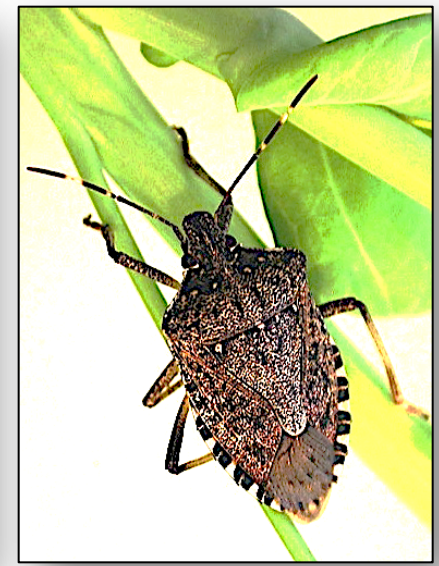


Insecticide Efficacy for Insect Management of Tree Fruit In Eastern NY



Long Island Agricultural Forum

January 8, 2019

Suffolk County Community College; Eastern Campus
Riverhead, New York Peconic Building.

Peter Jentsch

Senior Extension Associate – Entomology



Cornell University

Hudson Valley Research Laboratory

2018 Insect Pest Management Updates: Efficacy Screening & Invasive Insect Studies

Insecticide Registration Updates

Tree Fruit Insecticide Efficacy Studies

Invasive Insect Pest Complex Studies

Drape Net Exclusion



2019 Insecticide Registrations Updates

Minecto Pro SC



EPA Reg. No. 100-1592

Active ingredient: cyantraniliprole / abamectin

- IRAC 6/28 2nd gen. diamide
- Requires a NIS for foliar absorption
- Labeled in pome fruits to control lep. complex, plum curculio, European apple sawfly, pear psylla, white apple leafhopper, mite complex
- REI 12 hrs. PHI 28d in pome fruit

Labeled for NYS pome and stone fruit: Not For Use in Long Island



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2019 Insecticide Registrations Updates

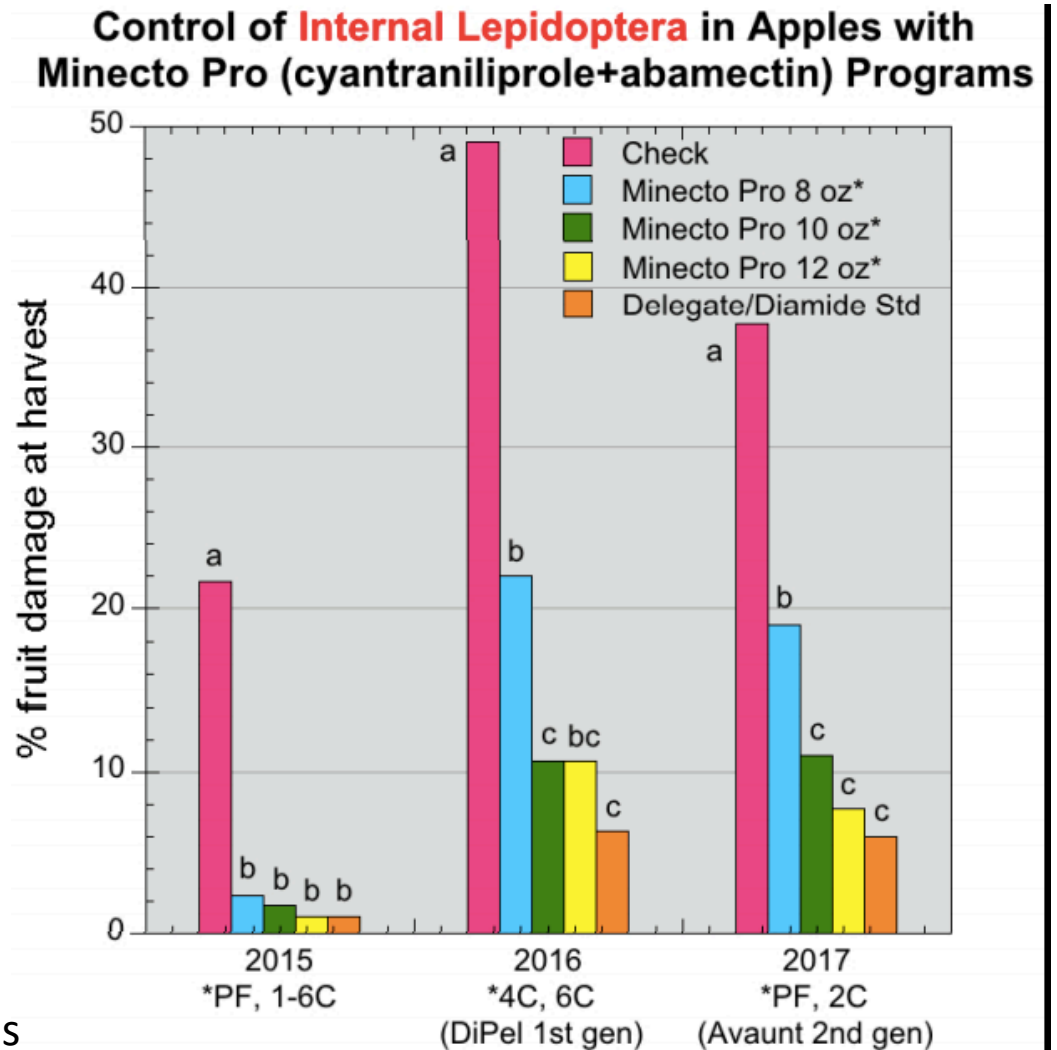
Minecto Pro SC

2 application program

Numeric differences:

Rate response

Strong Diamide standard



2017 Geneva Exp. Station. Agnello & Combs



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2019 Insecticide Registrations Updates

Closer SC



EPA Reg. No. 62719-623

- Active ingredient: sulfoxaflor
- IRAC 4C; translaminar movement (xylem)
- Labeled in pome fruits against aphids, fleahoppers, plant bugs, **stink bugs**, whiteflies and certain psyllids, **scale**, and thrips
- Low toxicity to bees and most beneficials.

Not yet labeled for NYS (Likely 2019)



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2019 Insecticide Registrations Updates

Cormoran

ADAMA

Active ingredient: Novaluron 9.1% / Acetamiprid 7.3%

EPA Reg. No. 66222-264

- IRAC 15 / 4A
- Dispersible concentrate
- REI 12hr, PHI 12 d
- Labeled in pome fruits: Aphids, Apple Maggot, Budmoths, Codling Moth, Dogwood Borer, European Apple Sawfly, Fruitworm, Leafhoppers, Leafminers, Leafrollers, Lesser Appleworm, Plum Curculio, Japanese Beetle, Mealybug, Mullein Plant Bug, San Jose Scale (Suppression), Oriental Fruit Moth, Plant Bug, Pear Psylla, White Apple Leafhopper, Stink Bugs Including Brown Marmorated Stink Bug.

Not yet labeled for NYS (Submitted in 2017)



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2019 Insecticide Registrations Updates

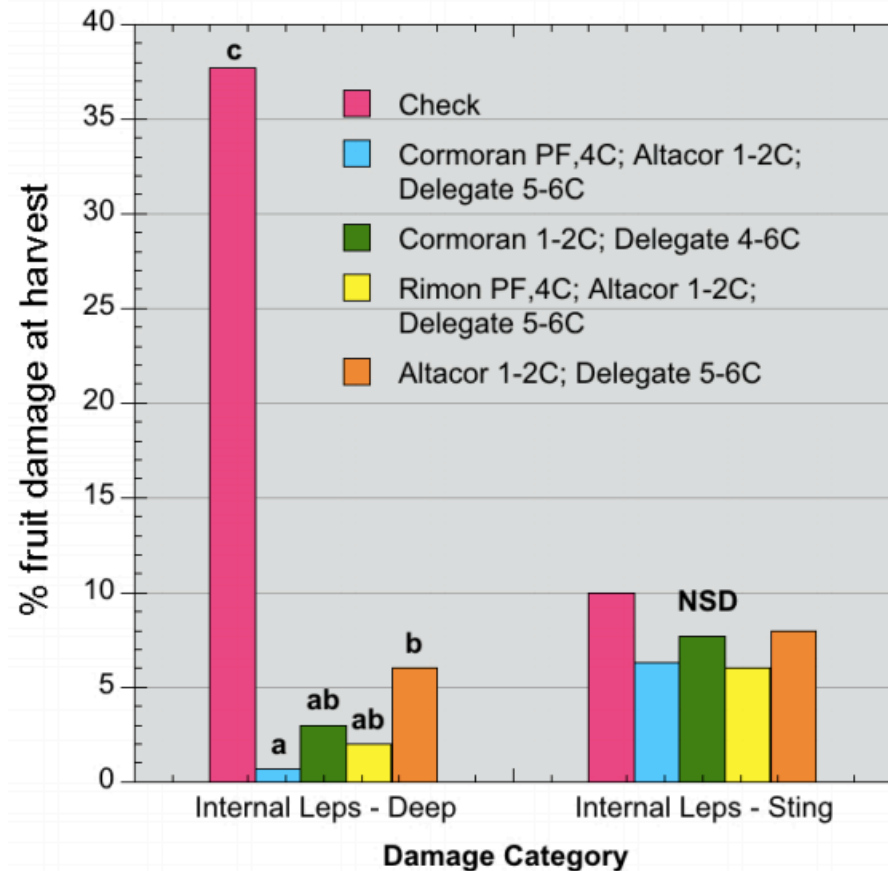
Cormoran

Resistance management strategies:

- Include rotation for each generation
- Use 2 applications for 1st of insecticide A and 2 apps. for 2nd generation of insecticide B

2017 Geneva Exp. Station. Agnello & Combs

ADAMA
Control of **Internal Lepidoptera** in Apples with
Cormoran (novaluron+acetamiprid) Programs - 2017



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2018 Insecticide Updates: On The Horizon

Harvanta: Active ingredient cyclaniliprole

- EPA Reg. No. 71512-26-88783
- Diamide class (IRAC 28)
- Same mode of action as Altacor and Exirel
- Activates ryanodine receptors preventing muscle contraction.
- Plum curculio and Leps in apples and peach
- Small fruit uses for spotted wing Drosophila
- Low toxicity to bees



2019 Insecticide Registrations Updates

Venerate XC (*Burkholderia* spp.)



EPA Reg. No. 84059-14

- Biological insecticide derived from a bacterium;
- Labeled in pome fruits against **San Jose scale**, pear psylla, **stink bug** and plum curculio, and in stone fruits against leafrollers and other leps.
- OMRI-approved
- Low toxicity to bees and most beneficials.



2019 Insecticide Registrations Updates

Grandevo (Chromobacterium subtsugae)



- EPA Reg. No. 84059-17
- A microbial containing fermentation solids from **bacterium**, labeled against **internal feeding leps** and **leafrollers** in pome and stone fruit.
- Stomach poison, impacting feeding, fecundity and oviposition; toxic to aquatic invertebrates.
- OMRI-approved
- Low toxicity to bees and most beneficials.



2019 Insecticide Registrations Updates

Sivanto Prime (flupyradifurone)



EPA Reg. No. 264-1141

- In the butenolide class (IRAC 4D)
- Registered in pome fruits against aphids (except WAA), leafhoppers, **San Jose scale**, and pear psylla.
- EPA Reduced-Risk, low bee toxicity and safe to beneficials.

Not yet available in Suffolk & Nassau Counties except under FIFRA Section 24 (C), special needs label.



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2019 Miticide Registrations Updates

Banter SC (bifenazate)



EPA Reg. No. 70506-322

- Acaricide registered in pome and stone fruit
- Same a.i. as *Acramite*, WDG & SC formulations

Onager Optek (hexythiazox)



EPA Reg. No. 10163-337

- Liquid (emulsion) formulation same a.i. as *Savey*
- Acaricide registered in pome and stone fruit



2019 Insecticide Registrations Updates

Cidetrak CMDA Combo Meso-A



Codling moth pheromone

EPA Reg. No. 51934-16)

- Mating disruption dispenser for codling moth registered in pome fruits
- "Meso" formulation releases for 120-150 days
- **Hand-applied at 18-36 dispensers per acre.**
- Monitor CM using high release lures
- Apply insecticides 1st yr; along borders 2nd yr.



2019 Insecticides

Not For Use in Long Island & RUP (†*)

Actara (thiamethoxam)

Altacor (chlorantraniliprole)

Centaur (buprofezin) IGR

Endigo (thiamethoxam/ lambda-cyhalothrin

Exirel (cyantraniliprole)

Intrepid 2F (methoxyfenozid) IGR

Minecto Pro (cyantraniliprole/abamectin)

Voliam Flexi (thiamethoxam/ chlorantraniliprole)

Voliam Xpress (chlorantraniliprole/ lambda-cyhalothrin)

Pre-Mix A.I. Combinations



2019 Insecticide For Use in Long Island & *RUP

Organophosphates & Carbamates

*Diazinon - WAA

*Lannate (methomyl) – Internal Lep. complex

*Imidan (phosmet) – PC, AM

Lorsban (chlorpyrifos) – BSB, DWB

Malathion - AM

Sevin (carbaryl) – Crop Load Reduction + PC



2019 Insecticide For Use in Long Island & *RUP

Pyrethroids

- *Asana (esfenvalerate) 7 App. @ 14.5 oz./A; 21d PHI
- *Baythroid (*b*-cyfluthrin) 1 App. 7d PHI
- *Danitol (fenpropathrin) 2 App. @ 16.0 oz./A; 14d PHI
- *Leverage (*b*-cyfluthrin/ imidacloprid) 1 App. 7d PHI
- *Warrior (lambda-cyhalothrin) 5 App. @ 2.56 oz./A; 21d PHI
- *Pounce (permethrin) 4 App. @ 16.0 oz./A; pre-bloom only



2019 Insecticide For Use in Long Island & *RUP

Other Active Ingredients (Organic-OMRI)

§Entrust (spinosad) – Int. Lep & LR

§Grandevo (*Chromobacterium subtsugae*)

§Aza-Direct, §Neemix (azadirachtin)

§M-Pede (insecticidal soap)

§Surround (kaolin) – Pear psylla / PC

§Venerate XC (*Burkholderia* spp. strain A396)



2019 Insecticide For Use in Long Island & *RUP

Other Active Ingredients (IPM)

Avaunt (indoxacarb) Plum curculio

Beleaf (flonicamid) WAA

Delegate (spinetoram) Leafroller, Int. Lep



2019 Insecticide For Use in Long Island & *RUP

Neonicotinoids

*Admire Pro (imidacloprid) Aphid complex
Assail (acetamiprid) Apple Maggot & CM



2018 Insect Pest Management Updates: Efficacy Screening & Invasive Insect Studies

New & Old Insecticide Updates

Tree Fruit Insecticide Efficacy Studies



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THE JENTSCH LAB

INSECT BIOLOGY, ECOLOGY, AND MANAGEMENT IN HUDSON VALLEY AGRICULTURAL COMMODITIES



WELCOME **ENTOMOLOGY** BROWN MARMORATED STINK BUG INVASIVES ORGANIC AG. RESEARCH TREE FRUIT THE HEIRLOOM ORCHARD
VEGETABLE SWEET CORN SMALL FRUIT GRAPE IN THE NEWS

Plant Protection Presentations

Fruit Production IPM Presentations:

2018

Insecticide Efficacy HVRL IPM Workshop, Highland, NY October 10th, 2018.



2017 BLOG PAGES

<http://blogs.cornell.edu/jentsch/presentations/>

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INSECTICIDE AND ACARICIDE STUDIES



RESULTS OF INSECTICIDE AND ACARICIDE STUDIES
IN EASTERN NEW YORK;
Hudson Valley Laboratory,
Highland, NY

Insecticide screening is a critical component of pest management research. Results from these screens provide information to producers on how effective specific management programs work on key insect pests. It also provides options for timing and rates of newly developed modes of action on these insects, while demonstrating the negative impact these programs may have on important biological control agents such as predatory arthropods and a phytophagous mite response to both old and new formulations in these comparative studies.

Past Reports

[2018 Preliminary Report](#)

[2017](#)

[2016](#)



Search

2017 BLOG PAGES

- Updated Workshop Agenda:
'Fungicide, Insecticide Efficacy and Horticultural Studies Updates' 2PM,
Oct 10th 2018 October 4, 2018
- First Fruits: Supporting the Hudson Valley Regional Food Bank in 2018.
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- Adult BMSB Trap Captures
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<http://blogs.cornell.edu/jentsch/results-of-insecticide-and-acaricide-studies-in-eastern-new-york-cornell-universitys-hudson-valley-laboratory/>

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UPDATED WORKSHOP AGENDA: 'FUNGICIDE, INSECTICIDE EFFICACY AND HORTICULTURAL STUDIES UPDATES' 2PM, OCT 10TH 2018

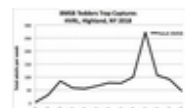
BMSB Update: Stink Bug Feeding Continues on Apple. Assessing Fruit Damage at Harvest for Stink Bug.

by [PETER J. JENTSCH](#) posted on [OCTOBER 8, 2018](#) [\[EDIT\]](#)

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 Tridellers traps placed along the woodland orchard edges. It's no surprise that we also see 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 normally fall open by the 3rd complex will likely be harvested and stored without BMSB, only to find the same fruit with very high levels of fruit damage after it is removed 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 Tridellers may decrease, followed by scouting along the orchard perimeter and use of a single adult stink bug on a doctored within 100' of perimeter row, then followed by border 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 in field, preparing for overwintering.



A doctored depression.

Always a 'ring' site in the center of the depression.

Upon doing, working up to the skin surface.

* Small injury during the season

A doctored depression.

Never a 'ring' site in the center of the depression.

Upon doing, working up to the skin surface.

* Bitter pit from calcium deficiency requiring applications throughout the season

A doctored depression.

Never a 'ring' site in the center of the depression.

Upon doing, working up to the skin surface.

* Apple russeting from copper deficiency or egg laying site or 'ring' in fruit surface

Sometimes a depression. Most often only slight discoloration.

Always a 'ring' site in the center of the depression.

Upon doing, no working BUT soft, mottled fruit flesh, often with tunneling well into the fruit

being larger than 30 feeding sites, and always easy to see.

Cutting directly beneath the ring will give rise to juice seeping up from the egg laying wing.

See images related to injury below.

Overview:

Scouting efforts throughout the Hudson Valley have documented the presence of brown marmorated stink bug since late April. However, its presence in border rows or even in traps has not, up until late August, been a sign of BMSB presence in orchards causing feeding damage. The BMSB has recently begun movement into orchards to intensify feeding, stacking 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 traps captures over the course of the past two weeks. Populations above the 10 adult per trap threshold, spread prior to trap reset with an effective insecticide.

Indicators of stink bug presence can be observed in the presence of live BMSB in fruit clusters and harvested bins with examples of the injury of various remaining on the trees as shown in the photos below. Control measures should be taken if this type of fruit injury is being observed. Very few insecticides are very effective against this insect complex with regards to residual efficacy.

These listed below are labeled for use against BMSB in NY and represent the best of currently and USDA, binary insecticides that will help to reduce the injury and increase mortality of the population. Consider using a systemic surfactant to increase penetration of the active ingredients. However, a tight schedule of no less than 7 days should be made if new fruit damage and stink bug adults continue.



SEVERE BMSB FEEDING INJURY TO PINK LADY



SEVERE BMSB FEEDING INJURY TO PINK LADY

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SEARCH RESULTS FOR: BMSB

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posted in [UNCATEGORIZED](#) | [LEAVE A COMMENT](#)

Adult BMSB Trap Captures Skyrocket During Harvest; September 18th, 2018

by [PETER J. JENTSCH](#) posted on [SEPTEMBER 18, 2018](#) [\[EDIT\]](#)

Synopsis: The 2nd generation of adult Brown Marmorated Stink Bug (BMSB) *Halyomorpha halys* (Stål) have been on the increase at the HVRL in Highland, NY this week. We are seeing the highest numbers at the lab trap site since 2012. ... [Continue reading →](#)

posted in [UNCATEGORIZED](#) | [LEAVE A COMMENT](#)

BMSB 2nd Generation Emergence; August 15th, 2018

by [PETER J. JENTSCH](#) posted on [AUGUST 16, 2018](#) [\[EDIT\]](#)

Synopsis: The 2nd generation of Brown Marmorated Stink Bug (BMSB) *Halyomorpha halys* (Stål) has been observed at the HVRL in Highland, NY this week. Fresh BMSB eggs in Tree of Heaven seed pods and on jalapeño pepper foliage have been ... [Continue reading →](#)

posted in [UNCATEGORIZED](#) | [LEAVE A COMMENT](#)

Late Bite: Summer OBLR Emergence; Increasing BMSB in Tree Fruit and Vegetable; August 13th

by [PETER J. JENTSCH](#) posted on [AUGUST 13, 2018](#) [\[EDIT\]](#)



BMSB

Search

2017 BLOG PAGES

• BMSB Update: Stink Bug Feeding Continues on Apple. Assessing Fruit Damage at Harvest for Stink Bug. October 8, 2018

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<http://blogs.cornell.edu/agnello/insecticide-efficacy-trials-2/>

Insecticide Efficacy Trials

2017

[Evaluation of Seasonal Insecticide Programs Against NY Apple Pests, 2017](#)

[Comparison of Insecticides Against Woolly Apple Aphid, 2017](#)

2016

[Evaluation of Seasonal Insecticide Programs against New York Apple Pests, 2016](#)

[Evaluation of Insecticides against San Jose Scale, 2016](#)

2015

[Evaluation of Miticides for Control of Phytophagous Mites, 2015](#)

[Evaluation of Seasonal Insecticide Programs against New York Apple Pests, 2015](#)

[Comparison of Insecticides against Woolly Apple Aphid, 2015](#)

[Evaluation of Insecticides against San Jose Scale, 2015](#)

[Evaluation of Fall Insecticides against San Jose Scale, 2015 \(Table\)](#)

2014

[Evaluation of Miticides for Control of European Red Mite, 2014](#)

[Evaluation of Seasonal Insecticide Programs Against New York Apple Pests, 2014](#)

[Comparison of Early Season Applications Against San Jose Scale, 2014](#)

[Comparison of Insecticides Against Woolly Apple Aphid, 2014](#)



Volume 43, Issue 1
2018

(In Progress)


< Previous Next >

Chemical Control of Woolly Apple Aphid, 2017


Adrian T Marshall , Elizabeth H Beers


Arthropod Management Tests, Volume 43, Issue 1, 1 January 2018, tsy026, <https://doi.org/10.1093/amt/tsy026>


Published: 07 April 2018

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Over the past decade, WAA densities have increased in Washington apple orchards. This may be due to recent restrictions on certain organophosphates, which were highly toxic to WAA relative to available alternatives. The current lack of effective insecticides has created a need to test new materials, especially for organic growers. In this trial, the efficacy of a conventional standard organophosphate is compared with an OMRI-approved insecticide for WAA control. This research was conducted in an apple block composed of four cultivars ('Gala', 'Jonagold', 'Golden', 'Granny Smith') at the Tree Fruit Research Extension Center Sunrise Farm near Rock Island, WA. Trees were planted in 2008 on an M9 rootstock at an 8 × 14 ft spacing. Varieties were planted in rows and only 'Jonagold' were used for this experiment. Four insecticide treatments and an untreated check were evaluated with four replications in an RCB design. Each experimental plot consisted of a single tree with three tagged WAA colonies, and plots were spaced at least one tree apart to provide a buffer.

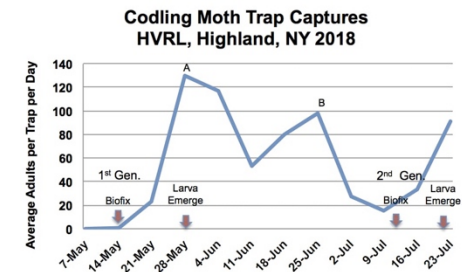
Tree Fruit Pest Management Concepts

- **Insect Pest Phenology, Field Observations, Orchard History**



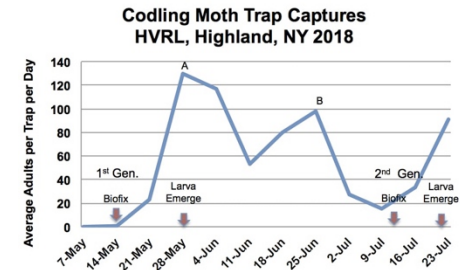
Tree Fruit Pest Management Concepts

- **Insect Pest Phenology, Field Observations, Orchard History**
- **Timing is everything..... then**



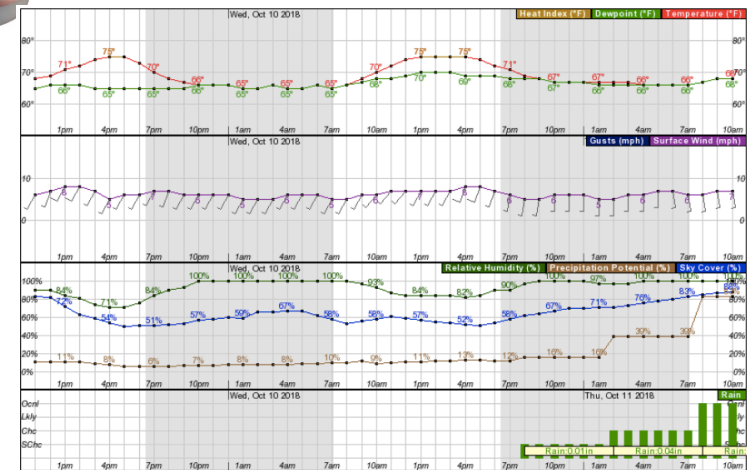
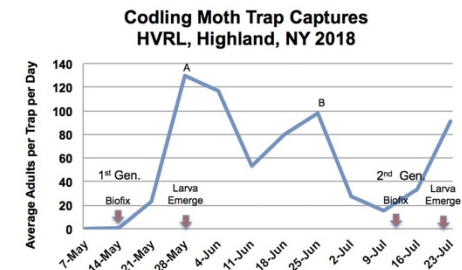
Tree Fruit Pest Management Concepts

- Insect Pest Phenology, Field Observations, Orchard History
- Timing is everything..... then
- Efficacy is everything.....



Tree Fruit Pest Management Concepts

- Insect Pest Phenology, Field Observations, Orchard History
- Timing is everything..... then
- Efficacy is everything.....
- Effective Residue.....



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Hudson Valley Research Laboratory

Tree Fruit Pest Management Concepts

- Insect Pest Phenology, Field Observations, Orchard History

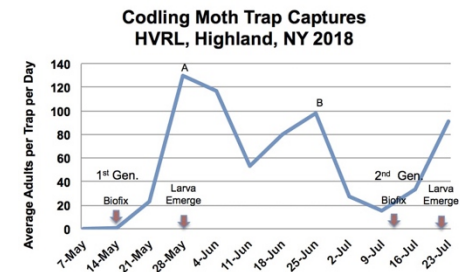
- Timing is everything..... then

- Efficacy is everything.....

- Effective Residue.....

- Complete Coverage.....

- Resistance Mgt.....



Alternate Row Coverage vs Whole Orchard

- Insect Mobility (sedentary (WAA) or fly & crawl (PC / BMSB))
- Endemic (resides within orchard) Selected genes
- Migratory (yearly migration) Diverse genes



Tree Fruit Pest Management Concepts



Required Tools & Understanding for Pest Management

- | | | |
|--|---|---|
| • Insect Pest Phenology, Field Observations, Orchard History | ➔ | Insect Biology, Scouting, Trapping & Thresholds, Field Experience |
| • Timing is everything..... then | ➔ | Modeling (NEWA / RIMPro) & Weather |
| • Efficacy is everything..... | ➔ | Insecticide Selection & Rate |
| • Effective Residue..... | ➔ | Impact of Weather, Re-Application |
| • Complete Coverage..... | ➔ | Sprayer Calibration, Wind, Canopy Mgt. |
| • Resistance Management..... | ➔ | Insecticide Class Rotation |



Principles of Efficacy & Rainfastness*

(*John Wise, Mich. State)

Rainfastness rating chart: General characteristics for insecticide chemical classes

Insecticide class	Rainfastness ≤ 0.5 inch		Rainfastness ≤ 1.0 inch		Rainfastness ≤ 2.0 inches	
	Fruit	Leaves	Fruit	Leaves	Fruit	Leaves
Organophosphates	Low	Moderate	Low	Moderate	Low	Low
Pyrethroids	Moderate/High	Moderate/High	Moderate	Moderate	Low	Low
Carbamates	Moderate	Moderate/High	Moderate	Moderate	Low	Low
IGRs	Moderate	Moderate/High	Moderate	Moderate	Low	Low
Oxadiazines	Moderate	Moderate/High	Moderate	Moderate	Low	Low
Neonicotinoids	Moderate, Systemic	High, Systemic	Low, Systemic	Low, Systemic	Low, Systemic	Low, Systemic
Spinosyns	High	High	High	Moderate	Moderate	Low
Diamides	High	High	High	Moderate	Moderate	Low
Avermectins	Moderate, Systemic	High, Systemic	Low, Systemic	Moderate, Systemic	Low	Low

Highly rainfast = ≤ 30% residue wash-off

Moderately rainfast = ≤ 50% residue wash-off

Low rainfast = ≤ 70% residue wash-off

Principles of Efficacy & Rain fastness

Insecticide persistence, plant penetration and rainfastness rating

Compound class	Persistence (residual on plant)	Plant penetration characteristics	Rainfast rating
Organophosphates	Medium - Long	Surface	Low
Carbamates	Short	Cuticle Penetration	Moderate
Pyrethroids	Short	Cuticle Penetration	Moderate - High
Neonicotinoids	Medium	Translaminar & Acropetal	Moderate
Oxadiazines	Medium	Cuticle Penetration	Moderate
Avermectins	Medium	Translaminar	Moderate
IGRs	Medium - Long	Translaminar	Moderate
Spinosyns	Short - Medium	Translaminar	Moderate - High
Diamides	Medium - Long	Translaminar	Moderate - High

- **Surface:** Reside (A.I.) on leaf or fruit
- **Cuticle:** Movement of the insecticide into the wax layer of the leaf.
- **Translaminar:** Movement of the insecticide into and through the leaf.
- **Acropetal:** Movement of the insecticide from the center of the leaf to the growing tip.
- **Systemic:** Movento SC, moves into tree vascular system. Requires a penetrant and takes 10-14d and full canopy (post PF) to be effective.

Apple insecticide precipitation wash-off re-application decision chart. Expected codling moth control in apples, based on each compound's inherent toxicity to codling moth larvae, maximum residual and wash-off potential from rainfall.

Insecticides	Rainfall = 0.5 inch		Rainfall = 1 inch		Rainfall = 2 inches	
	*1 day	*7 days	*1 day	*7 days	*1 day	*7 days
Imidan	Sufficient insecticide residue	Insufficient insecticide residue	Sufficient insecticide residue	Insufficient insecticide residue	Insufficient insecticide residue	Insufficient insecticide residue
Asana	Sufficient insecticide residue	Insufficient insecticide residue	Insufficient insecticide residue	Insufficient insecticide residue	Insufficient insecticide residue	Insufficient insecticide residue
Assail	Sufficient insecticide residue	Sufficient insecticide residue	Insufficient insecticide residue	Insufficient insecticide residue	Insufficient insecticide residue	Insufficient insecticide residue
Proclaim	Sufficient insecticide residue	Insufficient insecticide residue	Sufficient insecticide residue	Insufficient insecticide residue	Insufficient insecticide residue	Insufficient insecticide residue
Rimon	Sufficient insecticide residue	Sufficient insecticide residue	Insufficient insecticide residue	Insufficient insecticide residue	Insufficient insecticide residue	Insufficient insecticide residue
Delegate	Sufficient insecticide residue	Sufficient insecticide residue	Sufficient insecticide residue	Sufficient insecticide residue	Insufficient insecticide residue	Insufficient insecticide residue
Altacor	Sufficient insecticide residue	Sufficient insecticide residue	Sufficient insecticide residue	Sufficient insecticide residue	Insufficient insecticide residue	Insufficient insecticide residue

Insects Causing Significant Injury to Apple 2017-2018

- Black Stem Borer, *Xylosandrus germanus* (BSB)
- San Jose Scale, *Quadraspidiotus perniciosus* (Comstock) (SJS)
- Plum Curculio *Conotrachelus nenuphar* (PC)
- Codling Moth, *Cydia pomonella* (CM)
- Woolly Apple Aphid, *Eriosoma lanigerum* (Hausmann) (WAA)
- Brown Marmorated Stink Bug & Complex, *Halyomorpha halys* (BMSB), (BSB, GSB)



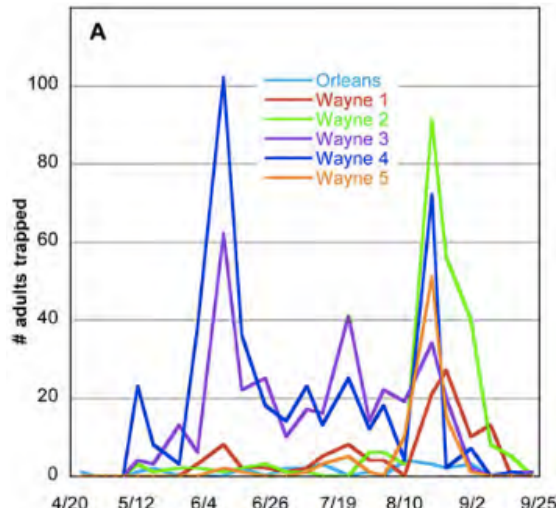
Black Stem Borer, *Xylosandrus germanus*



- Black Stem Borer, 2mm in length, is a species of ambrosia beetle native to eastern Asia, but is an invasive species in Europe and North America.
- It carries an associated ambrosia fungus, *Ambrosiella hartigi* and *Fusarium solanii*. Females bore holes 1 mm in diameter to form reproductive galleries into the wood of trunks or limbs of **stressed trees that appear healthy and those that are dying**.
- **Ethanol-baited traps are used to monitor female flight. Entry sites found in wood from early July through early August in NYS.**
- Female BSB preferentially lands on and attacks physiologically stressed hosts emitting ethanol.
- Upon infesting the tree, the mycelium growth that the insects feed on, signals the tree that it is under attack, walling off its vascular system in response, symptoms develop including wilting, dieback, tree decline and death.



Black Stem Borer, *Xylosandrus germanus*

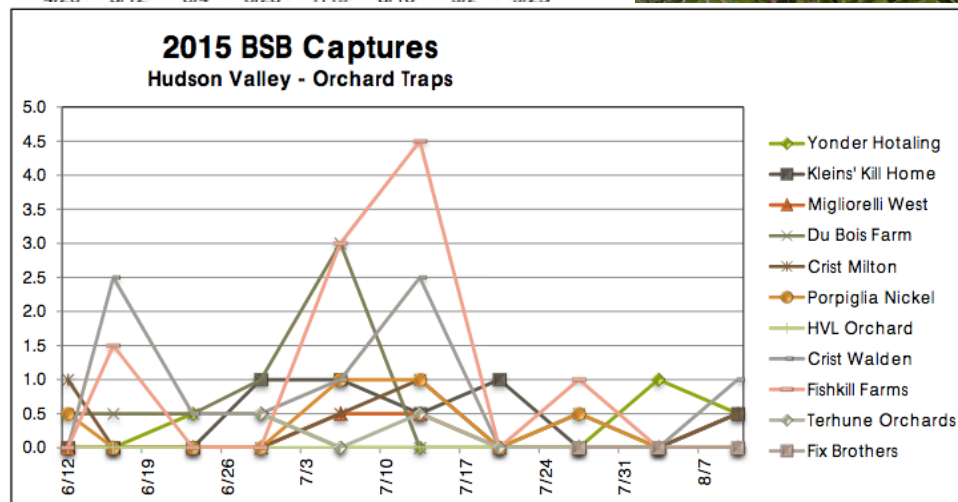


Monitoring flight

- AgBio ethanol lures
- Inverted 'juice' container opening for beetle entry

Monitoring boring activity

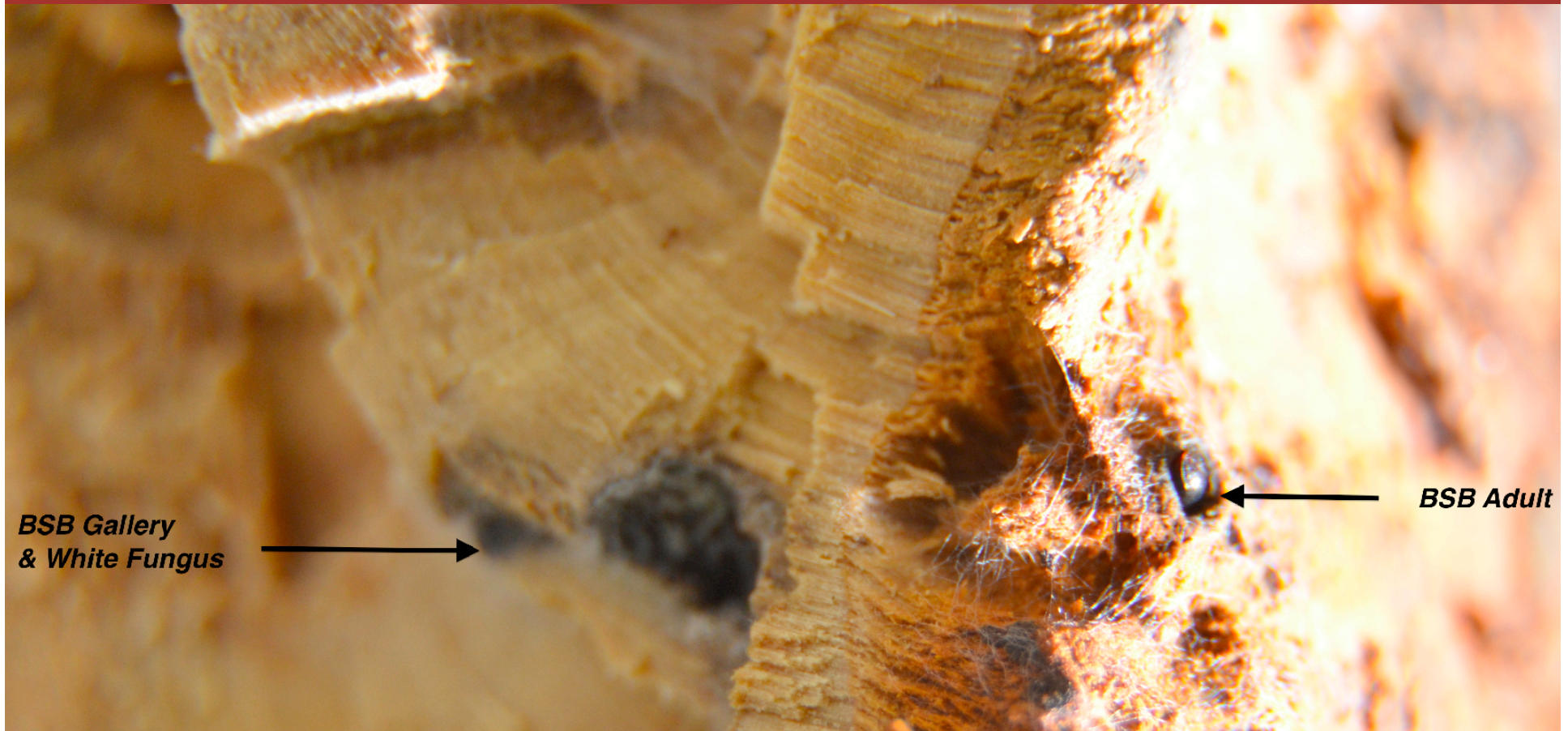
- Use Ethanol-treated wood or AgBio ethanol lures
- Beech, maple
- Soak 9" x 1" / lure
- Monitor for shot holes



*Lorsban trunk application at first sign of boring



Black Stem Borer, *Xylosandrus germanus*



- Trees under drought or excessive water stress trees are susceptible to BSB burrowing
- Once inside the tree, insecticide applications are ineffective
- Directed trunk application are only effective prophylactically, primarily during early spring.



Black Stem Borer, *Xylosandrus germanus*



Table 1. Nursery Trial for control of 1st generation BSB at Wafler - 2015 A. Agnello

Stress	Treatment	% Infested	# Holes	Gallery	Adults	Brood	Adult dead
No flood	untreated *	0	0	0	0	0	0
Flooding	untreated	38	14	3	3	2	2
Flooding	Lorsban	13	2	0	0	0	0
Flooding	Lorsban then Permup	13	2	0	0	0	0
Flooding	Permup x2	38	10	0	3	0	4
Flooding	Warrior x2	56	16	1	3	0	2
Flooding	Warrior then Keyplex	25	6	2	7	1	3
Flooding	Metarhizium	6	1	0	0	0	0

8 Trmts 4 replicates of sleeping eye M-9 trees. May 7th application using Solo sprayer.

Discussion:

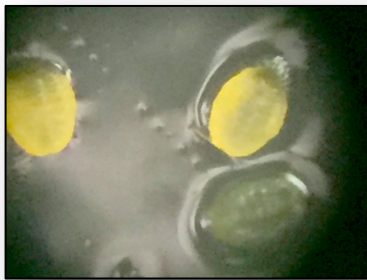
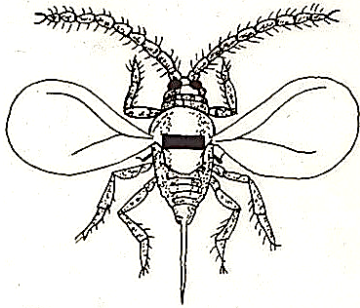
- Lorsban was effective at reducing the pressure in the Wafler nursery site.
- The pyrethroids did not show very promising control.
- Metarhizium, biological control fungus, appeared to be effective but severely burned trees

Reference:

- https://cpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/1/3910/files/2017/09/Agnello-et-al.JEE_.2017-22q89w0.pdf

San Jose Scale

Quadraspidiotus perniciosus (Comstock) (SJS)

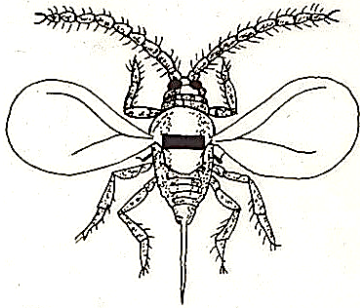


- **San Jose scale (SJS)** is an **endemic pest** of tree fruit. SJS infestations on the bark contribute to an overall decline in tree vigor, growth, and productivity. Loss of broad-spectrum post PF tools & increased tolerance from yearly exposure contribute to recent outbreaks.
- Feeding on the fruit induces local **red to purple discoloration** around feeding sites to decrease the cosmetic quality of the crop.
- **SJS produce 2 generations.** Crawlers are produced continuously over the season, fruit infestations are a constant threat once crawlers begin to emerge.
- Crawlers emerge from beneath the female scale cover, crawl or are **air-borne to new sites** of infestation on the bark, fruit, and leaves.
- **Develop waxy covering** within 48 hours of emergence (whitecap) that transitions to blackcap phase for 2nd gen. or overwintering.



San Jose Scale

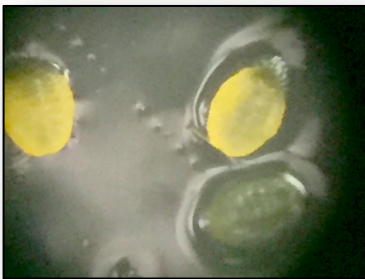
Quadraspidiotus perniciosus (Comstock) (SJS)



SJS Injury

SJS Crawler Modeling:

- Pheromone trap for **adult male monitoring**.
- Black electrical tape with Vaseline to detect **first crawlers**



In 2018, the first SJS male flight in Highland occurred on the 19th May.

Model uses a 51°F lower threshold and 90°F upper threshold with 400 DD accumulations after the beginning of the male flight.



- **Emergence Model date:** June 15th, 2018.
- **Crawler emergence of nymphs on tape:** June 16th, 2018.
- **Fruit Injury on infested trees:** June 26th, 2018.



San Jose Scale

Quadraspidiotus perniciosus (Comstock) (SJS)



**Table 1 Treatment Schedule for 2017 Apple Insecticide Screen
Hudson Valley Research Laboratory, Highland, NY - 2017**

Treatment/Formulation	Rate	Timing	Application Dates
1. Sivanto	10.5 oz./A	P	24 April
Danitol 2.4 EC	16.0 oz./A	PF	8 May
2. Sivanto	14.0 oz./A	P	24 April
Danitol 2.4 EC	16.0 oz./A	PF	8 May
3. Sivanto	10.5 oz./A	P, 1C	24 April, 18 May
Danitol 2.4 EC	16.0 oz./A	PF	8 May
4. Sivanto	10.5 oz./A	P	24 April
Danitol 2.4 EC	16.0 oz./A	PF	8 May
Movento + LI700	9.0 oz./A	1C	18 May
5. Danitol 2.4 EC	16.0 oz./A	PF	8 May
Movento + LI700	9.0 oz./A	1C	18 May
6. Lorsban 4 EC	1.0 pt./100 gal.	P	24 April
Danitol 2.4 EC	16.0 oz./A	PF	8 May
Altacor	4.0 oz./A	SJS Emg. + 14 d.	15 June, 29 June
7. Danitol 2.4 EC	16.0 oz./A	PF	8 May
Venerate XC	2.0 qt./A	SJS Emg. + 14d.	15 June, 29 June
8. Danitol 2.4 EC	16.0 oz./A	PF	8 May
Grandevo WDG	2.0 lb./A	SJS Emg. + 14d.	15 June, 29 June
9. Exirel	20.5 fl. oz./A	P, PF, 1C	24 April, 8 & 18 May
		SJS Emg. + 14d.	15 June, 29 June
10. Untreated Check (UTC)			

The entire block except the UTC was treated for apple maggot on 19 July and 8 August with Assail (acetamiprid) at 9.0 oz./A



San Jose Scale

Quadraspidiotus perniciosus (Comstock) (SJS)



Table 2 Evaluations of Insecticides for Controlling Early Season Insect Complex on Apple ^a
Hudson Valley Research Laboratory, Highland, NY - 2017

Trmt. / Formulation	Rate	Incidence (%) of insect damaged cluster fruit							Clean
		PC	TPB	EAS	MPB	E. LEP	CM	SJS	
1. Sivanto	10.5 oz./A	10.9 a	0.9 ab	0.9 a	0.0	1.3 abc	3.0 ab	22.5 ab	62.3 ab
Danitol 2.4EC	16.0 oz./A								
2. Sivanto	14.0 oz./A	15.5 ab	1.0 ab	0.8 a	0.0	2.4 abc	5.1 b	7.5 ab	69.7 ab
Danitol 2.4EC	16.0 oz./A								
3. Sivanto	10.5 oz./A	14.5 a	0.8 a	0.5 a	0.0	0.0 a	3.8 ab	40.0 b	47.5 ab
Danitol 2.4EC	16.0 oz./A								
4. Sivanto	10.5 oz./A	18.5 ab	2.8 ab	0.5 a	0.0	2.3 abc	1.5 ab	2.3 a	74.2 b
Danitol 2.4EC	16.0 oz./A								
Movento + LI700	9.0 oz./A								
5. Danitol 2.4EC	16.0 oz./A	9.9 a	1.2 ab	0.9 a	0.0	0.3 ab	1.0 ab	0.0 a	64.9 ab
Movento + LI700	9.0 oz./A								
6. Lorsban 4EC	1.0 pt./100	14.8 ab	1.5 ab	0.8 a	0.0	2.0 abc	0.0 a	5.3 ab	76.8 b
Danitol 2.4EC	16.0 oz./A								
Altacor	4.0 oz./A								
7. Danitol 2.4EC	16.0 oz./A	11.0 a	2.8 ab	2.0 a	0.0	4.0 c	3.5 ab	3.8 ab	75.3 b
Venerate XC	2.0 qts./A								
8. Danitol 2.4EC	16.0 oz./A	37.5 ab	1.1 a	0.3 a	0.0	3.8 bc	3.5 ab	1.8 a	51.4 ab
Grandevo WDG	2.0 lbs./A								
9. Exirel	20.5 fl.oz./A	18.7 ab	1.5 ab	0.3 a	0.0	1.5 abc	0.3 ab	21.9 ab	59.6 ab
10. UTC		47.3 b	4.0 b	0.4 a	0.0	3.4 bc	2.0 ab	30.0 ab	24.9 a
P value for transformed data		0.2741	0.5015	0.779	-	0.1631	0.273	0.3186	0.433

^a Evaluation made on 16 June on 'Red Delicious' cultivar.



Plum Curculio *Conotrachelus nenuphar*



Sweet Cherry

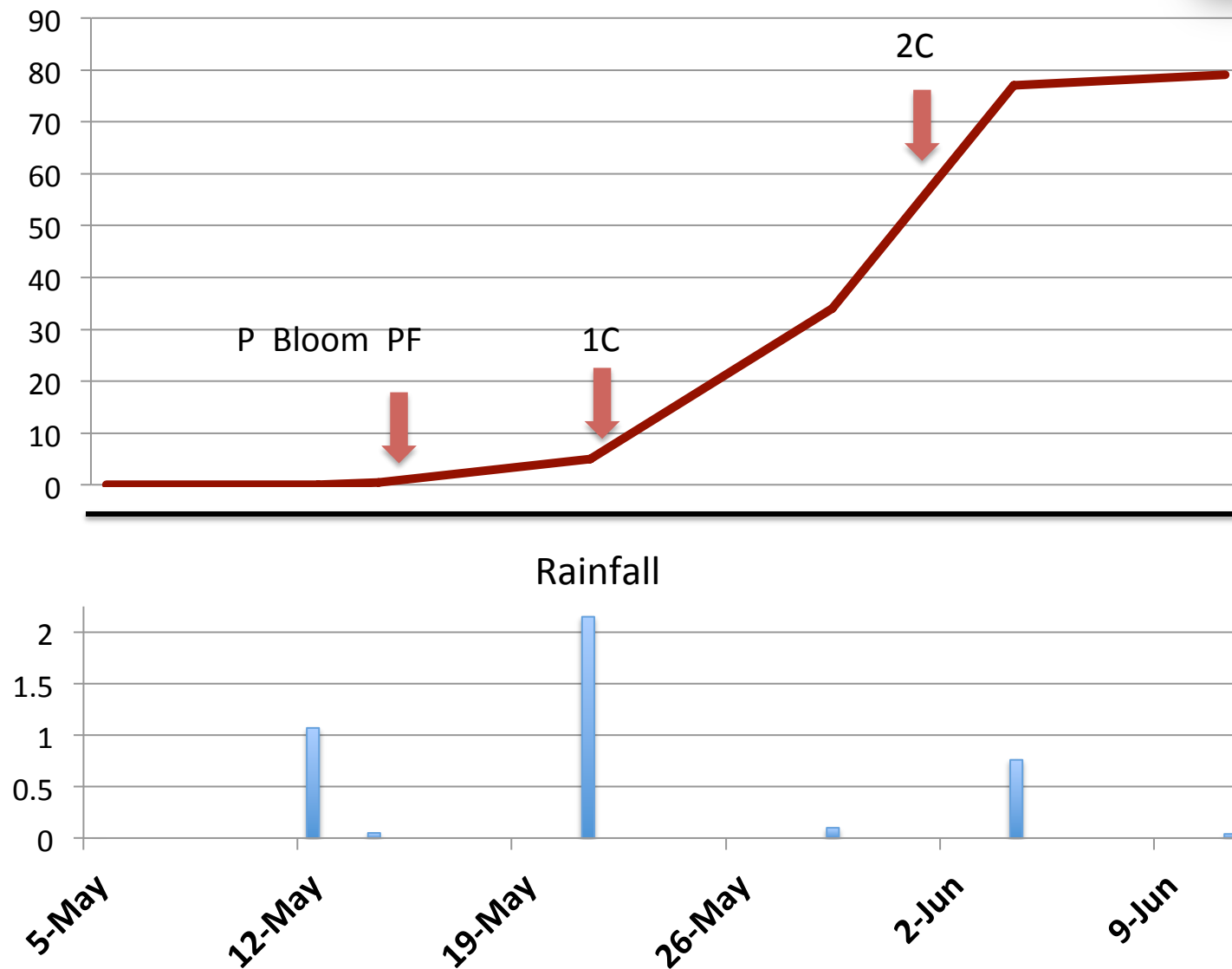


Apple

- Adult beetle overwinters outside of the orchard as adults.
- Emergence and migration during warming temperatures $\geq 60^{\circ}\text{F}$ for $\geq 3\text{d}$ from Pink through 308DD 50F (2nd Cover).
- Adult females cut fruit to feed and lay eggs $\geq 5\text{mm}$ in diameter, deposit eggs beneath the slit flap. Early damage along woods
- Applications are made at
 - Pink as a prophylactic to inhibit migration during bloom
 - Mixed variety blocks
 - Extended periods of bloom
 - King blossom set followed by cool temps
 - 80% Petal Fall. Insecticide prior to $\leq 5\text{mm}$
 - No treatment residue needed beyond 308DD 50F (2nd Cover).
 - 1st Cover requires CM efficacy
- Infested fruit fall during 'June Drop'; larva burrow into soil
Adults emerge, feeding on summer fruit



% PC Injury on Untreated Ginger Gold Apple Hudson Valley Research Lab, Highland, NY - 2018



Plum Curculio



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Danitol 2.4 EC	16.0 oz./A	PF	8 May
4. Sivanto	10.5 oz./A	P	24 April
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Movento + LI700	9.0 oz./A	1C	18 May
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Venerate XC	2.0 qt./A	SJS Emg. + 14d.	15 June, 29 June
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Grandevo WDG	2.0 lb./A	SJS Emg. + 14d.	15 June, 29 June
9. Exirel	20.5 fl. oz./A	P, PF, 1C	24 April, 8 & 18 May
		SJS Emg. + 14d.	15 June, 29 June
10. Untreated Check (UTC)			

The entire block except the UTC was treated for apple maggot on 19 July and 8 August with Assail (acetamiprid) at 9.0 oz./A



Plum Curculio



Table 2 Evaluations of Insecticides for Controlling Early Season Insect Complex on Apple ^a
Hudson Valley Research Laboratory, Highland, NY - 2017

		Incidence (%) of insect damaged cluster fruit	
Trmt. / Formulation	Rate	PC	
1. Sivanto	10.5 oz./A	10.9 a	
Danitol 2.4EC	16.0 oz./A		
2. Sivanto	14.0 oz./A	15.5 ab	
Danitol 2.4EC	16.0 oz./A		
3. Sivanto	10.5 oz./A	14.5 a	←
Danitol 2.4EC	16.0 oz./A		
4. Sivanto	10.5 oz./A	18.5 ab	
Danitol 2.4EC	16.0 oz./A		
Movento + LI700	9.0 oz./A		
5. Danitol 2.4EC	16.0 oz./A	9.9 a	←
Movento + LI700	9.0 oz./A		
6. Lorsban 4EC	1.0 pt./100	14.8 ab	
Danitol 2.4EC	16.0 oz./A		
Altacor	4.0 oz./A		
7. Danitol 2.4EC	16.0 oz./A	11.0 a	←
Venerate XC	2.0 qts./A		
8. Danitol 2.4EC	16.0 oz./A	37.5 ab	
Grandevo WDG	2.0 lbs./A		
9. Exirel	20.5 fl.oz./A	18.7 ab	←
10. UTC		47.3 b	←
P value for transformed data		0.2741	

^a Evaluation made on 16 June on 'Red Delicious' cultivar.

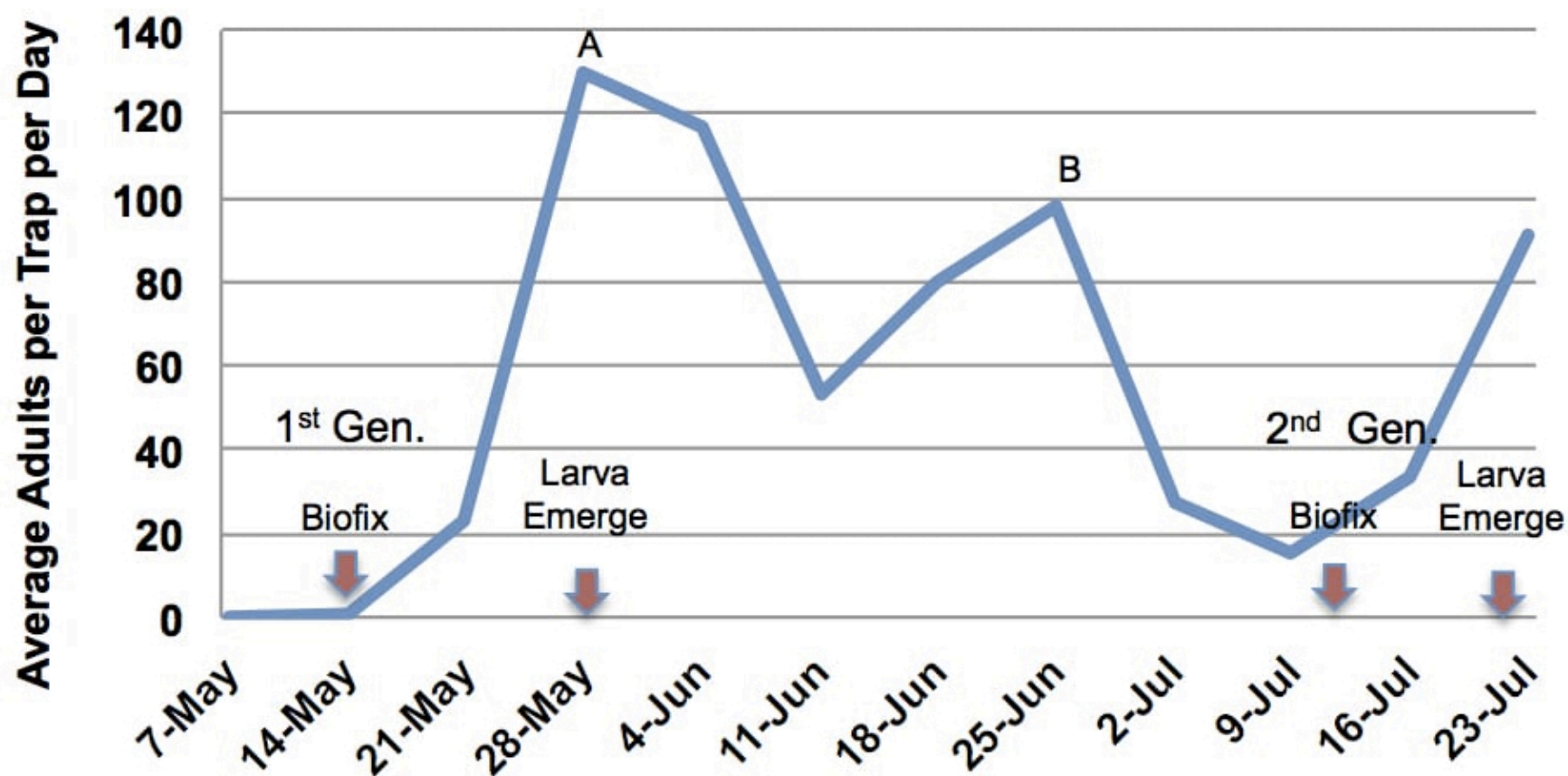


Cornell University

Hudson Valley Research Laboratory

Codling Moth, *Cydia pomonella* (CM)

Codling Moth Trap Captures HVRL, Highland, NY 2018



Codling Moth, *Cydia pomonella* (CM)

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Trmt. / Formulation	Rate	Incidence (%) of insect damaged cluster fruit							
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1. Sivanto	10.5 oz./A	10.9 a	0.9 ab	0.9 a	0.0	1.3 abc	3.0 ab	22.5 ab	62.3 ab
Danitol 2.4EC	16.0 oz./A								
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Danitol 2.4EC	16.0 oz./A								
3. Sivanto	10.5 oz./A	14.5 a	0.8 a	0.5 a	0.0	0.0 a	3.8 ab	40.0 b	47.5 ab
Danitol 2.4EC	16.0 oz./A								
4. Sivanto	10.5 oz./A	18.5 ab	2.8 ab	0.5 a	0.0	2.3 abc	1.5 ab	2.3 a	74.2 b
Danitol 2.4EC	16.0 oz./A								
Movento + LI700	9.0 oz./A								
5. Danitol 2.4EC	16.0 oz./A	9.9 a	1.2 ab	0.9 a	0.0	0.3 ab	1.0 ab	0.0 a	64.9 ab
Movento + LI700	9.0 oz./A								
6. Lorsban 4EC	1.0 pt./100	14.8 ab	1.5 ab	0.8 a	0.0	2.0 abc	0.0 a	5.3 ab	76.8 b
Danitol 2.4EC	16.0 oz./A								
Altacor	4.0 oz./A								
7. Danitol 2.4EC	16.0 oz./A	11.0 a	2.8 ab	2.0 a	0.0	4.0 c	3.5 ab	3.8 ab	75.3 b
Venerate XC	2.0 qts./A								
8. Danitol 2.4EC	16.0 oz./A	37.5 ab	1.1 a	0.3 a	0.0	3.8 bc	3.5 ab	1.8 a	51.4 ab
Grandevo WDG	2.0 lbs./A								
9. Exirel	20.5 fl.oz./A	18.7 ab	1.5 ab	0.3 a	0.0	1.5 abc	0.3 ab	21.9 ab	59.6 ab
10. UTC		47.3 b	4.0 b	0.4 a	0.0	3.4 bc	2.0 ab	30.0 ab	24.9 a
P value for transformed data		0.2741	0.5015	0.779	-	0.1631	0.273	0.3186	0.433

^a Evaluation made on 16 June on 'Red Delicious' cultivar.



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Wooly Apple Aphid (WAA), *Eriosoma lanigerum* (Hausmann)



Pest: Wooly Apple Aphid (WAA) is native to North America and occurs in most apple-growing areas of the world and a sporadic pest in orchards in the northeastern United States

Damage: Cover fruit and limbs with honey dew and sooty mold and galls on the plant parts, , excreting white filament waxy secretions for protection.



Failure to control aerial infestations can result in **underground infestations** on susceptible rootstocks (M.26 & M.9), **causing galls** & transmission of **perennial apple canker**, *Pezicula malicorticis* Jacks .

Biology: WAA aerial colonies feed mainly on apple, pear, quince, mountain ash, hawthorn, and Cottoneaster, on current season's growth, water sprouts, unhealed pruning wounds, or cankers.



Reproduction is asexual (parthenogenetic: mating is not required) as wingless female producing live young in aerial colonies or sexual, producing males, found to occur in Elm trees near fruit hosts.



Wooly Apple Aphid (WAA)

E. Beers, TFREC, Washington State - 2017

		WAA/colony		
		Pre-Treatment	2 DAT	7 DAT
Treatment/formulation	Rate/100 gal	28 Sep	4 Oct	9 Oct
Diazinon 50W	4 lb	36.50a	2.00c	0.33c
Venerate XC +	2 qt	36.58a	26.92ab	19.92ab
Bond Max	12 fl oz			
Venerate XC +	2 qt	35.50a	32.33a	22.67ab
NWW Supreme Oil	1% v : v			
NWW Supreme Oil	1% v : v	37.83a	8.33bc	6.08bc
Check	-	35.08a	30.83a	31.25a

- WAA frequencies are increasing, with the likely cause being materials used against the CM.
- Treatments were applied to the point of drip on 2 Oct using a backpack sprayer
- Aphid densities were evaluated at 2 and 7 DAT.
- Diazinon 50W excellent rescue tool for WAA.

Means within the same column followed by the same letter are not significantly different ($P \leq 0.05$)



Wooly Apple Aphid

A. Agnello, D. David Combes. NYSAES-Geneva - 2017

Treatment/formulation	Rate amt/acre	Timing	Application Dates
Closer 5SC+	5.75 oz	15% infestation + 14d	27 Jun, 12 Jul
LI-700	32.0 oz		
Closer 5SC+	5.75 oz	15% infestation + 14d	27 Jun, 12 Jul
Dyne-amic	48.0 oz		
Movento 240 SC+	9.0 oz	Approximately 1 st Cover	12 Jun
LI-700	32.0 oz		
Movento 240 SC+	9.0 oz	Approximately 1 st Cover	4 Jun
LI-700	32.0 oz		
Sivanto	14.0 oz	First appearance of WAA	24 Jun
LI-700	32.0 oz		
Untreated Check			

Dow AgroSciences: Closer 5 SC

(sulfloxaflor)

Anitfeedent

Bayer Crop Science: Movento 240 SC

(spirotetramat)

Systemic toxicant

Bayer Crop Science: Sivanto

(flupyradifurone)

Translaminar: acropetallyto xylem

Surface toxicant



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Wooly Apple Aphid

A. Agnello, D. David Combes. NYSAES-Geneva - 2017

*Aphelinus mali

Treatment/formulation	Rate amt/acre	% WAA Infested Terminals								
		11 Jun	22 Jun	29 Jun	3 Jul	10 Jul	17 Jul	26 Jul	1 Aug	7 Aug
Closer 5SC+	5.75 oz	0.0 a	17.0 ab	52.7 a	5.7 b	7.3 b	0.0 a	0.0 a	0.7 a	0.3 a
LI-700	32.0 oz									
Closer 5SC+	5.75 oz	0.0 a	29.3 a	60.7 a	10.7 b	10.7 b	0.0 a	0.0 a	0.3 a	0.7 a
Dyne-Amic	48.0 oz									
Movento 240 SC+	9.0 oz	0.0 a	16.3 ab	44.0 ab	14.7 b	11.0 b	0.0 a	0.0 a	1.3 a	0.0 a
LI-700	32.0 oz									
Movento 240 SC+	9.0 oz	0.0 a	8.3 b	41.3 ab	10.7 b	10.0 b	0.0 a	0.0 a	1.7 a	1.0 a
LI-700	32.0 oz									
Sivanto+	14.0 oz									
LI-700	32.0 oz									
Untreated Check		0.0 a	15.7 ab	15.7 b	40.7 a	31.0 a	0.0 a	0.3 a	2.0 a	2.3 a

Means within a column followed by the same letter are not significantly different (Student's t Test, $P \leq 0.05$).

Agnello Lab: <http://blogs.cornell.edu/agnello/insecticide-efficacy-trials-2/>

<https://cpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/1/3910/files/2016/10/WAA-2017-report-1irkrya.pdf>



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2018 Insect Pest Management Updates: Efficacy Screening & Invasive Insect Studies

New & Old Insecticide Updates

Tree Fruit Insecticide Efficacy Studies

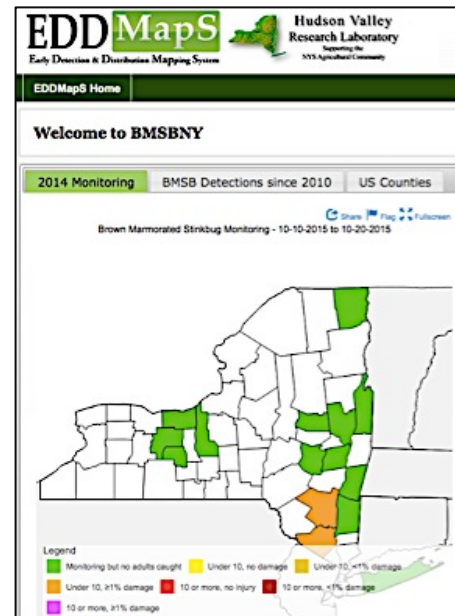
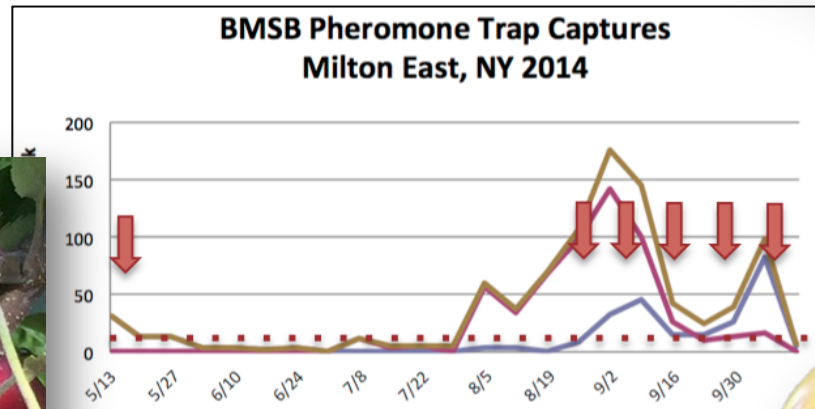
Invasive Insect Pest Complex Studies



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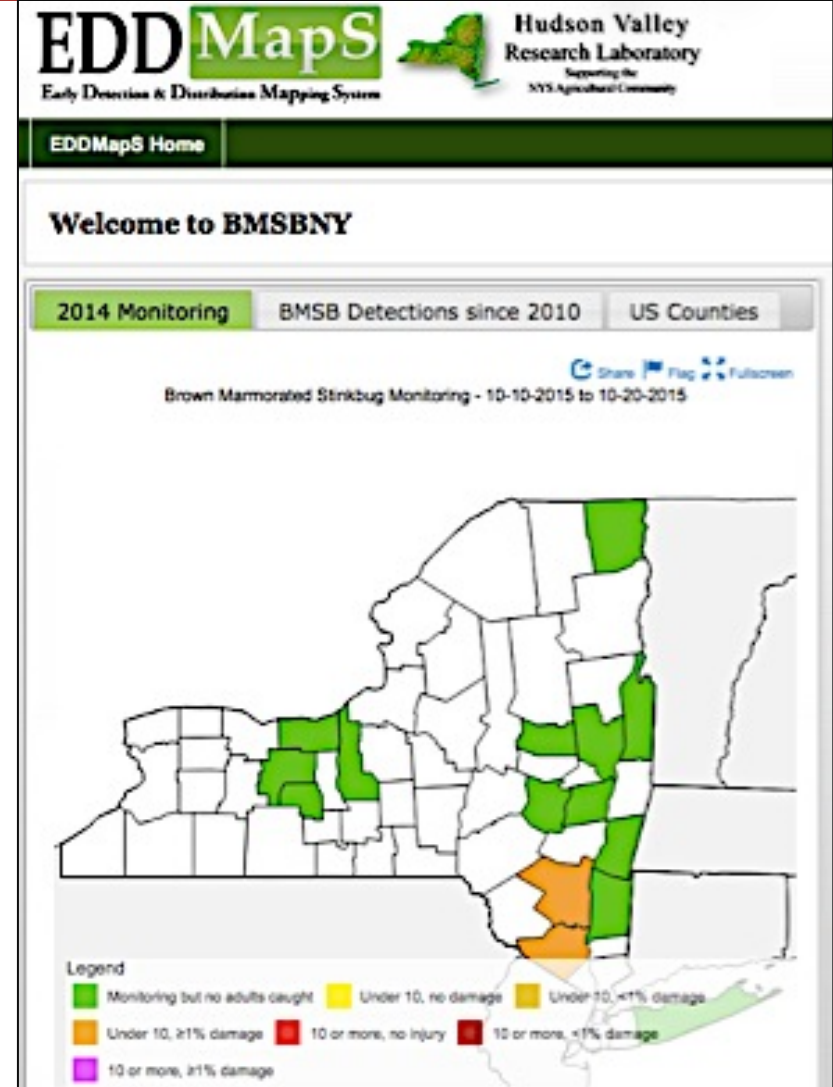
Monitoring and Management of the Stink Bug Complex



Brown Marmorated Stink Bug (BMSB)



- Seasonal presence of BMSB in your county



Brown Marmorated Stink Bug (BMSB)



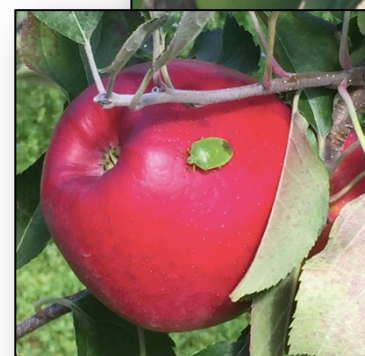
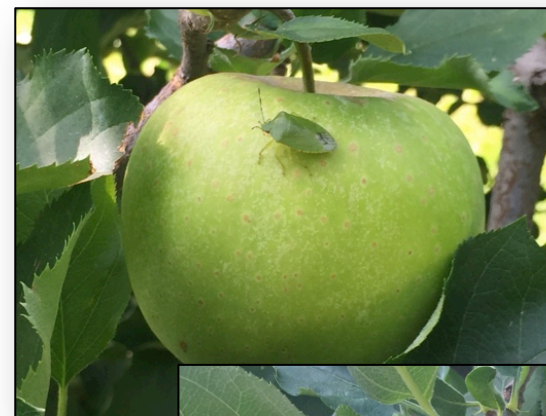
- Seasonal presence of BMSB in your county
- Tedders traps placed along the orchard edge near woodlands (4/farm or ≥ 50 A orchard).



Brown Marmorated Stink Bug (BMSB)

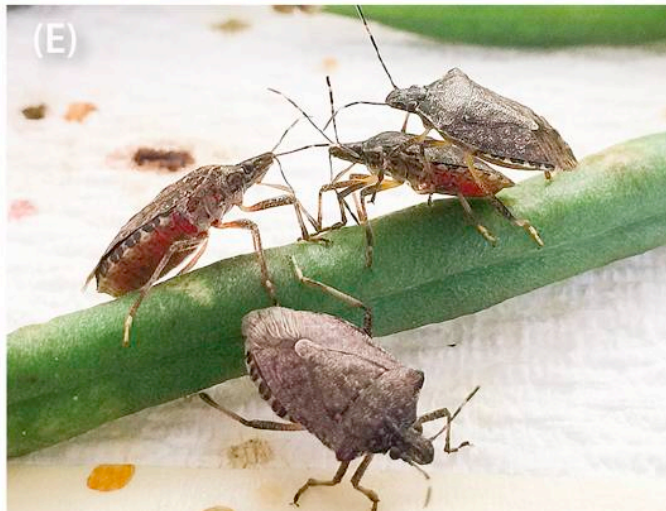
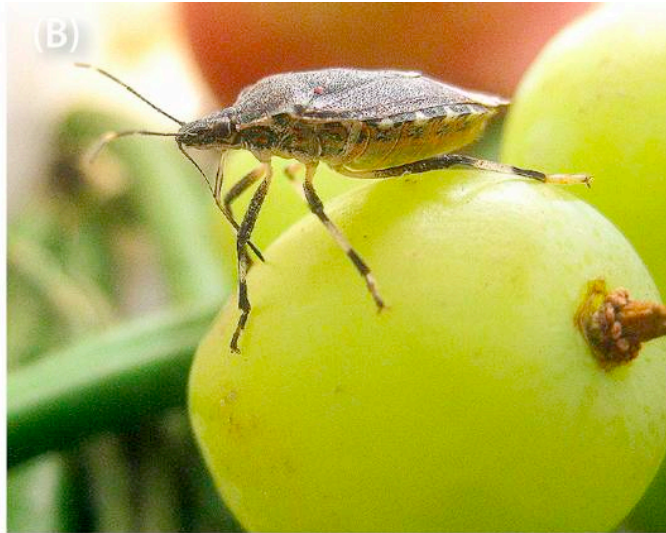


- Seasonal presence of BMSB in your county
- Tedders traps placed along the orchard edge near woodlands (4/farm or ≥ 50 A orchard).
- If 10 adults are found, scout orchard perimeter and interior. Use 1 SB per 100' of row as action threshold.



BMSB: Residual Efficacy

Feeding Sheath & Limited Abdominal Contact with Fruit




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BMSB mortality based on direct contact bioassays – organophosphates, IRAC 1B

G. Krawczyk, PSU FREC 2011.

PRODUCT	ACTIVE INGREDIENT	FIELD RATE tested	FRUIT REGISTRATION*	% DIRECT MORTALITY**			RESIDUAL: LETHALITY INDEX ¹
				24 h	72 h	120 h	
Acephate 97UP	acephate	4 oz	Nonbearing/border	13	42	63	88
Acephate 97UP	acephate	1 lb	Nonbearing/border	10	45	73	88
Diazinon 50W	diazinon	3 lb	PF, SF	0	3	7	20
Guthion	azinphos-methyl	2 lb	PF	3	13	27	71
 Imidan	phosmet	4 lb	PF, SF	2	20	35	20
Lorsban Adv.	chlorpyrifos	3 pt	Before bloom	42	73	82	89
Penncap-M	methyl parathion	6 pt	Not registered	65	82	87	93
Thionex 50W	endosulfan	2 lb	PF, SF	52	98	100	90
Thionex 50W	endosulfan	4 lb	PF, SF	33	98	100	90

*PF- Pom Fruits, SF- Stone Fruits, G- Grapes

** Mortality includes dead plus moribund

¹ – based on dry residual bioassays T. Leskey, USDA ARS

BMSB mortality based on direct contact bioassays – pyrethroids, IRAC 3

G. Krawczyk, PSU FREC 2011.

PRODUCT	ACTIVE INGREDIENT	FIELD RATE tested	FRUIT REGISTRATION*	Percent DIRECT MORTALITY **			RESIDUAL: LETHALITY INDEX ¹
				24 h	72 h	120 h	
Asana XL	esfenvalerate	14 oz	Apple, Pear, SF	15	27	48	43
Baythroid XL	beta-cyfluthrin	2 oz	PF, SF, G	7	13	37	55
Baythroid XL	beta-cyfluthrin	2.8 oz	PF, SF, G	42	30	53	55
Bifenture EC	bifenthrin	12.8 oz	G, Pears	98	100	100	92
Brigade 2EC	bifenthrin	10 oz	G, Pears	100	100	95	92
Danitol 2.4EC	fenpropathrin	12 oz	PF, SF, G	87	65	60	67
Danitol 2.4 EC	fenpropathrin	16 oz	PF, SF, G	95	82	82	67
Hero	bifenthrin zeta-cypermethrin	10 oz	Not registered	93	87	82	92 52
Lambda-Cy EC	lambda-cyhalothrin	4.4 fl oz	Not registered	52	40	35	53
Mustang Max	zeta-cypermethrin	4 oz	PF, SF, G	67	37	30	52
Pounce 25 WP	permethrin	16 oz	PF, SF	45	42	35	77
Warrior II	lambda-cyhalothrin	2 oz	PF, SF	73	72	77	53
Warrior II	lambda-cyhalothrin	2.5 oz	PF, SF	52	51	53	53



*PF- Pome Fruits, SF- Stone Fruits, G- Grapes

** Mortality includes dead plus moribund

¹ – based on dry residual bioassays T. Leskey, USDA ARS

BMSB mortality based on direct contact bioassays – carbamates (IRAC 1A)

G. Krawczyk, PSU FREC 2011.

PRODUCT	ACTIVE INGREDIENT	FIELD RATE	FRUIT REGISTRATION*	Percent DIRECT MORTALITY**			RESIDUAL: LETHALITY INDEX ¹
				24 h	72 h	120 h	
Carzol SP	formetanate	1 lb	PF, SF	58	68	68	64
 Lannate LV	methomyl	2 pt	Apple, Peach, G	88	90	90	90
Lannate LV	methomyl	3 pt	Apple, Peach, G	87	92	92	90
Lannate SP	methomyl	6 oz	Apple, Peach, Nectarine	52	55	60	90
Lannate SP	methomyl	9 oz	Apple, Peach, Nectarine	88	92	92	90
Lannate SP	methomyl	12 oz	Apple, Peach, Nectarine	85	87	87	90
Lannate SP	methomyl	16 oz	Apple, Peach, Nectarine	92	98	98	90
Sevin XLR Plus	carbaryl	3 pt	PF, SF	3	12	8	9
Vydate L	oxamyl	4 pt	Apple, Pear	52	58	63	34
 Vydate L	oxamyl	6 pt	Apple, Pear	68	73	82	34








*PF- Pome Fruits, SF- Stone Fruits, G- Grapes

** Mortality includes dead plus moribund

¹ – based on dry residual bioassays T. Leskey, USDA ARS

BMSB mortality based on direct contact bioassays – neonicotinoids, IRAC 4A

G. Krawczyk, PSU FREC 2011.

PRODUCT	ACTIVE INGREDIENT	FIELD RATE tested	Fruit REGISTRATION*	Percent DIRECT MORTALITY**			RESIDUAL LETHALITY INDEX ¹
				24 h	72 h	120 h	
 Actara	thiamethoxam	4 oz	PF, SF, G	92	95	97	56
Actara	thiamethoxam	5 oz	PF, SF, G	77	95	98	56
 Admire Pro	imidacloprid	7 oz	PF, G	82	87	88	40
Assail 30SG	acetamiprid	6 oz	PF, SF, G	87	87	63	19
Assail 30SG	acetamiprid	8 oz	PF, SF, G	83	83	95	19
Assail 70WP	acetamiprid	3.4 oz	PF, SF, G	78	83	75	19
 Belay	clothianidin	6 oz	PF, Peach, G	100	100	100	56
Calypso 4F	thiacloprid	8 fl oz	PF	58	52	53	18
 Endigo ZC	lambda-cyhalothrin thiamethoxam	3 oz	PF, SF	93	95	87	53 56
Endigo ZC	lambda-cyhalothrin thiamethoxam	5 oz	PF, SF	98	100	98	53 56
 Leverage 360	imidacloprid beta-cyfluthrin	2.8 oz	PF, SF, G	95	93	88	40 55
 Scorpion 35SL	dinotefuran	5 oz	G	97	98	97	67
 Venom	dinotefuran	3 oz	G	93	98	98	67


*PF- Pom Fruits, SF- Stone Fruits, G- Grapes

** Mortality includes dead plus moribund

¹ – based on dry residual bioassays T. Leskey, USDA ARS

BMSB mortality based on direct contact bioassays – mixes (IRAC various)

G. Krawczyk, PSU FREC 2011.

PRODUCT	ACTIVE INGREDIENT	FIELD RATE tested	FRUIT REGISTRATION*	Percent DIRECT MORTALITY**			RESIDUAL LETHALITY INDEX ¹
				24 h	72 h	120 h	
Endigo ZC	lambda-cyhalothrin thiamethoxam	3 oz	PF, SF	93	95	87	53 56
Endigo ZC	lambda-cyhalothrin thiamethoxam	5 oz	PF, SF	98	100	98	53 56
Hero	bifenthrin zeta-cypermethrin	10 oz	Not registered	93	87	82	92 52
Leverage 360	imidacloprid beta-cyfluthrin	2.8 oz	PF, SF, G	95	93	88	40 55
Besiege	lambda-cyhalothrin chlorantraniliprole	10 fl oz	PF, SF	40	40	38	53 N/A
 Voliam Flexi	thiamethoxam chlorantraniliprole	6 oz	PF, SF, G	100	100	100	56 N/A

*PF- Pom Fruits, SF- Stone Fruits, G- Grapes

** Mortality includes dead plus moribund

¹ – based on dry residual bioassays T. Leskey, USDA ARS

BMSB mortality based on direct contact bioassays – Various IRAC Groups

G. Krawczyk, PSU FREC 2011.

PRODUCT	ACTIVE INGREDIENT	FIELD RATE tested	FRUIT REGISTRATION*	Percent DIRECT MORTALITY**			RESIDUAL LETHALITY INDEX ¹
				24 h	72 h	120 h	
Agri-Mek 0.15EC	abamectin	15 oz	Apple, Pear, SF, G	2	7	8	16
Altacor	chlorantraniliprole	3 oz	PF, SF, G	3	7	12	N/A
Avaunt	indoxacarb	6 oz	PF, SF, G	0	5	13	11
Beleaf 50SG	flonicamid	2.8 oz	PF, SF	5	10	15	8
cyazypyr		100 ppm	Not registered	5	3	5	
Delegate WG	spinetoram	7 oz	PF, SF, G	0	3	15	N/A
Esteem 0.86EC	pyriproxyfen	5 oz	PF, SF	0	5	8	N/A
M-Pede	insecticidal soap	2%	PF, SF, G	0	2	5	N/A
M-Pede Spray	insecticid soap	2%	PF, SF, G	10	15	15	N/A
Neemix 4.5	azadirachtin	16 oz	PF, SF, G	0	2	8	N/A
Rimon 0.83EC	novaluron	30 oz	PF, SF	0	2	2	N/A
Stylet Oil	mineral oil	2%		2	2	5	
Besiege	lambda-cyhalothrin chlorantraniliprole	12 fl.ox.	PF, SF	40	40	38	53 N/A
Voliam Flexi	thiamethoxam chlorantraniliprole	6 oz	PF, SF, G	100	100	100	56 N/A

*PF- Pome Fruits, SF- Stone Fruits, G- Grapes

** Mortality includes dead plus moribund

¹ – based on dry residual bioassays T. Leskey, USDA ARS



NY Management Options

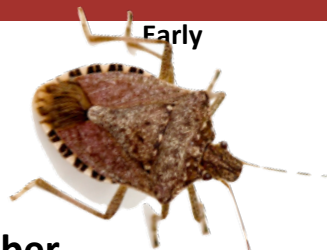
Insecticide Group	Product	Active Ingredient	% Adult BMSB Mortality ¹
Pyrethroid	Bifenture	bifenthrin	100
	Danitol	fenpropathrin	95
	Warrior II	lambda-cyhalothrin	73
Carbmate	Lannate	methomyl	92
	Vydate	oxymyl	68
Neonicotinoid	Actara	thiamethoxam	92
	Assail	acetamiprid	87
Pre-mix	Leverage 360	imidacloprid and β -cyfluthrin	95
	Endigo	lambda-cyhalothrin and thiamethoxam	98
	Voliam Flexi	chlorantraniliprole and thiamethoxam	98

1. Direct contact activity of insecticides against BMSB adults in a lab setting may be very high, yet the activity of field-aged residue may, over time, quickly becomes ineffective at preventing feeding injury.



NY BMSB Management Options

August



Early

Mid

Late

Blondee
Sansa

Blondee
Paulared
Tydeman
Zestar

Single application in early August
14-7d PHI

September

Autmn Crisp
Blondee
Gala
Ginger Gold

Autmn Crisp
Cortland
Empire
Honeycrisp

Ambrosia
Autmn Crisp
Braeburn
Golden Delicious

2-4 applications beginning in early August
35-7d PHI

Golden Supreme
Greening
Jonamac
McIntosh
Twenty Ounce
Tydeman

Macoun
Shamrock
Snow Sweet
Tydeman

Jonagold
Mutsu/Crispin
Pinova
Red Delicious
Ruby Frost™
Ruby Jon
Snap Dragon™
Snow Sweet

October

Braeburn
Cameo
Fortune
Idared
Northern Spy
Rome
Ruby Frost™
Shizuka
Snap Dragon™
Snow Sweet

Braeburn
Cameo
Fuji
Granny Smith
Ruby Frost™
Shizuka
Spigold
Suncrisp

Braeburn
Cameo
Fuji
Granny Smith
Spigold
Suncrisp

5-8 applications beginning in early August
35-7d PHI

>6 applications beginning in early August
35-7d PHI

November

Pink Lady



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NY BMSB Management Options

August	Early	Mid	Late
		Blondee Sansa	Blondee Paulared Tydeman Zestar
September	Autmn Crisp Blondee Gala Ginger Gold Golden Supreme Greening Jonamac McIntosh Twenty Ounce Tydeman	Autmn Crisp Cortland Empire Honeycrisp Macoun Shamrock Snow Sweet Tydeman	Ambrosia Autmn Crisp Braeburn Golden Delicious Jonagold Mutsu/Crispin Pinova Red Delicious Ruby Frost™ Ruby Jon Snap Dragon™ Snow Sweet
October	Braeburn Cameo Fortune Idared Northern Spy Rome Ruby Frost™ Shizuka Snap Dragon™ Snow Sweet	Braeburn Cameo Fuji Granny Smith Ruby Frost™ Shizuka Spigold Suncrisp	Braeburn Cameo Fuji Granny Smith Spigold Suncrisp
November	Pink Lady		

**High Volume of Fruit
Low Injury Level**

**Low Volume of Fruit
High Fruit Injury Levels**



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2017 Field Application

Applications using tractor mounted sprayer on 20th Sept. 300 psi. using dilute handgun applications:

• Closure SC	7d PHI	5.75 fl.oz./A
• Bifenthrin SC	14d PHI	32.0 fl.oz./A
• Actara 25 WDG	14d PHI	5.5 oz./A
• Venerate XC	0d PHI	128.0 fl.oz./A



BMSB adults placement beginning on 20th Sept.

- 24h; 48hr; 72hr placement. Collection made after 7d of placement.
- Insects placed inside portion cups with screened bottoms, rubber band onto the north side of the tree and the north side of those apples to reduce sun exposure.
- BMSB adults placed into growth chamber supplied green beans
- Observations made 2x/wk
- Fruit harvested on 12 Oct. for fruit feeding evaluations



Field Application: Fruit Residue

BMBS placed on apples 24 hours after pesticide application on Sep.20, 2017.

	Number of feeding sites per fruit	Dimpling per fruit	Corking per fruit	Clean fruit (%)	Survival (%)
Closer SC	0.1a	0.1a	0.1a	90a	0a
Bifenthrin	0a	0a	0a	100a	0a
Actara	0a	0a	0a	100a	0a
Venerate	0a	0a	0a	100a	20a
UTC	0.7a	0a	0a	50a	20a
Kruskal-Walis Test, Prob>ChiSq	0.0115	0.8123	0.8123	0.0136	0.3071

Means followed by the same letter are not significantly different by Steel-Dwass Method at $\alpha=0.05$ Apples were rated on Oct.12, 2017. BMSB survival were recorded 7 days after exposure to the fruit.



Field Application: Fruit Residue

BMBS placed on apples 48 hours after pesticide application on Sep.20, 2017.

	Number of feeding sites per fruit	Dimpling per fruit	Corking per fruit	Clean fruit (%)	Survival (%)
Closer SC	0.1b	0.1a	0.1a	90a	0a
Bifenthrin	0b	0a	0a	100a	10a
Actara	0.1b	0.1a	0.1a	90a	0a
Venerate	0.2ab	0a	0a	80ab	40a
UTC	1.2a	0.4a	0.4a	20b	0a
Kruskal-Walis Test, Prob>ChiSq	0.0001	0.4313	0.4313	0.0002	0.0873

Means followed by the same letter are not significantly different by Steel-Dwass Method at $\alpha=0.05$ Apples were rated on Oct.12, 2017. BMSB survival were recorded 7 days after exposure to the fruit.



Field Application: Fruit Residue

BMBS placed on apples 72 hours after pesticide application on Sep.20, 2017.

	Number of feeding sites per fruit	Dimpling per fruit	Corking per fruit	Clean fruit (%)	Survival (%)
Closer SC	0.2a	0.2a	0.2a	90a	80a
Bifenthrin	0.2a	0.2a	0.2a	90a	10b
Actara	0.2a	0.2a	0.2a	90a	100a
Venerate	0.1a	0a	0a	90a	70a
UTC	1.2a	0.1a	0.1a	40a	30ab
Kruskal-Walis Test, Prob>ChiSq	0.0687	0.9254	0.9254	0.0795	0.0006

Means followed by the same letter are not significantly different by Steel-Dwass Method at $\alpha=0.05$ Apples were rated on Oct.12, 2017. BMSB survival were recorded 7 days after exposure to the fruit.



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BMSB Adult Topical Treatment

- Applications were made topically to BMSB adults on 28th Sept. placed on the tree in 10 replicates for each treatment
 - Insects were placed inside portion cups with screened bottoms with a rubber band on the north side of the tree and the north side of those apples to reduce sun exposure as much as possible
- Fruit was collected on 12th October for fruit feeding evaluations



BMSB Adult Topical Treatment

BMSB treated topically on Sep.28, 2017 and placed on apples for 7 days.

	Number of feeding sites per fruit	Dimpling per fruit	Corking per fruit	Clean fruit (%)	Survival (%)
Closer SC	0.3a	0.2a	0.2a	90a	30b
Bifenthrin	0.1a	0a	0a	90a	0b
Actara	0a	0a	0a	100a	10b
Venerate	0a	0a	0a	100a	100a
UTC	0.9a	0a	0a	60a	90a
Kruskal-Walis Test, Prob>ChiSq	0.1288	0.5348	0.5348	0.1093	<.0001

Means followed by the same letter are not significantly different by Steel-Dwass Method at $\alpha=0.05$ Apples were rated on Oct.12, 2017. BMSB survival were recorded 7 days after exposure to the fruit.



Drape Net Exclusion

Hail, Birds, Crop Load Mgt; Late Season Insects



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Treatment/Formulation	RateTiming	Application Dates
Early Season IPM		
Actara	5.5 oz/A	18 th May
Avaunt	6.0 oz/A	25 th May
Entrust SC	10.0 fl oz/A	8 th June
Venerate	2.0 gal/A	21 st June
Season Long IPM		
Actara	5.5 oz./A	18 th May
Avaunt	6.0 oz./A	25 th May
Imidan 70W	4.9 lbs/A	7 th June
Esteem 35WP	5.0 oz/A	21 st June
Assail 30SG	4.0 oz/A	21 st June
Altacor	4.5 oz/A	21 st June
Assail 30SG	4.0 oz/A	10 th July
Exirel	20.5 oz/A	24 st July
Exirel	20.5 oz/A	31 st July
Exirel	20.5 oz/A	6 th Aug.
Bifenture 10DF	32.0 oz/A	6 th Aug.

1. Treatments were applied concentrate using a Slim Line tower sprayer using 100 psi, delivering 0.05 to 0.07 gal/tree traveling at 2.5-2.86 mph averaging 74 gal/A. Insecticide calculations (presented as amt/A) are based on a standard dilution of 100 gal/A . Maintenance applications for disease control and crop load reduction were also made using concentrate airblast, delivery using 100 GPA. Rows were treated with Drape net shortly after fruit set.



Drape Net Exclusion

Late Season Insect Mgt. & Exclusion

Net Type							
Treatment / Rate	PC	EAS	TPB	Lf.Rlr	Int. Lep	Ext.Lep	CM
1. Black Drape Early Season IPM	3.0 a	0.6 a	4.4 a	10.9 bc	2.2 b	18.8 b	11.3b
2. White Drape Early Season IPM	4.7 a	0.0 a	4.4 a	11.9 b	3.1 b	20.3 b	12.5 b
3. No Drape Early Season IPM	10.8 a	0.8 a	4.6 a	22.9 a	6.7 a	37.1 a	23.8 a
4. Black Drape Season Long IPM	5.6 a	1.3 a	7.8 a	0.3 d	0.0 c	1.6 c	0.3 c
5. White Drape Season Long IPM	7.8 a	0.9 a	7.8 a	0.3 d	0.0 c	0.6 c	0.0 c
6. No Drape Season Long IPM	5.6 a	0.9 a	5.0 a	0.6 cd	0.3 c	1.3 c	0.0 c
P value	0.2062	0.6565	0.5998	0.0001	0.0001	0.0001	0.0001



Drape Net Exclusion

Late Season Insect Mgt. & Exclusion

Net Type Treatment / Rate	AM.P	AM.T	SJS	SB	Clean
1. Black Drape Early Season IPM	0.6 b	0.6 b	96.3 a	0.3 b	1.3 c
2. White Drape Early Season IPM	0.9 b	0.9 b	95.6 a	0.9 b	0.6 c
3. No Drape Early Season IPM	7.5 a	4.2a	83.8 b	3.8 a	1.3 c
4. Black Drape Season Long IPM	0.0 bc	0.0 b	6.6 d	0.0 b	82.5 a
5. White Drape Season Long IPM	0.3 b c	0.3 b	20.0 c	0.0 b	65.9 b
6. No Drape Season Long IPM	0.6 b c	0.3 b	6.3 d	0.9 b	81.3 a
P value	0.0001	0.0135	0.0001	0.0154	0.0001





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Thank You For Your Attention



Technical & Summer Staff – 2013
Cicada Brood II Emergence Year

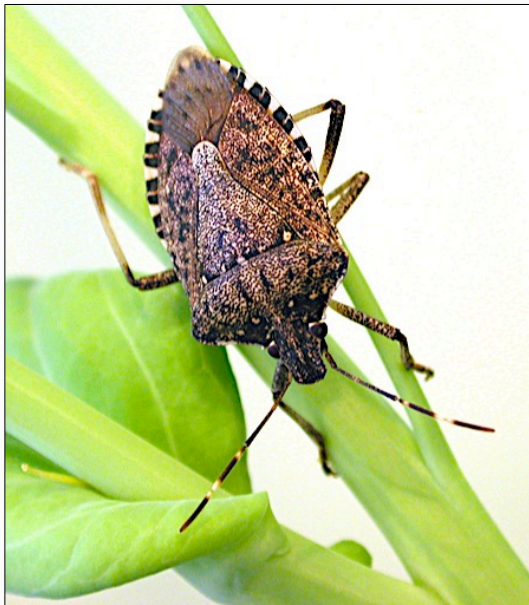


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The National March Madness
Citizen Science Project
To Find
The Brown Marmorated Stink Bug



Trissolcus japonicus



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