



# Codling Moth SIR in Washington: Re-inventing the Wheel?



Elizabeth H. Beers, Kacie Athey, Tobin Northfield, Dave Crowder, Jay Brunne

WSU-Tree Fruit Research & Extension Center, Wenatchee, WA

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Trinity Baptist Church, 1905 Springfield Rd, Kelowna, BC

# Codling Moth Research in Washington 1960s-1970s

## SIR

Butt 1964 – principles of SIR  
Hathaway 1966 – TEPA for  
sterilization  
Butt 1967 – trial SIR release  
Butt 1970 – pre-release sanitation,  
Wenas Valley  
Butt 1971 – release of 1.5M sterile  
moths, Wenas Valley

## Pheromones

Butt 1966 – female sex pheromone  
demonstrated for CM  
Roelofs 1971 – synthetic CM  
pheromone  
Cardé 1977 – CM mating disruption  
from hollow fiber dispensers (1700  
points/ha)

# Washington: The rise of CM-MD

Areawide CM-MD projects:

CAMP/GRABS: 1996-1999

AWII: 2001- 2004

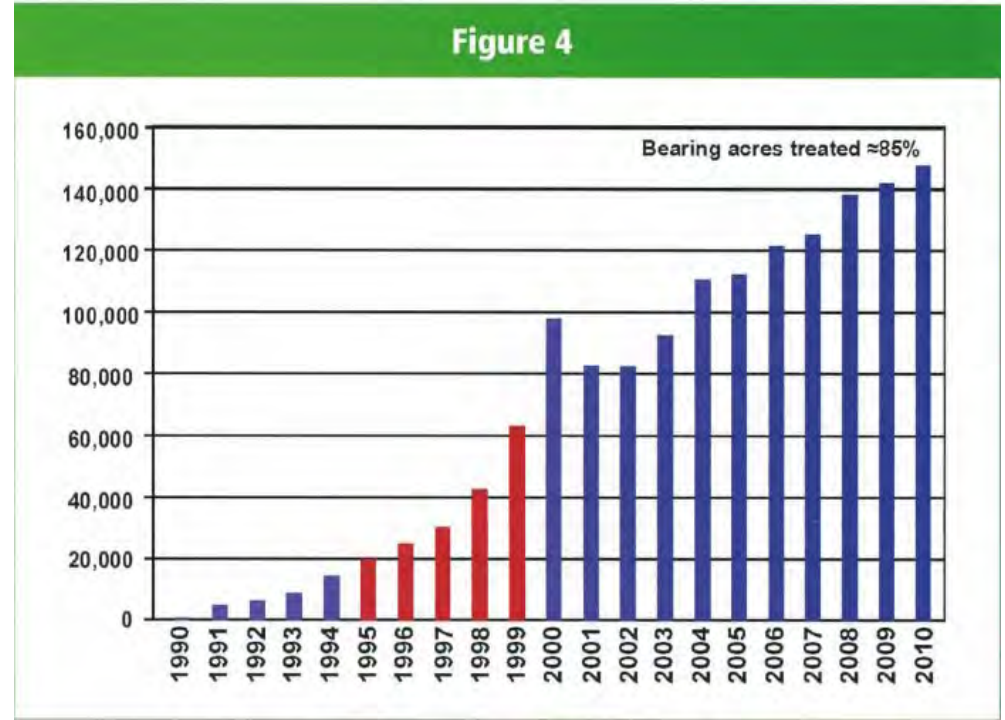
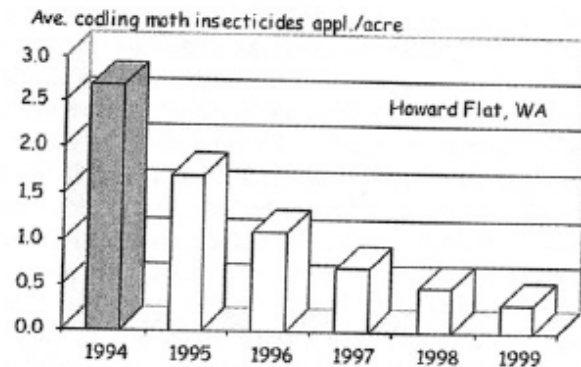
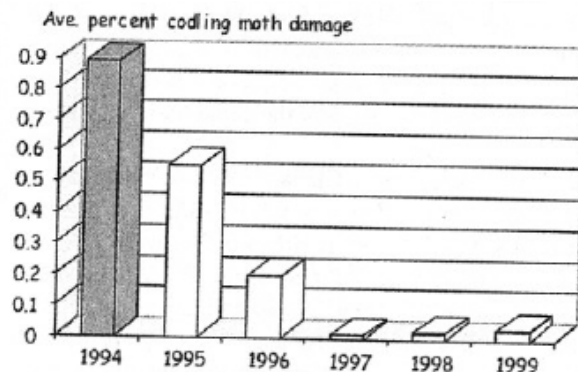
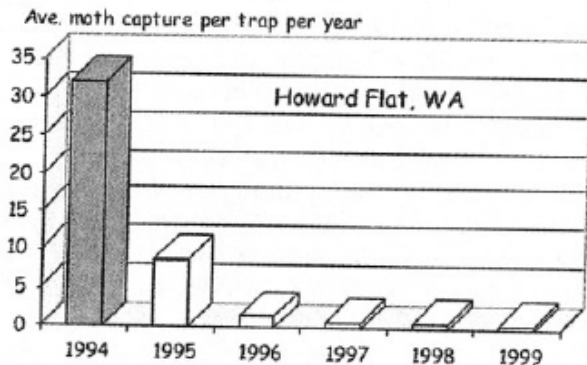


FIGURE 4 – ACRES OF APPLE TREATED WITH CODLING MOTH PHEROMONE PRODUCTS

Brunner, J. F., and M. Doerr. 2011. Pest management transition: Challenges and consequences. Compact Fruit Tree April, 2011: 23-29.

# Mating Disruption a Success



Brunner, J. F., J. E. Dunley, E. H. Beers, and V. P. Jones. 2007. Building a multi-tactic biologically intensive pest management system for Washington orchards, Chap. 9, pp. 131-143. In A. S. Felso and K. D. Rake (eds.), *Crop protection products for organic agriculture*, ACS symposium series 947. American Chemical Society, Washington, DC.

# 2010s: Demise of the OPs, rise of the Diamides

2007 - 2012 – phase out of azinphosmethyl (Guthion)

2009 – chlorantraniliprole (Altacor) registered

2006 - 2010 – Pest Management Transition Project (PMTTP)

Table 1

Years	Pounds AI per acre	Number of applications
2007	4 pounds	4 applications
2008-2009	3 pounds	3 applications
2010	2 pounds	2 applications
2011-2012	1.5 pounds	1 application

TABLE 1 – SCHEDULE OF EPA PHASE-OUT OF AZM SHOWING AMOUNT OF ACTIVE INGREDIENT (AI) ALLOWED PER ACRE PER YEAR AND THE NUMBER OF EFFECTIVE APPLICATIONS A GROWER COULD MAKE

Brunner, J. F., and M. Doerr. 2011. Pest management transition: Challenges and consequences. Compact Fruit Tree April, 2011: 23-29.

Figure 6

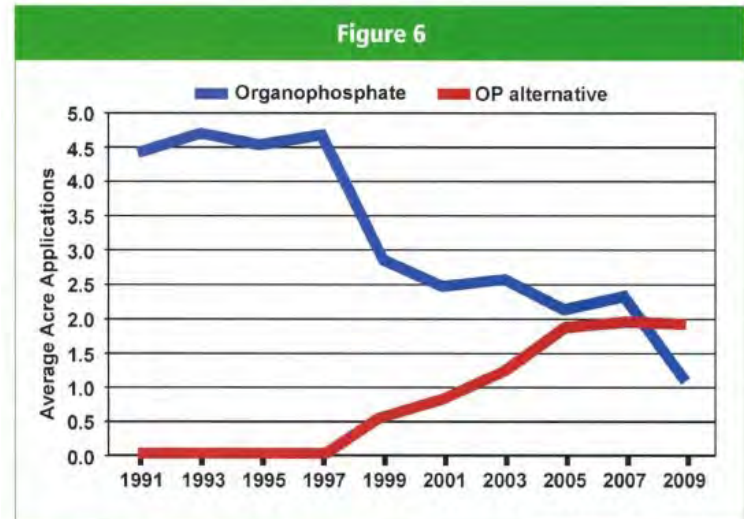


FIGURE 6 – ACRE APPLICATIONS OF ORGANOPHOSPHATE AND OP ALTERNATIVE INSECTICIDE IN WASHINGTON APPLE ORCHARDS, BASED ON NASS DATA

## MD starts to slip: late 2010s

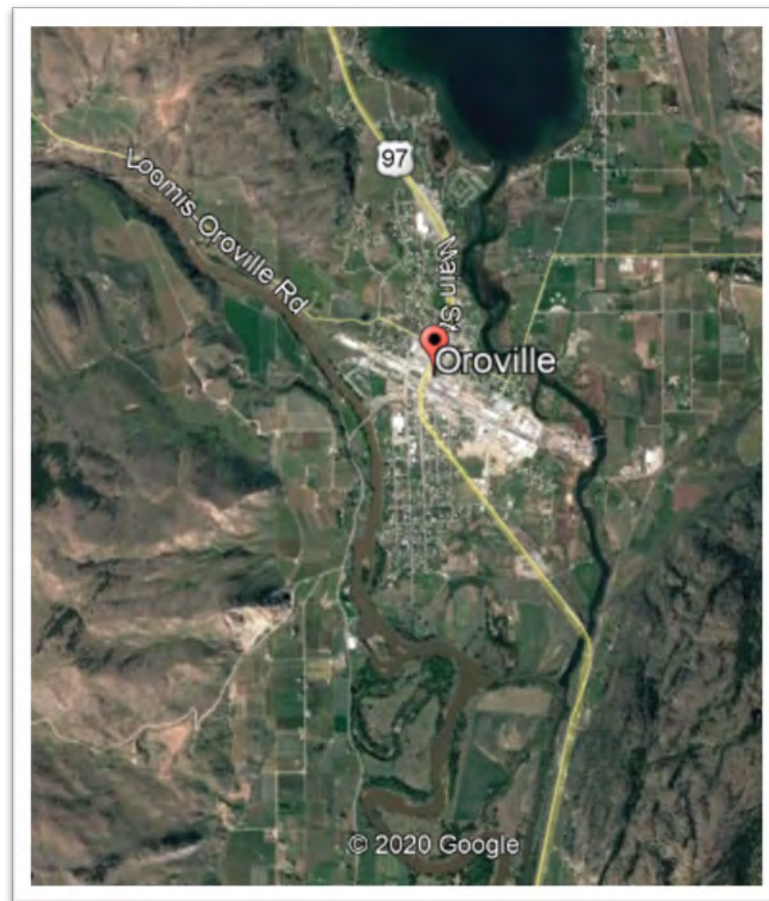
- ✓ Earlier seasons = 3 generations more common
- ✓ Diamides  $\neq$  Organophosphates (not adulticidal)
- ✓ More organic acreage, fewer control options
- ✓ Mating disruption does not work at high CM densities

## Other SIR research in Washington

Alan Knight: SIR as part of the  
Areawide Oroville Project  
(1990s)

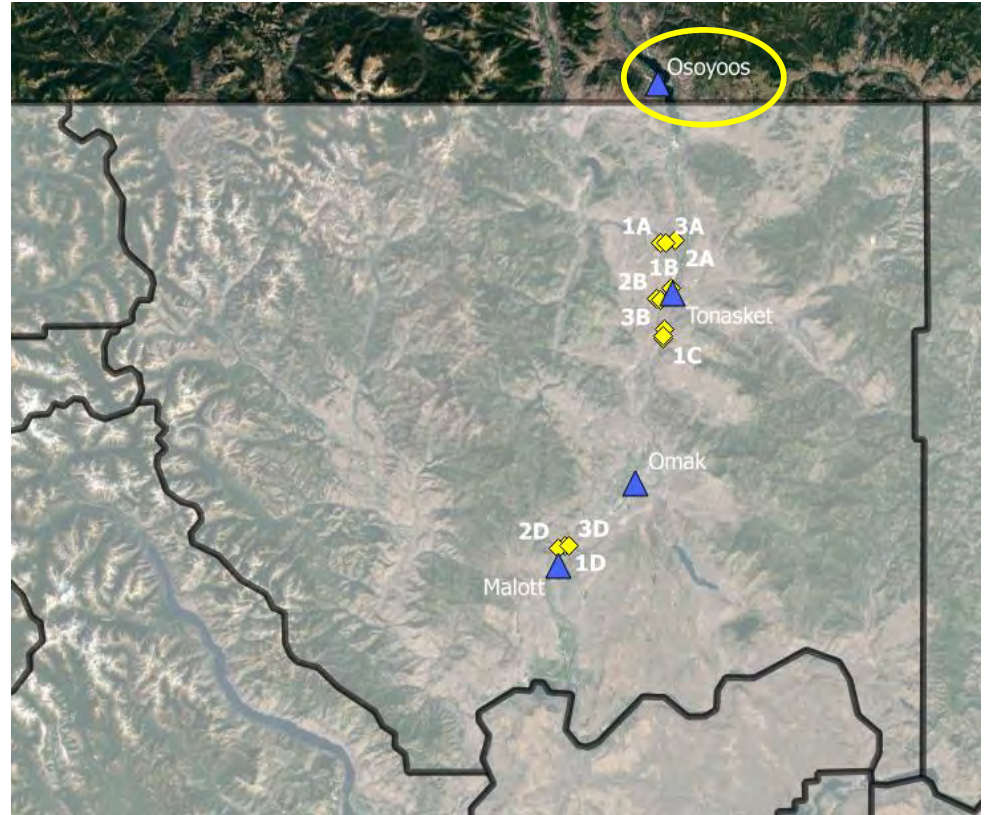
Jay Brunner: SIR to address  
'hotspots' (2011)

Use of sterile moths to define  
attractive radius of traps



# WA-SIR Pilot Study, 2018-2019

- Organic apple, Okanogan County (close to Canadian facility)
- Target: 8 acres/plot (limited by sterile moth availability)
- All plots received full organic program, grower applied
- 3 treatments, 4 groups
- Plots separated by ¼ mile
- Tonasket to Malott
- Moth release weekly April-September (22 weeks)
- All Moth Releases Made by Drone (M3 Consulting)





# SIR – Moth Distribution Re-invented



British Columbia

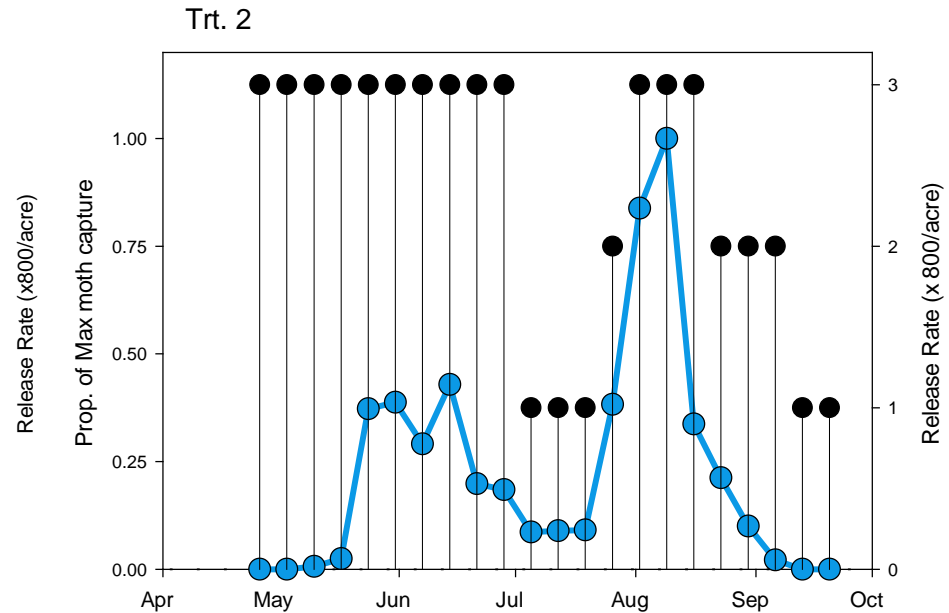
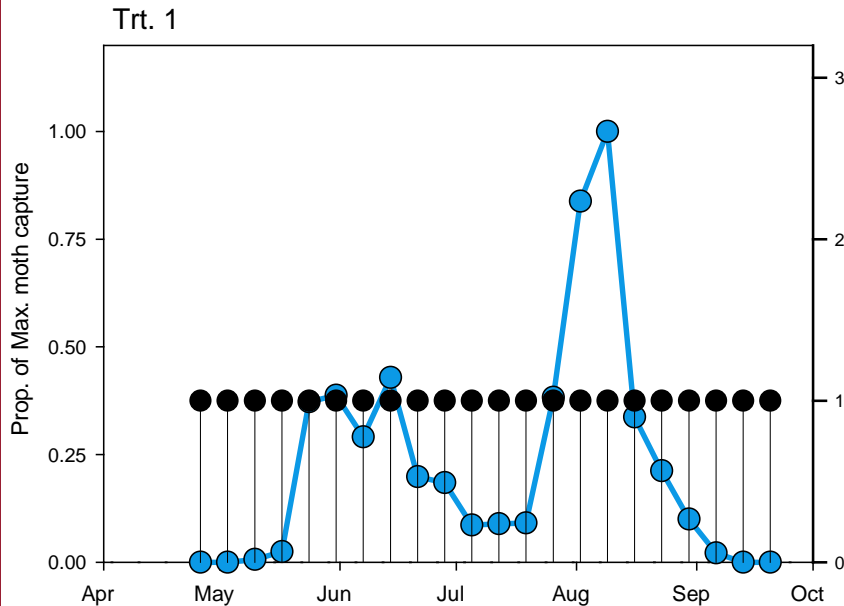


Washington



# Pilot Project: 2018-2019

1. Std. CM program + std. rate of SIR (800 sterile moths/acre/week)
2. Std. CM program + gradated rate of SIR  
(base rate increased to 2x and 3x rate as CM activity increases)
3. Std. CM program + insecticides



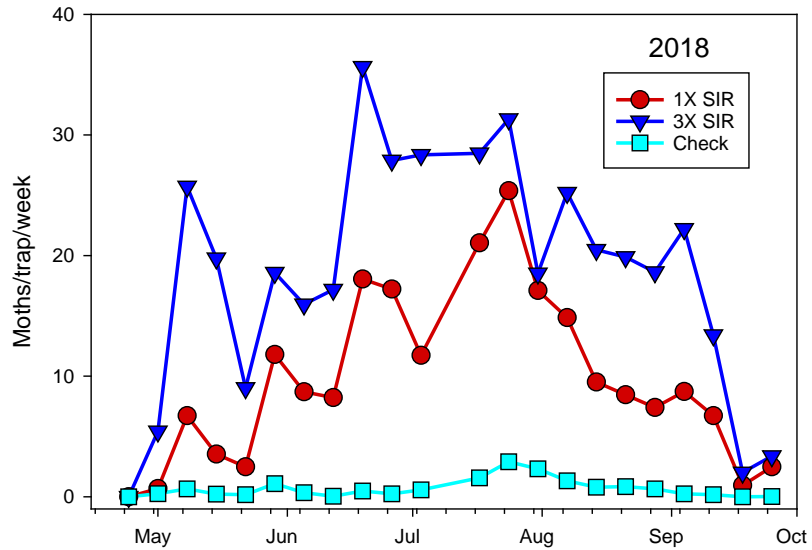
# Plot Sampling: 1 trap/acre



Trécé combo+AA lure/orange delta trap

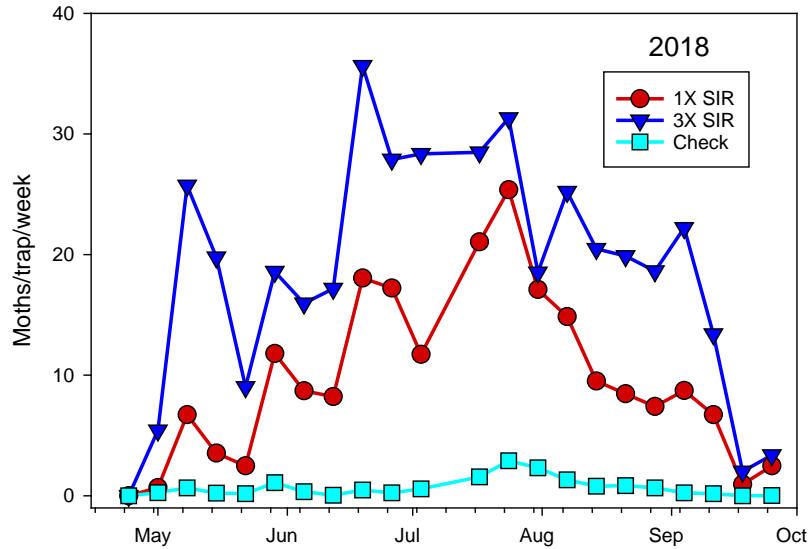
# Pheromone Capture of Sterile Moths

2018

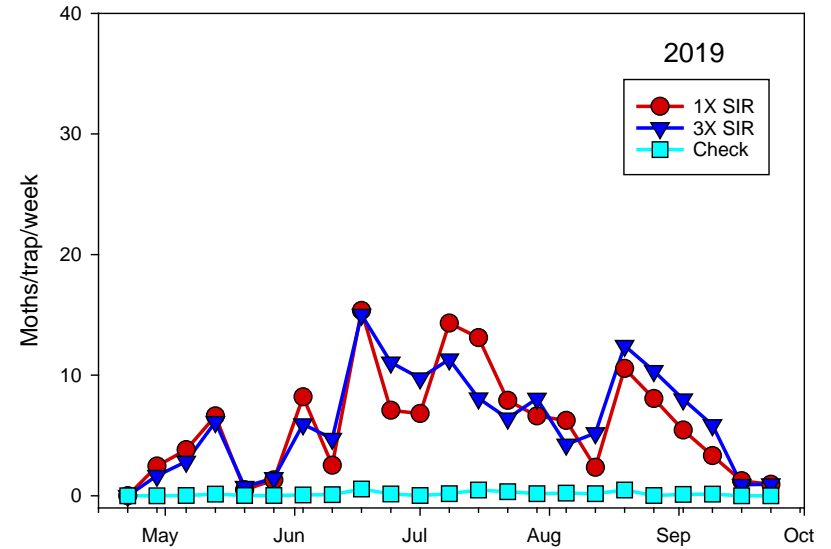


# Pheromone Capture of Sterile Moths

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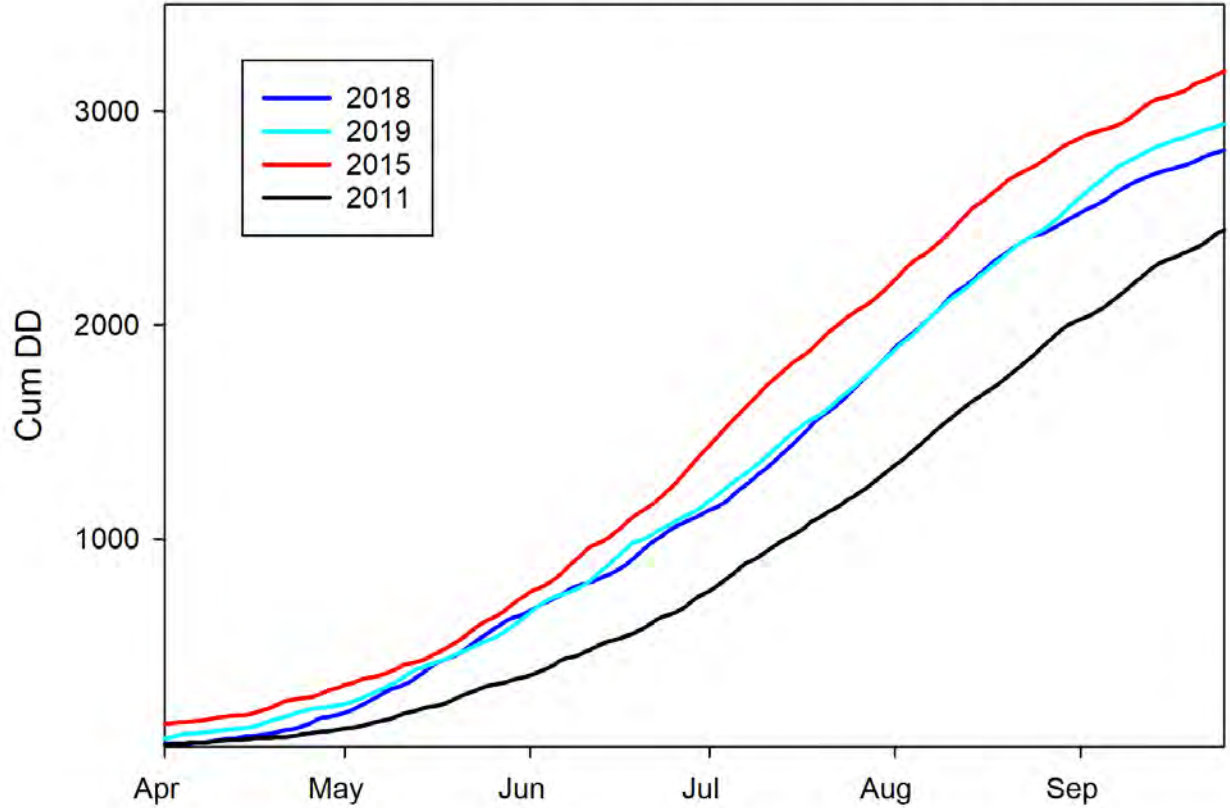


2019

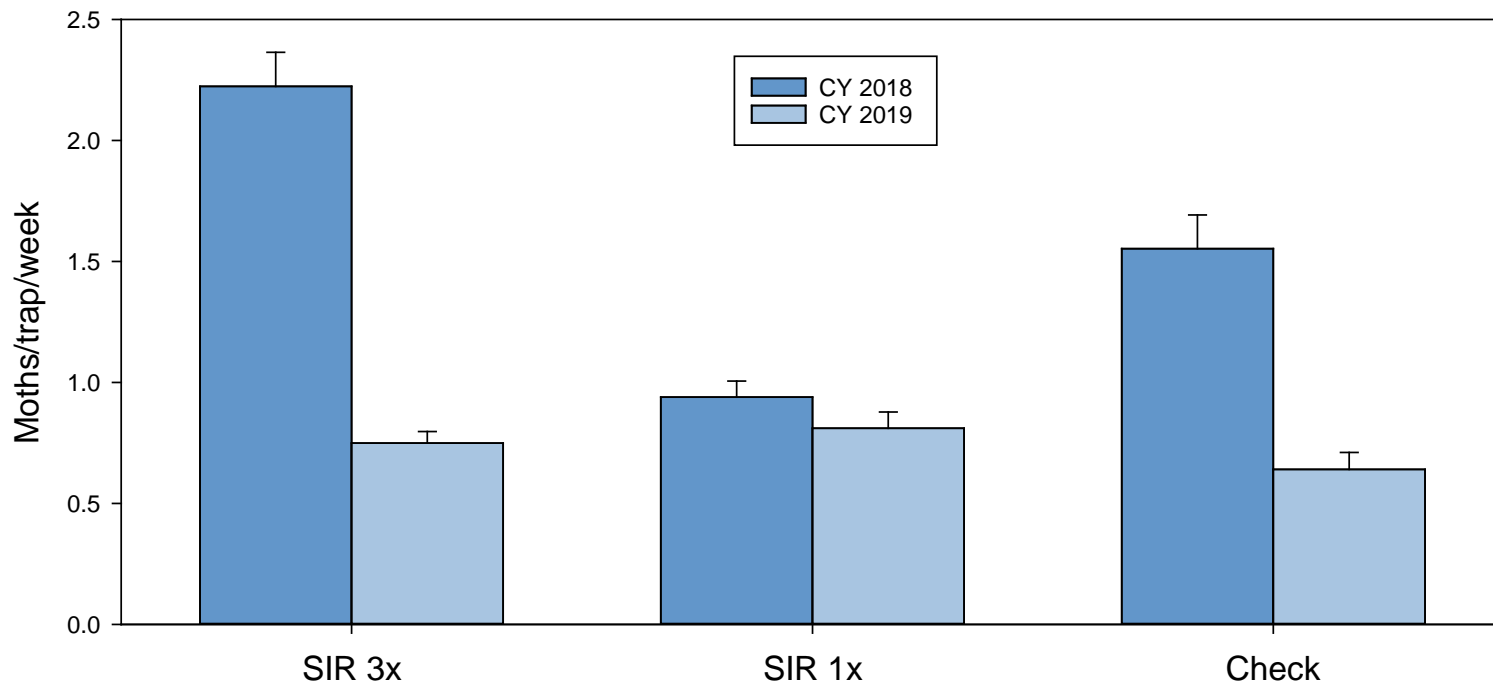


**Codling  
moth DD  
comparison  
S. Tonasket  
AgWeatherNet  
Station**

CM-DD, 2018 v 2019 v 2015 (hot) and 2011 (cold)

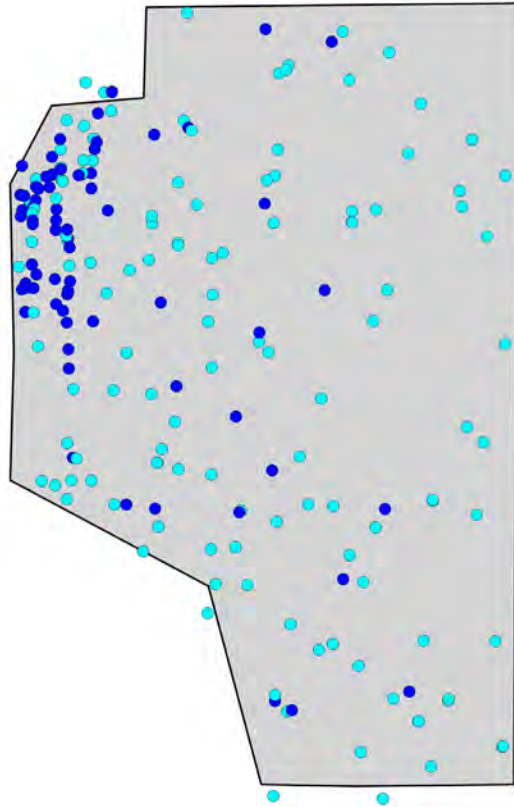


# Wild moth populations

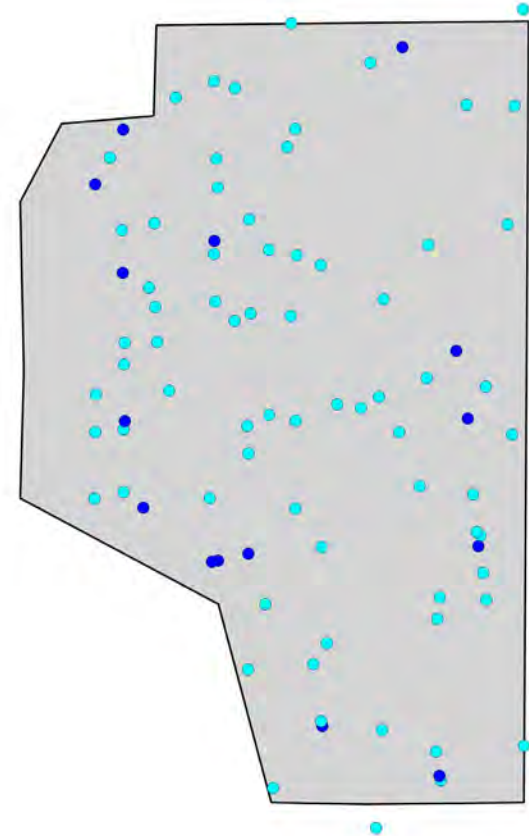


# Fruit Damage Patterns – 3x SIR

2018



2019

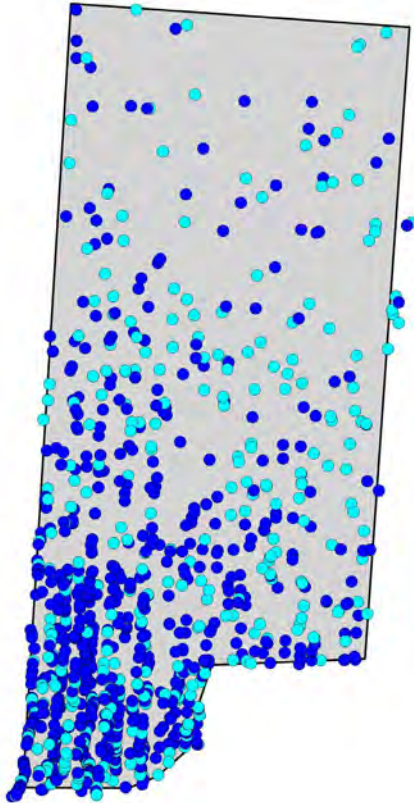


- Entries
- Stings

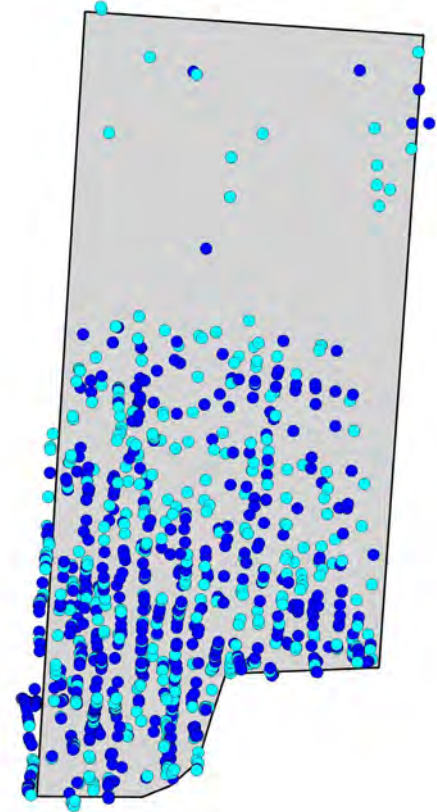


# Fruit Damage Patterns - Check

2018



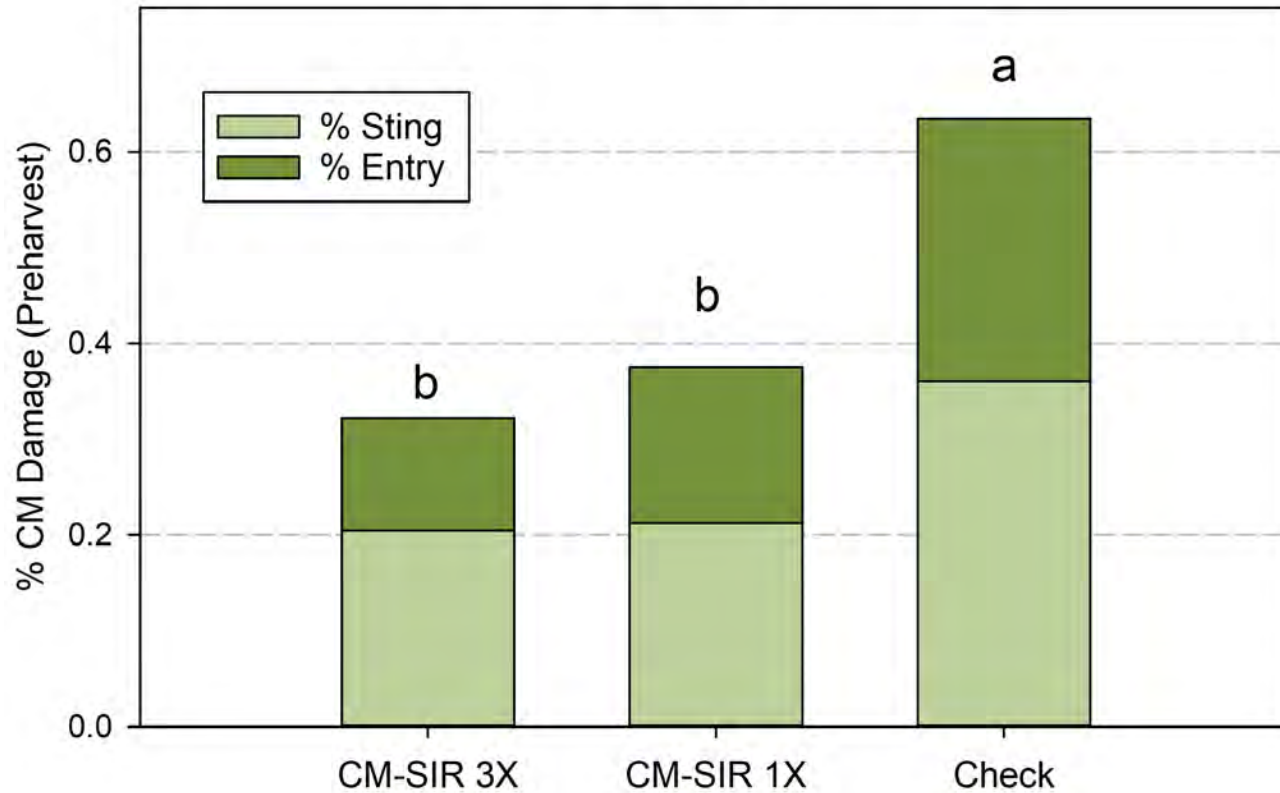
2019



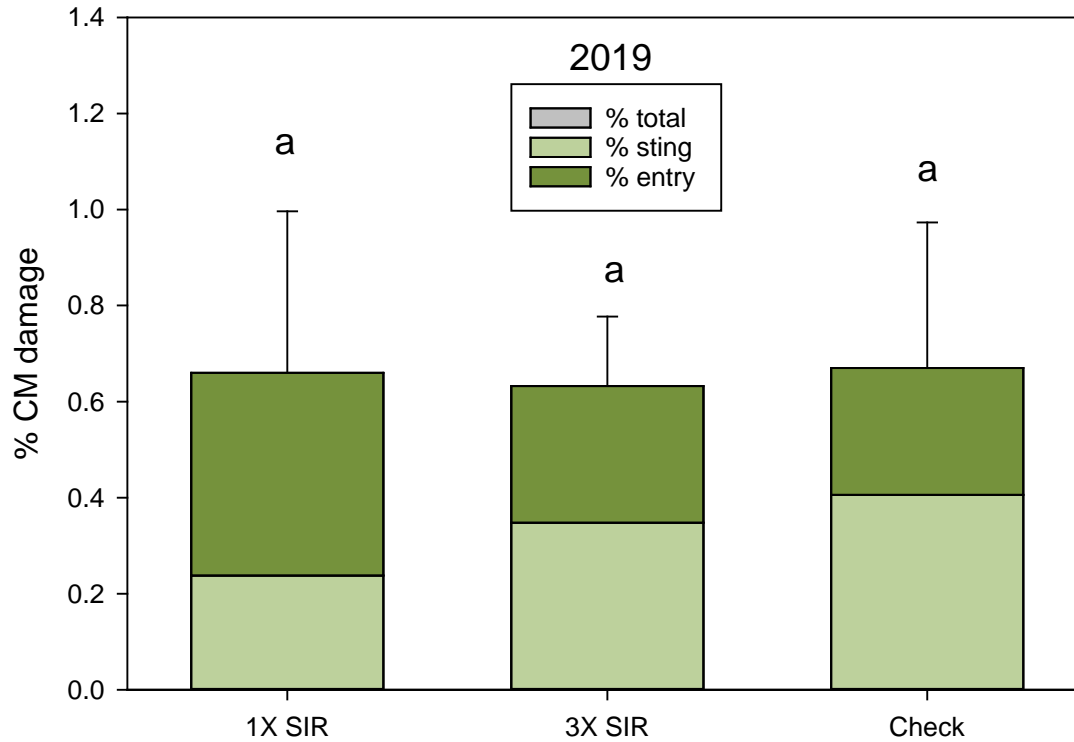
- Entries
- Stings

# 2018

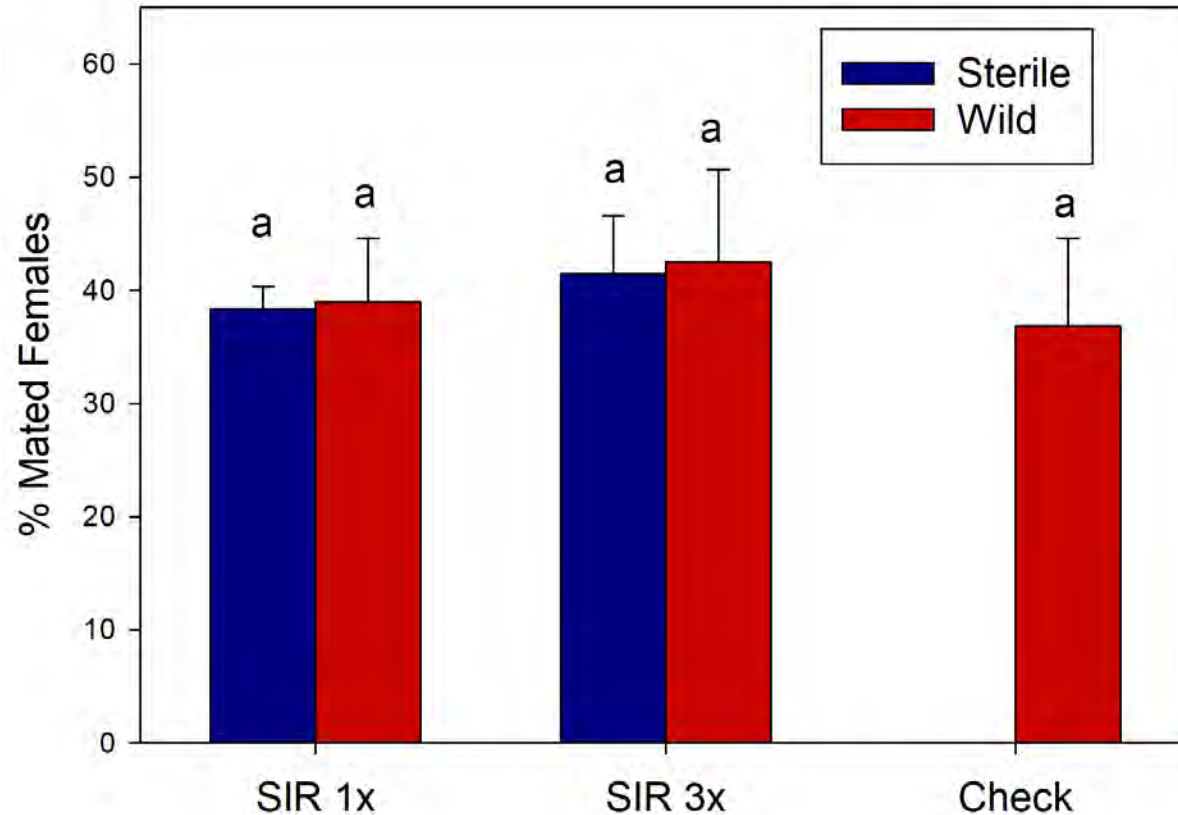
## CM Damage - Preharvest



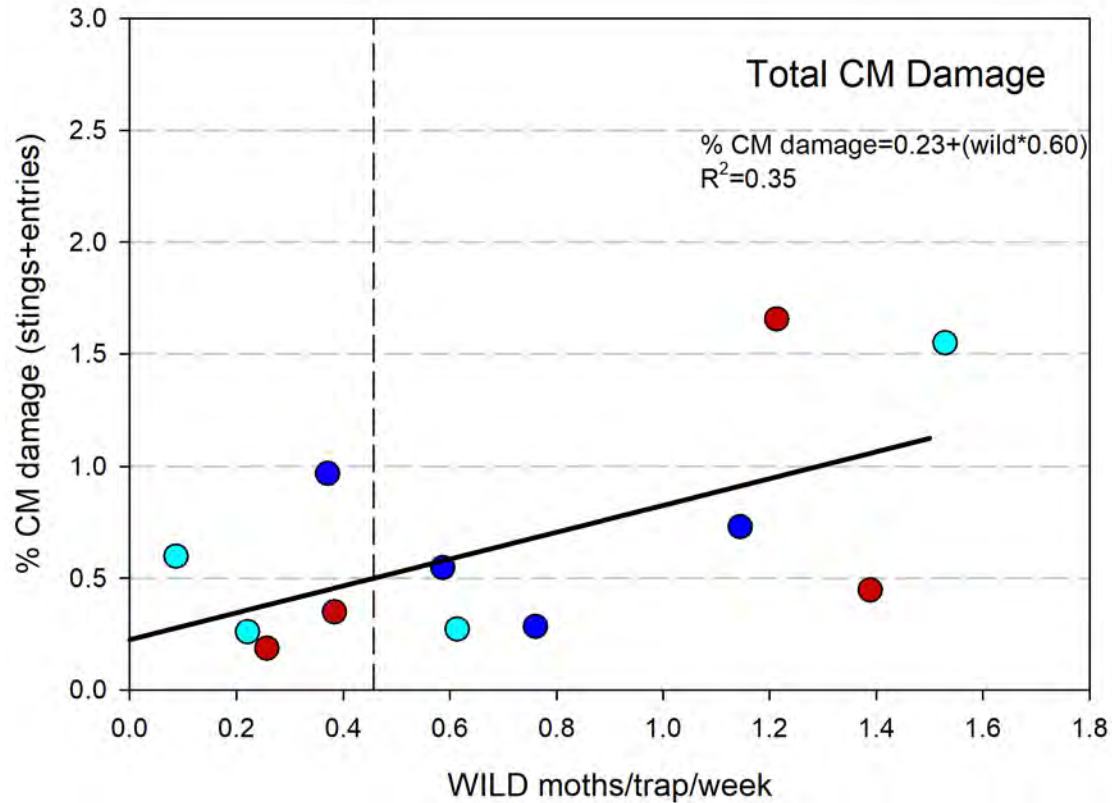
# 2019



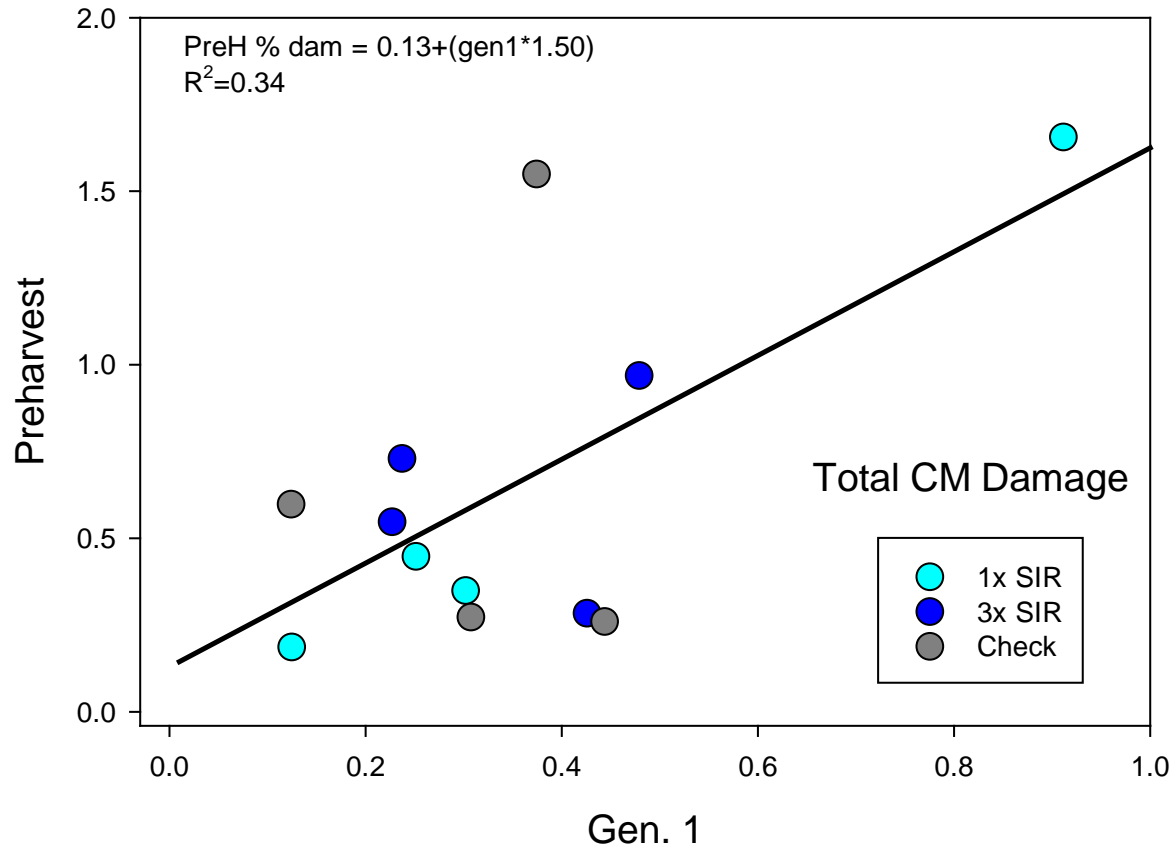
# Does Releasing SIR moths Change Mating Status?



# Is Damage Related to the number of WILD moths?



# Does 1<sup>st</sup> gen damage predict preharvest damage?

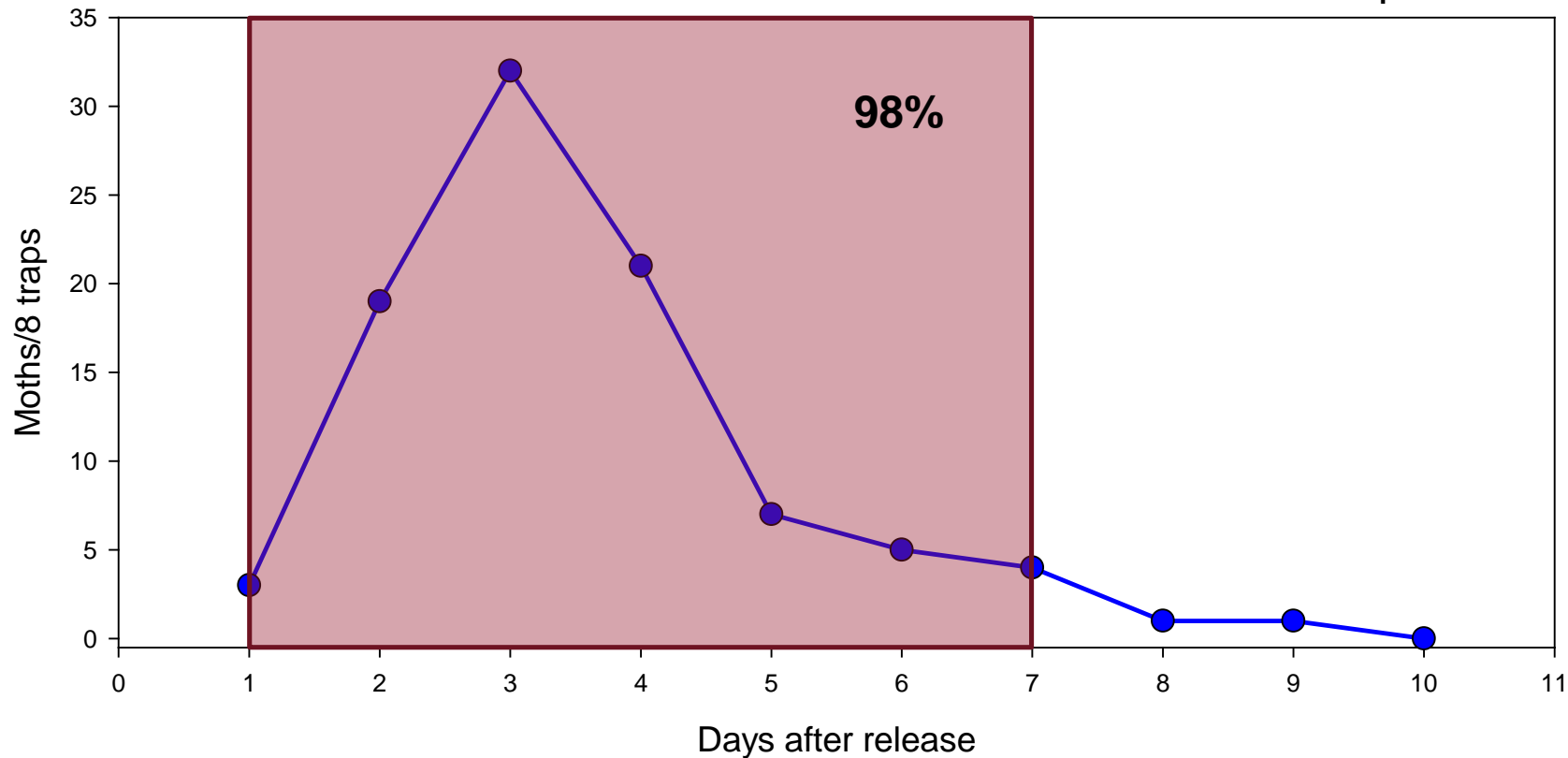


# How quickly are sterile moths recaptured?



# Recapture over time

93 recaptured  
3200 released  
2.9% recaptured





## WA-SIR Myths

Q1 If I use SIR on my orchard,  
can I stop spraying?

A1: It depends...(but probably not)

# The High Cost of Doing Business

Mating Disruption: USD\$110 – the Ford Fiesta option

SIR per acre cost in the US ca. **USD\$500/acre** – the Cadillac option

Cost of CM control without SIR ca. USD\$1,000/acre (organic)

Timing	Horticultural Oil	Granulosis Virus	DA MEC	Entrust
April	Every 14 days			
May	Every 7 days	Every 7 days	Every 7 days*	once
June	Every 7-14 days	Every 7 days	Every 14 days	once
July	Every 7 days	Every 7 days		
August	Once, 1 <sup>st</sup> week			

# Love Thy Neighbor

Growers see traps filling up with moths (off-target drift)  
Not used to sterile moths  
Higher monitoring expenses  
\*\*Communication!



# Here come the tariffs...

Linda Baker: Freightwaves.com

## Not liking them apples: An abundance of fruit and shrinking markets spell uncertainty for Washington apple growers

Tariffs are dampening enthusiasm for apples grown in Washington state, the country's number one producer.

Linda Baker, Staff Writer  Wednesday, August 14, 2019

 1  938  2 minutes read



**China** slapped a 50 percent tariff on U.S. apples in 2018, reducing state shipments to that country by 20 percent. The levy is likely to be even more damaging in the 2019-2020 season, “when we anticipate a larger crop than last year and need to move more volume overseas,” Powers said.

...

Take **India** for example, the state's third-largest export market. Following nine months of threats, the country hiked tariffs on U.S. apples to 70 percent in June 2019, reducing shipments from Washington by 67 percent during the 2018- 2019 season.

Washington growers did get a reprieve this year when **Mexico**, the state's number one export market – importing 13 million boxes annually – removed the threat of a 20 percent retaliatory tariff. **Canada**, the state's number two market, also dialed back threatened tariffs.

# From Cadillac to Tesla?



- ✓ Minimize heat stress
- ✓ Eliminate overhead cooling
- ✓ Improve fruit size, skin color
- ✓ Reduces worker exposure to UV and heat stress
- ✓ Excludes vertebrate (birds/deer)
- ✓ Exclude insects

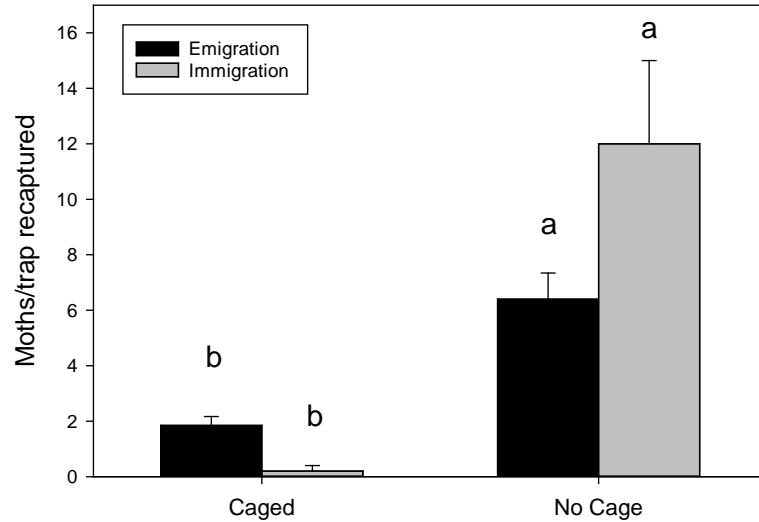
Retrofit cost: USD\$10,000/acre

# How do nets influence codling behavior?

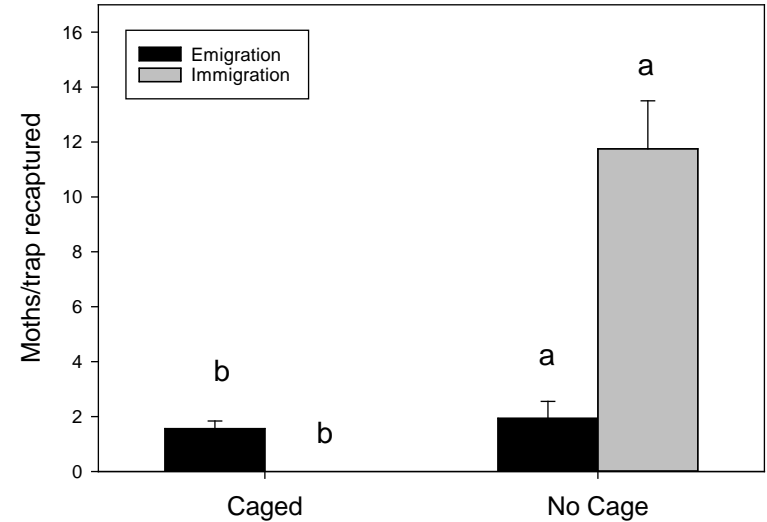


# Small Cage Experiments

2018

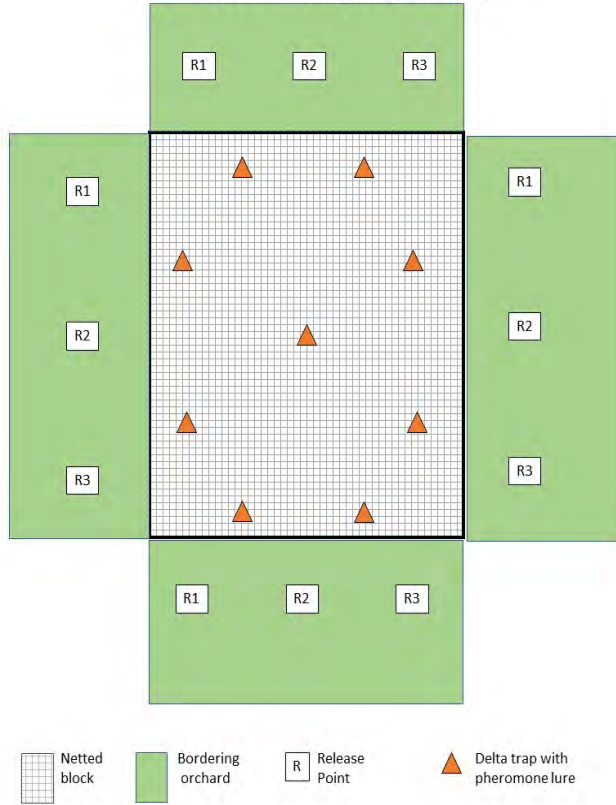


2019



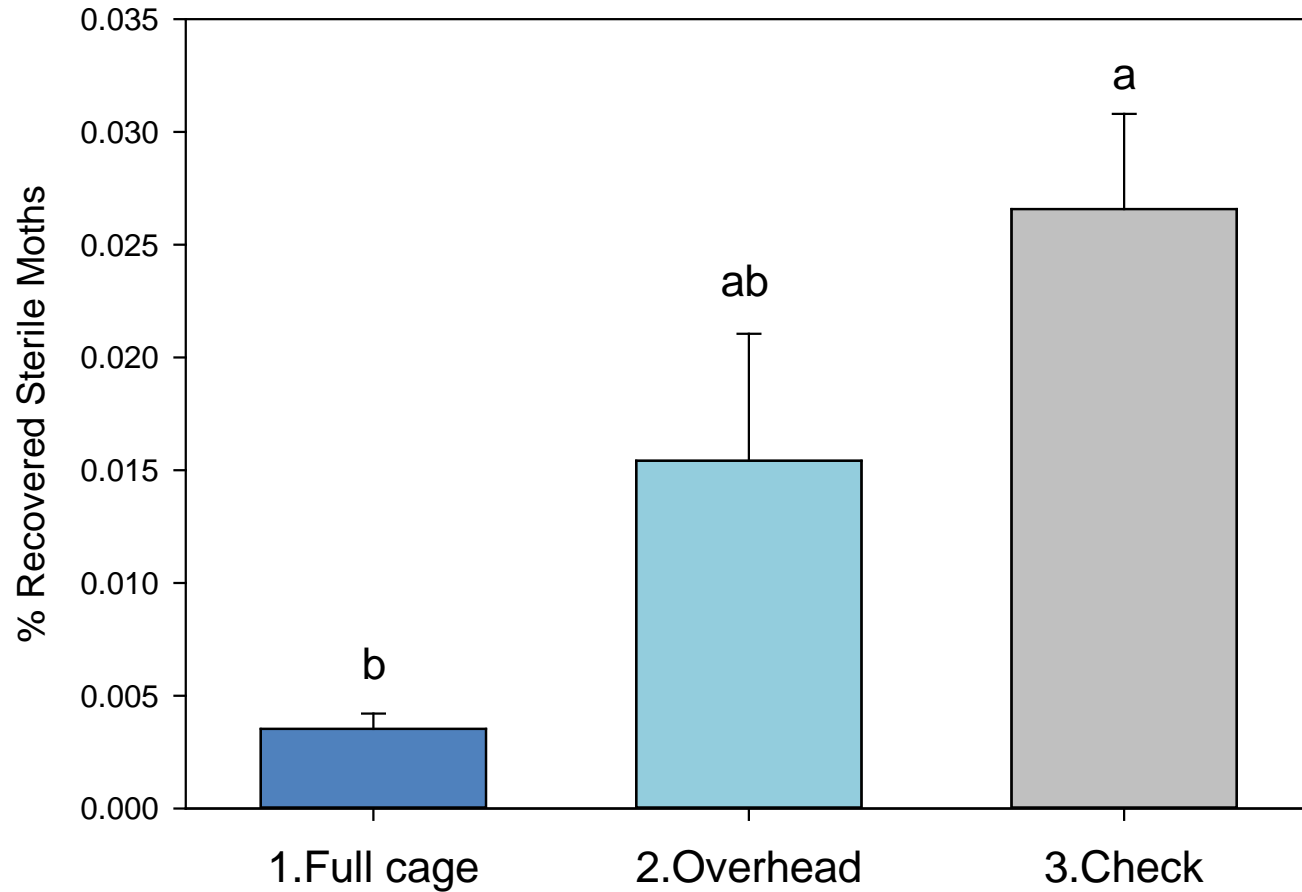
# How do nets influence codling moth capture?

Exp. 1927 – Plot layout schematic





# % Recapture of released sterile moths



# Re-inventing the Wheel

- ✓ NOT areawide
- ✓ Compulsory vs *ad hoc*
- ✓ NO prior sanitation
- ✓ Hotspots, not low pressure
- ✓ Unknown compatibility of other tactics



<https://exceptionnotfound.net/reinventing-the-square-wheel-the-daily-software-anti-pattern/>

# Thoughts for Future Research

- What are traps telling us?
- How compatible are various techniques?
- Can this work on a smaller scale or as an IPM tool?

# Thanks!



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