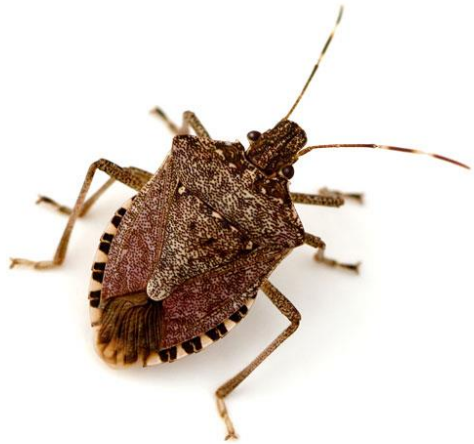

SWD and BMSB Pest Management Recommendations for 2016

Jaime Piñero

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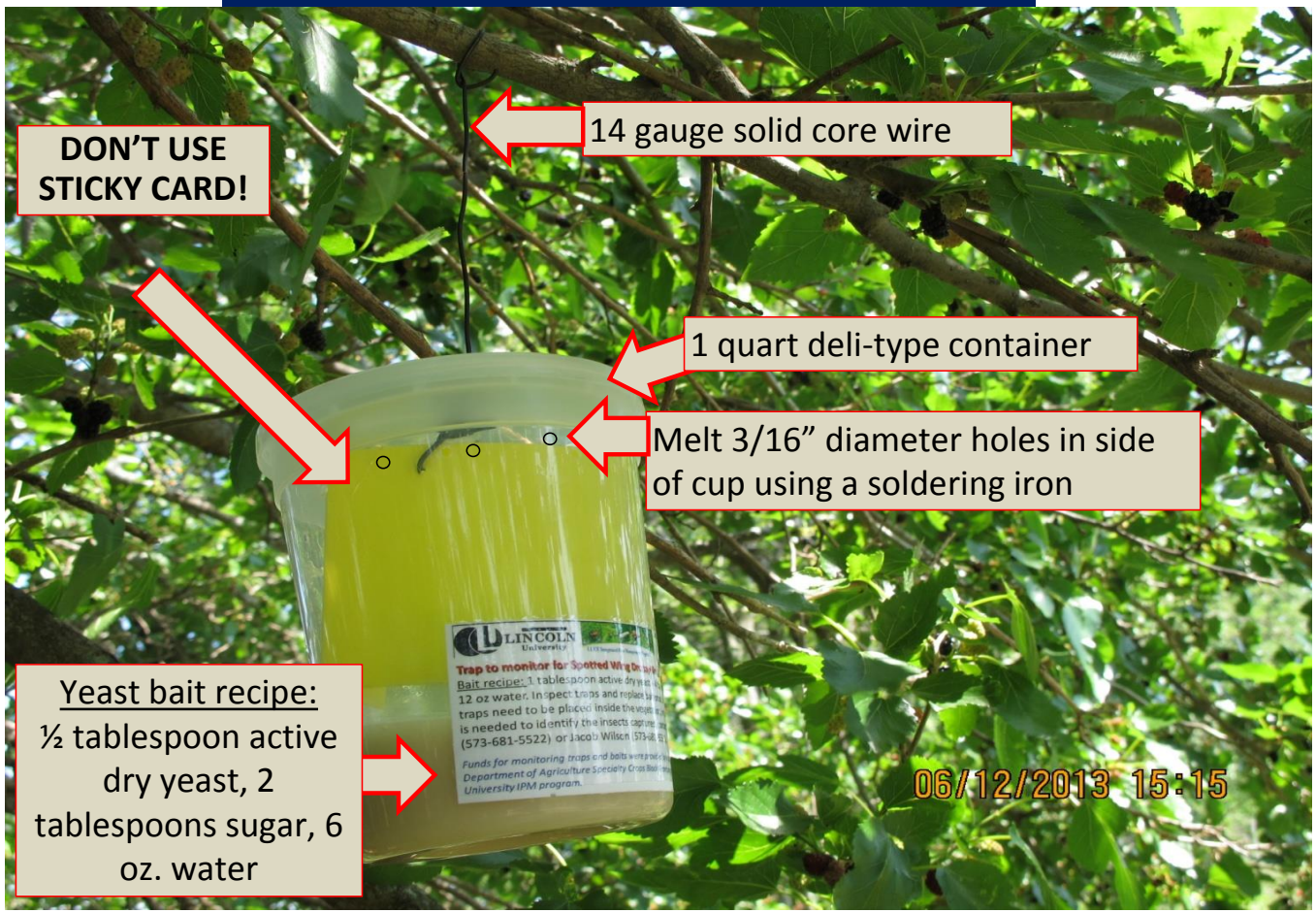
Spotted Wing Drosophila (SWD)

Monitoring

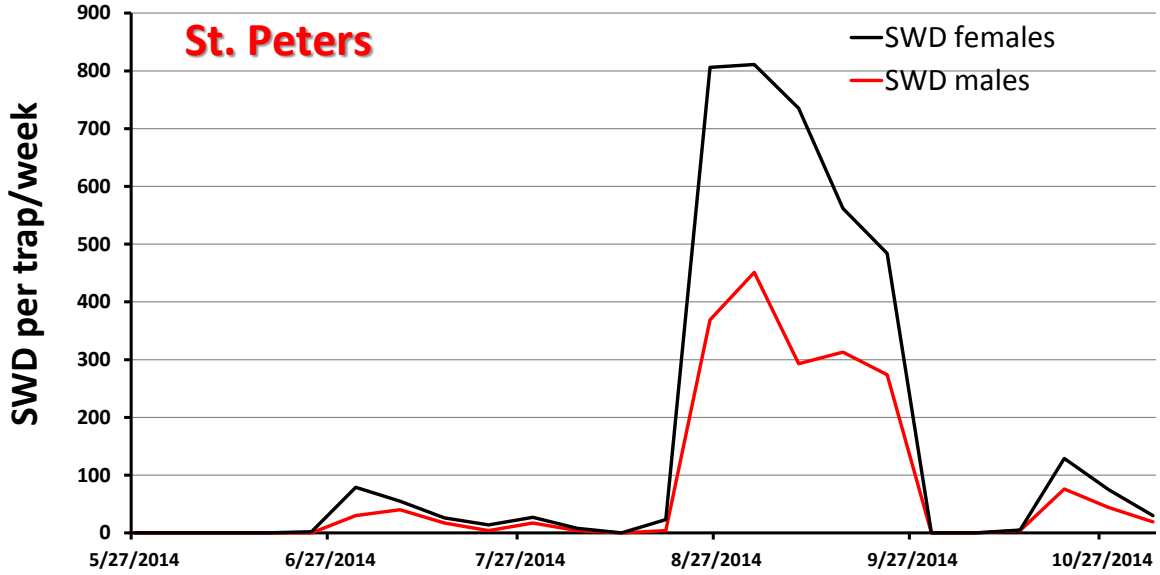
- ✓More synthetic lures are commercially available but none beats the yeast / sugar (home-made) bait
- ✓Traps indicate presence of SWD; but they do not indicate infestation (egg-laying in fruit)
- ✓Number of flies captures are not predicting potential for infestation

How to make a trap to monitor for SWD

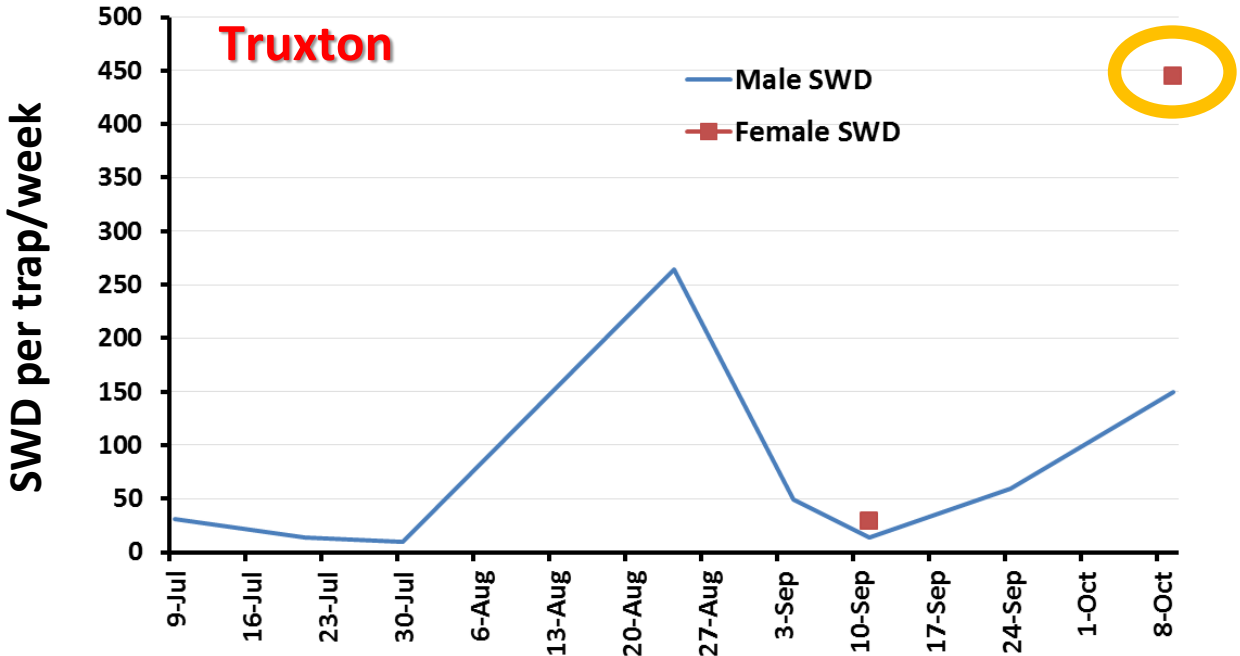


Seasonal SWD captures

2014



2015



Insecticide spray programs – *within a few minutes*

Chemical control for SWD is one of the necessary tools for creating a robust IPM program and should be the last line of defense once a program is developed

Contents lists available at ScienceDirect

Crop Protection

journal homepage: www.elsevier.com/locate/cropro

Season-long programs for control of *Drosophila suzukii* in southeastern U.S. blueberries

Lauren M. Diepenbrock [a, 1], Danielle Olivieri Rosensteel [b, 1], Jesse A. Hardin [a], Ashfaq A. Sial [b], Hannah J. Burrack [a, *]

[a] North Carolina State University, Department of Entomology, United States
[b] University of Georgia, Department of Entomology, United States

This study documents the efficacy of season-long insecticide programs with weekly applications for control of SWD in conventional blueberry growing systems

Diepenbrock study

Table 1
Field site and application rates. Maximum label rates for each state were applied every 7–10 days.

Year	Location	Cultivar/Variety	Treatment replications	Application equipment	Application rate (l/ha)
2013	Bladen County, NC (grower)	Southern highbush, var. Duke	3	Airtech air cannon trailer mounted	468
2013	Sampson County, NC (grower)	Southern highbush, var. Legacy	3	Airblast Jacto Arbus 1000 trailer mounted	682
2014	Sampson County, NC (grower)	Rabbiteye, var. Tiff Blue	4	Airblast Jacto Arbus 1000 trailer mounted	664
2014	Bacon County, GA (research farm)	Southern highbush, var. Star	4	Airblast Jacto Arbus 400 (top two nozzles and the bottom nozzles were closed)	468
2014	Bacon County, GA (research farm)	Rabbiteye var. Climax, Powderblue and Brightwell	3	Airblast Jacto Arbus 400 (top two nozzles and the bottom nozzle were closed)	468
2014	Bacon County, GA (grower)	Southern highbush, var. Star, V1	3	Airblast	468
2014	Bacon County, GA (grower)	Rabbiteye, var. Brightwell, Powderblue, Premier	3	Airblast	468

The season-long programs included:

- ✓ Export-friendly insecticide rotation **1** ($ 128/acre*): phosmet, malathion, spinetoram, fenpropathrin
- ✓ Export-friendly insecticide rotation **2** ($ 133/acre*): methomyl, malathion, spinetoram, fenpropathrin
- ✓ Export-friendly insecticide rotation **3** ($ 148/acre*): spinetoram, novaluron, phosmet
- ✓ Short pre-harvest interval rotation ($ 64/acre*): zeta-cypermethrin, malathion
- ✓ Reduced-risk rotation ($ 395/acre*): Spinetoram, acetamiprid, cyantraniliprole
- ✓ Untreated control

* For entire 6 week rotation

Diepenbrock study

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Season-long programs for control of *Drosophila suzukii* in southeastern U.S. blueberries

Lauren M. Diepenbrock [a, 1], Danielle Olivieri Rosensteel [b, 1], Jesse A. Hardin [a],

Table 3
Insecticide application rates, Reentry, and Postharvest Intervals.

Insecticide (trade name)	Maximum application rate	REI/PHI
acetamiprid (Assail 30SG)	371.3 ml/ha	12 h/1 day
fenpropathrin (Danitol 2.4EC)	1120.9 ml/ha	24 h/3 days
spinetoram (Delegate 25WG)	420.3 ml/ha	4 h/3 days
Cyantraniliprole[a] (Exirel 10SE)	1498.1 ml/ha	12 h/3 days
phosmet (Imidan 70W)	1490.7 ml/ha	24 h/3 days
methomyl (Lannate 2.4SL)	3362.6 ml/ha	48 h/3 days
malathion (Malathion 8F)	2241.7 ml/ha (NC) 2802.1 ml/ha (GA)	12 h/1 day
zeta-cypermethrin (Mustang Max 0.8SC)	292.3 ml/ha	12 h/1 day
novaluron (Rimon 0.83EC)	876.9 ml/ha	12 h/1 day

[a] Non-ionic surfactant added at GA grower locations 1169.2 mL/ha.

- **Main result**: organophosphates (phosmet and malathion) and pyrethroids (zeta-cypermethrin and fenpropathrin) were the most effective
- **Trap captures** were low in all programs, averaging less than one fly per trap per day
- **After harvest and treatments ceased**, the number of adult flies captured increased to an average of **45 flies per trap per day** (Site 1, 16 Jul-23 Jul) and **270 flies per trap per day** (Site 2, 23 Jul-30 Jul)

Diepenbrock study

- Heavy rain events occur regularly during the blueberry harvest season in the southeastern US, and likely reduced the residual effectiveness of programs in the field
- Toxicity of some materials lost within 1 week, highlighting the importance of considering rain-fastness of specific insecticide components within spray programs for areas with frequent precipitation
- Some chemicals may remain effective after rain events, but the majority of the chemicals available for SWD management in blueberries do not appear to do so
- **Level of damage to fruit at harvest:**

Supporting Table 4. 2014 North Carolina Average larval infestation per berry (Rabbiteye)

Treatment	7/2/2014	7/10/2014	7/23/2014	7/30/2014*	8/6/2014	8/12/2014	8/21/2014	8/25/2014
Export1	0.0±0.0a	0.0±0.0a	0.01±0.01a	0.01±0.01a	0.0±0.0a	0.09±0.04c	0.06±0.03a	0.13±0.04b
Export2	0.0±0.0a	0.0±0.0a	0.02±0.01a	0.0±0.0a	0.01±0.01a	0.16±0.05bc	0.05±0.02a	0.06±0.03b
Short PHI	0.0±0.0a	0.0±0.0a	0.01±0.01a	0.0±0.0a	0.01±0.01a	0.14±0.06b	0.08±0.03a	0.03±0.02b
Reduced Risk	0.0±0.0a	0.0±0.0a	0.03±0.02a	0.0±0.0a	0.05±0.02a	0.20±0.10b	0.03±0.02a	0.09±0.03b
Untreated control	0.0±0.0a	0.0±0.0a	0.0±0.0a	0.05±0.05a	0.08±0.02a	0.41±0.09a	0.03±0.02a	0.33±0.12a

*Final insecticide application 30 Jul 2014

Rainfall and control of SWD

MSU studies have shown that rainfall can compromise the efficacy of insecticides for SWD protection. Research on the rainfastness of insecticides on blueberries have been used to develop this table that helps to determine when the residues decline below a level that will provide control. Imidan, Mustang Maxx, and Lannate are the three products that have been tested and show some activity through rainfall, but only if application has been made relatively recently (the last 1-3 days). We expect that the pyrethroid clas of insecticides will perform similar to Mustang Max, providing a few more options. Use the chart below to help guide selection of insecticides when rain is in the forecast.

Blueberry insecticide precipitation wash-off re-application decision chart - spotted wing Drosophila

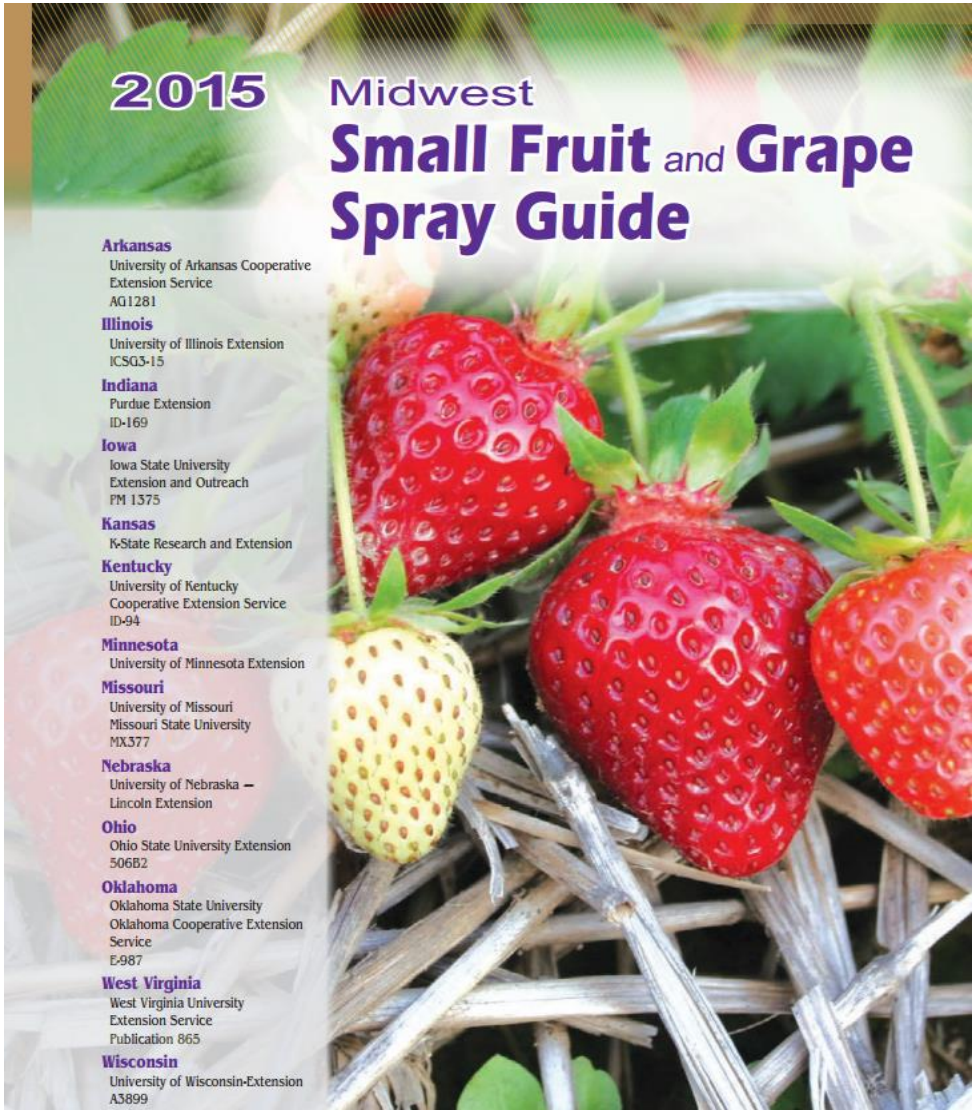
Insecticides	Rainfall = 0.5 inch		Rainfall = 1.0 inch		Rainfall = 2.0 inches	
	*1 day	*7 days	*1 day	*7 days	*1 day	*7 days
Imidan	OK	Insufficient	OK	Insufficient	Insufficient	Insufficient
Mustang Maxx	OK	Insufficient	OK	Insufficient	Insufficient	Insufficient
Lannate	OK	Insufficient	OK	Insufficient	Insufficient	Insufficient
Malathion	Insufficient	Insufficient	Insufficient	Insufficient	Insufficient	Insufficient
Delegate	Insufficient	Insufficient	Insufficient	Insufficient	Insufficient	Insufficient
Assail	Insufficient	Insufficient	Insufficient	Insufficient	Insufficient	Insufficient

*** Number of days after insecticide application that the precipitation event occurred.**

Insufficient = Insufficient insecticide residue remains to provide significant activity on the target pest, and thus re-application is recommended.

OK = Sufficient insecticide residue remaining to provide significant activity on the target pest, although residual activity may be reduced.

Insecticide spray options



2015 Midwest Small Fruit and Grape Spray Guide

Contents

Midwest Small Fruit Pest Management Handbook

The *Midwest Small Fruit Pest Management Handbook* is a companion publication to this spray guide that contains additional information on control strategies for small fruit diseases, insect pests, and weeds. Pesticide safety, sprayer calibration, plant nutrition, and weed identification are also covered. Copies of the publication (OSU Bul. 861) may be available from your state Extension office or from Ohio State University Extension Publications, 385 Kottman Hall, 2021 Coffey Rd., Columbus, OH 43210-1044, (614) 292-1607. It is also available from Ohioline: ohioline.osu.edu.

Legal Responsibilities for Pesticide Use

Pesticides suggested in this publication have been registered by the Pesticides Regulation Division of the Environmental Protection Agency. At the time this bulletin was published, these pesticides were registered for use as indicated on the individual product labels. These registrations can change at any time. In order to keep you informed of the latest updates on pesticide registrations, a Web version of this publication is updated regularly and can be viewed online at www.ag.purdue.edu/hla/Hort/Pages/sfg_sprayguide.aspx.

It is your responsibility as a pesticide user to read and follow all current label directions for the specific pesticide being used. The legal limitations on the use of these pesticides should be strictly observed to prevent excessive residues in or on harvested fruit. All growers should read product labels, follow directions carefully, and observe pre-harvest intervals and application rates. Some of the pesticides suggested in this publication are on the EPA Restricted Use List, and users must be certified private applicators to purchase and apply these materials.

The pesticide label is a legal document.

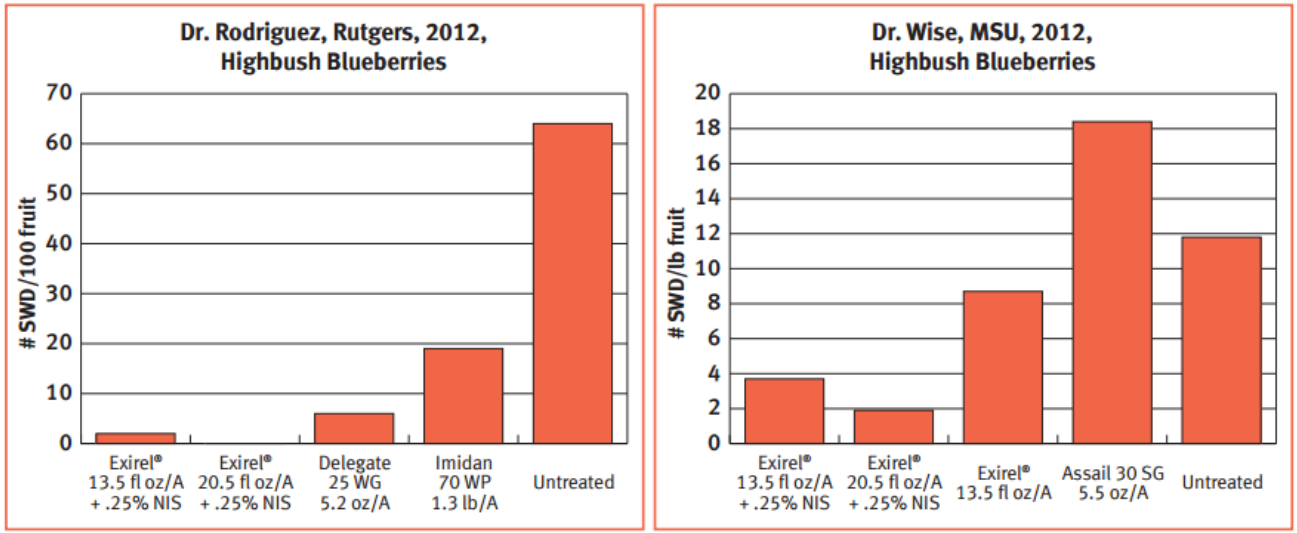
Check this publication online at www.ag.purdue.edu/hla/Hort/Pages/sfg_sprayguide.aspx for the most recent information concerning pesticide registrations.

FREE online at: https://ag.purdue.edu/hla/Hort/Documents/ID-169.pdf

Insecticidal options

Drosophila (also known as fruit flies and vinegar flies), including spotted wing Drosophila	Brigade WSB (10WP)	8-16 oz	**BLUEBERRY** See Special Insect Pest Problems on page 63.
	Danitol 2.4EC	10.7-16 fl oz	
	Delegate 25WG	3-6 oz	
	Entrust 2SC	4-6 fl oz	
	Exirel 0.83SE	13.5-20.5 fl. oz	
	Entrust 80WP	1.25-2 oz	
	Imidan 70W	1.33 lb	
	Lannate LV	1.5-3 pt	
	Lannate SP	0.5-1 lb	
	Malathion 8F	1.25 pt	
	Mustang Max 0.8EC	4.0 fl. oz	

Active ingredient in **Exirel** (new insecticide) is Cyazypyr, from the chemical class of anthranilic diamides



Source: Dr. Rodriguez, Rutgers, EAF-12-789, 2012: three applications at 7-day intervals; application dates: July 5, July 12, July 19. Evaluation made 6 days after last application.
Dr. Wise, Michigan State University, MWH-12-789, 2012: three applications at 14-day intervals; application dates: June 29, July 13, July 27. Evaluation made 13 days after last application.

Insecticidal options

Drosophila (also known as fruit flies and vinegar flies), including spotted wing Drosophila	Brigade WSB (10WP)	5.3-16 oz
	Danitol 2.4EC	10.67-16 fl oz
	Delegate 25WG	3-6 oz
	Entrust 2SC	4-6 fl oz
	Entrust 80WP	1.25-2 oz
	Malathion 8F	2.5 pt
	Mustang Max 0.8EC	4.0 fl. oz

RASPBERRY AND BLACKBERRY

See Special Insect Pest Problems on page 63.

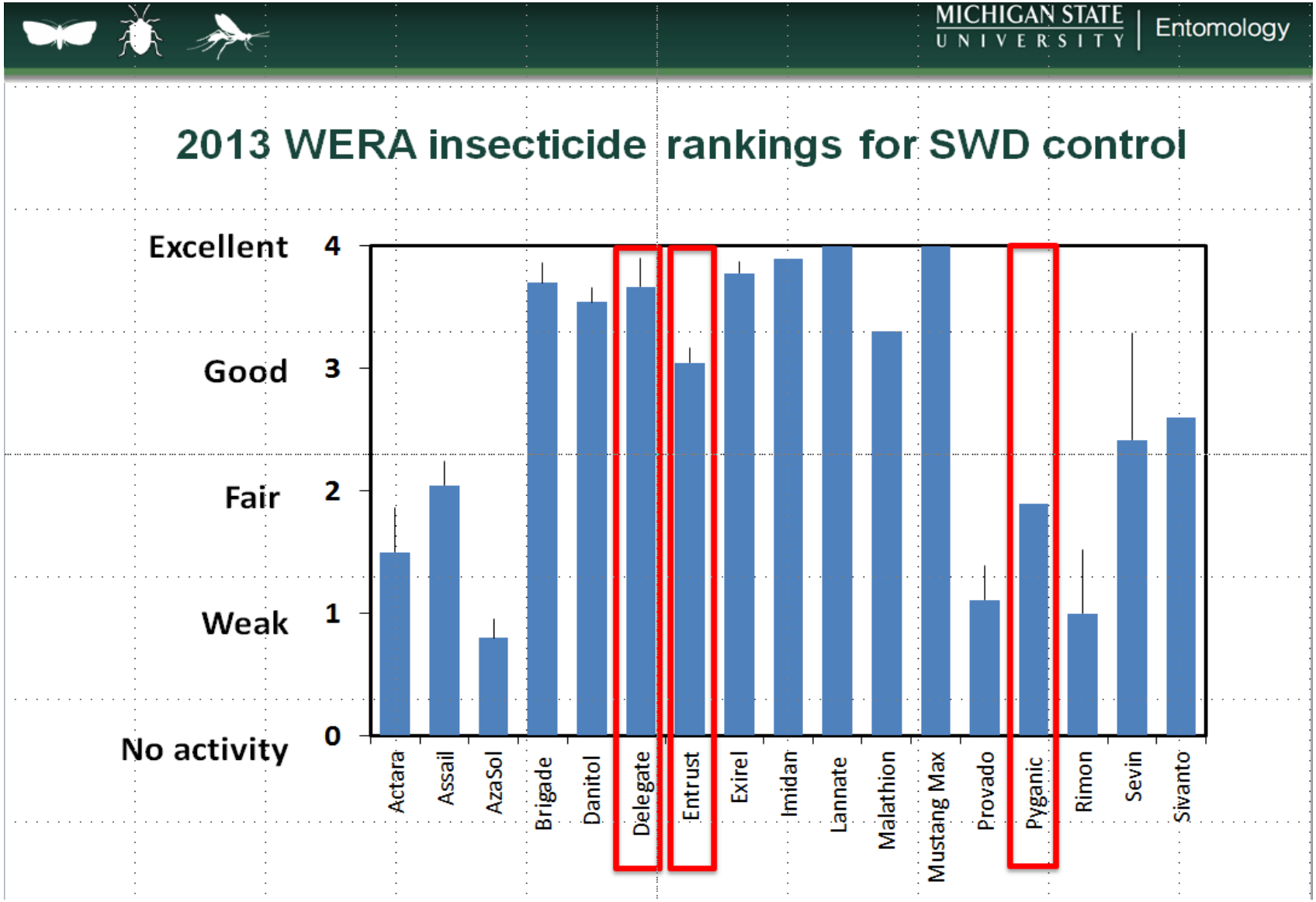
Drosophila (also known as fruit flies and vinegar flies), including spotted wing Drosophila	Brigade WSB (10WP)	5.3-16 oz
	Danitol 2.4EC	10.7-21.33 fl oz
	Entrust 80WP	1.25-2 oz
	Radiant 1SC	6-10 fl. oz

STRAWBERRY

See Special Insect Pest Problems on page 63.

Delegate: Effective, but not OMRI-listed

- **Spinetoram** is a new chemical in the spinosyn class of insecticides
- It is a semi-synthetic spinosyn (not for certified organic production)



Organic insecticide options

azera® Insecticide

For Organic Production

OMRI Listed

Organic Materials Review Institute

ACTIVE INGREDIENTS:

Azadirachtin	1.20%
Pyrethrins, a botanical insecticide	1.40%
OTHER INGREDIENTS	97.40%
	100.00%

Contains: 0.10 lb of azadirachtin and 0.11 lb of pyrethrins per gallon.

- **Quick knock-down and kill**
- **Kills listed pests on contact or by ingestion**
- **Contains Pyrethrins, a botanical insecticide derived from chrysanthemums**
- **Kills a broad spectrum of listed insects including aphids, whiteflies, leafminers and caterpillars**
- **Kills larval, pupae and adult stages of listed insects**

$ 330 / gallon

Organic (OMRI-approved) options

- **Microbial-based insecticide**
- **Spinosad** is a fast-acting, somewhat broad-spectrum material that acts on the insect primarily through **ingestion**, or by **direct contact** with a spray droplet or a newly treated surface

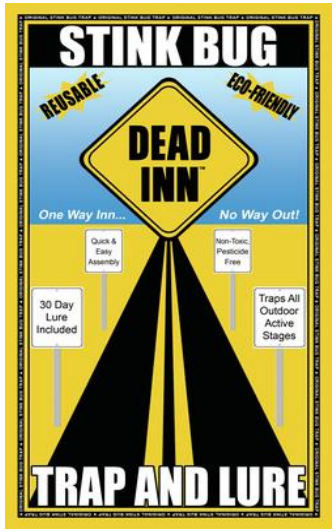
Spinosad residues on the leaf surface are be broken down by **sunlight**. Half-lives for spinosyn A are 1.6 to 16 days depending on the amount of sunlight received

Brown Marmorated Stink Bug (BMSB)

Monitoring

Enhanced pheromone lure:
Stink Bug Xtra Combo

Stink Bug Xtra Combo, Broad Spectrum 5-7 week lure: Brown, Brown Marmorated, Conchuela, Consperse, Dusky, Green (*Acrosternum*), Harlequin, Red Shouldered



AgBio, Inc., 9915 Raleigh St.
Westminster, CO 80031
P: 303.469.9221
F: 303.469.9598
agbio@agbio-inc.com

AGBIO

Monitoring

Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Nov

Live BMSB found in Springfield

Jul. 25th:

1 BMSB adult found inside home in St. Louis

Aug. 24th:

1 BMSB nymph collected near St. Louis (Ferguson area) using sweep nets

Sep. 28th:

26 adult BMSB captured in 2 pheromone-baited traps (Ferguson)

Oct. 22nd:

3 BMSB in 1 trap (Ferguson) + Live BMSB found in Hillsboro (10.15) and Tuxton (10.22)

Dec. 15th:

1 BMSB adult found inside home in Bloomsdale

Management

Effective management requires information about the behavior and biology of the pest

1) Proximity to **woods** is a risk factor for ag crops. Proximity to soybeans has been a risk factor for MD nurseries
2) Management mostly using insecticides, almost no other options (trap cropping / biological control very limited)
3) Like many tough-to-control pests, earlier life stages more susceptible to insecticides, especially true for organic options.
4) Overwintering adults more susceptible than first generation adults

Insecticide spray programs

BMSB can be more difficult to kill than other stink bug species

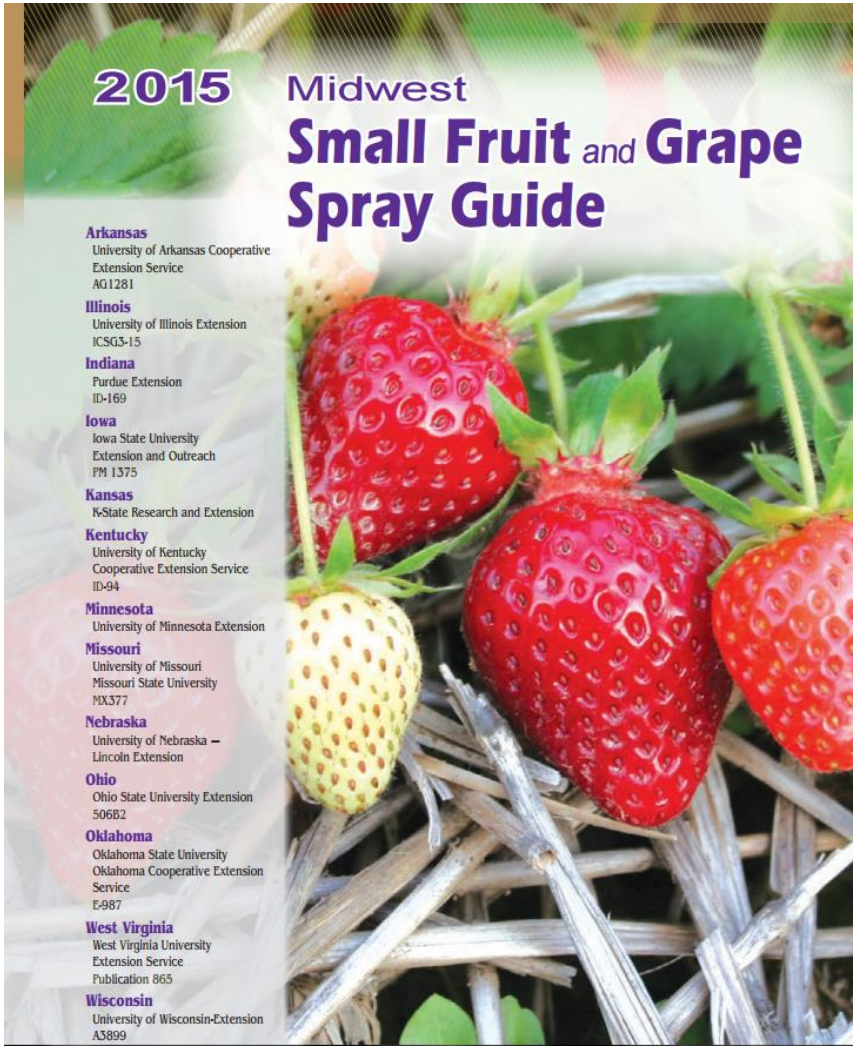
In the **mid-Atlantic**, 6+ sprays are being recommended against this pest in **peach**

++++ = excellent, +++ = good, ++ = fair, + = poor, – = not rated or recommended for this pest, S = suppression.

Sixth and Later Covers — **See Miticide Table. Avoid killing bees on blooming ground cover.**

INSECT PEST: Efficacy Rating[1] and Rate/A

Product and Formulation	Leaf-rollers	Oriental Fruit Moth	Plum Curculio	Scale Insects	Japanese Beetle/ June Beetle	Thrips	Stink Bugs/ Tarnished Plant Bugs	Brown Marmorated Stink Bugs	REI PHI
Neonicotinoid → **Actara 25WG**	–	–		–	+ 5.5 oz.	–	+++ 4.5-5.5 oz.	++++ 4.5-5.5 oz.	12 hrs. 14 days
Neonicotinoid → **Admire Pro[2]**	–	–	S 2.8 oz.	+++ 1.4-2.8 oz.	+++ 1.4-2.8 oz.	–	+ 1.4-2.8 oz.	–	12 hrs. 0 days
Anthranilic diamide → **Altacor**	++++ 3.0-4.5 oz.	++++ 3.0-4.5 oz.		–	–	–	–	+	4 hrs. 10 days
Pyrethroid → **Ambush 25W/Pounce/ Perm-Up 3.2EC[2]**	++++ 8.0-16.0 oz.	++++ 10.0-16.0 oz.		–	+ 10.0-16.0 oz.	–	+++ 10.0-16.0 oz. 4.0-12.0 oz.	+++ 10.0-16.0 oz. 12.0 oz.	12 hrs. 14 days
Pyrazole → **Apta**	+++ 21.0-27.0 oz.	–	+++ 21.0-27.0 oz.	–	–	S	S	S	12 hrs. 14 days
Pyrethroid → **Asana XL[2]**	++++ 4.8-8.0 oz.	++++ 4.8-8.0 oz.		–	++ 6.0-10.0 oz.	–	+++ 10.0-14.5 oz.	++ 10.0-14.5 oz.	12 hrs. 14 days
Assail 30SG	–	+++ 6.0-8.0 oz.		+++ 6.0-8.0 oz.	+++ 5.3-8.0 oz.	–	+++ 5.3-8.0 oz.	++ 5.3-8.0 oz.	12 hrs. 7 days
Avaunt	+++ 5.0-6.0 oz.	+++ 5.0-6.0 oz.		–	+++ 6.0 oz.	–	++ 5.0-6.0 oz.	+ 6.0 oz.	12 hrs. 7 days
Pyrethroid → **Baythroid XL**	++++ 2.4-2.8 oz.	++++ 2.0-2.4 oz.		–	+++ 2.4-2.8 oz.	–	++++ 2.0-2.4 oz.	+++ 2.0-2.4 oz.	12 hrs. 7 days
Belay	–	–	+++ 6.0 oz.	+++ 6.0 oz.	+++ 2.0-4.0 oz.	–	+++ 6.0 oz.	++++ 6.0 oz.	12 hrs. 21 days
Beleaf 50SG	–	–		–	–	–	+++ 2.0-2.8 oz.	+ 2.0-2.8 oz.	12 hrs. 14 days
Belt SC	++++ 3.0-4.0 oz.	++++ 3.0-4.0 oz.		–	–	–	–	–	12 hrs. 7 days
Centaur WDG	–	–		++++ 34.5 oz.	–	–	–	–	12 hrs. 14 days
spinosyns → **Danitol 2.4 EC**	++++ 10.6-21.3 oz.	+++ 10.6-21.3 oz.		–	++++ 10.6-21.3 oz.	–	++++ 10.6-21.3 oz.	++ 10.6-21.3 oz.	24 hrs. 3 days
spinosyns → **Delegate 25WG**	++++ 4.5-7.0 oz.	++++ 6.0-7.0 oz.		–	–	+++ 4.5-7.0 oz.	–	–	4 hrs. 1/14 day
Diazinon 50WP	++ 2.0-3.0 lbs.	+++ 3.0-4.0 lbs.		+++ 3.0-4.0 lbs.	+++ 3.0-4.0 lbs.	–	++ 3.0-4.0 lbs.	+ 3.0-4.0 lbs.	96 hrs. 21 days
Endigo ZC	++++ 5.0-5.5 oz.	++++ 5.0-5.5 oz.	S 5.5-6.0 oz.	–	+++ 5.0-5.5 oz.	–	+++ 5.0-5.5 oz.	++++ 5.0-5.5 oz.	24 hrs. 14 days
Entrust SC	++++ 4.0-8.0 oz.	+++ 4.0-8.0 oz.	–	–	–	++++ 4.0-8.0 oz.	–	–	4 hrs. 1 day
Esteem 35WP	–	+++ 4.0-5.0 oz.		++++ 4.0-5.0 oz.	–	–	–	–	12 hrs. 14 days
Exirel	–	++++ 10.0-20.5 oz.	+++ 13.5-20.5 oz.	–	–	–	–	–	12 hrs. 3 days
Imidan 70WSB	++ 2.5-3.0 lbs.	+++ 2.5-3.0 lbs.		+ 2.0-3.0 lbs.	+++ 2.0-3.0 lbs.	–	+++ 2.5-3.0 lbs.	+ 2.5-3.0 lbs.	4 days 14 days
Intrepid 2F	++++ 8.0-16.0 oz.	+++[4] 12.0-16.0 oz.		–	–	–	–	–	4 hrs. 7 days
Lannate LV[3]	+++ 3.0 pts.	+++ 3.0 pts.		–	+++ 3.0 pts.	+++ 3.0 pts.	+++ 3.0 pts.	++ 3.0 pts.	4 days 4 days
Lannate SP[3]	+++ 0.5-1.0 lb.	+++ 0.5-1.0 lb.		–	+++ 0.5-1.0 lb.	+++ 0.5-1.0 lb.	+++ 1.0 lb.	+++ 1.0 lb.	3/4 days[5] 1/4 days[6]
Leverage 360	++++ 2.4-2.8 oz.	++++ 2.4-2.8 oz.		+++ 2.4-2.8 oz.	+++ 2.4-2.8 oz.	–	++++ 2.4-2.8 oz.	+++ 2.4-2.8 oz.	12 hrs. 7 days
Madex HP	–	++++ 0.5-3.0 oz.		–	–	–	–	–	4 hrs. 0 days
Movento	–	–		++++ 8.0-9.0 oz.	–	–	–	–	24 hrs. 7 days



FREE at https://ag.purdue.edu/hla/Hort/Documents/ID-169.pdf

Brown Marmorated Stink Bug

The brown marmorated stink bug (BMSB) has an extremely wide host range and is a pest of all small fruit crops including grapes, blueberries, raspberries, and blackberries. BMSBs are attracted to these plantings throughout much of the growing season while fruit are present. The injury caused by BMSB piercing sucking mouthparts may appear as sunken areas on the fruit. BMSB that are hidden in grape clusters at harvest may cause a stink bug taint in the juice. While insecticide recommendations vary according to availability on different crops, Actara, Venom, Brigade, Danitol, and Lannate have shown good efficacy in trials; however, multiple applications may be needed with reinfestation.

Raspberry & Blackberry (continued)

Post-bloom through Harvest (continued)

Tarnished plant bug, stink bugs	Actara 25WB	3 oz	
	Assail 30SG	4.5-5.3 oz	
	Bifenture 2EC	6.4 fl oz	Labeled for brown marmorated stink bug control.
	Pyganic 5%EC	4.5-18 fl oz	
	Sevin XLR Plus (4F)	1.5-2 qt	Other formulations may be available.

From Midwest Tree Fruit Spray Guide 2016:

CHERRY: “Of the insecticides listed on page 10 for the control of plant bugs and stink bugs, **Actara**, **Baythroid**, **Belay**, **Danitol**, **Endosulfan** and **Lannate** have been effective against this species in early trials in the eastern United States”

Use of the **pyrethroids** Ambush, Asana, Baythroid, Danitol, Mustang Max, Pounce, Proaxis, Renounce, and Warrior will kill **predatory** mites that feed on European red mite and two-spotted spider mite, thereby triggering outbreaks of these pests. Use these pyrethroid insecticides only if the potential for plant bug and stink bug damage is high.

Organic options

Pyrethrins and pyrethrins + kaolin resulted in knockdown effects on BMSB yielding significantly higher lethality immediately after 4.5-h exposure to dried residues.

Grandevo and Venerate: good results 4-7 days after application

- ✓AZERA insecticide expected to be one of the most effective
- ✓Tank mixing can provide better prospect of control

Florida Entomologist 97(2) June 2014

IMPACT OF ORGANIC INSECTICIDES ON THE SURVIVORSHIP AND MOBILITY OF *HALYOMORPHA HALYS* (STÅL) (HEMIPTERA: PENTATOMIDAE) IN THE LABORATORY

DOO-HYUNG LEE[1,3,*], BRENT D. SHORT[1], ANNE L. NIELSEN[2] AND TRACY C. LESKEY[1]

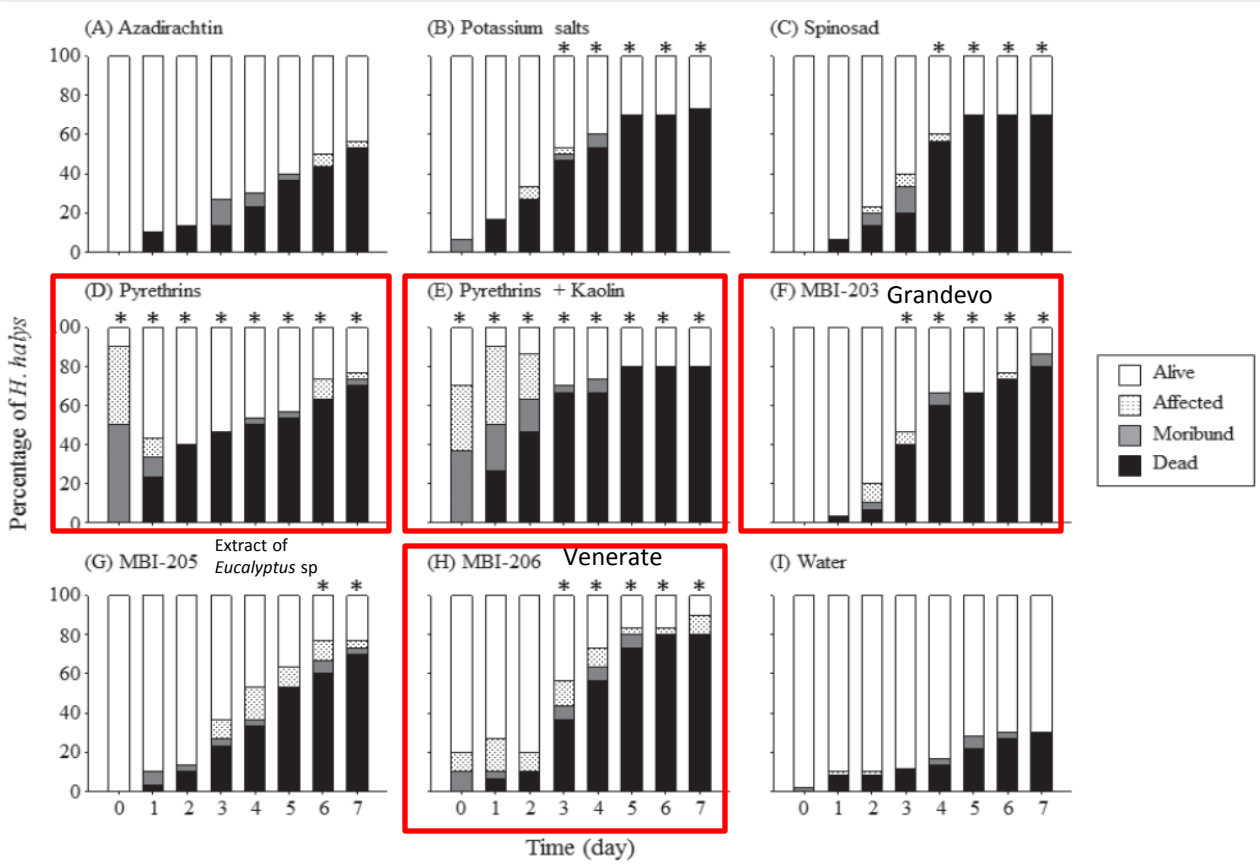


Fig. 1. Percentage of adult *Halyomorpha halys* by physical condition over 7 d following 4.5-h exposure period on insecticide-treated and untreated surfaces in the Petri dish arenas. Asterisk indicates that insecticide lethality (the percentage of 'moribund' plus 'dead' individuals) was significantly different from the untreated control ($P < 0.05$).

azera® Insecticide

For Organic Production

To Kill the Following Listed Insects:

Aphids including:
- Apple Aphids
- Alfalfa Aphids
- Artichoke Aphids
- Bean Aphids
- Black Margined Aphids
- Black Bean Aphids
- Black Peach Aphids
- Blue Alfalfa Aphids
- Cabbage Aphids
- Cotton / Melon Aphids
- Cowpea Aphids
- European Asparagus Aphids
- Filbert Aphids
- Foxglove Aphids
- Green Peach Aphids
- Lettuce Aphids
- Lettuce Root Aphids
- Melon Aphids
- Pea Aphids
- Potato Aphids
- Rose Aphids
- Spotted Alfalfa Aphids
- Willow Carrot Aphids

Armyworms, Caterpillars and Loopers including:
- Alfalfa Caterpillars
- Artichoke Plume Moths
- Bagworms
- Beet Armyworms
- Black Cutworms
- Budworms
- Cabbage Loopers
- Cankerworms
- Carpenterworms
- Citrus Cutworms
- Corn Earworms
- Cross-striped Cabbageworms
- Cutworms
- Diamondback moths
- Eastern Tent Caterpillars
- Fall Armyworms
- Fall Cankerworms
- Fall Webworms
- Filbert Worms
- Fireworms
- Forest Tent Caterpillars
- Garden Webworms
- Grapefruit Worms
- Grape Leaf Skeletonizers
- Green Fruit Worms
- Hickory Shuckworms
- Hornworms
- Imported Cabbageworms
- Lawn Armyworms
- Lesser Webworm Loopers
- Melonworms
- Navel Orangeworms
- Oriental Fruit Moths
- Pecan Nut Case bearers
- Rindworms
- Sod Webworms
- Southern Armyworms
- Soybean Loopers
- Saltmarsh Caterpillars
- Tent Caterpillars
- Tobacco Budworms
- Tomato Hornworms
- Tomato Fruitworms
- Tomato Pinworms
- Yellow striped Armyworms
- Walnut Caterpillars
- Webworms
- Western Yellow-Striped Armyworms
- Western Grapeleaf Skeletonizers

Beetles and Weevils including:
- Alfalfa Weevils
- Asparagus Beetles
- Bean Beetles
- Bean Leaf Beetles
- Black Vine Weevils
- Blister Beetles
- Boll Weevils
- Carrot Weevils
- Chestnut Weevils
- Clover Weevils
- Colorado Potato Beetles
- 12-Spotted Cucumber Beetles
- Cucumber Beetles
- Darkling Beetles (lesser meal worms)
- Egyptian Alfalfa Weevils
- Elm Leaf Beetles
- Flea Beetles
- Fuller Rose Beetles
- Grape Bud Beetles
- Japanese Beetles
- June Beetles
- Mexican Bean Beetles
- Navel Orangeworms (NOW)
- Pecan Weevils
- Pink Bollworms
- Potato Flea Beetles
- Rice Weevils
- Rose Chafers
- Saw-Toothed Grain Beetles
- Strawberry Beetles
- Twig Girdlers
- All other beetles and weevils

Leafrollers:
- Blueberry Leafrollers
- Filbert Leafrollers
- Fruit Tree Leafrollers
- Grape Leafrollers
- Oblique Banded Leafrollers
- Omnivorous Leafrollers
- Orange Tortrix
- Western Avocado Leafrollers

Borers such as:
- European Corn Borers
- Pacific Flatheaded Borers
- Peach Tree Borers
- Peach Twig Borers
- Squash Vine Borers
- Shothole Borers
- Branch and Twig Borers

Flies:
- Australian Sod Flies
- Caribbean Fruit Flies
- Crane Flies
- Fruit Flies
- Fungus Gnats
- Hessian Flies
- Mediterranean Fruit Flies
- Melon Flies
- Mushroom Flies
- Oriental Fruit Flies
- Olive Fruit Flies
- Sawflies
- Shore Flies
- Vinegar Flies
- Walnut Husk Flies

Leafhoppers & Sharpshooters:
- Aster Leafhoppers
- Beet Leafhoppers
- Glassy-winged Sharpshooters
- Grape Leafhoppers
- Potato Leafhoppers
- Variegated Leafhoppers
- Three-Cornered Alfalfa hoppers

Leafminers:
- Citrus Leafminers
- Holly Leafminers
- Serpentine Leafminers
- Vegetable Leafminers

Midges (plant pests):
- Millipedes
- Onion Maggots
- Plant Bugs
- Proba Bugs
- Scale Insects
- Silverfish
- Skippers
- Soft Scales
- Spider Mites
- Sowbugs
- Spiders (except Black Widow and Brown Recluse Spiders)
- Springtails
- Squash Bugs
- Stink Bugs
- Tarnished Plant Bugs
- Spittle Bugs
- Wireworms
- European Chafers
- Northern Masked Chafers
- Southern Masked Chafers
- Western Boxelder Bugs

Moths:
- Artichoke Plume Moths
- Codling Moths
- Diamondback Moths
- European Pine Tip Moths
- Grape Berry Moths
- Gypsy Moths (adult & larvae)
- Indian Meal Moths
- Mediterranean Flour Moths
- Pine Tip Moths
- Tussock Moths

Whiteflies:
- Greenhouse Whiteflies
- Silverleaf Whiteflies
- Sweetpotato Whiteflies

Other:
- Ants (except Pharaoh, Harvester, Carpenter and Fire Ants)
- Apple Maggots
- Billbugs
- Brown Marmorated Stinkbugs
- Cabbage Maggots
- Clover Mites
- Cutworms
- Crickets
- Dichondra Flea Beetles
- Earwigs
- Firebrats
- False Chinch Bugs
- Garden Symphylan
- Garden Tortrix
- Glassy Winged Sharpshooters
- Grasshoppers
- Harlequin Bugs
- Grape Phylloxera
- Katydids
- Leaffooted Plant Bug
- Lace Bugs
- Leaf tiers
- Lice
- Lygus
- Lace bug
- Mealybugs (all)

Psyllids:
- Pear Psylla

Thrips:
- Avocado thrips
- Citrus Thrips
- Flower Thrips
- Greenhouse Thrips
- Thrips Palmi
- Northern Masked Chafers
- Southern Masked Chafers
- Western Flower Thrips

Biological control

- The Asian parasitic wasp, *Trissolcus japonicus*, is considered the primary parasitoid of the BMSB in its native region of origin.
- Asian fruit growers consider BMSB as only a secondary pest of apple, likely due to the suppression of native biological control agents that include *Trissolcus japonicus*
- *T. japonicus* wasp clusters have been found in Maryland, Virginia, and Washington State
- https://www.youtube.com/watch?v=rbdXiiM538I

TRISSOLCUS-JAPONICUS.IMAGE: ELIJAH TALAMAS, USNM

A FEMALE TRISSOLCUS JAPONICUS PARASITOID WASP EMERGING FROM PARASITIZED HALYOMORPHA HALYS EGGS (IMAGE:USDA-APHIS QUARANTINE FACILITY, CORVALLIS, OREGON.)

Attract-and-Kill / Trap Cropping

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Stink Bug Management Using Trap Crops in Organic Farming

Organic Agriculture November 18, 2015 Print

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eOrganic author: Russell F. Mizell III, University of Florida

Preliminary findings from other researchers:

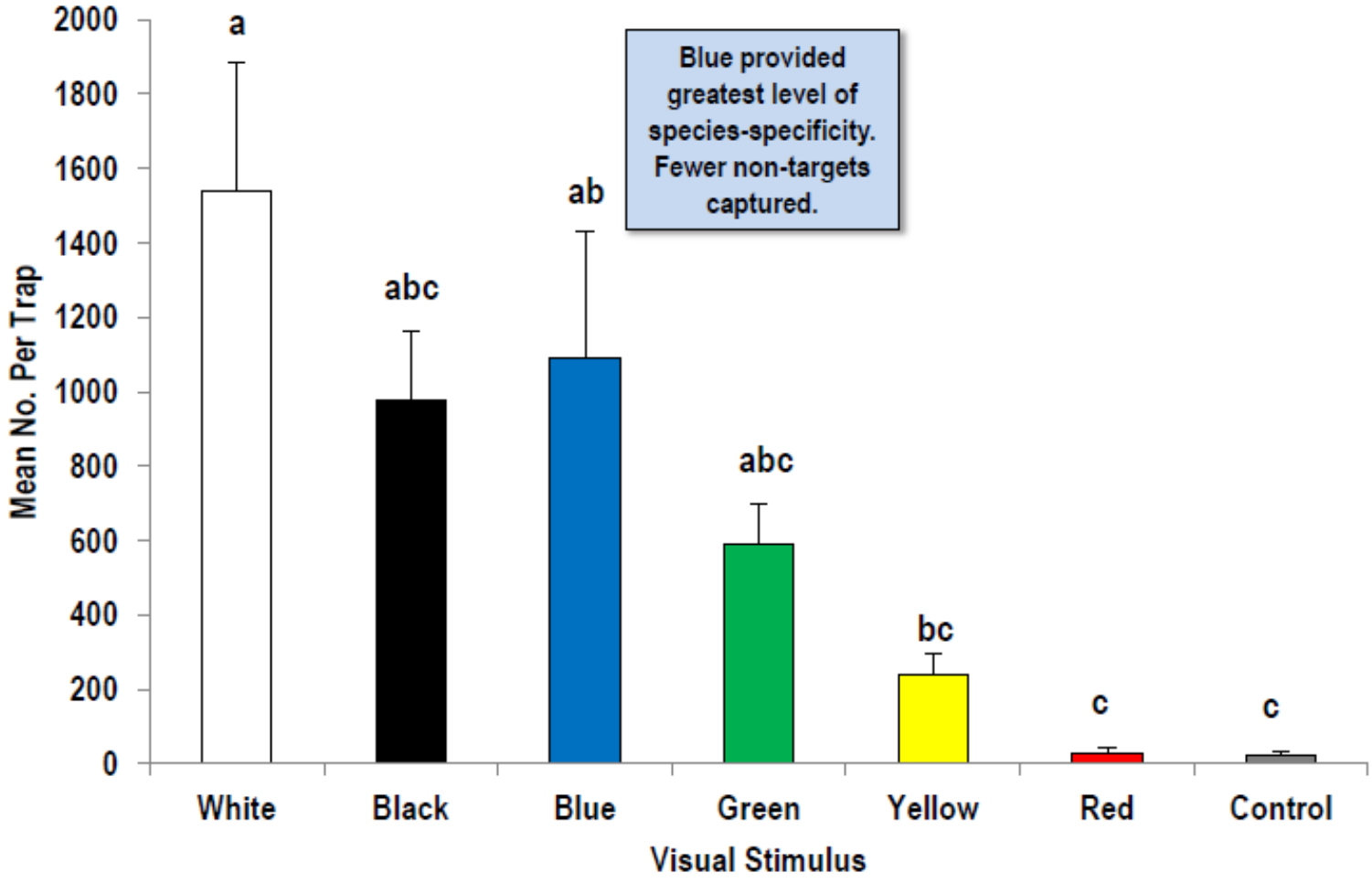
Combining **pheromone lures**, pollenless **sunflowers** (earlier in the season) and **sorhgum** (later in the season) can attract BMSB away from cash crops. BMSB need to be killed using insecticides

Note that the best plants to use as trap crops for the Brown Marmarated Stink Bug (BMSB) have not been determined to date, but sunflowers, squash, zucchini, and pumpkin appear to have strong merit. Hollyhocks are also used by all stages of the first generation of BMSB, are easy to grow, and may have some merit for use by homeowners to attract and kill BMSB as they leave dwellings where they have overwintered.

Light Response Studies

Courtesy of Dr. Tracy Leskey (USDA / ARS)

A Total of 21 Traps Baited With Light-Based Stimuli Captured 13,457 Adult BMSB in ~6 Weeks During Late Summer



Courtesy of Dr. Tracy Leskey

Thank You!

Questions?