Insecticide Efficacy for Insect Management of Tree Fruit In Eastern NY



Pest Management Efficacy Workshop

October 10, 2018

Hudson Valley Research Laboratory
Conference Room
3357 Route 9W, Highland, NY

Peter Jentsch
Senior Extension Associate – Entomology

THE JENTSCH LAB

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Plant Protection Presentations

Fruit Production IPM Presentations:

2018

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

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

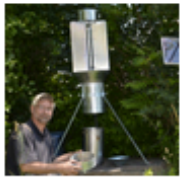
INSECTICIDE AND ACARICIDE STUDIES

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



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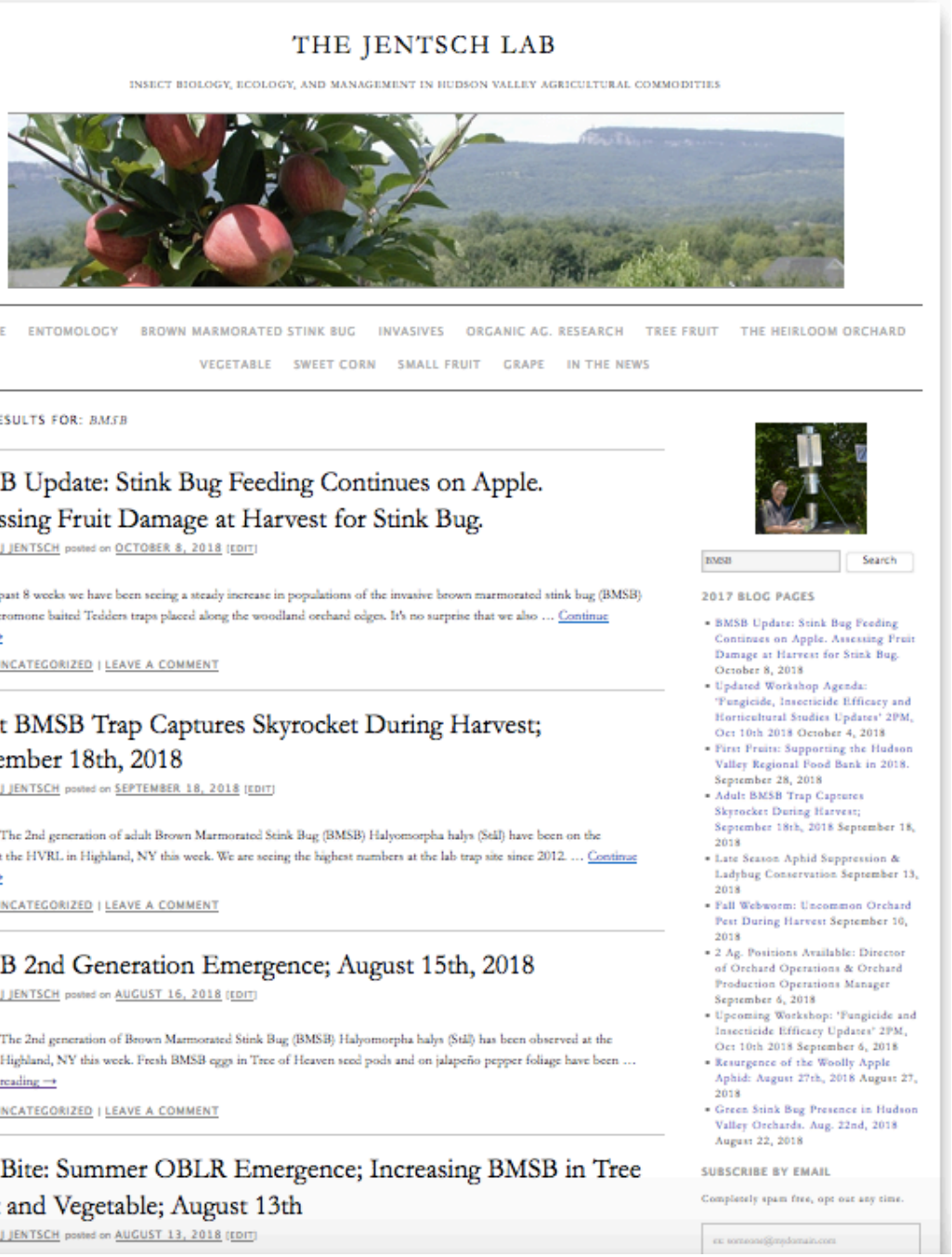
2017 BLOG PAGES

- 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. September 28, 2018
- Adult BMSB Trap Captures Skyrocket During Harvest; September 18th, 2018 September 18, 2018
- Late Season Aphid Suppression & Ladybug Conservation September 13, 2018

http://blogs.cornell.edu/jentsch/results-of-insecticide-and-acaricide-studies-in-eastern-new-york-cornell-universitys-hudson-valley-laboratory/



Subscribe to Email; Search Specific Insect Articles

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

ARTHROPOD MANAGEMENT TESTS

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

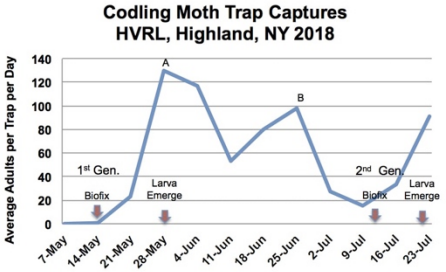
Over the past decade, WAA densities have increased in Washington apple orchards. This may be due to recent restrictions on certain organophosphates, which were highly toxic to WAA relative to available alternatives. The current lack of effective insecticides has created a need to test new materials, 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**

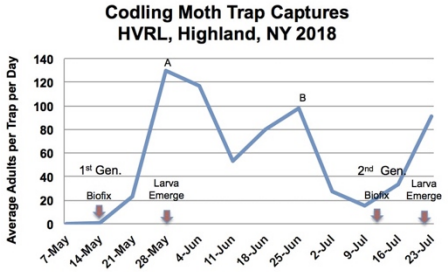
Tree Fruit Pest Management Concepts

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



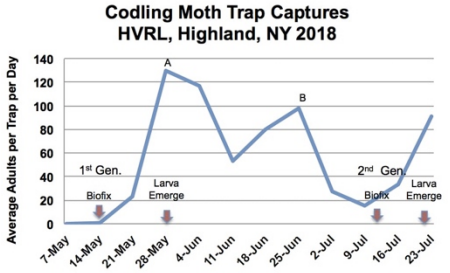
Tree Fruit Pest Management Concepts

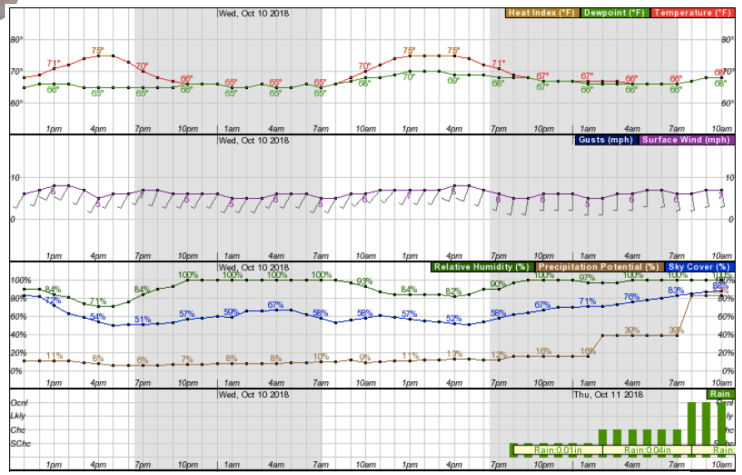
- **Insect Pest Phenology, Field Observations, Orchard History**
- **Timing is everything…… then**
- **Efficacy is everything……**



Tree Fruit Pest Management Concepts

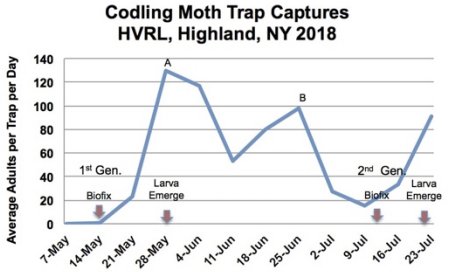
- **Insect Pest Phenology, Field Observations, Orchard History**
- **Timing is everything…… then**
- **Efficacy is everything……**
- **Effective Residue……**





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

Insecticides for NYS

Over the past 25 - >50 Years

Organophosphates

Chlorpyrifos (Lorsban)
Diazinon
Malathion
Phosmet (*Imidan)

- Broad Spectrum / Contact Activity
- Neurotoxins, targeting nicotinic acetylcholine receptors (nAChR)
- Harmful to mammals & humans

Carbamates

Carbaryl (Sevin)
Methomyl (*Lannate)
Oxamyl (*†Vydate)

- Pome fruit crop load reduction / thinning agent
- ERM / TSSM / ARM flare-ups likely
- Reduced biological control (increase of STLM/Aphid)

Pyrethroids

Bifenthrin (*Brigade)
Esfenvalerate (*Asana XL)
Fenpropathrin (*Danitol)
Lambda-cyhalothrin (*Warrior)
Permethrin (*Pounce)

- 'Usre Friendly' − low mamalian toxicity
- Relatively low rates compared to OP's
- Reduced biological control (increase of WAA)
- Suppression of ERM / TSSM / ARM
- Yet, mite flare-ups likely after use ends

Insecticides for NYS
Over the past 10 - 20 Years

Organophosphates

Chlorpyrifos (Lorsban)
Diazinon
Malathion
Phosmet (*Imidan)

Carbamates

Carbaryl (Sevin)
Methomyl (*Lannate)
Oxamyl (*†Vydate)

Pyrethroids

Bifenthrin (*Brigade)
Esfenvalerate (*Asana XL)
Fenpropathrin (*Danitol)
Lambda-cyhalothrin (*Warrior)
Permethrin (*Pounce)

Neonicotinoids – *Translaminar (penetrant)* contact & locally systemic
Neurotoxins, targeting nicotinic acetylcholine receptors (nAChR), OP replacement

Acetamiprid **(Assail)**
Imidacloprid **(*Admire Pro)**
Thiamethoxam **(*†Actara)**

Avermectin *(penetrant required)*
Abamectin **(*Agri-Mek, *Agri-Flex, *Abba)**

Bacillus thuringiensis (Bt, Dipel, Deliver) *(short UV field life)*

Spinosyns
Spinosad **(Spintor - Organic)**
Spinetoram **(Delegate)**

IGR's *(Excellent Soft SJS, CM (egg), Lep materials)*
Buprofezin **(*†Centaur)**
Novaluron **(*Rimon)**, Pyriproxyfen **(Esteem)**
Methoxyfenozide **(*†Intrepid)**

Insecticides for NYS
Over the past 5 - 10 Years

Pyridinecarboxamide (*systemic, supression of feeding*)
Flonicamid **(Beleaf)**

Oxadiazine *(Soft, broad spectrum)*
Indoxacarb (**Avaunt)**

Anthranilic Diamide *(Soft, excellent for the lepidopteran complex)*
Chlorantraniliprole **(*†Altacor) (***narrow spectrum)*
Cyazypyr **or** Cyantraniliprole **(Exirel)** *(Broad spectrum)*

Pre-Mixes *(many not equivelant to high rate of each active ingredient, broad spectrum)*

- Chlorantraniliprole/Lambda-cyhalothrin **(*†Voliam Xpress, *†Besiege)**
- Chlorantraniliprole/Thiamethoxam **(*†Voliam Flexi)**
- Cyfluthrin/Imidacloprid **(*Leverage)**
- **L**ambda-cyhalothrin/Thiamethoxam **(*†Endigo)**
- Thiamethoxam/Abamectin **(*†Agri-Flex)**
- Zeta-Cypermethrin/Avermectin B1 **(*Gladiator)**

Insecticides for NYS
New / Novel

Biologicals
Burkholderia spp. strain A396 (**Venerate**), Chromobacterium subtsugae (**Grandevo**)
Codling Moth Granulosis Virus (**Carpovirusine, Cyd-X, Madex**)

Butenolide
Flupyradifurone (**Sivanto 250SC**)

Neonicotinoid
Sulfoxaflor (Closer)

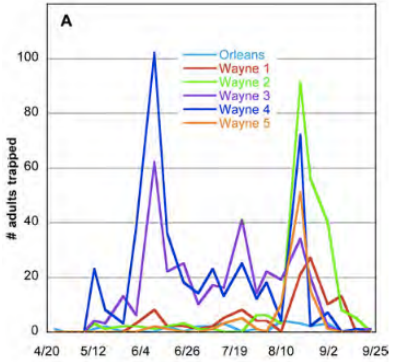
Anthranilic Diamides
Cyantraniliprole (*†**Exirel**)
Flupyradifurone (**Sivanto 250SC; Prime**) Targets insect nicotinic acetylcholine receptor (nAChR)
Cyazypyr **or** Cyantraniliprole **(Exirel)**
Cyclaniliprole (**Harvanta 50SL** (ISK Corp.))

Pre-mix
Chlorantraniliprole/Lambda-cyhalothrin **(Besiege = formally Voliam Xpress)**
Cyantraniliprole, Abamectin **(Minecto Pro)**
Novaluron & Acetamiprid **(Cormoran)**

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)**
- **Wooly 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.

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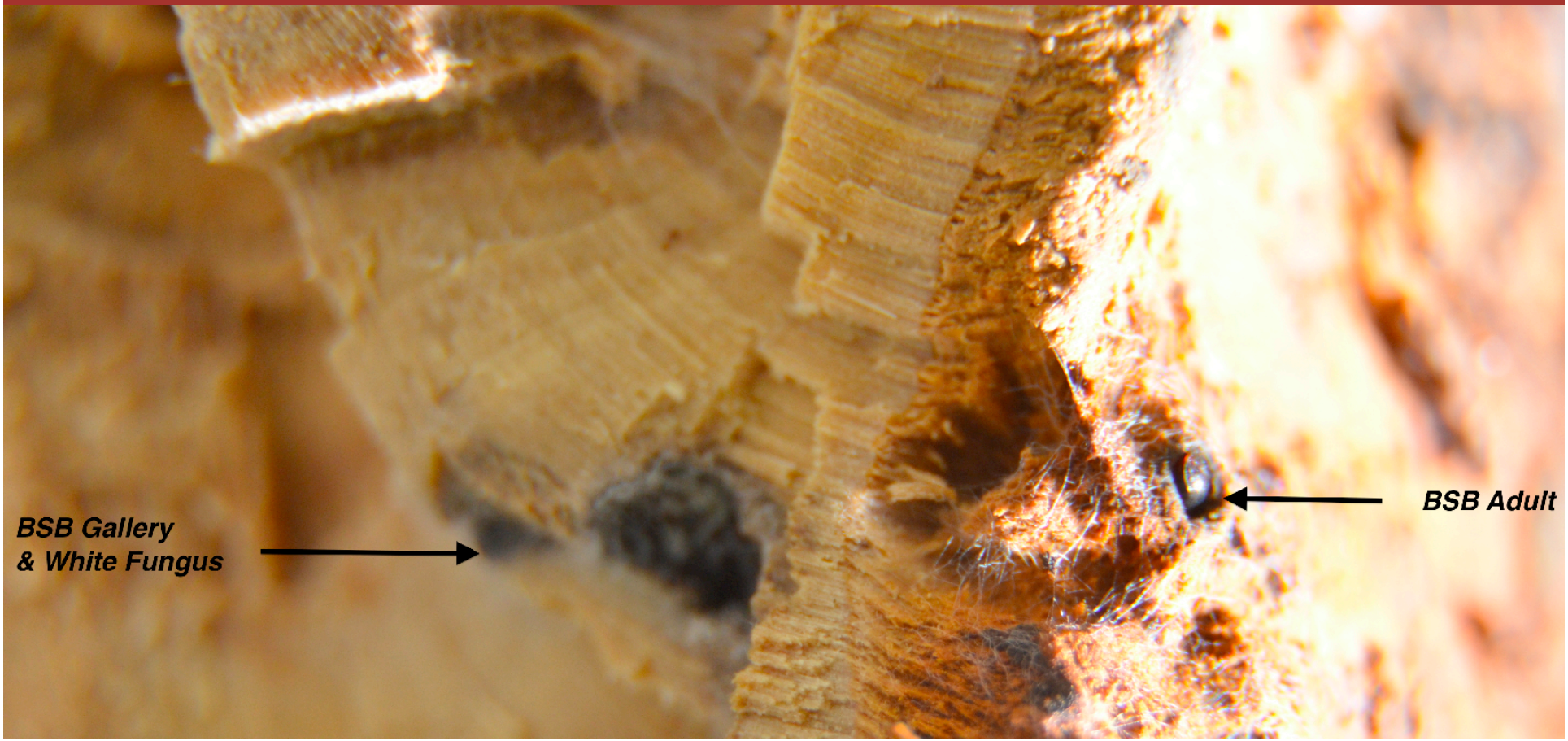
Black Stem Borer, *Xylosandrus germanus*



- 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.

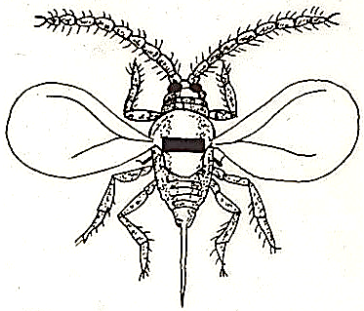
Discussion:

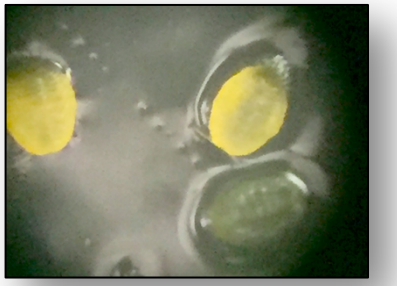
- Lorsban was effective at reducing the pressure in the Wafler nursery site.
- The pyrethroids did not show very promising control.
- Metarhizium, biological control fungus, appeared to be effective but severely burned trees

Reference:

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

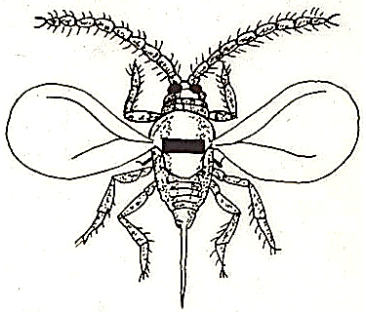
San Jose Scale
Quadraspidiotus perniciosus (Comstock) (SJS)

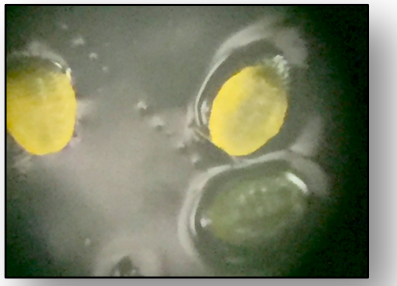




- **San Jose scale (SJS)** is an **endemic pest** of tree fruit. SJS infestations on the bark contribute to an overall decline in tree vigor, growth, and productivity. Loss of broad-spectrum post PF tools & increased tolerance from yearly exposure contribute to recent outbreaks.
- Feeding on the fruit 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

			Incidence (%) of insect damaged cluster fruit							
Trmt. / Formulation		Rate	PC	TPB	EAS	MPB	E. LEP	CM	SJS	Clean
1.	Sivanto Danitol 2.4EC	10.5 oz./A 16.0 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
2.	Sivanto Danitol 2.4EC	14.0 oz./A 16.0 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
3.	Sivanto Danitol 2.4EC	10.5 oz./A 16.0 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
4.	Sivanto Danitol 2.4EC Movento + LI700	10.5 oz./A 16.0 oz./A 9.0 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
5.	Danitol 2.4EC Movento + LI700	16.0 oz./A 9.0 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
6.	Lorsban 4EC Danitol 2.4EC Altacor	1.0 pt./100 16.0 oz./A 4.0 oz./A	14.8 ab	1.5 ab	0.8 a	0.0	2.0 abc	0.0 a	5.3 ab	76.8 b
7.	Danitol 2.4EC Venerate XC	16.0 oz./A 2.0 qts./A	11.0 a	2.8 ab	2.0 a	0.0	4.0 c	3.5 ab	3.8 ab	75.3 b
8.	Danitol 2.4EC Grandevo WDG	16.0 oz./A 2.0 lbs./A	37.5 ab	1.1 a	0.3 a	0.0	3.8 bc	3.5 ab	1.8 a	51.4 ab
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.

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

			Incidence (%) of insect damaged cluster fruit							
Trmt. / Formulation		Rate	PC	TPB	EAS	MPB	E. LEP	CM	SJS	Clean
1.	Sivanto Danitol 2.4EC	10.5 oz./A 16.0 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
2.	Sivanto Danitol 2.4EC	14.0 oz./A 16.0 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
3.	Sivanto Danitol 2.4EC	10.5 oz./A 16.0 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
4.	Sivanto Danitol 2.4EC Movento + LI700	10.5 oz./A 16.0 oz./A 9.0 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
5.	Danitol 2.4EC Movento + LI700	16.0 oz./A 9.0 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
6.	Lorsban 4EC Danitol 2.4EC Altacor	1.0 pt./100 16.0 oz./A 4.0 oz./A	14.8 ab	1.5 ab	0.8 a	0.0	2.0 abc	0.0 a	5.3 ab	76.8 b
7.	Danitol 2.4EC Venerate XC	16.0 oz./A 2.0 qts./A	11.0 a	2.8 ab	2.0 a	0.0	4.0 c	3.5 ab	3.8 ab	75.3 b
8.	Danitol 2.4EC Grandevo WDG	16.0 oz./A 2.0 lbs./A	37.5 ab	1.1 a	0.3 a	0.0	3.8 bc	3.5 ab	1.8 a	51.4 ab
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

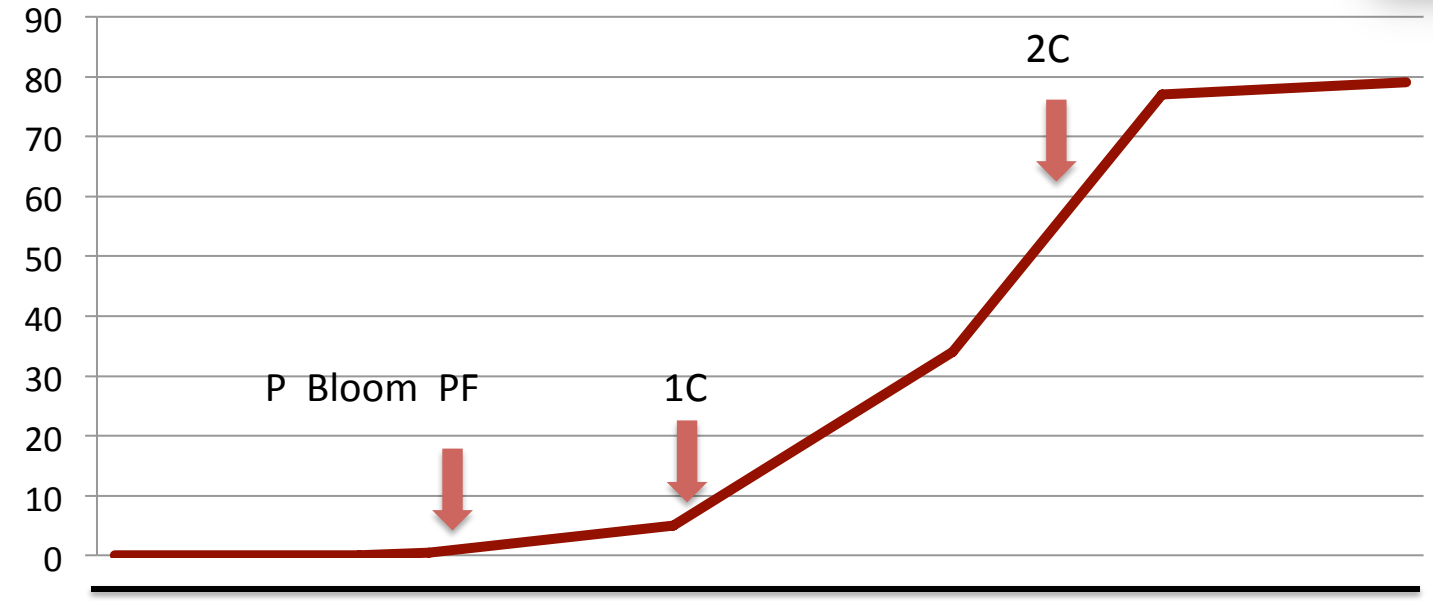
[a] Evaluation made on 16 June on 'Red Delicious' cultivar.

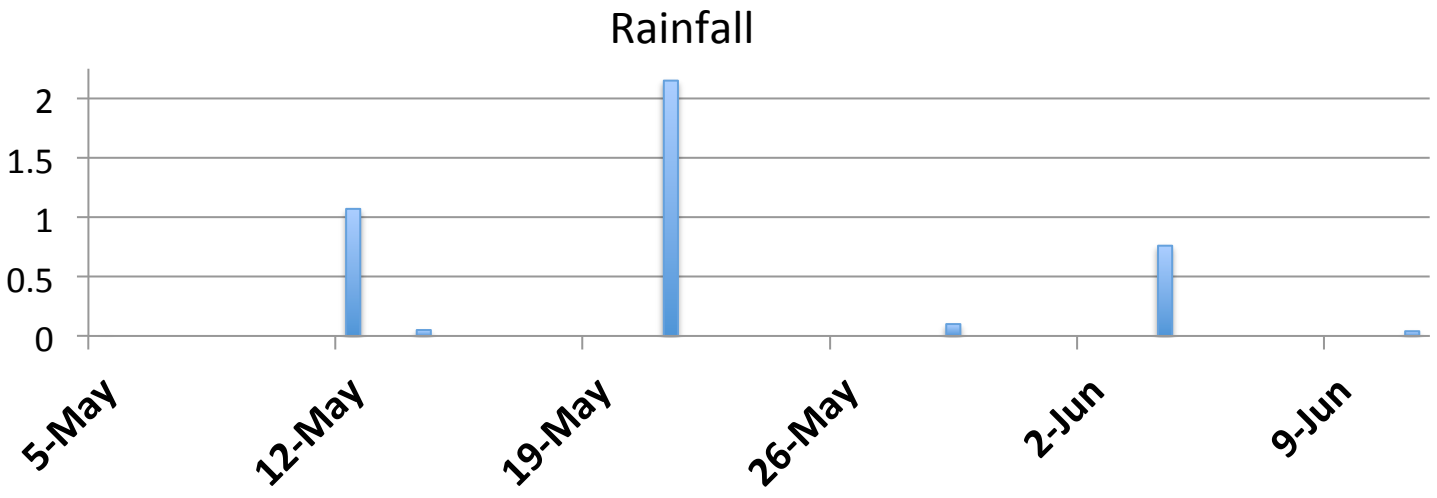
Plum Curculio *Conotrachelus nenuphar*

Sweet Cherry Apple

- Adult beetle overwinters outside of the orchard as adults.
- Emergence and migration during warming temperatures ≥ 60°F for ≥ 3d from Pink through 308DD 50F (2nd Cover).
- Adult females cut fruit to feed and lay eggs ≥ 5mm 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 ≤ 5mm
  - 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

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

Plum Curculio

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

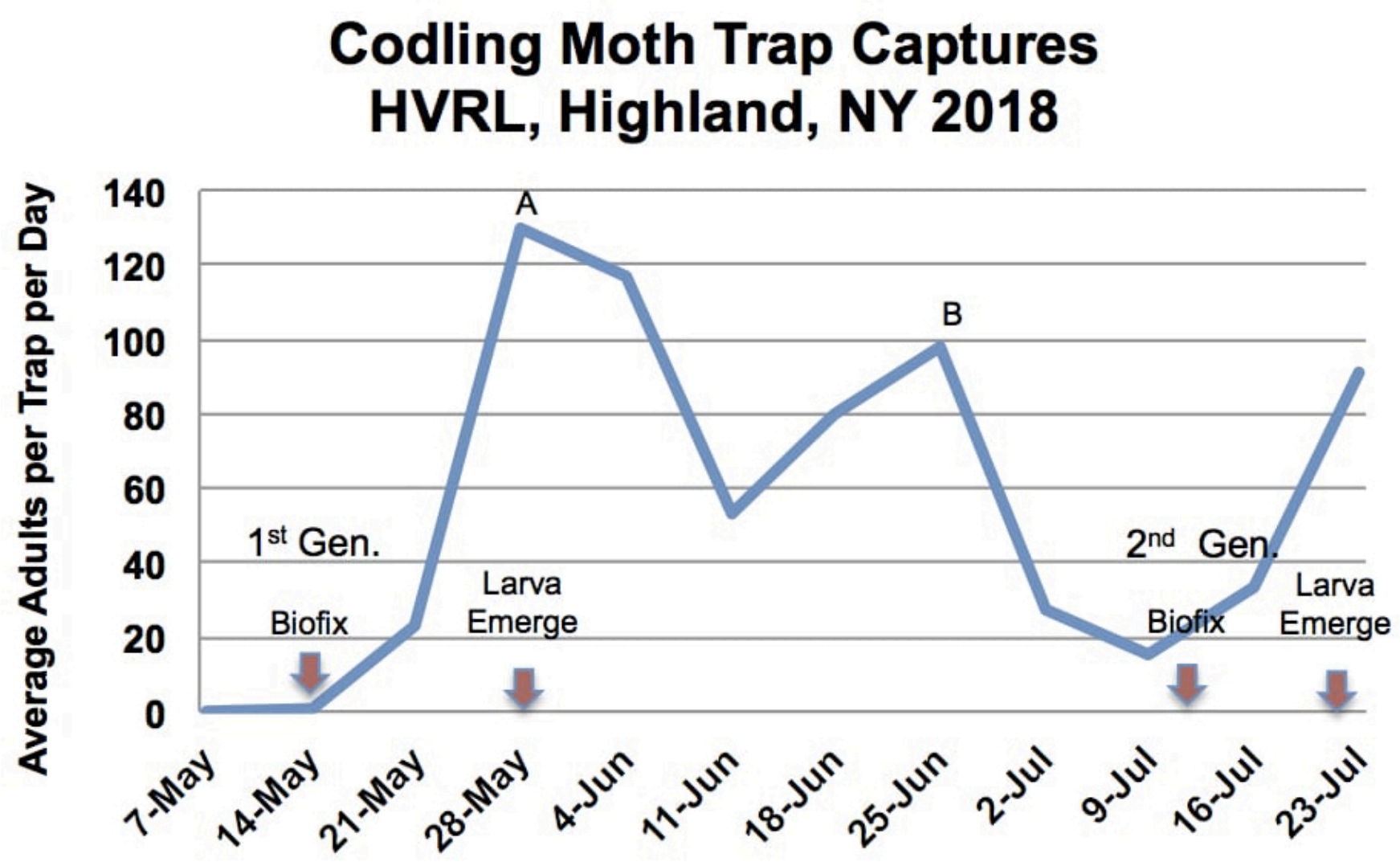
Plum Curculio

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 Danitol 2.4EC	10.5 oz./A 16.0 oz./A	10.9 a
2.	Sivanto Danitol 2.4EC	14.0 oz./A 16.0 oz./A	15.5 ab
3.	Sivanto Danitol 2.4EC	10.5 oz./A 16.0 oz./A	14.5 a
4.	Sivanto Danitol 2.4EC Movento + LI700	10.5 oz./A 16.0 oz./A 9.0 oz./A	18.5 ab
5.	Danitol 2.4EC Movento + LI700	16.0 oz./A 9.0 oz./A	9.9 a
6.	Lorsban 4EC Danitol 2.4EC Altacor	1.0 pt./100 16.0 oz./A 4.0 oz./A	14.8 ab
7.	Danitol 2.4EC Venerate XC	16.0 oz./A 2.0 qts./A	11.0 a
8.	Danitol 2.4EC Grandevo WDG	16.0 oz./A 2.0 lbs./A	37.5 ab
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.

Codling Moth, Cydia pomonella (CM)



Codling Moth, *Cydia pomonella* (CM)

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							
		PC	TPB	EAS	MPB	E. LEP	CM	SJS	Clean
1. Sivanto Danitol 2.4EC	10.5 oz./A 16.0 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
2. Sivanto Danitol 2.4EC	14.0 oz./A 16.0 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
3. Sivanto Danitol 2.4EC	10.5 oz./A 16.0 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
4. Sivanto Danitol 2.4EC Movento + LI700	10.5 oz./A 16.0 oz./A 9.0 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
5. Danitol 2.4EC Movento + LI700	16.0 oz./A 9.0 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
6. Lorsban 4EC Danitol 2.4EC Altacor	1.0 pt./100 16.0 oz./A 4.0 oz./A	14.8 ab	1.5 ab	0.8 a	0.0	2.0 abc	0.0 a	5.3 ab	76.8 b
7. Danitol 2.4EC Venerate XC	16.0 oz./A 2.0 qts./A	11.0 a	2.8 ab	2.0 a	0.0	4.0 c	3.5 ab	3.8 ab	75.3 b
8. Danitol 2.4EC Grandevo WDG	16.0 oz./A 2.0 lbs./A	37.5 ab	1.1 a	0.3 a	0.0	3.8 bc	3.5 ab	1.8 a	51.4 ab
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.

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

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

- 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.

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 1st Cover	12 Jun
LI-700	32.0 oz		
Movento 240 SC+	9.0 oz	Approximately 1st 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

Wooly Apple Aphid

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

*Aphelinus mali

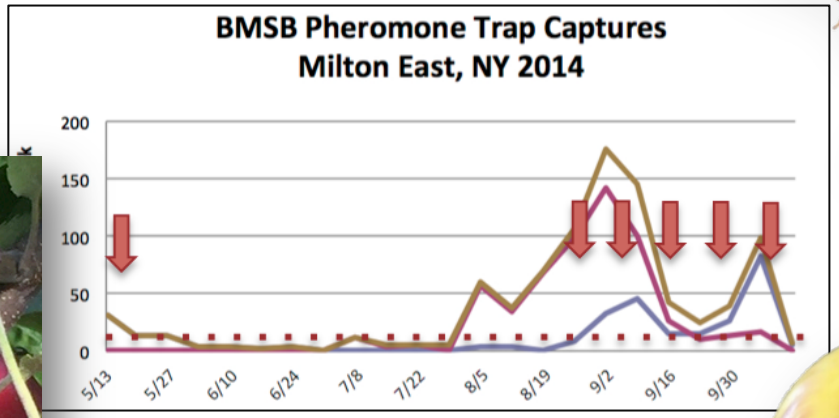
Treatment/formulation	Rate amt/acre	% WAA Infested Terminals								
		11 Jun	22 Jun	29 Jun	3 Jul	10 Jul	17 Jul	26 Jul	1 Aug	7 Aug
Closer 5SC+ LI-700	5.75 oz 32.0 oz	0.0 a	17.0 ab	52.7 a	5.7 b	7.3 b	0.0 a	0.0 a	0.7 a	0.3 a
Closer 5SC+ Dyne-Amic	5.75 oz 48.0 oz	0.0 a	29.3 a	60.7 a	10.7 b	10.7 b	0.0 a	0.0 a	0.3 a	0.7 a
Movento 240 SC+ LI-700	9.0 oz 32.0 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
Movento 240 SC+ LI-700 Sivanto+ LI-700	9.0 oz 32.0 oz 14.0 oz 32.0 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
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

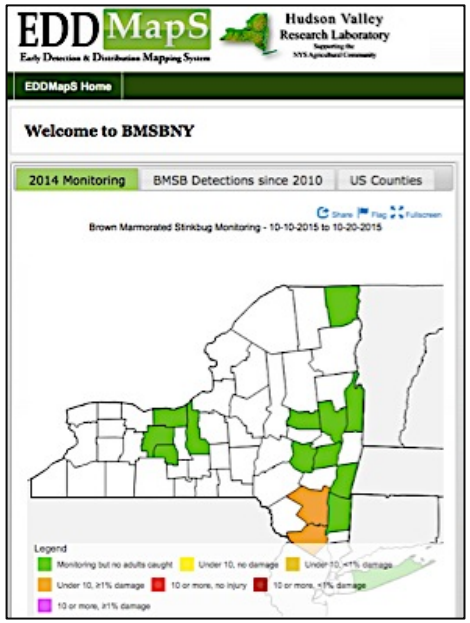
Means within a column followed by the same letter are not significantly different (Student's t Test, $P \leq 0.05$).

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

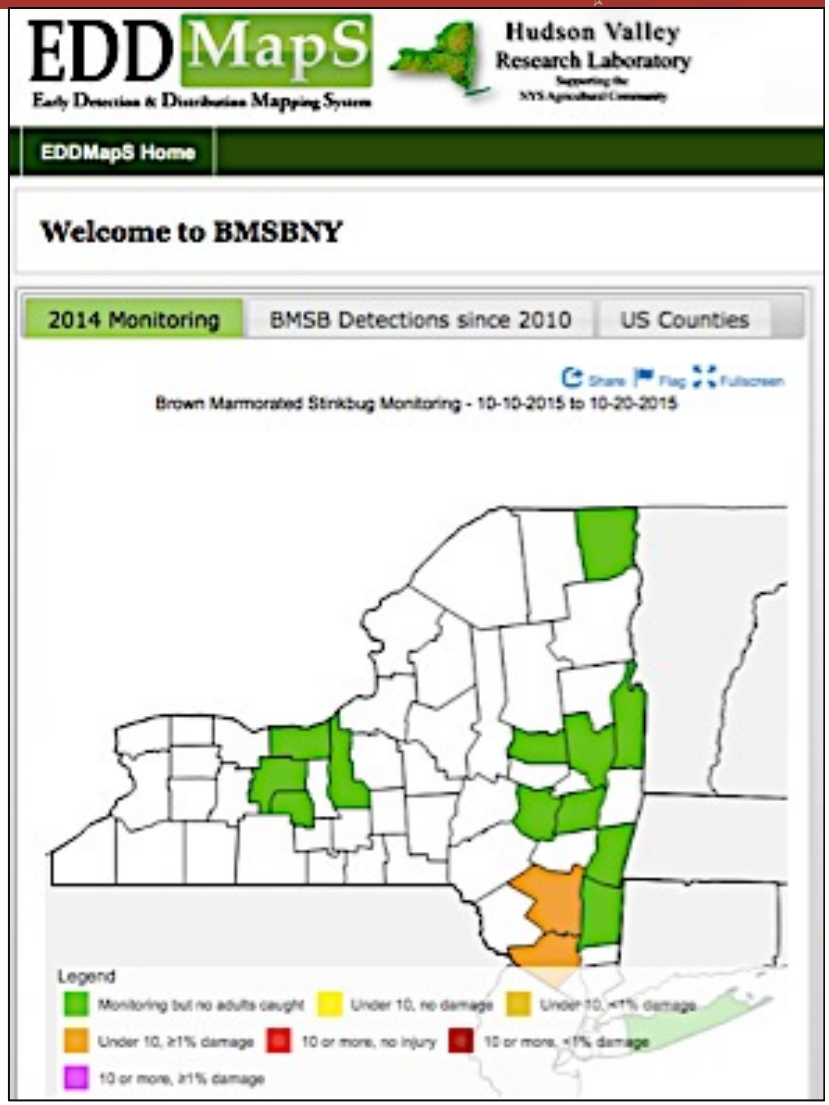
Monitoring and Management of the Stink Bug Complex





Brown Marmorated Stink Bug (BMSB)

- Seasonal presence of BMSB in your county



Brown Marmorated Stink Bug (BMSB)

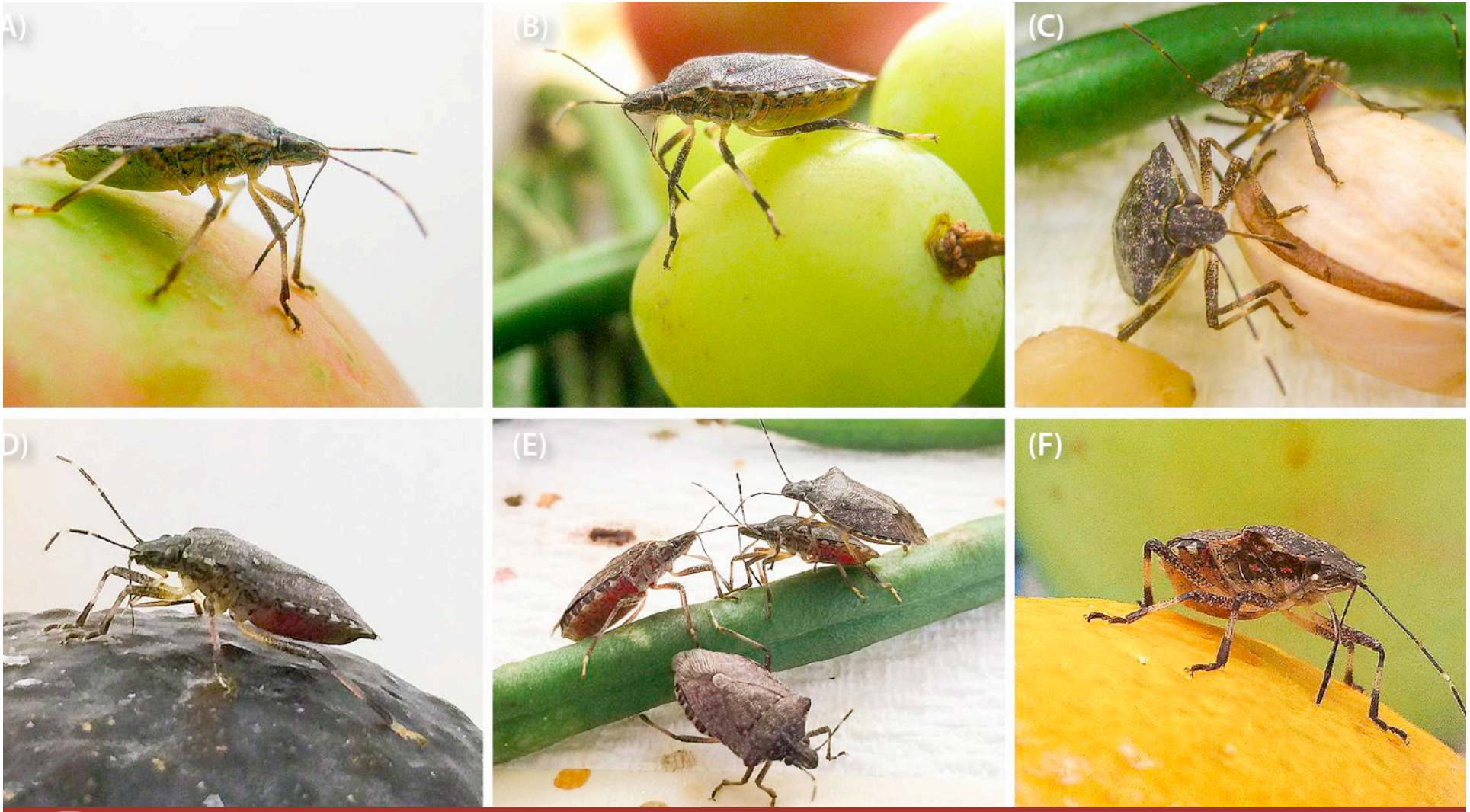
- Seasonal presence of BMSB in your county

- Tedders traps placed along the orchard edge near woodlands (4/farm or ≥50A 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 ≥50A 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



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

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

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

*** Mortality includes dead plus moribund*

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*

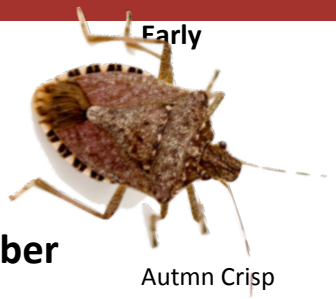
[1] – based on dry residual bioassays T. Leskey, USDA ARS

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.

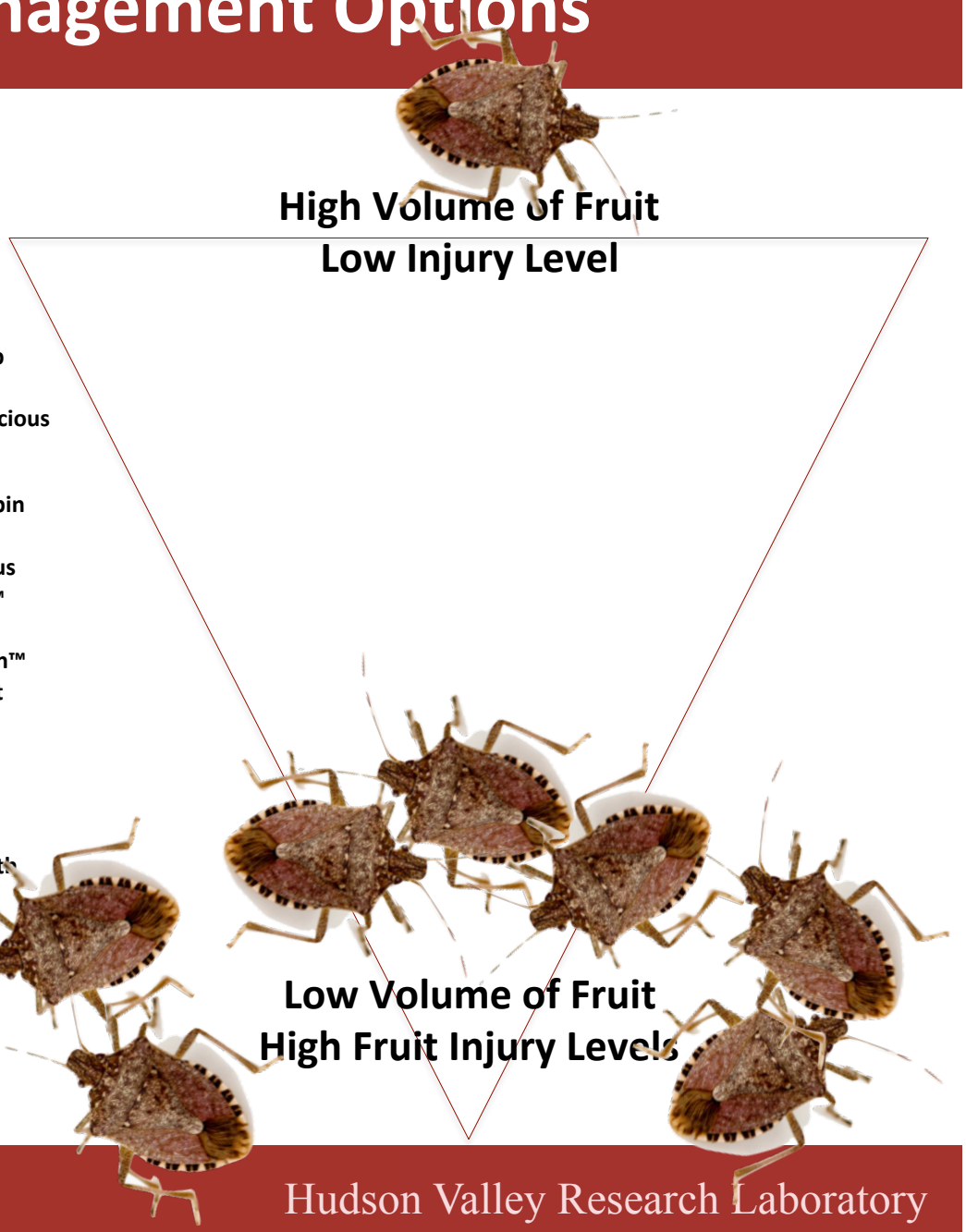
NY BMSB Management Options



	Early	Mid	Late	
August		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			

NY BMSB Management Options

	Early	Mid	Late
August		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		



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
• Bifrenthrin 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 α=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 α=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 α=0.05 Apples were rated on Oct.12, 2017. BMSB survival were recorded 7 days after exposure to the fruit.

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 α=0.05 Apples were rated on Oct.12, 2017. BMSB survival were recorded 7 days after exposure to the fruit.

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NY *farm viability* INSTITUTE

Thank You For Your Attention

Technical & Summer Staff – 2013
Cicada Brood II Emergence Year

Questions??

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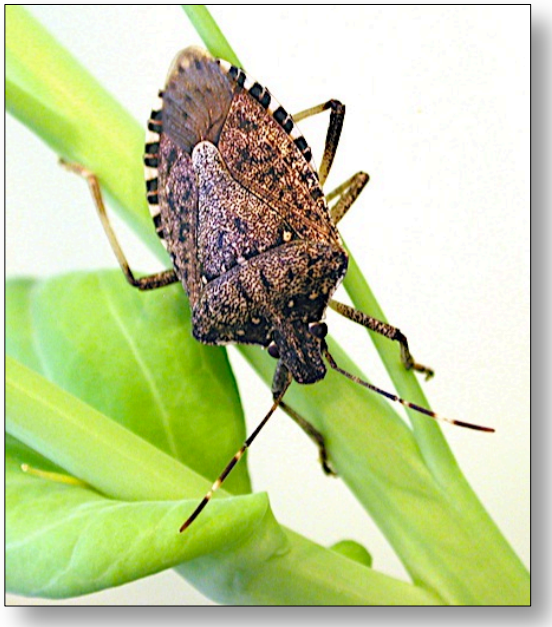

The National March Madness
Citizen Science Project
To Find
The Brown Marmorated Stink Bug

Trissolcus japonicus