



# Insect Pest Management Tools

(e.g., insecticides)

New names

but not new active ingredients:

Bexar<sup>®</sup>, Voliam<sup>®</sup> flexi,  
Besiege<sup>®</sup>, Cormoran<sup>®</sup>,  
Leverage<sup>®</sup>, Admire Pro<sup>®</sup>,  
Ultor<sup>®</sup>, and more...

Assail

SpinTor

**New products for 2019:**

Versys<sup>®</sup> - afidopyrofen

PQZ<sup>®</sup> - pyrifluquinazon

*Conventional insecticides*

**Mating  
disruption  
products**

Grandevo

Surround

Venerate

Entrust

*Bacillus  
thuringiensis*

CM Virus

Horticultural oils  
and soap

*Bio-rational and organically  
approved insecticides*

# How do insect pheromones function?

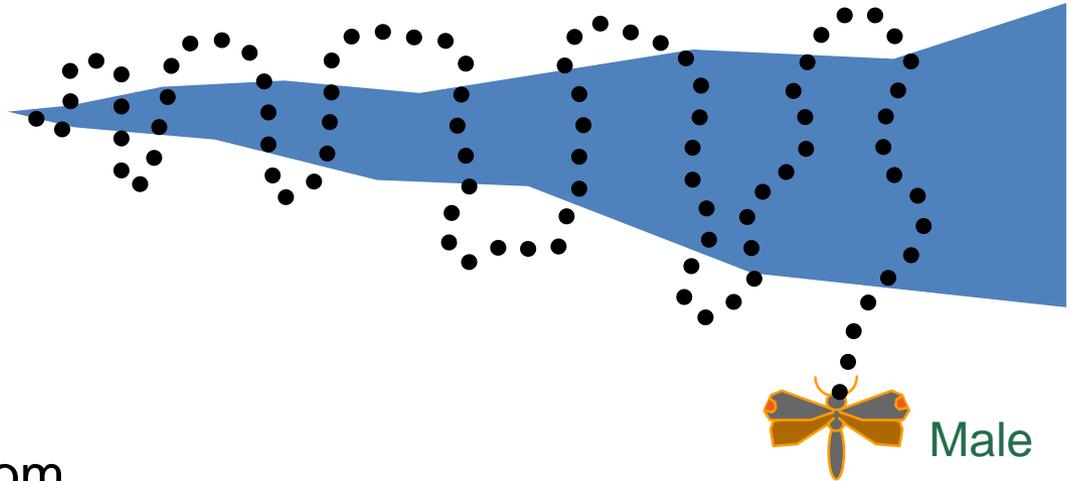
Wind



Female

Female release pheromone from specialized gland;  
Straight chain of ca. 12-14 carbon alcohols, acetate, aldehydes;  
Typical pheromone is a blend of 3-4 compounds.

Pheromone Plume



Male

Male antennal sensilla detect and sift pheromone molecules from air;  
Odorant stimulates receptor cells within antenna;  
Males become able to find female moths.

Each insect species has unique, species specific sex pheromone

# Use of insect sex pheromones in pest management...

- Mating disruption does not kill anything: influences insect behavior – “*Birth Control for Bugs*”.

## Mating disruption

Sex pheromone is the main MD pest management tool

Insects are “Confused!”



No death with MD, population reproductive effect only

Very selective, only target pest is affected, beneficial insects are not affected

Delayed mating effect

Each species has a different, species specific sex pheromone

## Insecticides

Corrective, fast acting, approach, good for immediate response

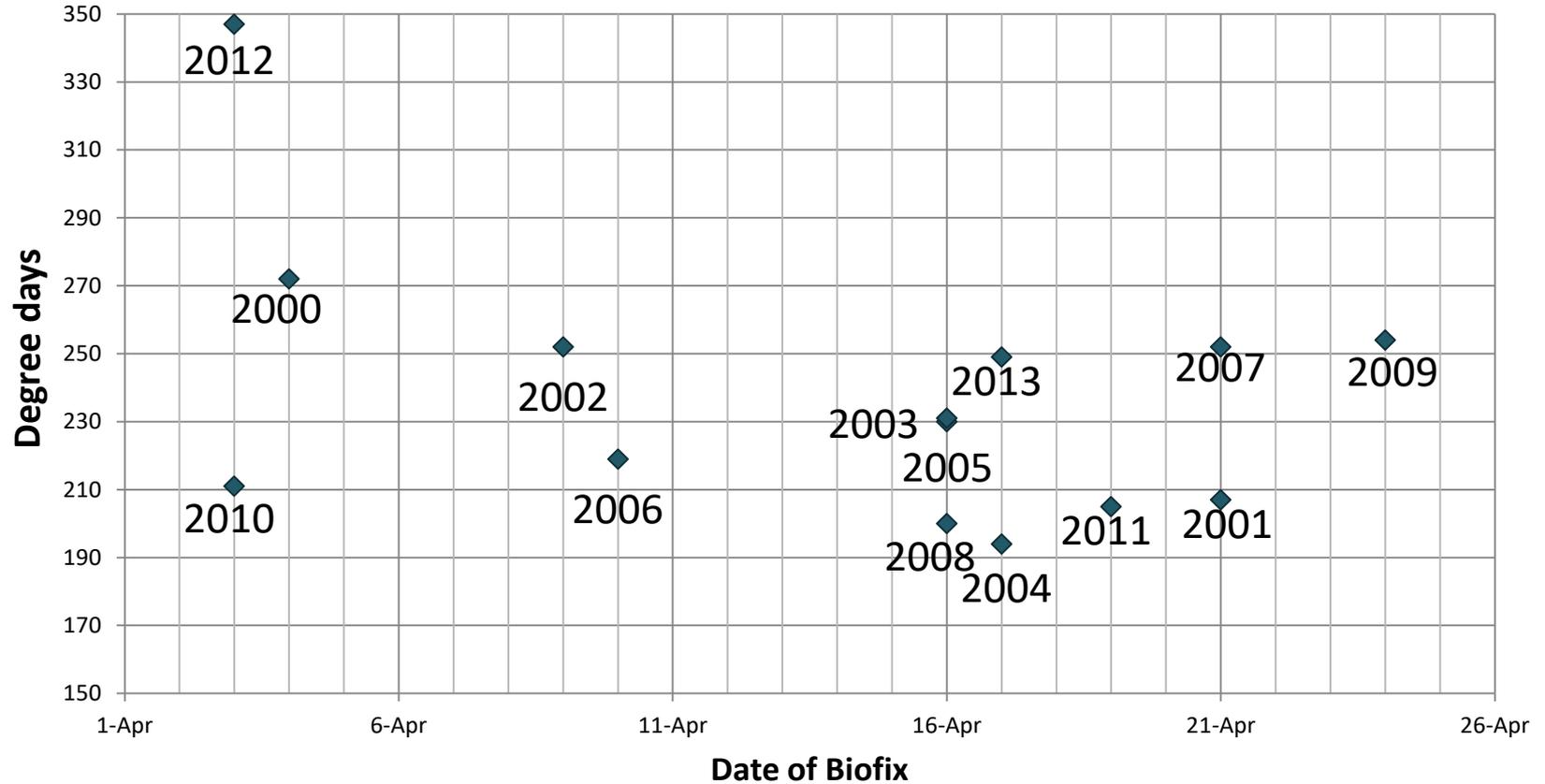


Possible negative environmental effect

Broad spectrum activity, pests and beneficial insects are killed (non-target impact).

# Oriental Fruit Moth

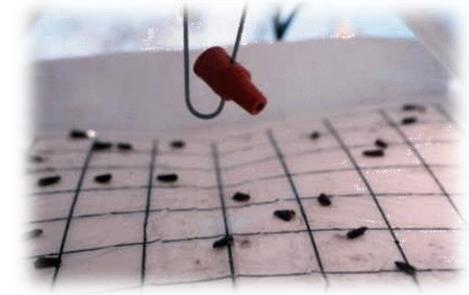
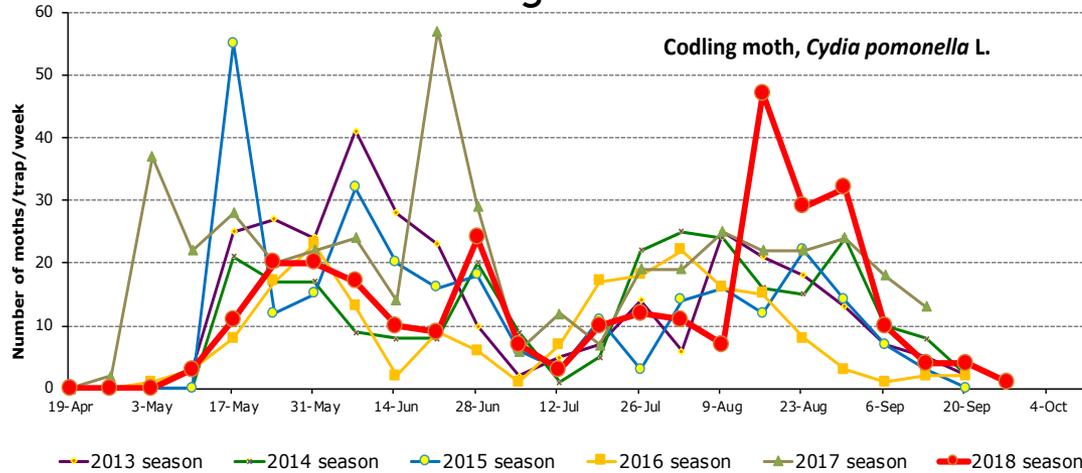
Degree days (DD) accumulated from **Jan 1 to Biofix**



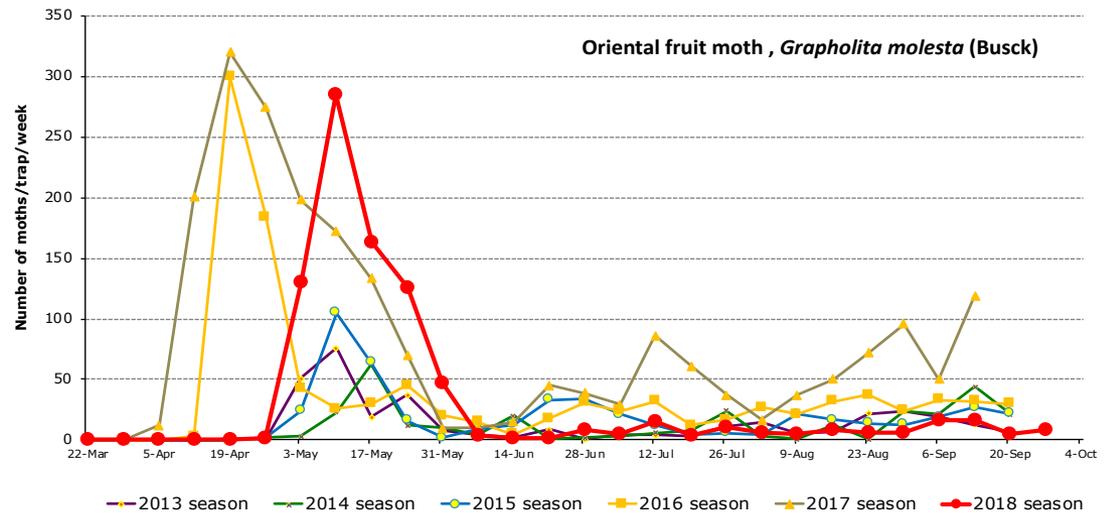
*OFM biofixes from 2000 to 2013 season (base 45°F)*

# Seasonal activity of CM and OFM

## Codling moth



## Oriental fruit moth



Moth capture data collected from the the same PSU FREC Biglerville orchards

Moth capture information at the PSU FREC web site available during the season

Greg Krawczyk, 2019



## Mating disruption: products

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# Mating disruption products in fruit (2019)

**Suterra®**

**CheckMate®**  
OFM Dispenser

**CheckMate®**  
CM-XL 2.0  
Dispenser

**CheckMate®**  
Puffer® OFM-O

**CheckMate®**  
Puffer® CM-OFM Pro

**CheckMate®**  
Puffer® CM-O

**CheckMate®**  
CM 2.0  
Flowable

**CIDETRAK® DAMEC**

**CIDETRAK® CMDA COMBO MESO-A**

**CIDETRAK® CMDA + LR Dual MESO**

**CIDETRAK® CMDA + OFM MESO™**

**CIDETRAK® CM-OFM COMBO**

**CIDETRAK® OFM-L MESO™**

**TRÉCÉ®**  
INCORPORATED



**ISOMATE® PTB DUAL**



**ISOMATE® DWB**



**ISOMATE® OFM TT**



**ISOMATE® CM/OFM MIST PLUS**



**ISOMATE® CM/OFM TT**



**PACIFIC BIOCONTROL CORPORATION**  
The Market Leaders in Pheromone Mating Disruption

# Mating disruption products in fruit

## Borers, 2019



**Dogwood Borer**



**ISOMATE® DWB**

Dogwood borer,  
150-100 disp.

**Peach Tree Borer**

**Lesser Peach Tree Borer**



**ISOMATE® PTB DUAL**

Lesser peachtree  
borer,  
Peachtree borer,  
150 disp.



# Mating disruption products in fruit

## Oriental fruit moth, 2019



**CheckMate®**  
Puffer® OFM-O

1-2 /ac

**CheckMate®**  
Puffer® CM-OFM Pro

1-2 /ac



**ISOMATE® CM/OFM MIST PLUS**

1 /ac



**CIDETRAK® CMDA + OFM MESO™**

30-32 /ac

**CIDETRAK® OFM-L MESO™**

18-32 /ac

**CIDETRAK® CM-OFM COMBO**

200 /ac

**CheckMate®**  
OFM Dispenser

100-200 /ac



**ISOMATE® OFM TT**

50-100 /ac



**ISOMATE® CM/OFM TT**

200 /ac



# Mating disruption products in fruit Codling moth, 2019



2.4-4.8 fl oz/ac

**CheckMate**<sup>®</sup>  
CM 2.0  
Flowable



18A+18B /ac

**CIDETRAK** CMDA+LR Dual MESO<sup>™</sup>

120-200 /ac

**CheckMate**<sup>®</sup>  
CM-XL 2.0  
Dispenser

18-36 /ac

**CIDETRAK** CMDA COMBO MESO-A

**CheckMate**<sup>®</sup>  
Puffer<sup>®</sup> CM-O

1-2 /ac

**CheckMate**<sup>®</sup>  
Puffer<sup>®</sup> CM-OFM Pro

1-2 /ac



**ISOMATE**<sup>®</sup> CM/OFM MIST  
PLUS

1 /ac



30-38 /ac

**CIDETRAK** CMDA+OFM MESO<sup>™</sup>

200 /ac



**CIDETRAK** CM-OFM COMBO

200 /ac



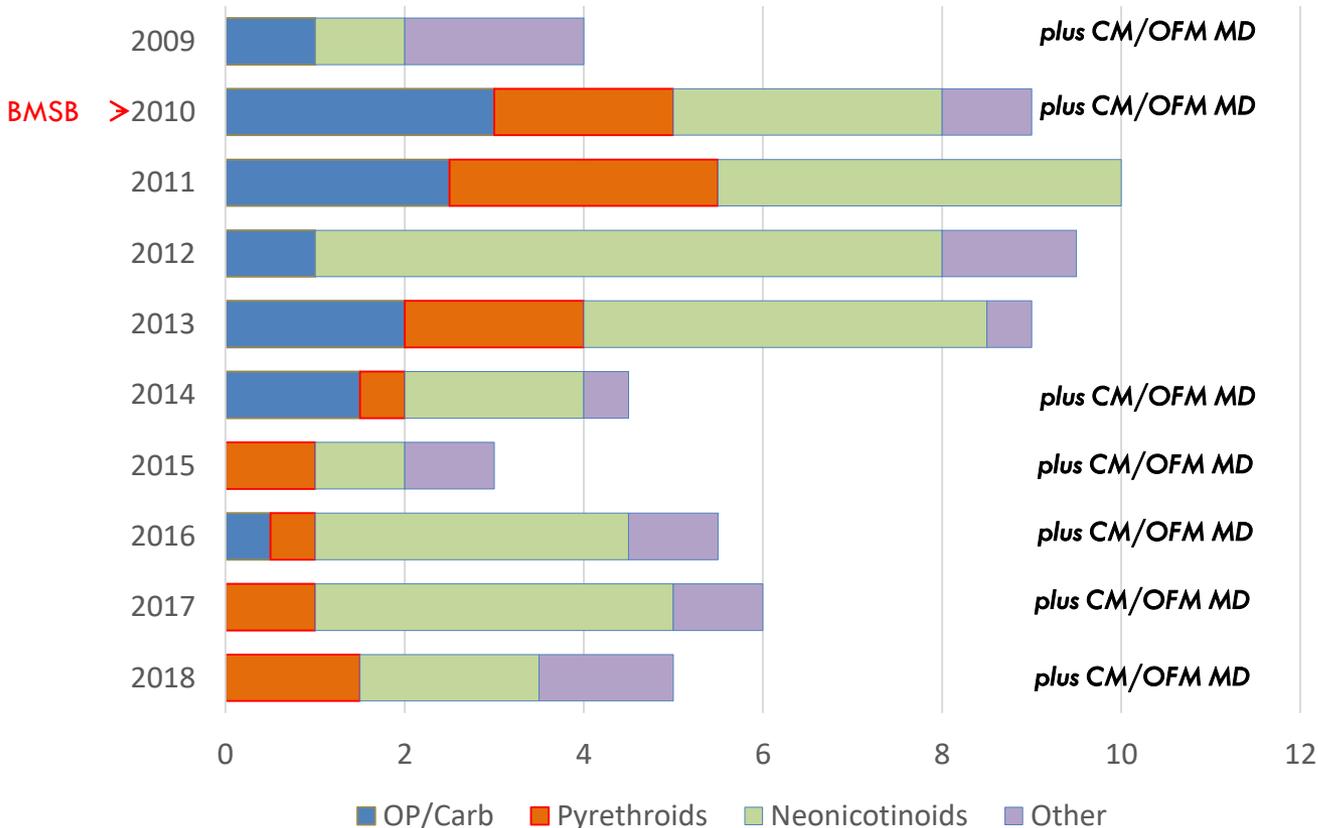
**ISOMATE**<sup>®</sup> CM/OFM TT

# Changes in seasonal insecticide applications - apples

2009-2018 seasons  
(Commercial orchard, PA)



## Insecticide applications after bloom



## Potential other controlled pests:

- *Codling moth*
- *Oriental fruit moth*
- *Plum curculio*
- *Japanese beetle*
- *Tufted apple budmoth*
- *Spirea aphids*
- *European apple sawfly*
- *Scales*
- .....

### Insecticides:

Carbamates (IRAC Group 1A) – methomyl,

Organophosphates (IRAC Group 1B) – phosmet,

Pyrethroids (IRAC Group 3A) – fenpropathrin, lambda cyhalothrin, bifenthrin,

Neonicotinoids (IRAC Group 4A) – acetamiprid, clothianidin, thiametoxam, dinotefuran, thiacloprid,

Other (IRAC Groups 5, 18, 28) – methoxyfenozide, spinetoram, rynaxypyr.

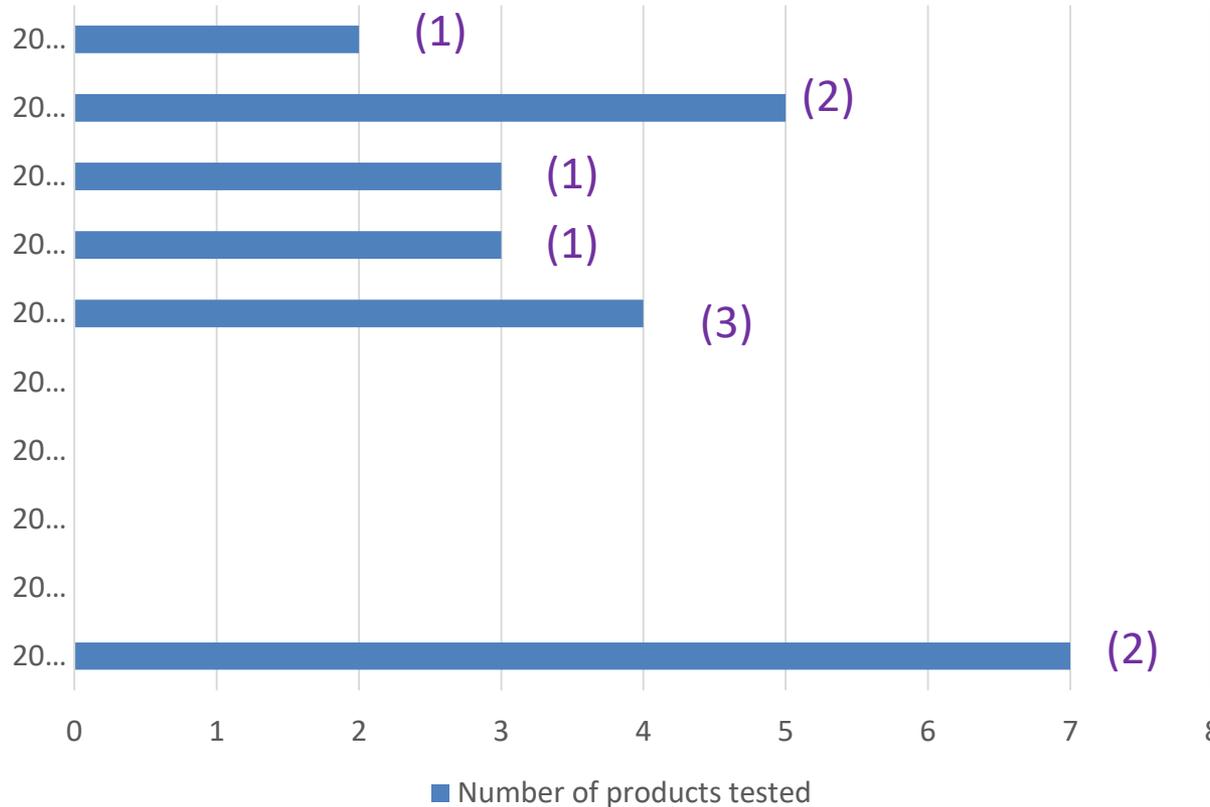


Recent trials with codling moth and Oriental fruit  
moth mating disruption

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# Mating disruption projects at PSU

Data from 2009-2018 seasons



## Companies with MD products:

Hercon

Pacific Biocontrol/CBC America

Suterra

Trece

(x) – number of pheromone companies with products included for testing per season



# Mating disruption trials

## 2014 CM/OFM mating disruption trials

### Sites and activities:

Three commercial orchards plus PSU FREC  
Pheromone traps monitored weekly  
In season and harvest fruit evaluations

### Suterra LLC MD products:

Puffer CM-OFM – standard, 1 dispenser/acre  
Puffer SPX-PM1 - experimental (0.5x pheromone load rate)

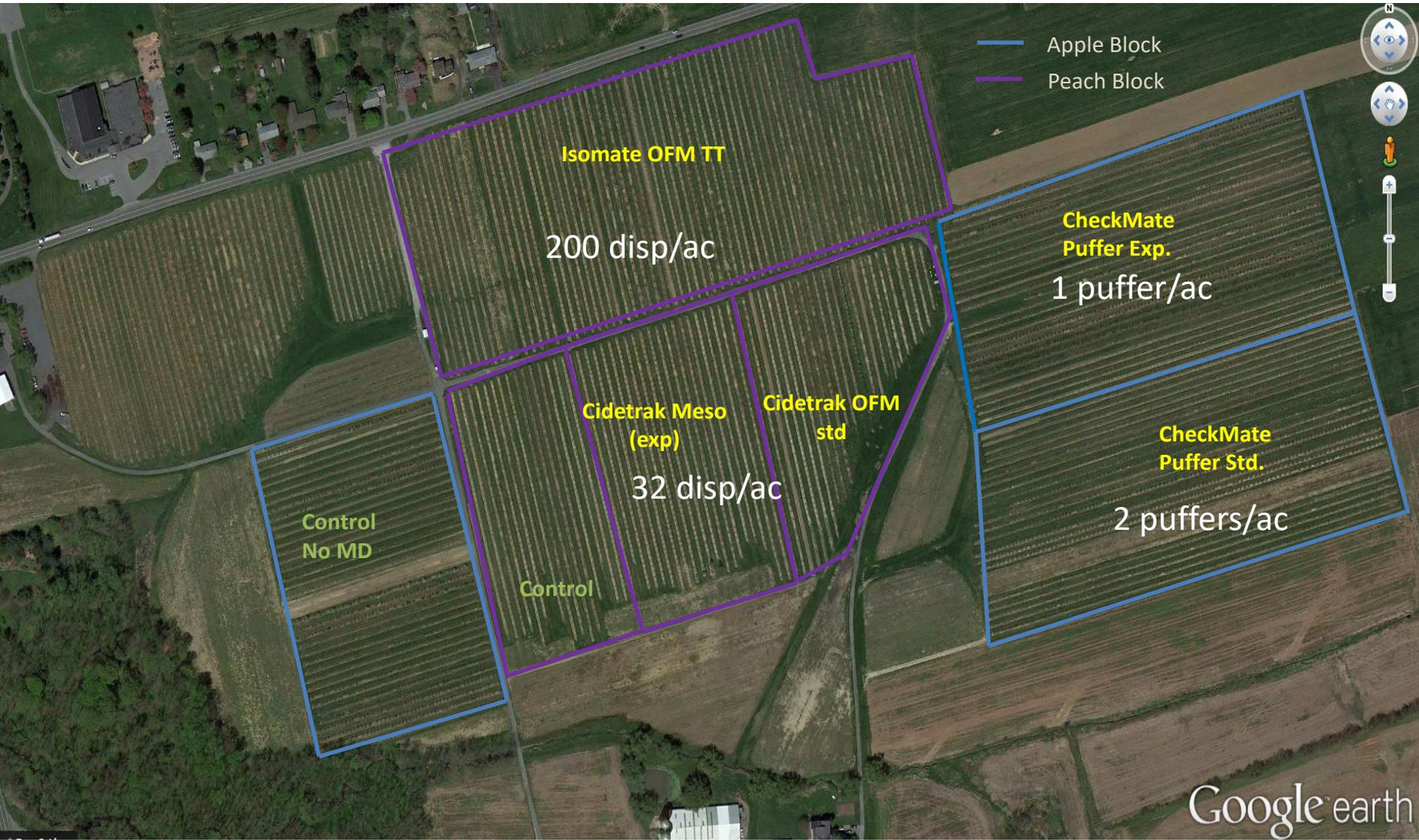
### TRECE Inc. MD products:

CIDETRAK CM/OFM Meso, 32 dispensers/acre, apples (experimental)  
CIDETRAK CM/OFM – 150 dispensers/acre, apples  
CIDETRAK OFM Meso, 30 dispensers/acre, peach (experimental)  
CIDETRAK OFM only, 150 dispensers/acre, peach



# Mating Disruption Project

Adams County, 2014



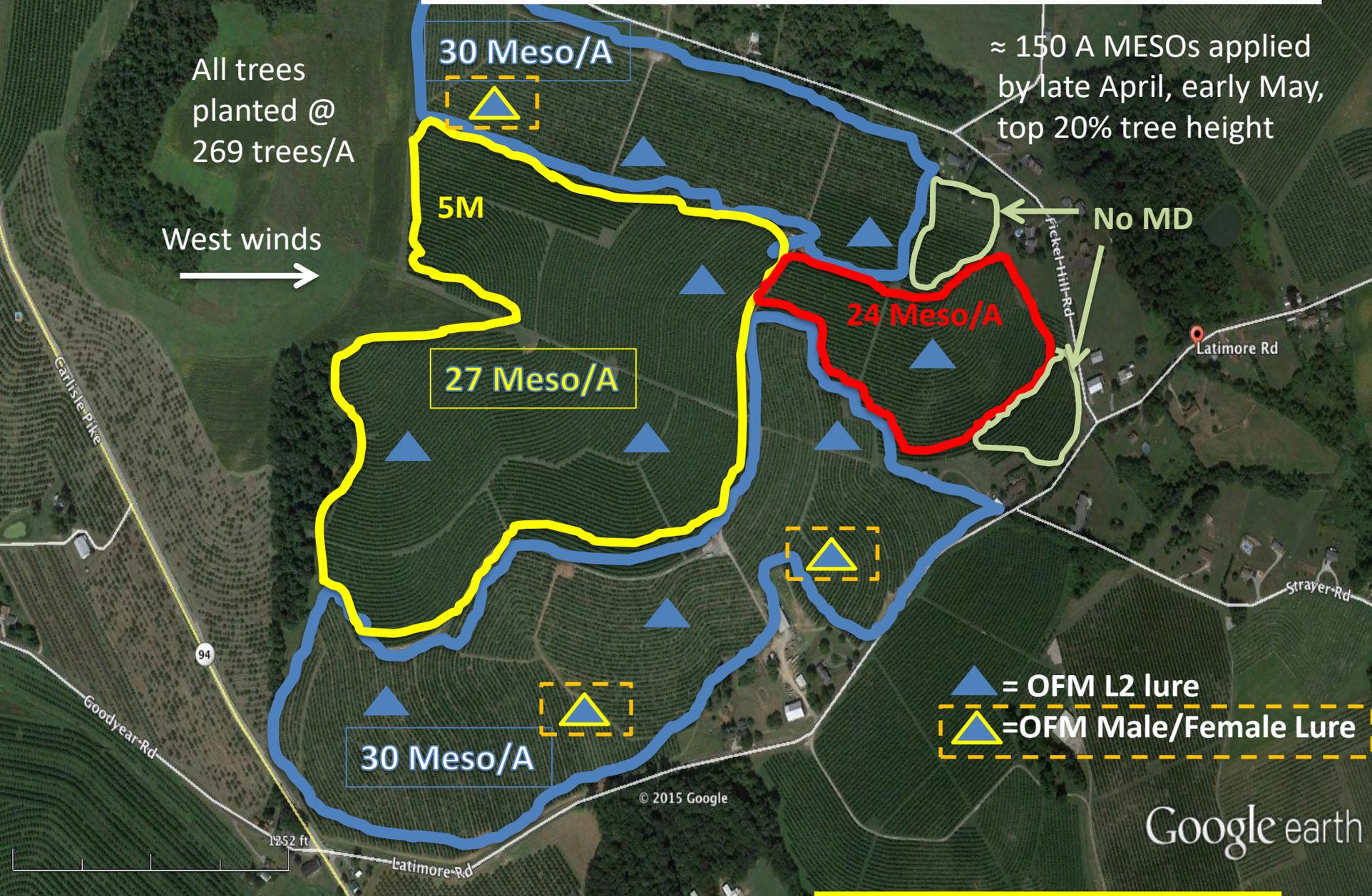
# 2014 Mating disruption trials apples

Treatment	Percent injured fruit at harvest (apples only )	
	CM	OFM
<i>Puffer CM/OFM (exp)</i>	0.0 a	0.0 a
Puffer CM/OFM	0.0 a	0.0 a
<i>Cidetrak Meso (exp)</i>	0.0 a	0.0 a
Cidetrak CM/OFM	0.0 a	0.0 a
<b>Isomate CM/OFM TT</b>	<b>0.0 a</b>	<b>0.0 a</b>

*Harvest fruit evaluations, averages from 3 commercial orchards*



# 2018 CideTrak OFM-L MESO Study

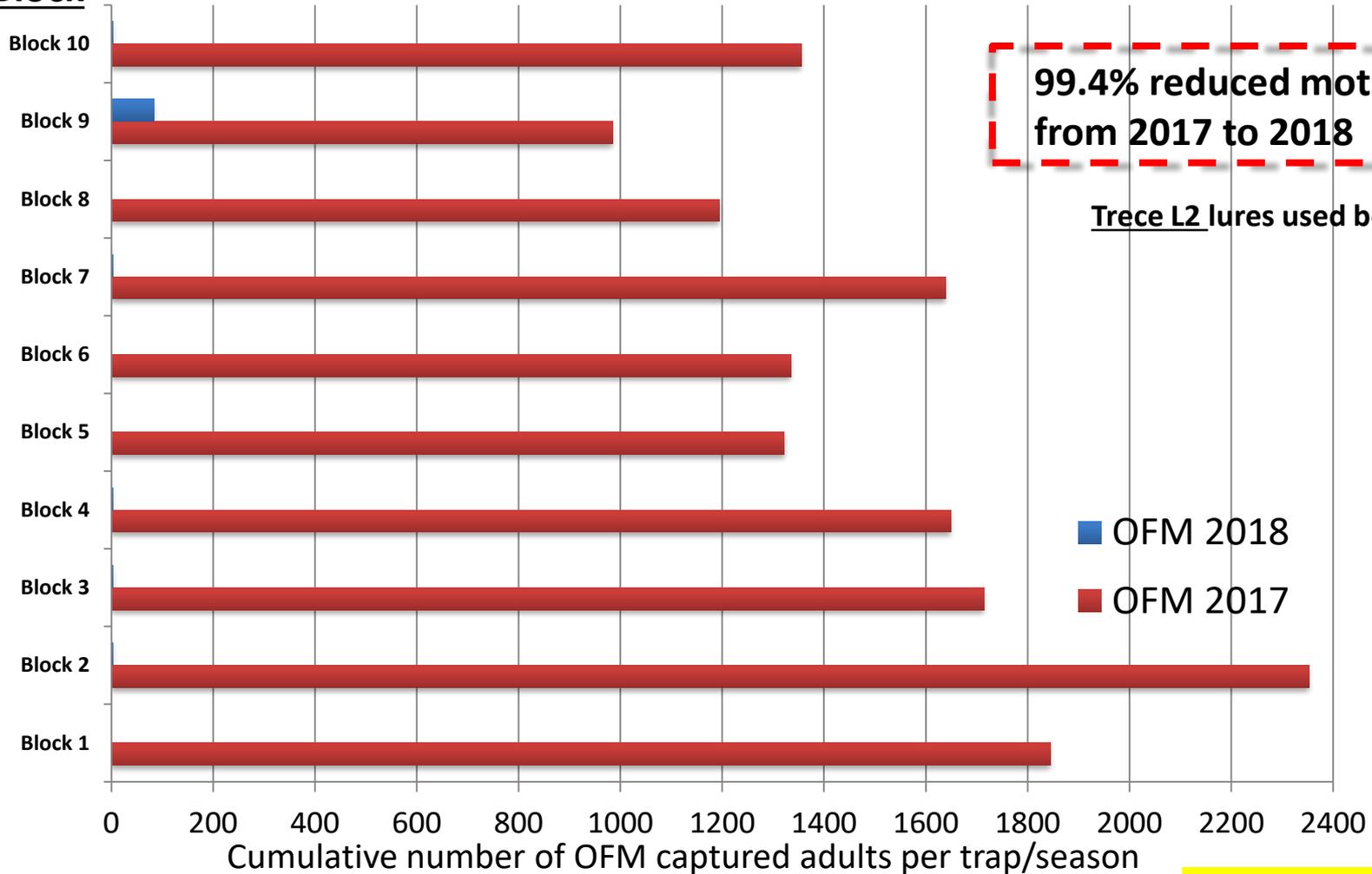


Orchard in Adams County, 2018

# OFM Moth Capture -

Orchard with **No MD (2017)** vs **CideTrak OFM-L MESO (2018)**

## Block



**99.4% reduced moth capture  
from 2017 to 2018**

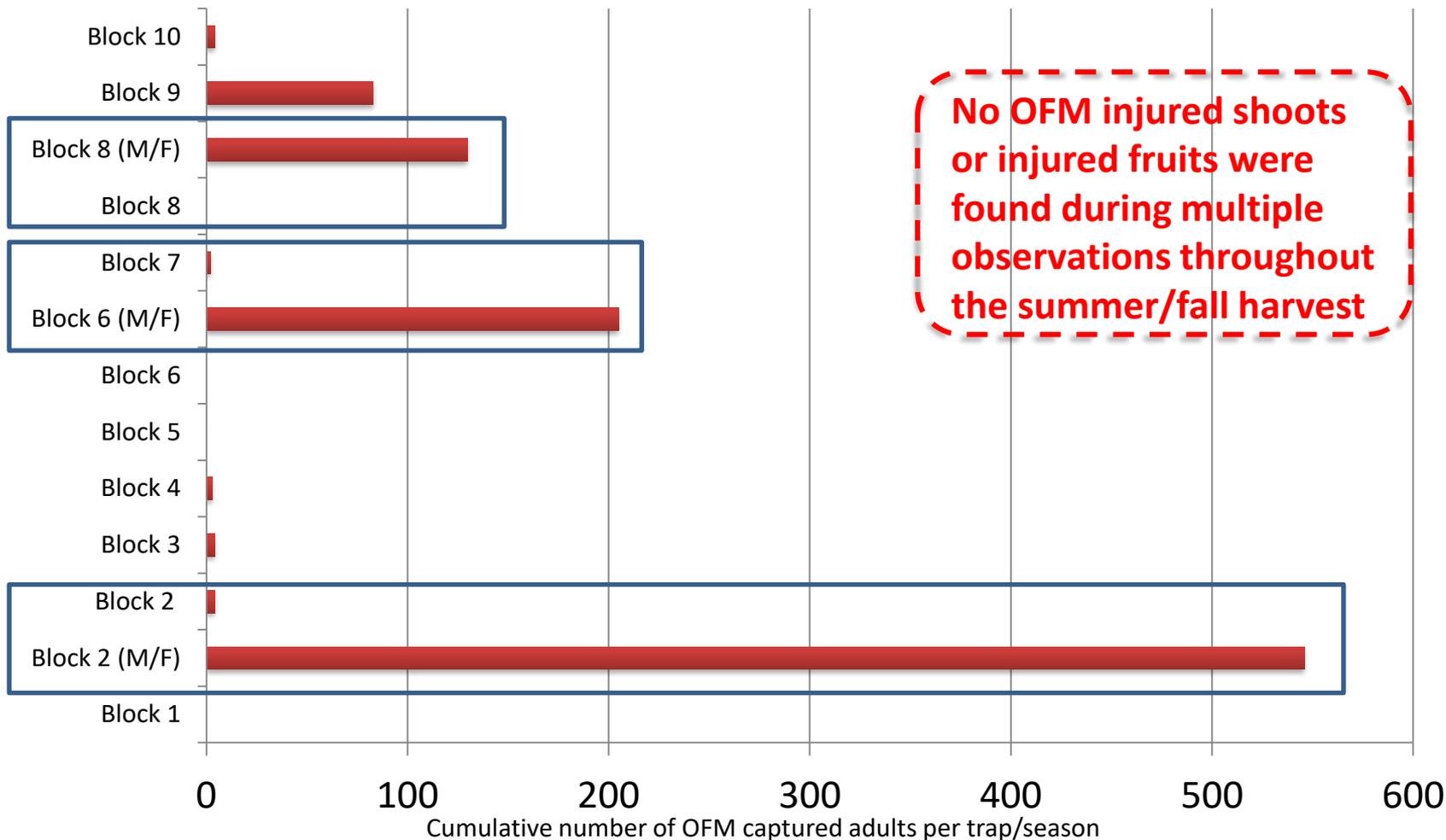
Thirteen L2 lures used both years

■ OFM 2018  
■ OFM 2017

Data from  
Hull Pest Management Services  
Greg Havelley, 2020

# OFM Total Moth Capture

CideTrak OFM-L Meso Study – OFM capture in L2 and M/F traps



No OFM injured shoots or injured fruits were found during multiple observations throughout the summer/fall harvest

M/F = OFM Male/Female Lure Trap

Data from  
Hull Pest Management Services  
Greg Krawczyk, 2019

\*Moth capture from 5/2 to 9/19

# OFM Pheromone Trap Catch Thresholds for Apple and Peach in Pennsylvania

*Orchard without OFM mating disruption*



No. adult males/trap/week

<u>Brood 1*</u>		<u>Broods 2-4*</u>	<u>Recommended action</u>
<u>Apple</u>	<u>Peach</u>	<u>Apple &amp; Peach</u>	
0 – 15	0 – 5	0 - 5	Not a problem
16 – 30	6 – 15	6 – 10	Potential problem
31 – 60	16 – 30	11 – 25	Treatment required
>60	>30	>25	Severe problem

*\*average moth captures from a minimum of 2 traps per 5-7 ha  
(Recommendations from the 2018-2019 PSU Tree Fruit Production Guide)*

# Monitoring lures

- **Codling moth** monitoring lures:

[Pherocon<sup>®</sup> CM DA Combo \(8 week lure\)](#)

[Pherocon<sup>®</sup> CM DA Combo + AA \(8 week lure\)](#)

Pherocon<sup>®</sup> CM LL (12 week lure)

Pherocon<sup>®</sup> CM lure (4 week lure)

- **Oriental fruit moth** monitoring lures:

[Pherocon<sup>®</sup> OFM Combo Dual \(6-8 weeks lure\)](#)

Pherocon<sup>®</sup> OFM LL (12 week lure)

Pherocon<sup>®</sup> OFM (4 week lure)



Plus various lures from AlphaScent<sup>®</sup>, Suterra<sup>®</sup>, Scentry<sup>®</sup>, AgBio<sup>®</sup> and others.....



Evolution of “ghost “  
net trapping for  
BMSB  
2013-2018

# BMSB captures in “ghost traps”

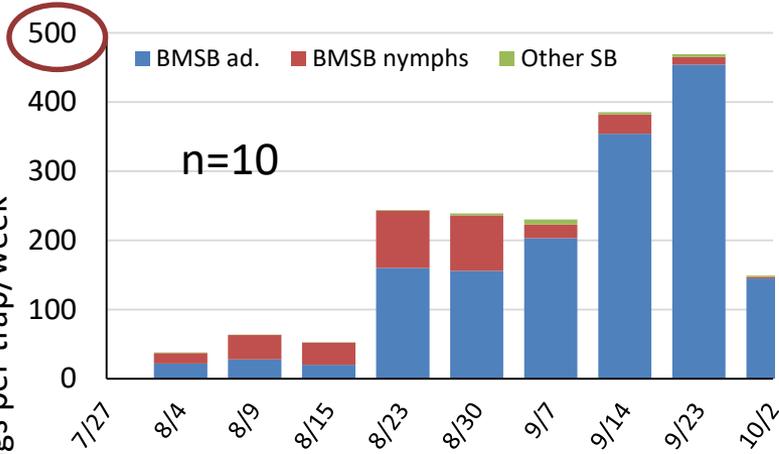


# Average SB captures in “ghost traps”

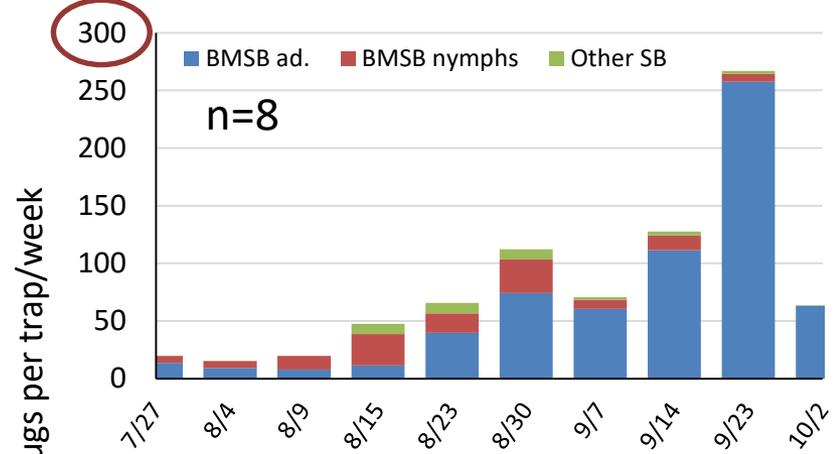
2017 season



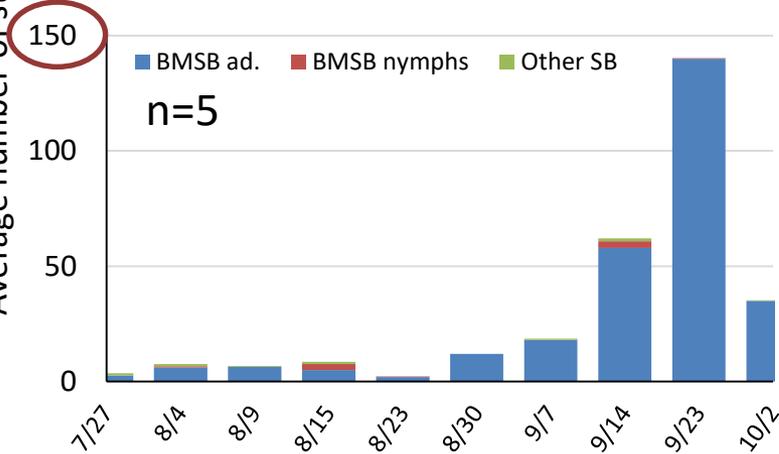
JL orchard, York Spring, PA, 2017



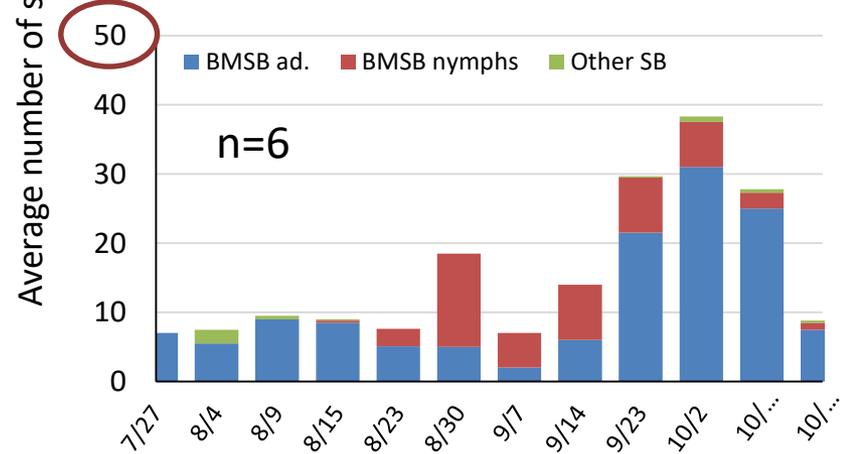
BH orchard, Biglerville, PA, 2017



FR orchard, Biglerville, PA, 2017



CH orchard, Lancaster, PA, 2017



n- number of ghost traps per site

# BMSB captures in monitoring traps

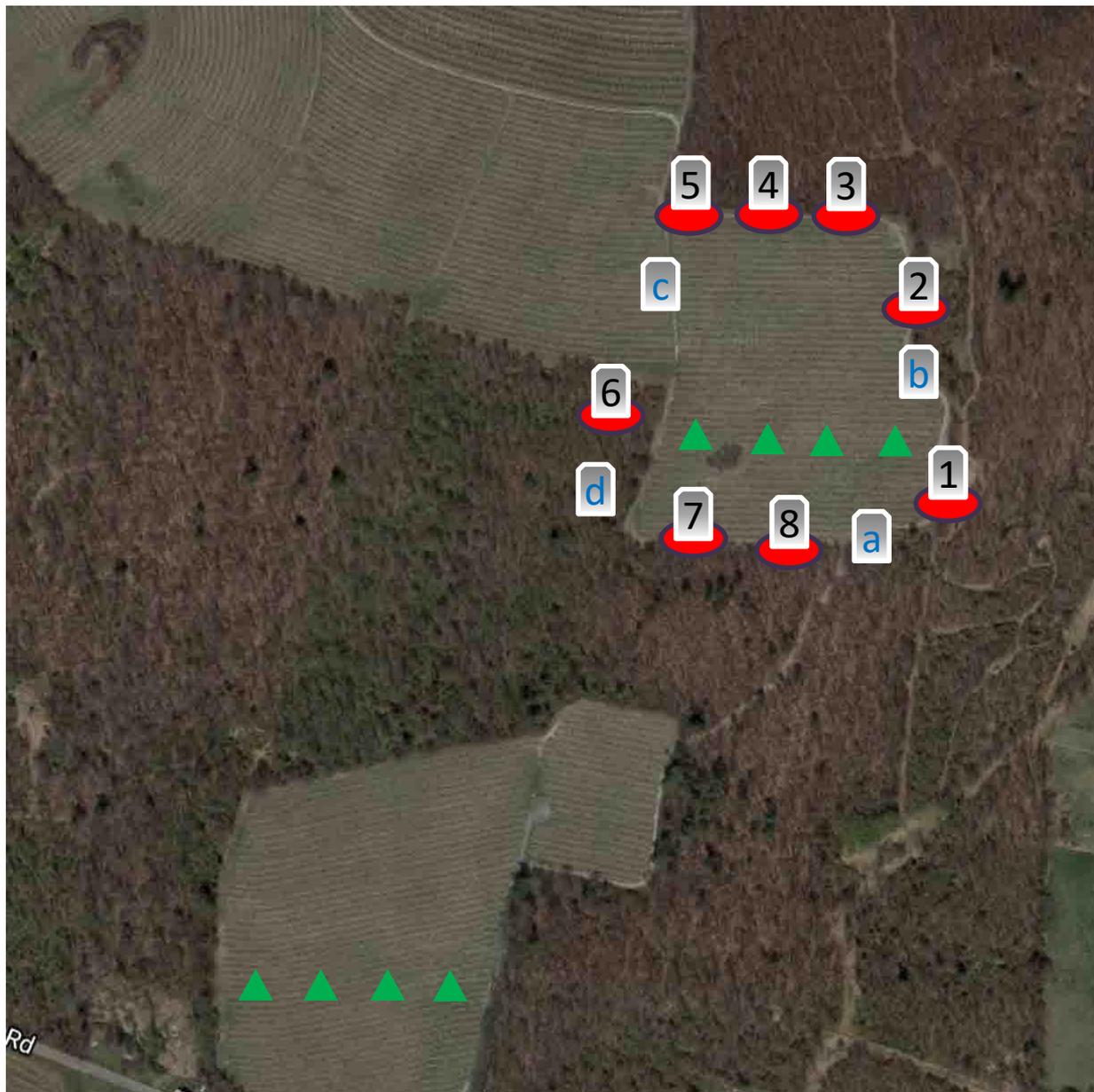
JL Orchard, 2017

BMSB	Ghost traps	Control
Adults	<b>0.58 a</b>	<b>2.86 b</b>
Nymphs	<b>0.31 a</b>	<b>1.28 b</b>

*Average BMSB captures per trap/week. Rescue traps baited with Ag Bio lures. Four traps per treatment*



Each block had about 8 ha



**a** Ghost trap

**1** Ghost trap with tarp

**▲** Monitoring trap

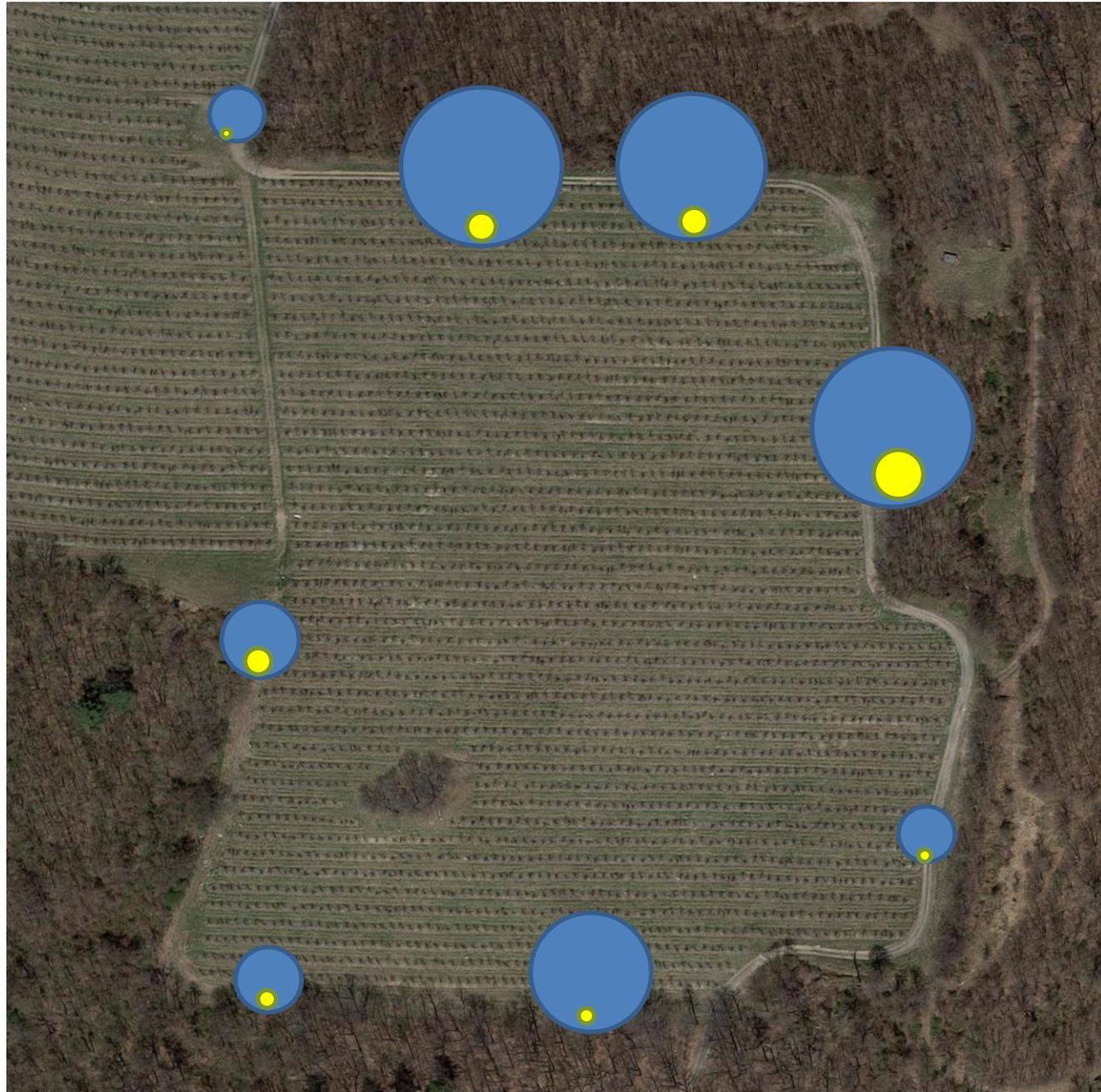
# BMSB captures in ghost traps

JL Orchard, 2017

2351 BMSB adults

2351 BMSB nymphs

↑ *Size equivalent of 2351 dead SB*



# Summary



Monitoring of insect pests in orchards constitute the basis for effective and economical pest management practices;



Combination of mating disruption products with effective insecticides products provides excellent control of codling moth and Oriental fruit moth;



Traditional high density materials (e.g., Isomate, Checkmate or Cidetrak hand applied dispensers) and newly registered low labor mating disruption products (e.g., CheckMate puffers, Isomate Mist or Cidetrak Meso product) provided excellent control of internal fruit feeders;



Combinations of BMSB targeted treatments with available soft and selective management tools for the control of internal feeders will help to revive practical long term benefits from effective integrated pest management (IPM).



- Projects supported by funding from the State Horticultural Association of Pennsylvania
- Mating disruption products and monitoring materials provided by Hercon<sup>®</sup>, Suterra<sup>®</sup>, and Trece<sup>®</sup>.

Thank you