Spotted Wing Drosophila & other pests on berry crops

Celeste Welty
Extension Entomologist
January 2016

THE OHIO STATE UNIVERSITY

New invasive pests

Spotted wing Drosophila

Brown marmorated stink bug

Topics

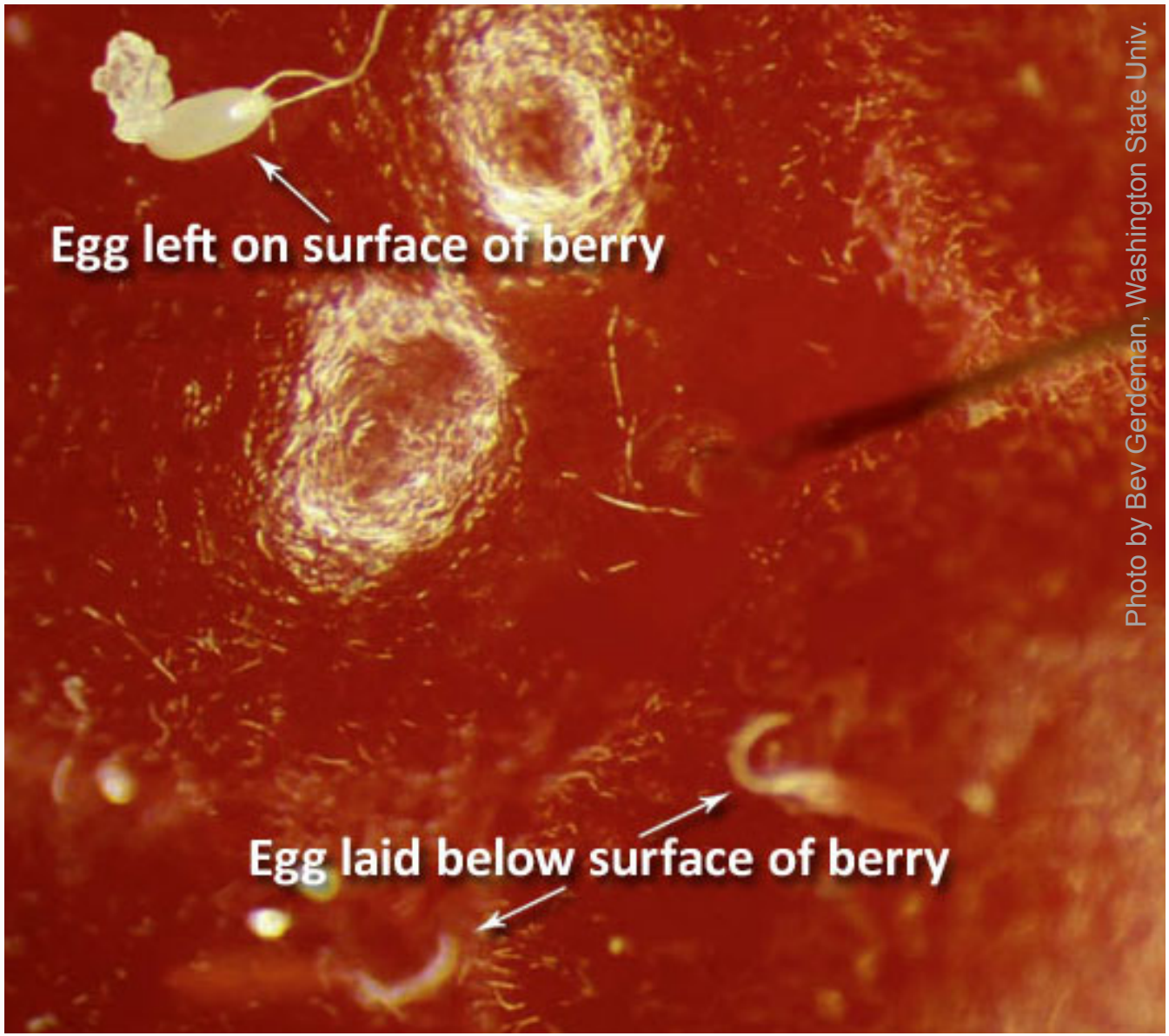
- Pests
  - SWD
    - New lures
    - Salt tests
    - Hummingbirds? Insecticides?
  - Brown marmorated stink bug
  - Spotted lanternfly
- Insecticide update
- Bulletin update

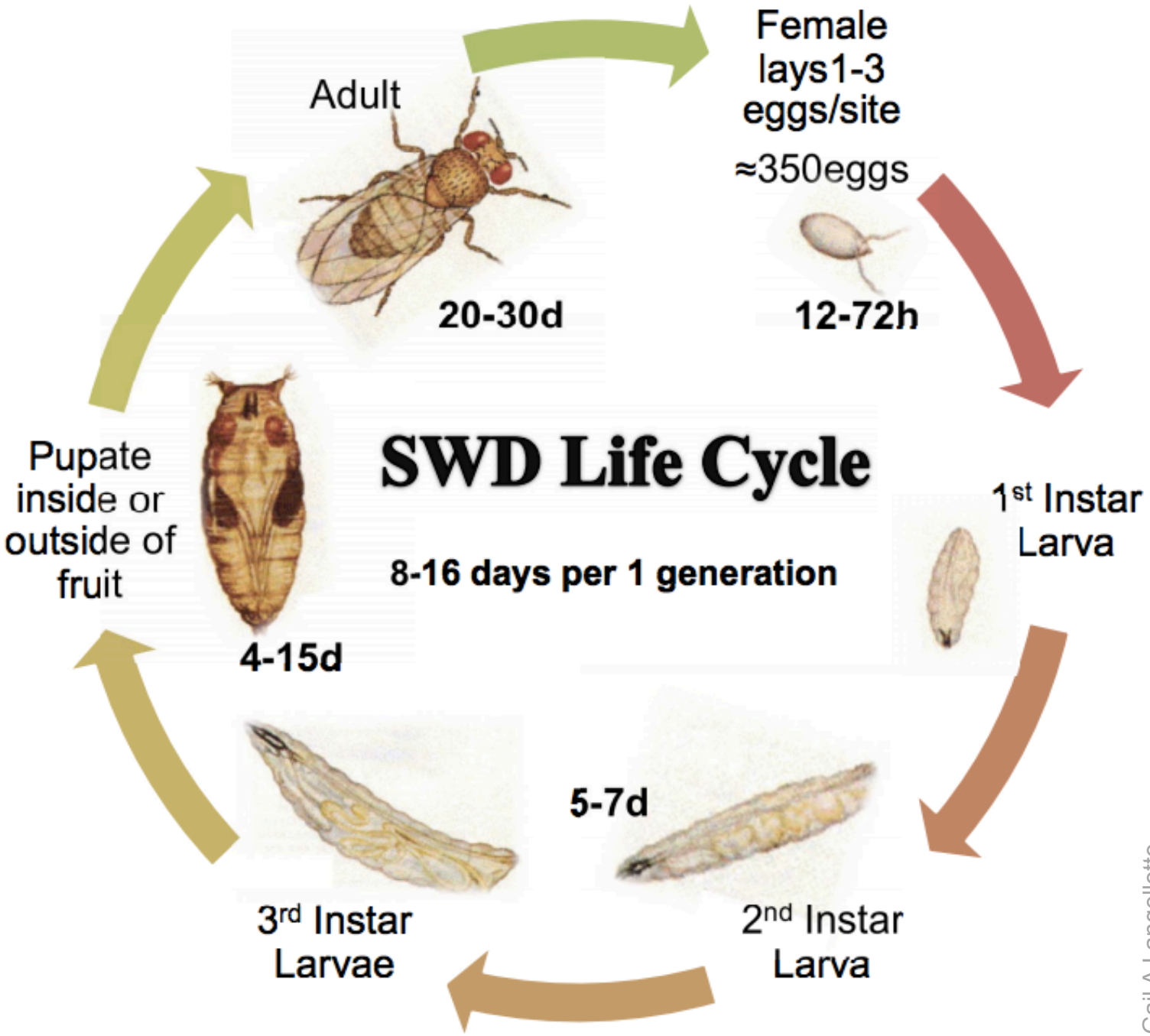
Spotted wing Drosophila

- ***Drosophila suzukii***
- **Looks like common vinegar flies on overripe, fallen, decaying fruit**
- **The new species attacks <u>healthy</u> ripening fruit**

SWD eggs

Egg being deposited by female fly





Gail A Langellotto

Fruit injury by Spotted wing Drosophila

Ohio: SWD reports

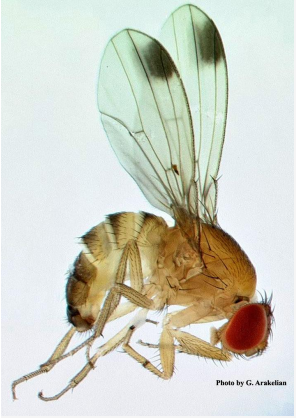
- Most reports
  - Blackberries
  - Raspberries
- Some reports
  - Blueberries
  - Peaches
  - Grapes

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”!



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

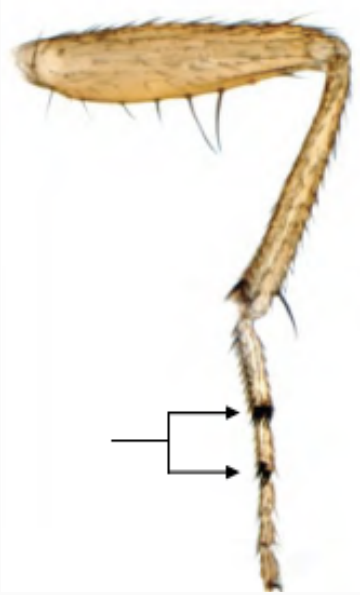
- Hang in canopy
- On shady side

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

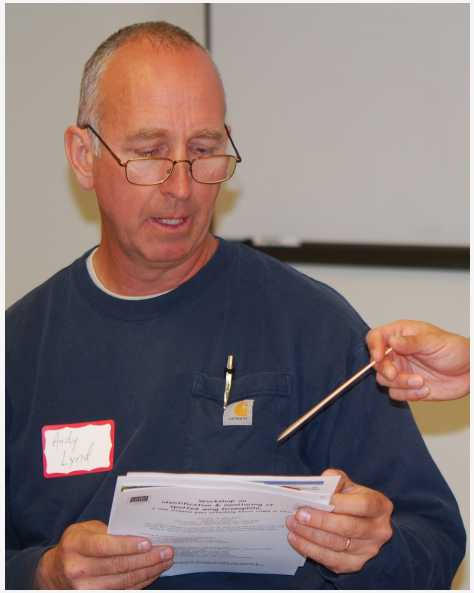


i.d. of adult female

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

SWD Workshops, 2013, 2014, 2015

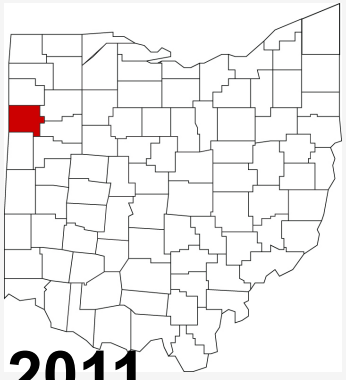


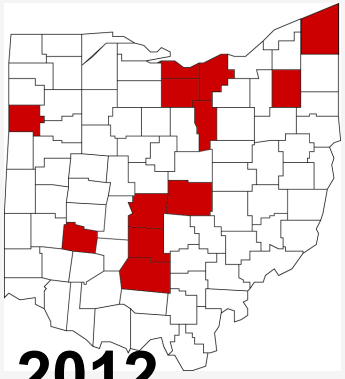


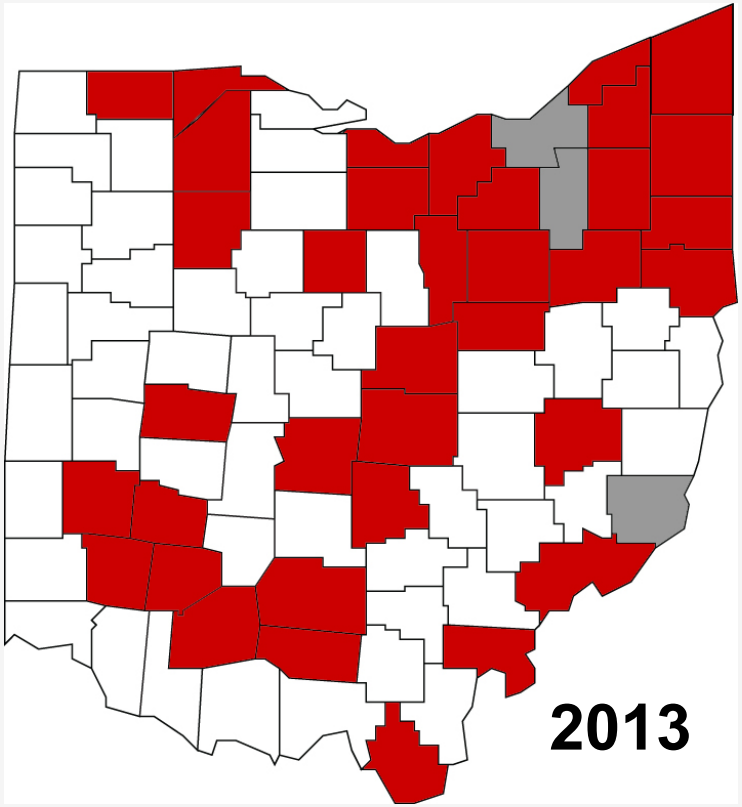
Seasonal trends in SWD traps

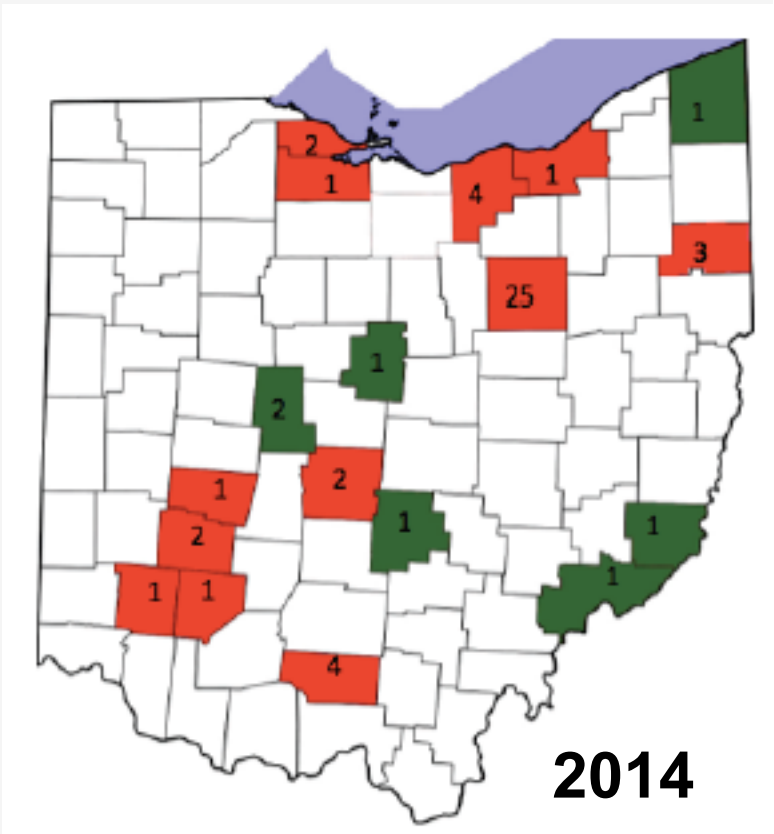
- 1st catch mid-July at most sites
- 1st catch June at few sites
- Higher catch when cool & wet
- Lower catch when hot & dry
- Peak catch in Sept.- October

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

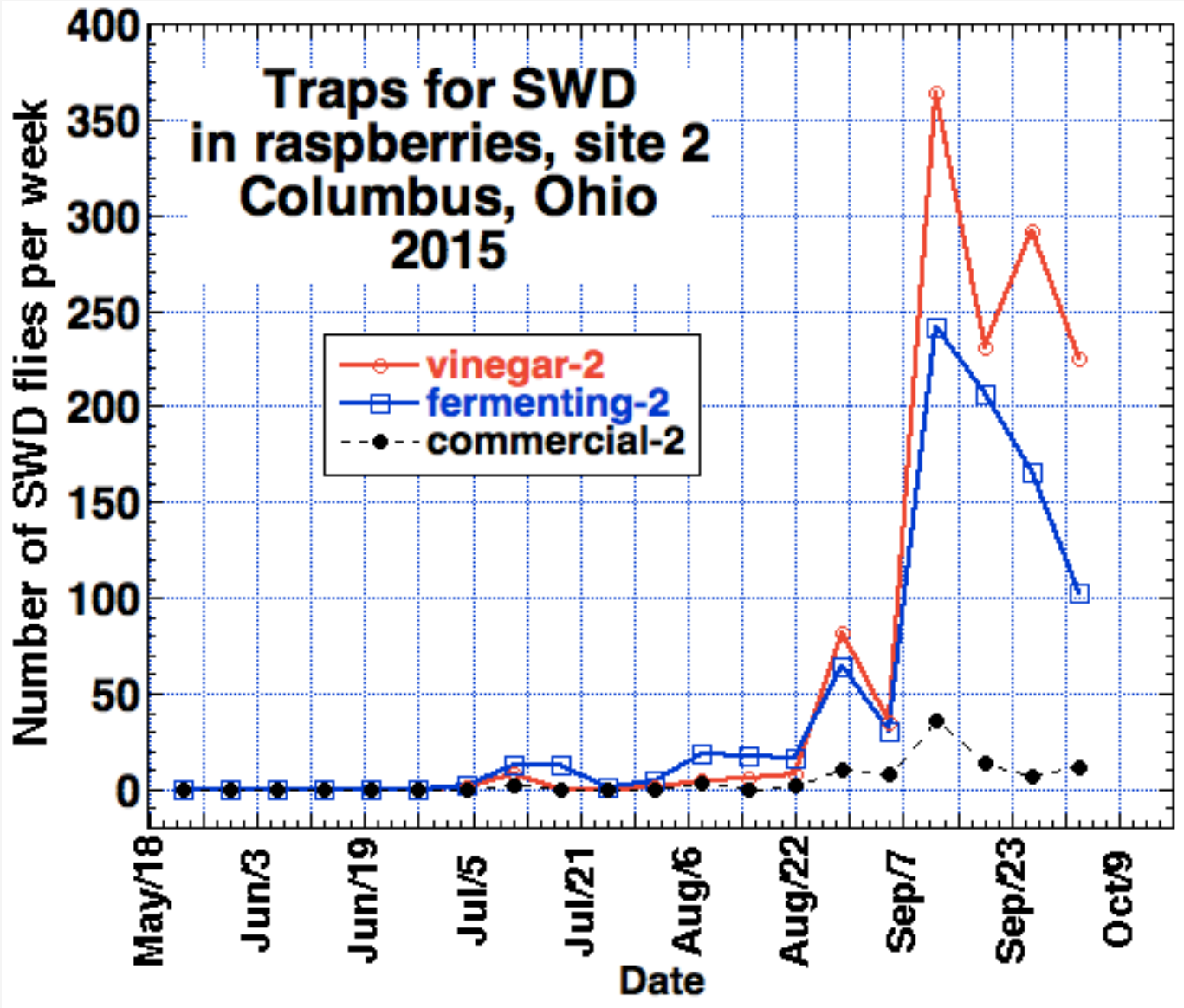
Trap results, 2014

- 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

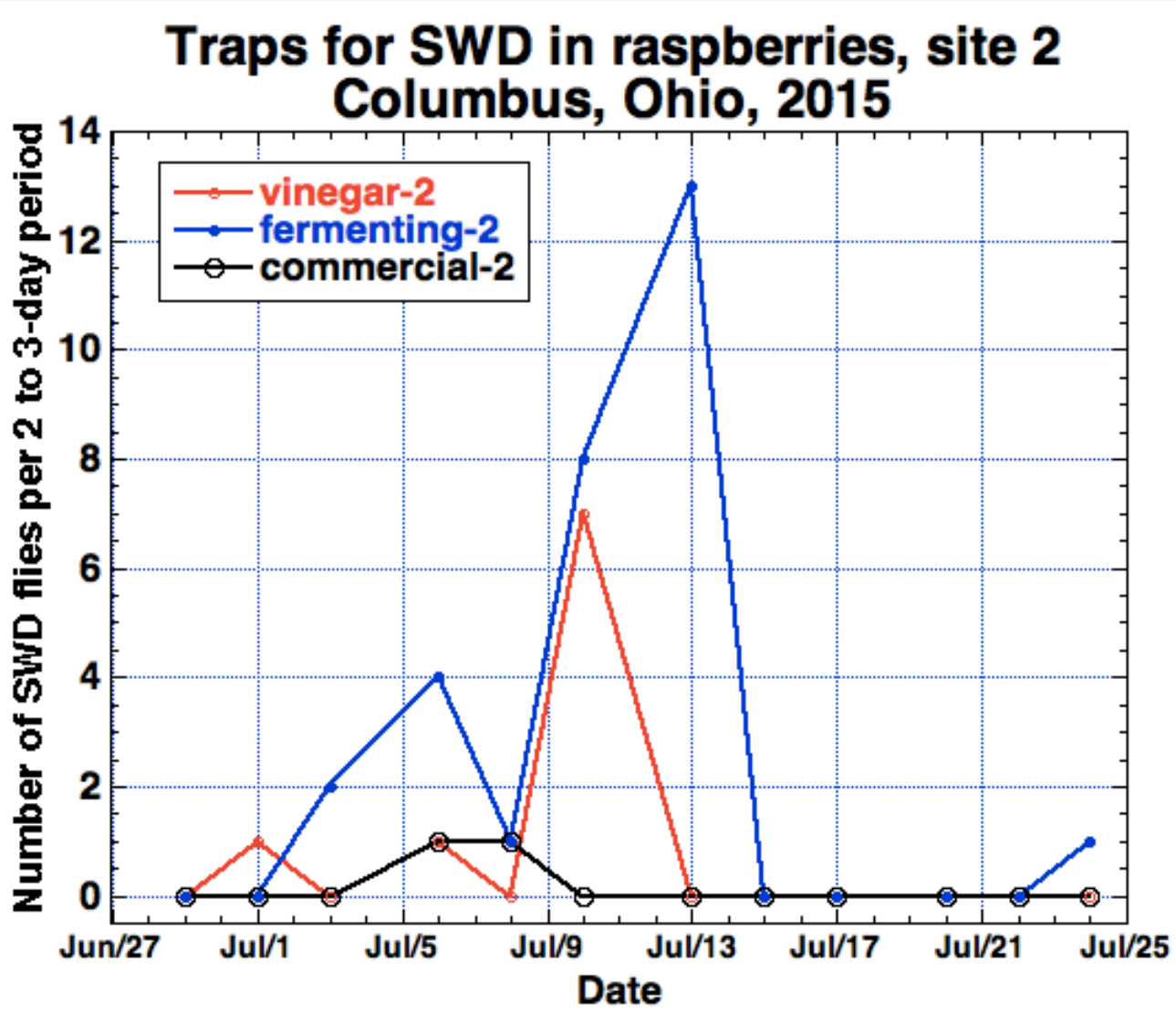
- New commercial lure
- Made by Trécé
- @ $3.00
- Lasts 7 weeks
- Hang in quart container
- Placed over water with drop of detergent
- Hope for early catch & fewer non-targets

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



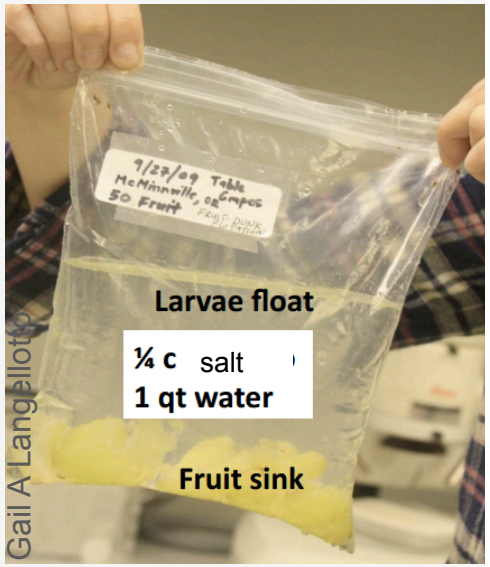
Commercial lure, 2015

- **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

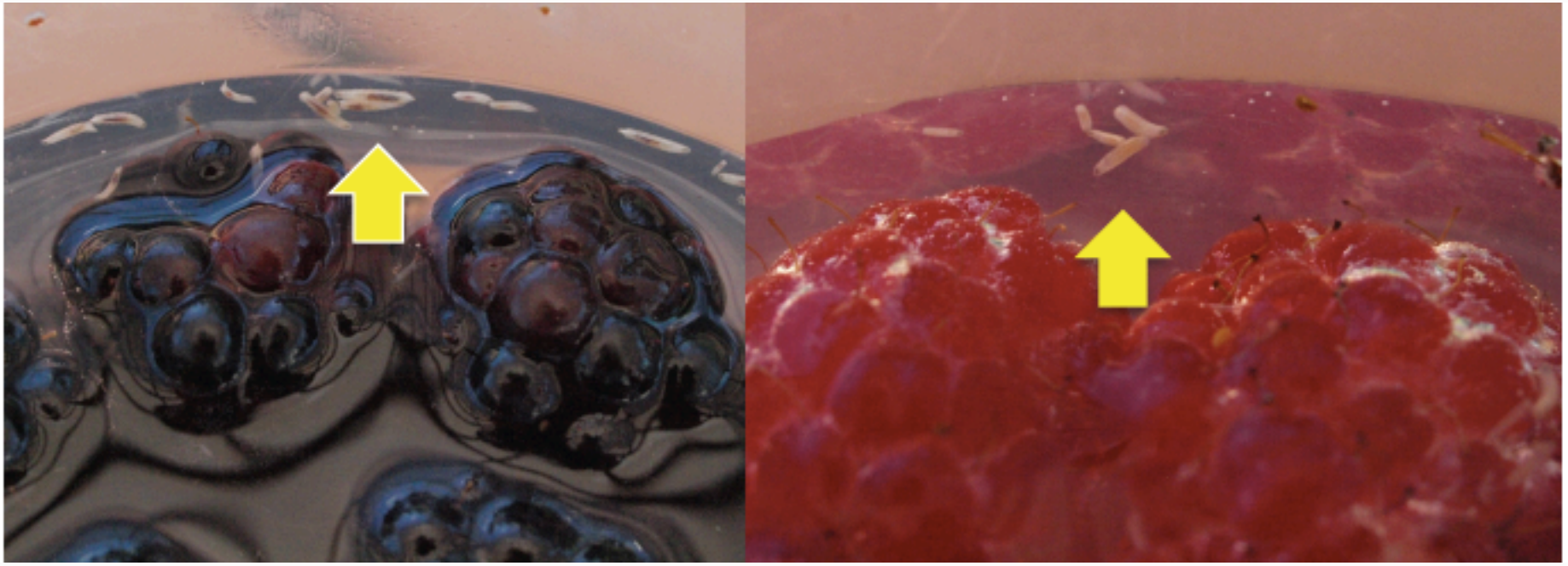
- **Minimum: 2 traps per crop**
  - **1 in interior**
  - **1 at field edge**
  - **Reduce to 1 trap after 1st detect**
- **Place in crop canopy 1-2 weeks prior to fruit ripening, near fruit clusters**
  - **Holes facing outward**
- **Trécé recommendation:**
  - **5-6 traps per 10 A of berries**
  - **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

Salt	Warm water
1 Tablespoon	1 cup
¼ cup	1 quart (4 cups)
1 cup	1 gallon

Salt test results: fruit lots inspected for SWD larvae at Holmes County produce auction, 2014

Fruit	Auction lots SWD positive	Auction lots SWD negative	% Positive
mulberry	0	2	0
elderberry	0	8	0
plums	0	1	0
garden huckleberry	0	1	0
ground cherry	0	1	0
grapes	3	32	9
blackberry	3	8	27
red raspberry	12	14	46

Approach to SWD Monitoring

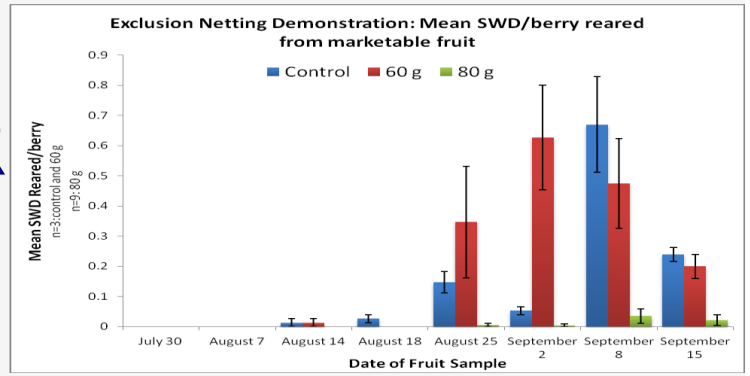
	Traps	Salt Test
Before 1st SWD detected	Check weekly and sort sample within 24 hrs (5-10 min/trap) Report findings, even if 0	No Ripe fruit – No Test Ripe fruit – Test Optional
After 1st SWD detected	Check weekly, keep samples, no need to check for SWD	Weekly, best 1-2 days prior to insecticide spray

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 Ila 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

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

How often to spray?

When residues no longer active

Product	*Residual activity*
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	1-3 days

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

Product	*Pre-harvest interval*	*Maximum number of applications allowed (if used at max rate)*
Delegate	1 day	3
Mustang Max	1 day	6
Malathion	1 day	3
Entrust [OMRI]	1 day	4
Danitol	3 days	2
Brigade	3 days	2
Hero	3 days	2
Pyganic [OMRI]	0 days	-

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

Efficacy	Mode of action group	Product	Residual activity (days)	Pre-harvest interval (PHI)						
				raspberry, blackberry	blue-berry	straw-berry	grape	cherry	peach	plum
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	Exirel	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	Imidan	7	X	3 days	X	14 days	7 days	14 days	7 days
	1B	!§ Diazinon	7	7 days	7 days	5 days	X	21 days	21 days	21 days
	1A	! Lannate	3-6	X	3 days	X	X	X	4 days	X
Effective	1B	Malathion	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	Sevin	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	Pyganic [OMRI]	1-3	0 days	0 days	0 days	0 days	0 days	0 days	0 days
Not effective	4A	Actara	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.

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

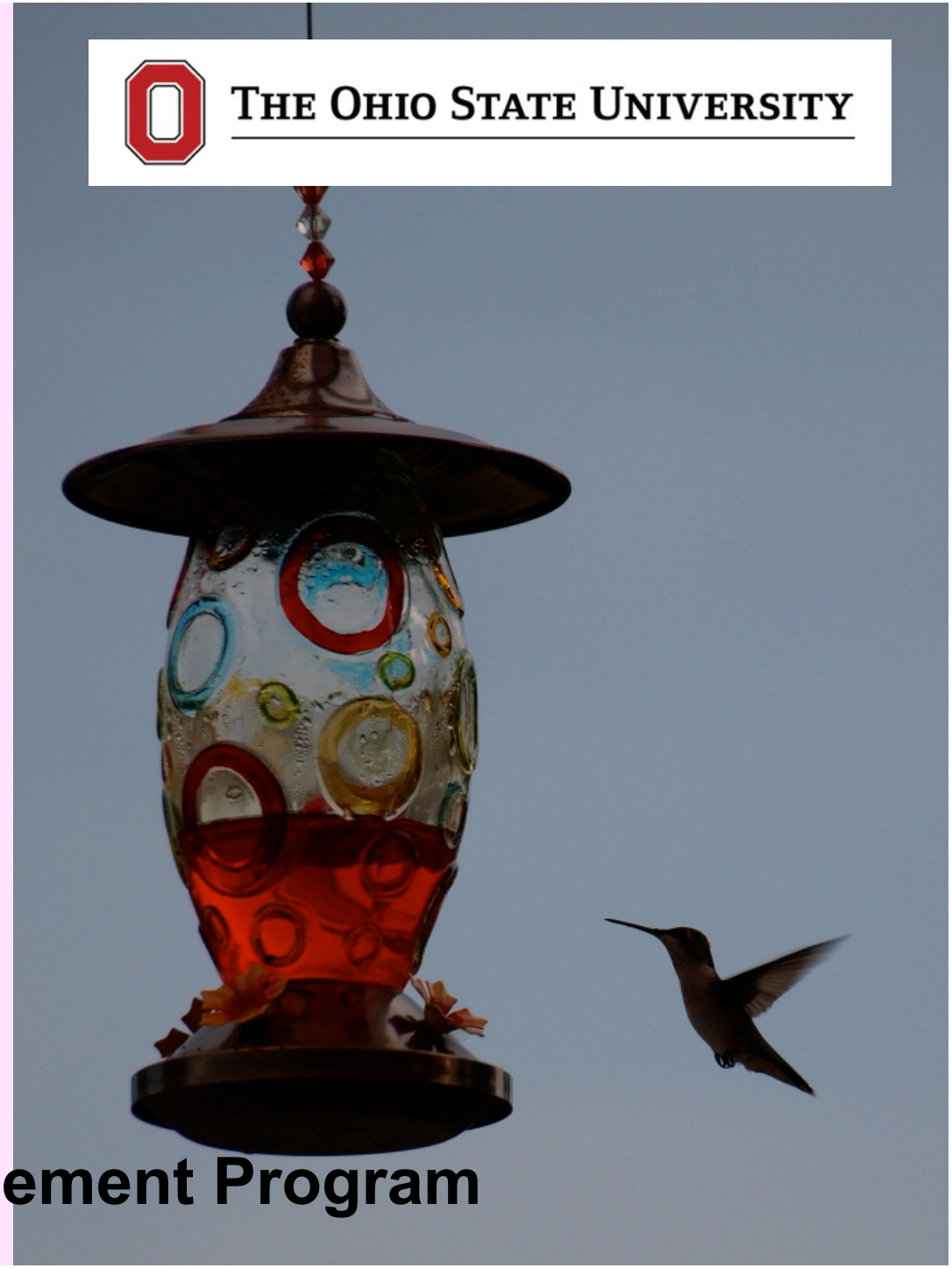
Managing spotted wing Drosophila

Scenario	*Action needed*
SWD not yet found on farm	Use bait trap for adult fly, weekly, all season or until first detection of adult
SWD was found on farm last year	Use bait trap for adult fly, until first catch of the new year, to determine when spray schedule should start
SWD was found on farm this year	Use salt test weekly to see if control program effective

SWD management approaches

Your ability	Timing	Traps?	Spray?	Salt Test?
Can trap and identify SWD adults	Before 1st SWD detected	Check weekly, sort sample w/in 24 hrs (5-10 min/ trap)	None yet	If no ripe fruit: No test needed
			None yet	If ripe fruit present: Test is optional
	After 1st SWD detected	Check weekly, keep samples, no need to i.d. or count SWD	Begin weekly sprays, until final harvest	Test weekly, best 1-2 days prior to spray
Can trap but not identify SWD adults	Before any fruit is ripe	No traps	None yet	If no ripe fruit: No test needed
	As soon as any fruit is ripe	No traps	Begin weekly sprays until harvest	Test weekly, best 1-2 days prior to spray

What do we know about hummingbirds controlling SWD?



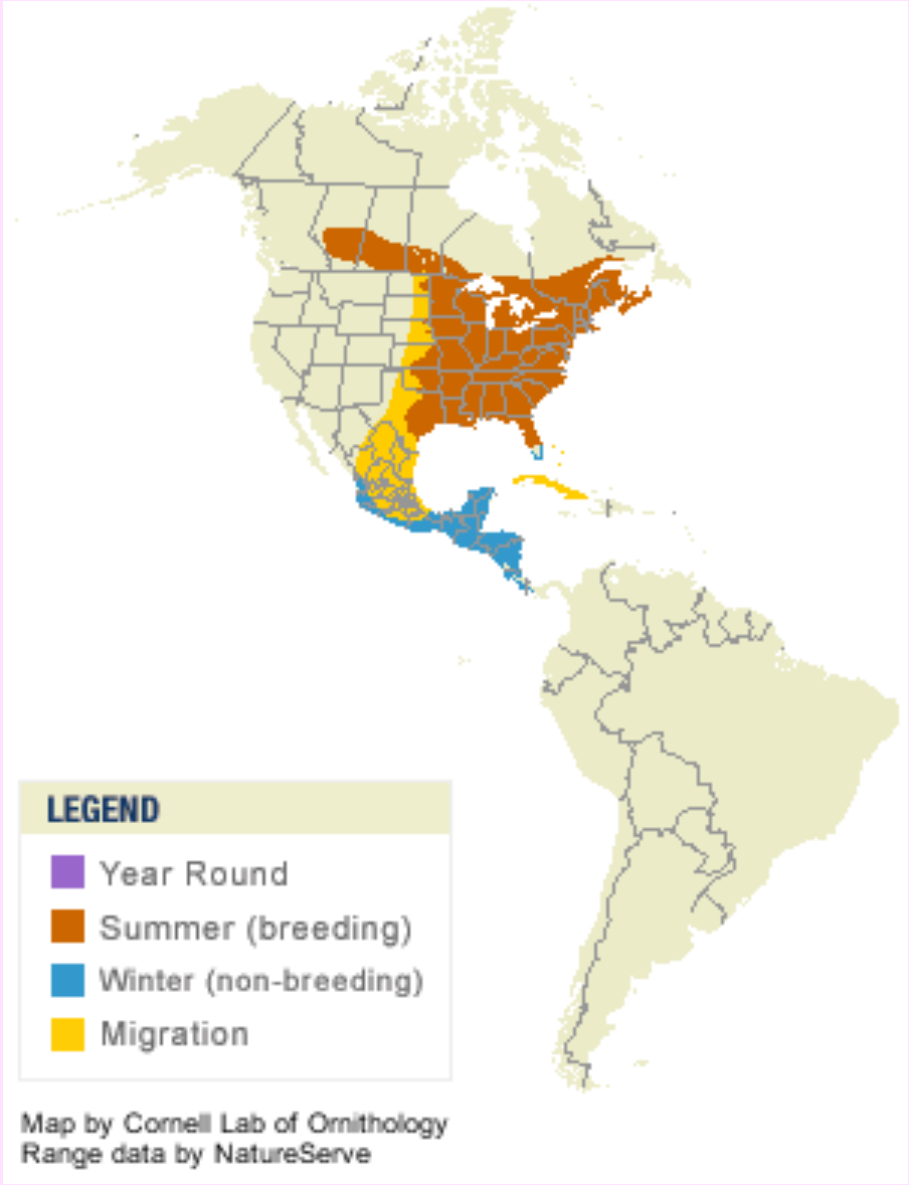
Jim Jasinski
OSU Extension
Integrated Pest Management Program

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

Jim Jasinski

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

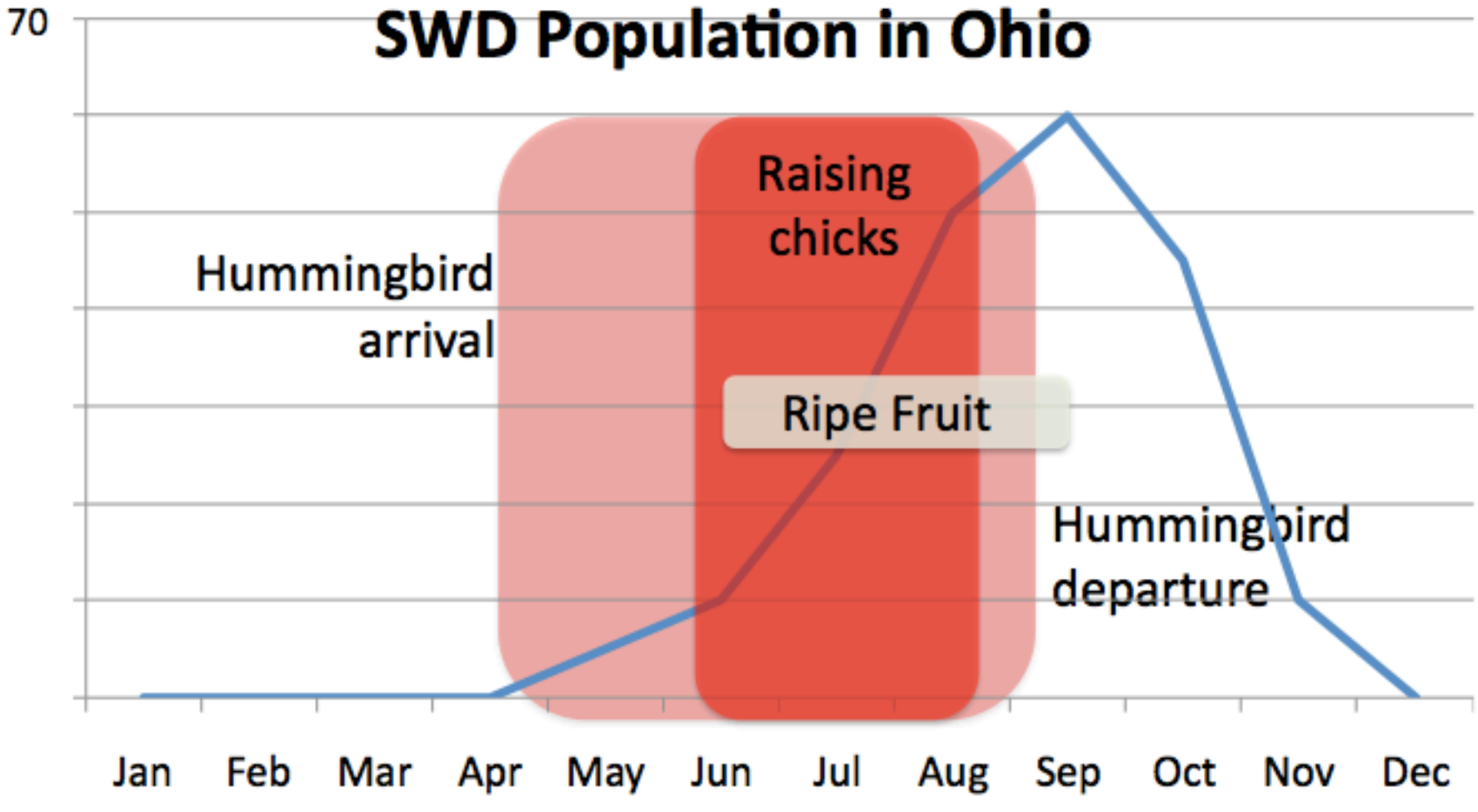
Assuming no predation and full survival

- 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

Jim Jasinski

Predator / Prey Overlap



Jim Jasinski

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

	Speed of invasion into Ohio	Potential for damage on crops
Spotted wing Drosophila 	fast	Slight (tree fruit) to severe (small fruit)
Brown marmorated stink bug 	slow	Severe for all crops

Brown marmorated stink bug

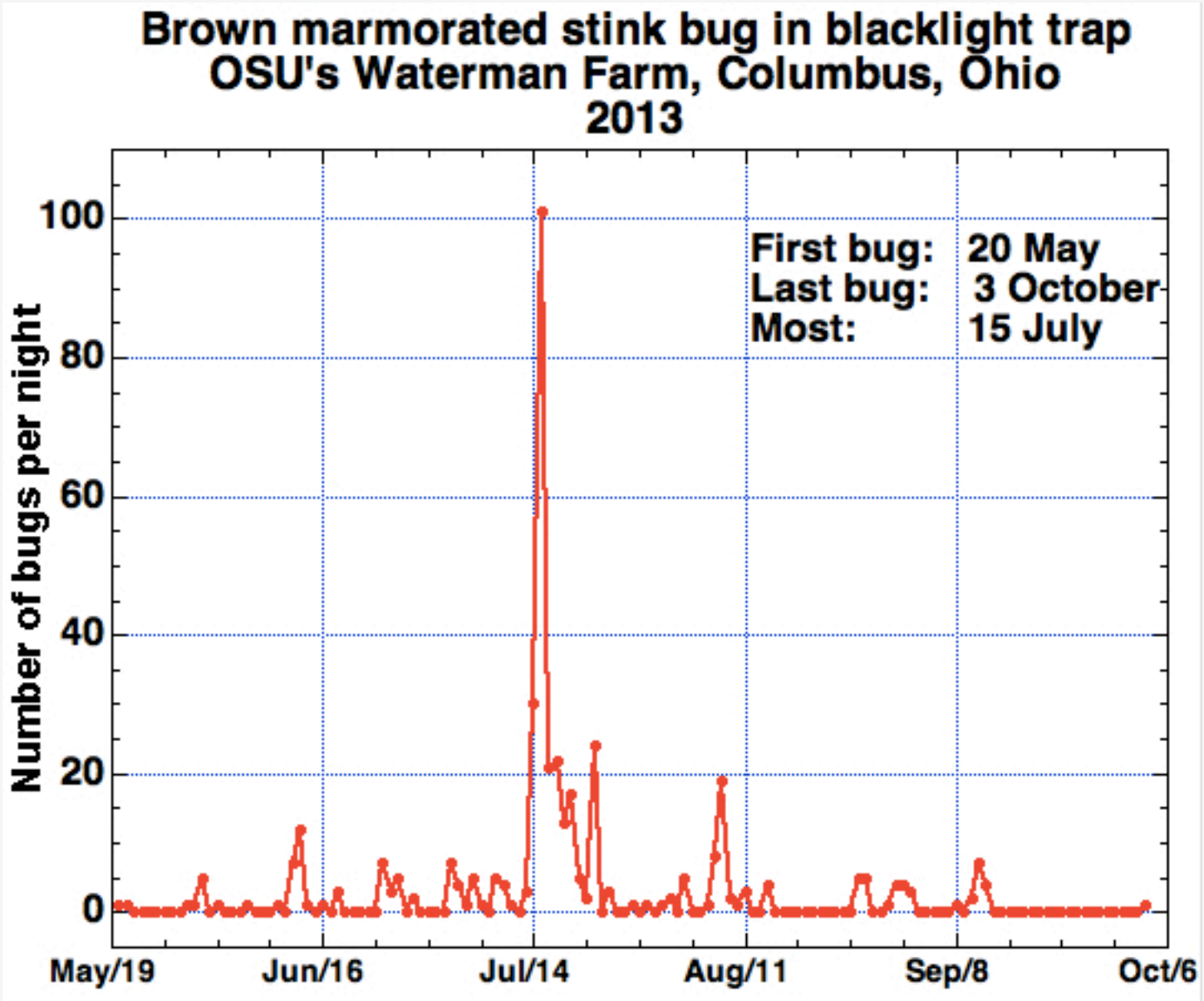

adult


nymph

- Attacks fruits & seed pods
- Invading Ohio since 2007

Brown marmorated stink bug: injury on grapes & berries

BMSB monitoring by blacklight trap, 2013



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

Product	*Apple*		*Peach*		*Raspberry*	
	PHI	*Limit*	*PHI*	*Limit*	*PHI*	*Limit*
Venom	-	-	3	1-2 ap.	-	-
Brigade, Hero	-	-	-	-	3	2-4 ap.
Belay	7	1 ap.	21	2 ap.	-	-
Leverage	7	1 ap.	7	2 ap.	-	-
Baythroid	7	1 ap.	7	2 ap.	-	-
Danitol	14	2-4 ap.	3	2-4 ap.	3	2-3 ap.
permethrin	Not after petal-fall	2 ap.	14	3 ap.	-	-
Assail	7	4 ap.	7	4 ap.	1	5 ap.
Actara	35	3 ap.	14	2 ap.	3	2-3 ap.

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
- Stong 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**

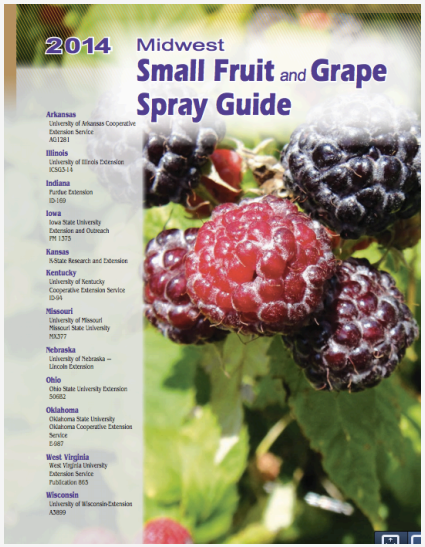
Sivanto™: Pre-harvest interval

Crop	PHI (days)	
	foliar	soil
Blueberry	3	-
Strawberry	0	-
Grape	0	30
Apples, pears	14	-
Hops	21	-

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