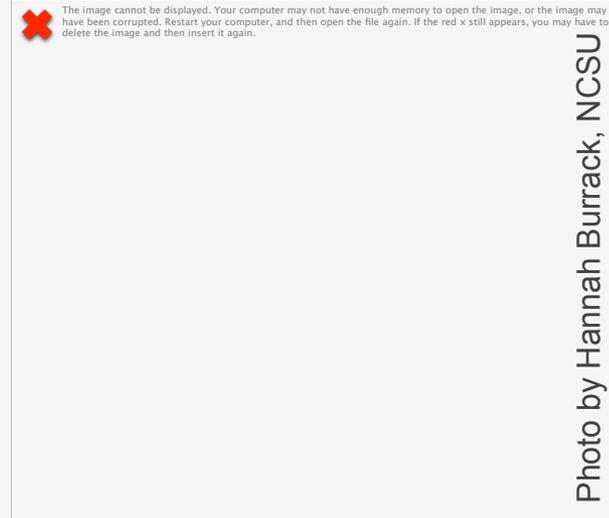
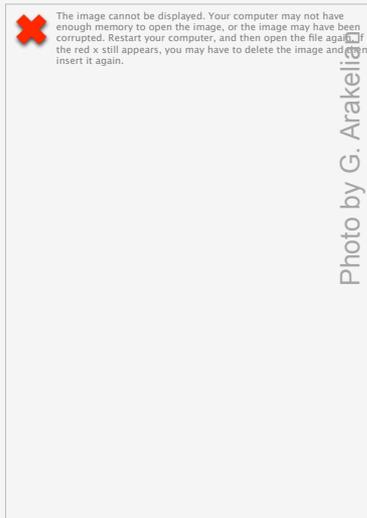


Spotted Wing Drosophila insecticide choices & timing



Celeste Welty
Extension Entomologist
June 2016

SWD status in Ohio

- **Bad news**
 - **Widespread**
 - **Severe damage**
- **Good news**
 - **Under control if insecticide program used**

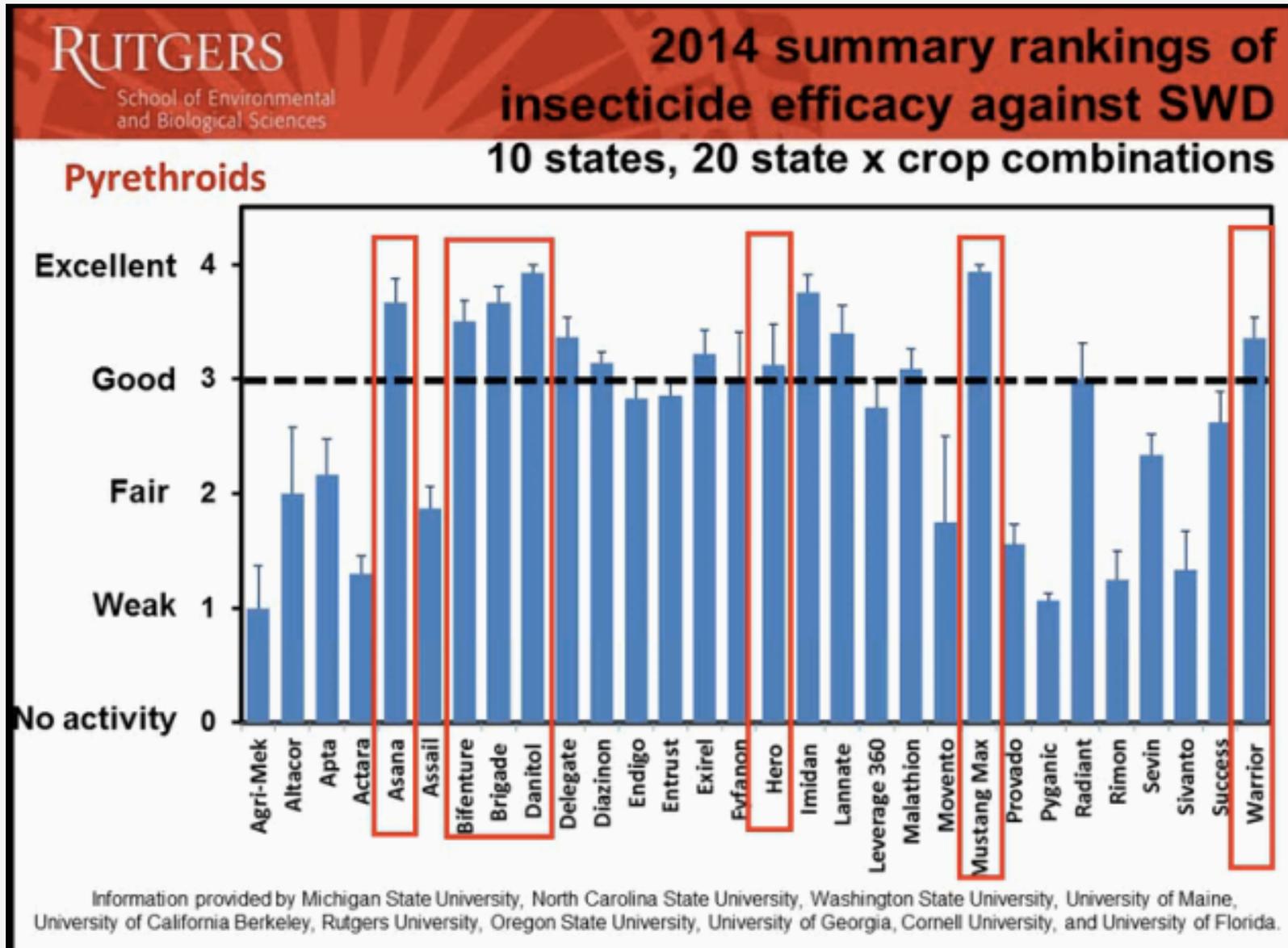
Insecticide strategy for SWD control

- **Decisions**
 - When to start spraying?
 - What product(s) to spray?
 - How often to spray?
- **Factors**
 - How often crop is harvested
 - Pre-harvest interval
 - How long residue is active

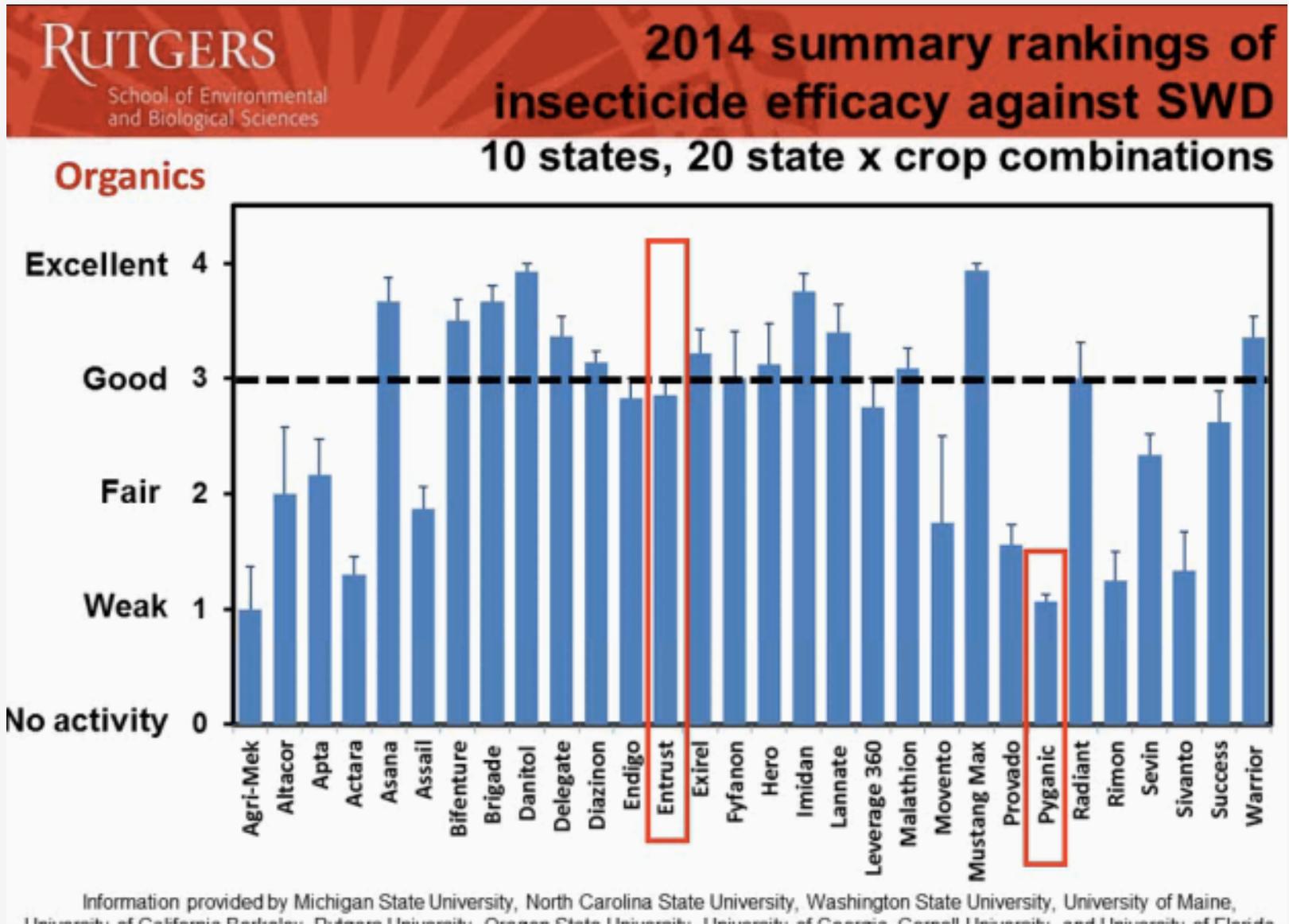
When to start spraying insecticide for SWD?

- **If the adult flies are detected**
- **Fruit is susceptible to injury once it has started to **turn color****

Conventional insecticide choices for SWD?



Organic insecticide choices for SWD?



Insecticide choices for SWD control

Efficacy	Group	Product
Most effective	spinosyns	Delegate
	diamides	Exirel
	o-phosphates	Imidan, Diazinon
	pyrethroids	Mustang Max, Brigade, Pounce, Hero, Danitol, Baythroid, Asana, Warrior
	carbamates	Lannate
Effective	o-phosphates	Malathion
	carbamates	Sevin
	spinosyns	Entrust [OMRI]
Moderately	neonicotinoid	Assail, Actara, Provado
Slightly	bacteria	Grandeye, Venerate [OMRI]

Insecticides for home gardens

Efficacy	Group	Product
Most effective	spinosyns	-
	diamides	-
	o-phosphates	-
	pyrethroids	✓
	carbamates	-
Effective	o-phosphates	✓
	carbamates	✓
	spinosyns	✓ [OMRI]
Moderately	neonicotinoid	✓
Slightly	bacteria	-

Insecticides for SWD for gardeners

- **Most effective:**
 - **pyrethroids (but not for all crops):**
 - bifenthrin, permethrin, esfenvalerate, gamma-cyhalothrin
- **Effective:**
 - **spinosyns:**
 - Captain Jack's Deadbug Brew (spinosad)
 - **organophosphates:** malathion
- **Moderately effective:**
 - **carbaryl:** Sevin
 - **acetamiprid:** Ortho Flower Fruit & Veg Insect Killer

Insecticides for high tunnels?

For products used for SWD control:

- Label allows in greenhouses:

- Malathion

- Label prohibits in greenhouses:

- Delegate

- Diazinon

- Label 'silent' on greenhouses
therefore ok to use:

- pyrethroids: Asana, Baythroid, Brigade,
Danitol, Hero, Mustang, Pounce, Warrior

- Lannate

- Imidan

- Entrust

What time of day to spray?

- SWD flies most active in early morning and evening
- Best to **spray in evening** to minimize bee effects

**How often
to spray?**

**When
residues no
longer active**

<i>Product</i>	<i>Residual activity</i>
Exirel	5 days
Delegate	5-7 days
Imidan, Diazinon	7 days
Pyrethroids: Asana Brigade Danitol Hero Mustang Max Warrior	7-10 days
Malathion	5-7 days
Lannate	3-6 days
Entrust	3-5 days
Pyganic, Grandevo	1-3 days

How many sprays total?

- **Depends on product**
- **Many have limits**

Insecticides for SWD on **brambles**

<i>Product</i>	<i>Pre-harvest interval</i>	<i>Maximum number of applications allowed</i> <i>(if used at max rate)</i>
Delegate	1 day	3
Mustang Max	1 day	6
Malathion	1 day	3
Entrust [OMRI]	1 day	2 + 2
Danitol	3 days	2
Brigade	3 days	2
Hero	3 days	2

Insecticides for SWD on **brambles**

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Observations on Ohio farms: 2014

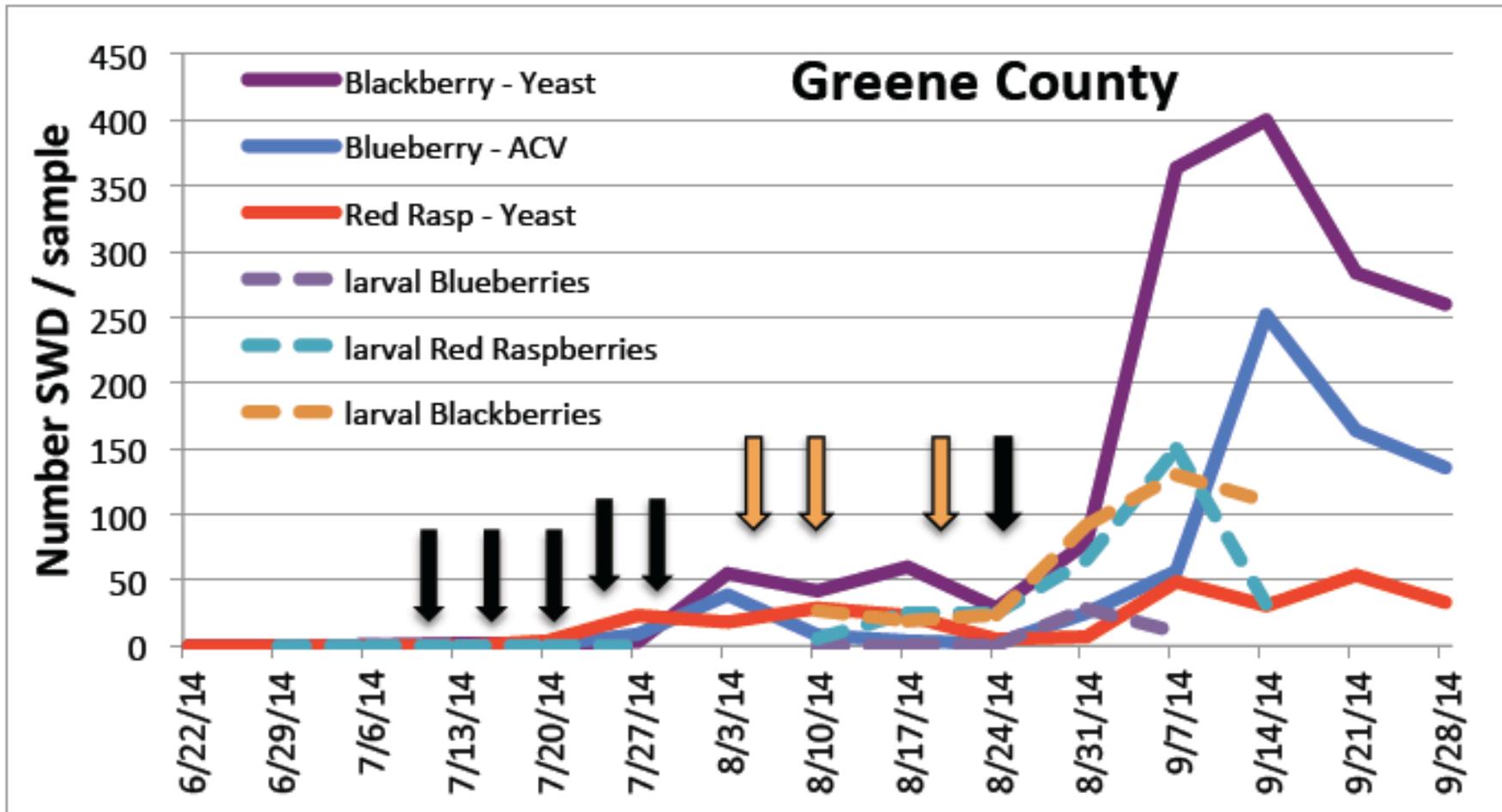


Figure 3. Density of SWD in weekly samples and timing of insecticide sprays on multiple crops in Greene County. Black arrows represents Evergreen EC60 (6oz/A) applied July 10, 15, 19, 22, and 28 on raspberry; orange arrows represents Entrust (3 oz/A) applied August 4, 9, and 18 on raspberry and blackberry. The last black arrow is Evergreen EC60 (3 oz/A) applied on raspberry and blackberry on August 24.

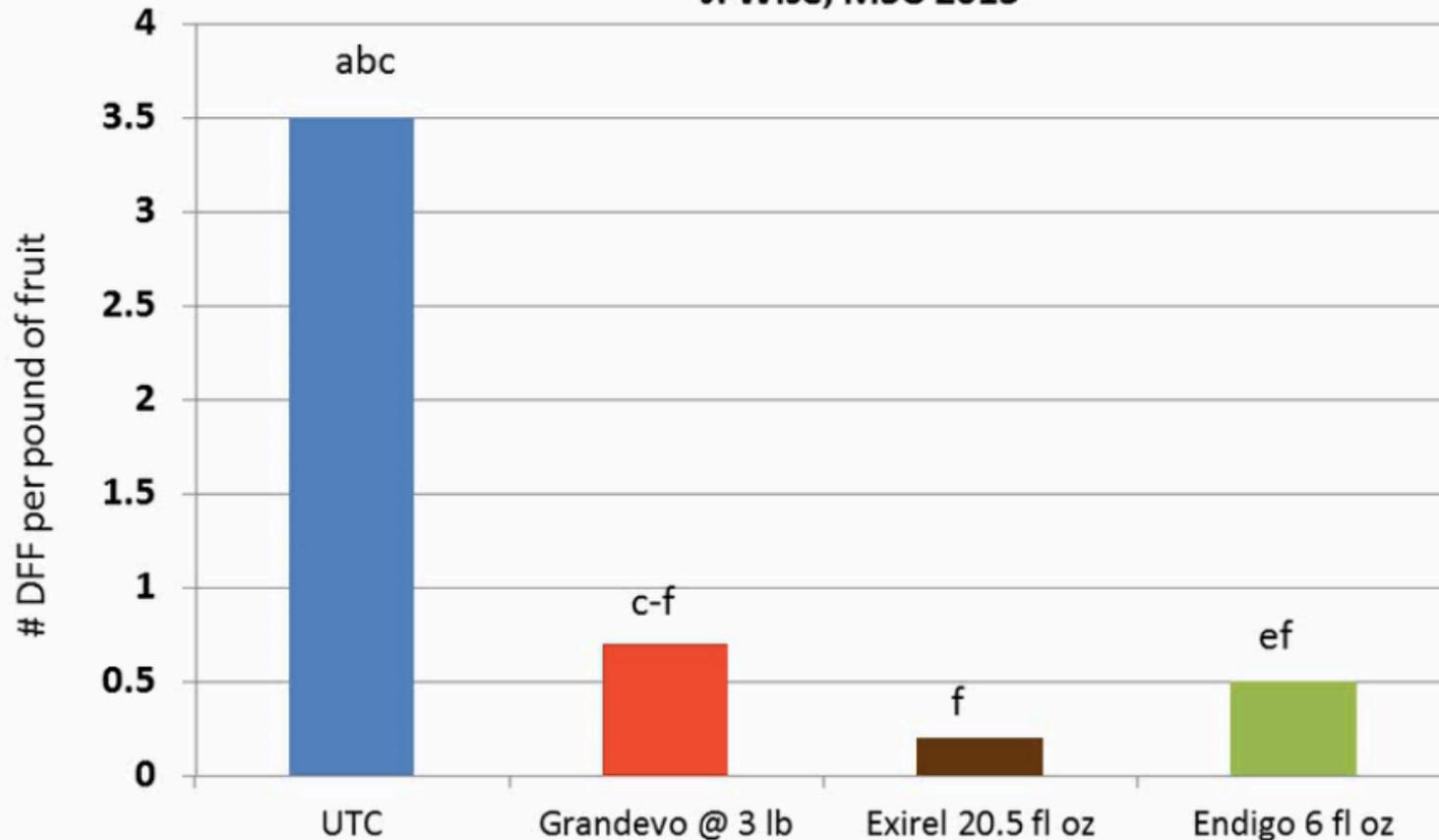
New options for organic growers: bacteria-based products

- **Grandevo**
 - 2(ee) labels for SWD
 - Control on stone fruit
 - Suppression on bushberries
 - Suppression on caneberries
 - 3 lbs / acre
- **Venerate**
 - No 2(ee) labels for SWD
 - 4 – 8 qt/A



Grandevo® DF on Tart Cherry vs. Spotted Wing Drosophila and Cherry Fruit Fly

Number of pupae per pound of fruit at harvest
J. Wise, MSU 2013



ABCD

ACE

ACE

Partial treatment list, adjuvants included in applications.

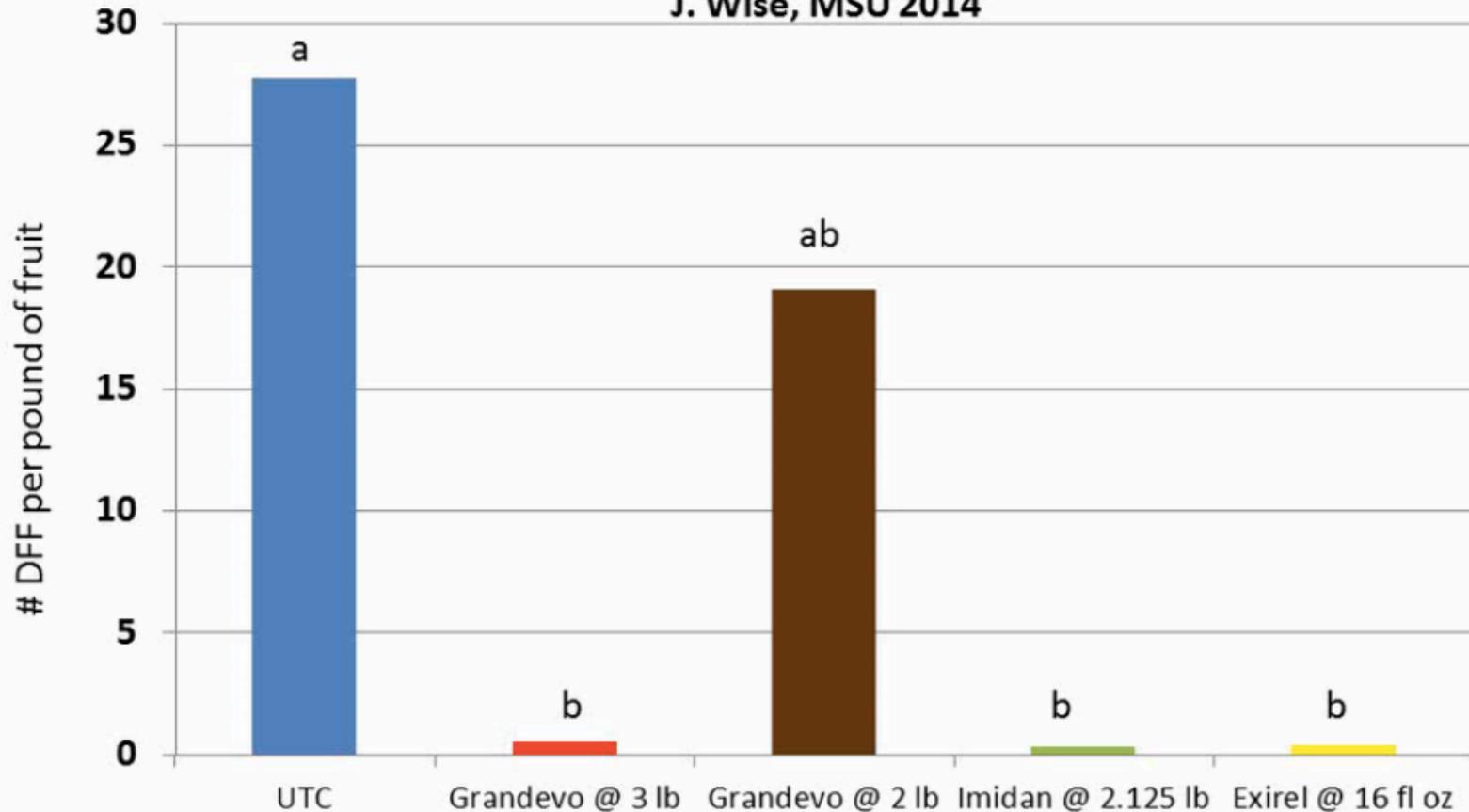
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Slide by Tim Johnson, Marrone Bio Innovations

Grandevo[®] DF on Tart Cherry vs. Spotted Wing Drosophila

Number of pupae per pound of fruit at harvest
J. Wise, MSU 2014



A-F

A-F

ACE

A-F

Partial treatment list, adjuvants included in applications.

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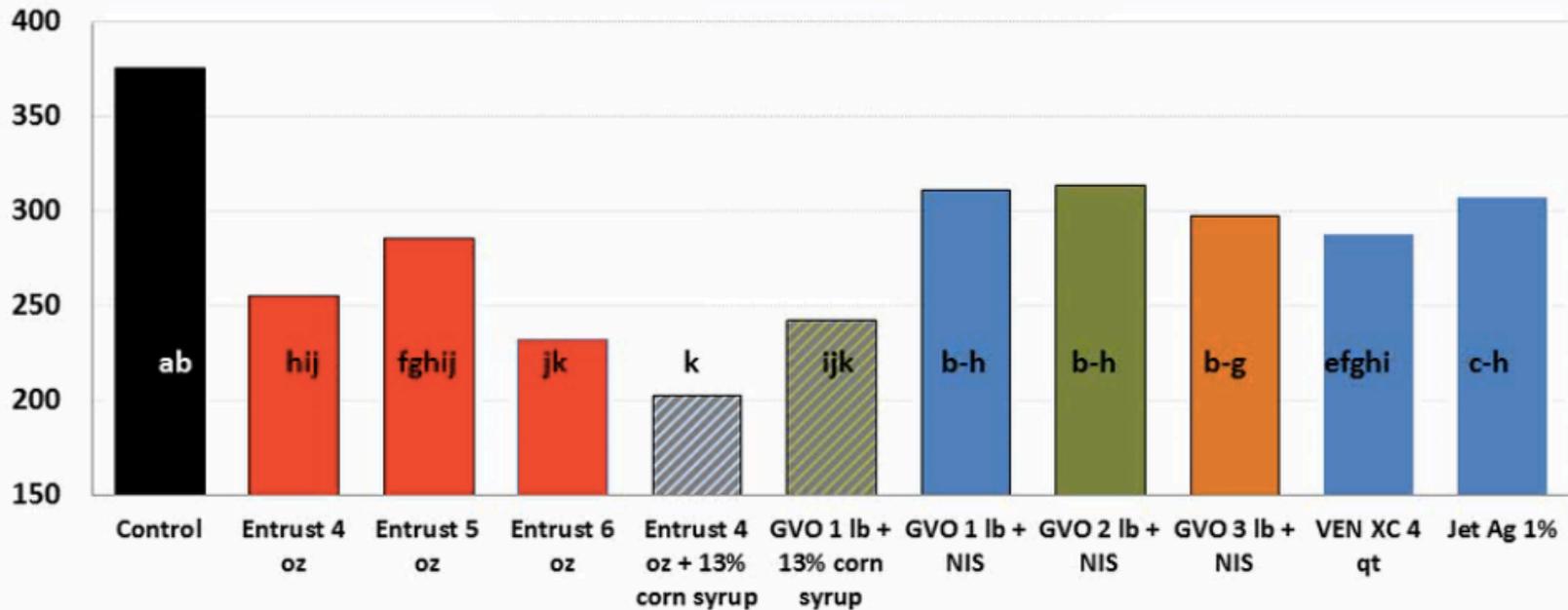


Slide by Tim Johnson, Marrone Bio Innovations

Control of Spotted Wing Drosophila on Blackberry in Washington State



SWD Larvae/140 Blackberry Fruit
(Sum of 7 Evaluations of 20 Fruit Each)



Six applications in 150 GPA, means separated by SNK ($P=0.05$) following data transformation.
Trial conducted by Agricultural Development Group.

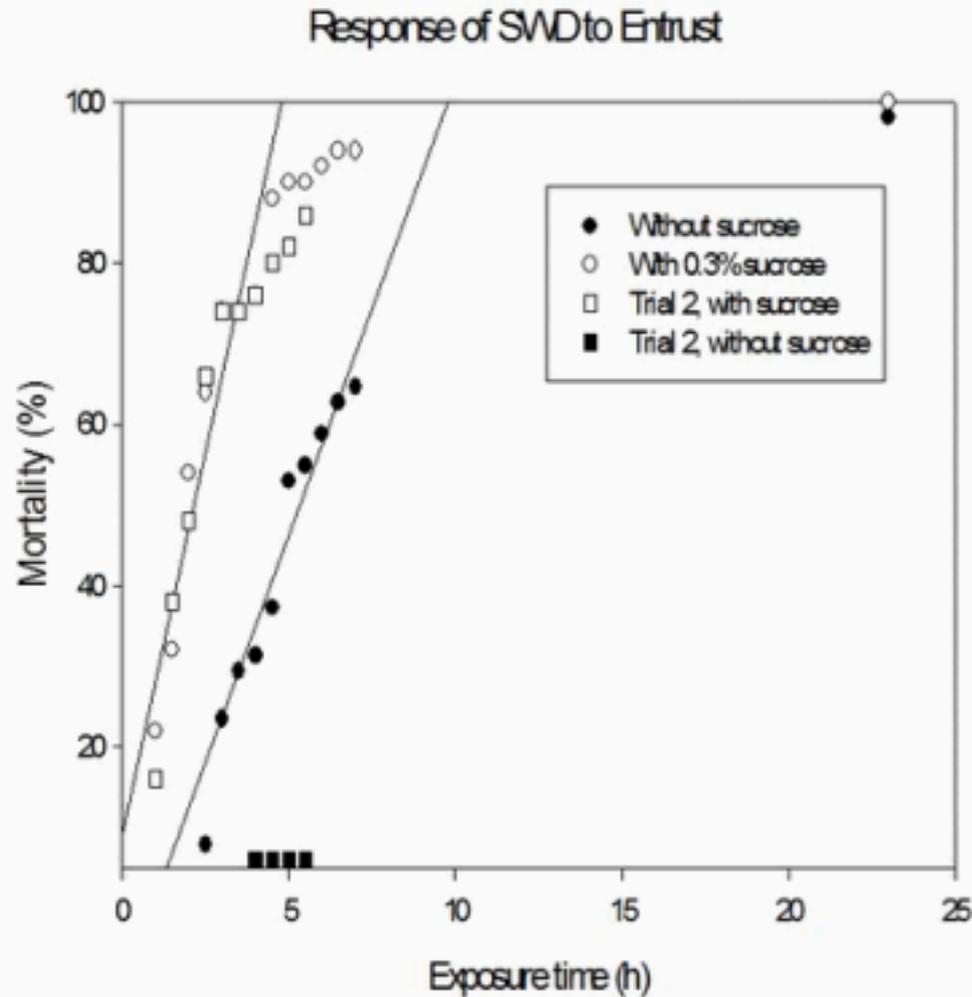
Phagostimulants: adjuvants to boost mortality?

- **Receptors in feet of SWD detect sweetness**
- **Sugar?**
- **Sugar + yeast?**

Sucrose adjuvant to increase efficacy

(Cowles et al. 2015)

- **Add sucrose (sugar)**
- **Assume 50 gal water/acre**
- **Use 1 pound/acre**



Laboratory test:
SWD died about
twice as quickly
when the
insecticide was
presented with
0.3% sucrose,
dried onto
substrate

Sucrose adjuvant: trials

- **Blueberry (NJ, 2013)**
 - Delegate & Assail, w/ sucrose: 76% reduction
 - Brigade & Imidan, w/o sucrose: 65% reduction
- **Blueberry (NJ, 2013)**
 - Delegate & Exirel:
 - w/ sucrose: 95-100% reduction in larvae
 - w/o sucrose: 46-91% reduction
- **Strawberry (NY 2012): Entrust + sugar reduced larvae >50% vs no sugar**

Which products benefit from sugar adjuvant?

- **Yes**
 - spinosyns (Entrust, Delegate)
 - neo-nics (Assail, Admire, Venom)
 - diamides (Exirel)
 - pyrethroids (Brigade)
- **No**
 - organophosphates (Malathion, Imidan)

Other adjuvants?

- **Trials in 2016 in Georgia blueberries**
- **Silicone surfactant: Leaf Life (Loveland)**
 - **Significant benefit for Azera**
 - **No signif. benefit for Entrust, Pyganic**
- **Spreader and sticker: Nu Film P (Miller)**
 - **Extended residue life for Entrust**
 - **Better control for Delegate**

Rainfall effects?

- **Can adjuvants help?**
- **Trials in GA with simulated rainfall:**
 - **1/2", 1", 1.5"**
 - **5 insecticides**
 - **Evaluated 1, 3, 5, 7, 10 days after trtmt**
- **Trial 2014: with vs w/o Nu Film 17**
 - **Mustang : signif. effect**
- **Trial 2015: with vs without Nu Film P**
 - **Positive for Delegate, Entrust, Malathion**

Summary: Management of SWD on brambles

1. Use **bait traps**, check weekly
2. If any SWD in traps, start spray program when berries start to color
- **Spray*** until final harvest
3. Do a **salt test** with ripe fruit, weekly, to see if program effective
4. Spray more often if control not good

* every 7 days if conventional: Delegate & Mustang

* every 5 days if organic: Entrust & Pyganic, + sugar

Chart for SWD on all crops

u.osu.edu/pestmanagement/files/2014/12/SWD_Ohio_handoutV14-1dmqcv7.pdf

Efficacy	Mode of action group	Product	Residual activity (days)	Pre-harvest interval (PHI)						
				<u>raspberry</u> <u>blackberry</u>	<u>blue</u> <u>berry</u>	<u>straw</u> <u>berry</u>	<u>grape</u>	<u>cherry</u>	<u>peach</u>	<u>plum</u>
Very effective	5	§ Delegate	5-7	1 day	3 days	X	7 days	7 days	14 days	7 days
	5	§ Radiant	5-7	X	X	1 day	X	X	X	X
	28	<u>Exirel</u>	5	X	3 days	X	X	3 days	3 days	3 days
	3A	! Mustang Max	7-10	1 day	1 day	X	1 day	14 days	14 days	14 days
	3A	! Brigade	7-10	3 days	1 day	0 days	30 days	X	X	X
	3A	! Hero	7-10	3 days	1 day	X	30 days	X	X	X
	3A	! Danitol	7-10	3 days	3 days	2 days	21 days	3 days	3 days	3 days
	3A	! Asana	7-10	7 days	14 days	X	X	14 days	14 days	14 days
	3A	! Baythroid	7-10	X	X	X	3 days	7 days	7 days	7 days
	3A	! Warrior	7-10	X	X	X	X	14 days	14 days	14 days
	3A	! Pounce	7-10	X	X	X	X	3 days	14 days	X
	1B	<u>Imidan</u>	7	X	3 days	X	14 days	7 days	14 days	7 days
	1B	!§ <u>Diazinon</u>	7	7 days	7 days	5 days	X	21 days	21 days	21 days
	1A	! <u>Lannate</u>	3-6	X	3 days	X	X	X	4 days	X
Effective	1B	<u>Malathion</u>	5-7	1 day	1 day	3 days	3 days	3 days	7 days	X
	5	Entrust [OMRI]	3-5	1 day	3 days	1 day	7 days	14 days	14 days	7 days
Moderately effective	1A	<u>Sevin</u>	10	7 days	7 days	7 days	7 days	3 days	3 days	3 days
	4A	§ Assail	1-3	1 day	1 day	1 day	3 days	7 days	7 days	7 days
Slightly eff.	3A	<u>Pvganic</u> [OMRI]	1-3	0 days	0 days	0 days	0 days	0 days	0 days	0 days
Not effective	4A	<u>Actara</u>	1-3	3 days	3 days	X	5 days	14 days	14 days	14 days
	4A	Admire Pro	1-3	3 days	3 days	7 days	0 days	7 days	0 days	7 days

! *Restricted-Use Pesticide*

§ *Not allowed in greenhouses or high tunnels*

X *means that the product is NOT ALLOWED for use on that crop.*

Attract-and-kill: A new tactic, coming soon?

- **Red ball with cap of wax, sugar, insecticide**
- **Tested with 9 insecticides**
- **Works for 6 weeks**
- **Results promising**
- **Production cost high**

the end



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