Fruit Notes

Volume 83, Number 2: Spring, 2018

Fruit Notes

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

Fruit Notes (ISSN 0427-6906) is published four times per year by the Stockbridge School of Agriculture, University of Massachusetts Amherst. **The cost of a 1-year hard-copy subscription is $40 for U.S. and $50 for non-U.S. addresses. The cost of a 1-year electronic subscription is $20.** Each 1-year subscription begins January 1 and ends December 31. Some back issues are available for $10 each. Payments via check must be in United States currency and should be payable to the **University of Massachusetts Amherst**. Payments by credit card must be made through our website: *http://extension.umass.edu/fruitadvisor/*.

Correspondence should be sent to:

Fruit Notes
Stockbridge School of Agriculture
205 Paige Laboratory
University of Massachusetts Amherst
Amherst, MA 01003

Table of Contents

Cover: Three-year-old Asian pear variety trial on *Pyrus betufolia* rootstock at the Rutgers Snyder Research & Extension Farm, Pittstown, NJ. Photo credit Win Cowgill.

Mating Disruption, Stink Bugs, and Reduced Insecticide Use for Apples at the Snyder Research & Extension Farm, 2016

Dean Polk and Anne Nielsen
Rutgers University

Brown marmorated stink bug (BMSB) has cost many growers both in terms of crop loss and additional dollars spent on insecticides. Prior to BMSB establishment, many growers were using mating disruption to control oriental fruit moth, combined with ground cover management to control catfacing insects. These high impact IPM practices resulted in high percentages of clean fruit, reduced insecticide use, and "good neighbor relationships." Since BMSB has so many hosts, can reproduce in the orchard over the entire season, and is so motile, it has practically destroyed our traditional IPM programming. BMSB also spends much of its time in the woods and wooded edges around orchards. This behavior helps define BMSB as an edge pest, where much of the time it moves into orchards from wooded edges, hedgerows or other borders, such as field corn or maturing grain. Over the past several years we have been working to bring back high impact IPM practices. These efforts originally focused in peach orchards, and combined oriental fruit moth (OFM) mating disruption, with the elimination of broad leaf weeds and legumes on the orchard floor for control of tarnished plant bug and other catfacing insects. This program also monitors BMSB with traps around the edge of the orchard, and combines weekly orchard border sprays of insecticide for BMSB control, while eliminating insecticide from the orchard interior. We coined the term, "Crop Perimeter Restructuring (IPM-CPR)" for this combined set of practices.

We are currently expanding this research to apples. In 2016, as part of a larger USDA funded program, we worked with the entire Snyder Research & Extension Farm tree fruit acreage, placing an IPM-CPR treatment in about half the acreage, while using standard insecticides in the other half. There is only one block of peaches at the Snyder Farm, so while this was monitored and treated under IPM-CPR guidelines, it is not covered here.

Methods

During 2016 the Snyder Farm tree fruit plantings totaled 12.1 acres in various small plantings originally designed for rootstock, tree training and other horticultural practices. We collected data from block 12.1 (2.1 acres) as the standard insecticide treatment, and blocks 25 and 26 (4.4 acres) as the mating disruption/IPM-CPR treatments. In effect, a line was drawn through half the plantings with half the area devoted to the Standard and half to the IPM-CPR. However due to the size and layout of the plantings, only those mentioned were monitored. The peach block (17.1, 17.2) was included in the mating disruption, but has no comparison and is composed mostly of early to mid-season varieties, so is not dealt with here. In both treatments, 6 pyramid BMSB traps were established, 1 on the outside row or end tree, half way down, such that there were 4 traps in the middle of the block edge, and 2 traps in the center, spaced about 40 feet apart. Two trees were marked by each trap from which in-season and at-harvest fruit injury data was taken. Traps were baited with AgBio XtraCombo lures at the end of May, and monitored every 7 days for BMSB and native stink bug nymphs and adults. Lures were changed every 4 weeks. Codling moth pheromone traps (2 placed near the center of each planting) were checked every 7 days with lures replaced every 12 weeks. During each weekly monitoring session a 25 insect sweep net sample was taken in the ground cover to count tarnished plant bugs and other catfacing insects. The tall fescue groundcover

Table 1. Weekly stink bug trap summary.

Treatment	6/8	6/13	6/22	6/29	7/7	7/13	7/18	7/27	8/3	8/10	8/17	8/24	9/7
	Total Weekly Counts of BMSB and Native Stink Bugs in Traps*												
BMSB IPMCPR	0	0	0	0	3	0	0	0	0	8	0	6	15
BMSB Standard	0	0	0	0	0	0	0	0	0	0	0	35	35
Native IPMCPR	0	0	0	0	9	4	1	0	2	2	0	0	0
Native Standard	0	2	0	0	1	2	2	2	0	0	0	0	0

*Each number represents a total of 6 traps with both adults and nymphs for each date.

in all blocks had been annually treated with 2,4-D and clopyralid (Stinger) to eliminate broad leaf weed hosts for catfacing insects. A non destructive 25 fruit sample was scanned each week for the presence of catfacing or other pest injury. Within several days of the normal apple harvest for each variety, a 25 fruit sample was picked from each of 2 trees bordering the BMSB pyramid traps, for 16 total samples per block/treatment.

The IPMCPR blocks received a treatment of Isomate CM/OFM TT @ 200 dispensers per acre in early May. This product disrupts the mating of both oriental fruit moth and codling moth, and was intended to replace any insecticide normally used for those pests. Regular pesticide cover sprays were applied to the standard treatment throughout the season, but only through May in the IPMCPR treatment for plum curculio. After May insecticide was eliminated from the IPM-CPR blocks, with only border sprays of insecticide applied to that treatment starting on June 3. If a pyramid trap count reached a combined 10 nymphs and adults, then a whole block insecticide application would be justified.

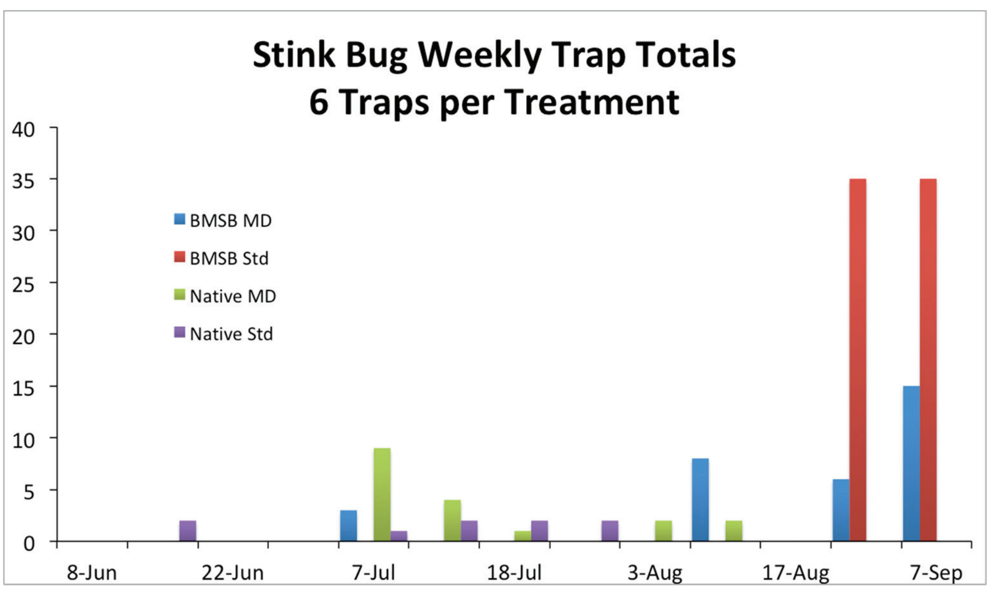


Figure 1. Graphic summary of weekly trap count totals.

Results & Discussion

Very few BMSB were captured until late August (Table 1, Figure 1). Native stink bugs, the majority of which were brown stink bugs, were captured during the middle of the season. Numerically higher numbers of brown stink bugs were seen in the IPMCPR plots, while numerically higher numbers of BMSB were seen in the standard plots.

Stink bug feeding damage is often seen only after the fruit is peeled and cut to see internal damage. While the majority of damage can be seen externally without peeling, cutting the fruit is the only way to get a 100% accurate assessment of the damage. With low levels of

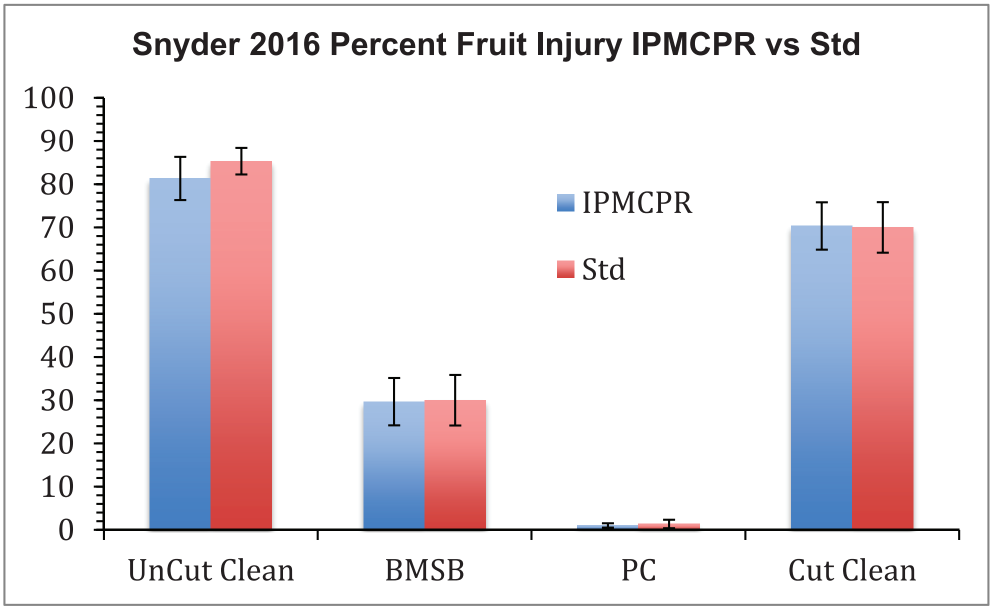


Figure 2. Percent fruit injury from at harvest samples.

damage, growers will often assume that since there may be no external feeding signs, then the fruit is undamaged. While this may be true for marketing, there still may be low levels of feeding. Therefore, we report the clean fruit here as both uncut and cut fruit (Figure 2). The difference between the truly undamaged uncut and cut fruit was about 10%. Uncut visible clean fruit was about 80%, while cut fruit scored 70%. There were no differences between the standard spray program compared to the IPMCPR program. BMSB damage was the same in both treatments.

The insecticide program summary (Table 2) is reported as the number of applications, the number of full rate equivalents, and the total pounds of product used. A rate equivalent (Rate Eq. or REq) is defined as when any product was used within the range of the full labeled rate for a specific target pest. For example, if Sevin XLR was used at 32 oz/A as an insecticide, it is 1 REq., but if it was use as a thinner at 8 oz/A, then it is calculated as .25 REq. The IPMCPR treatment used almost 40% less insecticide in terms of the number of applications, and about 50% in terms of REqs. However, the percentage of clean fruit would have probably been increased if the number of applications, full covers and borders, had been increased in late August and early September when BMSB moved into the apples. These blocks consisted of multiple varieties, some of which are early ripening and being used for human consumption. This combined with the lack of late season insecticides, prevented late season applications. In commercial situations, this points to the need of having uniform blocks and the availability of late season, short PHI materials for BMSB treatments. The results also demonstrate that in many cases, insecticide use can be reduced and that regular cover sprays can be excessive, but that application timing is important to match insect activity. This work is being continued in commercial orchards.

Table 2. Insecticide use in 2016.

Treatment	Number of applications	Number of rate equivalents	Product used (lbs)
Standard	8	7.25	3.6
IPMCPR	5	3.45	2.9

Special thanks to the NJ State Horticultural Society for funding this project. Thank you to Jake Peterson, summer intern who collected the data for this project.

Refinement of Plum Curculio Biology in Southern New Jersey Peaches

Anne L Nielsen and Clement Akotsen-Mensah
Rutgers University

Plum curculio (PC) is a pest of apple, plum, peach, cherry, and blueberry, and can cause significant crop losses through early season scarring of the fruit (Fig 1). Untreated peach blocks at Rutgers Agricultural Research and Extension Center (RAREC) in Bridgeton, NJ can have >90% injury through scarring, direct fruit loss, and larval contamination of the fruit. Depending on geographic location, PC has two distinct populations that vary in the number of generations per year and are distinguishable through DNA analysis. The southern population has multiple generations per growing season, which can result in live larvae contaminating peaches at harvest. Regardless of location, only first generation PC impact apples, they cannot develop in apples later in the growing season.

Beginning in 2012, we have found live PC larvae in harvested peaches at RAREC and observed continual adult activity, which strongly indicates the presence of a second generation. We conducted molecular analysis for 83 specimens from 2016 peaches at RAREC. Using an IQ tree analysis, all 83 specimens align with the southern plum curculio population. This confirms that the southern strain of PC is present in New Jersey for the first time.

The presence of the southern strain alone does not change the risk posed by PC, however, if a second

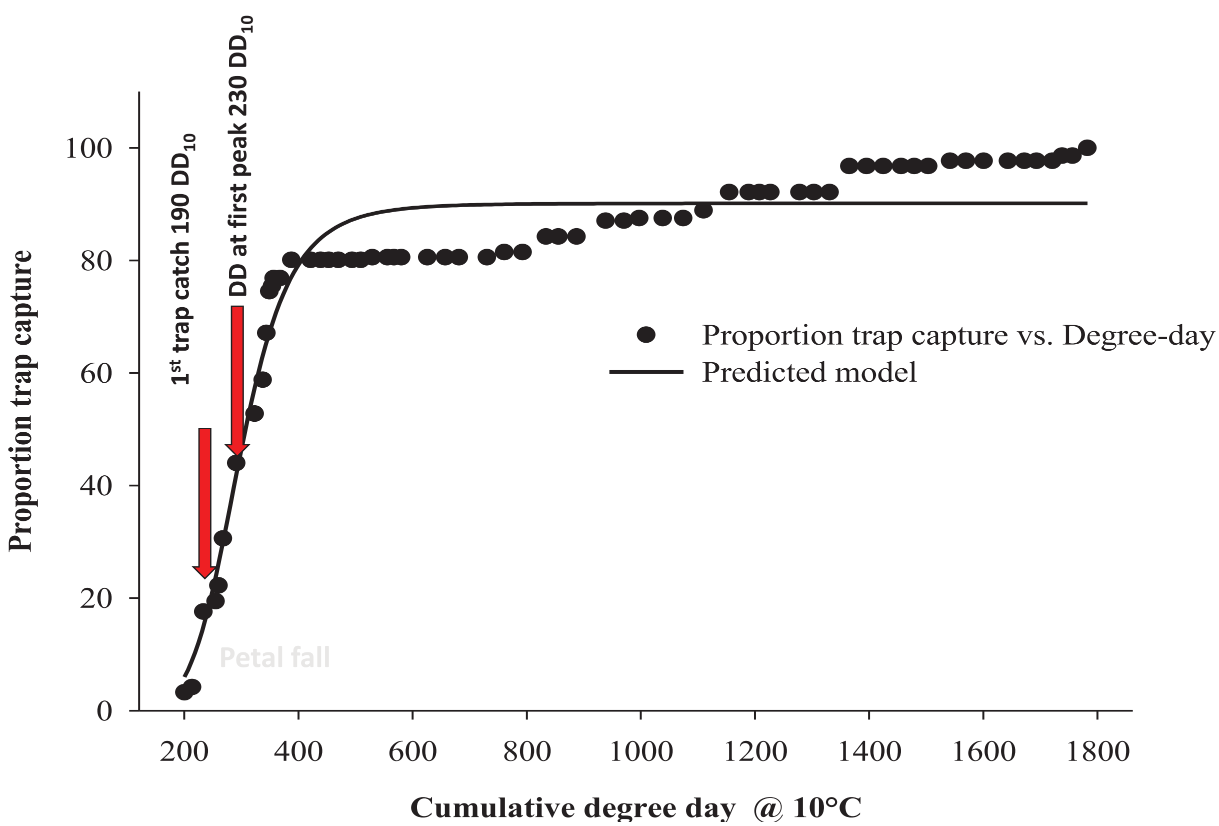


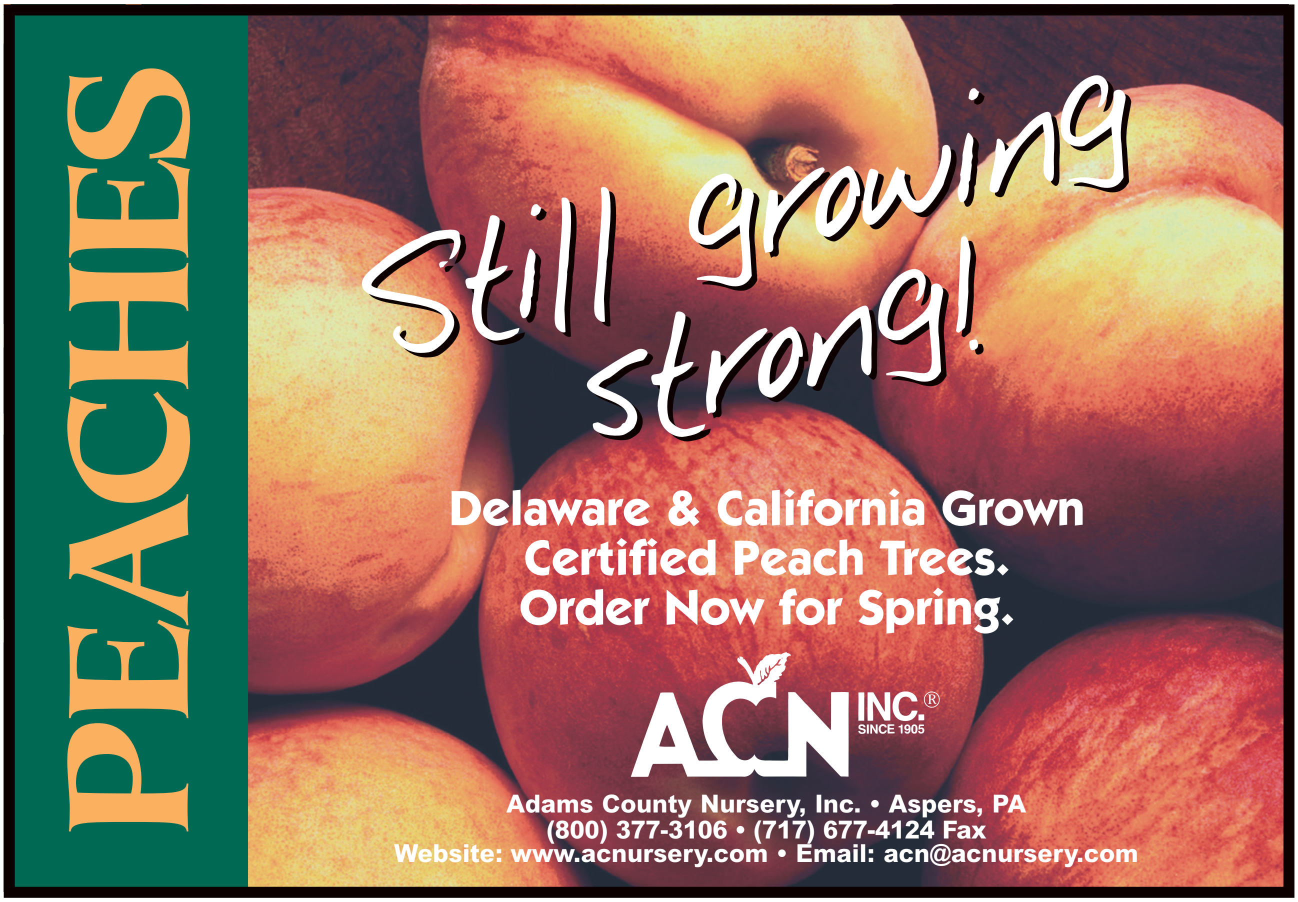
Figure 2. Cumulative degree-day and proportion trap catch. The first red arrow indicates the first peak trap catch and the second arrow indicates proportion at which 50% of the spring populations appear in peach.

Figure 1. Plum curculio adult.

generation exists it could impact management programs and increases the risk of fruit with live worms at harvest. In recent years, growers have applied 3-4 insecticides against PC in the spring due to prolonged activity of adults. Growers and extension professionals have no IPM tools for determining when to start spraying or when to stop spraying in NJ peaches. We applied historic weather station data to seasonality data and compared the two degree-day models for best fit. The degree-day model developed for southern peaches best fits the PC population in Bridgeton, NJ. The model predicts PC movement into orchards at 190 DD_{10oC} and that if PC is present, insecticide applications should start at 220 DD_{10oC} (Fig. 2). There are also sufficient degree-days for the development of two generations in Bridgeton, NJ.

In 2017, 8.6% of nectarines harvested from a lightly treated block at RAREC had live PC larvae in them at harvest in 2017. In contrast, previous work by Anatas Atanassov (Rutgers Fruit IPM program) for Northern New Jersey showed the degree-day model for apples fit well with that population (genetic analysis still pending). This suggests that we may need two different degree-day models in NJ to make management decisions for PC.

Editor's Note: I asked Dr. Neilson if she had more information on where the two strains of PC might diverge and if we had just the Northern Strain of PC in Northern NJ? Her response was: "Regarding PC, we aren't entirely sure where the populations would separate. We have a few specimens from additional farms in NJ that hopefully will help clarify this question. research considerably."


PEACHES
Still growing strong!
Delaware & California Grown
Certified Peach Trees.
Order Now for Spring.
ACN INC.® SINCE 1905
Adams County Nursery, Inc. • Aspers, PA
(800) 377-3106 • (717) 677-4124 Fax
Website: www.acnursery.com • Email: acn@acnursery.com

Fruit Quality Characteristics of Three New Peach and Nectarine Varieties: Brigantine, Evelynn, and Tiana

Hemant Gohil and Daniel Ward
Rutgers University

Two exciting new peach cultivars and one new nectarine 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 com-

Figure 1. Fruit of Brigantine nectarine from the Stone Fruit Breeding Program of Rutgers/NJAES (photograph credit: Hemant Gohil).

Figure 2. Fruit of Evelynn a new peach from the Stone Fruit Breeding Program of Rutgers/NJAES (photograph credit: Hemant Gohil).

Table 1. Physical properties of fruit harvested from three 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
Brigantine (NJH21-44)	Fruit firmness (lbs)	8.2	5.1	9.9	4.4	-	-
	Fruit diameter (in)	2.6	0.1	2.6	0.2	-	-
	Fruit mass (g)	160.9	18.1	183.5	37.8	-	-
Evelynn (NJH7-47)	Fruit firmness (lbs)	10.0	6.1	7.3	2.4	10.7	3.1
	Fruit diameter (in)	2.9	0.2	2.9	0.2	2.8	0.1
	Fruit mass (g)	203.0	31.7	236.2	34.6	174.7	23.0
Tiana (NJK64-197)	Fruit firmness (lbs)	10.3	0.8	12.3	1.7	-	-
	Fruit diameter (in)	3.0	0.1	3.2	0.2	-	-
	Fruit mass (g)	228.6	27.5	330.2	57.5	-	-

Figure 3. Fruit of Tiana a new peach from the Stone Fruit Breeding Program of Rutgers/NJAES (photograph credit: Hemant Gohil).

Table 2. Chemical properties of fruit harvested from three 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
Brigantine (NJH21-44)	TTA (g/l)	1.52	0.11	1.4	0.2	-	-
	pH	3.36	0.06	-	-	-	-
	TSS (°Brix)	10.10	0.22	10.0	0.2	-	-
Evelynn (NJH7-47)	TTA (g/l)	0.40	0.05	0.3	0.1	1.58	0.09
	pH	4.70	0.17	-	-	3.30	0.02
	TSS (°Brix)	9.96	0.44	9.8	0.9	10.93	0.06
Tiana (NJK64-197)	TTA (g/l)	1.50	0.04	-	-	-	-
	pH	3.58	0.01	-	-	-	-
	TSS (°Brix)	11.53	0.15	-	-	-	-

mercial maturity for each cultivar was based on ground color change and size. After picking, fruits were transported to the laboratory at Rutgers Agricultural Research and Extension center were all analyses were performed. Fruit were evaluated for firmness, size, total soluble solids (°Brix), total titratable acidity, and pH.

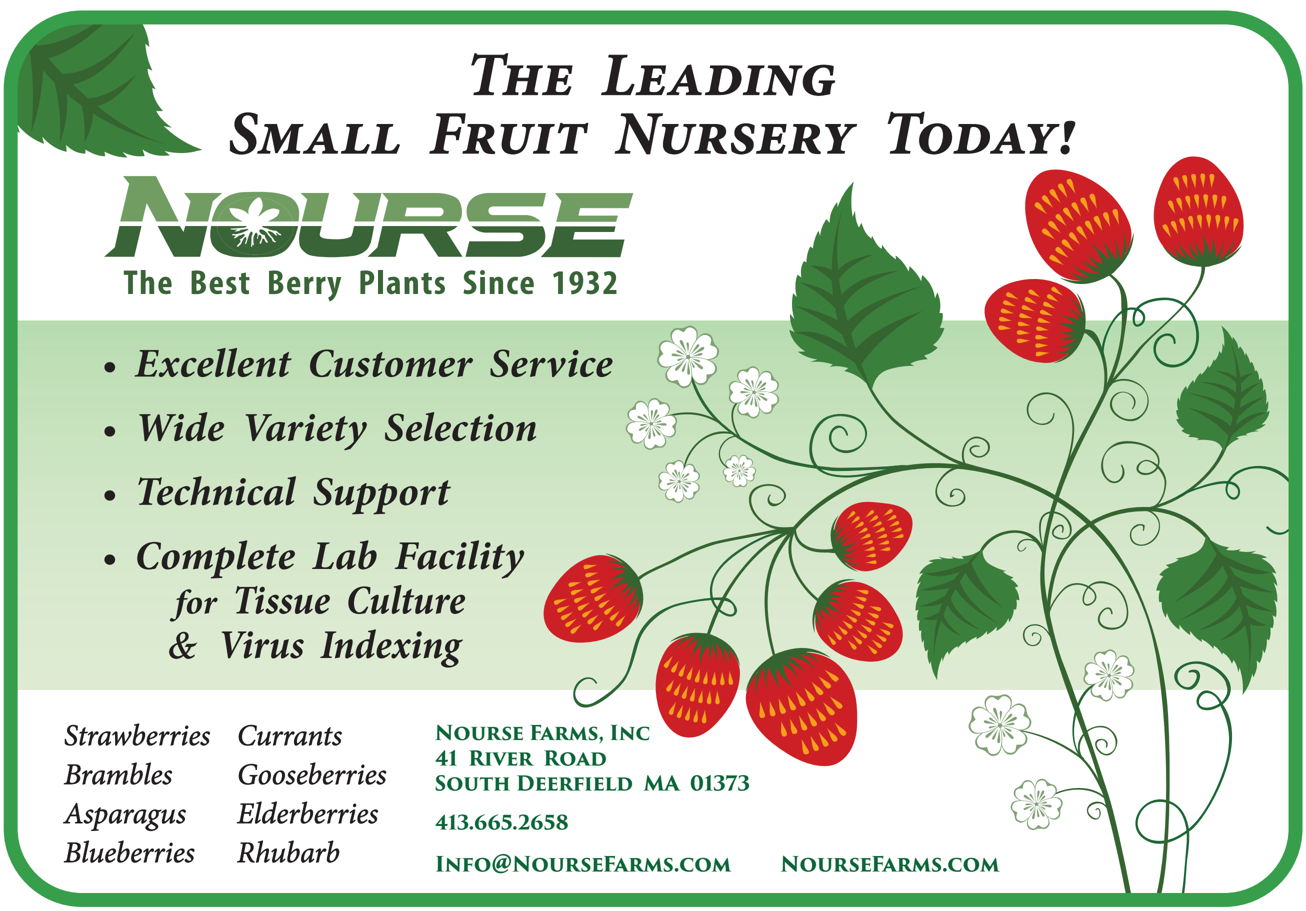
All three of these varieties have yielded attractive fruit with good commercial potential (Figures 1, 2, and 3). Harvest dates (all harvest dates are from southern New Jersey) for Brigantine, the nectarine, have ranged from 15 July to 3 August. Brigantine has produced very attractively finished fruit with good size and firmness (Table 1) that are sweet, acidic (Table 2) and tangy in flavor. Harvest dates for Evelynn have ranged from 20 July to 5 August. Evelynn has produced large fruit with very good firmness (Table 1) that are low in acid (Table 2) giving them a sweet and delicate flavor. Tiana harvest dates have ranged from 2 August to 28 August. Tiana has yielded consistently firm, large fruit that are sweet and acidic giving them a tangy flavor. These three varieties are available through Adams County Nursery and can be recommended for trial plantings (see inserted text Box).

- **Tianna** (testing ID K64-197) is a late-season, yellow-fleshed, freestone peach. It ripens between the time of Cresthaven and Encore. The sweet, nicely acidic flavor, beautiful coloring, and large fruit size make it an appealing peach. Skin color is mottled (50-75%) red on yellow ground color. It has shown low susceptibility to bacterial spot.

- **Evelynn** (testing ID H7-47) is an early-season, yellow-fleshed, semi-freestone, peach with very firm flesh. It ripens near the time of Redhaven and has large fruit size with very attractive full scarlet coloring. The skin is smooth with low pubescence. The flesh is low acid and retains firmness well. Trees have been productive and shown low susceptibility to bacterial spot.

- **Brigantine** (testing ID H21-44) is a yellow-fleshed, semi-freestone nectarine. It ripens just before Summer Beaut and Redhaven. It has solid scarlet coloring and a nicely acidic flavor with firm melting flesh. Trees have been productive, leaves have shown low susceptibility to bacterial spot, while fruit has shown moderate susceptibility to bacterial spot.


A Whole Farm Revenue Protection policy could be a part of your coverage...
...but, not all of it.
A Whole-Farm Revenue Protection policy working along with Hail and Single-crop policies is a great way to minimize your revenue risk. Protect your income from whatever happens to your crops.
Call us today at 877-867-9291 to learn more.
11539 Nuckols Road, Suite B; Glen Allen, VA 23059
AgRISK MANAGEMENT
By Weller & Associates, Inc.
agRISKmgt.com


The Leading Small Fruit Nursery Today!
NOURSE
The Best Berry Plants Since 1932
• Excellent Customer Service
• Wide Variety Selection
• Technical Support
• Complete Lab Facility for Tissue Culture & Virus Indexing
Strawberries
Brambles
Asparagus
Blueberries
Currants
Gooseberries
Elderberries
Rhubarb
Nourse Farms, Inc
41 River Road
South Deerfield MA 01373
413.665.2658
Info@NourseFarms.com
NourseFarms.com

Peach Bacterial Spot Management: Evaluation of Kasugamycin and a Bactericide Application Timing Program

Norman Lalancette and Lorna Blaus
Rutgers University

Infection of peach fruit by the bacterial spot pathogen *Xanthomonas arboricola* pv. *pruni* results in the formation of blackened, pitted lesions on the fruit epidermis. Infections that occur early in growing season result in larger, deeper pitted lesions, while those that occur in mid-to-late summer tend to be more numerous, but shallow. Infection of foliage, results in the formation of angular, black lesions that eventually shot-hole. If a sufficient number of lesions occur, the leaves become chlorotic and abscise. In disease favorable years, significant crop loss and defoliation can occur on susceptible cultivars.

Currently, only two types of bactericides are available for management of peach bacterial spot: copper and the antibiotic oxytetracycline. Recently, however, the antibiotic kasugamycin, sold as Kasumin 2L, has been registered for use on apple, but not yet on peach. This antibiotic acts directly on the pathogen by inhibiting protein synthesis. Most importantly, kasugamycin has a different mode of action than oxytetracycline. Thus, if found effective for peach bacterial spot management, kasugamycin could provide important resistance-management benefits in an integrated program with copper and oxytetracycline.

Given the possible availability of kasugamycin for stone fruit, the main objective of this study was to determine its ability to manage bacterial spot. Results from the Kasumin treatment were compared to the current copper and antibiotic standards, Kocide 3000 and oxytetracycline (FireLine, Mycoshield). Comparisons will be made using disease incidence and marketable fruit assessments.

When applied for disease control, antibiotics break down quickly and therefore have short residual capacity. Copper materials have better residual capabilities, but can only be applied to peach at very low rates due to phytotoxicity. Thus, for both types of bactericides, application immediately prior to an infection event should provide the greatest control since residuals will be at their highest at the time of infection. Therefore, a second objective of this study was to evaluate a set of rules or program for timing bactericide applications. These rules will forecast sprays based on rainfall probability and time of last bactericide application.

Materials & Methods

Orchard Site. The experiment was conducted during the spring and summer of the 2016 and 2017 growing seasons at the Rutgers Agricultural Research and Extension Center. The test block trees consisted of highly susceptible O'Henry cultivar grafted on Halford or Lovell rootstock. Trees were 10-13 years old and planted at 25 ft x 25 ft spacing.

Treatments. In each year, bactericide treatments were replicated four times in a randomized complete block design. Experimental plots consisted of single trees. Treatment trees were surrounded on all sides by non-sprayed buffer trees. A Rears Pak-Blast-Plot airblast sprayer calibrated to deliver 100 gal/A at 100 psi traveling at 2.5 mph was used for applications. Insecticides were applied as needed using a commercial airblast sprayer. No fungicides were applied during the course of the study. Bactericide treatment application dates and phenological timing are shown in Table 1.

Available water for spraying was acidic (pH=4.8). Thus, an alkaline buffer, potassium carbonate, was used to adjust water pH to 7.0 prior to addition of the copper material, Kocide 3000. This pH correction was not necessary for the two antibiotics.

Application Timing Program. The timing program was based on two variables, daily rainfall probability (DRP) and time since last spray (TLS). The program was purposely kept simple for ease of implementation and future modifications.

Application Timing Rules

- ❖ First application at ~ 5% shuck split
- ❖ Subsequent sprays at 10-day intervals while DRP < 50 % (default interval)
- ❖ If DRP is forecasted ≥ 50% then:
  1. If TLS < 5 days, no spray required (assume 4-day residual after spray)
  2. If 5 ≤ TLS < 7 days & DRP ≥ 70%, then apply next spray
  3. If TLS ≥ 7 days & DRP ≥ 50%, then apply next spray

Daily rainfall probabilities (DRP) were obtained from the 'Intellicast' web-based weather forecast system; other systems, such as Accuweather, could also be used. Forecasts are parsed two-days prior to an expected rain event to allow application on the day before the rain.

Assessment. Fruit disease incidence and marketable fruit evaluations were conducted at the end of the study in each year on 1 Aug16 and 26Jul17. A total of 25 fruit were examined per plot (tree) during each assessment. For the marketable fruit assessment, fruit were graded based on lesion size and area of fruit surface covered by lesions. Definitions for the grades, which are used commercially by NJ growers, are given in the data table footnotes.

During the 2017 epidemic from early May through the end of June, bacterial spot disease progress on fruit was monitored in the block on a set of five non-treated trees, which were separate from the four NTC trees used in the study. Twelve fruit were tagged on each tree and a total of eight assessments were performed at approximately 7-day intervals. During each assessment, the total number of lesions were counted on each fruit, allowing estimation of disease incidence and severity. Although disease progress was not monitored in 2016, an assessment was performed at the end of June, which allowed for comparison to the 2017

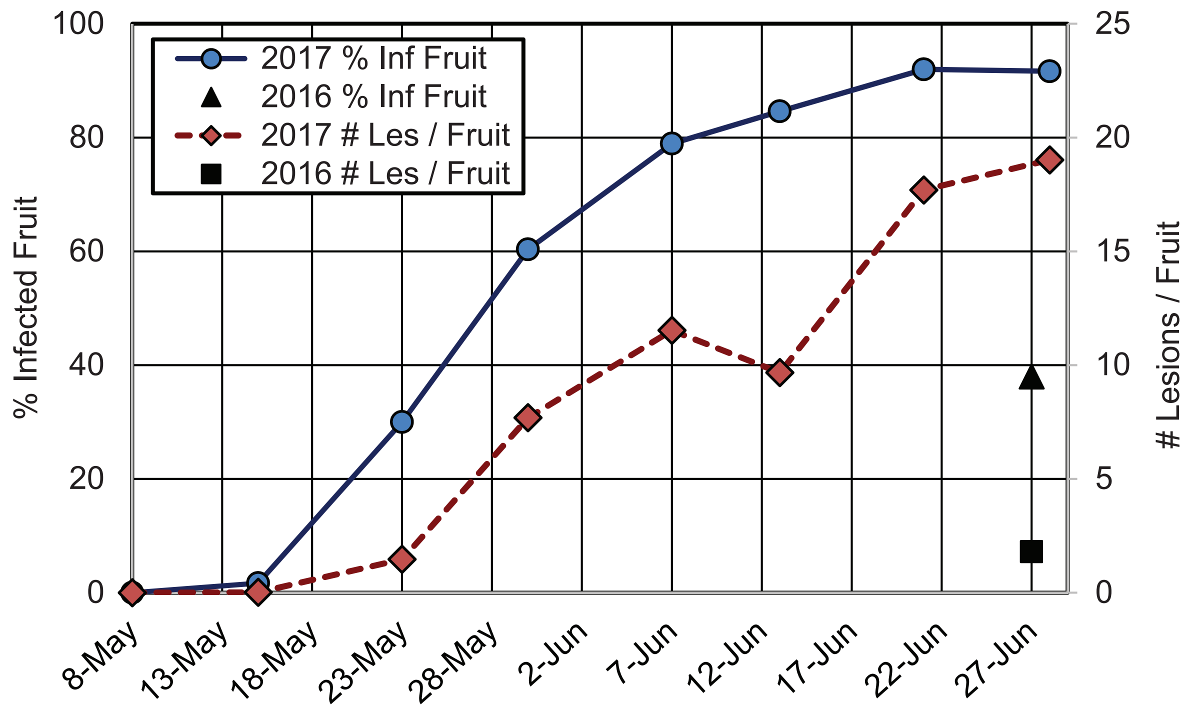


Figure 1. Progression of bacterial spot fruit disease incidence (% infected fruit) and severity (# lesions / fruit) on O'Henry peach during the 2017 epidemic. Data points are means of 7 to 12 tagged fruit on five non-treated trees (48 – 60 fruit total / assessment). The triangle and square data points represent disease incidence and severity levels, respectively, observed on NTC trees in the same block in 2016.

data.

Weather Data. Air temperature and rainfall data were recorded by a Campbell Scientific 23X data logger located at the research station. This weather station is part of the Mesonet Network operated by the Office of the NJ State Climatologist. Observations were taken every two minutes and summarized every hour. Hourly temperature and rainfall data were aver-

TABLE 1. Average air temperature, rainfall frequency, and total rainfall during bactericide spray intervals resulting from application timing rules

Bactericide Application Interval			Ave. Temp.	# Rains	Rainfall
Spray Interval	Phenology	Length (d)	°F	≥ 0.10 in	Total (in)
2016					
27 Apr – 2 May	SS – 1C	5	48.8	1	0.52
2 May – 10 May	1C – 2C	8	53.8	4	1.92
10 May – 17 May	2C – 3C	7	57.7	4	0.93
17 May – 23 May	3C – 4C	6	57.8	4	1.56
23 May – 31 May	4C – 5C	8	71.8	4	2.06
31 May – 6 Jun	5C – 6C	6	71.7	2	0.91
6 Jun – 15 Jun	6C – 7C	9	70.3	1	0.19
15 Jun – 24 Jun	7C – 8C	9	71.8	2	1.55
24 Jun – 1 Jul	8C – 9C	7	72.3	2	2.33
1 Jul – 12 Jul	9C – 10C	11	75.4	4	1.35
12 Jul – 21 Jul	10C – 11C	10	78.3	4	0.72
Mean / Total	-----	7.8	66.3	32	14.04
2017					
21 Apr – 1 May	SS – 1C	10	61.0	3	1.02
1 May – 11 May	1C – 2C	10	61.3	1	1.54
11 May – 21 May	2C – 3C	10	63.5	1	1.84
21 May – 2 Jun	3C – 4C	12	62.8	4	4.92
2 Jun – 12 Jun	4C – 5C	10	66.8	4	2.06
12 Jun – 22 Jun	5C – 6C	10	77.2	2	1.06
22 Jun – 30 Jun *	6C – 7C	8	75.0	2	0.44
30 Jun – 6 Jul	7C – 8C	6	79.2	1	0.18
6 Jul – 14 Jul	8C – 9C	8	77.6	3	1.15
14 Jul – 21 Jul	9C – 10C	7	78.9	1	1.93
Mean / Total	-----	9.1	70.3	22	16.14

aged and summed, respectively, for each day.

Results

Epidemic Development. By the end of June in 2016, only 38% of non-treated fruit were infected with an average of two lesions per fruit (Fig. 1). However, disease development continued throughout July so that 86% of non-treated fruit were infected by the first of August, an increase of 48%.

In contrast to the 2016 epidemic, 92% of fruit were infected by late June 2017, with an average of 19 lesions per fruit (Fig. 1). By late July, disease incidence increased to 95% fruit infection, an increase of only 3%. Thus, the 2017 epidemic began and developed much more quickly than the 2016 epidemic. However, by late July / early August, both epidemics had achieved a similar amount of infected fruit.

Application Timing and Environment. When sprays were applied according to the program rules, a total of 11 bactericide applications were made in 2016 versus 10 applications in 2017 (Table 1). Spray intervals in 2016 ranged from 5 to 11 days with an average interval length of 7.8 days, while in 2017 application intervals ranged from 6 to 12 days with an average length of 9.1 days.

Application intervals in 2016 were relatively short during the early shuck-split through 5C period, ranging from 5 to 8 days in length (Table 1). In contrast, most of the spray intervals during this same early period in 2017 were 10 days in length. The shorter, more frequent intervals in 2016 were due to a greater number of rain events that triggered a spray advisory. A total of 17 rain events (≥ 0.10 in) were recorded between SS and 5C in 2016, while 13 rain events were observed during the same period in 2017.

Temperatures during the SS-5C period in 2016 were relatively cool, averaging 58.0°F; total rainfall accumu-

TABLE 2. Bacterial Spot on Fruit

Treatment	Rate/A	Timing	% Infected Fruit [2]	% Fruit in Category [1, 2] Market Grade 1	Market Grade 2	Grades 1 + 2
1 August 2016						
Non-treated control	--------	------	86.0 a	35.0 c	19.0 ab	54.0 b
Kocide 3000 30DF	1.7 oz	SS, 1C-11C	46.5 c	70.1 a	14.6 b	84.7 a
FireLine 17WP	1.5 lb	SS, 1C-11C	42.0 c	72.0 a	16.0 b	88.0 a
Kasumin 2L + Regulaid	64 fl oz + 1 pt	SS, 1C-11C	63.0 b	55.0 b	22.0 a	77.0 a
26 July 2017						
Non-treated control	--------	------	95.0 a	10.0 b	7.0 b	17.0 b
Kocide 3000 30DF [4]	1.7 oz	SS, 1C-10C	83.0 b	31.0 a	13.0 ab	44.0 a
FireLine 17WP	1.5 lb	SS, 1C-10C	86.0 ab	24.0 ab	18.0 a	42.0 a
Kasumin 2L + Regulaid	64 fl oz + 1 pt	SS, 1C-10C	84.0 b	26.0 a	15.0 ab	41.0 a

[1] Market grade 1 = total lesion area no larger than 1/8” diameter; market grade 2 = total lesion area no larger than 3/16” diameter and no single lesion larger than 1/8”; cull = total lesion area larger than 3/16” and/or single lesion larger than 1/8”.

[2] Within each year, means in the same column with the same letter do not differ significantly according to the Waller-Duncan *K*-ratio t-test (α=0.05, *K*=100).

lation during this period was 6.99 inches (Table 1). In comparison, average air temperature during this same SS-5C period in 2017 was 63.1°F with a total rainfall accumulation of 11.38 inches. Although there were 4 fewer rain events in 2017 during this early period, the 5°F higher temperatures and much greater amount of total rainfall most likely contributed to the early and more severe development of the epidemic in that year.

Fruit Infection in 2016. By 1 August, 86% of non-treated fruit were observed to have bacterial spot infections (Table 2). All bactericides significantly reduced disease incidence, but the level of control varied. The Kocide 3000 and FireLine standards were the most effective, providing 46% and 51% control, respectively, and were not significantly different from each other. The Kasumin, however, provided an intermediate response, having significantly less disease than the non-treated control, but significantly more than the two standards. At this late stage in the epidemic, Kasumin yielded 27% control.

Results from the marketable fruit assessment mimicked results for disease incidence (Table 2). On non-treated trees, 54% of fruit were saleable (grades 1+2) with 35% grade 1 and 19% grade 2. Trees receiving the Kocide and FireLine standards had significantly greater amounts of grade 1 and saleable (grades 1+2) fruit than the control. Approximately 70 to 72% of fruit for these two standards were grade 1 and 85 to 88% were saleable.

As with the disease incidence results, Kasumin provided an intermediate level of control relative to the standard and control treatments (Table 2). Only 55% of fruit were grade 1 for the Kasumin treatment, which was significantly more than the control, but less than observed for the two standards. However, total saleable fruit (grades 1+2) for the Kasumin treatment was not significantly different from the levels observed for Kocide and FireLine. This outcome was due to the

Table 3. Bacterial spot on foliage.

Treatment	Rate / A	Timing	% Infected Leaves [1, 2]	% Abscised Leaves [1, 2]	% Infected & Abscised Leaves [1, 2]
25 July 2016					
Non-treated control	--------	------	57.6 a	28.0 a	67.5 a
Kocide 3000 30 DF [3]	1.7 oz	SS, 1C-11C	27.0 b	31.0 a	49.1 b
Fireline 17WP	1.5 lb	SS, 1C-11C	30.3 b	12.2 b	36.9 b
Kasumin 2L + Regulaid	64 fl oz + 1 pt	SS, 1C-11C	67.1 a	37.0 a	77.4 a
24-25 July 2017					
Non-treated control	--------	------	68.6 a	28.4 ab	76.3 a
Kocide 3000 30DF [3]	1.7 oz	SS, 1C-10C	72.6 a	31.0 a	80.5 a
FireLine 17WP	1.5 lb	SS, 1C-10C	69.6 a	20.3 b	75.3 a
Kasumin 2L + Regulaid	64 fl oz + 1 pt	SS, 1C-10C	65.9 a	30.4 a	75.7 a

[1] Infected leaves = leaves with at least one lesion and/or one shot-hole; abscised leaves are missing leaves.

[2] Within each year, means in the same column with the same letter do not differ significantly according to the Waller-Duncan *K*-ratio t-test (α=0.05, *K*=100).

significantly higher amount of fruit recorded in market grade 2 for the Kasumin. Essentially, the increase in grade 2 fruit compensated for the lower amount of grade 1 fruit.

Fruit Infection in 2017. Under the more disease favorable conditions of 2017, 95% of non-treated fruit were observed to have bacterial spot infections by 26July (Table 2). Fruit receiving the Kocide and Kasumin treatments had significantly lower incidence, but still relatively high disease levels (83-84%). Fruit treated with FireLine had an intermediate disease incidence level, being not significantly different from the control or other treatments.

Results from the marketable fruit assessment clearly revealed the intensity of the 2017 epidemic. Of non-treated fruit, only 17% were saleable with 10% grade 1 and 7% grade 2 (Table 2). The percent of grade 1, grade 2, and grade 1+2 (total saleable) fruit were not significantly different among all three bactericide treatments. And as observed in 2016, all three bactericides significantly increased the percent of total saleable fruit.

2016 vs 2017 Fruit Infection. Marketable fruit levels for the bactericide treatments in 2017 were nearly half the levels observed in 2016 (Table 2). This outcome was most likely due to the early season severity of the 2017 epidemic. Nevertheless, under both the moderate and severe epidemics of 2016 and 2017, the percent of total saleable fruit for the Kasumin treatment was equivalent to that provided by the two standards. Significantly fewer grade 1 fruit were observed for the Kasumin treatment in 2016, but this difference was not observed in 2017.

Foliar Infection in 2016. On non-treated control trees, more than half the leaves on shoots were infected and nearly one-third had abscised by late July (Table 3). The Kocide and FireLine standards significantly reduced the number of infected leaves and number of infected + abscised leaves. However, only FireLine significantly reduced defoliation. Although Kocide reduced infection, it also causes leaf drop from foliar phytotoxicity; hence the high level of defoliation.

Unlike results observed for fruit disease control, Kasumin did not appear to provide any control of foliar infection (Table 3). No significant differences were observed between the Kasumin foliar disease levels and those of the non-treated control treatment.

Foliar Infection in 2017. Under the more severe epidemic conditions of 2017, none of the bactericide treatments significantly reduced the amount of leaf infection or defoliation (Table 3). Significant leaf infection, shot-holing, and loss is often observed in disease-favorable growing seasons, regardless of treatment.

FireLine treated trees had significantly less defoliation than observed on Kocide or Kasumin treated trees (Table 3). However, the amount of leaf abscission on FireLine treated trees was still not lower than observed on non-treated control trees.

Discussion

Kasugamycin. Overall, Kasumin 2L was nearly as effective as FireLine and Kocide 3000. Kasumin did provide an equivalent amount of total saleable fruit as these standards in both years of the study. However, in one of the study years (2016), the proportion of grade 1 and grade 2 fruit were significantly lower and higher, respectively, than observed for the standards. Thus, crop values in this year would have been diminished, even though total saleable fruit was the same.

Kasumin 2L is not currently registered on peach. Given the intermediate level of fruit disease control and apparent lack of foliar disease control, Kasumin would probably be best deployed in combination with copper bactericides if it were to become available. This combination may provide enhanced control (to be determined). Also, alternation of this mixture with FireLine or Mycoshield would produce a robust program for pathogen resistance management.

Application Timing Program. The same spray timing rules were followed in both years of the study, yet only about 50% as much saleable fruit were obtained in 2017 versus 2016. Several possible causes for this discrepancy are discussed below.

1. **Control Failure.** Disease progress data indicated a much more severe epidemic in 2017 than in 2016, particularly during the critical early part of the growing season. Under this heavy disease pressure, none of the tested bactericides may have been capable of providing effective control. Saleable fruit declined simply because of control failure.
2. **Temperature and Rainfall.** Fewer rain events in 2017 triggered less frequent applications, hence the longer spray intervals. However, temperatures were more disease-favorable and rainfall amounts were much higher early in the season, resulting in a rapid early development of the epidemic. Higher temperatures favor bacterial multiplication in the

overwintering cankers and heavy rains rapidly deplete bactericide residues. Neither of these factors are evaluated in the timing program; their addition as “triggers” for spray advisories may be needed.

3. **Overwintering Inoculum.** The number of overwintering cankers in 2017 may have been very high relative to the number of cankers present in 2016. A higher amount of cankers would have provided more initial inoculum for the epidemic. And this greater amount of inoculum resulted in the early rapid increase in disease in 2017.
4. **Dormant Season Temperatures.** From January through April, air temperatures were 2°F warmer in 2017 than in 2016. Perhaps most importantly, for the critical month of April (one month before epidemic initiation in May), the average daily and maximum temperatures were 6°F warmer in 2017 than 2016. These warmer temperatures favor greater bacterial multiplication in cankers and therefore greater inoculum for the ensuing epidemic.

Editor’s Notes: I asked Dr. Lalancette some questions regarding Kasumin:

1) *Where is* **Kasumin 2L** *with relation to labeling on Peaches in NJ?* ***Response:*** In fall 2016 the EPA was holding up antibiotic registrations pending additional review. However, that is now over and IR-4 has just recently received the PR 09888 kasugamycin / peach residue analytical report from EPA. IR-4 will now be writing the final report and should be making a submission this year for registration on stone fruit. Arysta is in support of this registration. **So, Kasumin 2L might be available late this year or in 2019 on Peaches in NJ.**

2) *Technical question, did you look at how fast Kasugamycin breaks down in sunlight after application? My memory says that is a limitation of* oxytetracycline*, that it breaks down quickly. That is why your weekly low rate copper program for peaches has been so useful.* ***Response:*** Yes, oxytetracycline breaks down quickly from light decomposition – even on cloudy days. Hence, the suggestion that sprays be applied late in the day or evening so as to maximize contact with the pathogen (overnight) before the next day. However, we usually spray in the early morning and have still managed to get very good control, perhaps because we’re spraying right before a rain [infection] period. To my knowledge, no one has examined kasugamycin for photo or other degradation on plant surfaces. However, since we coddle ALL of our various antibiotics in the laboratory by keeping them in the refrigerator, it’s probably safe to assume that all antibiotics, including kasugamycin, have very short residuals in the field. We keep our streptomycin (Agri-Mycin, FireWall) in the refrigerator even though the companies don’t recommend doing so on the label. Our spray shed doesn’t get very hot, but is certainly not a “cool” environment in the middle of the summer.

3) Please note that Kasumin 2L - Arysta Lifesciences is labeled on apple and pear for the control of fire blight.

International Fruit Tree Association in New Zealand

Jon M. Clements
University of Massachusetts

From late February to early March, 2018 the International Fruit Tree Association (www.ifrtuittree.org) hosted 250 apple growers from around the world on two, 2-week-long Study Tours to New Zealand's North and South Islands. Study Tour attendees overlapped in Napier for a 1-day Annual Conference. I was fortunate enough to partake in the orchard tours while also enjoying some New Zealand hospitality and sites during the second leg of the tour. Below are just a few of the pictures I took and comments from my notebook. To see more, visit the IFTA Facebook Page (www.facebook.com/IFruitTree/) or search the Twitter hashtag #iftanz

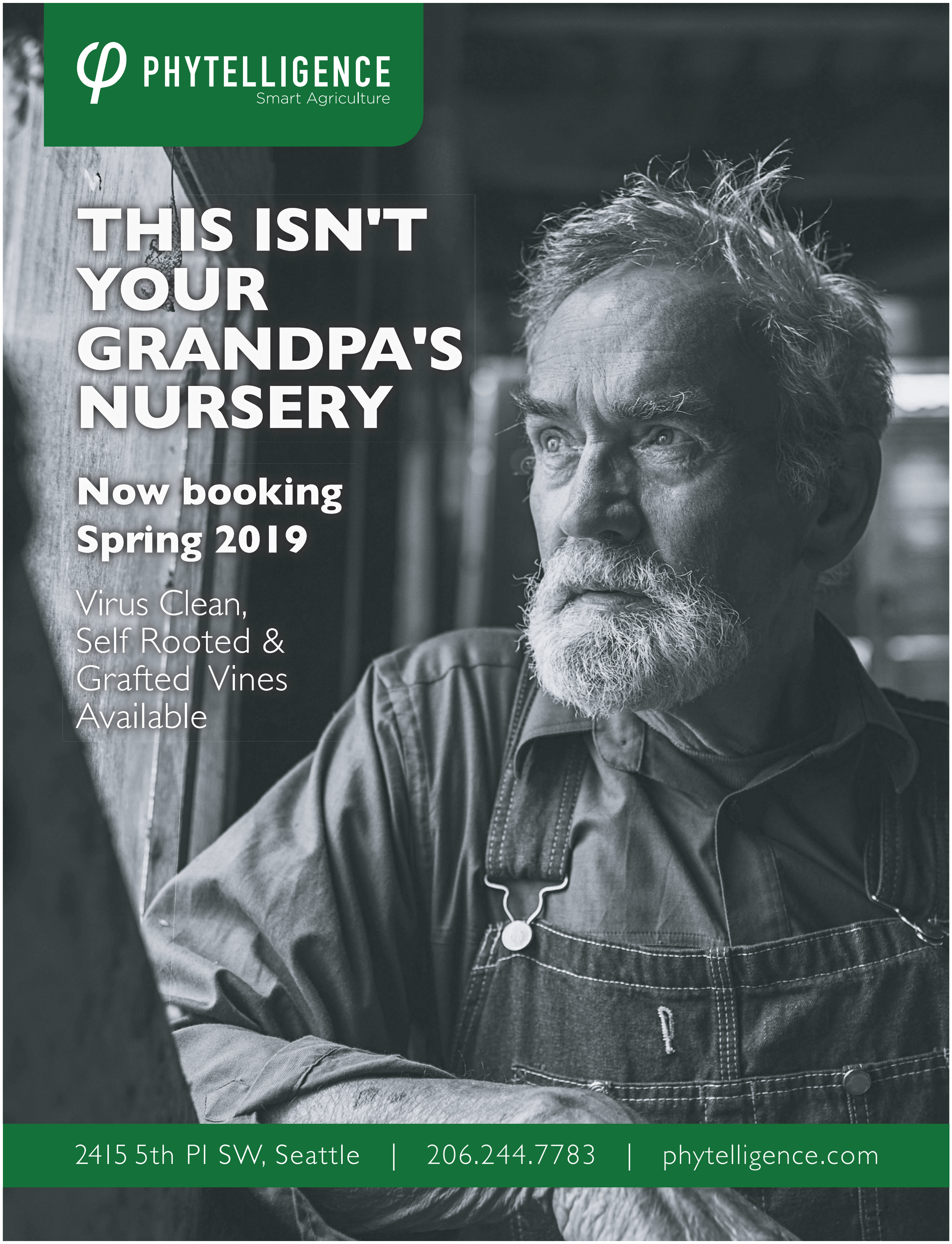
Picture 1. Dr. Stuart Tustin of NZ Plant & Food Research (Havelock North, just outside Napier on the North Island) discusses goals of FOPS (Future Orchard Production System) in this young 'Envy' block. Goals with these cordoned apples include increased light interception (higher yields) and equal light distribution to all fruit (quality fruit). Note that across-row spacing is only about six feet, requiring specialized (TBD) equipment for spraying. Harvest should be accomplished using robotics, or if with people, on very short ladders at the most as tree height will be limited to about eight feet. Planting a tree and growing several (many?) upright fruiting shoots spreads out the vigor so tree height can be minimized, allowing greater management efficiency. Tustin says yields per acre can almost be doubled over more conventional (tall-spindle even) systems because less sunlight falls on the ground where it would be unused to grow apples.

Picture 2. Drape Net demonstration in a young orchard just outside Nelson on the South Island. Drape Net (www.drapenet.com.au) is an alternative to whole orchard hail net/sunburn protection particularly for existing orchards where the infrastructure is not already in place to support more traditional hail netting. A specialized installation/removal piece of equipment that appears to make pretty short work of putting it on and taking it off was demonstrated and is available for purchase. In addition to hail and sunburn protection, Drape Net was also purported to have (some) insect (codling moth in particular) exclusion properties. (What about plum curculio and apple maggot fly?) Drape Net is available in North America here: www.drapenetnorthamerica.com Note also the Extenday fabric in the orchard middle to improve apple red color. Very commonly used in New Zealand.

Picture 3. Interesting method of top-working apple trees where it was desired to have the grafts (bark inlays) down low but retain temporary branching above the grafting location. A diagonal cut is made into the trunk where the new tree is desired to start — in this case a bi-leader tree — and the tree is sawed off several feet above that but leaving some nurse limbs. Grafts are made using dormant scion wood at around bloom (results in best graft take). Once grafts are up and growing rapidly, nurse limbs are removed and then a careful horizontal cut to take the nurse limb section down is made the following season. Hard to describe, but seemed to solve the problem where nurse limbs are higher than the desired grafting/re-start point. This at Easton Apples (www.loveapples.co.nz) in the Nelson (South Island) region. Not sure, but the scion variety might have been Ambrosia, one of Easton Apples favorites.

Picture 4. Honeycrisp at M A Orchards (www.maorchards.co.nz) near Timaru on the South Island. Timaru is two hours south of Christchurch, and was hand-selected by And McGrath (McGrath Nurseries in NZ) and Dave Allan (Allan Bros. in Washington) — hence the name M A — to exclusively grow Honeycrisp (under a license from the University of Minnesota) in New Zealand. Remember, south is cooler in NZ, and a better Honeycrisp growing climate than farther north on the South Island. (Which is kind of tropical actually). Honeycrisp planting began in 2012, primarily on CG.202 rootstock. Eventually production will reach 500,000 boxes, and will be mostly exported as very large, very red, premium Honeycrisp apples. Harvest had just started, and after casual tasting of a few apples, most agreed they were very firm and very flavorful. (Among the best Honeycrisp I have ever tasted!) But, as you can see, fruit drop (push-off?) was a bit of an issue. Note again the use of reflective material, in this case mylar-coated, to improve red color.

Picture 5. The IFTA Study Tour New England contingent in one of M A Orchards Honeycrisp blocks. Left to right: Tim Smith, Apex Orchard; Dana Clark, Clark Bros. Orchards; Gil Garden, Barden Family Orchard; Bruce Carlson, Carlson Orchards; and yours truly. (Yup, I was just listening to Tunes on my iPod!).


PHYTELLIGENCE
Smart Agriculture
THIS ISN'T YOUR GRANDPA'S NURSERY
Now booking Spring 2019
Virus Clean, Self Rooted & Grafted Vines Available
2415 5th Pl SW, Seattle | 206.244.7783 | phytelligence.com

Ernie Christ Memorial Lecture, 2018

Win Cowgill
Emeritus Professor, Rutgers University

The Ernie Christ Memorial Lecture, is presented at the Mid Atlantic Fruit and Vegetable Convention in January each year, held in Hershey, PA. The lecture was established in memory of Ernie Christ, the long-time New Jersey Tree-fruit Specialist at Rutgers Cooperative Extension. Ernie passed on September 12, 2000. He was loved and respected by fruit growers across North America. Ernie's passion was the furthering of knowledge of each culture and science.

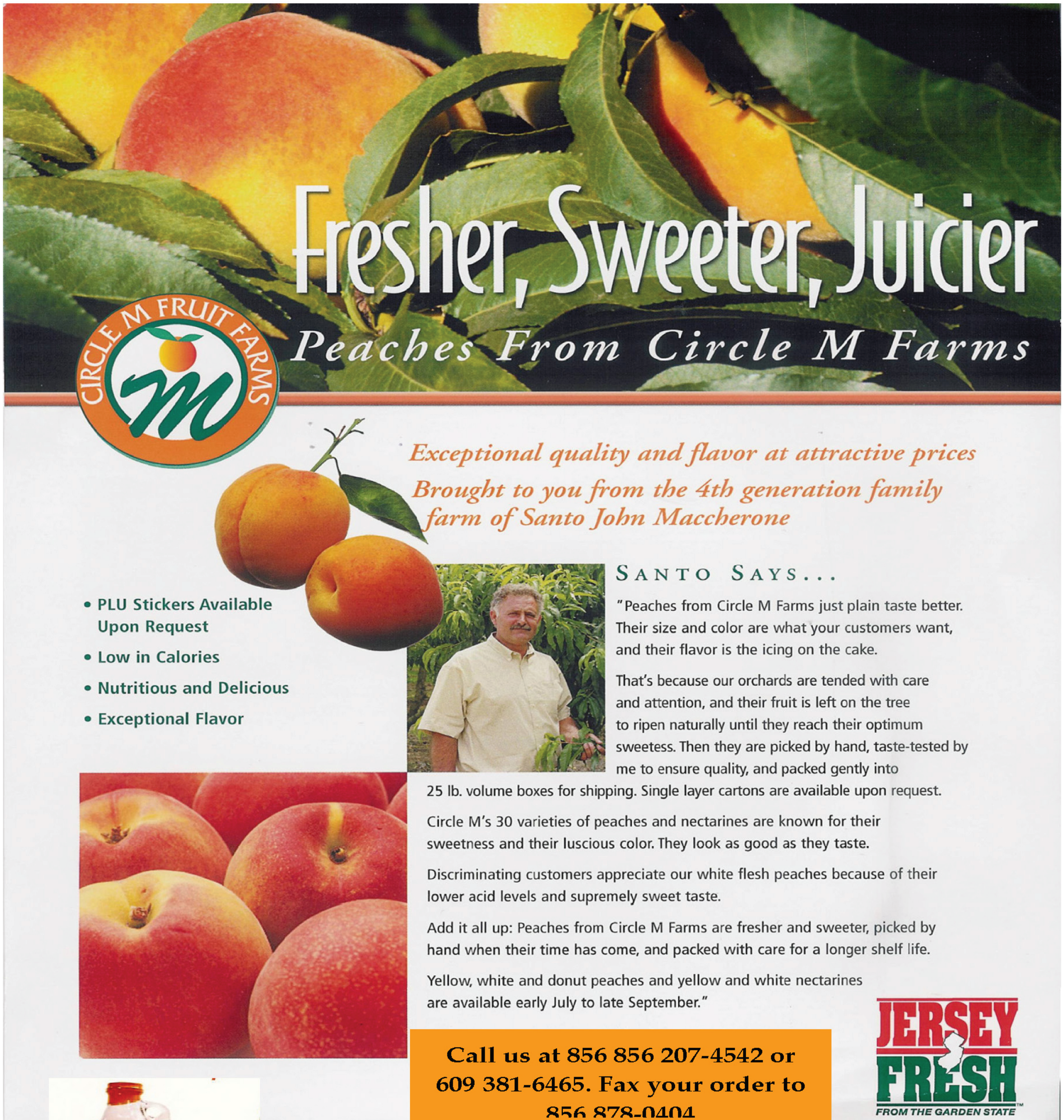
Ernie was a great friend and mentor to dozens of young scientists, extension workers, and farmers including Rich Marini, Sue Brown, Jerry Frecon, Mark Robson, Robert Best, Peter Melick, Ken Wightman, and Win Cowgill to name only a very few!

We referred to him as Mr. Peach. The fruit industry thought so much of Ernie they named a NJAES breeding program selection after him, 'Ernie's Choice' which is still grown today.

A speaker fund was established by the NJ State Horticultural Society with an initial gift by Adams County Nursery and with continued funding from grower donations. The fund supports an invited speaker each year at the Mid Atlantic Conference. The first Ernie Christ Memorial Lecture was presented by Dr. Rich Marini, Horticulture Department, Penn State University, in January of 2002.

Dr. Ted DeJong, Professor Emeritus, University of California -Davis, presented the 2018 Ernie Christ Memorial Lecture at the 2018 Mid-Atlantic Fruit and Vegetable Conference.

Dale Davis, IV, President of the NJ State Horticultural Society, presented a certificate recognizing Dr. Ted DeJong, Professor Emeritus, UC-Davis, for presenting the Ernie Christ Memorial Lecture at the 2018 Mid-Atlantic Fruit and Vegetable Conference: "The Effect of Early Season Temperatures on Peach Fruit Size "



Made from fresh New Jersey Peaches

"Peach Cider Drink, Peach Salsa, Peach Preserves"

Santo John Maccherone
circlemfarmsllc@gmail.com
Circle M Farms
88 Sandy Ridge Road
Salem, N.J. 08079

Fruit Notes
University of Massachusetts Amherst
Stockbridge School of Agriculture
205 Paige Laboratory
Amherst, MA 01003-9286