Fruit Notes

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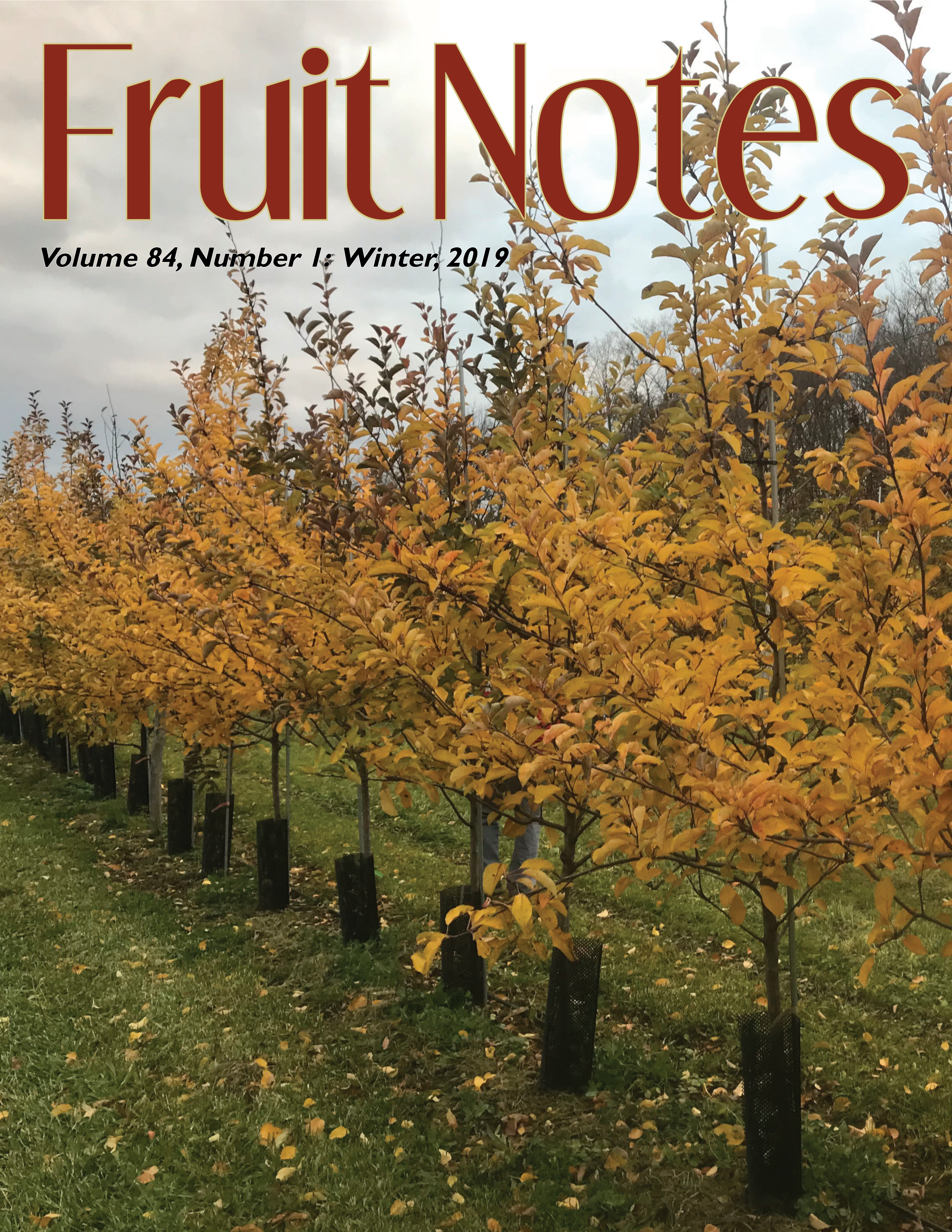

Fruit Notes

Editors: Wesley R. Autio & Winfred P. Cowgill, Jr.

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Cover: Harrison apple tree at Black Diamond Cider https://www.blackdiamondcider.com/ owned by retired Cornell University friend and colleague, Dr. Ian Merwin. The Harrison apple hails from Newark, NJ once the hard cider capital of the USA. Almost extinct, the Harrison apple is making a comeback. Photo credit: Win Cowgill.

Managing Plum Curculio Using an Attract-and-kill Approach: 2018 On-farm Research Results

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To successfully manage plum curculio (PC) in a reduced-spray environment, it is imperative that alternative management strategies consider the ecology and behavior of the target pest. Previously, extensive field research that aimed at screening compounds for attractiveness to PC led to the identification of a synergistic two-component lure. This dual lure, comprised of the plant volatile benzaldehyde (BEN) in association with grandisoic acid (GA), the synthetic PC pheromone, was used successfully by the late R.J. Prokopy to develop an effective monitoring system for PC involving odor-baited trap trees. More recently, odor-baited trap trees were evaluated for direct control of PC. This new approach calls for baiting the branches of several perimeter-row trees, which results in aggregations of adult PCS on those trap trees, and then confining insecticide applications to those trees only.

Here, we assessed the efficacy of odor-baited trap trees as an 'attract-and-kill' system to manage PC populations after the full-block petal fall insecticide spray in three commercial apple orchards in 2018.

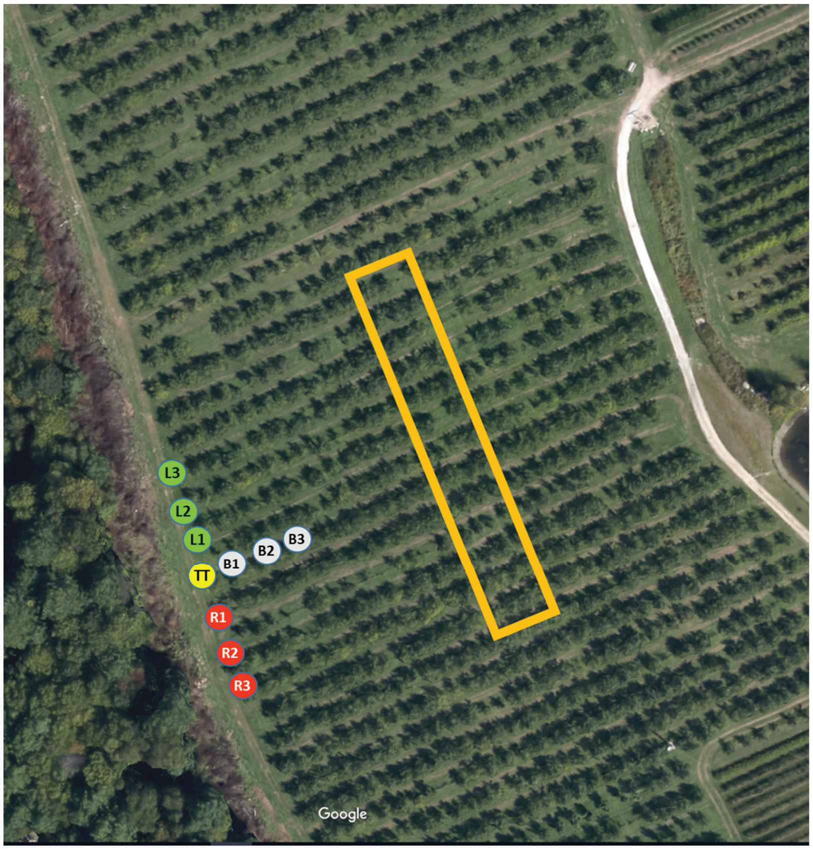
Materials & Methods

Study sites. This study was conducted from mid-May to mid-August 2018, in three commercial orchard blocks, one located in in Massachusetts (Clarkdale, in Deerfield) and two in New Hampshire (Poverty Lane Orchards in Lebanon; Apple Hill Orchard in Concord).

Treatments. Each block was divided into two plots. One plot was used to evaluate the attract-and-kill system involving spraying insecticides to odor-baited traps trees only (= TT plots), and the second plot was assigned to perimeter-row sprays (= PR plots). Our grower cooperators have been implementing IPM for many years; therefore, they were more interested in comparing the trap tree approach versus the perimeter-row approach rather than comparing trap tree plots against the conventional approach involving three full block insecticide sprays against PC.

Table 1. For each cooperating orchard block, area of perimeter-row (PR) and trap-tree (TT) plots, number of trap trees established in the TT plots, and trap tree densities.

Orchard	PR plot area (acres)	TT plot area (acres)	Number of trap trees established	Trap tree density (#/Acre)
Clarkdale	1.6	1.6	11	ca. 7/acre
Poverty Lane	2.7	6.2	22	ca. 4/acre
Apple Hill	3.7	9.0	25	ca. 3/acre



For one of the orchard plots, depiction of the approach taken to fruit sampling to assess the effectiveness of two management strategies to protect fruit from PC injury. *Trap trees were deployed along the entire perimeter, but only one trap tree and its neighboring trees are being shown*. Twenty fruit were sampled from each trap tree (TT, denoted as a yellow circle), and from each of nine neighboring (three on the left, three on the right, three behind) trees. Sampling in PR plots mirrored this approach, except that the 'control' trees were unbaited. For the analyses, data from L1 and R1, from L2 and R2, and from L3 and R3, were combined to generate values for 'Perimeter-1', 'Perimeter-2', and 'Perimeter-3', respectively, as shown in Figure 2A. The orange rectangle represents the approximate area were 20 fruit from each of 20 interior trees were sampled.

Experimental approach. At full bloom, trap trees were baited with the synergistic PC lure consisting of four dispensers of benzaldehyde and a single dispenser of grandisoic acid. Trap trees were spaced 35-38 yards apart along the entire perimeter of each TT plot. At petal fall, each grower applied a full block insecticide application. The protocol called for one to two additional insecticide sprays, as deemed necessary by the growers, confined to trap trees or to the plot perimeter. Information on the experimental area of each PR and TT plot, the number of trap trees established in TT plots, and trap tree densities is presented in Table 1.

To evaluate the plot-wide outcome of insecticide application against PC in TT plots and in PR plots, in mid-August 2018 we quantified the level of fruit injury caused by PC based on a sample of 20 fruit per tree in trap trees in the TT plot and in 'control' trees in the PR plot. The 'control' trees consisted of randomly selected perimeter-row trees that did not receive any lures. We also sampled 20 fruit from the three most immediate perimeter-row trees neighboring (on the left and right sides) each trap tree and each 'control' tree. In addition, we sampled 20 fruit from three trees located behind each trap tree and each 'control' tree. To measure the level of injury to fruit located in the plot interior, we sampled 20 fruit from each of 20 interior trees, for a total of 400 interior fruit per plot. In all, 11,640 fruit were sampled across all experimental orchard plots.

To assess the effectiveness of the two PC management strategies being evaluated here, for the analyses we compared percentage of PC injury in (1) trap trees (in TT plots) and unbaited 'control' trees (in PR plots); (2) the three nearest lateral trees surrounding each trap tree (in TT plots) and 'control' tree (in PR plots), combining data from the left and right sides of each trap tree and each 'control' tree; (3) three trees behind the trap trees and behind 'control' trees in TT plots and PR plots, respectively, and (4) interior trees within TT plots and PR plots.

Results

About 10 times more injury by PC was found within trap trees (17.2% on average) in TT plots compared with unbaited 'control' trees (1.5% on average) in PR plots (Figure 1). This result confirms findings from previous studies indicating that the synergistic lure composed on benzaldehyde and grandisoic acid, the PC aggregation pheromone, results in significant aggregations of PC adults and fruit injury in trap trees.

Figure 2(A) shows that more PC injury was record-

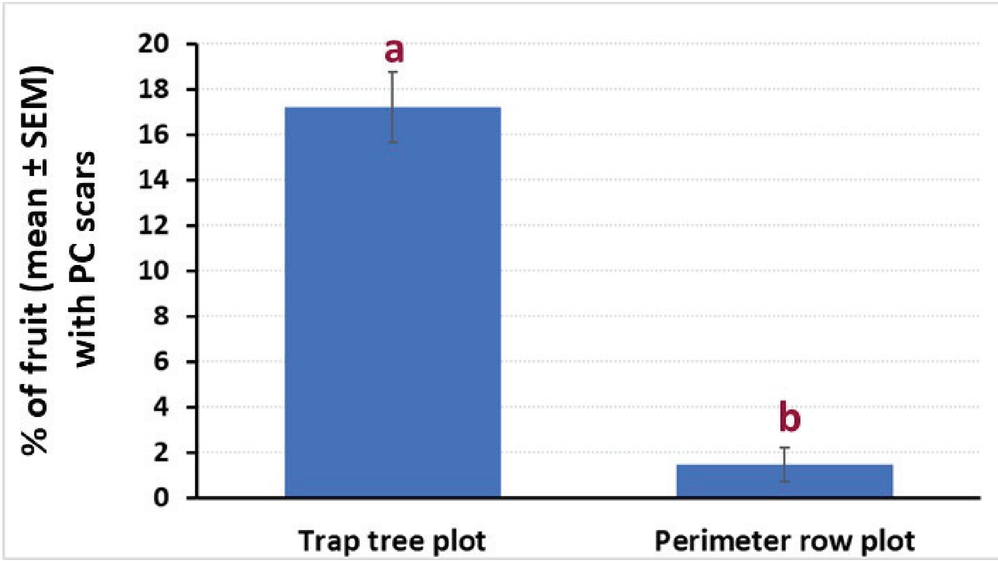


Figure 1. Percentage of PC injury to fruit (mean ± standard error of the mean [= SEM], *a measure of how precise the estimate is*) in odor-baited trap trees (in TT plots) and unbaited 'control' trees (in PR plots). Different letters above bars denote statistically significant differences between treatments at odds of 19:1.

in fruit sampled from any of the trees that were located behind the trap tree (in TT plots) and 'control' trees (in PR plots) (Figure 2B).

The percentage of PC injury to fruit (1.1 on average) recorded in the interior of plots managed using the trap tree approach was not different from the percentage of injury (1.2 on average) noted in plots managed with perimeter row sprays (Figure 3).

ed (5.3% on average) in fruit sampled from perimeter-row trees that were adjacent (= Perimeter-1) to the trap tree in TT plots compared to similarly located 'control' tress in PR plots (1.6% injury, on average). Such an effect was lost as the sampled trees were located farther (i.e., Perimeter-2, Perimeter-3) away from the trap tree. No differences in the level of injury were recorded

Conclusions

Our findings confirm that the presence of the synergistic dual lure (grandisoic acid and benzaldehyde) deployed within the canopies of perimeter-row apple

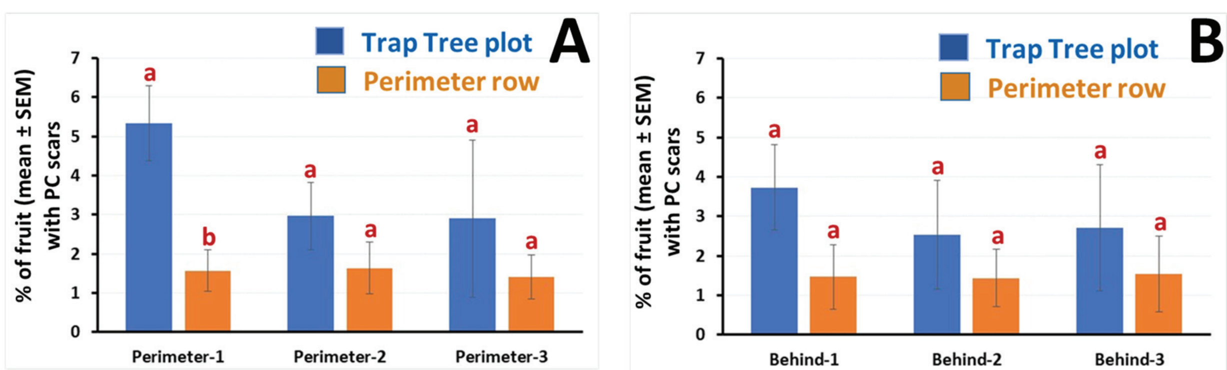


Figure 2. Percentage of PC injury to fruit (mean ± SEM) recorded in (A) three nearest lateral trees surrounding each trap tree (in TT plots) and each unbaited 'control' tree (in PR plots), and (B) three trees behind trap trees and 'control' trees in TT plots and PR plots, respectively. For the comparison of TT versus PR treatments, different letters above bars denote statistically significant differences between treatments at odds of 19:1.

trees at bloom results in significant aggregation of fruit injury in those specific canopies compared with unbaited trees. These specific insecticide-treated trap tree canopies function as an "attract-and-kill" trap crop for adult PCs. Application of insecticides only to trap trees resulted in the same level of PC control that was achieved with perimeter-row sprays, with a concomitant reduction in insecticide use.

Figure 3. Percentage of fruit injury by PC (mean ± SEM) to fruit sampled from the plot interior according to treatment. Different letters above bars denote statistically significant differences between treatments at odds of 19:1.

Acknowledgments

We thank Tom and Ben Clark, Stephen Wood, and Chuck Souther for allowing us to work on their orchards. We also thank Natalie DiDomenico and Nicole Foley for assistance. The UMass Stockbridge School of Agriculture provided funding for this research.

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Assessment of One Year of Growth in the New Jersey Hard Cider Variety Trial

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There is much interest in hard cider in New Jersey. In New Jersey the manufacture of hard cider is covered under the Farm Winery Act, passed in 1981. NJ law treats hard cider as a type of wine as it is fermented from fruits (N.J.A.C. 18:3-1.2)

As such there is much interest from existing sweet cider producers to make and sell hard cider as a value added product. There is also great interest and for the establishment of new, stand alone hard cideries. NJ now has a mix of both established, seen the list at https://www.ciderculture.com/cideries/state/nj/

These hard cider producers all need a supply of the best apples for their cider. Some traditional fresh market apples make good hard cider, but many of the hard cider producers are looking for both the English and French hard cider varieties to source for production of craft hard ciders.

Apple growers and hard cider producers are looking to source these hard cider apple varieties that have specific characteristics for craft hard cider. There is an abundant interest and momentum from these NJ hard cider producers to evaluate and grow or purchase these varieties from other apple growers.

As a result, it is important to establish a demonstra-

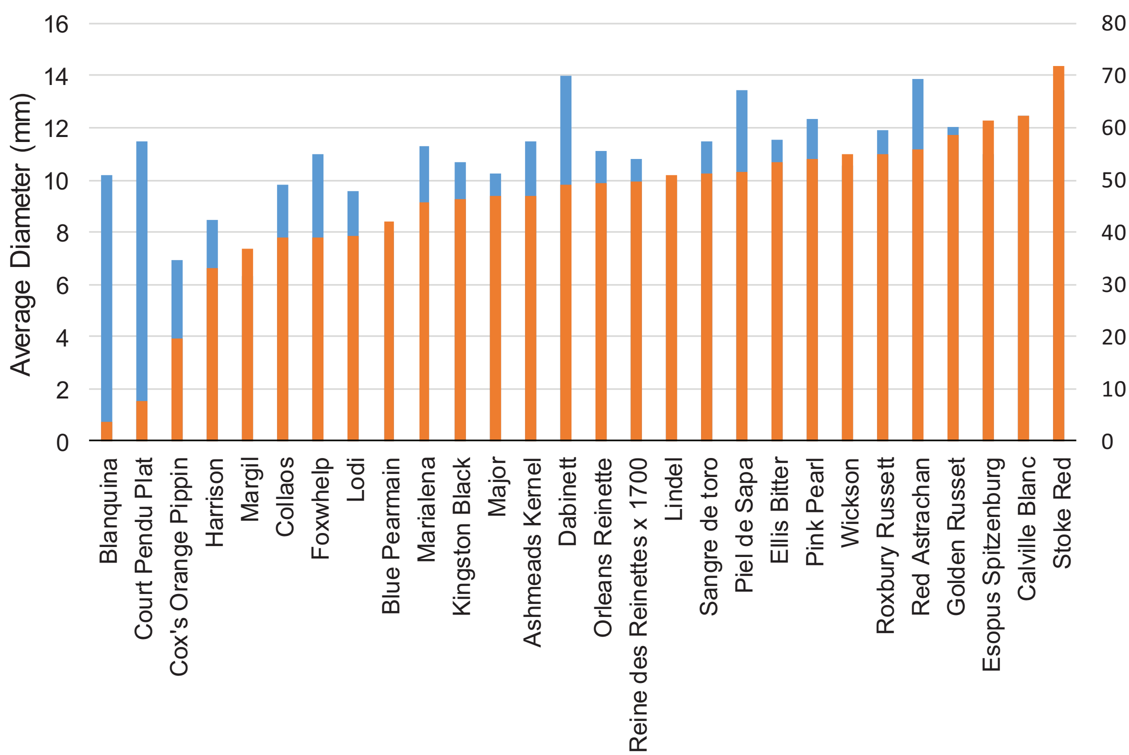

Figure 1. Growth in diameter (mm), and height (in) of 28 hard cider apple cultivar grafts from April 2018 to October 2018 at the Rutgers University, Snyder Research and Extension Farm in Pittstown, New Jersey.

Table 1. Previously characterized traits for varieties included in the hard cider variety trial during 2018 at the Rutgers Snyder Research and Extension Farm. Varieties labeled with TBD indicate information on tannins, sugars and acidity could not be found. Information sourced from the following: The Wittenham Hill Cider Pages. 1996. http://www.cider.org.uk/frameset.htm; Washington State University Extension and Cider. 2018. https://cider.wsu.edu/; Cummins Nursery. 2018. https://shop.cumminsnursery.com/shop/apple-trees/cider; Institut Francais Des Productions Cidricoles 2018. http://www.ifpc.eu/fileadmin/users/ifpc/infos_techniques/Varieties_cidricoles.pef

Variety	Tannin/Bitter	Sweet	Acid/Sharp	Aromatic
Blanquina[1]			X	
Court Pendu Plat			X	X
Cox's Orange Pippin			X	X
Harrison	X	X		
Margil			X	X
Collaos[1]			X	
Foxwhelp	X		X	
Lodi		X	X	
Blue Pearmain		X		
Marialena[1]	TBD	TBD	TBD	TBD
Kingston Black	X		X	
Major	X	X		
Ashmeads Kernel			X	X
Dabinett				X
Orleans Reinette			X	X
Reine des Reinettes x 1700				X
Lindel	X	X		
Sangre de toro[1]	TBD	TBD	TBD	TBD
Piel de Sapa[1]	TBD	TBD	TBD	TBD
Ellis Bitter	X	X		
Pink Pearl			X	
Wickson		X	X	
Roxbury Russett		X	X	X
Red Astrachan		X	X	X
Golden Russet		X	X	X
Esopus Spitzenburg			X	X
Calville Blanc			X	
Stoke Red	X		X	

[1]Varieties originating in Spain that were recently propagated in the United States.

tion variety trial of major hard cider varieties in New Jersey. This will enable us to make recommendations on variety choices and appropriate growing practices for these cultivars. Many of these varieties have had limited cultivation in New Jersey.

In April 2018, a plot was established at the Rutgers University Snyder Research and Extension Farm to begin our hard cider variety testing. Thirty-one hard cider varieties were top worked onto an existing dwarf research apple block. The hard cider varieties were cleft grafted onto five-year-old apples on M9(NAKBT337) rootstock, planted 3' x 12' growing in a tall spindle system. Four trees each of the 31 varieties were top worked. Twenty-eight of these varieties saw at least one successful graft. The three varieties that were entirely unsuccessful were Cristalina, Raxao, and Solarina. Unfortunately, all three of these unsuccessful varieties are new Spanish hard cider selections being tested in the United States.

Hard cider apple varieties are categorized primarily by their level of tannins (bitterness), sugars, acidity (sharpness), and aroma. The 28 varieties successfully grafted for this study are listed in Table 1, alongside their cider characteristics. Characteristics listed in Table 1 were referenced from previous studies and were used to determine their inclusion in this study. To date, the three unsuccessful varieties from Spain have yet to be characterized under New Jersey conditions. However, they will be added to this study in the 2019 growing season.

Preliminary results of the study show high grafting success. Just under 50% of all of the trees grafted had a 100% graft take (4 scions), followed by 33% of the trees resulted in 1-3 successful grafts. Of the remaining trees, 18% resulted in zero graft take and will be re-grafted next season.

Blossoms were thinned off of the trees during 2018 to allow for increased vegetative growth. Therefore, fruit data were not collected in 2018.

Graft vigor was assessed by scion length and diameter at the end of the growing season. Tree growth was measured above the original scion wood scar, and scion diameter was measured 12 inches above the top of the original scion wood. Tree vigor varied dramatically across cultivars, as shown in Figure 1. Stoke red was shown to have both the largest diameter (14 mm) and the greatest height (<70 inches) after one growing season. This was followed closely by Calville Blanc, Esopus Spitzenburg, and Golden Russet, all ~ 60 inches tall and 12 mm in diameter. Blanquina, Court Pendu Plat, and Cox's Orange Pippen all grew less than 20 inches in one season; however, diameters on these varieties were some of the largest, ranging from 7 to 12 mm.

Despite only one growing season of data, this study provides a first glimpse as to which varieties show initial vigorous growth in the New Jersey climate. Calville Blanc, Stoke Red, and Esopus Spitzenburg represent an array of flavor profiles, sharp, bittersharp, and sharp respectively, all of which are well suited to hard cider production.

Entomopathogenic Nematodes Are Effective at Killing Plum Curculio Larvae in the Soil

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Current recommendations to control plum curculio (PC) rely on insecticide applications targeting adults. Due to various environmental and regulatory concerns, there is a need to develop alternative and more sustainable management strategies for this pest. Entomopathogenic nematodes (EPNs) have been identified as being promising biological control agents of key insect pests. EPNs are very small, soft bodied, non-segmented roundworms that are parasites of insects. The nematodes are obligate parasites of insects in nature. EPNs occur naturally in soil environments. They locate their prey in response to carbon dioxide, vibration, and other chemical cues.

When an EPN is used against a pest insect, it is critical to match the right nematode species against the target pest. About a dozen nematode species are produced commercially as biological control agents of economically important insect pests including the larvae of several weevil species. Results from previous research conducted by USDA ARS scientists indicate that, relative to the untreated check, the EPN species *Steinernema riobrave* caused 85.0% and 97.3% control in 2011 and 2012, respectively, in Belchertown, Massachusetts, and 100% control in West Virginia on both years. Another nematode species, *Steinernema feltiae*, caused 0% and 84.6% control in 2011 and 2012, respectively, in Belchertown, and 78.2% and 69.7% control in West Virginia. These results are highly encouraging because this is the first time that biological control of

Pyramidal emergence trap used for the quantification of PC adult emergence after the application of either, the EPN *Steinernema riobrave,* or water (control). Trap dimensions: 1.1 x 1.1 yards at the base.

PC shows high potential for controlling immature stages of PC. Here, we present results of on-farm research that aimed at demonstrating the level to which EPN *Steinernema riobrave* applied to the soil underneath the canopies of perimeter-row apple trees is effective at killing PC larvae.

Materials & Methods

Study sites and experimental cages. This study was conducted in seven orchard blocks located in Massachusetts (five blocks) and New Hampshire (two blocks). Within each block, individual perimeter-row trees and their understory were used. Two pyramidal emergence traps (1.1 x 1.1 yards at the base) made of PVC and steel screen were placed underneath the canopy of each tree. Within each tree, the assignation of cages for treatment (EPN application, see below) or control (water only) was done at random. A plastic conical device that topped each cage permitted the capture of adult PCs that, upon adult emergence from the immature stages, walked upward on the interior surface of the capturing device. Thirty-two cages (16 were assigned to EPNs, 16 served as controls) were deployed in all across all seven blocks. Each orchard block received 4-8 cages.

Experimental approach. Prior to the placement of the emergence cages, 75 apple fruitlets that were suspected to have PC larvae were placed on the ground, underneath tree canopies. The fruit was spread out to cover about 50% of the area under the emergence cages. All fruitlets were collected from unsprayed trees in Belchertown, Massachusetts. EPNs were obtained from BASF Corporation. EPN application rate was 4 million of infective juvenile nematodes per square meter (1.1 yards) and were applied in 3.78 L of water. For each tree, one cage received EPNs and the other cage received water (3.78 L) alone. Afterwards, the cages were buried and flagged with treatment information and application date (July 16-20, 2018). Starting on 15 August 2018, the number of adult PCs collected in the capturing device were recorded and removed on a weekly basis. Other than the amount of water that was applied during treatment application, no additional

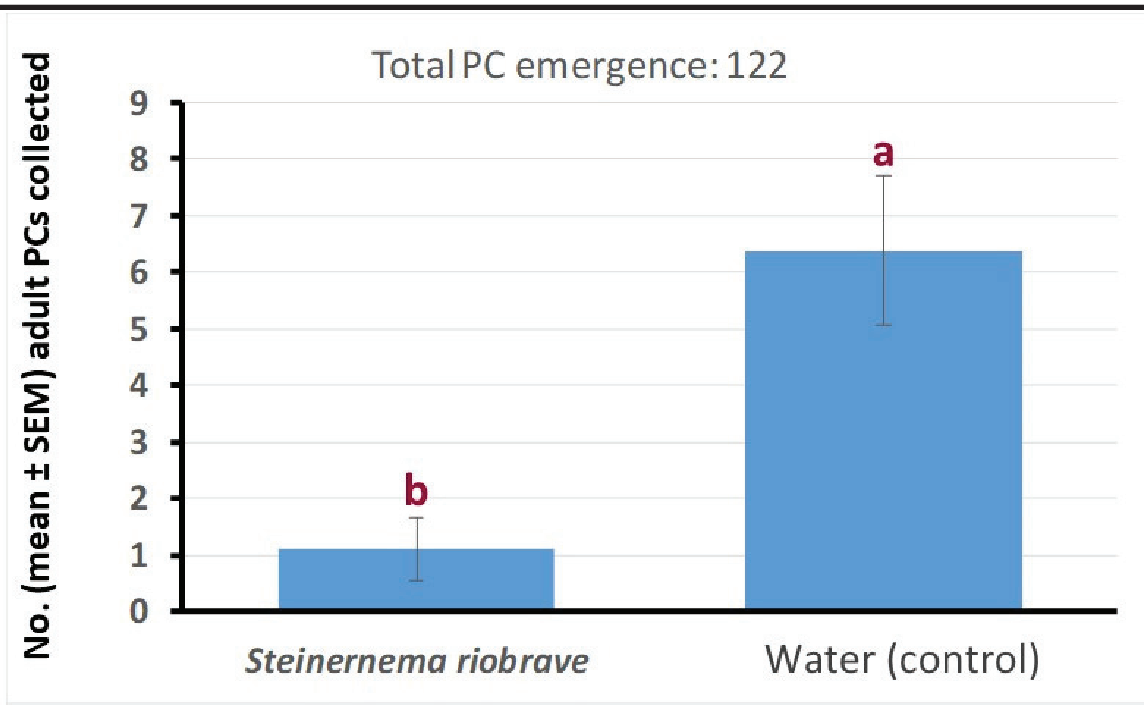
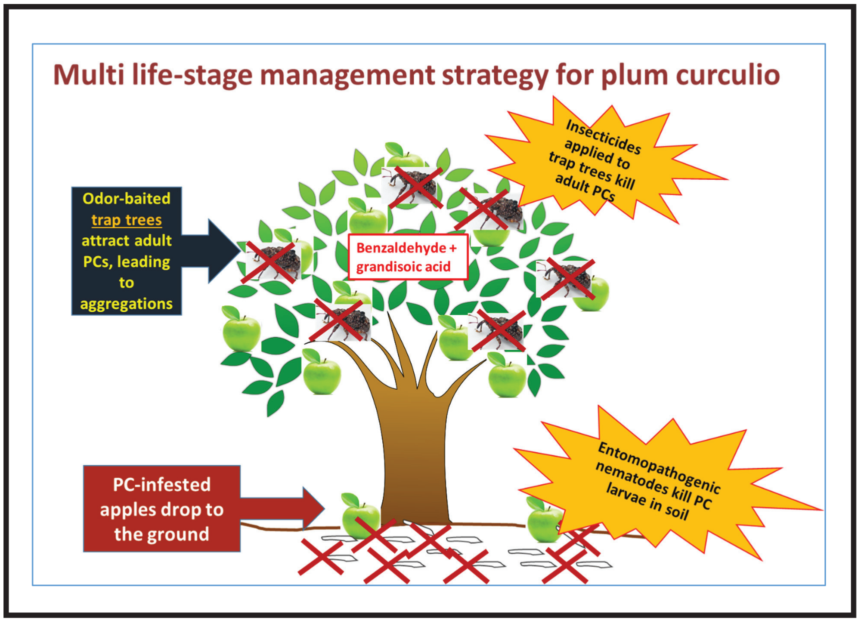


Figure 1. Number (mean ± standard error of the mean [= SEM], *a measure of how precise the estimate is*) of adult plum curculios (PCs) that were recovered from emergence cages following application of either, the EPN *Steinernema riobrave,* or water (control). Different letters above bars denote statistically significant differences between treatments at odds of 19:1.



irrigation took place. Treatment effects were assessed by comparing the number of adult PCs emerging from cages subject to EPN application versus control cages.

Results

Overall, 122 adult PCs were recovered from the 32 emergence cages (103 weevils from control cages, and 19 weevils from EPN-treated cages), a result that indicates that only a low number of fruit that was placed inside the cages (2,475 fruits) was actually infested with PC. On average, 1.1 adult PCs were recovered from EPN-treated cages while 6.4 adult PCs were recovered from control cages (Figure 1). Thus, the application of EPNs led to a 5.5-fold decrease in the number of adult PCs emerging relative to the untreated check.

Conclusions

Our results indicate that the EPN *Steinernema riobrave* is effective at killing PC larvae in the soil. The overall goal of this research is to use EPNs as a biologically-based component of an IPM program that targets multiple stages of PC. This approach makes use of attractive lures to pull adult PCs to selected perimeter-row trees. The canopies of odor-baited trees are then sprayed with adult-killing insecticides while the other trees in the block do not receive insecticides to control PC (see preceding *Fruit Notes* article). By only spraying odor-baited trees the total number of trees that receive insecticide treatment can be reduced by more than 90%. As a result of adult PC aggregations, there is also aggregation of fruit injury by PC in odor-baited trees. As shown here and also from previous research, EPNs can then be applied to the soil of those trees to kill PC larvae, which will also be concentrated in those areas compared to any other trees in the orchard.

Acknowledgments

We thank Steven Wood, Tom and Ben Clark, Keith Arsenault, Steve Lamphear, Kenneth Nicewicz, and Mark Madden for allowing us to work on their orchards, and to Shawn Mcintire (UMass Cold Spring Orchard) for support. We also thank Natalie DiDomenico and Nicole Foley for technical assistance. BASF graciously donated *Steinernema riobrave* for this investigation. The UMass Stockbridge School of Agriculture provided funding for this research.

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Fruit Quality Characteristics of New Peach and Nectarine Varieties: Selena and Silverglo

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Daniel Ward
Extension Specialist, Pomology, Rutgers New Jersey Agricultural Experiment Station

Two exciting new peach and nectarine cultivars have been released from the Rutgers Stone Fruit Breeding through Adams County Nursery. These new varieties were created and selected by Joseph Goffreda at the Rutgers Fruit and Ornamental Research Extension Center in Cream Ridge, New Jersey. To understand how best to select and market these varieties, growers need to better understand the characteristics of their fruit. We performed several studies to estimate fruit qualities, both chemical and physical, that determine much of the value of peaches.

For each study fruit were harvested from three-to-five-year-old trees established in commercial orchards in southern New Jersey. Harvesting at the time of commercial maturity for each cultivar was based on ground color change and size. After picking, fruit were transported to the laboratory at Rutgers Agricultural Research and Extension center where all analyses were performed. Fruit were evaluated for firmness, size, total soluble solids (°Brix), total titratable acidity, and pH.

These two varieties yielded attractive fruit with good commercial potential (Figures 1 and 2). 'Selena' is a late-season yellow peach with excellent firmness, and fruit can hang well on the tree. It has a traditional color (red-on yellow background skin) and taste (high sugar with acidity, Table 1 and 2). Three-year average for physical and chemical properties were firmness (9.9 lbs), diameter (3.1 in), mass (244 g), total titratable acidity (5.7 g/l), and total soluble solids (12.1 °Brix). 'Silverglo' is firm, and larger and more attractive than other white nectarines during their early-harvest window (Table 1 and 2). Three-year average physical and chemical properties were firmness (10.1 lbs), diameter (2.7 in), mass (191 g), total titratable acidity (7.4 g/l), and total soluble solids (10.5 °Brix). Harvest dates (all harvest dates are from southern New Jersey) for 'Selena' ranged from September 5 to 20 and for 'Silverglo' ranged from August 5 to 20.

These two varieties are available through Adams County Nursery and can be recommended for trial plantings (see inserted text Box).

- **Selena (NJ 358)** – Late season yellow peach with excellent firmness. Ripens between 'Jersey Queen' and 'Encore'. Very large fruited with attractive 50-80% red-on- yellow background. Hangs well on tree and has excellent flavor and coloring. Low susceptibility to bacterial spot and productive.
- **Silverglo (NJN 103)** – White fleshed nectarine with clingstone/semi free stone. It ripens between 'Artic Sweet' and 'Artic Jay'. It has larger and more attractive than other white nectarines in this season. Nice traditional acidic flavor. Attractive color, lots of pinkish red color and very low skin blemishes. Tree moderately vigorous and low susceptibility of bacterial spot.

Figure 1. Fruit of Selena peach from the Stone Fruit Breeding Program of Rutgers/NJAES (photograph credit: Jerry Frecon).

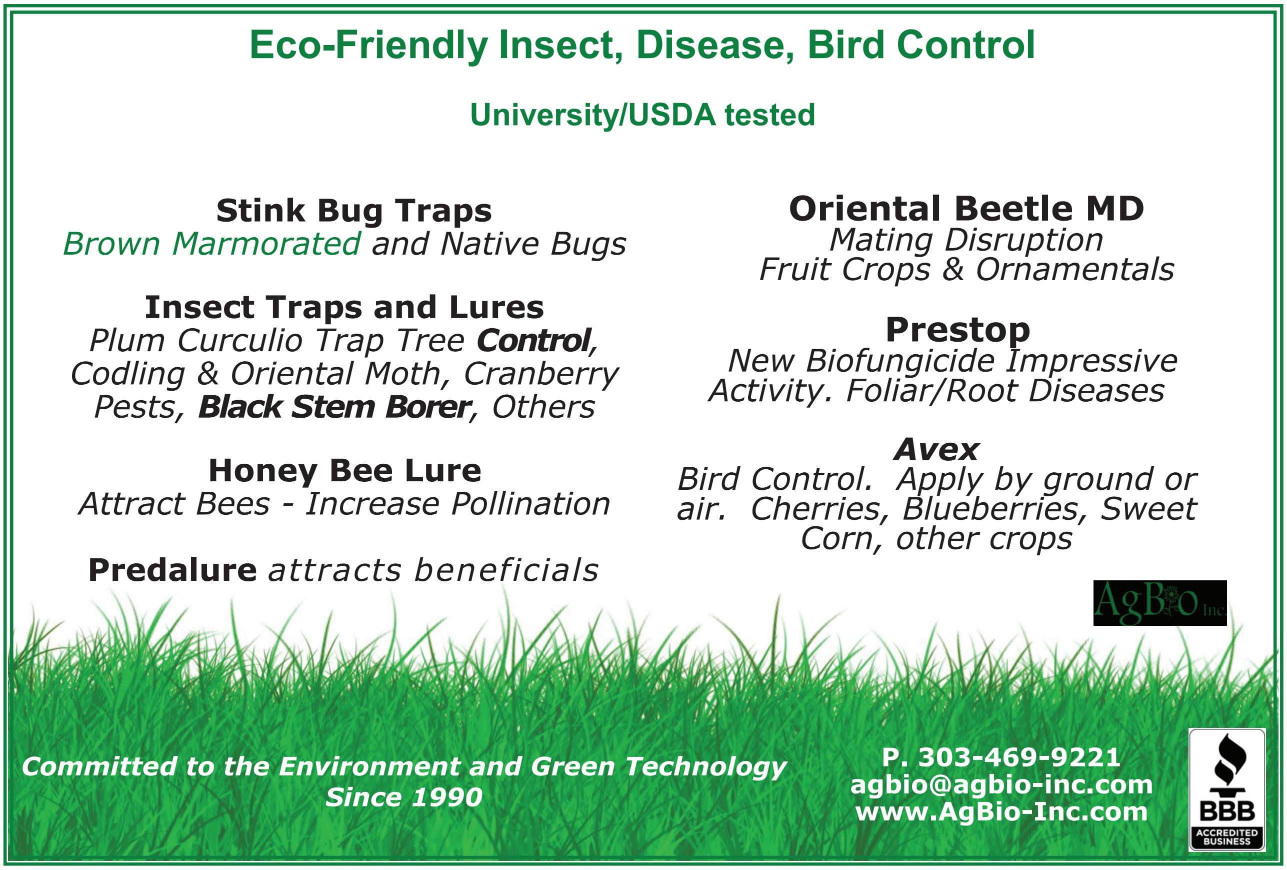
Table 1. Physical properties of fruit harvested from new varieties of peach and nectarine. Each value came from samples of approximately 24-30 fruit taken on each of 2-4 harvest dates in each year.

		2015		2016		2017	
Variety	Property	Average	Standard deviation	Average	Standard deviation	Average	Standard deviation
Selena (NJ 358)	Fruit firmness (lbs)	10.9	3.1	-	-	8.8	3.8
	Fruit diameter (in)	3.2	0.1	-	-	3.0	0.7
	Fruit mass (g)	261.8	26.8	-	-	225.5	37.6
Silverglo (NJN 103)	Fruit firmness (lbs)	11.9	3.1	10.8	2.4	7.5	4.4
	Fruit diameter (in)	2.8	0.2	2.6	0.1	2.6	0.1
	Fruit mass (g)	206.0	30.5	21.5	21.5	170.2	19.4

Figure 2. Fruit of Silverglo a new nectarine from the Stone Fruit Breeding Program of Rutgers/ NJAES (photograph credit: Jerry Frecon).

Table 2. Chemical properties of fruit harvested from two new varieties of peach and nectarine. Each value came from samples of approximately 24-30 fruit taken on each of 2-4 harvest dates in each year (no data for 2016).

		2015		**2017**	
Variety	Property	Average	Standard deviation	Average	Standard deviation
Selena (NJ 358)	TTA (g/l)	1.62	0.10	9.71	0.46
	pH	3.51	0.02	3.7	0.02
	TSS (°Brix)	13.03	0.48	11.1	0.58
Silverglo (NJN 103)	TTA (g/l)	1.51	0.07	13.2	1.9
	pH	3.46	0.05	4.6	0.09
	TSS (°Brix)	10.98	0.41	10.1	0.01


Eco-Friendly Insect, Disease, Bird Control
University/USDA tested
Stink Bug Traps
Brown Marmorated and Native Bugs
Insect Traps and Lures
Plum Curculio Trap Tree Control, Codling & Oriental Moth, Cranberry Pests, Black Stem Borer, Others
Honey Bee Lure
Attract Bees - Increase Pollination
Predalure attracts beneficials
Oriental Beetle MD
Mating Disruption
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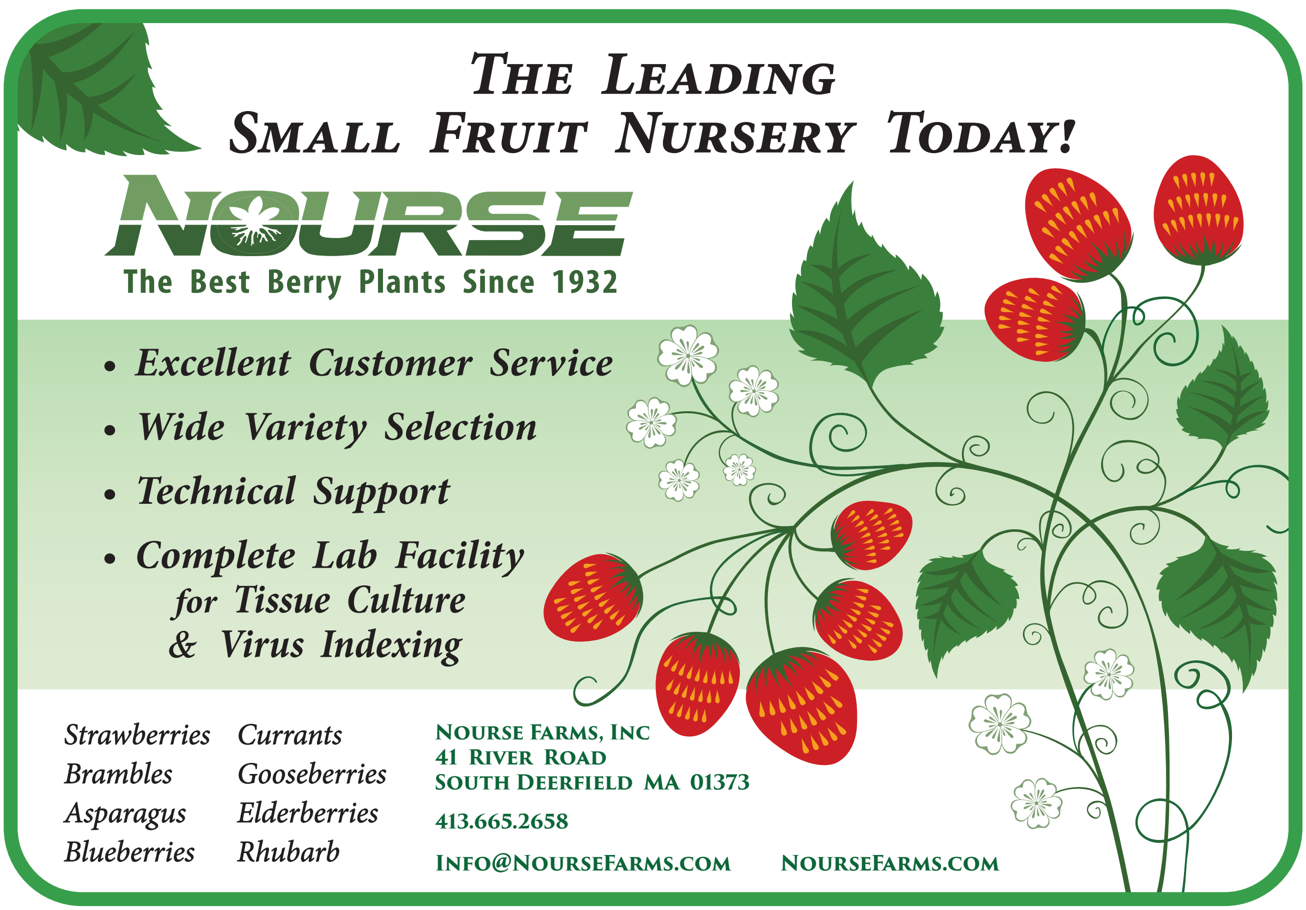
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Five Methods of Crop Thinning in Pinot Noir and Their Effects on Fruit Composition and Wine Quality

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One of the most labor intensive aspects of wine grape production is crop thinning. An average vineyard requires nearly 24 man hours per acre for this task alone. Although the task is time consuming and labor intensive, it is also necessary to ensure that vine capacity is appropriately balanced with crop load.

Crop load / vine capacity is particularly challenging to manage in pinot noir, a high value *Vitis vinifera* (European Wine Grape) grown throughout New Jersey. Pinot noir has a strong tendency towards over-cropping, and it is sensitive to high crop loads.

In 2018, Beneduce Vineyards (Franklin Township, Hunterdon County, NJ), led by Mike Beneduce, was awarded a SARE Farmer grant (FNE 18-885 https://www.nesare.org/Dig-Deeper/Newsroom/2018-Northeast-SARE-Awards) to investigate the impact of five thinning methods on fruit composition, wine quality, and profitability of pinot noir grape production.

Preliminary results in 2018 show the effect of cluster-thinning methods on the crop load (Tons/Acre), average cluster weight, average berry weight and fruit composition characteristics including brix, pH, and titratable acidity.

Field Design

A block of 7-year-old Pinot Noir clone #23 on Couderc 3309 rootstock was used for the study. Ten 350-foot rows were selected for the demonstration trial. Five thinning treatments were identified, including an untreated control for the study. There was a single replication for each treatment consisting of two 350-foot rows. Because there were no treatment replications, significant differences could not be calculated, rather trends observed.

Treatments

Two Clusters Method (two clusters per shoot), was thinned on July 24. The result was removal of approximately 90 lbs per row. Rot hazards were selected and removed first, and subsequently, the third cluster was removed on any shoots that had it (there were very few).

One Cluster Method (one cluster per shoot), was thinned on July 24. The result was removal of approximately 270 lbs per row. Rot hazards were prioritized and removed, followed by removal of any cluster with shot berries or those that would impede air flow.

Green Harvest Method was thinned to 1.5 clusters per shoot on August 8. Approximately 200 lbs per row of green clusters were removed for this method, leaving behind those that had started veraison.

Austrian Method thinned by removing the bottom portion of all clusters on July 25. This method resulted in removal of approximately 180 lbs of fruit per row. The bottom 40% of all clusters was removed, which helped to space out the remaining clusters and seemed to result in a reasonable crop load. This method was the most time consuming, and also left cut berries at the bottom of each cluster. These were hand removed (rubbed out) but left tissue exposed that could cause disease issues. No disease evaluation was made.

Untreated Control - no thinning treatments were made on the control. However, some clusters had to be removed because they were considered to be "hazard clusters." These clusters were wrapped around vines or grew into each other in such a way that they were certain to cause rot issues. Approximately 30 lbs of hazard clusters were removed per row, that amount could have impacted the fruit quality and yield measurements.

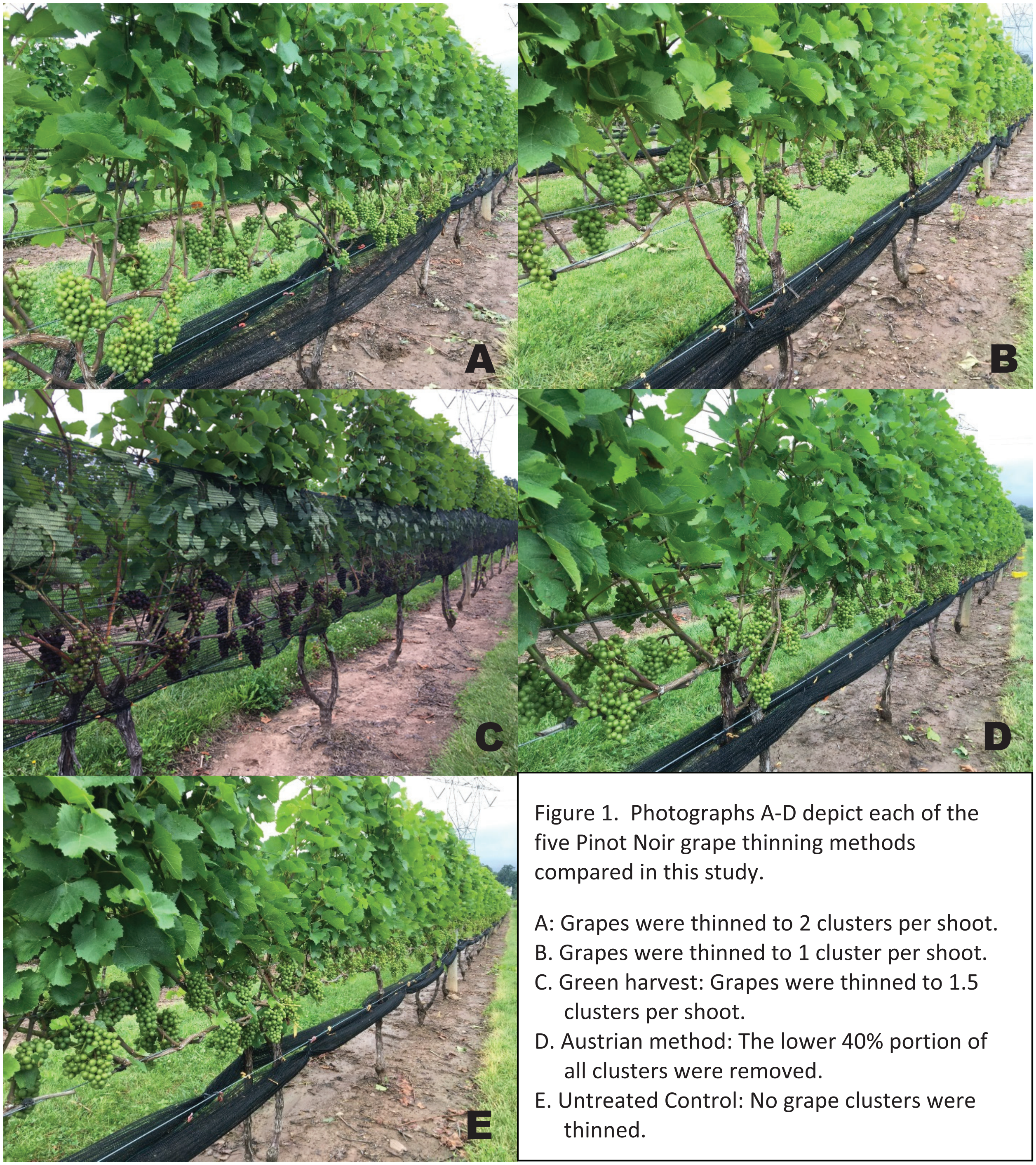

Figure 1. Photographs A-D depict each of the five Pinot Noir grape thinning methods compared in this study.

A: Grapes were thinned to 2 clusters per shoot.
B. Grapes were thinned to 1 cluster per shoot.
C. Green harvest: Grapes were thinned to 1.5 clusters per shoot.
D. Austrian method: The lower 40% portion of all clusters were removed.
E. Untreated Control: No grape clusters were thinned.

Data Collected

Total yield was harvested for each treatment/two rows per treatment. Twenty clusters were collected equally across the two rows, weighed, and averaged for a cluster weight per treatment. One hundred berries were collected equally across the two rows of each treatment, weighed then divided by 100 to calculate the average berry weight per treatment. All of the fruit per treatment/two rows, were crushed. A fruit sample was collected from each crush for the determination of °Brix, pH and titratable acidity.

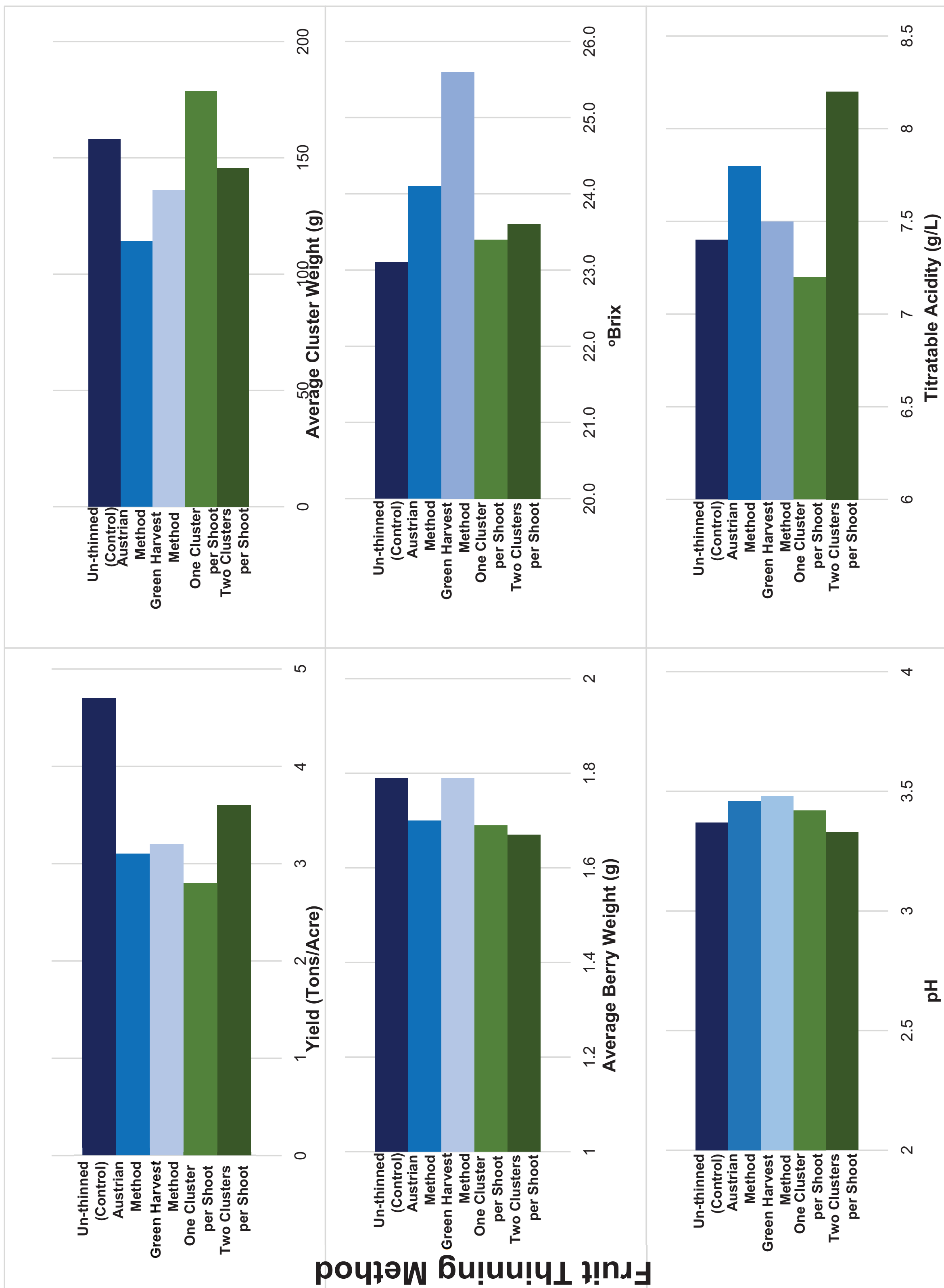

Figure 2: Yield at harvest, average cluster weight, average berry weight, sugar content (ºBrix), pH, and titratable acidity as a result of each thinning method.

Preliminary Results & Discussion

Several observations were made regarding treatments. The Austrian Method may not be suitable for clones of pinot noir or other tight-clustered varieties because of the difficulty in getting scissors into the clusters. This method might be better suited on the cultivars Blaufränkisch and Cab Franc.

The grower also noted that the One Cluster Method resulted in too much thinning for the amount of total vegetation contained on the vines.

The highest yield per acre was with the Untreated Control at 4.7 Tons/acre followed by the Two Clusters Method at 3.6 Tons/acre. The One Cluster, the Austrian, and the Green Harvest Methods all showed similar yields of ~3Tons per acre.

The average weight of clusters ranged from 114g for the Austrian Method and up to 178g for the One Cluster Method. The range of weights for individual berries showed less variability, and appeared not significant with only a 0.1g difference between treatments.

Total grape yield by treatment was inversely correlated with the degree of thinning. Treatments that removed the greatest number of clusters resulted in lower yields. This relationship was not consistent, however, when looking at cluster weight. The lowest yielding method was the One Cluster Method but it resulted in the highest cluster weight. The highest yielding method, the Untreated Control, resulted in the second highest cluster weight.

In terms of fruit chemistry, all of the methods resulted in a pH of ~3.4 at harvest with no difference between treatments. The titratable acidity was highest in the Two Clusters Method at ~8.3 and lowest in the One Cluster Method at ~7.2. All methods resulted in a higher titratable acidity than the One Cluster Method. Overall there was not a great difference in titratable acidity between treatments.

The °Brix (sugars) were highest (>25) in the Green Harvest Method and lowest in the Untreated Control (~23). All methods resulted in higher °Brix than the Untreated Control. Note that for production of pinot noir, there is no industry standard for yield per A, cluster weight, berry weight, pH, °Brix, or TA.

We found the Green Harvest and the Two Clusters Methods to be potential new thinning approaches for handling pinot noir grapes in Hunterdon County, northern New Jersey. It is also important to begin to understand the implications of each thinning method on crop load and berry characteristics.

2018 Northern New Jersey Fruit IPM Report

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Megan Muelhbauer and Dean Polk
Rutgers University

Horticulture

Thinning- we have been advocating for several years that growers use split multiple applications of PGR's for chemical thinning (the "nibble" approach), starting at bloom. This season, most growers in NJ and PA had a hard time with weather conditions at thinning time. At least one timing and sometimes multiple applications were problematic.

Across the board, growers that began thinning applications at bloom and got a petal-fall spray on, had better thinning results over all and less hand thinning to do than growers who waited for 'good' weather and missed some later applications. Sometimes the later applications did not fall within a good carbohydrate-deficit window based on the Cornell Model and thus did notwork.

Excessive Rainfall

Growers in North Jersey and eastern Pennsylvania experienced 35-40 inches of rainfall in July, August, and September. Our annual rainfall is normally only 43 inches. Most peaches and August and September (early) apples had poor flavor, as the sugars were diluted.

Sunburn

We had many days of 90°F or higher temperatures. Growers who did not apply sunburn materials prior to the heat had sunburn. With excessive rainfall in August and September, we had rapidly sizing fruit that were exposed as we continued to have 90°F days. Growers who did not appy sunburn material had excessive sunburn on many varieties, especially if the fruit was exposed on well-pruned tall-spindle trees.

Bitter Rot

Bitter rot was severe in northern New Jersey orchards that did not reapply fungicide after 2 inches of rainfall. Growers who reapplied were in good shape, but several indicated that their spray bill was almost double a normal year. Of note, bitter rot was not just a problem on Honeycrisp but appeared on cultivars across the board.

Glomerella

Glomerella was diagnosed by our Rutgers Diag-

Bitter Rot- Photo Credit Jon Clements-Fruitadvisor.info.

Bitter Rot- Photo Credit Good Fruit Grower.

nostic lab, from samples from one grower in northen New Jersey on Crips Pink. I suspect it was present in other orchards as well. It appeared in clusters of tress and seemed to spread from there. On trees that lost significant foliage, the fruit ripened prematurely and was discarded.

For diagnosing Glomerella, I received much assistance from the Rutgers Diagnostic Lab, Dr. Kieth Yoder, VPI, and Dr. Srdjan Acimovic, Cornell- see the links below.

https://blogs.cornell.edu/fruit/2012/08/31/glomerella-leaf-spot-a-new-disease-affecting-golden-delicious-apples-in-ny/

https://treefruitdisease.blogspot.com/search?q=glomerella

Dr. Sara Villani, NC State University, has the most recent disease-control trial data for Glomerella and published an excellent fact sheet *Preparing for Glomerella Leaf Spot and Fruit Rot in 2018* with data and fungicide recommendations.

https://apples.ces.ncsu.edu/2018/04/preparing-for-glomerella-leaf-

Spotted Lanternfly

Spotted lanternfly was first found in NJ in early July in Phillipsburg, Warren County at a homeowner location. Then on Friday, August 10, on a commercial Hunterdon County fruit and vegetable farm by Rutgers IPM personnel. The insect was found in a Tree of Heaven being used as a trap tree with a plastic catch basin placed around the base of the tree, and the first 5-6 feet of the trunk sprayed with dinotefuran to kill any insects that land on the tree. The dead insects were supposed to fall into the catch basin. They did not. The find was made by looking up into the foliage and seeing the adult stage. To our knowledge this is the first sighting of this insect on a commercial farm in NJ. Growers should be particularly aware of any possible activity in trees of heaven that border cultivated plantings. These trees are common in poor and disturbed soil. This capture was made from trees on a hillside that line the border of a power line which runs through the farm. With the amount of spraying that normally

Glomerella from the same Northwest Jersey Crips Pink Orchard. Photo Credit- Win Cowgill.

Three-year-old Crips Pink/M.9 Severely defoliated.

Same Crimps Pink in row view- adjacent trees start to defoliate.

Same Crips Pink/M.9 just starting to defoliate.

goes on in tree fruit, it is not likely that this insect will cause a major problem at this time of the season. However, if these insects are found on trees in close proximity to grapes, it can be more problematic. See the July 18 Plant and Pest for an article by Anne Nielsen here https://plant-pest- advisory.rutgers.edu/?s=spotted+lanternfly

In Northern New Jersey, we have found Spotted Lanternfly on 10 commercial farms in Hunterdon County New Jersey (Muelhbauer). They include several vineyards, two grain farms, several orchards and a nursery of ornamentals. Most sightings have been of one or two lanternflies, however one grower of ornamental trees in Hunterdon County reported his *Acer rubrum* was loaded with Spotted Lanternflies. In addition, one orchard has shown significant infestation of the lanternfly on his tree fruit and brambles.

Integrated Pest Management has just begun to be planned/implemented by Rutgers Cooperative Extension through the deployment of pheromone traps. Several farms have been chosen to have sticky bands stapled around vineyard poles and/or the host (Tree of Heaven), and small packs of pheromones were attached. This was just begun in late August, and was not found to be effective in luring/trapping the flies. Our preliminary hypothesis is that these traps might show greater efficacy if they were put out in the spring when the insects are mating instead of the late summer. Other early observations we have made are that they seem to be looking to lay their eggs on other trees in the fall (i.e. *Acer rubrum*) and not the Tree of Heaven as one might suspect.

Brown Marmorated Stink Bug

BMSB presence was spotty all summer in northern Jersey. In September the trap numbers began to increase (See Table 1 Below). In September, October, and Early November (Crimps Pink/GoldRush) apples (and pears) are the only fruit present for BMSB to feed on, growers must have a program to address this pressure. Growers need to protect the fruit with short-PHI insecticides at that time of year, especially with increased activity. BMSB effective materials that have a 7 day or less PHI include Baythroid (Apple, Pear and Peach), and Belay (Apple, Pear only). Dinotefuran, Venom and Scorpion, can be used under section 18 labels for the high rates effective for BMSB. These labels state a 3-day PHI for both pome fruit and stone fruit. Both products are toxic to bees and should be used when there are no flowering weeds in the orchard to attract bees. The Venom rate is 4-6.75 oz/A, and the Scorpion rate is 8-12 oz/A (both have a 2 application maximum). Make sure to apply thorough coverage, make frequent applications, and rotate chemistries as much as possible. Trap numbers are unreliable for making a determination of to spray or not spray a particular block. Since BMSB are so mobile it makes it hard to predict. See below the table for Treatment guidance:

On October 8, 2018 Peter Jenstch, Hudson Valley Lab, Cornell University, wrote: “Over the past 8 weeks we have been seeing a steady increase in populations of the invasive brown marmorated stink bug (BMSB) in our pheromone baited Tedders traps placed along the woodland orchard edges. It’s no surprise that we also seeing an increase in feeding injury BMSB on red and yellow colored varieties, especially along the orchard perimeter.

“It is very important to note that stink bug injury does not express itself immediately on the fruit. Apple recently fed upon by the SB complex will likely be harvested and stored without blemish, only to find the same fruit with very high levels of fruit damage after its removal from cold storage. Efforts should be made to manage this insect complex prior to harvest.

“Management for this insect pest should continue until the last fruit is off the tree. Use of a 10 BMSB per baited BMSB Tedders trap threshold, followed by scouting along the orchard perimeter and use of a single adult stink bug as a threshold within 100′ of perimeter row, then followed by border row, alternate row and whole orchard applications if these thresholds are met should be strongly considered as movement of native and BMSB populations begin to migrate to and from orchards to feed, preparing for overwintering. (In NJ the Rutgers IPM Program was using yellow sticky traps and scouting stopped in Mid September)

“The BMSB has recently begun movement into orchards to intensively feed, stocking up on reserves needed to successfully overwinter. In orchards throughout the Hudson Valley we’ve captured what we would consider the ‘Provisional Threshold’ numbers of adult BMSB in pheromone trap captures. Much confusion about injury can arise at harvest given the four types of late season injury that can occur to fruit.”

1. Stink bug injury for three different species
2. Hail injury during the season

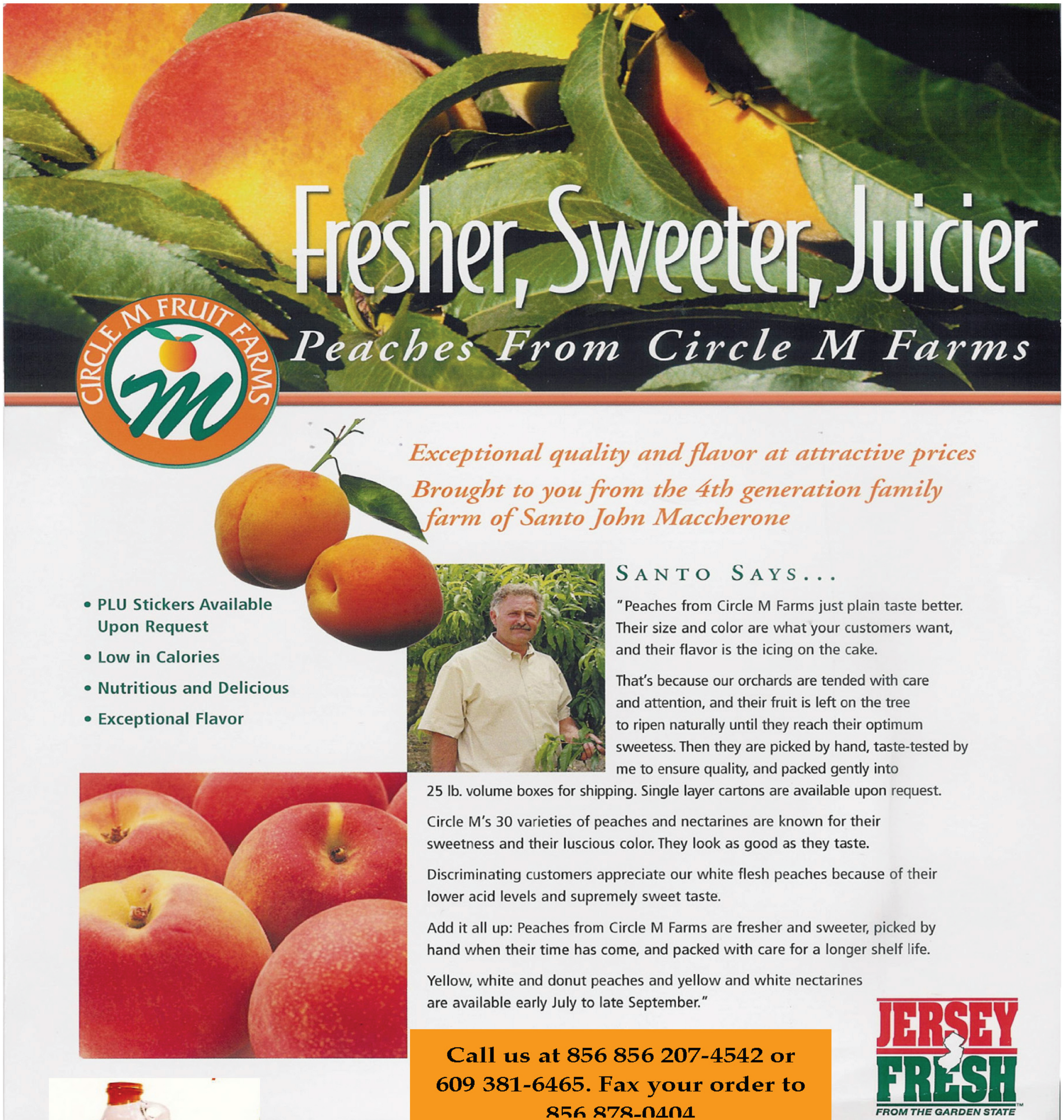
Table 1. Brown Marmorated Stink Bug Trap Counts – Northern Counties Late Summer to Fall 2018.

Week Ending	Average of Adults	Average of Nymphs	Max of Adults	Max of Nymphs
6/23	2.3	0	4	0
6/30	1	0	4	0
7/7	2	0.2	5	2
7/14	1	4	3	28
7/21	1	3	6	13
7/28	0.8	2.4	2	5
8/4	0.7	2.3	5	13
8/11	1.9	5.3	7	17
8/18	2.3	9.3	7	28
8/25	2.6	16.7	9	60
9/1	3.9	11.3	15	74
9/8	7.3	3.7	24	22
9/15	7.9	1.7	19	7

3. Bitter pit from calcium deficiency
4. Bitter pit from calcium deficiency

See Peter's Blog for the descriptions of other injury that is similar: https://blogs.cornell.edu/jentsch/2018/10/08/bmsb-update-stink-bug-feeding-continues-on-apple-assessing-fruit-damage-at-harvest-for-stink-bug/

Management of BMSB in apples should continue until the last fruit is off the tree. If the trap catch indicates of if scouting finds one BMSB in an orchard block, at least perimeter sprays should be applied up to harvest, which can be November for Crimps Pink and Goldrush.



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