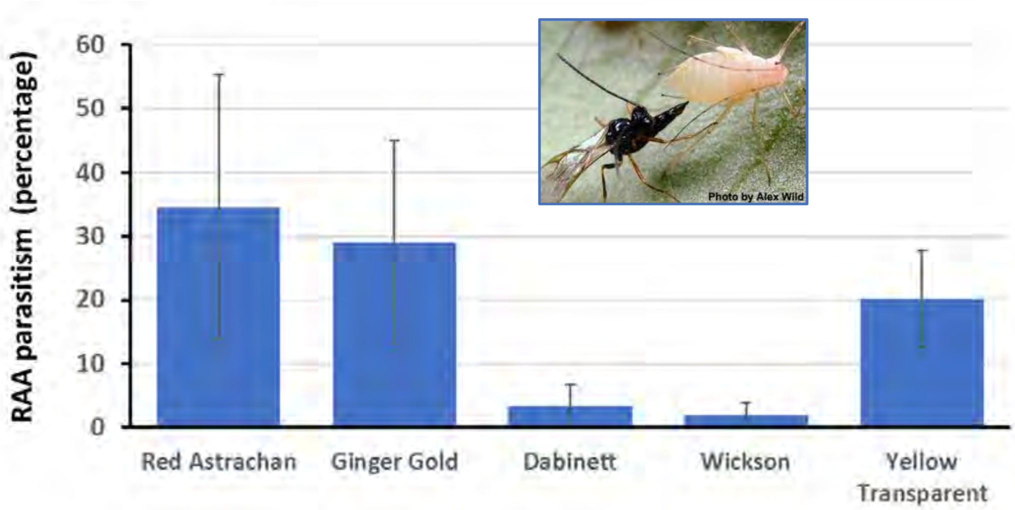

Figure 4. Parasitism of Rosy Apple Aphids recorded on June 8th, 2023, across the three experimental blocks at the UMass Amherst Cold Spring Orchard.

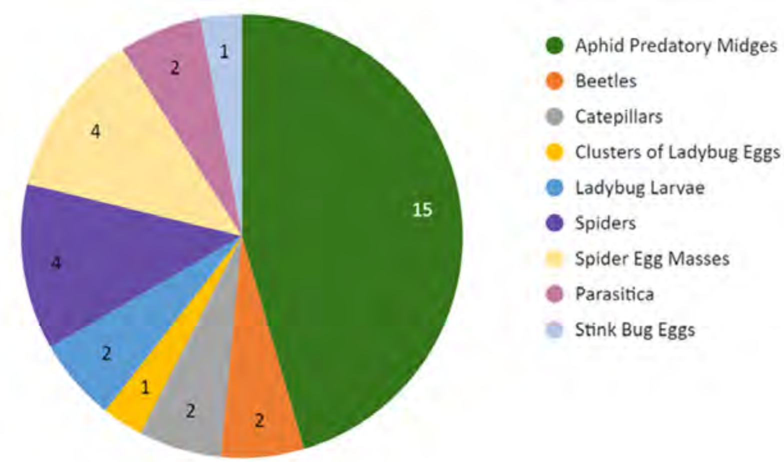

Figure 5. Beneficial arthropod counts across three apple tree blocks at the UMass Amherst Cold Spring Orchard in the June 8th sampling.

Predatory midge larvae were the most abundant beneficial insect present.

in 2024, the team plans to follow-up on this study including multiple orchards across Massachusetts.

Acknowledgements

We thank Zoe Robinson and the 2023 REEU interns for their support. Samina Mian and Mateo Rull-Garza are graduate students at the UMass Stockbridge School of Agriculture, Plant and Soil Sciences BS program.

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Also see Spray Mixing Instructions Considering Tree Row Volume

- **Bloom**
  - Ammonium Thiosulfate (ATS)- used with pollen tube growth model -2 apps
  - Lime Sulfur and Fish Oil- 1-2 apps
  - NAA*- 10PPM/ 4 ounces per acre@ 100 gpa/TRV dilute-Preferred for Return Bloom- we use a higher rate of NAA at bloom as it is less effective then
  - NAD***- 8 ounces per acre @ 100 GPA/TRV dilute- Preferred for Return Bloom- we use a higher rate of NAA at bloom as it is less effective then- remember NAD is a cousin to NAA

- **Petal Fall (fruits at 6mm) different varieties different mix's**
  - Sevin XLR*****- 1-3 pints per acre- variety dependent
  - 6Ba** + Sevin XLR- 6Ba ranges from 50-125ppm
  - NAA
  - NAA + Sevin XLR
  - NAD+Sevin XLR
  - Maxcel + NAA- if trying to not to use Sevin

- **Fruits at 10-14 mm -(traditional window)- different varieties different mix's**
  - NAA + Sevin XLR
  - 6Ba + Sevin XLR
  - 6Ba + NAA
  - NAD- used on Stayman at this time @50PPM

- **Fruits at 15-20 mm (rescue thinning)**
  - Accede- 300-400 + Regulaid@16 ounces/100- preferred at this timing based on 2023 results in NJ with /Accede for apple. Dr Greg Clark/Valent guides minimum of 300ppm on apple.
  - NAA + Sevin
  - 6Ba + Sevin + Oil/or Regulaid

- **Rescue Thinning 20-25MM- rarely needed with Nibble approach and now Accede**
  ****Ethrel (Ethephon 2)+ Sevin XLR- See UMASS Fact sheet F-129R - **Late-season "Rescue" Thinning with Ethephon: Autio and Cowgill.**

***NAA Formulations:** Fruitone L, Refine 24.2L, PoMaxa Plant Growth Regulator
****6Ba-**Formulations: MaxCel, Exilis 9.5 SC
***NAD- Formulation Amid-Thin W
****Ethrel-Ethephon 2
***** Sevin XLR Plus- is preferred, there are other formulations of Carbaryl but we have the most experience with the Sevin XLR Plus and thus most consistency

Reference

Spray Mixing Instructions Considering Tree Row Volume. Horticultural News, Summer, Vol 97, No3
http://www.horticulturalnews.org/97-3/a1.pdf

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2024 Summer Orchard Tour and Educational Program

@ Wightman Farms, Morris County NJ

Sponsored by the New Jersey State Horticultural Society
Hosted by Wightman Farms-Adam Costello

Date Thursday, June 27, 2024 10:00 AM -1:30 PM

Join our NJSH society members for this educational event
Who: all commercial tree fruit growers
Where: Whightman Farms, 111 Mt. Kimbal Ave., Morristown, NJ
Preregistration required- by Monday June 24, 2024
Pre-Register and Pay at *https://www.njshs.org/news or call Kim at RCE-908-788-1338*
Or email @ njhortsociety@gmail.com

Cost: $20.00 includes lunch- Pre-registration required- by Monday June 24, 2024

Lunch: Catered by Wightman Farms – Cold sandwiches, salads/drinks, etc.

Program:
10:00AM - Coffee and Registration
10:30 AM - Farm Tour/wagon ride, demos and instruction of Tall Spindle apple culture, summer pruning apple, apple crop load management, peach and cherry culture. Win Cowgill, Jon Clements and Adam Costello will demo the above. **Jon** is a master of the tall spindle apple system culture http://tallspindleapple.com/

Questions, answers, discussion with growers and industry personnel

Special Guest Speaker- Jon Clements, Extension Educator, University of Massachusetts.

Jon will demo and speak to using **Outfield drones/Vivid Machines**- for apple crop load management and yield maps. Jon will also review multiple programs for better predicting crop load management for better precision with plant growth regulators for improved yields and return bloom.

Any Questions please contact
Win Cowgill, 908-489-1476

Aerial view of Whightman Farms

Mature Tall Spindle Wightmans

https://wightmanfarms.com

Video of Whitman Farms

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