Spotted Wing Drosophila & other pests on berry crops

Celeste Welty
Extension Entomologist
January 2016
New invasive pests

- Spotted wing Drosophila
- Brown marmorated stink bug
Topics

• Pests
  – SWD
    • New lures
    • Salt tests
    • Hummingbirds? Insecticides?
  – Brown marmorated stink bug
  – Spotted lanternfly
• Insecticide update
• Bulletin update
Spotted wing Drosophila

- *Drosophila suzukii*

- Looks like common vinegar flies on overripe, fallen, decaying fruit

- The new species attacks healthy ripening fruit
SWD eggs

Egg being deposited by female fly

Egg left on surface of berry

Egg laid below surface of berry
SWD Life Cycle

8-16 days per 1 generation

Female lays 1-3 eggs/site
≈ 350 eggs
12-72h

1st Instar Larva

Pupate inside or outside of fruit
4-15d

Adult
20-30d

3rd Instar Larvae
5-7d

2nd Instar Larva

1st Instar Larva
Fruit injury by Spotted wing Drosophila

- raspberry
- blueberry
- strawberry
- grape
- cherry
- peach
Ohio: SWD reports

• Most reports
  – Blackberries
  – Raspberries

• Some reports
  – Blueberries
  – Peaches
  – Grapes
Ohio: news

• Bad news
  – Widespread
  – Severe damage

• Good news
  – Under control if insecticide program used
When talking to customers about worms in fruit...

• Say “Larvae”!

• Do not say “Maggots”!

Photo by Hannah Burrack, NCSU
Origin

• From Asia
• In Hawaii since 1980
• 2008: California
• 2009: Florida, Washington, Oregon
• 2010: Michigan, Carolinas, Utah
• 2011: Ohio (Van Wert County)
Monitoring spotted wing Drosophila

• Critical: is this pest present on farm?
• Use **bait traps** to monitor **adult** flies
• Use **salt test** to monitor **larvae** in fruit
Baits to trap adult flies?

- **Attractants**
  - Fermenting matter
  - Apple cider vinegar
  - Wine vinegar
  - Yeast dough

- **Differences?**
  - Earliest catch?
  - Fewest non-targets?
Bait traps

• Apple cider vinegar (2012-13) + a drop of dish soap

• Fermenting bait (2014)
  - Mix: Yeast (1/4 tsp active dry) Sugar (1/2 tsp) Flour (2 Tbsp) Water (4 tsp)
  - Put in 4-oz cup with mesh cover
  - Float cup on apple cider vinegar in jar trap

• Commercial bait (2015) over water + a drop of dish soap
Using traps in fruit crops

• Hang in canopy
• On shady side
Trap, then identify

• Threshold: a single SWD adult

• Need to separate:
  – Suspected SWD
  – All others

• Equipment:
  – Minimal: 30x magnifying lens
  – Better: Dissecting microscope
i.d. of adult male

- Spots on wings
- Spots can be absent on young (newly emerged) males
- 2 dark bands of combs on front leg

Photo by Eric LaGasa
i.d. of adult female

- No spots on wings
- Saw-like ovipositor
  - Large, dark, more obvious

Photo by Eric LaGasa
Seasonal trends in SWD traps

• 1st catch mid-July at most sites
• 1st catch June at few sites
• Higher catch when cool & wet
• Lower catch when hot & dry
• Peak catch in Sept.- October
SWD Range in Ohio

 Trap network
Red: found
Green: not found
SWD trap network, 2015

• 52 traps in 16 Ohio counties
• trap counts on website
  u.osu.edu/pestmanagement
Trap results, 2014

• First catch:
  – Earliest on 6/29 in vinegar trap (Columbus)
  – Latest on 10/5 in vinegar trap (Pike Co.)

• First catch at 6 sites with both types:
  – 1st in apple cider vinegar trap at 3 sites
  – Same date in both traps at 1 site
  – No catch all season at 2 sites

• Conclude: no advantage of fermenting bait
Trap study, 2015

• New commercial lure
• Made by Trécé
• @ $3.00
• Lasts 7 weeks
• Hang in quart container
• Placed over water with drop of detergent
• Hope for early catch & fewer non-targets
Comparison of baits, May – September 2015:
At site #2, weekly counts high (>100)
Comparison of baits for FIRST CATCH, 2015:
At site #2, 1st catch in vinegar trap on 7/1, in fermenting trap on 7/3, in commercial trap on 7/6
Commercial lure, 2015

• Sites w/ traps checked 3x per week:
  – Water fine as drowning solution

• Sites w/ traps checked once/week:
  – Specimens too rotten to i.d.
  – Water unacceptable

• Follow-up trial
  – Ethanol? anti-freeze? DDVP strip?
  – 50% ethanol better than 100% ethanol
Trap Deployment Basic Rules

• Minimum: 2 traps per crop
  – 1 in interior
  – 1 at field edge
  – Reduce to 1 trap after 1st detect

• Place in crop canopy 1-2 weeks prior to fruit ripening, near fruit clusters
  – Holes facing outward

• Trécé recommendation:
  – 5-6 traps per 10 A of berries
  – 3-4 traps per 40 A of tree fruit
Test fruit for SWD larvae with salt test

• Put fruit in bag or jar
• Add warm water + salt
• Examine top surface in 15 minutes
• Larvae will float
Salt test
Salt test: proportions

<table>
<thead>
<tr>
<th>Salt</th>
<th>Warm water</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Tablespoon</td>
<td>1 cup</td>
</tr>
<tr>
<td>$\frac{1}{4}$ cup</td>
<td>1 quart (4 cups)</td>
</tr>
<tr>
<td>1 cup</td>
<td>1 gallon</td>
</tr>
</tbody>
</table>
Salt test results: fruit lots inspected for SWD larvae at Holmes County produce auction, 2014

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Auction lots SWD positive</th>
<th>Auction lots SWD negative</th>
<th>% Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>mulberry</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>elderberry</td>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>plums</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>garden huckleberry</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>ground cherry</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>grapes</td>
<td>3</td>
<td>32</td>
<td>9</td>
</tr>
<tr>
<td>blackberry</td>
<td>3</td>
<td>8</td>
<td>27</td>
</tr>
<tr>
<td>red raspberry</td>
<td>12</td>
<td>14</td>
<td>46</td>
</tr>
</tbody>
</table>
# Approach to SWD Monitoring

<table>
<thead>
<tr>
<th></th>
<th>Traps</th>
<th>Salt Test</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Before 1&lt;sup&gt;st&lt;/sup&gt; SWD detected</strong></td>
<td>Check weekly and sort sample <strong>within 24 hrs</strong> (5-10 min/trap)</td>
<td>No Ripe fruit – No Test</td>
</tr>
<tr>
<td></td>
<td>Report findings, even if 0</td>
<td>Ripe fruit – Test Optional</td>
</tr>
<tr>
<td><strong>After 1&lt;sup&gt;st&lt;/sup&gt; SWD detected</strong></td>
<td>Check weekly, keep samples, no need to check for SWD</td>
<td>Weekly, best 1-2 days prior to insecticide spray</td>
</tr>
</tbody>
</table>
Non-chemical management

• Prompt harvest as soon as ripe
• **Chill** fruit as soon as harvested
  – Kills eggs & young larvae
  – 8 days at 33 – 34 °F
• **Sanitation**
  – Strongly recommended!
  – Destroy ALL leftover fruit
  – Do every 2 days
  – Culls in clear plastic bags in sun, 1 week
Mechanical control by netting

• Feasible but takes planning
• Add pollinators
• Study in **NY**
  – By Dale Ilia Riggs
• High tunnel studies
  – By Rufus Isaacs in **MI**
  – By Donn Johnson in **AR**
Non-chemical management

Removal of nearby wild hosts
  – Wild blackberry
  – Pokeweed
  – Bush honeysuckle
  – Silky dogwood
  – Buckthorn
Biocontrol??

• Natives: ~2% parasitism
• Exploration in Korea
  • 4 parasitoid species
  • In quarantine @ Berkeley
Insecticide strategy for SWD control

When to start spraying?

• If the adult flies are detected
• Fruit is susceptible to injury once it has started to turn color
# Insecticide choices for SWD control

<table>
<thead>
<tr>
<th>Efficacy</th>
<th>Group</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Most effective</strong></td>
<td>spinosyns</td>
<td>Delegate</td>
</tr>
<tr>
<td></td>
<td>diamides</td>
<td>Exirel</td>
</tr>
<tr>
<td></td>
<td>organo-phosphates</td>
<td>Imidan, Diazinon</td>
</tr>
<tr>
<td></td>
<td>pyrethroids</td>
<td>Mustang Max, Brigade, Pounce, Hero, Danitol, Baythroid, Asana, Warrior</td>
</tr>
<tr>
<td></td>
<td>carbamates</td>
<td>Lannate</td>
</tr>
<tr>
<td><strong>Effective</strong></td>
<td>organo-phosphates</td>
<td>Malathion</td>
</tr>
<tr>
<td></td>
<td>carbamates</td>
<td>Sevin</td>
</tr>
<tr>
<td></td>
<td>spinosyns</td>
<td>Entrust [OMRI]</td>
</tr>
<tr>
<td><strong>Moderately</strong></td>
<td>neonicotinoid</td>
<td>Assail, Actara, Provado</td>
</tr>
<tr>
<td><strong>Slightly</strong></td>
<td>pyrethrins</td>
<td>Pyganic [OMRI]</td>
</tr>
</tbody>
</table>
How often to spray?

When residues no longer active

<table>
<thead>
<tr>
<th>Product</th>
<th>Residual activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exirel</td>
<td>5 days</td>
</tr>
<tr>
<td>Delegate</td>
<td>5-7 days</td>
</tr>
<tr>
<td>Imidan, Diazinon</td>
<td>7 days</td>
</tr>
<tr>
<td>Pyrethroids:</td>
<td>7-10 days</td>
</tr>
<tr>
<td>Asana</td>
<td></td>
</tr>
<tr>
<td>Brigade</td>
<td></td>
</tr>
<tr>
<td>Danitol</td>
<td></td>
</tr>
<tr>
<td>Hero</td>
<td></td>
</tr>
<tr>
<td>Mustang Max</td>
<td></td>
</tr>
<tr>
<td>Warrior</td>
<td></td>
</tr>
<tr>
<td>Malathion</td>
<td>5-7 days</td>
</tr>
<tr>
<td>Lannate</td>
<td>3-6 days</td>
</tr>
<tr>
<td>Entrust</td>
<td>3-5 days</td>
</tr>
<tr>
<td>Pyganic</td>
<td>1-3 days</td>
</tr>
</tbody>
</table>
Sucrose adjuvant to increase efficacy
(Cowles et al. 2015)

- Add sucrose (sugar)
- 1.2 gram/liter
- Assume 50 gal water/acre
- = 1 pound/acre
Sucrose adjuvant: trials

• Blueberry (NJ, 2013)
  – Delegate & Exirel w/ sucrose 1.2 g/L
  – w/ sucrose: 95-100% reduction in larvae
  – w/o sucrose: 46-91% reduction

• Blueberry (NJ, 2013)
  – Delegate & Assail, w/ sucrose: 76% reduction
  – Brigade & Imidan, w/o sucrose: 65% reduction

• Strawberry (NY 2012): Entrust + sugar reduced larvae >50% vs no sugar
Insecticides for SWD on **brambles**

<table>
<thead>
<tr>
<th>Product</th>
<th>Pre-harvest interval</th>
<th>Maximum number of applications allowed (if used at max rate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delegate</td>
<td>1 day</td>
<td>3</td>
</tr>
<tr>
<td>Mustang Max</td>
<td>1 day</td>
<td>6</td>
</tr>
<tr>
<td>Malathion</td>
<td>1 day</td>
<td>3</td>
</tr>
<tr>
<td>Entrust [OMRI]</td>
<td>1 day</td>
<td>4</td>
</tr>
<tr>
<td>Danitol</td>
<td>3 days</td>
<td>2</td>
</tr>
<tr>
<td>Brigade</td>
<td>3 days</td>
<td>2</td>
</tr>
<tr>
<td>Hero</td>
<td>3 days</td>
<td>2</td>
</tr>
<tr>
<td>Pyganic [OMRI]</td>
<td>0 days</td>
<td>-</td>
</tr>
</tbody>
</table>
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

(bugs.osu.edu/welty/pdf/SWD_Ohio_handoutV13.pdf)

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

! Restricted-Use Pesticide
§ Not allowed in greenhouses or high tunnels
X means that the product is NOT ALLOWED for use on that crop.
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
# Managing spotted wing Drosophila

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Action needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>SWD not yet found on farm</td>
<td>Use bait trap for adult fly, weekly, all season or until first detection of adult</td>
</tr>
<tr>
<td>SWD was found on farm last year</td>
<td>Use bait trap for adult fly, until first catch of the new year, to determine when spray schedule should start</td>
</tr>
<tr>
<td>SWD was found on farm this year</td>
<td>Use salt test weekly to see if control program effective</td>
</tr>
</tbody>
</table>
## SWD management approaches

<table>
<thead>
<tr>
<th>Your ability</th>
<th>Timing</th>
<th>Traps?</th>
<th>Spray?</th>
<th>Salt Test?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can trap and identify SWD adults</td>
<td>Before 1(^{st}) SWD detected</td>
<td>Check weekly, sort sample w/in 24 hrs (5-10 min/ trap)</td>
<td>None yet</td>
<td>If no ripe fruit: No test needed</td>
</tr>
<tr>
<td></td>
<td>After 1(^{st}) SWD detected</td>
<td>Check weekly, keep samples, no need to i.d. or count SWD</td>
<td>Begin weekly sprays, until final harvest</td>
<td>Test weekly, best 1-2 days prior to spray</td>
</tr>
<tr>
<td>Can trap but not identify SWD adults</td>
<td>Before any fruit is ripe</td>
<td>No traps</td>
<td>None yet</td>
<td>If no ripe fruit: No test needed</td>
</tr>
<tr>
<td></td>
<td>As soon as any fruit is ripe</td>
<td>No traps</td>
<td>Begin weekly sprays until harvest</td>
<td>Test weekly, best 1-2 days prior to spray</td>
</tr>
</tbody>
</table>
What do we know about hummingbirds controlling SWD?

Jim Jasinski
OSU Extension
Integrated Pest Management Program
Hummingbird Biology

• Feed mainly on *nectar* to sustain energy
• do feed on *insects* to obtain protein, amino acids, and fat
• Capture more insects when raising chicks
• Generally 1-2 broods / year
• Generally 1-3 eggs / clutch
• Nesting 15-22 days (insectivore period)
• Very aggressive and territorial
• Migratory – not here year round

Jim Jasinski
Ruby-Throated Hummingbird

https://www.allaboutbirds.org/guide/

Jim Jasinski
Ruby-Throated Hummingbird: Food

• Feed on the nectar of red or orange tubular flowers
• Main prey: mosquitoes, gnats, fruit flies, small bees; spiders
Ruby-Throated Hummingbird: Habitat

- Deciduous woodlands of eastern North America & Canadian prairies
- Old fields, forest edges, meadows, orchards, stream borders, backyards
- This species is eastern North America’s only breeding hummingbird

Jim Jasinski
Robert Hayes, in Mississippi Feeder Set Up

- 6 A certified organic blackberry farm
- 150 Hummingbird feeders
- 25 feeders/A
- Filled w/ sugar water
- At 8 oz / trap = 9.4 gallons sugar water
- Changed every 3-4 days to avoid any bacterial contamination
- Hired 1 person full time to service feeders
- 6 days a week, changing & cleaning feeders
- >500 Hummingbirds flying around
- Claims never to have sprayed or had infested berries

Jim Jasinski
Rough Predation Calculations

• 500 hummingbirds at Rob Hayes Farm
• Can consume up to 2,000 insects / day
  – More when raising chicks?
• 1,000,000 insects / day potentially eaten
  – What % are SWD?
• Brood season is 18-22 days long
• 18-22+ million insects potentially eaten
• How many eaten during non-rearing times? Less?

Jim Jasinski
Rough SWD Population Increases

Assuming no predation and full survival

1-10 d  •  1 female x 350 eggs = 350 flies (50% F)
11-20 d  •  175 females x 350 eggs = 61,250 flies (50% F)
21-30 d  •  30,625 F x 350 eggs = 10.7 million flies

Available as hummingbird prey 65 - 75% life
Predator / Prey Overlap

SWD Population in Ohio

Hummingbird arrival
Raising chicks
Ripe Fruit
Hummingbird departure

Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec
Maximizing RTH at your farm

• Put feeders out in mid-May
• Use many smaller vs. fewer larger feeders
• Spread evenly around fields, don’t bunch
• Use sugar water (1:4) sugar:water (boil)
• No red dye in water
• Weekly: change water & clean feeders

Jim Jasinski
Attracting RTH using Plants

- Plants with red or orange tubular flowers
- Trumpet creeper
- Cardinal flower
- Honeysuckle
- Jewelweed
- Bee-balm
- Red buckeye
- Red morning glory
- Hostas

Jim Jasinski
Additional info on SWD

On website:  u.osu.edu/pestmanagement

• 2-page color info sheet
  – Includes insecticides for commercial farms

• Instructions for trapping

• Instructions for salt tests

• Insecticide list for home gardens

• Slide show
# New pests

<table>
<thead>
<tr>
<th></th>
<th>Speed of invasion into Ohio</th>
<th>Potential for damage on crops</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spotted wing Drosophila</strong></td>
<td>fast</td>
<td>Slight (tree fruit) to severe (small fruit)</td>
</tr>
<tr>
<td><strong>Brown marmorated stink bug</strong></td>
<td>slow</td>
<td>Severe for all crops</td>
</tr>
</tbody>
</table>
Brown marmorated stink bug

- Attacks fruits & seed pods
- Invading Ohio since 2007
Brown marmorated stink bug: injury on grapes & berries
BMSB monitoring by blacklight trap, 2013

Brown marmorated stink bug in blacklight trap
OSU's Waterman Farm, Columbus, Ohio
2013

First bug: 20 May
Last bug: 3 October
Most: 15 July
Monitoring BMSB

• Improved lure by USDA-ARS
• Double lure for synergy
  – ARS#20 (10 mg)
  – MDT (66 mg)
• Available from several companies
  – AgBio
  – Alpha Scents
  – Rescue
  – Trécé
  – Scentry
  – Bedoukian
Stink bug trapping study

- Pyramid vs pipe
- Black vs yellow; plain vs netted
# Insecticides for stink bug

<table>
<thead>
<tr>
<th>Product</th>
<th>Apple</th>
<th>Peach</th>
<th>Raspberry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PHI</td>
<td>Limit</td>
<td>PHI</td>
</tr>
<tr>
<td>Venom</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Brigade, Hero</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Belay</td>
<td>7</td>
<td>1 ap.</td>
<td>21</td>
</tr>
<tr>
<td>Leverage</td>
<td>7</td>
<td>1 ap.</td>
<td>7</td>
</tr>
<tr>
<td>Baythroid</td>
<td>7</td>
<td>1 ap.</td>
<td>7</td>
</tr>
<tr>
<td>Danitol</td>
<td>14</td>
<td>2-4 ap.</td>
<td>3</td>
</tr>
<tr>
<td>permethrin</td>
<td>Not after petal-fall</td>
<td>2 ap.</td>
<td>14</td>
</tr>
<tr>
<td>Assail</td>
<td>7</td>
<td>4 ap.</td>
<td>7</td>
</tr>
<tr>
<td>Actara</td>
<td>35</td>
<td>3 ap.</td>
<td>14</td>
</tr>
</tbody>
</table>
Cultural control by trap cropping

• Attract bugs away from main crop
• In R&D mode:
  – Sorghum
  – Sunflower
Potential pest of fruit crops in Ohio: Spotted lanternfly

- Found Sept 2014, Berks Co., PA (NW of Phila.)
- Native to China
- A planthopper
- Sucks sap
- 1” long
- Poor flier
- Strong jumper
Spotted lanternfly: hosts

• Feed on grape, apple, stone fruit

• Hosts in fall:
  – Tree of Heaven
  – Grapes

• Congregate on trunk at base
Spotted lanternfly: damage

- Weeping wounds of sap on bark
- Excrete large amounts of fluid
- Mold grows on sweet fluid
Spotted lanternfly: eggs

Egg masses:
• Laid in September
• New masses: covered with gray pitch-like material
• Older masses: columns of brown seed-like columns
• On trees, stones, furniture
Spotted lanternfly: life cycle

- Egg hatch April, May
- 4 nymph sub-stages
- Young: black with white spots
- Older: red with white spots
- Adults by July
Insecticide news

Sivanto™

• A.I.: flupyradifurone
• IRAC group 4D (butenolides);
  —‘cousin’ to neonicotinoids
• 200 SL (1.67 lbs a.i./gal)
• By Bayer
• Federal label January 2015
<table>
<thead>
<tr>
<th>Crop</th>
<th>PHI (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>foliar</td>
</tr>
<tr>
<td>Blueberry</td>
<td>3</td>
</tr>
<tr>
<td>Strawberry</td>
<td>0</td>
</tr>
<tr>
<td>Grape</td>
<td>0</td>
</tr>
<tr>
<td>Apples, pears</td>
<td>14</td>
</tr>
<tr>
<td>Hops</td>
<td>21</td>
</tr>
</tbody>
</table>
Sivanto: target pests

- leafhoppers
- aphids
- whiteflies
- squash bug
- pear psylla
- San Jose scale
- mealybug
- thrips
- blueberry maggot
- Colorado potato beetle
News on spray guides

• 2015 & earlier:
  – Midwest Small Fruit & Grape Spray Guide, 88 pp (~$10)
  – Midwest Tree Fruit Spray Guide, 72 pp (~$10)
  – buy from OSU

• 2016:
  – Midwest Fruit Pest Management Guide, 168 pp (~$15)
  – buy directly from Purdue University
Websites

- **Mine:**
  u.osu.edu/pestmanagement

- **OSU IPM:**
  ipm.osu.edu
the end

e-mail: welty.1@osu.edu
office phone: 614-292-2803
cell phone: 614-746-2429