

Tree Fruit Pest Management 2018

Bill Shane

Michigan State University Extension

2018 MSU Extension Monday afternoon fruit update sessions

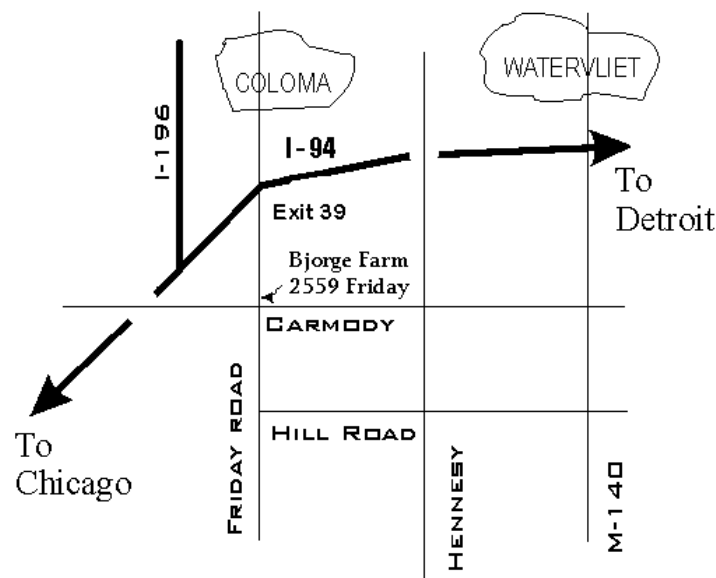
Mondays 5 PM to 6:30 PM

April 9th (tentative start date) to the end of June But no meeting on May 28th (Memorial Day).

Fruit Acre Farms (Annette & Randy Bjorge),
NE corner of Friday Rd (Coloma Exit) and
Carmody Rd, approximately 2 miles south of
I-94.

Credits toward Mich pesticide applicators
license for each meeting.

Bring samples for identification / discussion





**MICHIGAN STATE
UNIVERSITY**

MSU Agriculture Innovation Day

Focus on Fruit and Vegetable Technologies

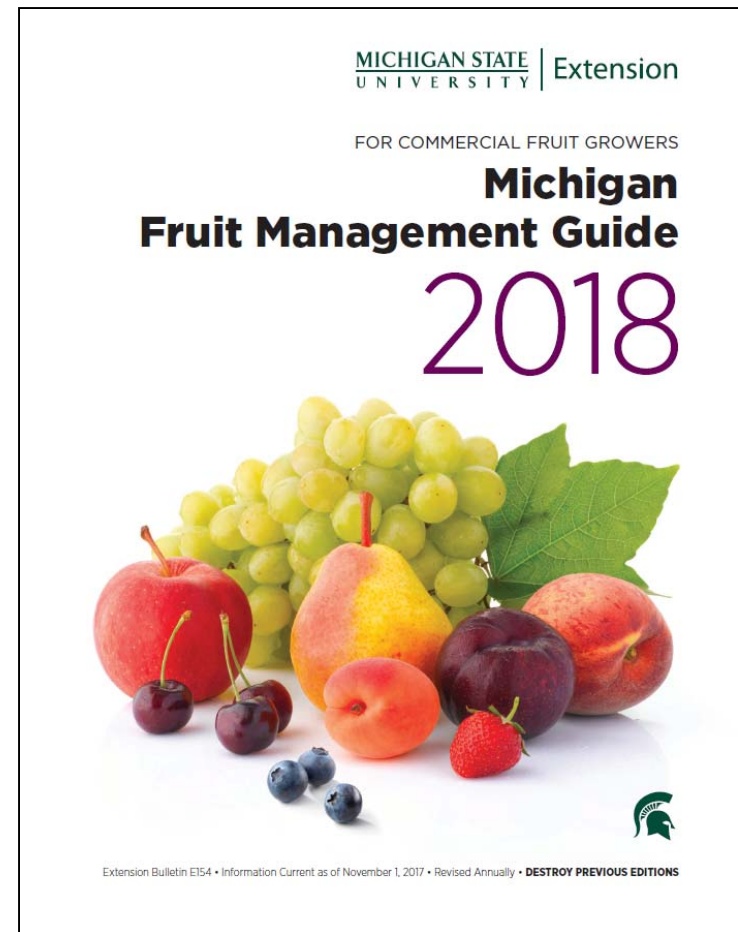
June 28, 2018

**Southwest Michigan Research and Extension Center
Benton Harbor, Michigan**

msue.anr.msu.edu/msuaginnovationday

Tree Fruit Management Update Topics:

- Early spring management
- 2018 tree fruit pest overlook
- New chemicals, label changes, resistance issues
- Insecticide & fungicide efficacies

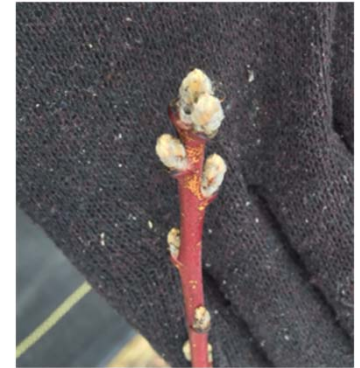


When do peaches need to be sprayed for peach leaf curl?

Peach bud swelling is estimated to start approximately 95 to 150 DD DD base 42 F from January 1.

Degree day accumulation Jan 1 through March 20

Year	Degree Days Base 42°F
2018	68
2017	183
2016	130
2015	36
2014	9
2013	40
2012	269



Peach leaf curl infections require over 10 hours leaf wetness, temperature range of 46 to 53 F and rainfall greater than 0.2 inch.



Phytophthora Root and Crown

Caused by multiple *Phytophthora* spp.

Generally related to poor soil drainage.

Made worse by planting trees too deep.

Trees 1- to 4-years-old are most susceptible.

Young trees are more likely to be infected following storms because fungus enters wounds.



Photo credit Phil Brannen, U. of Georgia



Trees affected by
Phytophthora crown
and root rot “rock”
easily

Ridomil is the most
effective, applied as a soil
spray or drench. Aliette is
applied to the foliage. It is
best used in spring when
leaves will remain attached
to the trees.

Photo credit Phil Brannen, U. of Georgia



Photo credit Phil Brannen, U. of Georgia

Streptomycin

- Kills the bacteria and has partial systemic activity
- Some areas of Michigan have streptomycin resistance
- Limit four applications of strep during bloom (re: the label)
- Antibiotics only work when the blooms are open.
- Apply antibiotics as complete sprays and add an adjuvant or surfactant.
- Antibiotic sprays are most effective when they are applied the day until the day after an infection event.
- DO NOT spray antibiotics post petal fall except in the case of a trauma event (hail, high winds)

Kasumin

- Kills the bacteria but has very little systemic activity
- Good, but costly alternative for regions having streptomycin resistance. More effective than oxytetracycline
- Like other antibiotics, it is active against blossom infections.
- Apply antibiotics as complete sprays and add an adjuvant or surfactant.

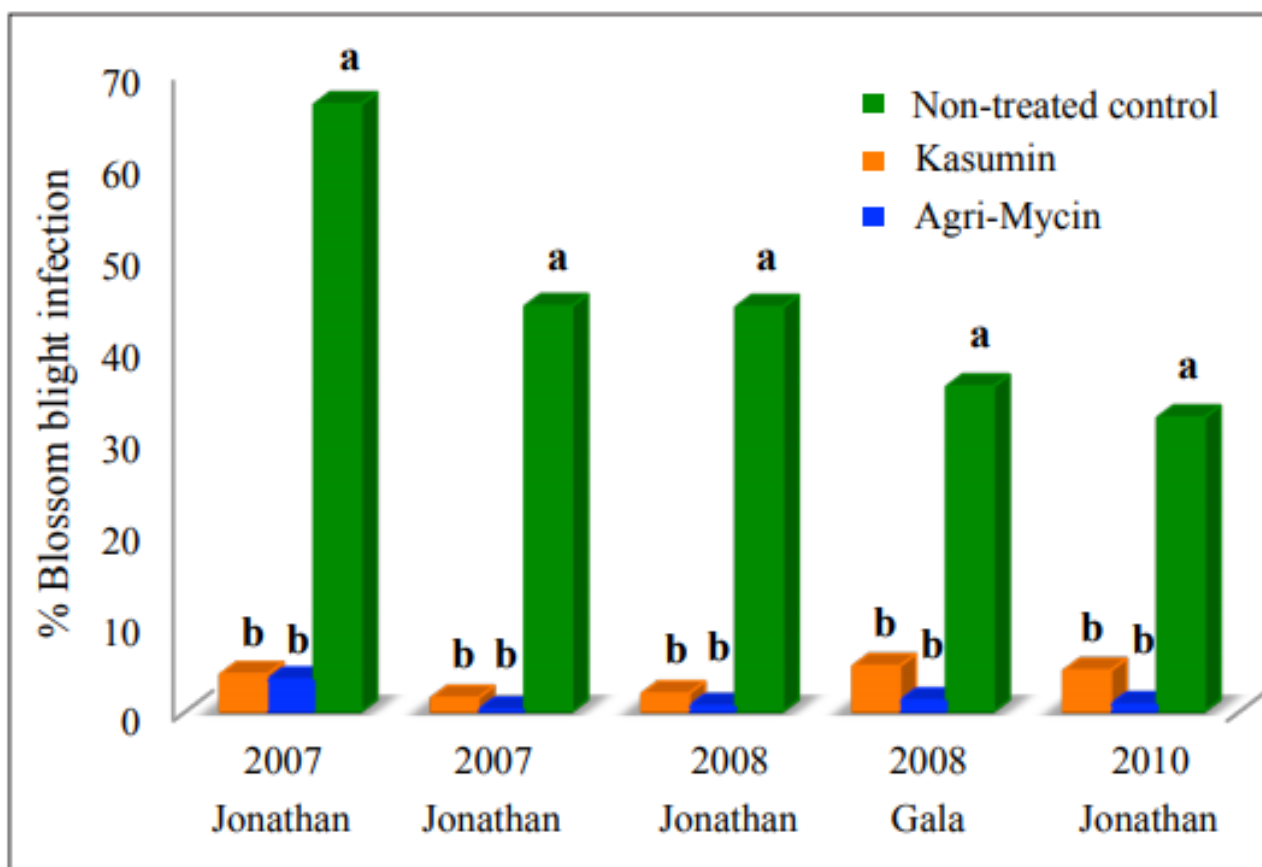


Figure 1. Disease incidence of fire blight infection (blossom blight) in non-treated apple flowers or in apple flowers treated with Kasumin 2L or Agri-Mycin in five field experiments conducted between 2007 and 2010. Trees were inoculated with a virulent strain of *E. amylovora* at full bloom. Two applications of Kasumin or Agri-Mycin were made, one day before and one day following inoculation. Different letters above bars for a particular experiment reflect significant differences ($P < 0.05$).

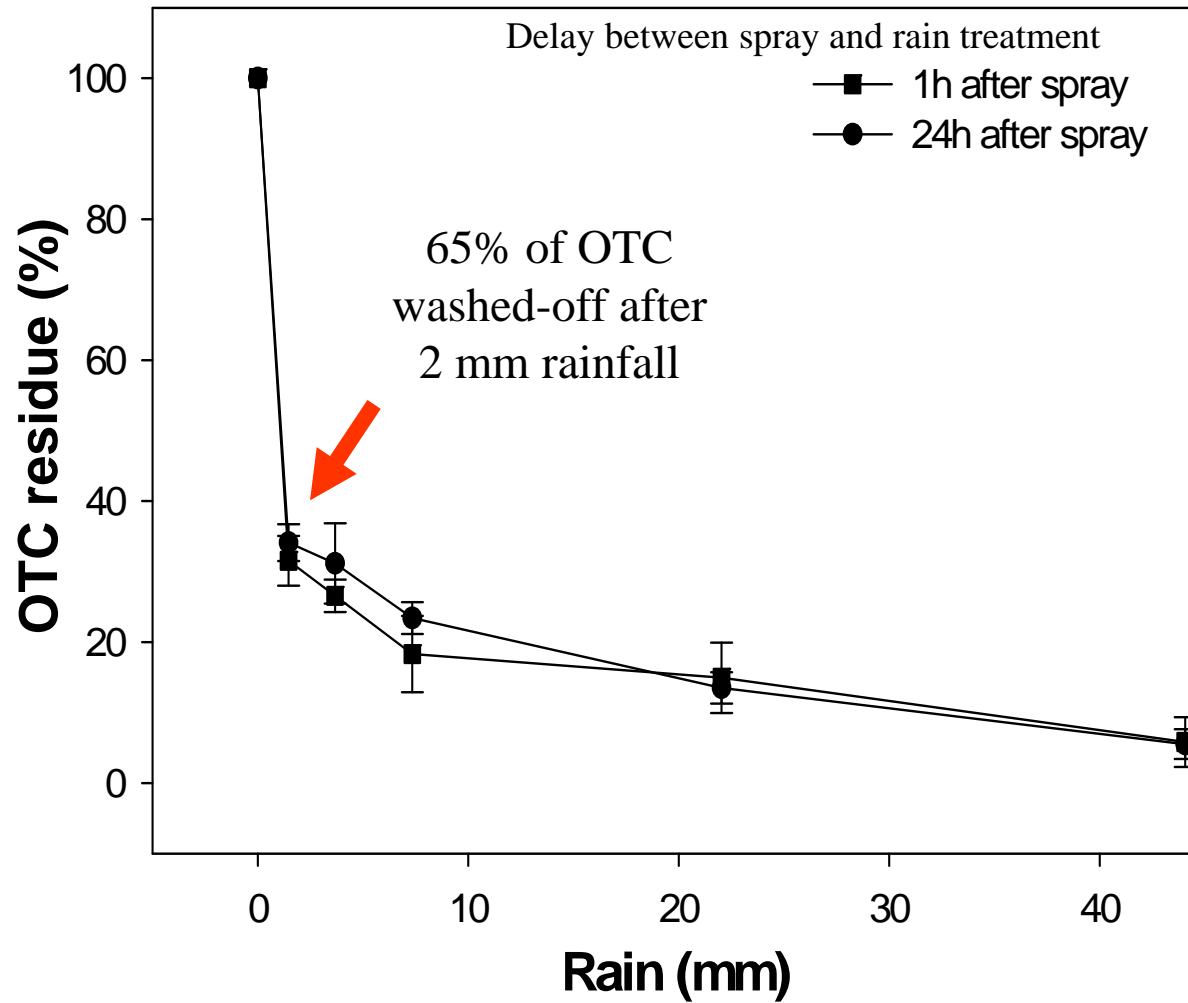
Review of materials for fire blight management

Oxytetracycline (Mycoshield & FireLine)

Limits the growth of the bacteria in the blossom. Has less back action than streptomycin



Effect of rain on Oxytetracycline (mycoshield) residue



Review of materials for fire blight management

Regalia

- Extract of giant knotweed
- Thought to stimulates the plants own defenses to fight disease.
- 1 and 2 qt/A were equal in providing approximately 20% control of the disease (compared to 70% control for strep).
- Regalia does cause some injury to blossoms: we observed brown spotting on the blossoms and premature petal fall at both rates; it was most severe at the highest rate.
- Regalia is safe on foliage and fruit.
- Growers may want to consider including Regalia in their cover sprays through terminal bud set.

Review of materials for fire blight management

Serenade Opti

Bacterial based product (*Bacillus subtilis*).

In rotation with strep, it kept the disease in check during mild to moderate conditions.

When used alone as three applications during bloom (without strep), we observed mild control under similar conditions.

Review of materials for fire blight management

Actigard

Actigard induces the plant immune response and it is labelled to be used as a tank mix with streptomycin.

Consider using Actigard (2 oz/acre) in the first and last strep sprays.

Actigard works best on small, young trees compared to larger, semi-dwarf trees. Actigard doesn't persist for a very long period of time and offers about a one week window of activated plant defenses.

Blossom Protect

- Yeast-based product (*Aureobasidium pullulans*)
- Colonizes flower, blocking the opening of the nectaries thereby preventing fire blight bacteria *Erwinia amylovora* from entering the plant.
- Penn State (K. Peters) reports 30-40% control using Blossom Protect the last couple of seasons.
- In 2016 Penn State did observe significant fruit russeting on Gala due to a lengthy wetting period following bloom last year.
- For growers concerned about fruit finish, caution is needed when using this product when rain is in the forecast.

Apogee

- Apogee is a growth inhibitor that provides excellent control of shoot blight.
- First timing for an Apogee spray is at king bloom petal fall
- Apogee is shoot specific, i.e., the effect is only observed if the shoot is covered; thus excellent coverage is essential.
- The “Apogee effect” on fire blight begins approximately 10-14 days after application
- Generally space Apogee applications out using 3 to 4 applications (once every two weeks). This strategy is effective for shoot growth control and fire blight management under low and moderate disease pressure.

Apple scab control with fungicides

Management during primary infection period; keep ahead of infection periods

Use at-risk compounds when they are most appropriate (high disease pressure, rapid leaf growth)

Use protectants early when leaf tissue area is small; in between at-risk fungicide sprays



Major apple scab fungicide classes

Broad-spectrum protectants

Captan

EBDCs – Manzate, Mancozeb

Captan + EBDC = Captozeb

– 2-2.5 lbs Captan 80WDG + 3 lbs EBDC per acre



Major apple scab fungicide classes

Single site fungicides

- SDHIs – succinate dehydrogenase inhibitors
- Anilinopyrimidines – Vangard, Scala
- ~~– Strobilurins – Flint, Sovran~~
- ~~– Sterol demethylation inhibitors – Rally~~
- 2nd generation sterol demethylation inhibitors – Inspire Super

Apple Scab Fungicide Strategies continued

FRAC Group 7 (SDHI)

Maximum of 4 (complete) applications per season

No more than 2 applications in a row.

Single ingredient - Aprovia, Fontelis, Sercadis

Premix - Lunas, Merivon



Apple Scab Fungicide Strategies continued

FRAC Group 7 (SDHI)

Aprovia - benzovindiflupyr

Fontelis - penthiopyrad

Sercadis - fluxapyroxad

Merivon – EC formulation of fluxapyroxad +
pyraclostrobin

Luna Sensation – fluopyram and trifloxystrobin
apples and cherries

Luna Tranquility – fluopyram and pyrimethanil (AP)
apples

Apple Scab Fungicide Strategies continued

Save 2 sprays of Merivon and/or Luna Sensation (FRAC Group 7) for shortly before harvest. These products will help with rots showing up in storage

Always tank mix systemic fungicides such as Merivon with a broad spectrum (EBDC, Captan) and rotate with another FRAC group. Other fungicides to consider rotating with a FRAC Group 7 could be Indar (FRAC Group 3), Inspire Super (FRAC Groups 3 and 9), Vanguard (FRAC Group 9), or Scala (FRAC Group 9).

Apple Scab Fungicide Strategies

Syllit (dodine)

- Applications aren't allowed in apples after pink, according to the label. However, applications after bloom are still allowed on pears.
- The Syllit label now requires mixing with either mancozeb or captan, but mixing with captan increases the risk of phytotoxicity.)
- Syllit has some post-infection action



Brown rot - blossom blight control strategies

Topsin (FRAC 1) with
protectant

Rovral 2F (FRAC 2) with
protectant

Vangard (FRAC 9)

Protectants - Captan, Bravo



Brown rot sporulation

Cover sprays for brown rot to prevent green fruit rot and inoculum build-up

Sulfur or Captan?

- cost (material vs. application intervals)
- efficacy (other diseases)
- chance for sulfur phytotoxicity at >80F
- Captan increases red blush on peach but has inking potential for varieties prone to this disorder

Preharvest sprays for brown rot

Use the most effective products

Consider fungicide resistance issues



Preharvest brown rot spray options

Solo products

FRAC 3 (DMI)

- (Tilt, Indar, Elite, generics)

FRAC 7 (SDHI)

- Fontelis

FRAC 11

- Abound and generics
- Extremely phytotoxic to some apple varieties

Premixtures

FRAC 7 + 11

- Pristine, Merivon

FRAC 3 + 11

- Quadris Top

Trade Name	Active Ingredient	Chemical Class	Manufacturer
1. Fontelis	Penthiopyrad	SDHI	DuPont
2. Luna Sensation	Trifloxystrobin + Fluopyram	Strobilurin + SDHI	Bayer
3. Merivon	Pyraclostrobin + Fluxapyroxad	Strobilurin + SDHI	BASF
4. Inspire Super	Difenoconazole + Cyprodinil	DMI + AP	Syngenta
5. Inspire XT	Difenoconazole + Propiconazole	DMI + DMI	Syngenta
6. Quadris Top	Difenoconazole + Azoxystrobin	DMI + Strobilurin	Syngenta
7. Topguard	Flutriafol	DMI	Cheminova
8. Pristine	Pyraclostrobin + Boscalid	Strobilurin + SDHI	BASF

2005 Peach Data

Treatment and rate/A	Brown rot incidence* (% symptomatic fruit)	
	4 days after harvest	7 days after harvest
Untreated Control	46.2 a	82.1 a
<u>PropiMax 3.6EC 4 fl oz (two applications)</u>	41.7 <u>ab</u>	68.6 <u>ab</u>
Abound 2.08F 15.4 fl oz (first spray)		
<u>PropiMax 3.6EC 4 fl oz (second spray)</u>	26.3 <u>bcd</u>	60.3 b
Pristine 38WG 14.5 oz (first spray)		
<u>PropiMax 3.6EC 4 fl oz (second spray)</u>	7.7 d	30.8 c
<u>CaptEvate 68WDG 5.25 lb (first spray)</u>		
<u>PropiMax 3.6EC 4 fl oz (second spray)</u>	34.0 <u>abc</u>	70.5 <u>ab</u>
Pristine 38WG 14.5 oz (two applications).....	17.3 cd	32.7 c
<u>Topsin M 70WP 1.5 lb + Captan 50W 6.0 lb (first spray)</u>		
<u>PropiMax 3.6EC 4 fl oz (second spray)</u>	14.1 d	53.2 b
LSD ($\alpha = 0.05$)	19.1	19.1

* Means followed by the same letter within each column are not significantly different according to Fisher's protected LSD test.

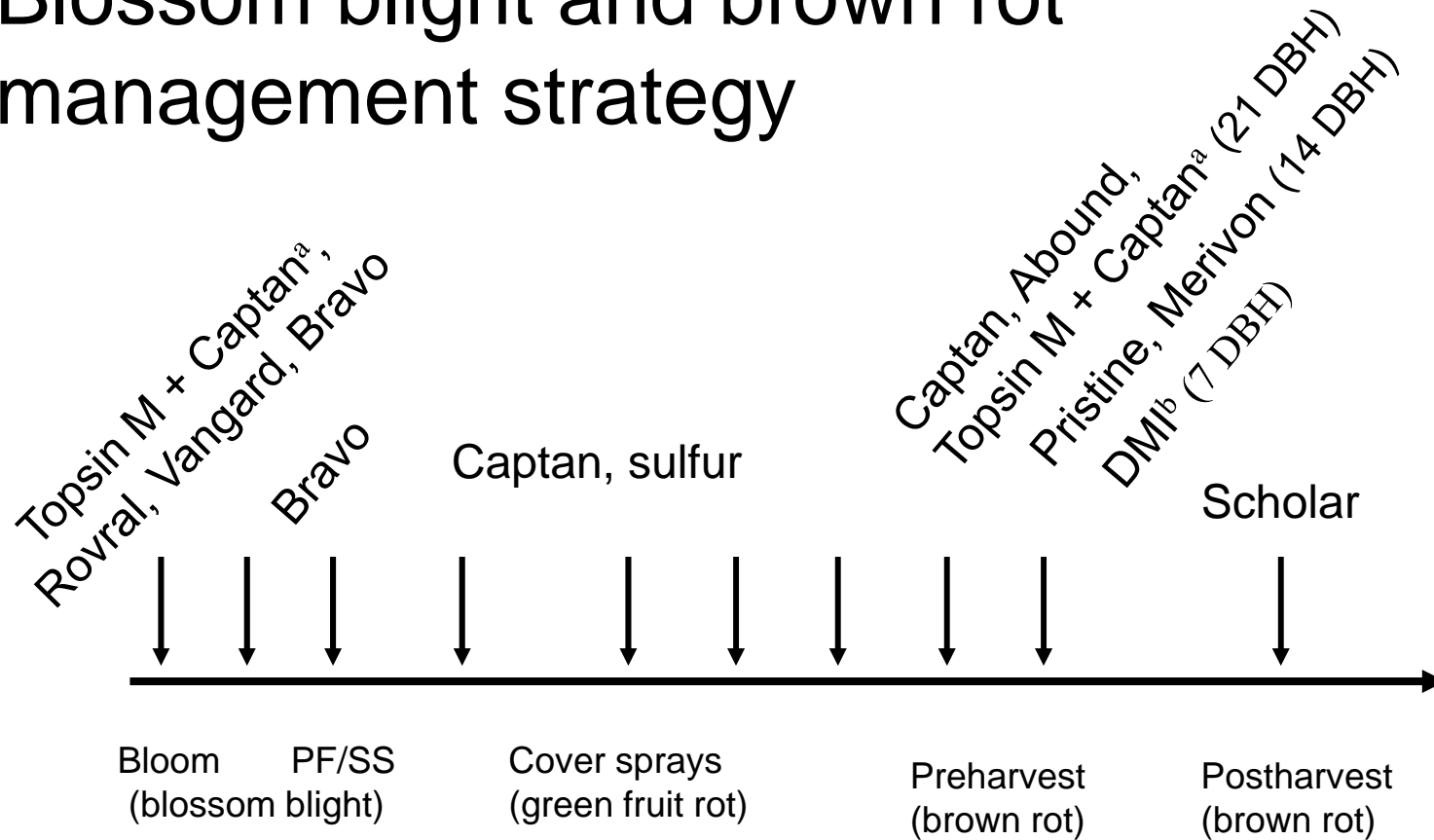
Brown rot has developed resistance to DMI fungicides.

Alternation or mixtures might overcome DMI resistance.

Pristine (boscalid) is a critical component of resistance management programs.

- Notes:
- Propiconazole = a.i. for DMI PropiMax, Propi-Star, Tilt
 - CaptEvate = fenhexamid and captan (not labeled for peach)
 - Abound = azoxystrobin (phytotoxic on some apple varieties)

Blossom blight and brown rot management strategy



^a Topsin M should only be utilized once per year, and it should always be tank-mixed with Captan products for resistance management.

^b If DMI resistance is suspected or documented, use captan instead of sulfur in cover sprays and use the high rate of Elite or Indar preharvest.

Move Over, Bedbugs: Stink Bugs Have Landed

Published: September 26, 2010

The New York Times



Steve Ruark for The New York Times

Maryland 2010

Kelli Wilson and her father, Richard Lee Pry, cleared stink bugs from her porch Friday in Burkittsville, Md. The shield-shaped invaders have damaged fruit and vegetable crops.

By KEN MACUIRE

Published: September 26, 2010



Cornell University

Hudson Valley Research Laboratory

Managing the Invasive Brown Marmorated Stink Bug Across the Urban Agricultural Interface.



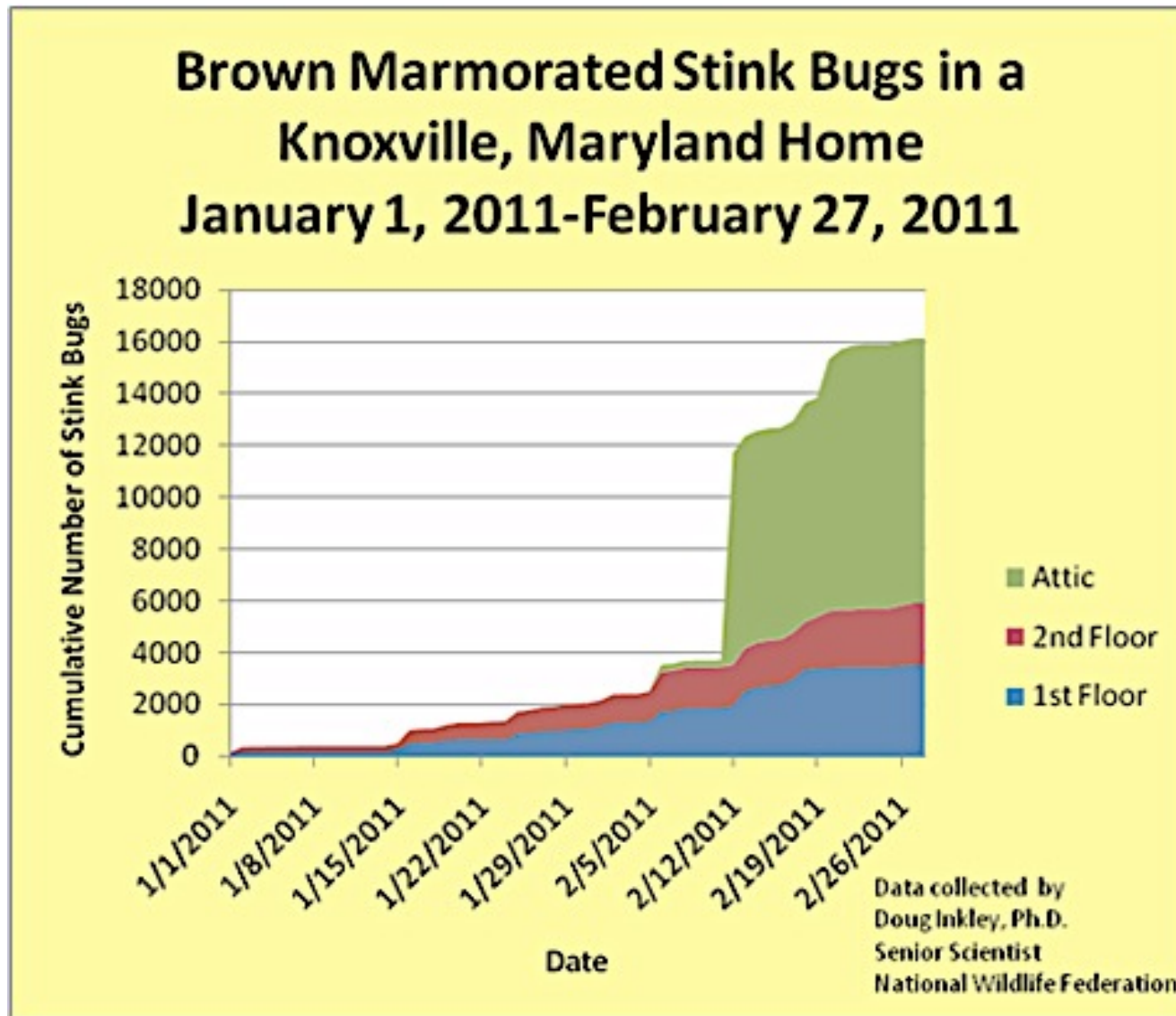
Udine, NE Italy 2017



Cornell University

Hudson Valley Research Laboratory

The Brown Marmorated Stink Bug in the Urban Environment



>22,000 BMSB collected from 1 home in Maryland 2011

Geotropic Response



Cornell University

Hudson Valley Research Laboratory

Brown Marmorated Stink Bug Feeding Injury

Surface and Internal Injury

'Loring' Peach at ~15 mm

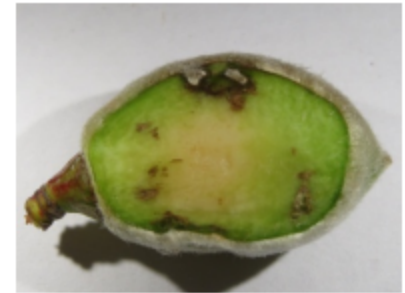
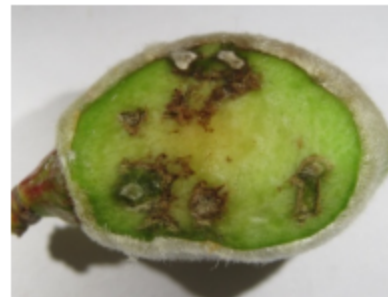
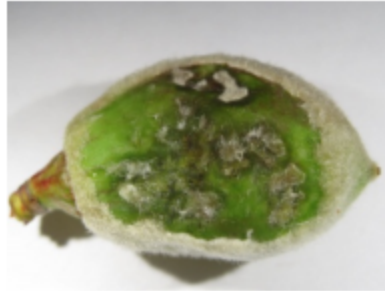
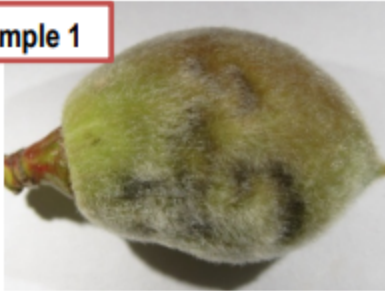
Appalachian Fruit Research Station

Kearneysville, WV 25430

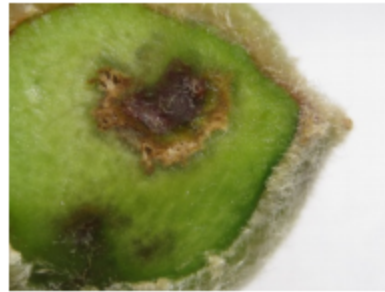
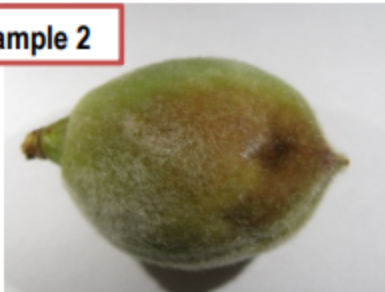
16 May 2011



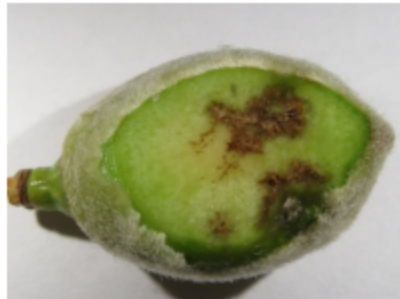
Example 1



Example 2

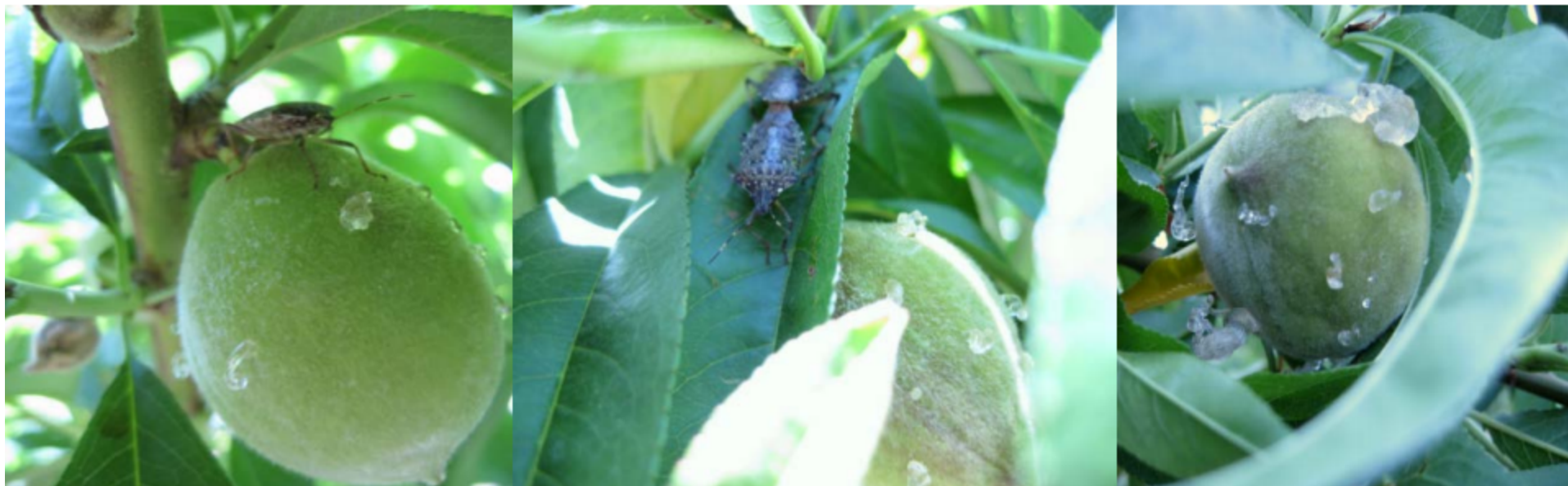


Example 3



Early and Mid-Season Damage

Internal Damage Can Be Present Even When External Damage Is Not Detectable



Tracy Leskey, USDA

Late-Season Injury on Peach



External Injury
No obvious Injury Sites on Skin



Internal Injury
Corky flesh just beneath the skin

BMSB Injury To Pears



1 Aug, 2014
d'Anjou
(+)

StopBMSB project, Orchard Crops Team

Tracy Leskey, USDA

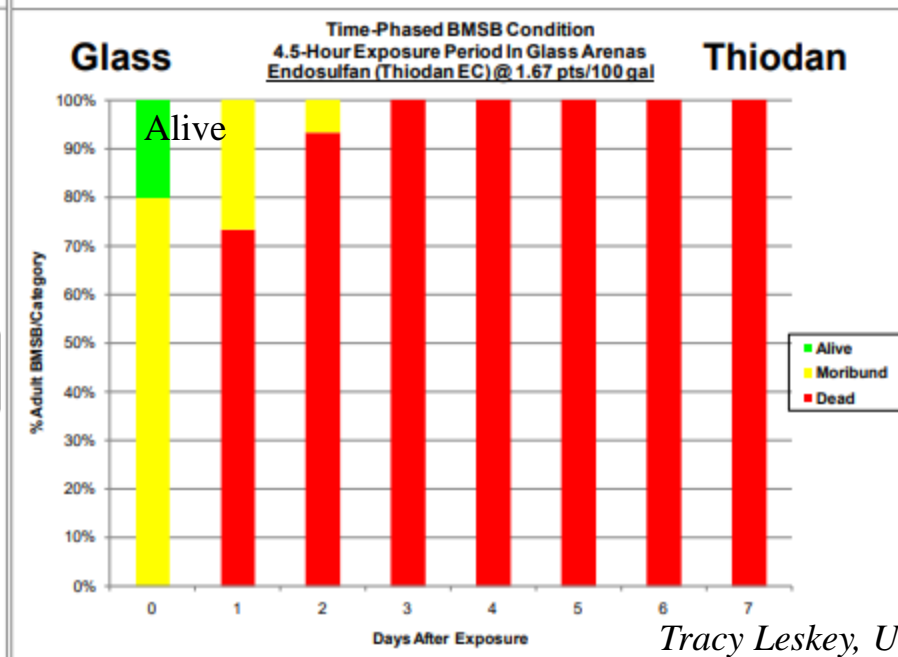
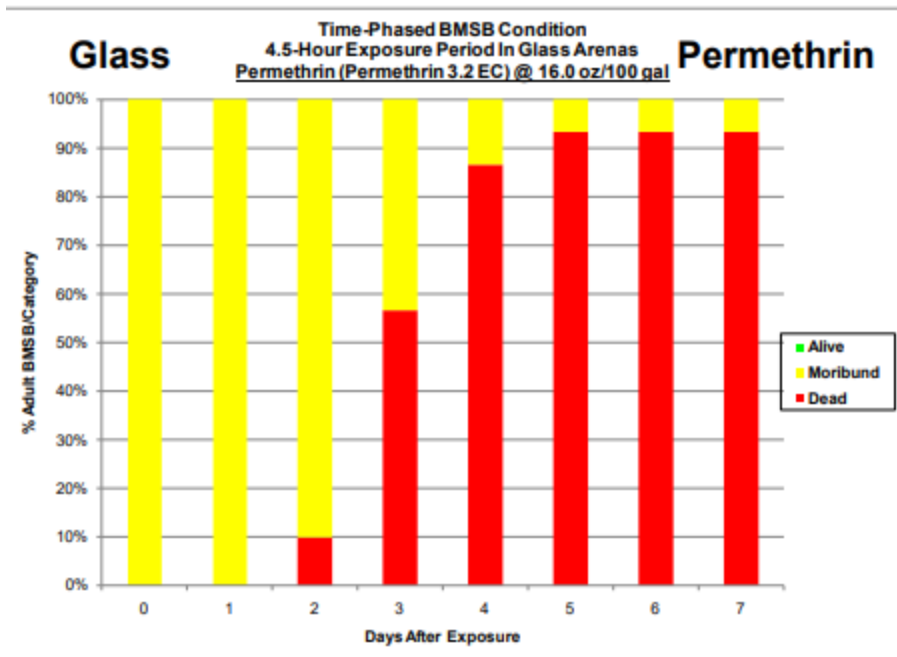
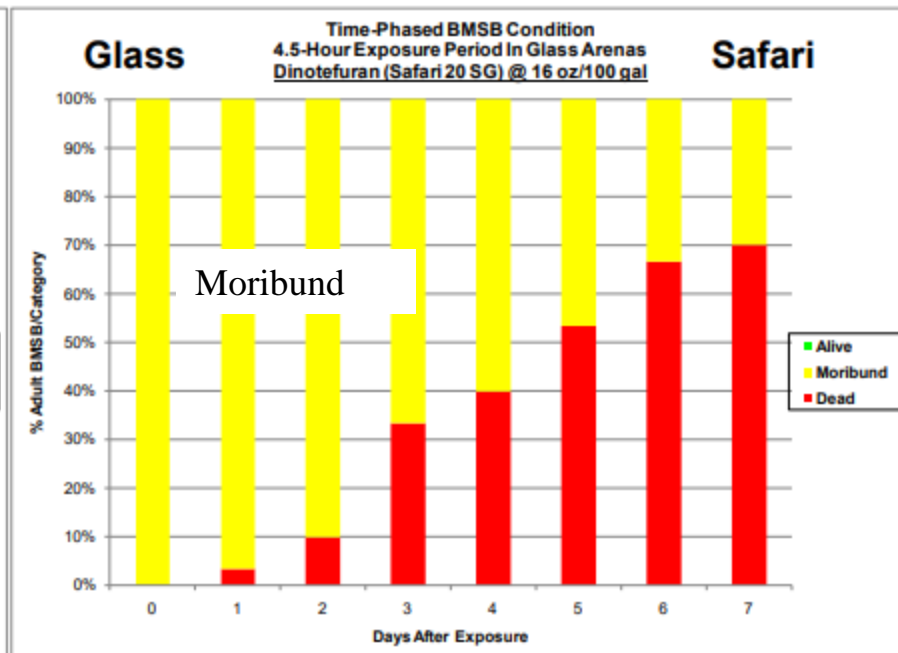
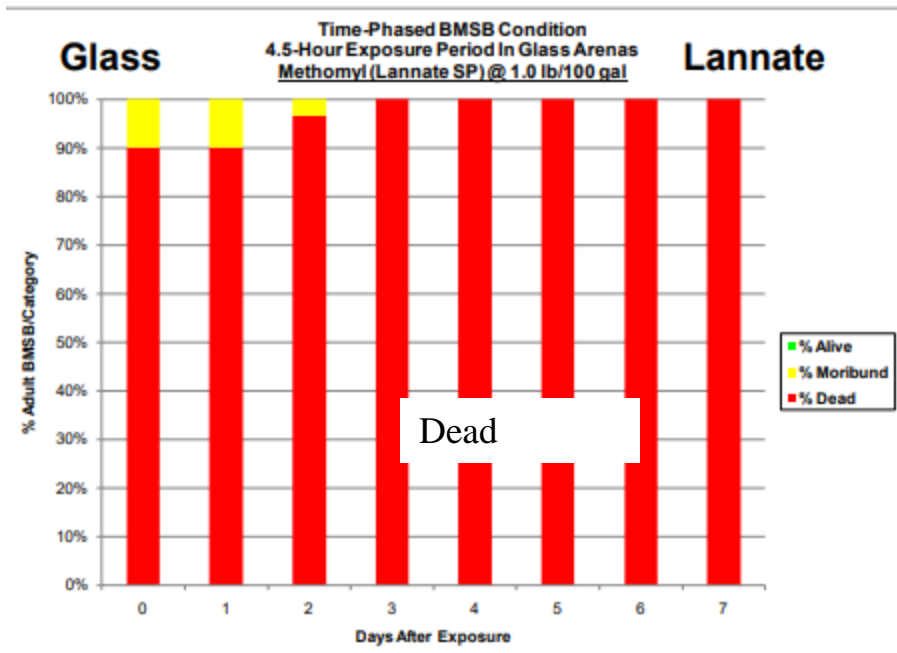
BMSB Insecticide Evaluations 7-Day Survivorship



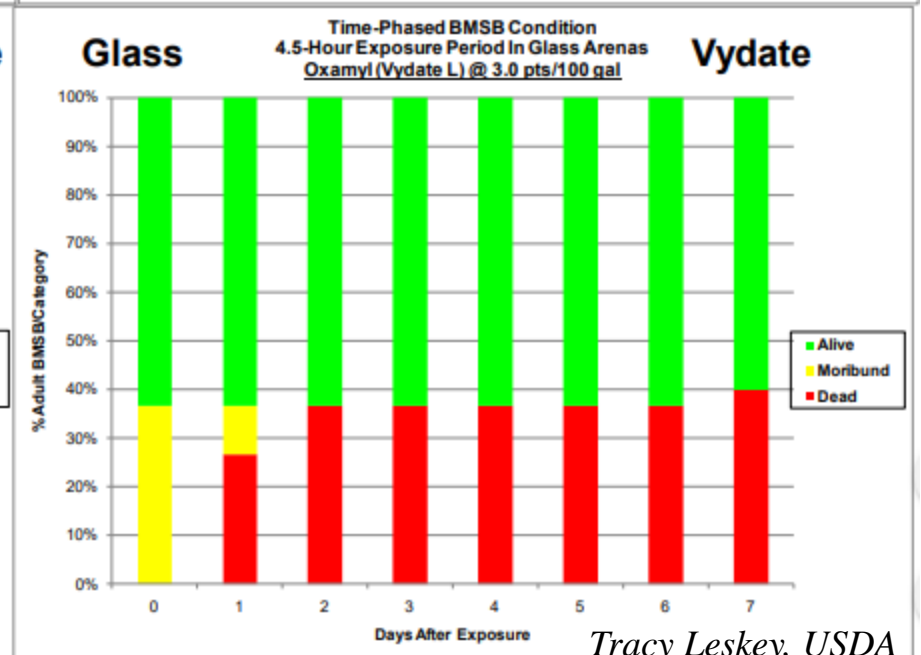
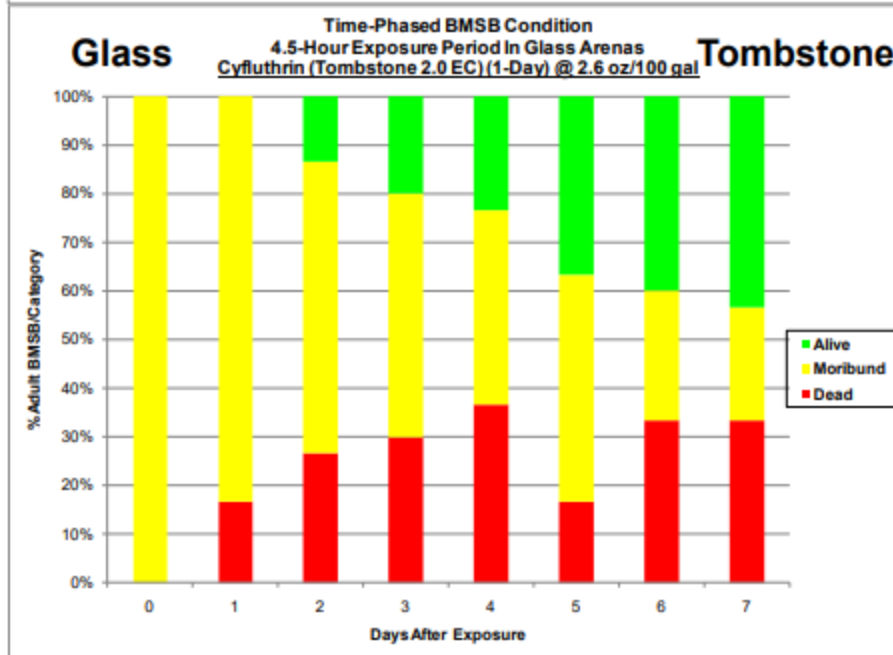
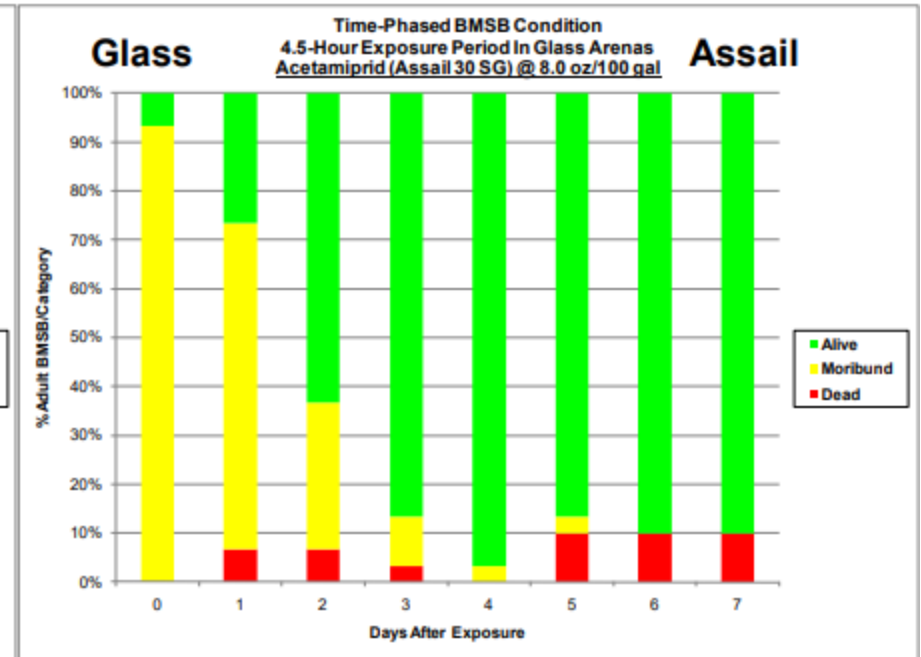
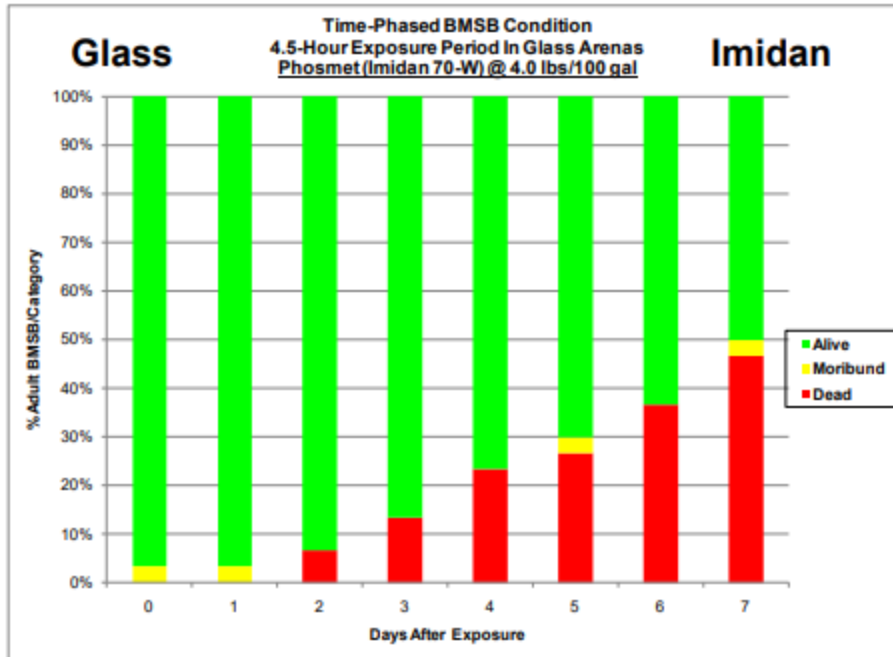
Treated carrot piece. BMSB given 4.5 hour exposure in glass arena

Tracy Leskey, USDA









Promising Compounds



Weaker Materials

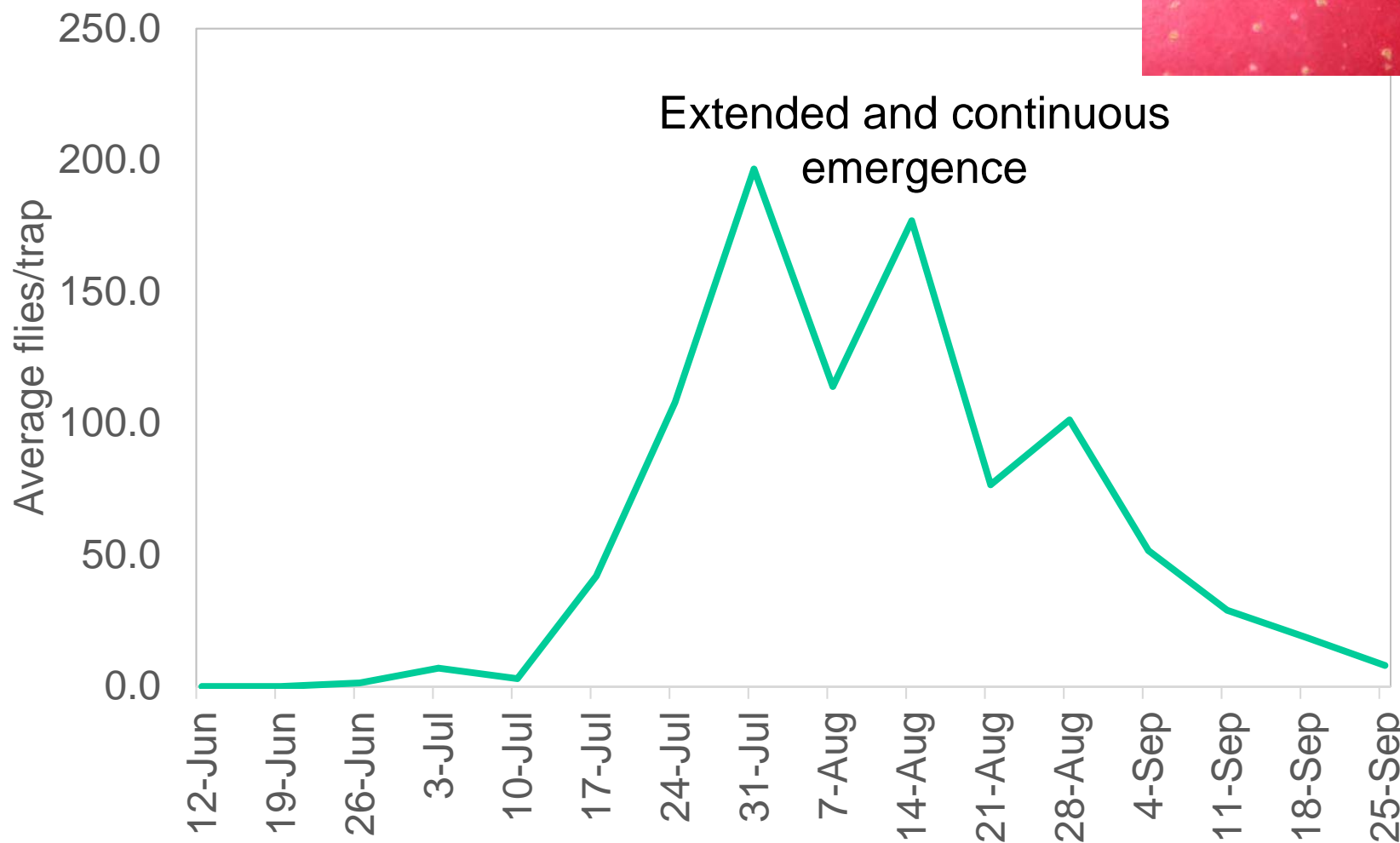


Insecticides Used Against BMSB in Tree Fruit

Insecticide	Lethality	Residual Activity (3d)	Beneficials
Methomyl (Lannate)	HIGH	LOW - MODERATE	
Endosulfan (Thionex)	HIGH	LOW	
Bifenthrin (Brigade)	HIGH	LOW	
Fenpropathrin (Danitol)	HIGH	LOW	
Lambda-Cyhalothrin (Warrior)	MODERATE	LOW	
Clothianidin (Belay)	MODERATE	MODERATE	
Dinotefuran (Scorpion, Venom)	HIGH	LOW	
Thiamethoxam (Actara)	MODERATE	LOW - MODERATE	

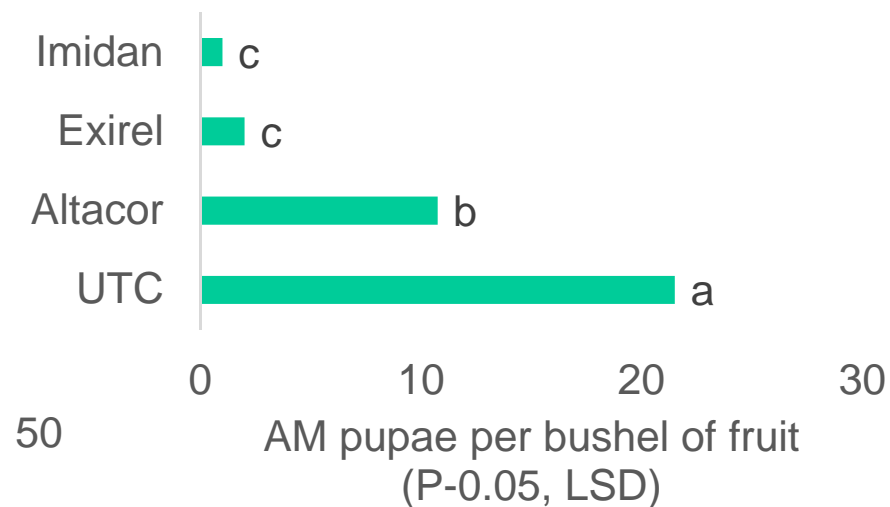
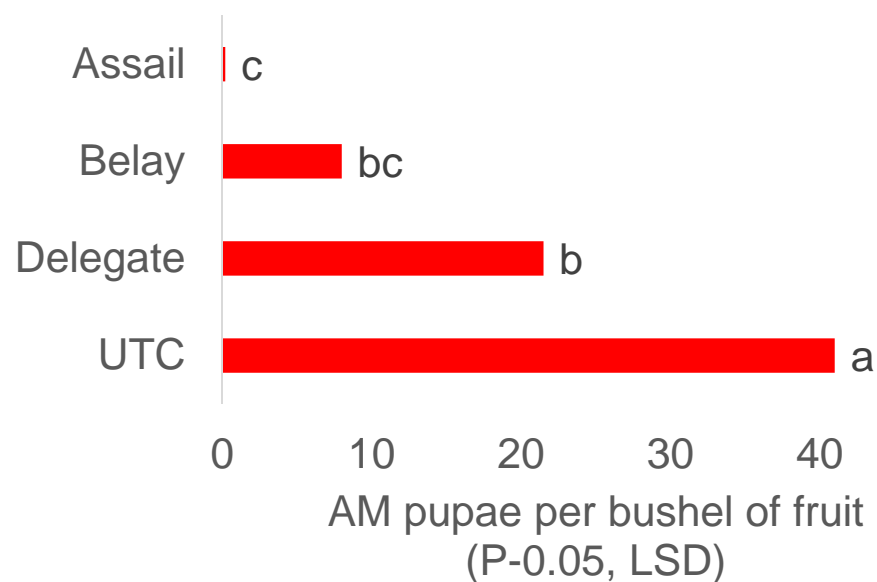
Tracy Leskey, USDA

AM activity 2017



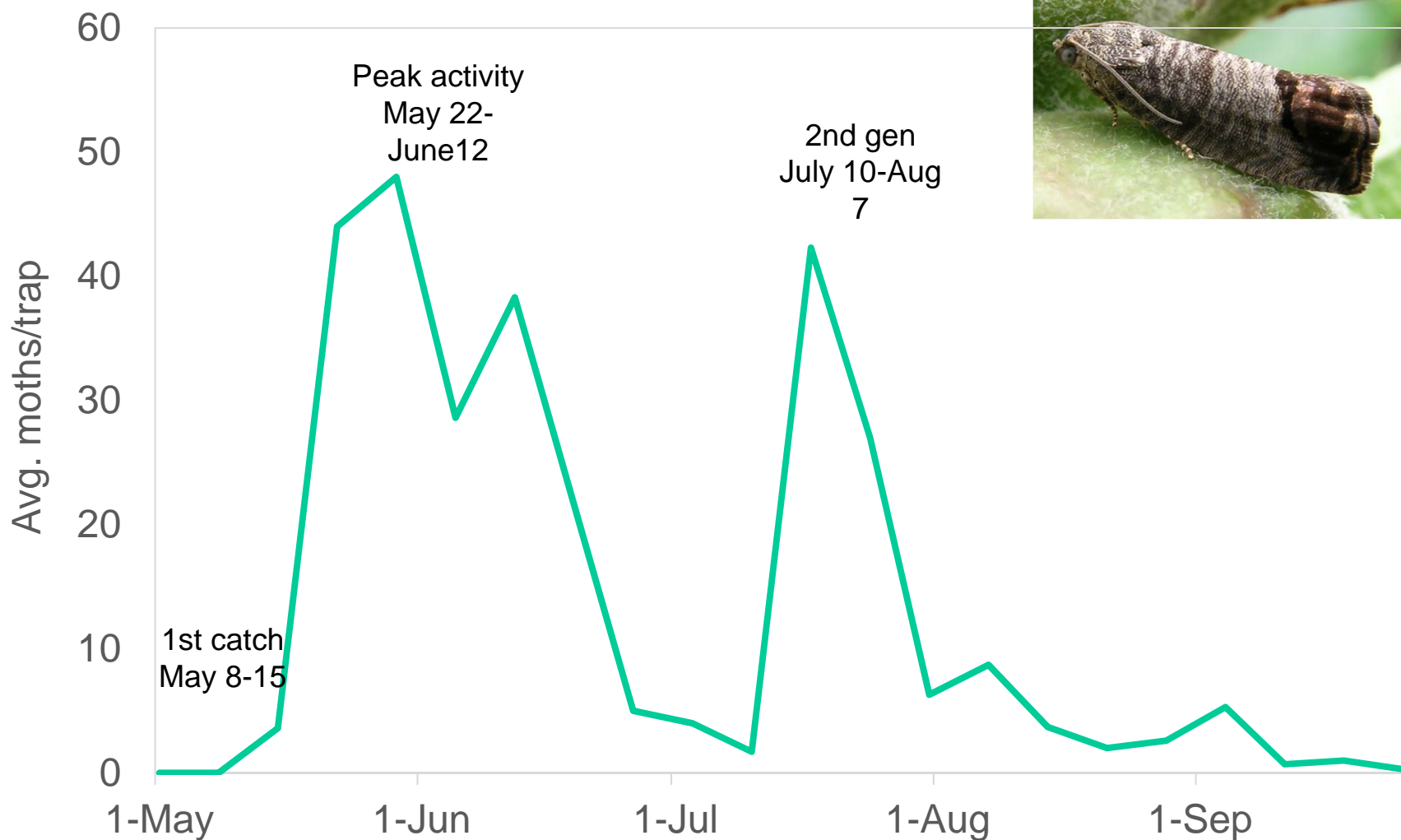
Larry Gut, Dept Hort MSU

Effectiveness of insecticides for AM control



Compound	AM efficacy	CM efficacy	Mite flaring
Imidan	Excellent	Resistance	Relatively safe
Exirel	Good-Excellent	Excellent	Relatively safe
Assail, Belay	Good-Excellent	Good-Excellent	Relatively safe
Delegate	Fair-Good	Excellent	Moderately toxic
Asana, Warrior, Danitol, Baythroid, Must. Max, Battalion	Fair-Good	Fair	Highly toxic
<u>Premixes</u>			
Leverage	Excellent	Fair	Highly toxic
Voliam Flexi	Excellent	Excellent	Moderately toxic
Minecto Pro	Good-Excellent	Excellent	Relatively safe
Endigo	Good	Good	Highly toxic

CM activity 2017



Select compounds rated excellent

Product	Chemical class	Other pests controlled
Chlorantraniliprole (Altacor)	Diamide	OFM, LR
Cyantraniliprole (Exirel)	Diamide	OFM, LR, AM
Cyclaniliprole (Verdepryn)	Diamide	OFM, LR, AM
Acetamiprid (Assail)	Neonicotinoid	OFM, LR, AM Aphids, Leafhoppers
Spinetoram (Delegate)	Spinosyn	OFM, LR, AM
Novaluron (Rimon)	IGR	OFM, LR
Flubendiamide (Belt) existing stock only	Phthalic acid diamide	OFM, LR

Larry Gut, Dept Hort MSU

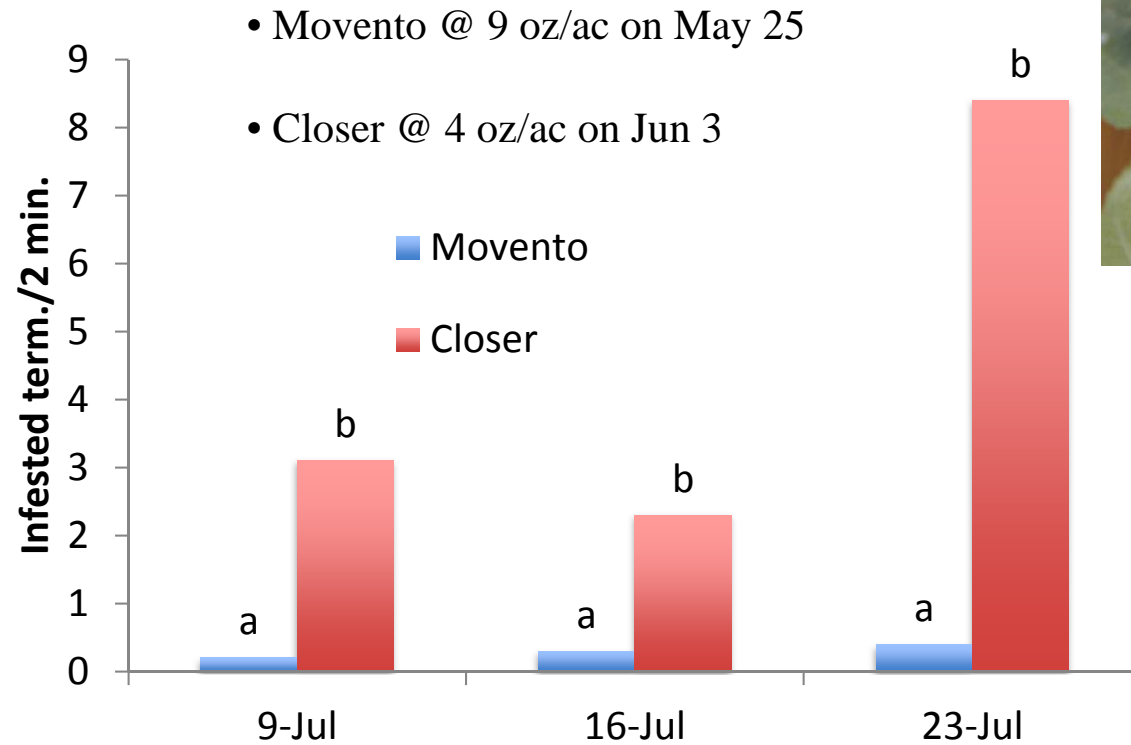
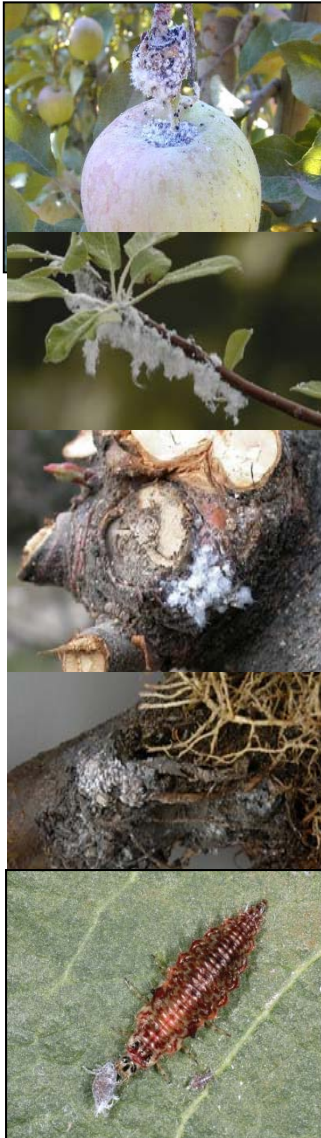
Fit in a program



Insecticide	CM	OFM	OBLR	AM
Avaunt	**	**	*	
Intrepid	**	**	***	
Esteem	**	*	**	
Delegate	***	***	***	**
Rimon	***	***	***	
Altacor	***	***	***	
Exirel	***	***	***	***
Verdepry				
β Proclaim	***	**	***	
Assail	***	***		***

Reasons for increasing occurrence of Woolly Apple aphid

- Reduced use of OP's
- Neonicotinoids less effective
- Negative impact of new compounds on natural enemies



Larry Gut, Dept Hort MSU

Insecticides for Woolly Apple Aphid in MI

Product	Chemical class	Efficacy rating
Movento	Tetramic acid derivative	Excellent
Closer	Sulfoximine	Good
Diazinon	OP	Good
Sevin	Carbamate	Fair
Neem products	Azadirachtin	Fair

Ideal peach and nectarine firmness for steps in supply chain for three marketing destinations.

Long distance chain store
16 to 12 lb*: picking, packing, transport to regional warehouse 12 to 8 lb: soft enough for transport to retail stores 8 to 6 lb: transfer to retail store & put out on display 3 to 2 lb: purchased by end consumer
Medium distance chain store
12 to 8 lb: picking, packing 8 to 6 lb: transport to retail market, put out on display 3 to 2 lb: purchased by end consumer
Local farm market
8 to 6 lb: picking and display 3 to 2 lb: should be purchased by end consumer

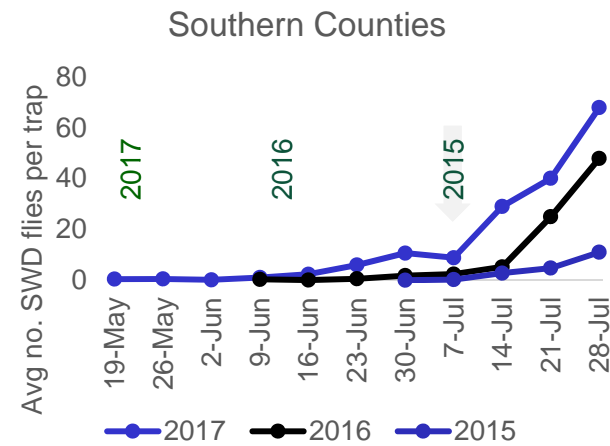
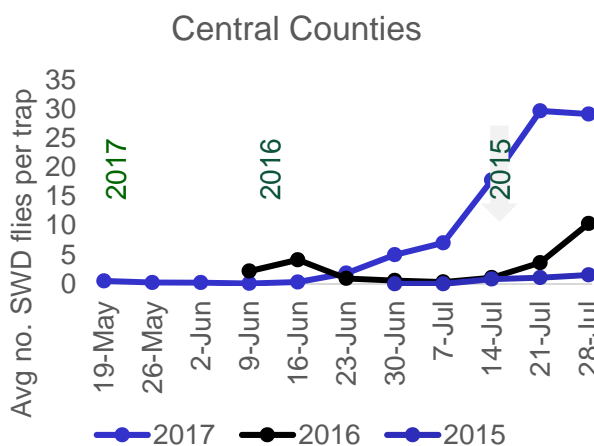
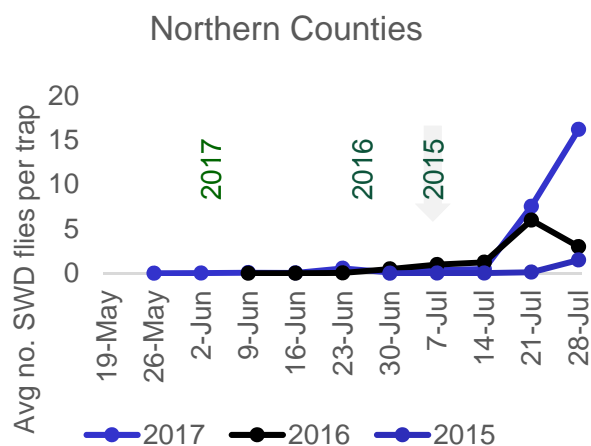
SWD trapping network 2015-2017



Summaries provided by Julianna Wilson

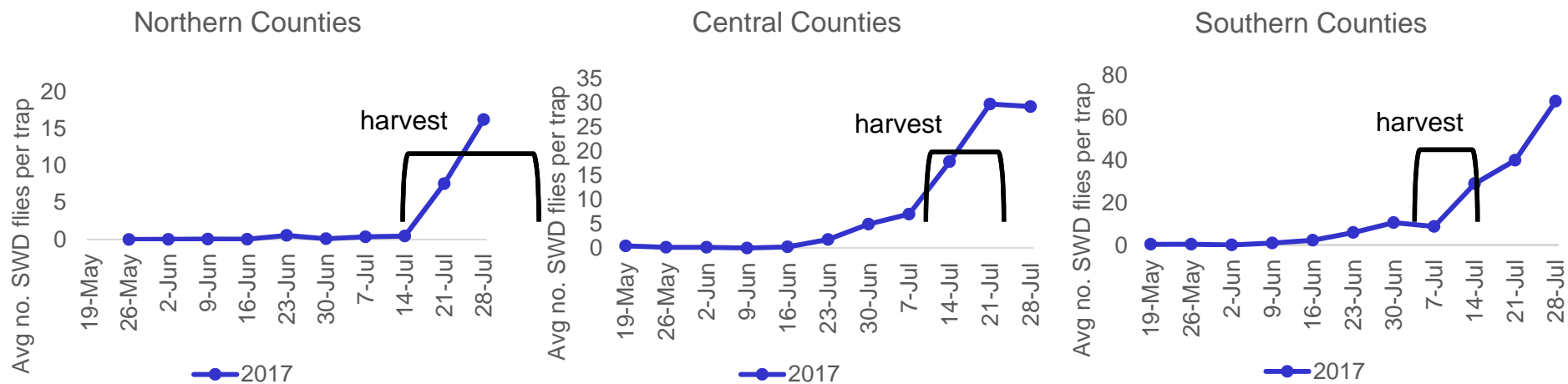
High SWD pressure in 2017

First sustained catch 3 weeks earlier than last year

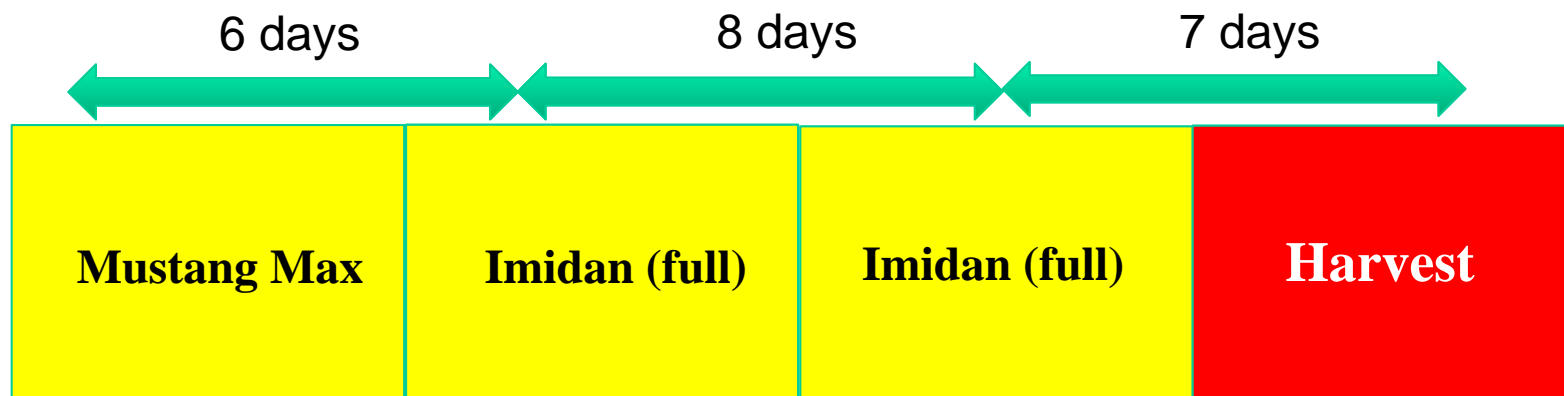


SWD trapping network - 2017

For the first time, SWD populations were building during harvest in all cherry production regions



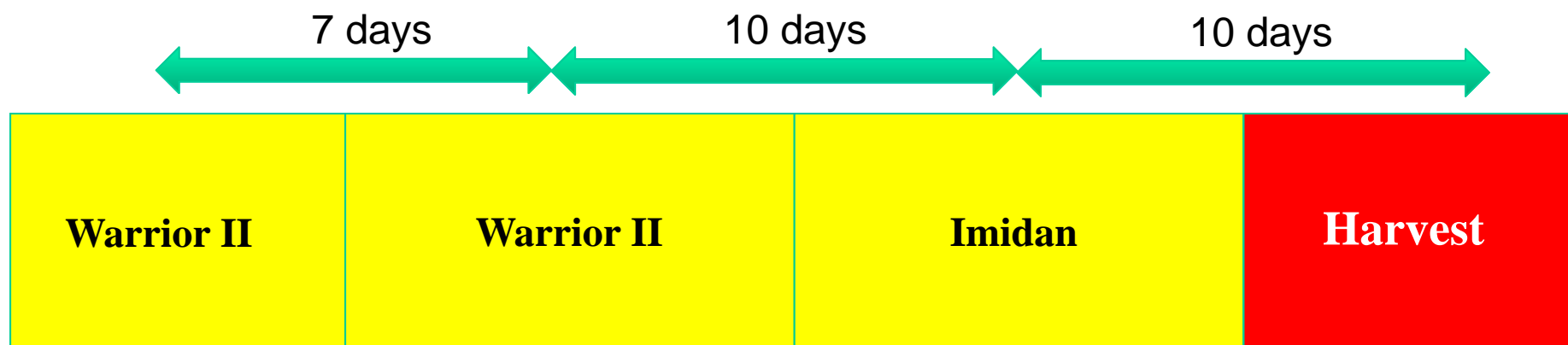
West Central program without detectable SWD larvae at harvest



ca 3 weeks
before
harvest

- **Good spray intervals**
- **Highly effective material (Imidan)**

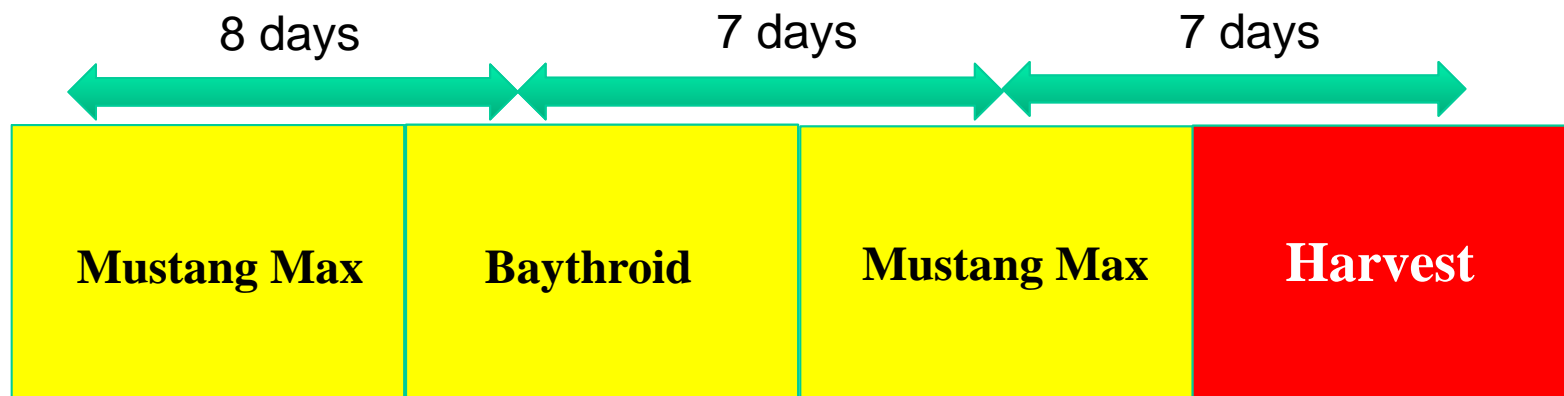
West Central program with detectable SWD larvae at harvest



ca 4 weeks
before
harvest

- **Highly effective material (Imidan)**
- **Extended spray intervals**

West Central program with detectable SWD larvae at harvest



ca 3 weeks
before
harvest

- **Dependence on pyrethroids with 7+ day intervals**
- **Including weaker material (Baythroid)**

Carefully consider the trade-off between efficacy and cost

Best not to select a pyrethroid for the critical 10-14 day prior to harvest time

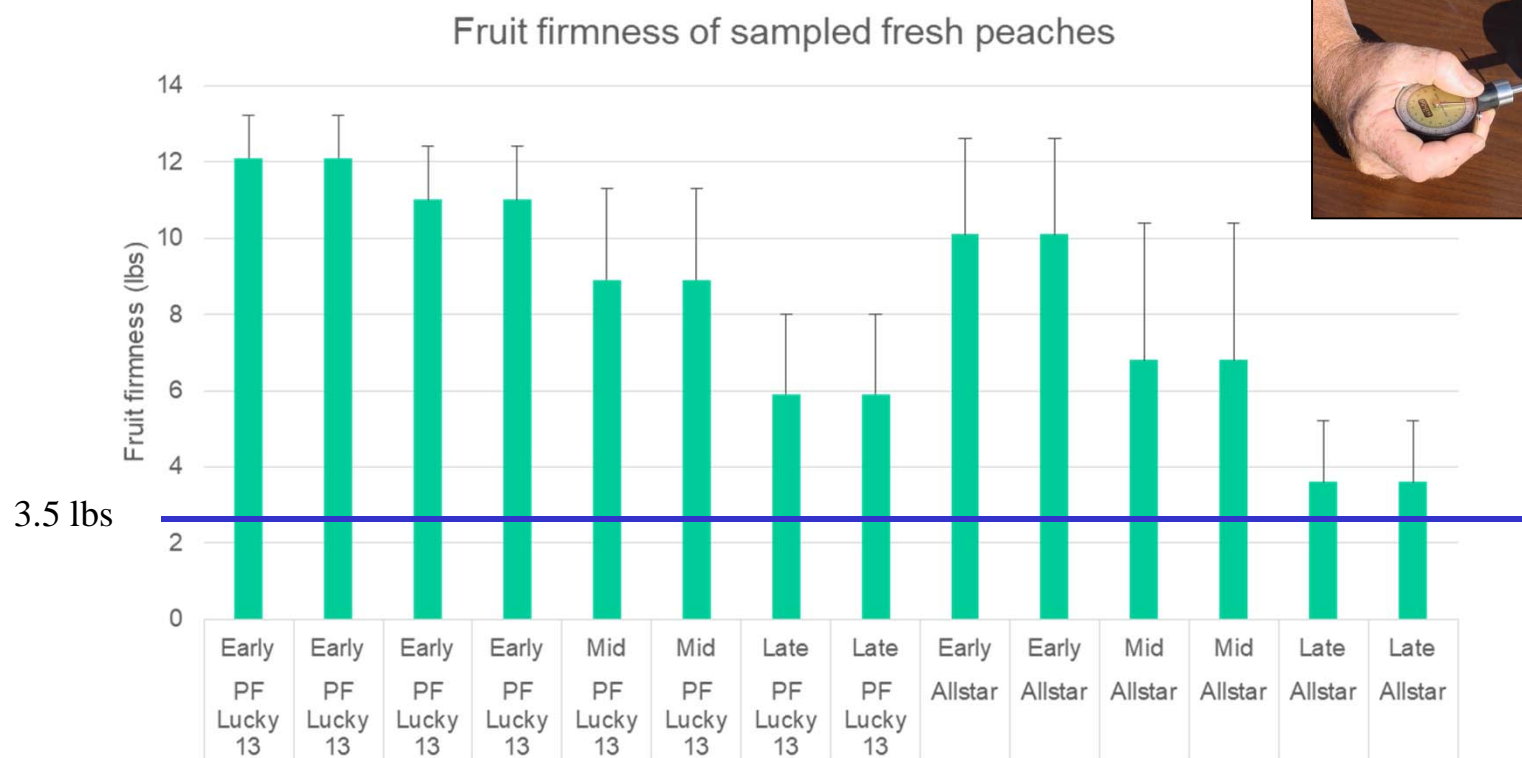
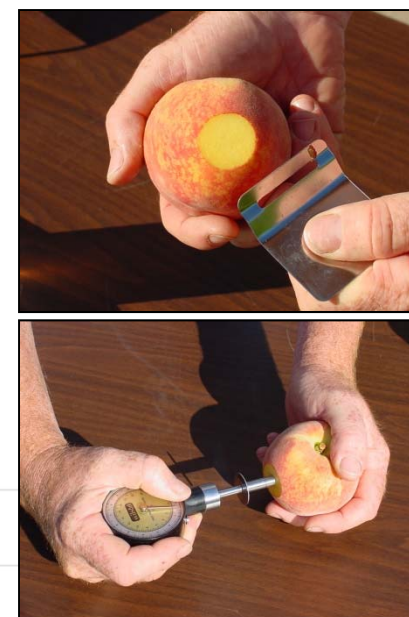
Relying on pyrethroids for 7 days of activity can be risky

Stretching pyrethroids past 7 days, is problem



Material	Cost /A est., 2017 data
Mustang Max (e)	\$4.06
Baythroid (g)	\$5.03
Warrior II (e)	\$6.25
Imidan (e)	\$22.19
Danitol (e)	\$30.05
Delegate, 6 oz (g)	\$52.90
Exirel, 13.5 oz (e)	\$56.14

Pressure testing results



Larvae and adult results

- No SWD larvae were isolated from these fruits at early, middle, or late season picking
- No adult SWD reared from field samples
- Several adults reared from Allstar “no choice” tests
- Fruits softer than 3.5 lbs not tested



Bacterial Spot Management



Begin early shuck split and continue on a 7-14 day interval up to pit hardening, perhaps longer if leaves are infected.

The disease is favored by warm (75°F to 85°F), wet, and windy conditions.

Primary management tools include oxytetracycline (FireLine, Mycoshield) and copper.

Oxytetracycline has a max of 48 hours activity

Other products Penn State has evaluated to date that show promise and can be used in rotation include Serenade Opti (14 oz/A) and Regalia (1 qt/A).

Questions?



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