Horticultural News

Volume 105, Number 1
Winter 2025

HorticulturalNews

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
Norman F Childers	1948 - 1980
Win Cowgill	1981 - 1988
Emily Brown Rosen	1988 - 1990
Linda Butenis Vorsa	1991 - 1995
Jerry Frecon	1995 - 2010
Win Cowgill & Wes Autio	2010 - 2021
Win Cowgill & Jaime Piñero	2021-

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.

Horticultural News is published four times per year by the New Jersey State Horticultural Society. It is provided as a benefit to membership in the society. Membership costs $50 per year. Each one-year subscription begins January 1 and ends December 31. Payments via check must be in United States currency and should be payable to the New Jersey State Horticultural Society. Horticultural News Electronic subscriptions are available as benefit of membership in the NJ State Horticultural Society. A hidden link will be mailed immediately after publication to members. Issues will be made freely available on this website six months after publication.

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Cover: International Fruit Tree Association (IFTA) South Africa tour participants walk out of an orchard at Chiltern Farms, Vyeboom Valley, South Africa on the afternoon of 7-December, 2024. For more information on the IFTA South Africa tour see: https://jmcextman.blogspot.com/2024/12/iftasafrica2024.html
Photo by Jon Clements.

Clements Receives the International Fruit Tree Association Industry Service Award for 2024

Andre Tougas
Grower and Board Member IFTA
Win Cowgill
Professor Emeritus Rutgers Univ. and Owner Win Enterprises International

At the recent winter conference of the International Fruit Tree Association (IFTA) in Rochester, NY Jon Clements was presented with the IFTA Industry Service Award by Andre Tougas.

Photo Credit Win Cowgill.

Jon Clements, self-proclaimed Mr. Liberty, now Mr. Honeycrisp, is a native Vermonter and received his B.S Degree in Wildlife Management in 1977 at the University of Vermont. After several intervening jobs, including short-order cook and hardware/garden center store manager, and a stint as daycare provider to his two daughters, Jon began his career in tree fruit as a Research Technician at the University of Vermont working with Dr. Joe Costante.

While there, he received his M.S in Plant & Soil Science in 1998 and shortly thereafter took a job with Michigan State University Extension as Berrien County Horticulture Extension Agent. Jon returned to New England in 2000 as Extension Tree Fruit Specialist at the University of Massachusetts based at the UMass Cold Spring Orchard in Belchertown, MA.

Jon has been on the cutting edge of digital outreach and education. He introduced the internet to fruit growers in the 1990s and saw the future value it could have as a communications tool. In 1993 he and Win Cowgill started the Virtual Orchard website (one of the first 10,000 websites in the world) and the Apple Crop email list serve group that reached 800 growers worldwide, both still operating today. Later they built IDFTAs first website creating video and photo reports for summer tours and winter conferences. Still up and running today.

Jon pushed Massachusetts and New England growers to modernize their orchards, planting Tall Spindle blocks on farms across the state through the his MOPUP Massachusetts Orchard Production Upgrade Program. Jon writes for and edits the UMASS Healthy fruit newsletter, regularly writes articles for his blog https://jmcextman.blogspot.com/, is spear heading the IFTA history project with Matthew Schuld, and runs the NC-140 Website. He planned the IFTA Boston conference and the England Belgium tour with my father, served on the IFTA board for 9 years, is a collaborator on GiselaCherry.com, and is Lead communications director for the Precision Apple Cropload Management Project aka PACMAN - he will be happy I'm plugging his website https://pacman.extension.org/ All growers should check it out.

He has posted countless tree fruit production videos on YOU TUBE that are viewed across the country and world (the most watched videos in all of India according to Win) - in fact after the conference in Yakima wrapped last winter Jon and I walked into a bar to have a drink and unwind, two Washington field managers, who had obviously enjoyed more than a few beverages at the bar, recognized Jon from his videos and were ecstatic to meet him!

Jon's passion is in tree fruit horticulture and digital communication & technology and where the two topics intersect. It would take too much time to list all the ways Jon has reached and helped growers in New England, the USA and across the world. My father and I have traveled across the country and the world with Jon to see cutting-edge orchards and we consider him the best of friends - despite the two of them arguing like an old married couple. It's my honor to present you with this award- Thank you Jon all you have done for our industry, congratulations- cheers!

It would take many more pages to list all the ways Jon has helped fruit growers in New England, the USA and truly the world

Citations

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Breeding Peaches for the True North: A Moving Target Amidst Climate Change and Consumer Demands

Jay Subramanian

Professor, University of Guelph, Vineland, ON, Canada

Ernie Christ Memorial Lecture,
Presented at the Mid Atlantic Fruit and Vegetable Conference, Jan, 29, 2025

Canada has grown peaches for the past 100 years and perhaps at the northern most latitude where peaches are grown. However, peaches are grown only small pockets in Canada- mainly along the southern/south-eastern shore of Lake Ontario (the Niagara Peninsula), some parts of south west Ontario and currently some more in British Columbia. Of these areas, the Niagara peninsula grows the most peaches, 10,000 acres. Most other regions are too cold for peaches to grow and even in the areas where peach is grown, we need to develop cultivars that could survive the cold weather of Canada.

Niagara peninsula enjoys a micro-climate thanks to the effects of Lake Ontario and the escarpment providing a slightly warmer winter than the rest of the Canadian peach growing areas. This is what is popularly called the 'lake effect' although it means a lot of other things as well. Briefly the lake effect micro-climate of the Niagara region is due to warmer air raising from the Lake Ontario in winter, which absorbs heat during summer and releases it lowly as long as there is open water in the lake. This coupled with the downhill breeze which develops from the top of the Niagara Escarpment, creating an airflow pattern that draws warmer air from higher inversion layers. As a result, the lake moderates temperature fluctuations by warming the offshore breezes in winter and cooling the onshore breezes in summer. This moderating influence is important as winter temperatures in the region seldom go below -18C/-0.4F or greater than 30C/86F in the summer. This effect delays the development of the fruit buds in spring, reducing the chance of damage caused by spring frost. The first fall frost is also delayed allowing for a longer growing season and greater heat units late into the season.

Utilizing this unique phenomenon, stone fruits are thriving in these northern latitudes. In order to develop cultivars that suit to these climate/temperatures, a stone fruit breeding program was established at the Vineland Research Station in early 1900s. The first peach variety that was released from the center in 1924 was named Vimy. Since then, 61 stone fruits varieties including peach, plum, cherry and apricots have been released from this center. After going through many hands and changes in these years the current breeding program – the only one for peach breeding left in Canada- has been led by me for the past 22 years. Although Vineland was focusing on developing processing peaches for a long time, since 2008 only fresh market peaches and nectarines are developed from this center.

With the constantly changing climate and the changing preference of modern consumers, the current breeding program is aiming to develop cultivars that will fit both these needs locally and beyond. A committee known as TFEC (Tender Fruit Evaluation Committee) was formed in late 2000s and this committee comprises of reps from the entire peach value chain- from the breeder, growers, extension agents, nursery, packers, shippers, the marketing board and retailers who all will also share their thoughts as consumer. Weekly tours are held for the committee by the breeder during the fruit season which typically spans from mid-July to first week of September (7-8 weeks). As a result of such wider input during the cultivar development process, most cultivars that are released from this center have been fairly successful in the value chain.

Based on the mandate from the tender fruit industry, the focus is to develop early ripening cultivars and late season cultivars that can store and ship well. Thus, the program has developed a number of cultivars in the recent past and some are furnished graphically below.

Currently, we are focusing on developing firm and crispy peaches by incorporating the 'Stony Hard' gene. This is gene known for a long time and seen in some early cultivars like 'Yumyeong' and 'Gloria' (NJ351). These cultivars also show a delayed abscission. As a result, the fruits are firm even after fully ripe and store well for a long time (~2-3 weeks compared 4-6 days in normal peach) and also hang in the tree even after ready for picking. These Stony Hard selections are in the testing stages and we anticipate to release a few in the next 4-5 years. They have a popular name as the 'neat peach' since they do not drip much juice like a normal peach. An example of a selection with Stony hard is presented below.

Veeblush ™

- Released in 2013
- Harrow Diamond x V790638
- July 28 – 2-3 days after HD
- Good size, nice red colour
- Consistent cropper
- Extremely low spilt pits <0.5%
- 34K trees planted (~110 acres)-2020
- <4 acres in 2015

V96141 – To be released

- Newhaven x Harblaze
- July31-Aug 3
- Large Fruits
- Excellent color and flavor
- Consistently rated high
- Should round out the early season

We hope these stony hard gene carrying neat peaches will be liked by the current younger generation of consumers and could also open up other value-added products like sliced peaches in bags etc. We do not anticipate these modern genotypes will replace the conventional peach as we know it but would complement them much like the flat peaches and form a niche market in the future.

Editor's Note: We are working on the best way to get some of these Canadian peach cultivars for trial in the USA. Because of quarantine issues between Canada and the US it is not simple

Midwinter Hardiness of Peach and Nectarine Flower Buds and Shoots Across 33 Varieties

Renae E. Moran[1], Peyton Ginakes[1], Jeremy DeLisle[2] and George Hamilton[3]

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[2] University of New Hampshire Cooperative Extension, 315 Daniel Webster Highway, Boscawen, NH 03303

[3]Hillside Meadows Ag Consulting, LLC, Milford, NH

Lack of cold hardiness limits peach flower bud and tree survival in northern climates where winter injury occurs nearly every year. Flower bud mortality directly impacts yield, and shoot injury reduces yield in subsequent years when it leads to tree or limb death (Shane 2020). When winter temperatures reach -13 °F (-25 °C) in more than one out of every seven years, peach production becomes unprofitable (Quamme et al. 1987). In northern New England, midwinter temperature minimums that cause injury occur once every four years (NOAA, Concord, NH station), making peach production risky in this region.

In recent decades, breeding programs have created many new peach and nectarine varieties and a greater diversity of fruit types, such as flat peaches or those with white flesh, many of which are planted by growers due to improved fruit quality and disease resistance (Frecon 2005; Shane, 2005). Preliminary testing has been done to characterize their cold hardiness (Shane 2020), but many varieties remain untested.

Most peach hardiness studies have focused on flower buds, but xylem and cambial tissues within shoots are also subject to cold injury (Figure 1), which can vary among varieties (Shane 2020). Redhaven, one of the most commonly grown varieties in colder regions, has midwinter xylem hardiness that is intermediate to 15 other varieties (Szabó 1992). When injury occurs in older shoot tissues, it can lead to poor tree growth and early tree deaths (Shane, 2020), making shoot hardiness an important factor in identifying varieties with lower winter injury risk.

Figure 1. Freezing injury within peach shoot xylem (left) and cambium (right).

Determining hardiness in peach varieties has often been based on survival following test winters, but this can be confounded by multiple injurious events. To address this, shoots can be subjected to artificial freezing with stepwise temperature decreases followed by injury assessment at each point to create a nonlinear curve, estimating the lethal temperature. Such methods detect varietal differences in hardiness at specific times (Shane 2020). Other factors also affect cold hardiness, complicating differences among varieties. Therefore, both artificial freezing and test winters, along with multiple years of measurement, are needed to characterize hardiness.

The goal of this study was to characterize the midwinter flower bud and shoot (xylem and cambium) cold hardiness in a collection of commercially available peach and nectarine varieties, including older and newer releases.

Materials and Methods

Cold hardiness was measured in 33 peach and nectarine varieties in 2021 (Table 1), and 22 varieties in 2023. Three trees of each variety on Lovell rootstock were planted in 2018 in a commercial orchard located in Concord, NH, USA. Nectafest trees were planted in 2019. Trees were trained to an open center, irrigated as needed, and were given standard pest and disease control measures as well as fruit thinning in early summer. Shoots were collected midmorning Feb. 24, 2021 and Jan. 28, 2023. From each variety, 25 to 30 shoots were cut and placed in buckets with tap water for transport to the laboratory. Transportation took 3 hours, and an additional 2 hours was spent preparing samples. Shoots were then placed in a programmable freezer at 23.2 °F (-4.9 °C) in 2021 and at 17.8 °F (-7.9 °C) in 2023 for 15 hours, after which a set of shoots was removed. Thereafter, freezer temperature was decreased every 24 hours, and a set of shoots was removed at each decrease. Freezer test temperatures were 23.2, 2.1, -4.4, -9.9, -13.2, -21.6, and -30.6 °F (-4.9, -16.6, -20.2, -23.3, -25.1, -29.8, and -34.8 °C) in 2021 and 17.8, 2.5, -2.7, -7.2, -11.9, -16.4, and -21.3 °F (-7.9, -16.4, -19.3, -21.8, -24.4, -26.9 and -29.6 °C) in 2023. Immediately after removal from the freezer, sets of shoots were placed in a cold room at 37 °F (3 °C) until analysis of injury.

A natural freeze to -9.9 °F (-23.3 °C) occurred on Jan. 22, 2022. Shoots were collected Feb. 7 and subjected to the same methods described above, but cold injury prior to collection rendered regression models nonviable. Thus, flower bud survival measured at the first test temperature 20.5 °F (-6.4 °C) is shown in place of artificial freezing data.

Shoots were removed from cold storage within one week of artificial freezing and left at room temperature for one day to allow for browning of injured tissues. Flower buds were measured as dead or alive based on visual browning of the pistil in cross-section. Xylem

Table 1. Origin and fruit descriptions of peach varieties included in Concord, NH trial.

Cultivar	Origin	Type	Flesh color
August Rose	New Jersey AES[i]	Peach	White
Avalon	New Jersey AES	Nectarine	Yellow
Brigantine	New Jersey AES	Nectarine	Yellow
BuenOs	New Jersey AES	Flat	Yellow
Contender	North Carolina	Peach	Yellow
Coralstar	Michigan - Stellar	Peach	Yellow
Cresthaven	Michigan – MSU[ii]	Peach	Yellow
Desiree	New Jersey AES	Peach	Yellow
Emeraude	France, Riviera Breeding	Nectarine	White
Evelynn	New Jersey AES	Peach	Yellow
Galaxy	California - USDA	Flat	White
Glenglo	West Virginia	Peach	Yellow
Jade	France, Riviera Breeding	Nectarine	White
John Boy	New Jersey	Peach	Yellow
July Rose	New Jersey AES	Peach	White
Manon	France, Riviera Breeding	Peach	White
Messina	New Jersey AES	Peach	Yellow
Nectafest	West Virginia - USDA	Nectarine	Yellow
PF17	Michigan - PF[iii]	Peach	Yellow
PF23	Michigan - PF	Peach	Yellow
PF5D	Michigan - PF	Peach	Yellow
PF9A 007	Michigan - PF	Peach	Yellow
Redhaven	Michigan - MSU	Peach	Yellow
Saturn	New Jersy AES	Flat	White
Scarlet Rose	New Jersey AES	Peach	White
Selena	New Jersey AES	Peach	Yellow
Silvergem	New Jersey AES	Nectarine	White
Silverglo	New Jersey AES	Nectarine	White
Spring Snow	California - Zaiger	Peach	White
Sugar Giant	California - Zaiger	Peach	White
Sugar May	California - Zaiger	Peach	White
TangOs	New Jersey AES	Flat	Yellow
White Lady	California - Zaiger	Peach	White

i AES is Agricultural Experiment Station.
[ii] MSU is Michigan State University.
[iii] PF is from the Flaming Fury® series bred by Paul Friday, Coloma, Michigan.

tissue browning was visually rated using a scale from 0 to 10, where 0 indicated no browning and 10 indicated 100% discoloration of the xylem in cross section (Figure 1). To assess browning of cambium, shoots were cut lengthwise to the depth of the outer xylem on two sides of each shoot and rated on the same scale as xylem. Cambial browning was measured as the relative length and circumference of discolored tissue. Additionally, tissues were rated according to the intensity of browning using a scale of 0 to 5, where 0 indicated no browning and 5 indicated dark browning to blackening of the tissues (Moran and Ginakes 2024). Both ratings were used to calculate an index of injury according to the equation:

$$index\ of\ injury = \frac{(discolored\ area + ((discolored\ intensity * 2))}{2}$$

In May 2024, trees were rated for signs of winter injury by assessing tree vigor, shoot growth, limb death and trunk cracking. A rating of 1 indicated poor vigor, more than half the limbs dead, no shoots growing at the base of the limbs, and obvious trunk cracking. A rating of 5 indicated strong vigor, new shoot growth at the base of the limbs and no trunk cracking. At this time, only one tree death had occurred and for an unknown reason. Some shoot dieback occurred in all the varieties, so this was not used as an indicator of overall tree health.

`*Statistical analysis*. Each shoot was considered an experimental unit with 4 to 5 replicate shoots for each variety and temperature combination during controlled freezing. Prior injury was measured in 4 to 5 additional shoots as a measure of ambient injury that occurred before the experiment, and was included in the model for the temperature 32 °F (0 °C). Flower bud and shoot tissue hardiness were estimated by nonlinear regression with differences among varieties based on the 95% confidence interval of the inflection point. Nonlinear regression was used to estimate the four parameters of an adjusted logistic sigmoid function:

$$y = \frac{a}{(1 + e^{b(c-x)})} + d$$

where *y* is the survival or index of injury, *a* the maximum injury or upper asymptote, *b* the slope at the inflection point, *c* the temperature at the inflection point, *x* as the controlled freezing temperature, and *d* the lower asymptote or injury that occurred prior to testing. When no prior injury occurred, *d* was not included in the model. Lethal temperatures for 50% of the flower buds (LT_{50}), and xylem and cambium tissue temperature of maximum increase in injury (TI) were calculated as parameter *c*. Varietal differences in cold hardiness were evaluated based on the LT_{50} for flower buds or TI for xylem and cambium, and their 95% confidence intervals. Significant injury differences among varieties were also based on means separation within a temperature using Tukey's HSD at $P \leq 0.05$. Differences among varieties in 2022 were likewise analyzed.

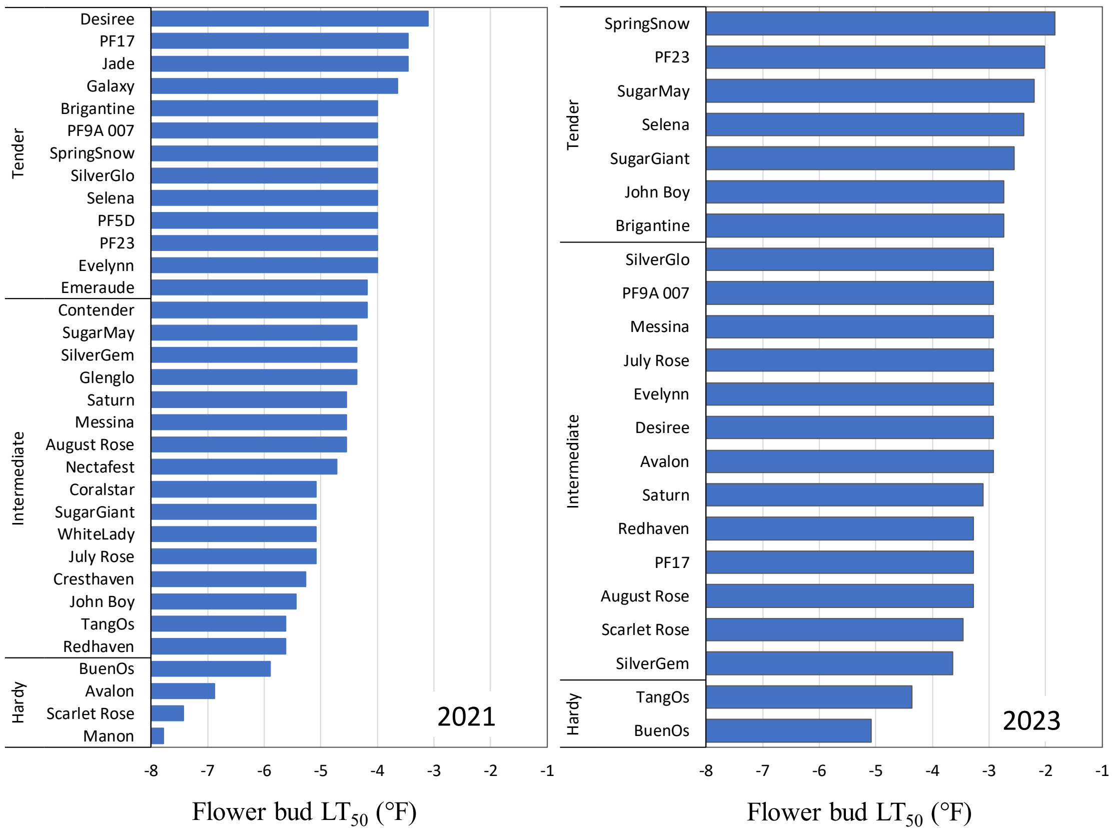
Results and Discussion

Flower bud LT50 ranged from -3.1 to -7.8 °F (-19.5 to -22.1 °C) in 2021 and from -1.8 to -5.1 °F (-18.8 to -20.6 °C) in 2023 (Figure 2). The LT50 is the temperature that kills 50% of flower buds. Hardiness rankings were based on statistical analysis, with intermediate varieties generally not significantly different from tender or hardy varieties. In 2021, the LT50 was coldest in Manon, with BuenOs, Avalon, and Scarlet Rose similarly hardy. Redhaven and varieties like Cresthaven and Contender were intermediate. The warmest LT50 occurred in Desiree, with several varieties as tender as Desiree. In 2023, BuenOs and TangOs had the coldest LT50. Redhaven remained intermediate, with many other varieties following suit. Spring Snow had the warmest LT50 in 2023, matching its ranking as tender in 2021.

A severe freeze to -10 ºF in Feb. 2022 prevented artificial freezing tests but was useful for measuring survival following a natural freeze. Flower bud survival was greatest in Contender and Redhaven (Figure 3). Varieties that had no survival included Brigantine, Galaxy, Glenglo, Jade, PF5D, Saturn, and Spring Snow. Several varieties had low survival (0.6 to 10%), including BuenOs, ranked as hardy in artificial tests. Other varieties had intermediate survival (12.3% to 20.5%). Silverglo had too few buds to measure in 2022.

Some varieties had a warmer LT50 in 2023 than in 2021. Redhaven buds were hardy to -5.6 °F in 2021 but -3.2 °F in 2023. This difference likely stemmed from warmer temperatures just before testing in 2023, which can reduce hardiness (Moran and Ginakes 2024). Flower bud hardiness varied by 10 °F (5.5 °C) between contrasting varieties (Szalay et al. 2010). The narrow range of LT50s in 2021 reflected low variability among

Figure 2. Temperature for 50% flower bud mortality (LT_{50}) in 33 peach varieties in 2021 and 22 peach varieties in 2023 following exposure to subfreezing temperatures.



the varieties. The range was even smaller in 2023, excluding the least hardy varieties.

Varieties differ in flower bud hardiness based on their timing of bud development, with some varieties as early as mid-January (Szabó et al. 2002). We measured hardiness in midwinter, assuming it was near its seasonal maximum, though some buds may have been fully chilled and more responsive to warm temperatures. PF23 and Galaxy, with low chill requirements, had relatively low hardiness, while Redhaven and Contender, requiring more chill, had greater hardiness. Other varieties with long chill requirements like Cresthaven and Coralstar were also hardy. Some varieties' chill requirements could not be found or are undetermined.

Cambial tissue appeared less hardy in some varieties in 2021 than in 2023 (Figure 4). Cambial injury temperatures ranged from -2 to -11 °F in 2021 and from -8 to -15 °F in 2023. TangOs and John Boy were hardiest in 2021 but tender in 2023, while July Rose was the hardiest in 2023 but intermediate in 2021. Cambial injury in Feb. 2022 varied among varieties. Some varieties had high injury levels, consistent with controlled freezing results. Severe cambial damage is typically followed by rapid tree decline (Shane 2020) or subsequent Cytospora cankers (Chang et al. 1989).

Xylem temperature response was similar in both years for Redhaven and most other varieties (Figure 5). Xylem TIs spanned 8 °F (4.5 °C) in 2021 and 3.6 °F (2.0 °C) in 2023. In 2021, BuenOs, Emeraude, Jade, John Boy, PF17, Redhaven, Silvergem, Silverglo, and Sugar Giant had the hardiest xylem with TIs below -11 °F (-24.0 °C). Tender xylem varieties included August Rose, Coralstar, Galaxy, Messina, Nectafest, PF23, Scarlet Rose, Selena, and Spring Snow, with TIs of -10 °F (-23.2 °C) or warmer. In 2023, Silvergem had the hardiest xylem with a TI of -14.1 °F (-25.6 °C). Other tender xylem varieties in 2023 included August Rose, Brigantine, Evelynn, July Rose, Saturn, Scarlet Rose, Selena, Spring Snow, Sugar Giant, and Sugar May.

Winter minimum temperatures in southern New Hampshire ranged from -5 to -21 °F (-20.6 to -29.4 °C) in the last 12 years (NOAA), cold enough to

Figure 3. Percent flower bud survival after a freeze to -10 ºF in February 2022.

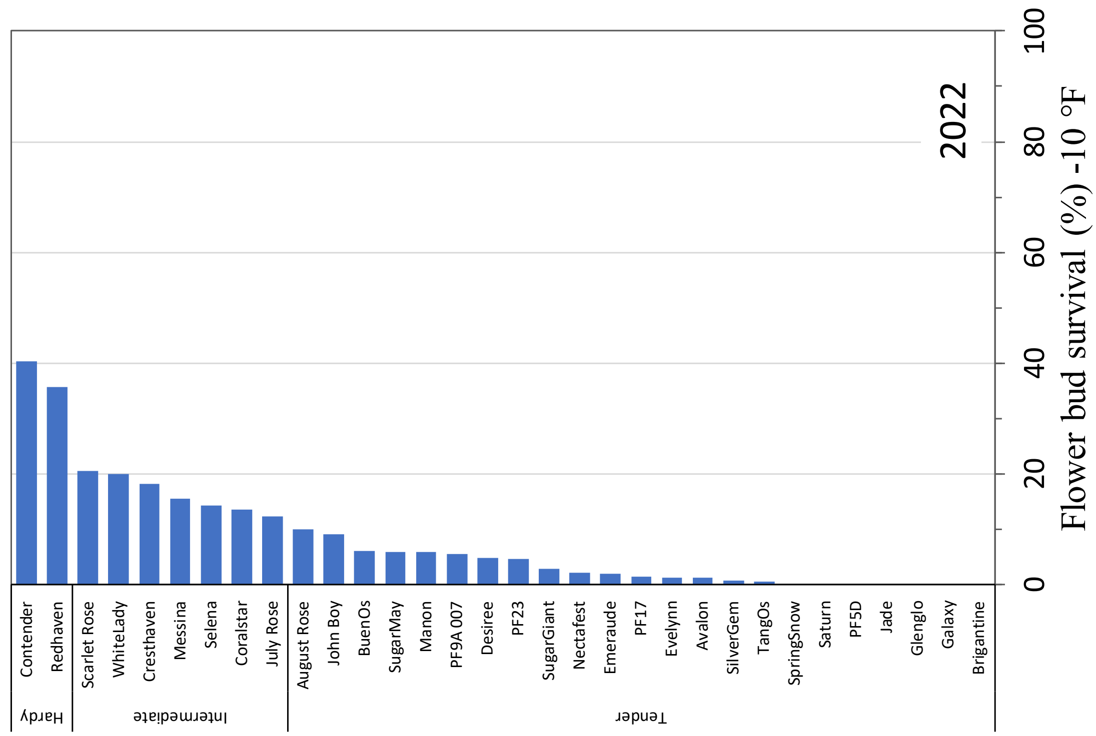


Figure 4. Temperature that causes injury (TI) to cambial tissues in peach shoots of 33 varieties in 2021 and 22 varieties in 2023.

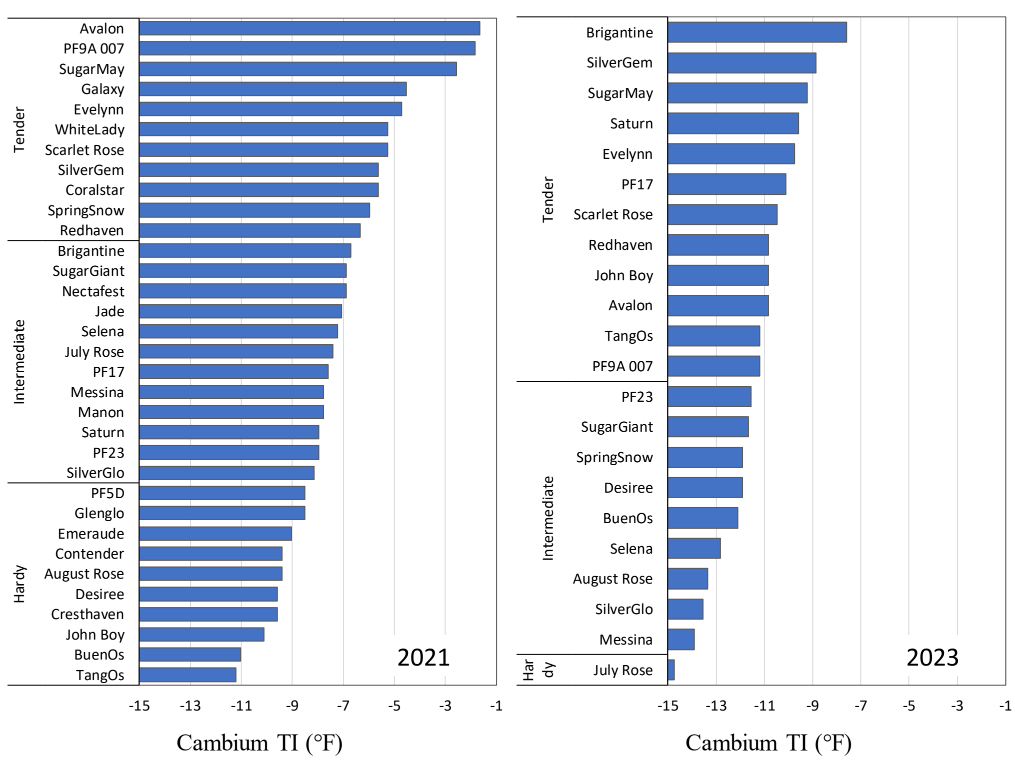
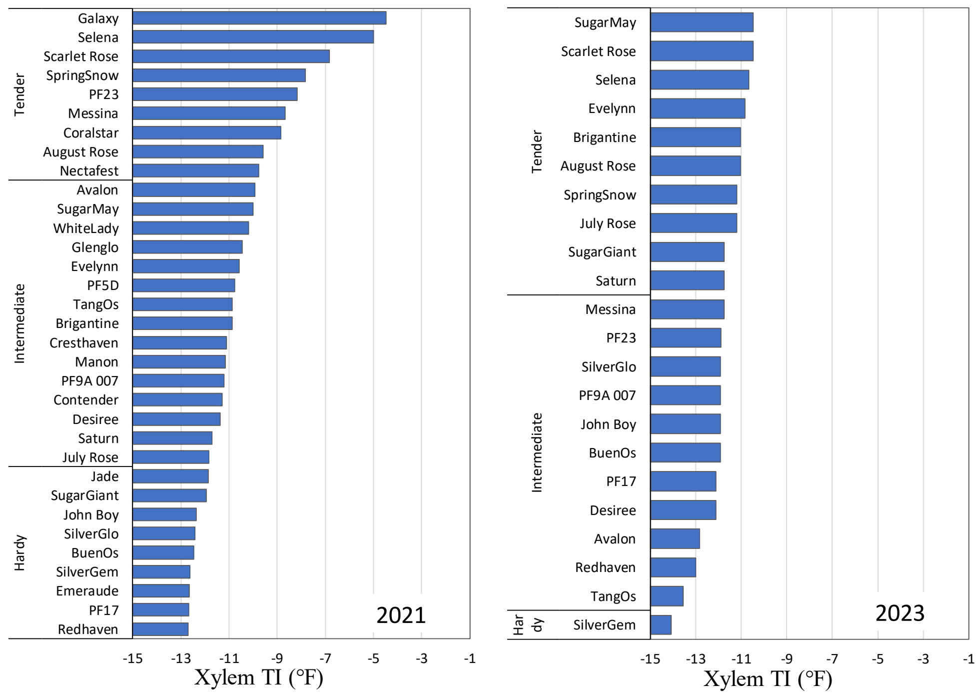


Figure 5. Temperature that causes injury (TI) to xylem tissues in peach shoots of 33 varieties in 2021 and 22 varieties in 2023.



damage xylem in hardiest varieties in four years. Redhaven's shoot xylem was hardy to -18 to -27 °F when artificially hardened (Layne 1989) but suffered severe injury after a freeze to -15 °F (Layne 1982). Cold tolerance reflects acclimation to ambient temperatures prior to testing.

General tree health ratings in 2024 varied (Table 2). Scarlet Rose and Sugar Giant showed signs of tree decline and trunk injury (Figure 6). This aligns with the lack of hardiness in cambial tissues of Scarlet Rose in 2022 and artificial freezing tests. Other varieties with low ratings included Desiree, Emeraude, Galaxy, and PF5D. Ratings were highest in BuenOs and Contender, with most other varieties similar.

Table 2. Tree health rating in five-year-old peach trees measured in May 2024. Trees were rated on a scale of 1 to 5 with 1 indicating signs of severe injury and 5 indicating intact tree trunks, good vigor and surviving limbs.

Severe <3.5	**Moderate** 3.5 to 4.0	**Mild** 4.1 to 4.5	**Little or None** >4.5
Desiree	Avalon	Coralstar	August Rose
Galaxy	Brigantine	Cresthaven	BuenOs
PF5D	Glenglo	Emeraude	Contender
Scarlet Rose	Jade	Evelynn	
Sugar Giant	Johnboy	July Rose	
	Manon	PF23	
	Messina	Redhaven	
	Nectafest	Selena	
	PF17	Silvergem	
	PF9A 007	Silverglo	
	Saturn	TangOs	
	Spring Snow		
	Sugar May		
	White Lady		

Factors other than genetics, such as crop load and prior temperatures, influence hardiness and may explain year-to-year variability. Warm temperatures can induce deacclimation, making buds and shoots vulnerable to freezes (Moran and Ginakes 2024; Minas and Sterle 2020). Two features of hardiness are important: maximum cold tolerance during dormancy and long chill requirements to prevent premature bud development. Varieties with the greatest cold tolerance during dormancy may not maintain high hardiness in late winter, explaining year-to-year inconsistencies in rankings.

Varieties consistently among the least hardy are more likely to experience 100% bud mortality in southern NH based on expected minimum temperatures in northern New England. Evelynn, Galaxy, PF5D, and Sugar May had consistently tender flower buds and shoot tissues, making them high-risk choices (Table 3). BuenOs, a flat peach, was the only variety consistently cold-hardy. Contender, Cresthaven, and Redhaven had consistently hardy flower buds but were not always hardy in shoot cambium and xylem tissues.

Acknowledgements

This research was supported in part by the Maine Specialty

Figure 6. Trunk and limb injury that was likely caused by cold temperatures.

Table 3. Relative rankings for midwinter hardiness in 33 peach varieties.

	Hardy	Intermediate	Tender	Inconsistent
Flower buds	BuenOs Contender Cresthaven Redhaven Scarlet Rose	August Rose Avalon Coralstar John Boy July Rose Messina Nectafest PF9A-007	Brigantine Desiree Emeraude Evelynn Galaxy Glenglo Jade PF5D PF23 Silverglo Spring Snow Sugar May	Manon PF17 Saturn Selena Silvergem Sugar Giant TangOs White Lady
Cambium	August Rose BuenOs Cresthaven Desiree Silverglo	Emeraude Jade Nectafest PF23 Redhaven Sugar Giant	Avalon Evelynn Galaxy PF5D PF9A-007 PF17 Scarlet Rose Silvergem Sugar May	Brigantine Contender Coralstar Glenglo John Boy July Rose Manon Messina Saturn Selena Spring Snow TangOs White Lady

Crop Block Grant Program made possible by a grant/cooperative agreement from the U.S. Department of Agriculture (USDA) Agricultural Marketing Service and by the Essex County Fruit Growers Association of Massachusetts. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the USDA.

We thank Chuck and Diane Souther for allowing us to collect shoots from their orchard Apple Hill Farm in Concord, NH.

The results of this research have been previously published in HortScience. To access the full paper, visit this site: https://doi.org/10.21273/HORTSCI18023-24.

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Assessing Biopesticide Effectiveness in Reducing Conventional Pesticide Use on American Grape Hybrids: A Comparative Study of Frontenac and Chardonel

Elsa Petit and Autumn Whelan
Stockbridge School of Agriculture, University of Massachusetts Amherst

Biopesticides offer a promising alternative for sustainable disease management in grape production. Studies demonstrate their efficacy against powdery mildew and gray mold, with Moyer et al. (2016) highlighting their use alongside cultural practices. Research on microbial technologies, including entomopathogenic bacteria (Vicente-Díez et al., 2023), supports their potential in reducing synthetic pesticide reliance. However, controlling downy mildew remains challenging, as organic systems often depend on copper-based fungicides, which pose environmental concerns and phytotoxic risks (Dagostin et al., 2011; Lamichhane et al., 2018, Pertot et al., 2017).

Fungicide resistance, regulatory restrictions, and consumer concerns have driven advancements in biopesticides. Disease-resistant American hybrid grapes like Frontenac and Chardonel could further reduce pesticide use (UMass Extension, 2024). This study compares a biopesticide-based program to conventional methods by evaluating its effectiveness in disease control, yield performance, and juice quality in Frontenac and Chardonel grapes.

Materials and Methods

Study site. This trial was conducted during the summer of 2024 at a vineyard in Belchertown, Massachusetts. Figure 1 shows the average monthly temperatures and total monthly precipitation for the summer 2024 compared to historical data. Temperatures and precipitations appear to be in line with historical data, a summer with warm and wet conditions conducive to diseases. Two grape varieties, Frontenac and Chardonel, were selected for evaluation due to their contrasting characteristics in disease resistance. For detailed information on disease susceptibility and chemical sensitivity of these varieties, refer to the New England Small Fruit Management Guide.

Experimental design. Each variety consisted of six rows, each consisting of 20 vines, with each row divided into two blocks of 10 vines. A treatment was randomly assigned to each of the two blocks within each row to account for potential spatial variability and ensure unbiased comparisons. Each treatment was therefore replicated six times.

Treatments. The vineyard was divided into two treatment groups: a conventional pesticide program and a program in which many of the conventional products were replaced with biopesticides, hereafter referred to as the biopesticide program. The conventional program followed industry-standard chemical applications, primarily using products such as Manzate, Captan, Flint, and Movento (Table 1): six out of the ten sprays in this program were conventional. The biopesticide program predominantly utilized products from Marrone Bio Innovations, including Stargus and Regalia, which were mixed and applied according to industry recommendations: only three out of ten sprays contained conventional chemicals (Table 1). Stargus (*Bacillus amyloliquefaciens* strain F727) enhances plant resistance by colonizing plant tissues and activating natural defenses, while Regalia (extract of *Reynoutria sachalinensis*) induces systemic resistance, prompting the plant to inhibit pathogen growth. Both products act preventively, aiming to inhibit disease establishment rather than eliminating existing infections, necessitating early and regular application.

Spray schedule. All sprays this season included 1 pint/acre of Nufilm. Table 1 outlines the spray schedule for both conventional and biopesticides treatments.

Vine Maintenance. Shoot thinning was performed on May 20-21, 2024, to maintain 6 shoots per foot of linear canopy. Other vineyard management practices, such as leaf pulling and shoot positioning, were consistent across treatments.

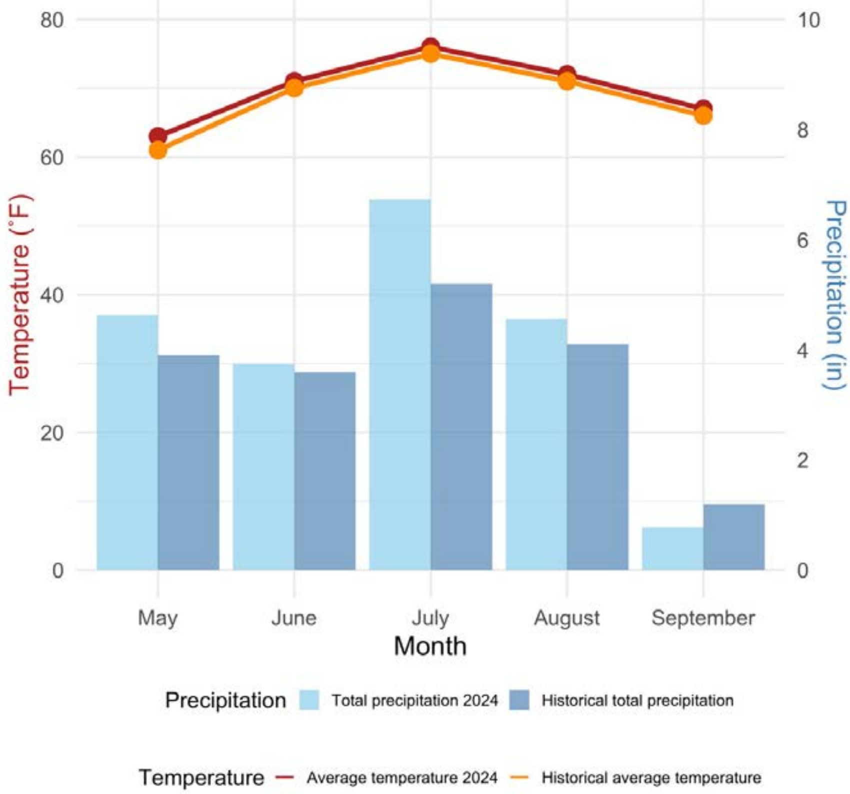

Figure 1. Average air temperature and total precipitation in summer 2024 compared to historical data.

Table 1. Spray schedule.

Date	Conventional Program	Biopesticide Program
5/17/2024	Manzate @ 3 lb/a, Rampart @ 3 qt/a	Stargus/Regalia mix @ 3 qt/a
5/28/2024	Manzate @ 3 lb/a, Captan @ 2 lb/a, Flint @ 2 oz/a, Movento @ 7 oz/a	Manzate @ 1.5 lb/a, Captan @ 1 lb/a, Flint @ 2 oz/a, Movento @ 7 oz/a, Stargus/Regalia @ 1.5 qt/a
6/04/2024	Manzate @ 3 lb/a, Captan @ 2 lb/a, Pristine @ 12.5 oz/a	Manzate @ 1.5 lb/a, Captan @ 1 lb/a, Pristine @ 6.25 oz/a, Stargus/Regalia mix @ 1.5 qt/a
6/13/2024	Stargus @ 4 qt/a, Regalia @ 2 qt/a	Stargus @ 4 qt/a, Regalia @ 2 qt/a
6/20/2024	Revus Top @ 7 oz/a, Manzate @ 4 lb/a	Stargus @ 4 qt/a, Regalia @ 2 qt/a
6/28/2024	JMS Stylet oil @ 2%, Flint @ 2 oz/a	Stargus @ 1.5 qt/a, Regalia @ 1 qt/a
7/09/2024	Stargus @ 4 qt/a, Regalia @ 2 qt/a	Stargus @ 4 qt/a, Regalia @ 2 qt/a
7/19/2024	Sevin @ 2 qt/a (insecticide), Scala @ 18 oz/a	Sevin @ 2 qt/a, Stargus @ 2 qt/a, Regalia @ 1 qt/a, Scala @ 9 oz/a
7/30/2024	Stargus @ 4 qt/a, Regalia @ 2 qt/a	Stargus @ 4 qt/a, Regalia @ 2 qt/a
8/21/2024	Stargus @ 4 qt/a, Regalia @ 2 qt/a, Captan @ 2.5 lb/a	Stargus @ 4 qt/a, Regalia @ 2 qt/a

Data Collection. The following metrics were collected to evaluate the impact of the conventional and biopesticide programs:

- **Diseases evaluated:** The main grape foliage diseases were quantified: black rot, downy mildew, powdery mildew, Phomopsis. We also noticed phytotoxicity in the form of leaves burned after certain pesticide treatments and evaluated it the same way as diseases.
- **Disease percentage**: Percentage of total foliage damaged with diseases was quantified. It was measured on each treatment the day before spraying. Here we report only on the day before the last spray, August 20, 2024.
- **Yield per vine**: Fruit production per vine was measured at harvest. For Frontenac, we encountered a main issue with bird feeding on the grapes thus the yield and juice quality data are inconclusive.
- **Fruit quality**: Soluble solids (Brix) and pH were measured for each treatment at harvest. Frontenac was harvested on September 6th, 2024, and Chardonel on October 4th 2024.
- **Cost of chemicals:** We computed the total cost of chemical for each treatment for the season to evaluate whether there was a major difference.

Statistical analysis. Statistical analysis was performed in R using one-way ANOVA to evaluate the effect of spray treatments on each measured variable (percent of diseases, yield and juice quality). Tukey's HSD post hoc test was conducted to identify pairwise differences between treatments, with significance determined at a p-value threshold of 0.05. Results are presented as treatment means (Table 2).

Results

Disease. The overall disease severity was very low on both varieties and for both treatments (Table 2). On August 20, there was a complete absence of downy mildew or Phomopsis recorded on Frontenac, and a complete absence of powdery mildew recorded on both Frontenac and Chardonel (Table 2).

On Frontenac, there were no statistical differences between the conventional and biopesticide treatments in the percentage of foliage diseases for any of the diseases assessed (Table 2). On Chardonel, there were also no statistical differences between the treatments in the percentage of foliage diseases, except for downy mildew (Table 2, Figure 2).

Phytotoxicity. On both Frontenac and Chardonel, symptoms of burnt leaves were observed on August 20. Phytotoxicity was significantly higher in the conventional treatment than in the biopesticide treatment. We attribute this phytotoxicity to JMS oil, which, despite being considered organic, was only applied in the conventional treatment (Table 2, Figures 3A, B).

Juice quality and yield. There were no statistical differences in juice quality, measured by Brix (sugar content) (Figure 4A,B), pH (Figure 5A,B), or in yield (Figure 6) between the conventional and biopesticide treatments (Table 2). The yield figure for Frontenac is not shown due to concerns that the numbers are not reflective of actual yield because of bird damage.

Table 2. Averages and P values showing statistical differences in diseases, burnt foliage, Brix (sugar), pH, and yield are presented. P values indicating statistical differences are marked with an asterisk in the results. When no disease was visible, statistical analyses were not conducted, and the P value was recorded as "NA" (not applicable). Yield in Frontenac was lower than expected due to bird damage.

	Frontenac			Chardonel		
Variable	Biopesticide	Conventional	P Value	Biopesticide	Conventional	P Value
Downy mildew (Percent)	0	0	NA	0.03	0.01	0.04*
Phomopsis (Percent)	0	0	NA	0.06	0.05	0.07
Black rot (Percent)	0.001	0.001	0.29	0.00067	0.00033	0.34
Powdery mildew (Percent)	0	0	NA	0	0	NA
Burnt foliage (Percent)	0.83	2.17	0.003*	0.83	3.67	0.001*
Brix	17.57	16.55	0.29	18.13	18.85	0.19
pH	3.14	3.2	0.19	3.12	3.13	0.94
Yield per vine (Pounds)	7.46	3.34	0.15	15.31	14.85	0.8

Economic analysis. The Chardonel and Frontenac plots were estimated at a total of 0.7 acres (0.35 acres per treatment). The treatment costs

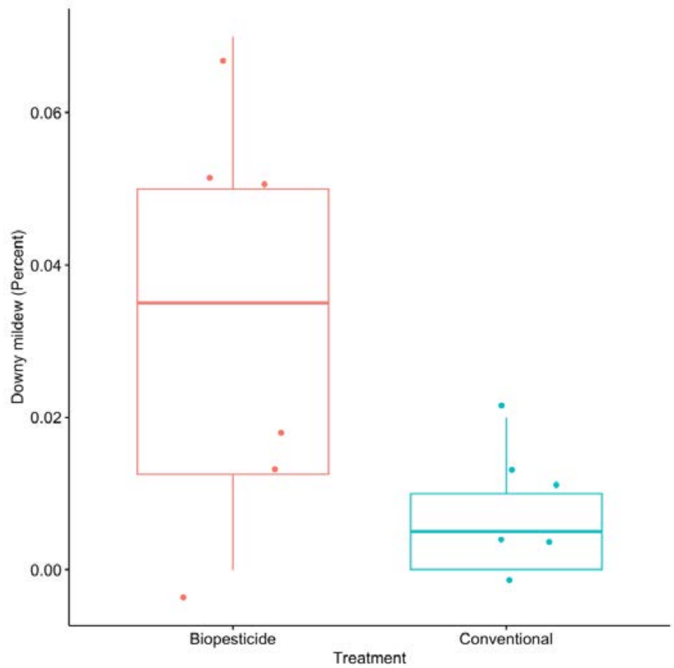

Figure 2. Downy mildew severity for the biopesticide and conventional treatments on Chardonel.

for conventional and biopesticide sprays differed minimally. The conventional treatment cost was $883 for the 0.35-acre plot, equating to approximately $1,600 per acre (Figure 7). The biopesticide treatment cost was $920 for the 0.35-acre plot, about $1,800 per acre (Figure 7).

Conclusions

Both treatments effectively controlled disease on Frontenac and Chardonel, except for downy mildew on Chardonel. Despite this, yield and juice quality (pH and Brix) remained unchanged between treatments.
While biopesticides were slightly more expensive per acre, the overall cost difference was minimal, making them a viable alternative. Frontenac showed no differences in disease severity between treatments, suggesting it is well-suited for biopesticide substitution. For Chardonel, downy mildew may still require some conventional sprays.

With comparable costs and no observed yield or quality reductions, this study suggests that integrating biopesticides into pest management could help reduce toxicity and resistance risks and lower cost on disease-resistant varieties like Frontenac. However, because the study lacked vineyard and year replicates, the findings should be interpreted with caution. Conventional sprays remain essential during high disease pressure particularly in May and July and post-infection, as biopesticides like Stargus and Regalia prevent disease but do not eliminate infections. Future studies will test whether fewer applications of

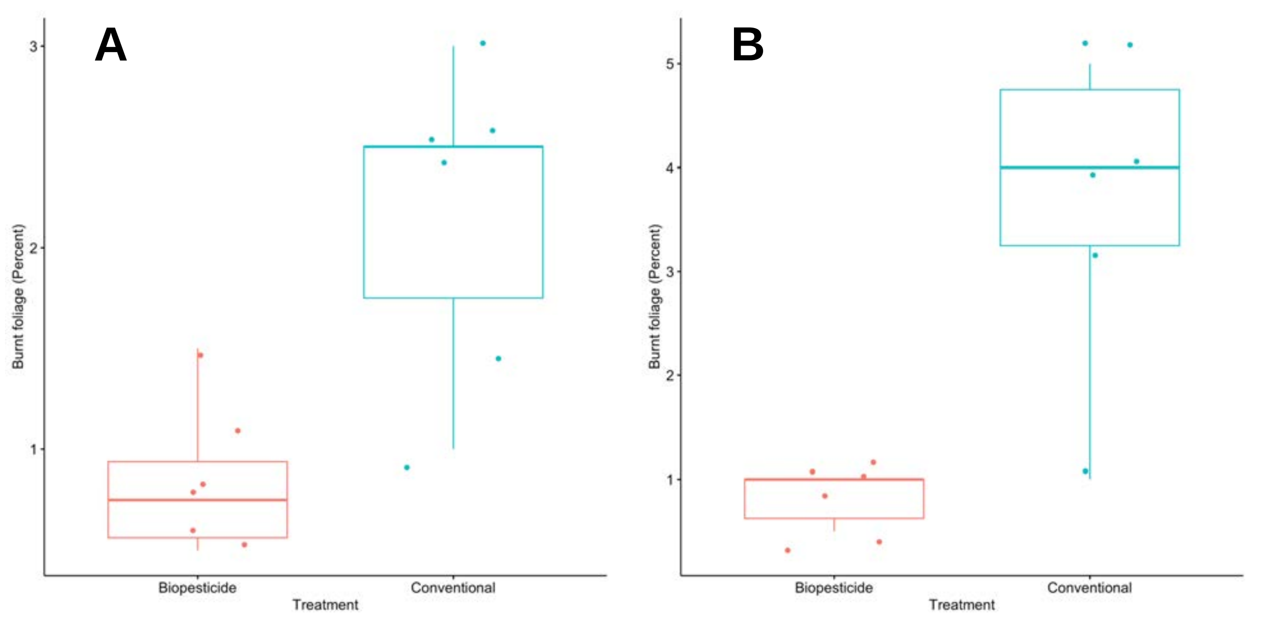

Figure 3. Phytotoxicity for the biopesticide and conventional treatments on (A) Frontenac, (B) Chardonel.

the mixed regimen on disease-resistant varieties like Frontenac can achieve similar results

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Acknowledgements

This project was supported by the Mass Fruit Growers' Horticultural Research Fund 2024 and CAFE Summer Scholars Program 2024. Special thanks to the vineyard staff and collaborators who contributed to the fieldwork and data collection.

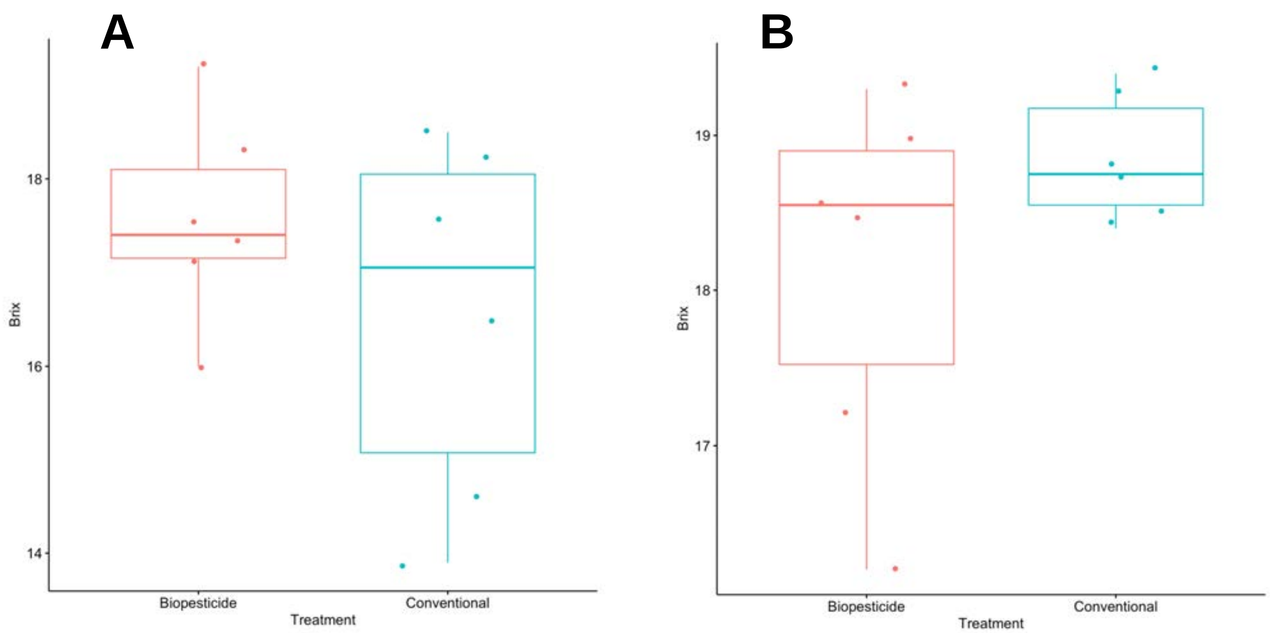

Figure 4. Brix for the biopesticide and conventional treatments on (A) Frontenac, (B) Chardonel.

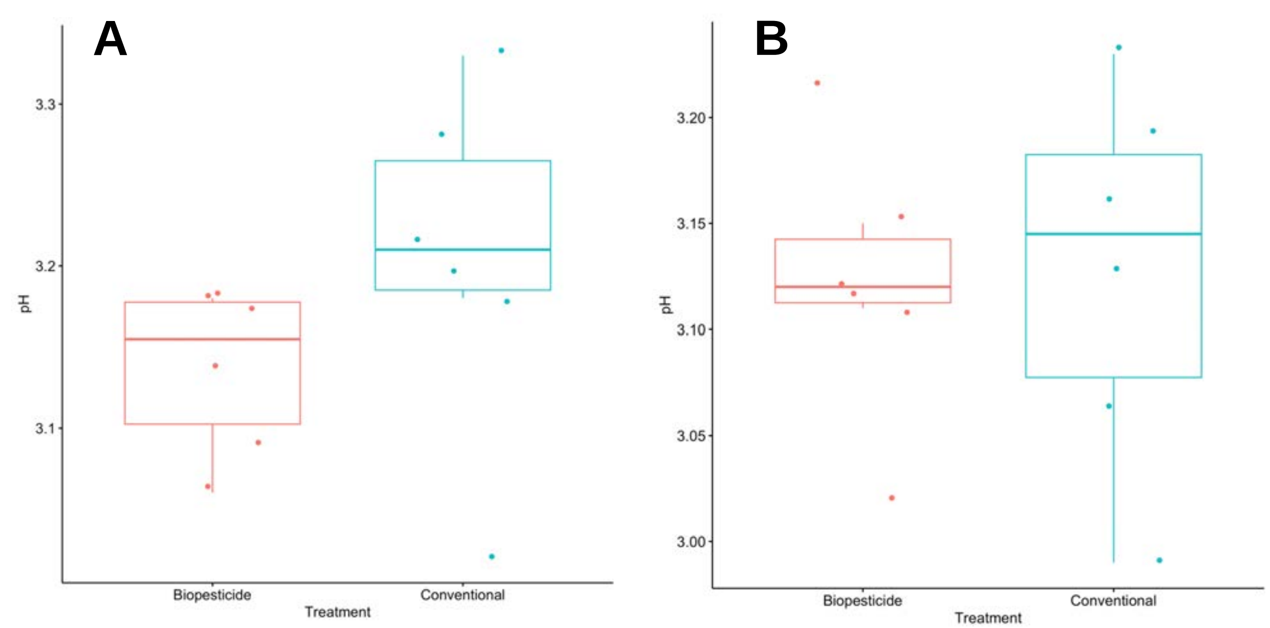

Figure 5. pH for the biopesticide and conventional treatments on (A) Frontenac, (B) Chardonel.

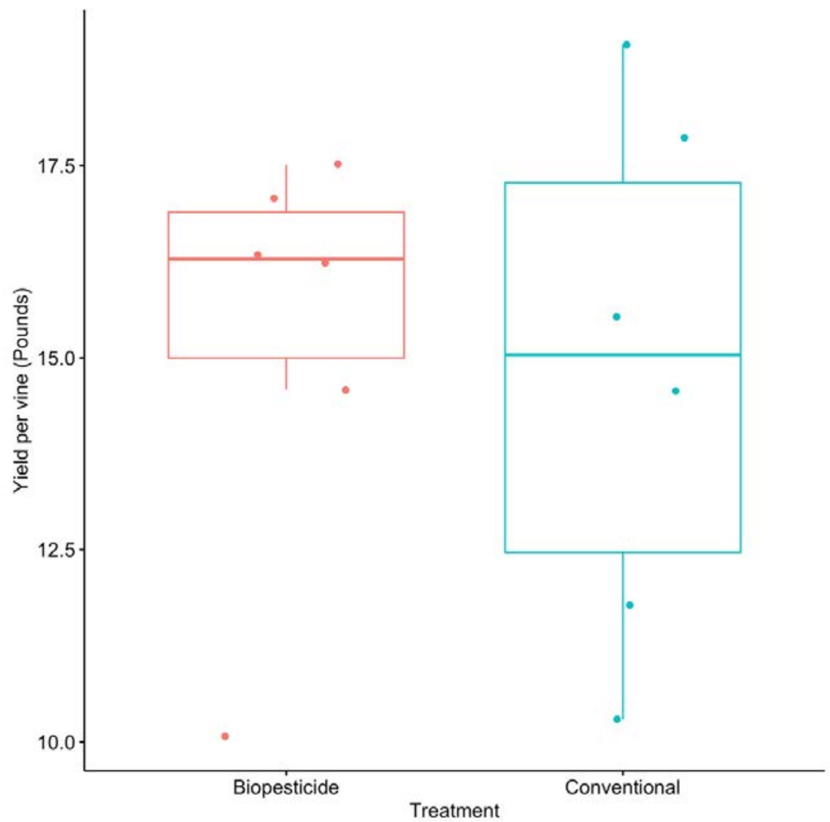

Figure 6. Yield for the biopesticide and conventional treatments on Chardonel.

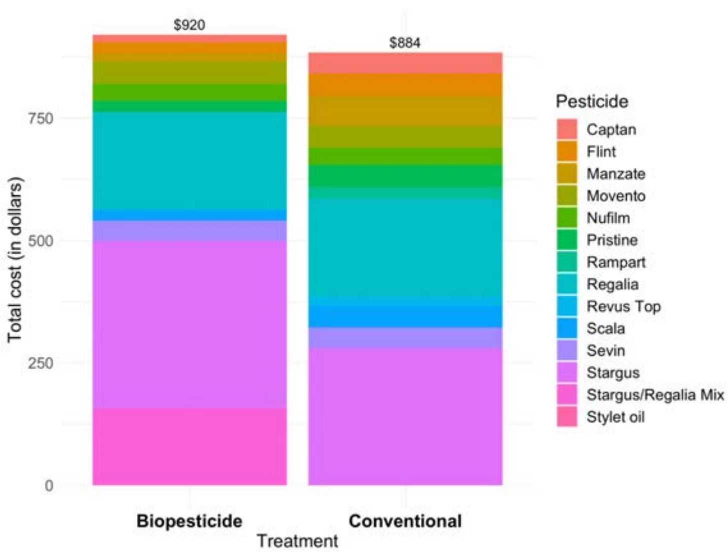

Figure 7. Comparison of the total cost for across varieties (about 0.35 acres) for conventional and biopesticide.

Where brand names for chemicals are used, it is for the reader's information. No endorsement is implied, nor is discrimination intended against products with similar ingredients. Please consult pesticide product labels for rates, application instructions and safety precautions. The label is the law. Users of these products assume all associated risks.

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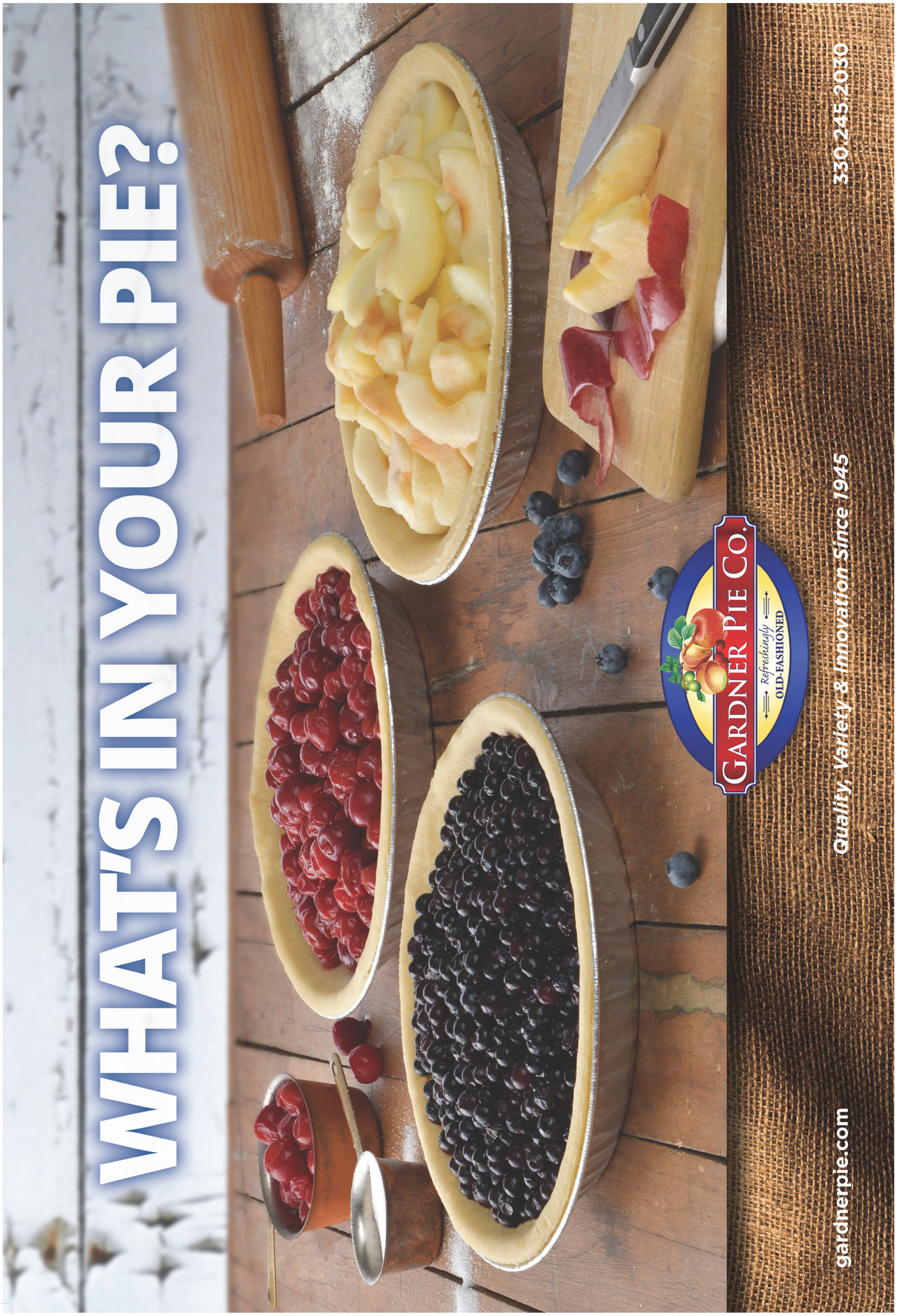
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Monitoring Ambrosia Beetles in Northern New Jersey Orchards

Kaitlin Quinn
North Jersey IPM Program Associate, Rutgers University

Ambrosia beetles have been a longtime ornamental pest in New Jersey. In more recent years they have been noted as an economically damaging orchard pest in this state. The Rutgers Plant Diagnostic lab has confirmed that we have both Granulate Ambrosia Beetle (*Xylosandrus crassiusculus*) and Black Stem Borer (*Xylosandrus germanus*) invading Northern New Jersey orchards. Both species are known to attack many species of young thinly barked deciduous trees that are exhibiting a stress response. These species of Ambrosia Beetle are attracted to ethanol which is released by trees experiencing some type of stress including flood stress, freeze stress, drought stress, etc. Ambrosia beetles are a very small pest, only 2-3 mm in size, which bore into the trunk of their host to reproduce. Some of the initial signs of infestation include a 1-2 mm diameter hole in the lower 2-3ft of the trunk as seen in Figure 1. If the weather has been mild with little wind or rain, you may also notice toothpicks of sawdust pushed out of these holes by the beetle as seen in Figure 2.

Figure 1. Sawdust toothpick caused by ambrosia beetle boring into apple tree trunk.

Once the Ambrosia Beetle has bored into the heartwood of the trunk, they will create a brood gallery and farm the *Ambrosiella* fungus, carried in on their mycangium, which the adult and her larvae will feed on. The combination of boring damage and the *Ambrosiella* fungus blocking the vascular system of the tree will cause symptoms such as wilting and dieback of branches. If the infestation is severe, tree death will eventually occur as seen in Figure 3.

Figure 2. Ambrosia beetle boring holes in apple tree trunk.

During the 2023 season in Northern New Jersey, we noted up to 5% loss of apple trees in flood stressed orchards. In another orchard in the 2024 season, we noted 43.3% loss of topworked apple trees. Understanding how economically damaging this pest can be the Rutgers University North Jersey Tree Fruit IPM program began a monitoring program for this pest which was made possible by funding from the New Jersey State Horticultural Society.

Figure 3. Apple tree killed by ambrosia beetle infestation.

Materials and Methods

A monitoring program was initiated at all 29 farms participating in the North Jersey Tree Fruit IPM Program through Rutgers University. One clear sticky trap (Figure 4) and three wood dowel traps (Figure 5) were placed on 3’ stakes at each farm with 20 meter spacing between each trap. All traps were placed along the edge of an orchard block closest to the wood line since this is where this pest overwinters. The clear sticky traps were all placed at farms between 3/28-4/5 and the wood dowel traps were placed once we began capturing ambrosia beetles at each farm. The wood dowel traps were utilized to time attacks of this pest while the clear sticky traps were used to monitor flights. Wood dowel traps were cut from fallen trees or limbs, most were taken from Black Walnut or Dogwood trees which are within the Black Stem Borer and Granulate Ambrosia Beetle’s host range. Each wood dowel trap was 2”-4” in diameter and cut at 1.5’-2’ long. A ½” hole was drilled down the center of each wood dowel trap and filled with 99.5% ethyl alcohol then corked on a weekly basis. The clear sticky traps were baited with a commercially available Trécé ethanol lure. This lure needs to be replaced every 6 weeks, and the clear sticky traps were replaced as needed. Both types of traps were checked at each location on a weekly basis. Each week data from the clear sticky traps was reported to the growers as number of ambrosia beetles per week while the data from the wood dowel traps was presented as positive or negative for the presence of attacks.

Figure 4. Clear sticky trap with lure. Right: Ambrosia beetle captured on clear sticky trap.

Figure 5. Wood dowel trap. Right: Borer holes indicting an attack

Results

The clear sticky traps captured ambrosia beetles at all 29 farms they were placed at during our monitoring period (4/6/2024 - 5/25/2024). Our first trap capture on the clear sticky traps occurred on 4/8/2024. We also found that the pest attacked the wood dowel traps at each of the 29 farms they were placed at. Our first attack on our wood dowel traps was noted on 4/18/2024. Our highest trap capture in a single week was 529 ambrosia beetles, however, the farm this capture occurred at did not have any evidence of ambrosia beetle attacks this year or in previous years. Our peak trap capture occurred during the week of 4/28-5/4 during the 2024 season as you can see in Figure 6.

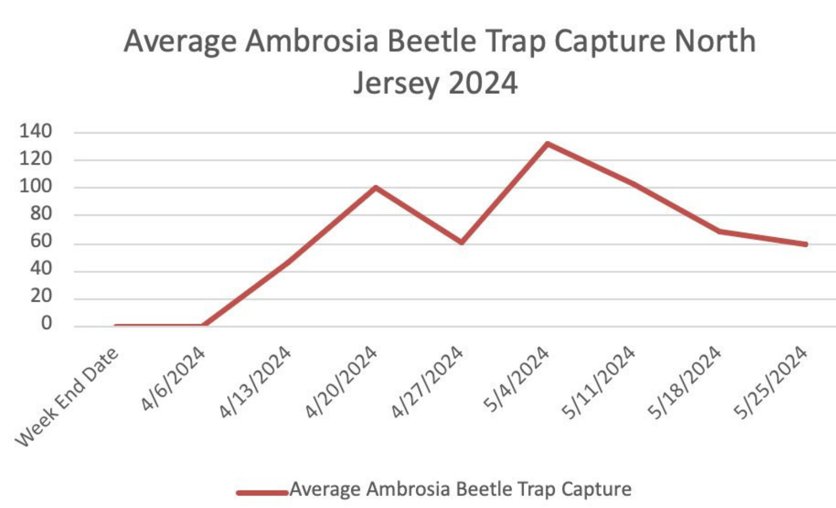

Figure 6. Average Ambrosia beetle trap captures in North Jersey 2020.

Conclusions

Based on this year's monitoring program ambrosia beetles are prevalent throughout North Jersey and are present at most farms where tree fruit is grown. Based on this information, managing stress within your orchard is the best line of defense against this pest since the species present are only known to attack stressed trees. There are very few chemical control options that are effective against this pest since they do not feed on the tree itself. Ambrosia beetles cannot be killed once they have bored into the tree so proper application timing is essential for management. Growers with a history of ambrosia beetle infestation in their orchard utilized the data provided from the wood dowel traps to properly time their insecticide applications. Observationally, the growers who did this have stated they felt they lost fewer trees to this pest this season, but more research needs to be done to confirm these observations. Moving into the 2025 season, we plan to continue our ambrosia beetle monitoring program in North Jersey. In 2024 we only utilized the clear sticky traps to monitor for a 6-week period but in 2025 we will monitor the flight of this pest over the course of the entire growing season. We also plan to utilize a third type of trap at each farm which will be juice bottle traps. This trap will be used to collect ambrosia beetles and bring them to the Rutgers Diagnostic lab to have the species identified. This will give us a better idea of what species are present in North New Jersey orchards so we can have a better understanding of this pest and how to manage it.

Acknowledgements

Thank you to the New Jersey State Horticultural Society for providing the funding which allowed us to get this project started. I would also like to thank Janine Spies, our Statewide Fruit IPM Program Leader for securing special purpose funding from Rutgers University to keep this project going. Lastly, thank you to all 29 growers who participated in this fee-based monitoring program, this work could not have been done without you all. Thank you to Rutgers Cooperative Extension, NJ Agricultural Experimentation and the County of Hunterdon for the resources to enable this program.

Expansion of the New Jersey Weekly Apple Maturity Review in 2024

Megan Muehlbauer, Rebecca Magron, Kaitlin Quinn, Janine Spies
New Jersey Agricultural Experiment Station, Rutgers University

The NJ Apple Maturity Review website was established in 2021 and has continued to grow with the financial support of the New Jersey Horticulture Society. The purpose of the website is to provide New Jersey fruit growers with weekly reports on stages of apple maturity based on variety and location. In 2024 the project was expanded to include 47 cultivars across 8 locations in northern and central New Jersey.

Beginning in late August 2024 apples were consistently collected from varieties expected to reach maturity within 1 to 3 weeks. Sampling occurred weekly; depending on varieties present at each orchard, between one and eight orchards were sampled each week. Eight apples were collected from high, low, shielded and exposed areas of the tree for each variety at each farm., Samples were transported for laboratory analysis and measurement of several characteristics, including: average fruit diameter; average percentage red surface color; average soluble solids (% sugar); average pressure (lbs.) and average starch rating.. Lastly tasting notes were recorded by one calibrated taste tester.

All data was inputted on a report on the Apple Maturity Website URL: https://njapplematurity.rutgers.edu/. At the top of each report the optimal measurements for each apple maturity indices were listed as a reference point. An example of a report is illustrated in Figure 1.

September 20, 2024

BY MEGAN MUEHLBAUER • SEPTEMBER 20, 2024

Location	Variety	Fruit Diameter (in)	Soluble Solids (% Sugar)	Pressure (lbs)	Starch Rating	Percentage of Red in Surface Color	Tasting Notes	Comments	Photo
***Optimum*:**			***12-14% SSC***	***13-15 lbs***	***6-7***				
Blairstown	Early Fuji	2.3″	13.3%	16.10	6.3	75%	Sweet	Ready	
Blairstown	Jonagold	2.7″	13%	16.31	4.5	50%	Crisp, starchy	Not Ready	
Blairstown	Empire	2.5″	10.9%	19.61	4.5	50%	Very sweet, flavorful	Ready	
Blairstown	Spartan	2.4″	11.8%	17.3	6.5	70%	Juicy, tart	Ready	
Hackettstown	Brookfield Gala	2.9″	13.6%	18.74	7	90%	Tart, crisp	Ready	

Figure 1. An example of a portion of one of the weekly reports published on the New Jersey Apple Maturity Website.

Table 1. Statistics on the number of views and visitors obtained from the Jetpack App linked to the NJ apple maturity WordPress website.

Eight posts encompassing samples collected from 8 locations and 47 cultivars			
	September	**October**	**November**
Views	250	647	152
Visitors	152	502	106

Readership for the website was high throughout the 2024 harvest season (Table 1). as expected, the greatest number of views and visitors, 647 and 502 respectively, were during October when the vast majority of apples were coming into maturity.

Growers throughout New Jersey, the MidAtlantic and New England are all encouraged to subscribe to weekly in season E-mails of the reports. https://njapplematurity.rutgers.edu/.

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Ernie Crist Memorial Lecture Presented at the 2025 Mid-Atlantic Fruit and Vegetable Conference 2025

Win Cowgill
Professor Emeritus Rutgers Univ. and Owner Win Enterprises International

Was given by Dr Jay Subramanian at the Mid-Atlantic Conference February 1, 2025. Dr jay gave an excellent presentation on New peach cultivars for the northern climates from his breeding program at the University of Guelph, Ontario, Candada.

A certificate of appreication was presented by Win Cowgill (Photo 1), business manage of the NJ State Horticultural Society in Hershey, PA at the CONFERENCE session.

In addition to the certificate (Figure 1) Dr. Subramanian received a stipiend of $500 from the NJSHSociety. Donations to the society from our members suppot this event in honor of our friend and mentor, Professor Ernie Christ, for the full history of this award and lecture see: http://www.horticulturalnews.org/100-2/a8.pdf

Photo 1. Win Cowgill Presents Award and Certificate to Dr Jay Subramanian.

Certificate of
Appreciation

Ernie Christ

AWARDED TO INVITED SPEAKER

Dr. Jay Subramanian
University of Guelph

ERNIE CHRIST MEMORIAL LECTURE

2025 Mid-Atlantic Fruit & Vegetable Convention ▯ January 29, 2025

Jim Giamarese
President
New Jersey State Horticultural Society

Horticultural News

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