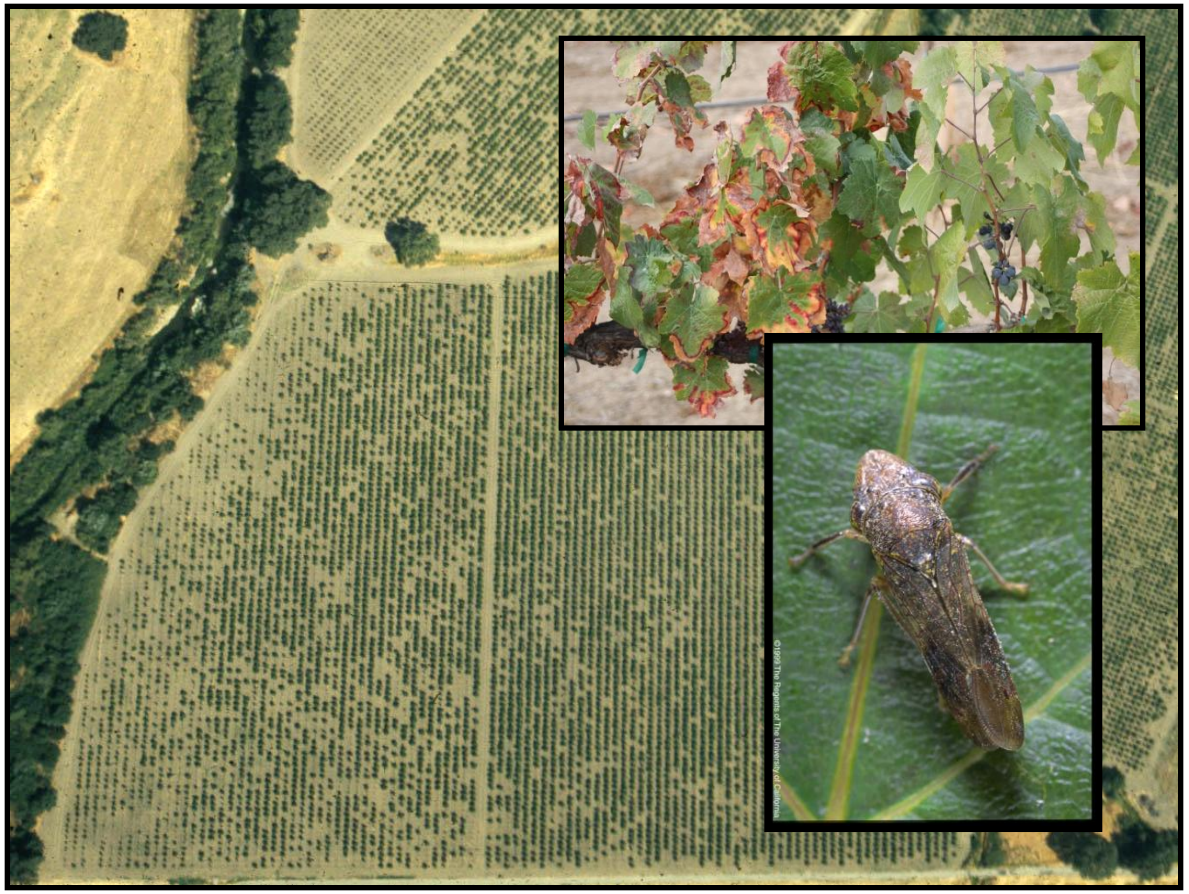
How effective is sharpshooter control at limiting Pierce's disease spread?



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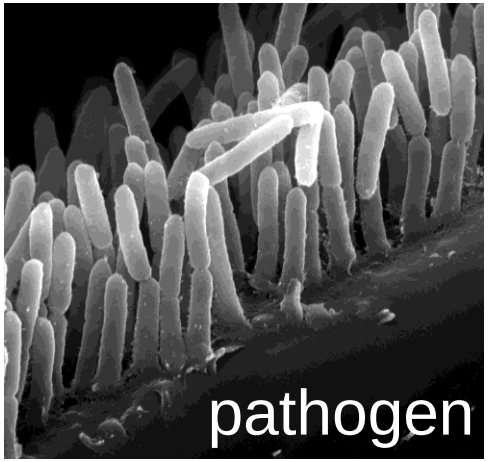
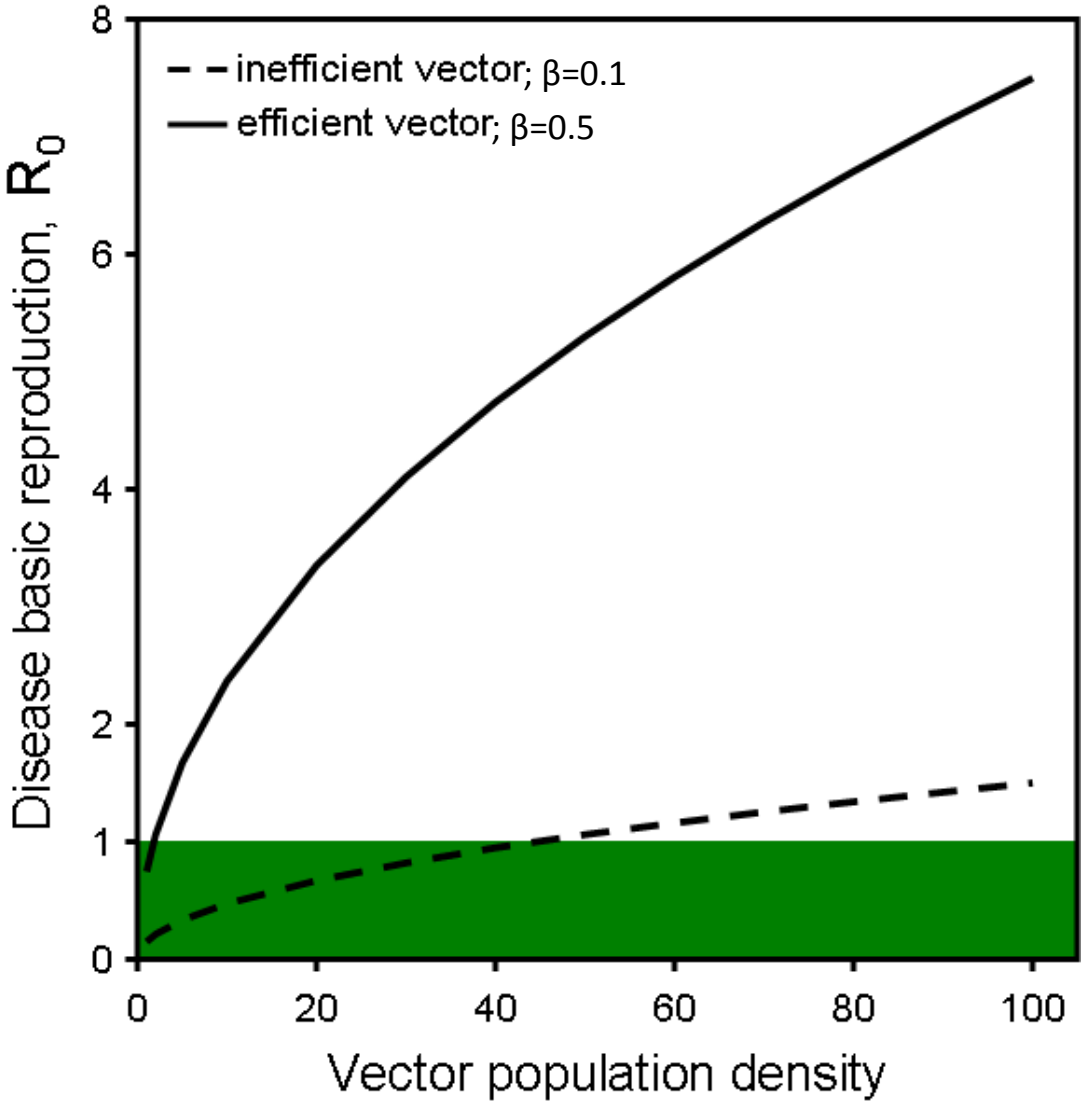
Disease management

1. Eliminate pathogen sources
2. Resistant hosts
3. Vector control



Feasibility of managing disease via vector control



-may be achievable for an inefficient vector

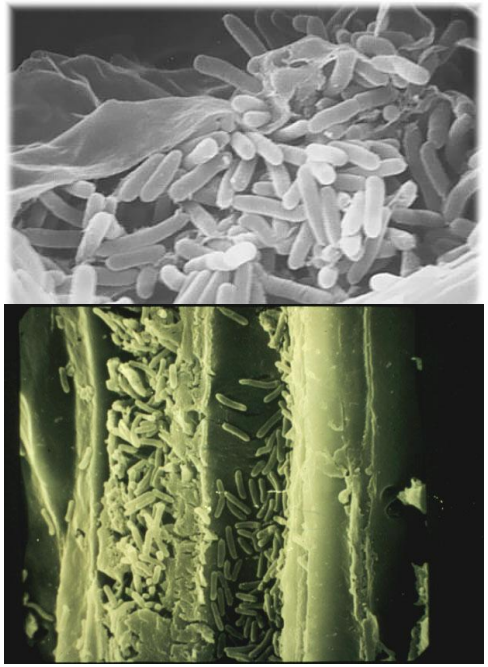
-challenging for an efficient vector

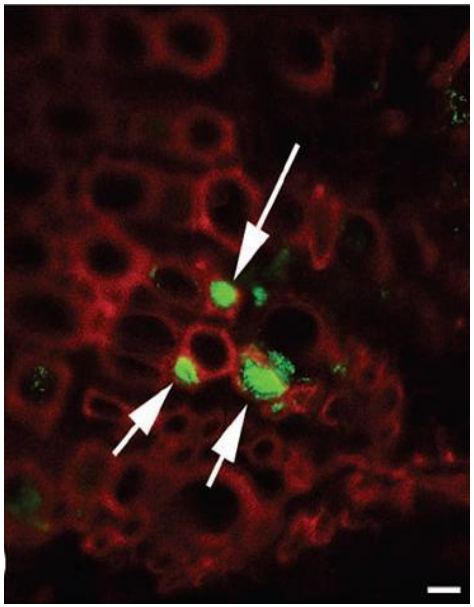
Xylella fastidiosa

Xylem-limited bacterium

Infects native, ornamental, & weedy plants

Threat to several crops
(e.g., grapes, almond, citrus, alfalfa)





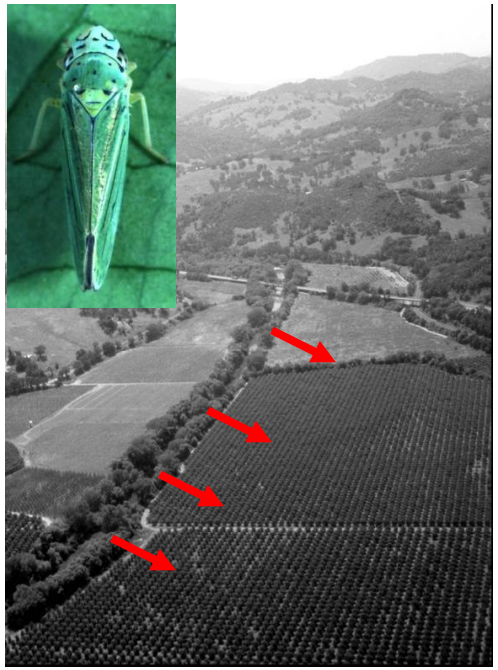
Xylella diseases

Plugs xylem vessels, restricts water flow

Leaf scorch or stunting symptoms vary among hosts (Pierce's disease in grapes, Alfalfa dwarf)

No cure


almond
pecan
oleander
olive
alfalfa dwarf
coffee
plum
citrus variegated
chlorosis
sweet gum



Pierce's disease Epidemiology in California

North Coast:

- consistent moderate infection
- concentrated along borders with riparian areas

Central Valley/Southern CA:

- historically moderate prevalence
- in the late 1990s severe PD outbreaks occurred

Glassy-winged sharpshooter
(*Homalodisca vitripennis*)

Pierce's disease outbreaks in Southern California

-attributed to recent invasion of Glassy-winged sharpshooter

-"100s to 1000s" of GWSS per vine

-up to 100% infection within 1 year

-40% loss for Temecula region overall

-similar outbreak began near Bakersfield

How efficient a vector is GWSS?

1. Transmission efficiency

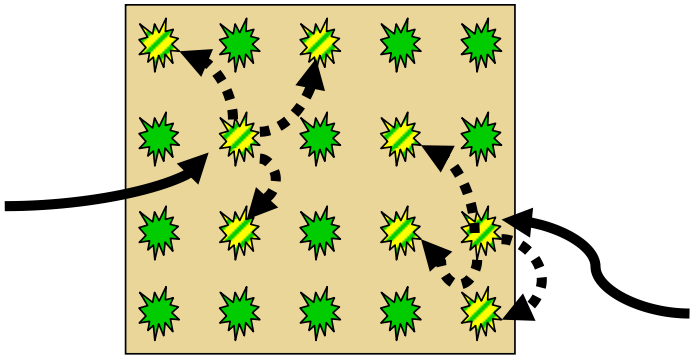
-GWSS less efficient at transmitting than native sharpshooters

2. Behavior

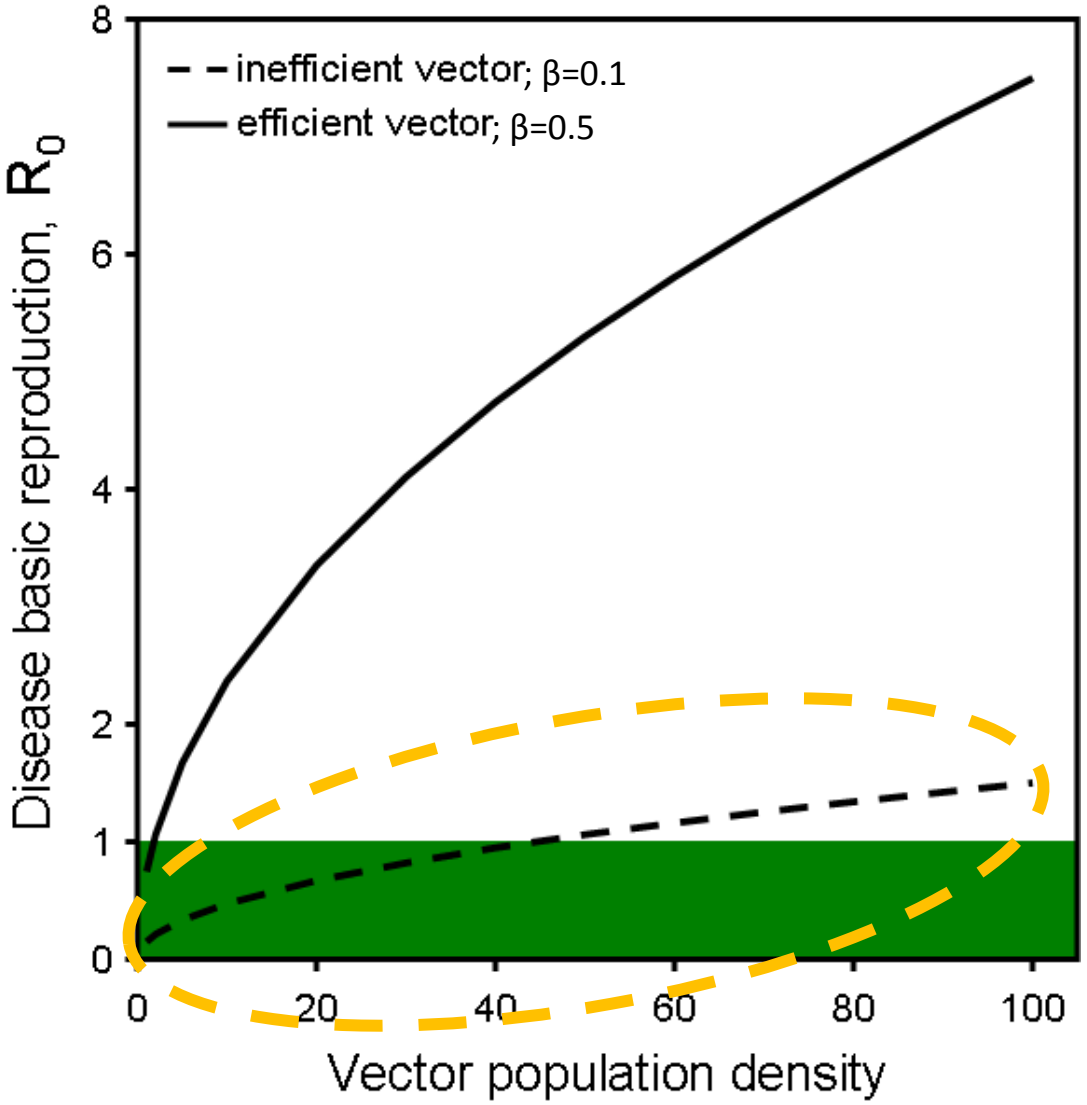
-GWSS behaves similarly to native sharpshooters

3. Pathogen spread

-GWSS not very efficient at moving pathogen



Feasibility of managing disease via vector control



-GWSS not all that efficient a vector

-GWSS's impact is largely attributed to high population density

GWSS control may be an efficient strategy for curbing PD spread

Glassy-winged sharpshooter control

1. Biological control

   -egg parasitoids

   -*Gonatocerus ashmeadi*

   -up to 80% parasitism

2. Chemical control

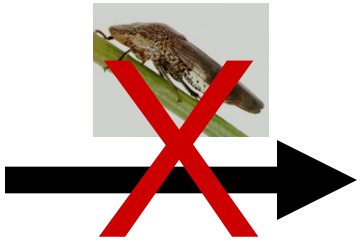
   -GWSS is highly susceptible to systemic insecticides

   -imidacloprid readily transported in xylem

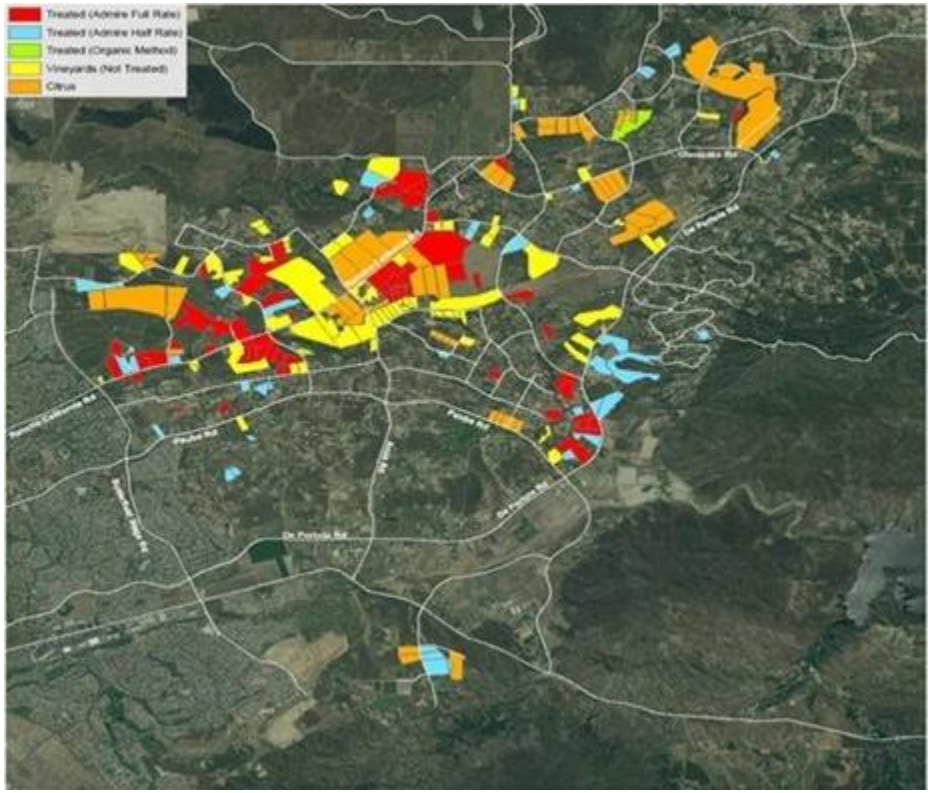
   -GWSS process 100 to 1000x body weight daily

Chemical control of GWSS

Treatments in citrus limit GWSS incursions into vineyards



Are within-vineyard treatments further beneficial?



Within-vineyard control

Chemical control commonly employed in vineyards for GWSS control

>70% of Temecula vineyards treated consistently with imidacloprid

Little data on whether vector pressure is affected

No information linking treatments with PD spread

Does within-vineyard chemical control reduce vector pressure and Pierce's disease spread?

Field surveys of PD prevalence

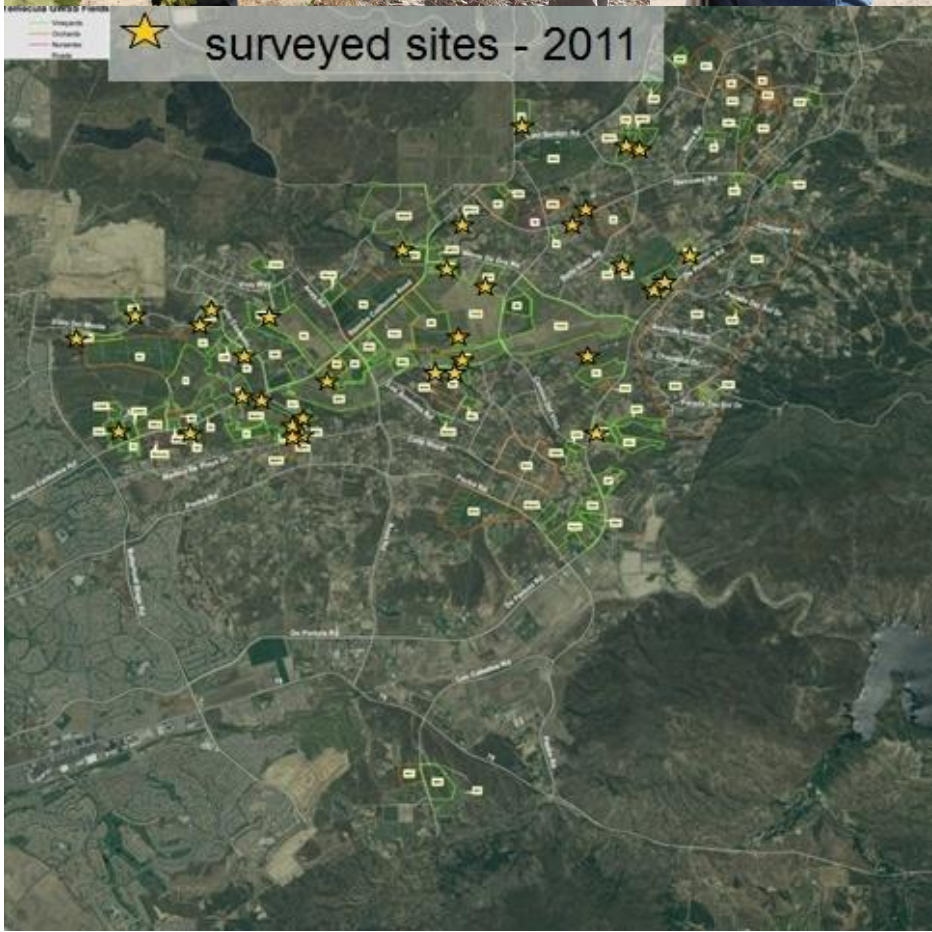
34 sites with known treatment history

Treated, untreated, mixed treatment

1. Verify imidacloprid treatments

2. Visual symptoms, culture symptomatic, ELISA asymptomatic

3. GWSS, natural enemy, pest monitoring



Field surveys of PD prevalence

34 sites with known treatment history

Treated, untreated, mixed treatment

1. Verify imidacloprid treatments

2. Visual symptoms, culture symptomatic, ELISA asymptomatic

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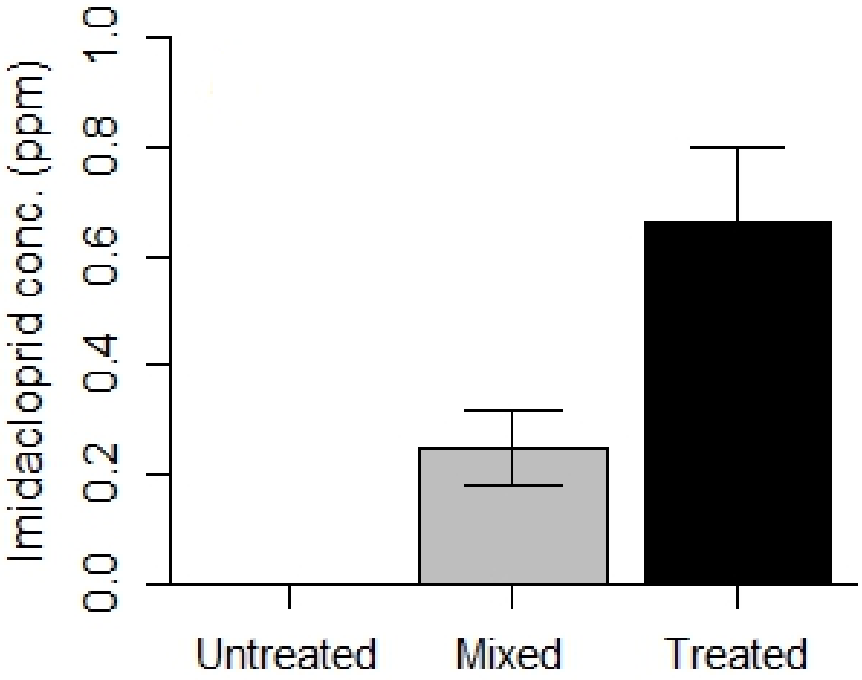
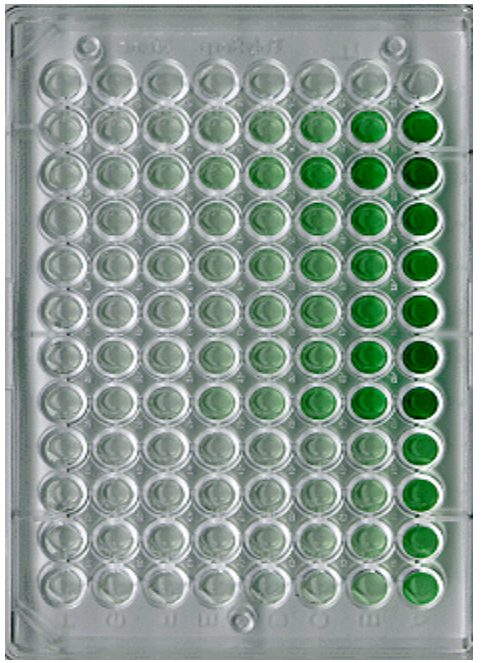
Pierce’s disease symptoms

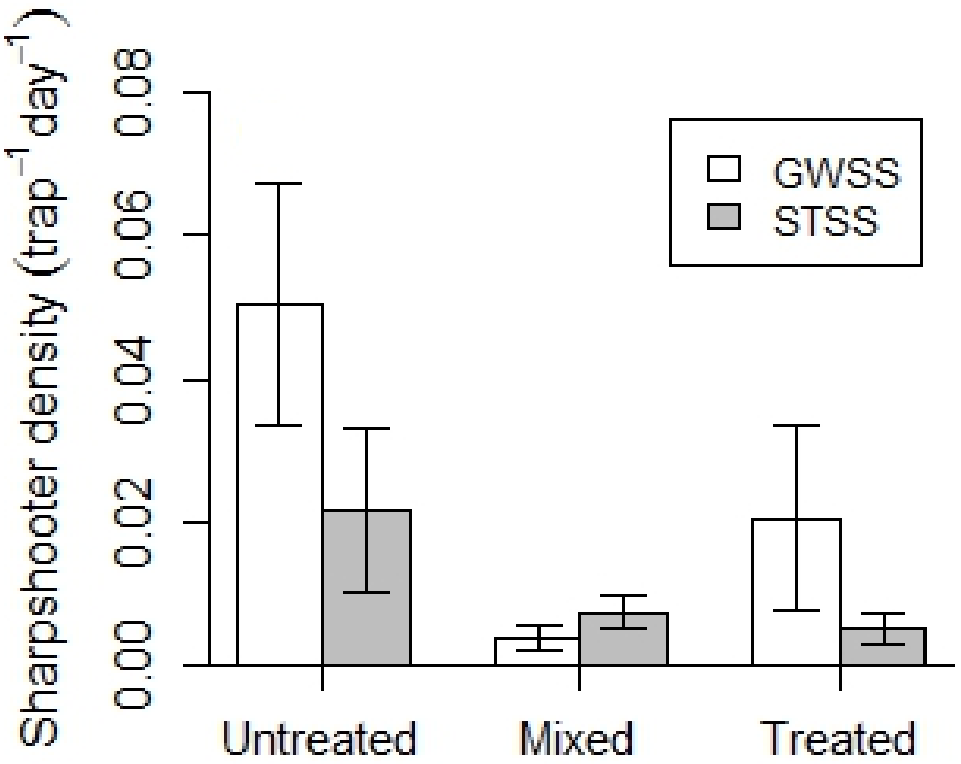
Other grapevine diseases





-ELISA assay to verify imidacloprid concentration

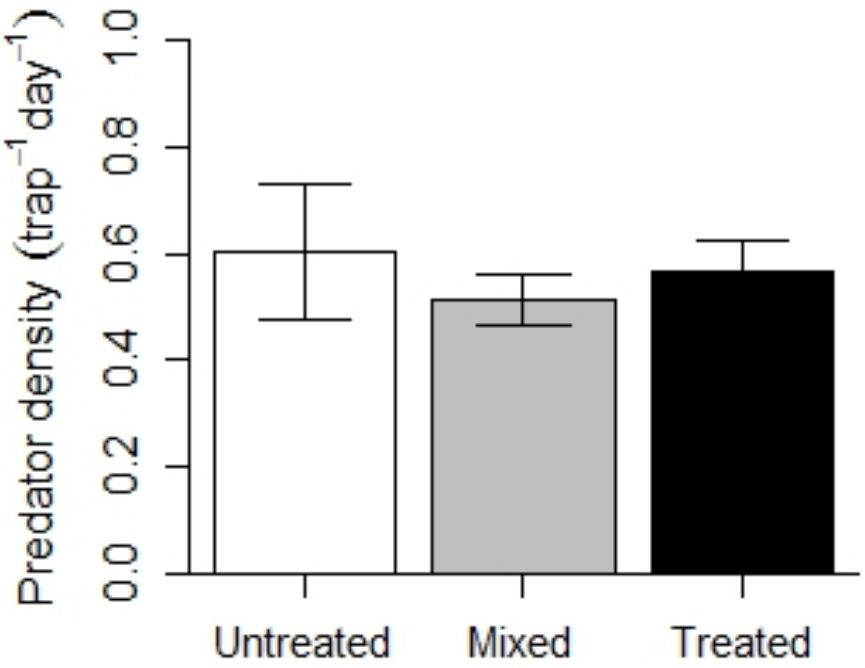
-regularly treated vineyards had higher concentration than intermittently treated vineyards

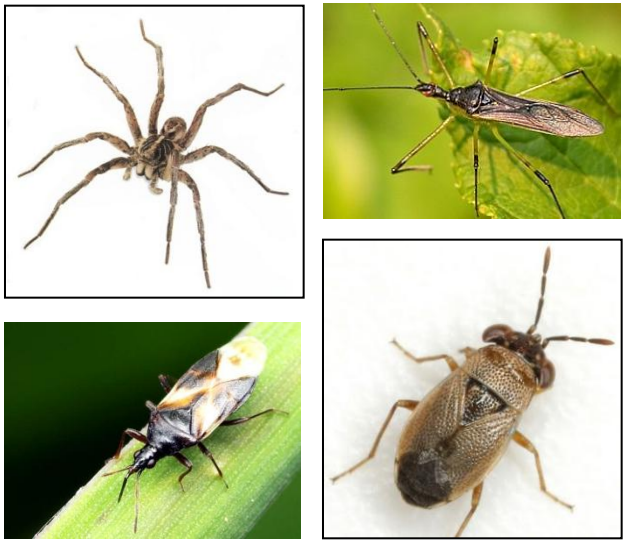


-GWSS more abundant than STSS

-most sharpshooters in untreated

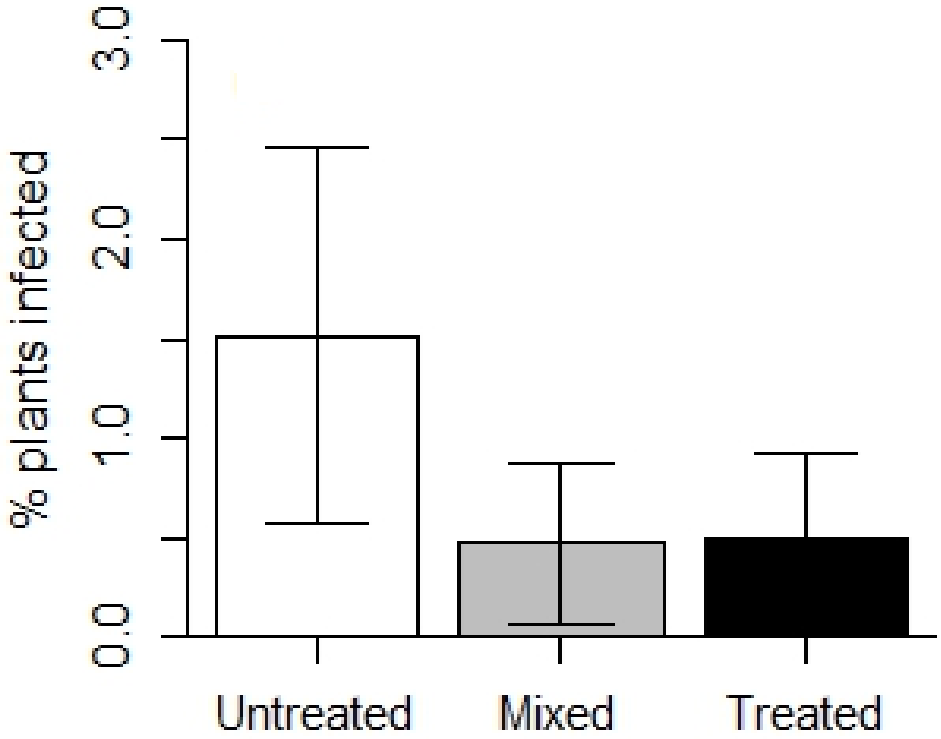
-fewest sharpshooters in intermittently treated





-abundance of most common generalist predators was not affected by treatment

-no obvious secondary pest outbreaks



-low prevalence overall

-high variability among untreated sites

-tendency for more disease in untreated sites

Within-vineyard chemical control may reduce disease spread

-lower vector pressure in treated sites

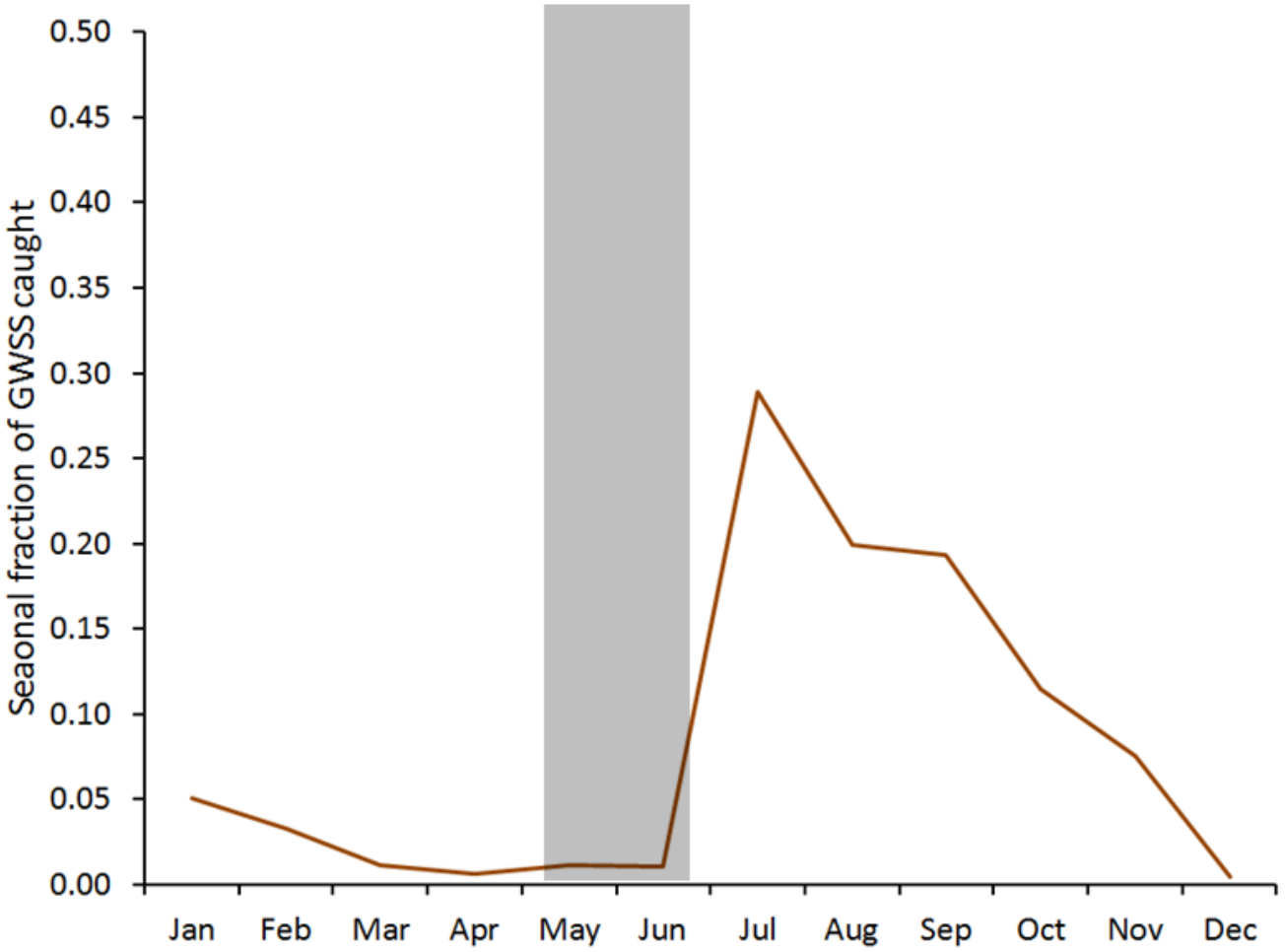
-lower prevalence in treated sites

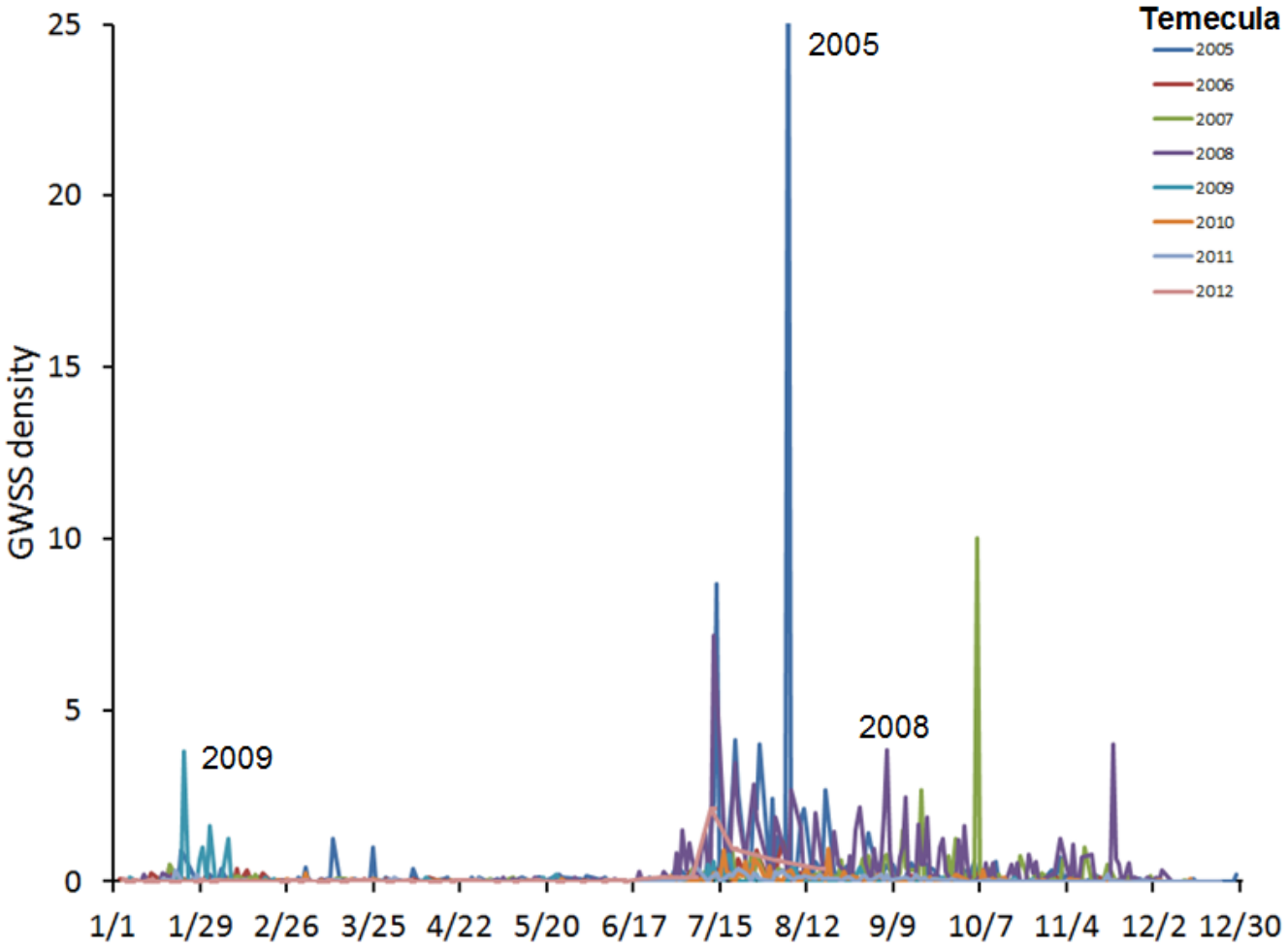
Treatments don’t appear to contribute to secondary pest outbreaks

Other considerations:

-may not need to apply imidacloprid every year

Is it possible to predict what will be a “bad GWSS year”?

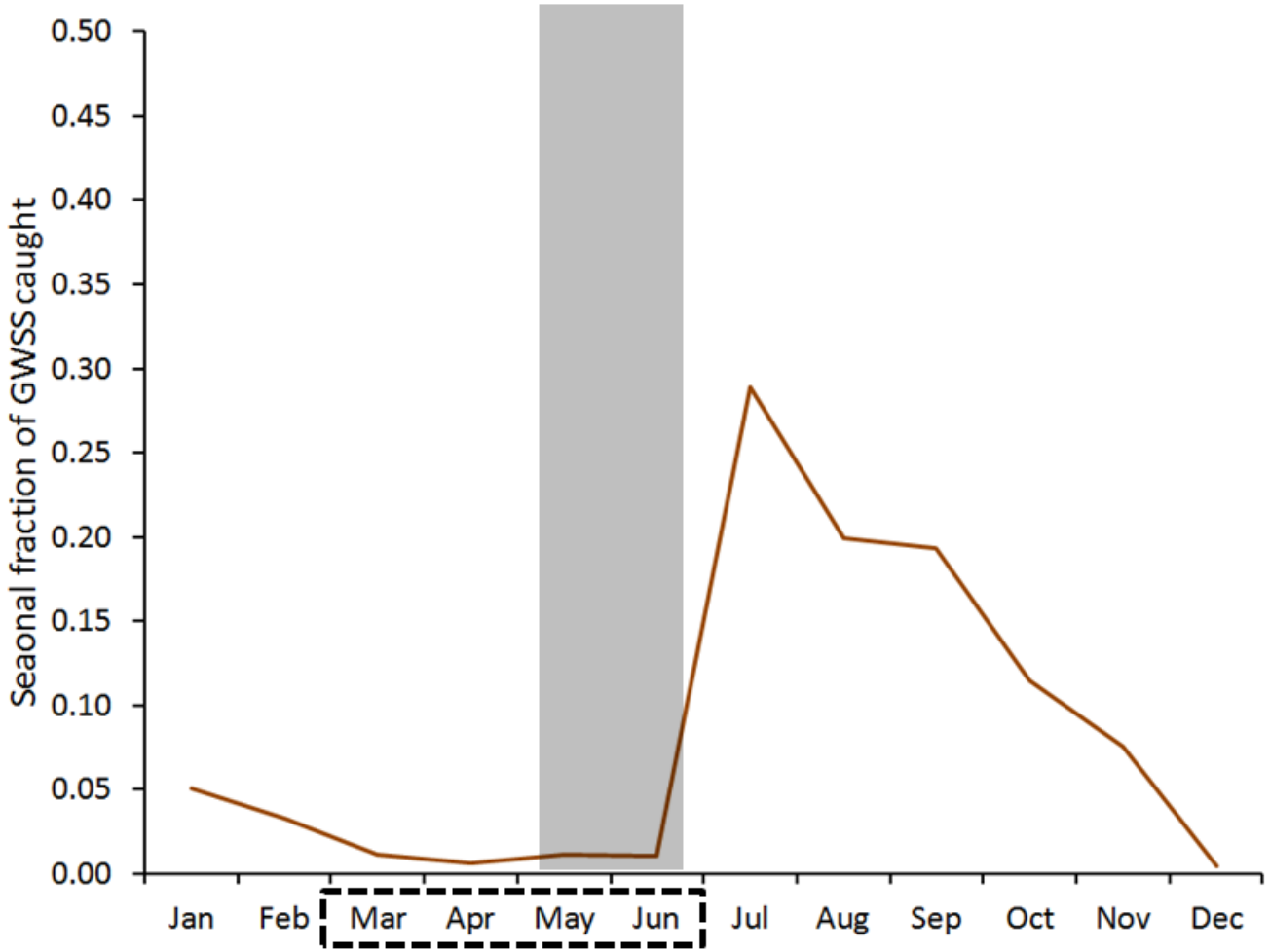




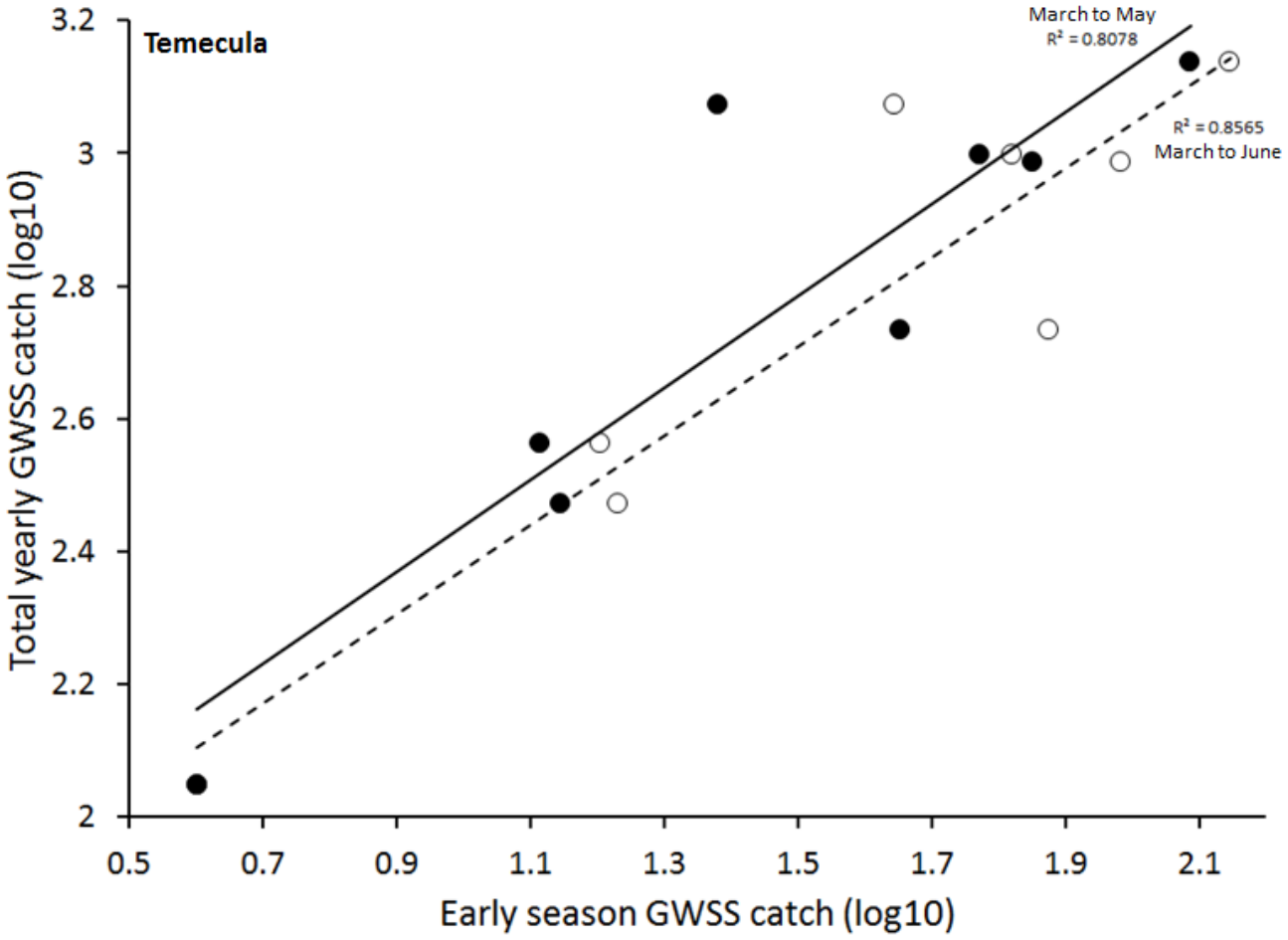
There is substantial variability in GWSS populations among years

-wet, warm winters favor sharpshooter populations

Is it possible to predict what will be a “bad GWSS year”?



Early season catch does a very good job of predicting "bad GWSS years"



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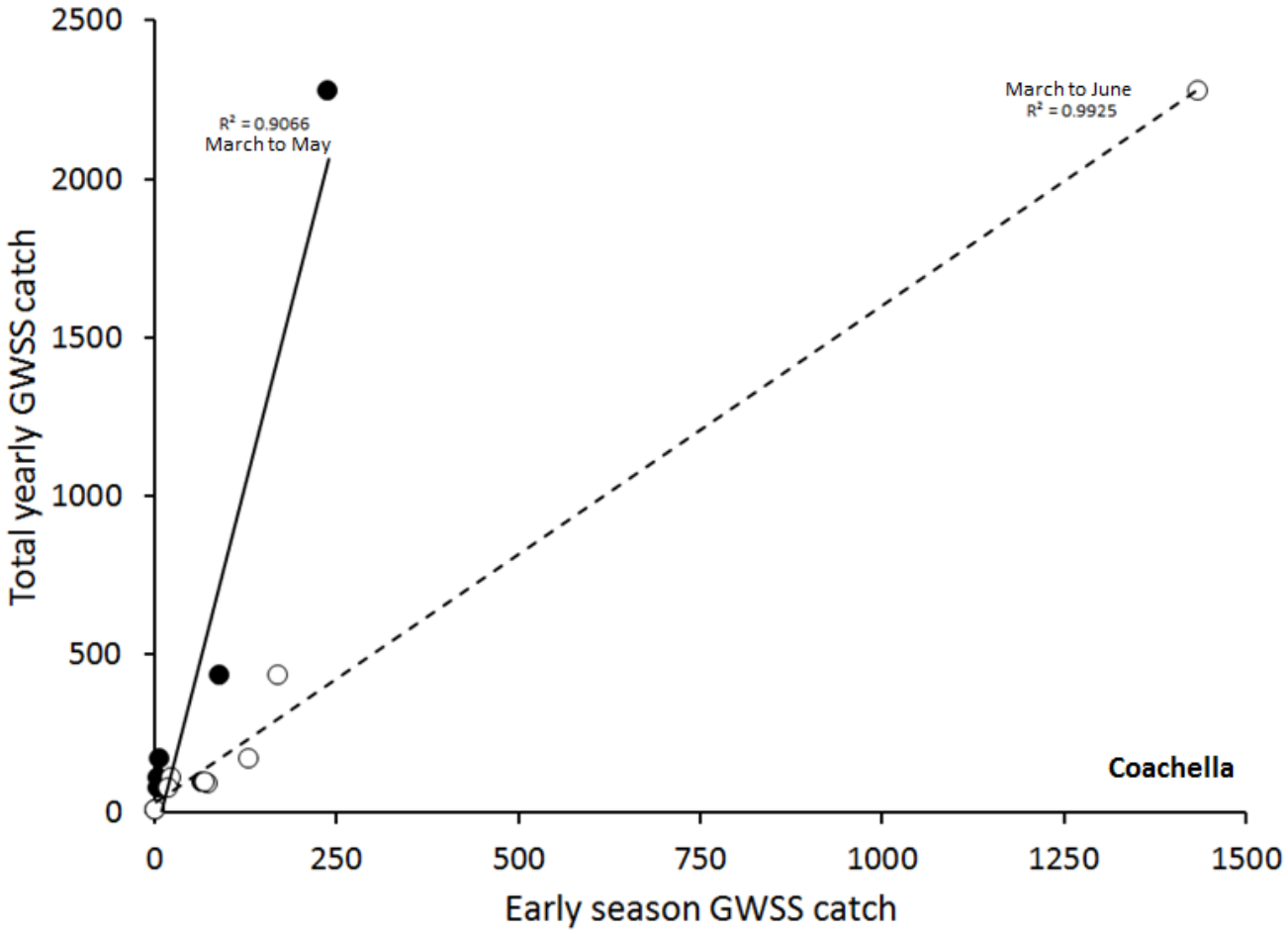

Within-vineyard chemical control may reduce disease spread

-lower vector pressure in treated sites

-lower prevalence in treated sites

Treatments don't appear to contribute to secondary pest outbreaks

Other considerations:

-may not need to apply imidacloprid every year

-**what if regional GWSS population is much larger?**