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Investigating the Impacts of Pecan Hedging on Pest and Beneficial Insects

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Mechanical Hedge Pruning

Manage tree size and optimize sunlight and water requirements

Common practice in dryer environments; removes upper canopy limbs top prevent excessive growth and outreach. (Lombardini 2006)

Benefits (for southeastern US)

1.) Prevents overcrowding of orchards

2.) Increases windstorm resistance

3.) Beneficial to nut quality and yield

4.) Reduces excessive shading

5.) Reduces alternate nut bearing

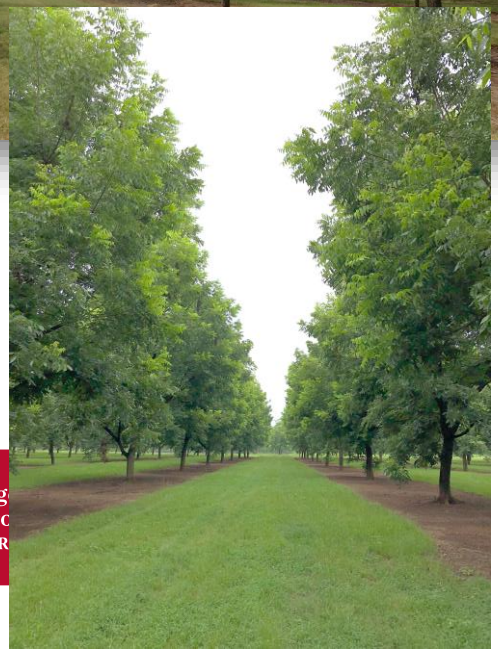
6.) Improves stem water level and decreases water stress

7.) Alleviates problems associated with new trend of high density planting (Wells 2018)

Mechanical Hedge Pruning

Mechanical Hedge Pruning

Hedged



Not Hedged

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PECAN HEDGING AND PEST MANAGEMENT

- Has shown to have positive implications on disease (scab) management by ensuring better fungicide coverage.

plant disease

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RESEARCH

Severity of Scab and its Effects on Fruit Weight in Mechanically Hedge-Pruned and Topped Pecan Trees

Clive H. Bock and **Michael W. Hotchkiss**, USDA-ARS-SEFTNRL, Byron, GA 31008; **Tim B. Brenneman** and **Katherine L. Stevenson**, University of Georgia, Tifton 31793; **William D. Goff**, Auburn University, Auburn, AL; **Michael W. Smith**, Oklahoma State University, Stillwater 74078; **Lenny Wells**, University of Georgia, Tifton 31793; and **Bruce W. Wood**, USDA-ARS-SEFTNRL

Will this have the same effect on insect pest management?

How does hedging affect insect pests and natural enemies?

Crop Protection
Volume 113, November 2018, Pages 75-83

Canopy management of macadamia trees and understory plant diversification to reduce macadamia felted coccid (*Eriococcus ironsidei*) populations

Rosemary Gutierrez-Coarite [a], Javier Mollinedo [a], Alyssa Cho [b], Mark G. Wright [a]

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https://doi.org/10.1016/j.cropro.2018.07.014

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- Pruning the canopy increased sunlight availability and understory plant species diversity.
- Sunlight and plant diversity increases predation and parasitism on *Eriococcus ironsidei*.
- Increase in natural enemies likely contributed to the reduction of *E. ironsidei* abundance.

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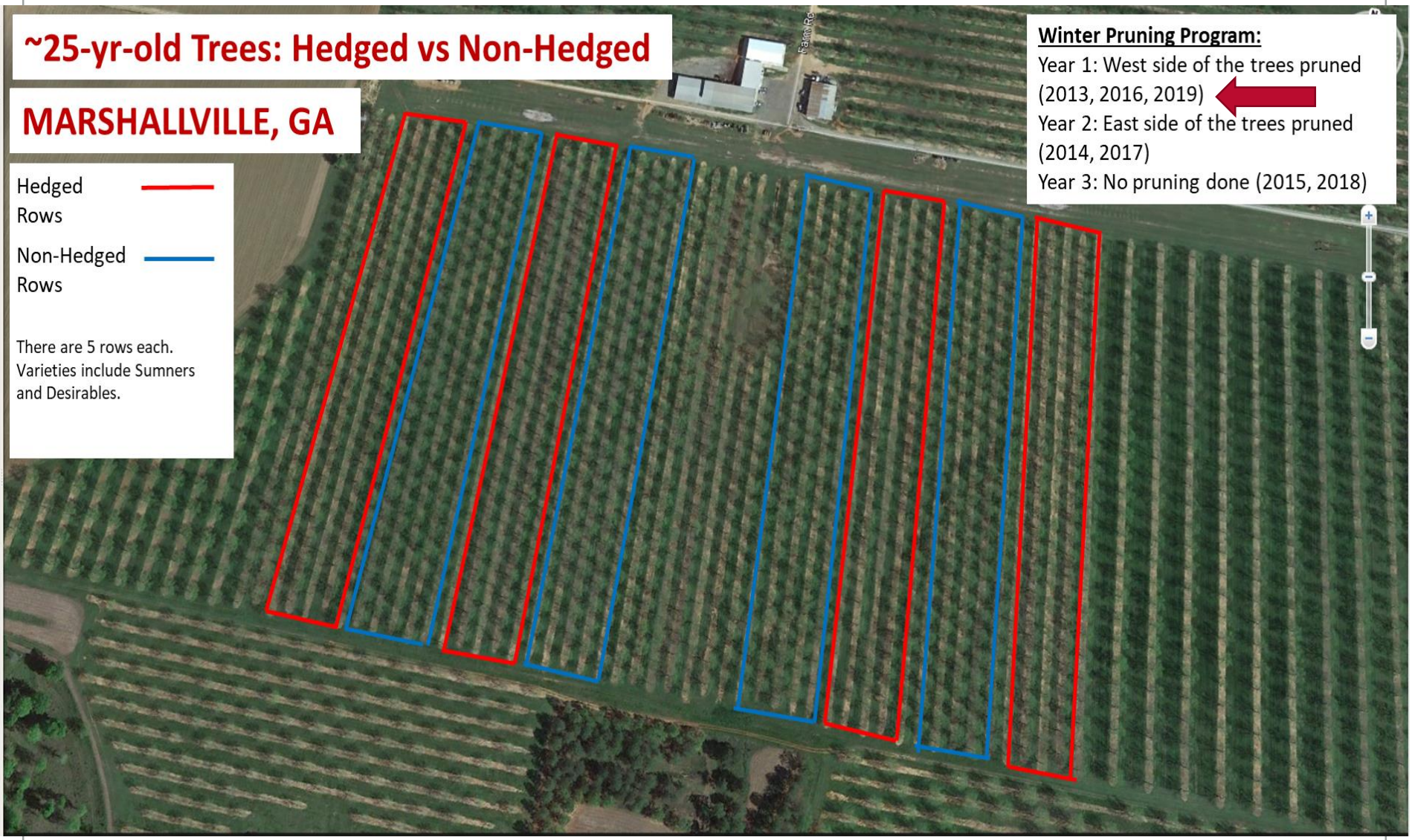
What about in pecans?

STUDY SITE: Marshallville, GA

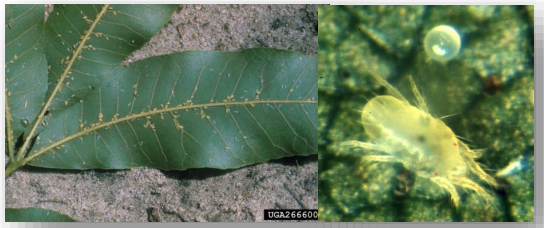


PEST AND PEST INJURY SAMPLING: 2018 & 2019

Foliage Feeders

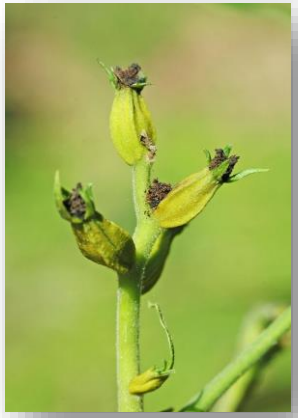
Aphids

Mites



Nut Feeders

Nut casebearers



Insect Injury at Harvest

Counted insects in the lab.

We collected samples:

upper and lower canopy

NATURAL ENEMIES: 2018 & 2019

Aphid Parasitism & Predatory Mites

- Leaf Samples

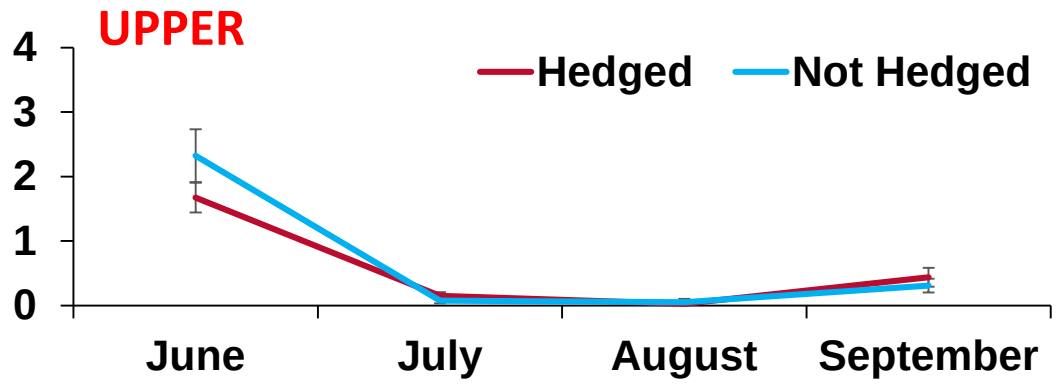
Parasitized Aphids

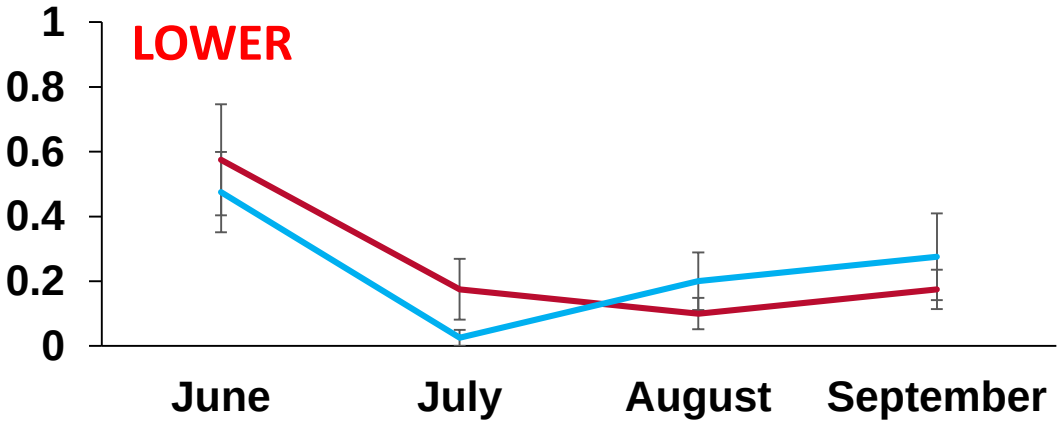
Western Predatory Mites

Predators & Parasitoids

- Yellow Sticky Card Trapping

RESULTS: NO. OF APHIDS (2018)





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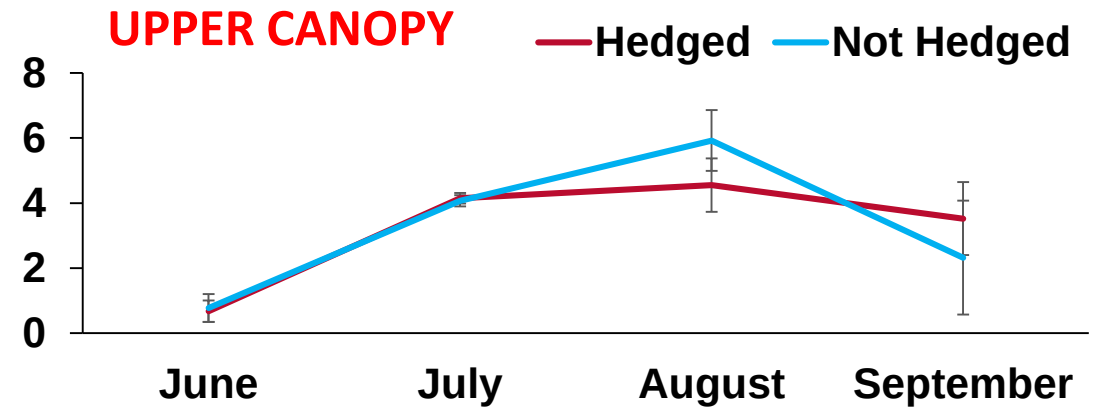
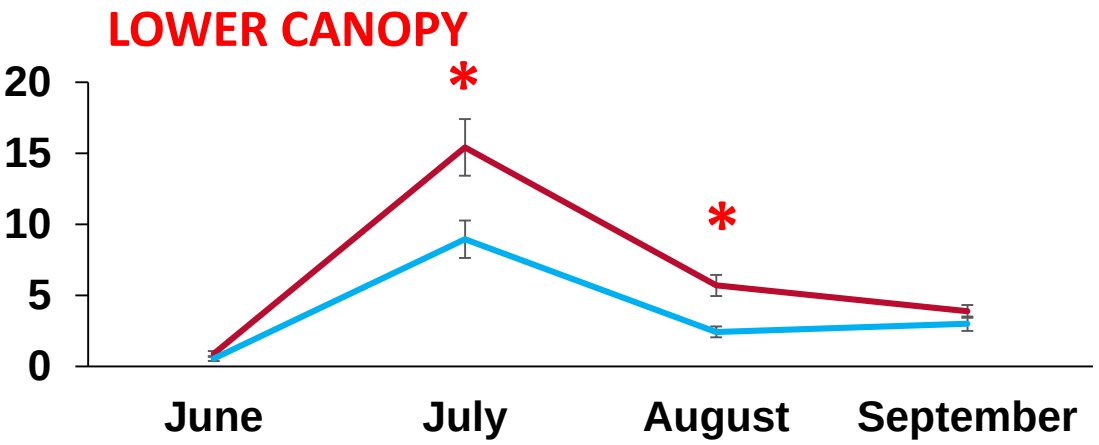
- June: more aphids in the upper canopy
- Aphid populations did NOT differ between hedged vs non-hedged trees

RESULTS: NO. OF APHIDS (2019)





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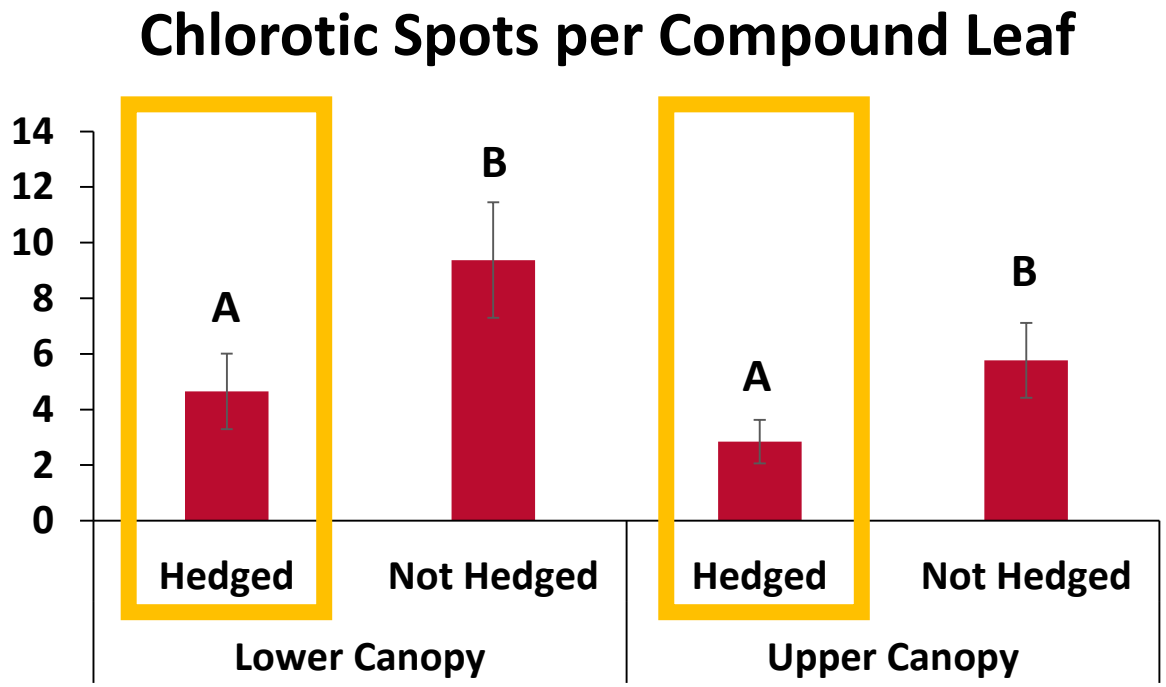
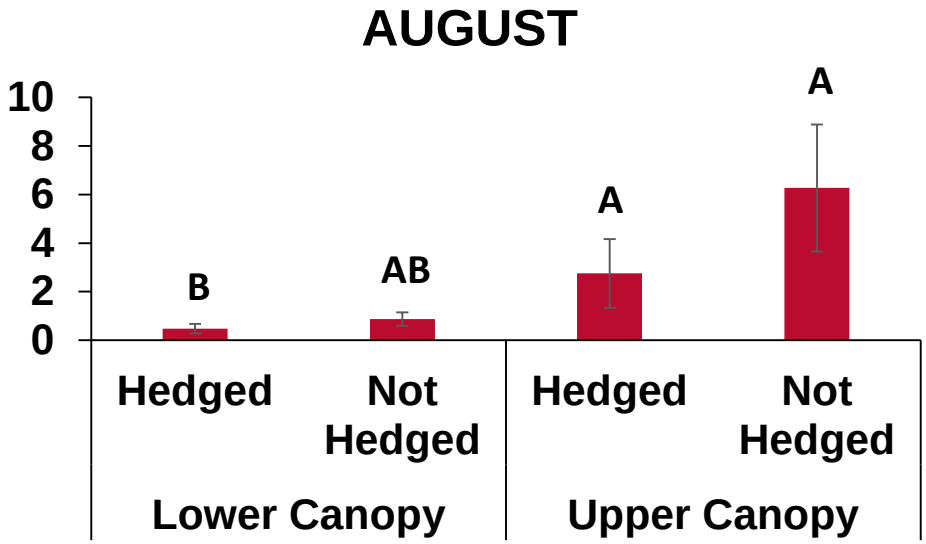
- Upper canopy: no difference between hedged and non-hedged trees.
- Lower canopy: aphids were higher on hedged trees compared to non-hedged trees in July and August.

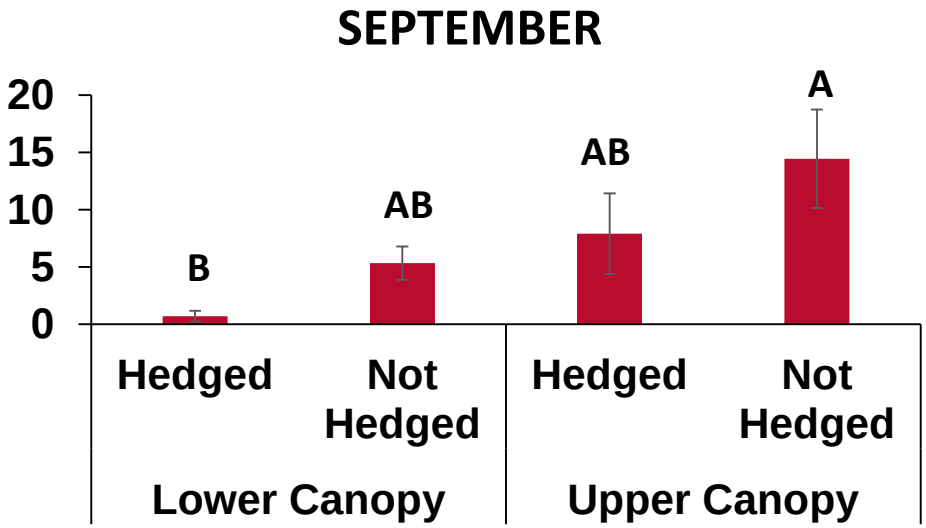
RESULTS: BLACK APHID INJURY (2018, September)



Black aphid injuries on hedged trees were lower.

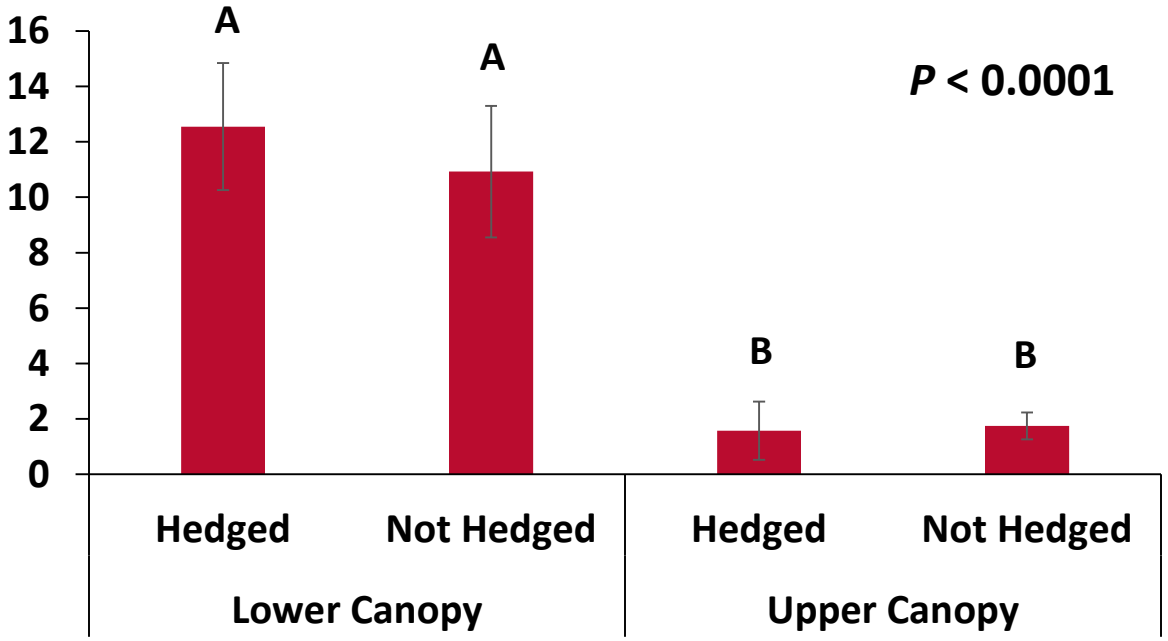
RESULTS: BLACK APHID INJURY (2019)





- No difference in injury between hedged and non-hedged trees.
- Significantly more injury in the upper canopy.

RESULTS: LEAF SCORCH MITES (2018, August)



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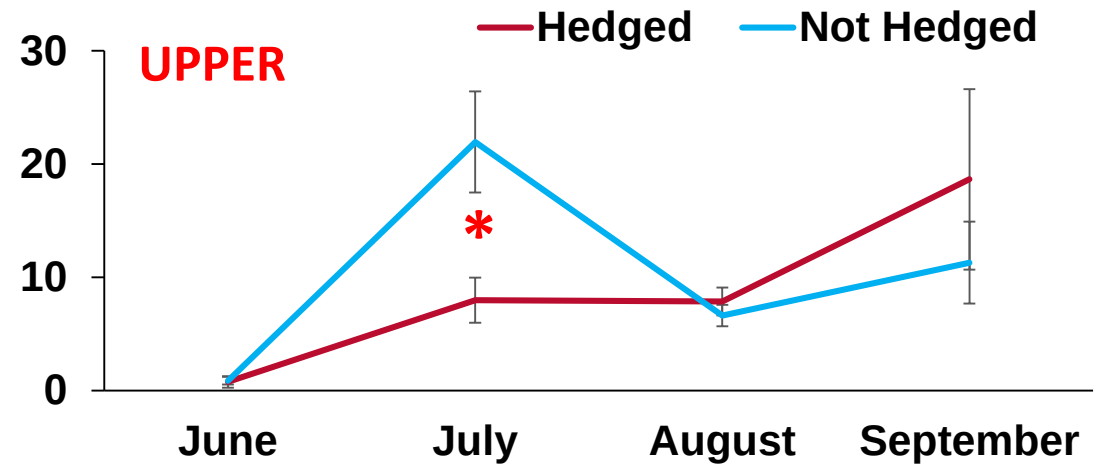
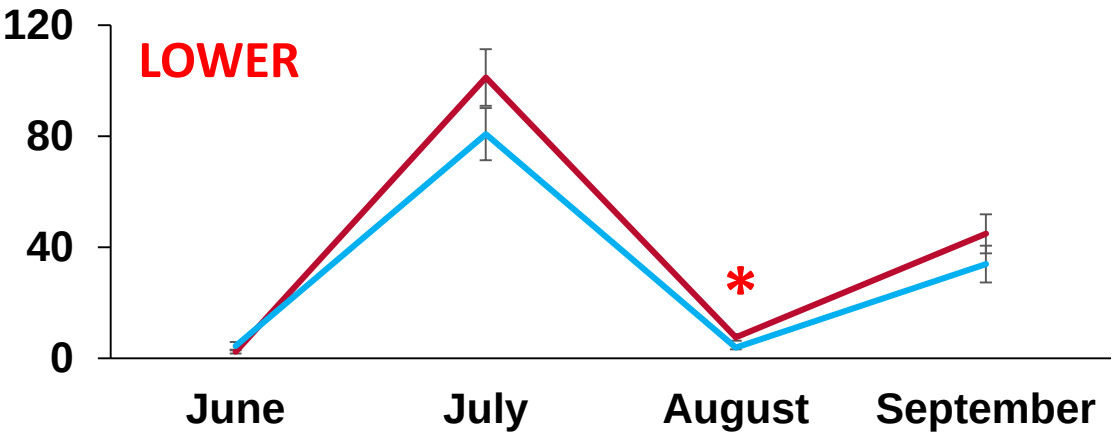
- More PLSM in the lower canopy than upper canopy
- No diff. between hedged vs non-hedged

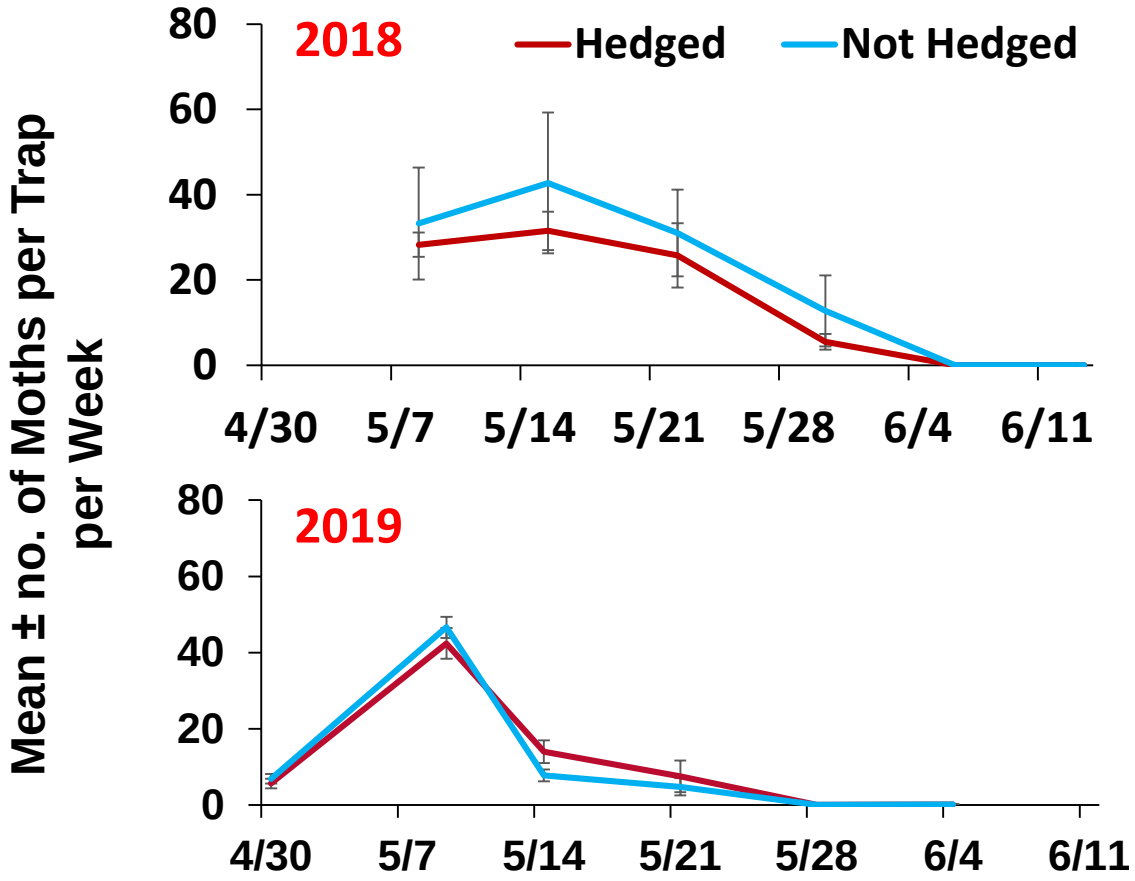
RESULTS: SCORCH MITES (2019)





- More mites in the lower canopy than in upper canopy.
- Upper canopy: more mites in non-hedged trees in July.
- Lower canopy: more mites in hedged trees in August.

RESULTS: Nut Casebearer Moths



Pheromone-baited Trap (deployed lower canopy)

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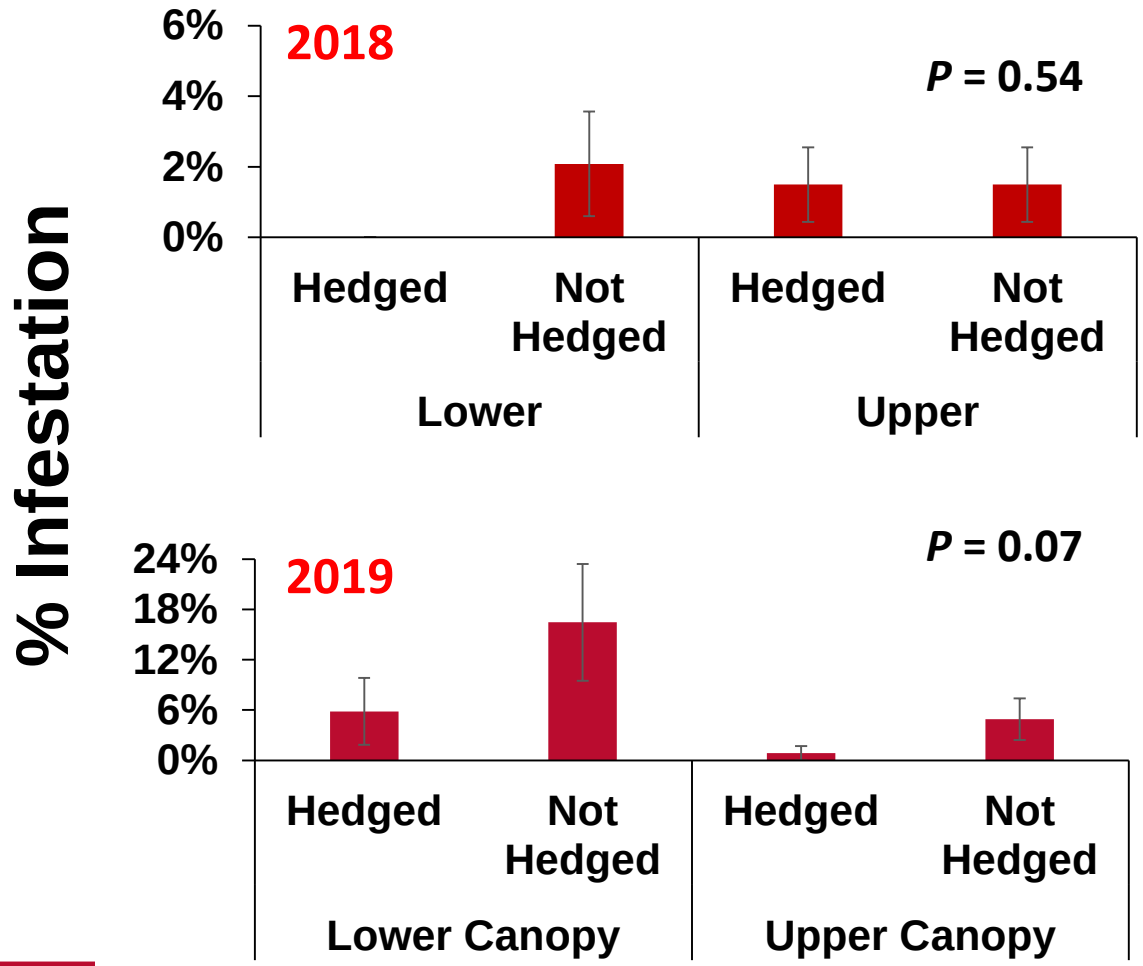
- No differences in the PNC moths between hedged and non-hedged blocks

RESULTS: Nut Casebearer Infestation (June)

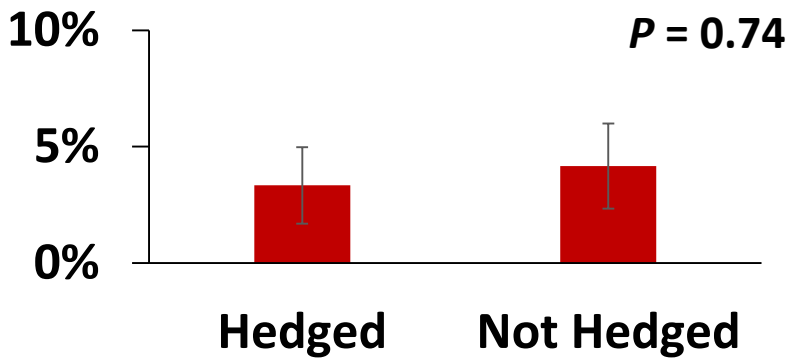


Infestation = nuts with egg, larva or larval feeding

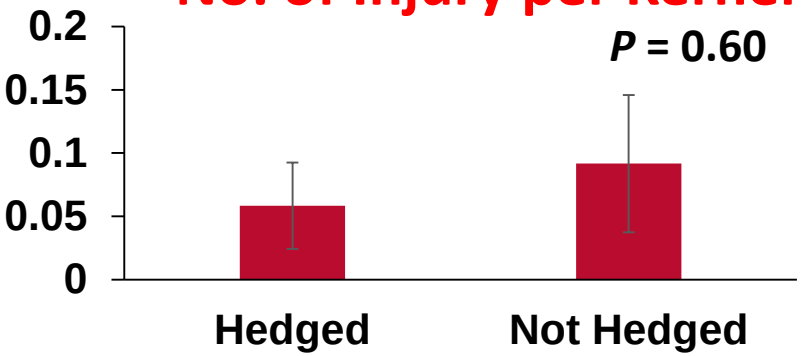
- **Infestation was higher in 2018 than 2019.**
- **No differences in the PNC infestation rates between hedged and non-hedged blocks.**

RESULTS: Insect-Related Injury at Harvest (2018)

% Infestation



No. of Injury per Kernel



Examined total of 120 nuts from each treatment.

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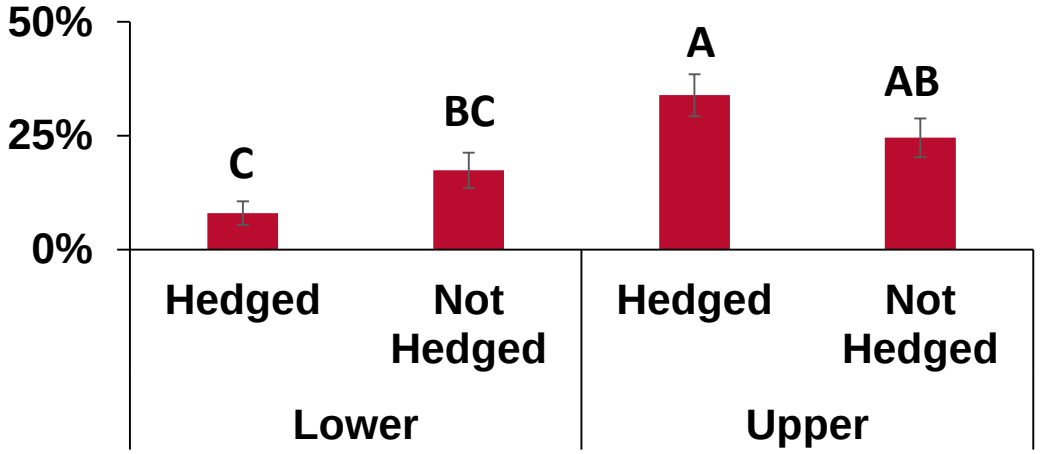
- No differences in insect-related injury at harvest between hedged and non-hedged blocks

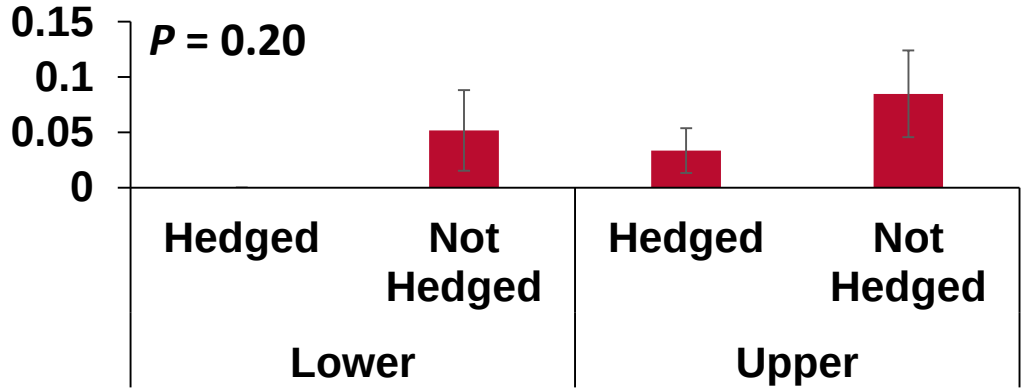
RESULTS: Insect-Related Injury at Harvest (2019)

% Infestation



Examined total of 240 nuts (120 upper and lower) from each treatment.

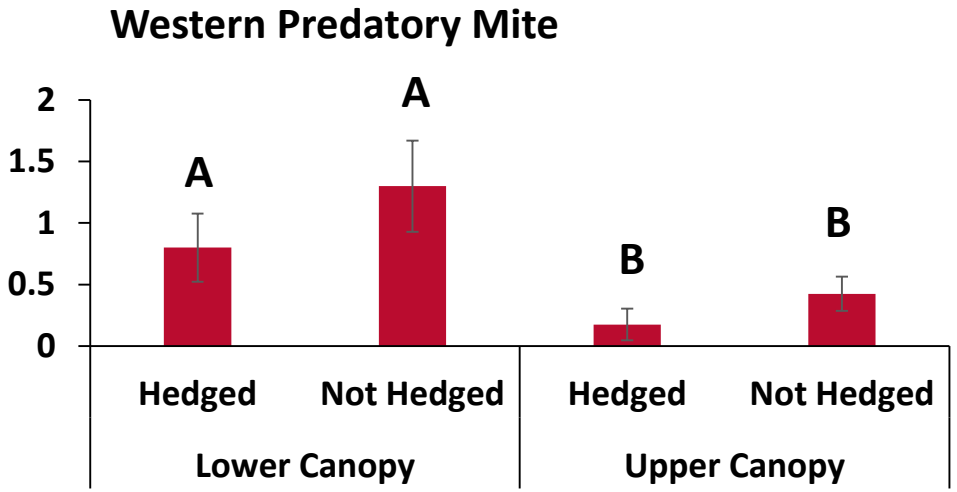
No. of Injury per Kernel



- No differences in insect-related injury at harvest between hedged and non-hedged blocks

NATURAL ENEMIES

PREDATORY MITES (2018)



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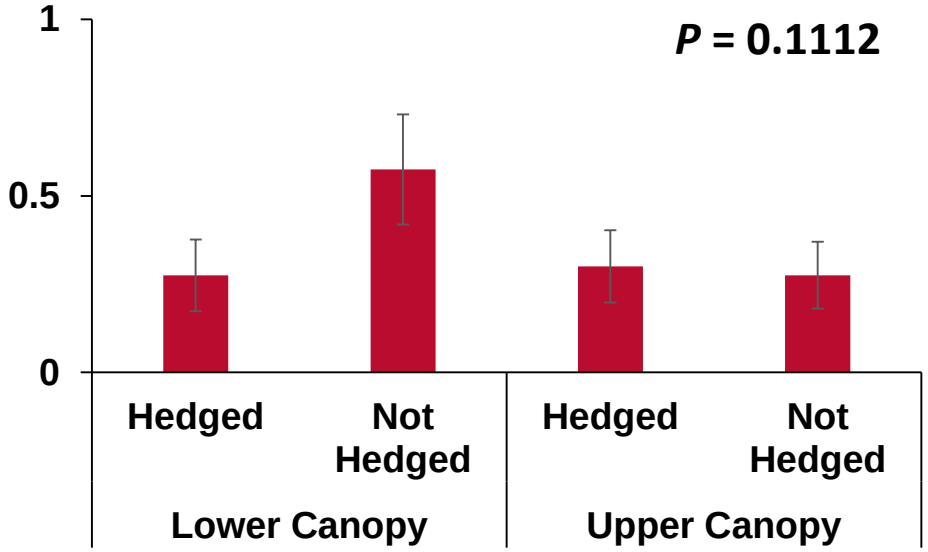
- More predatory mites in lower than upper canopy (~more PLSM in the lower canopy)
- No difference between hedged vs non-hedged

NATURAL ENEMIES

PREDATORY MITES (2019)



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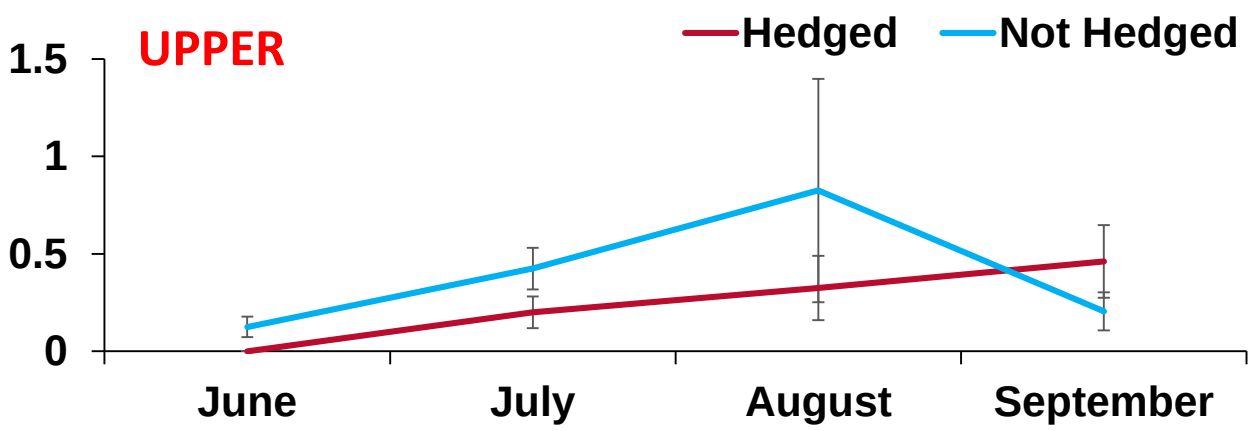
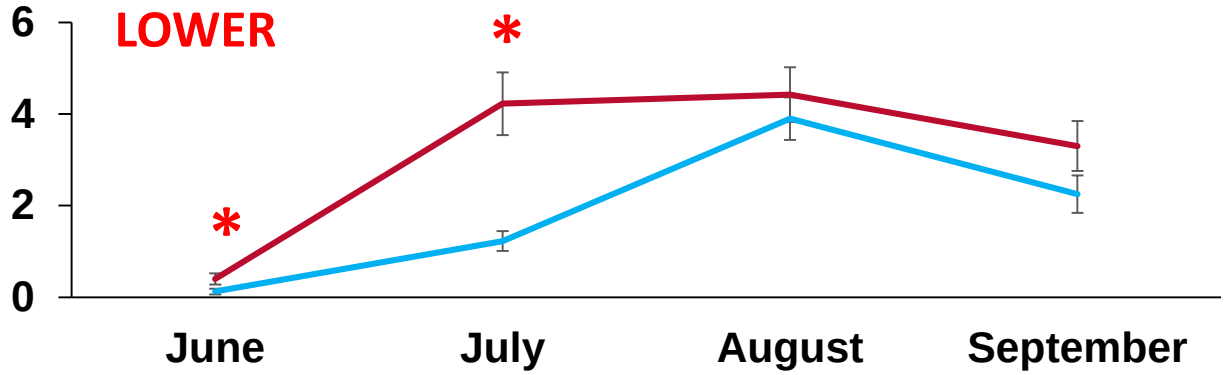
- **No difference in predatory mite populations between hedged vs non-hedged**

RESULTS: APHID PARASITISM (2018)

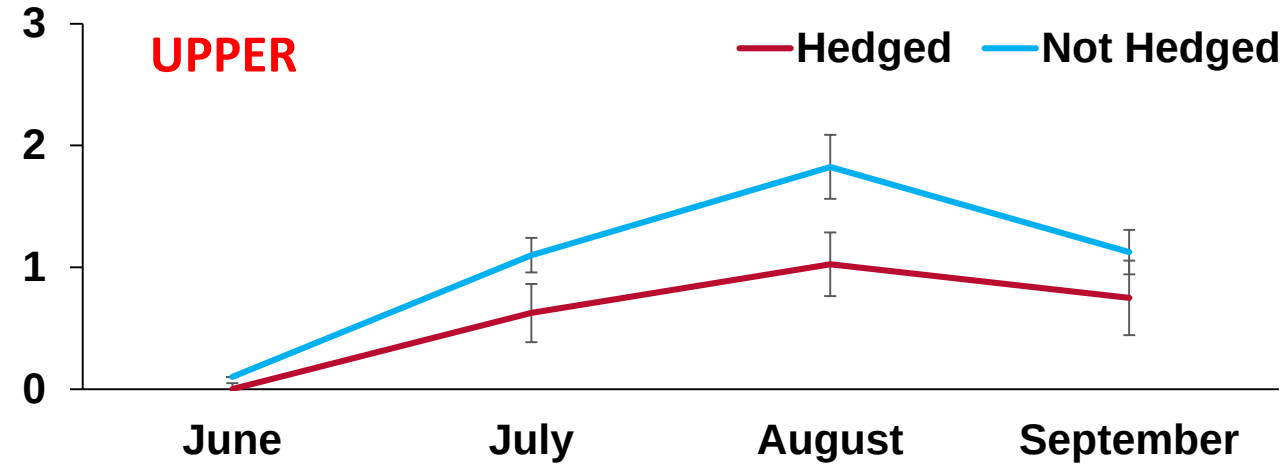


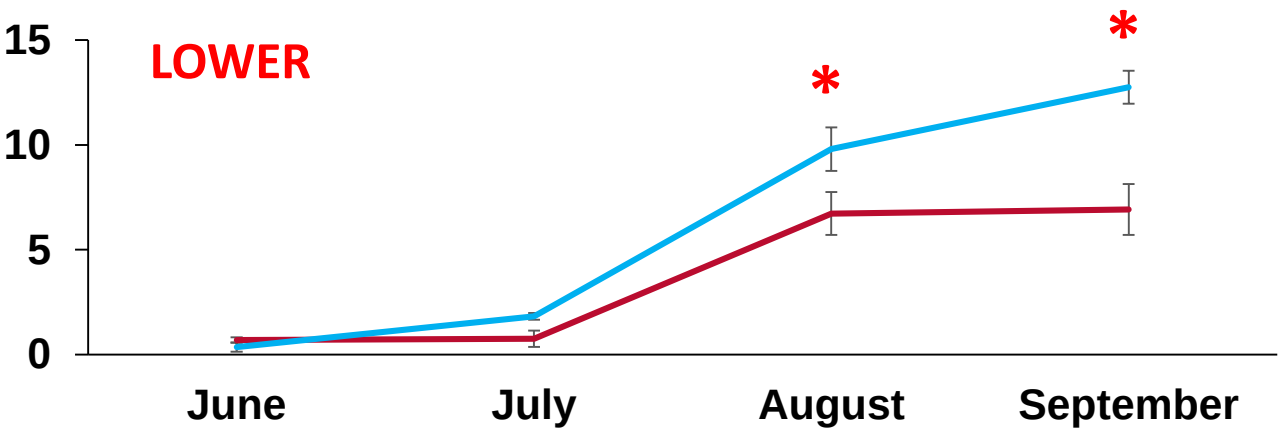


Parasitized Aphid

- Upper canopy, no difference between hedged and non-hedged trees.
- Lower canopy, more parasitized aphids were found on hedged trees.

RESULTS: APHID PARASITISM (2019)

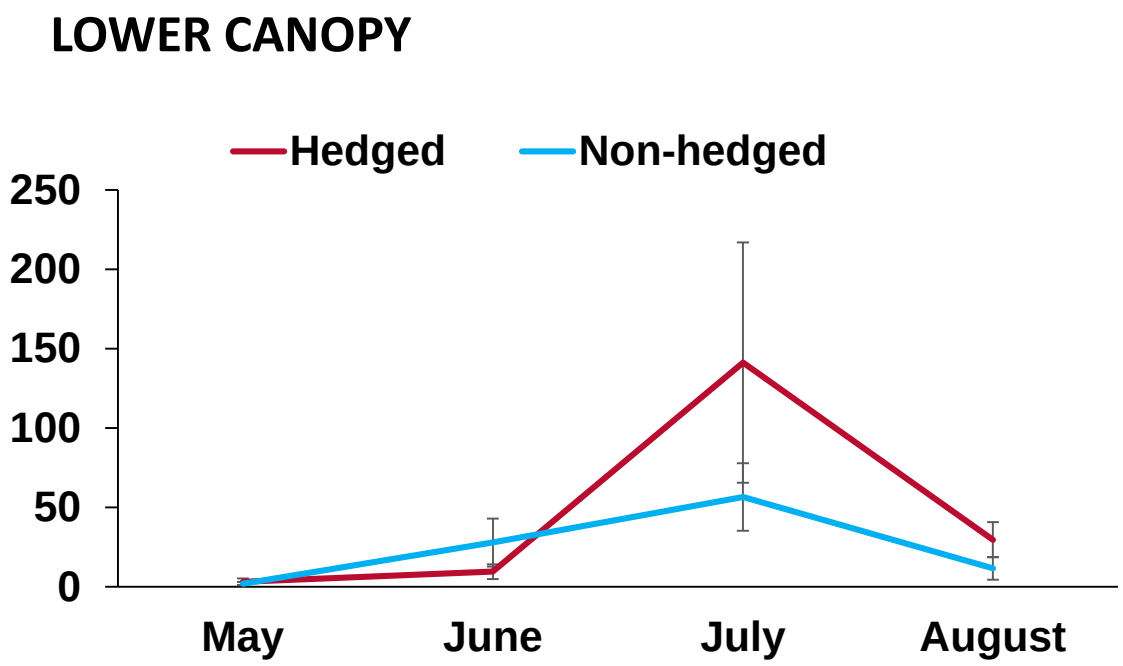




Parasitized Aphid

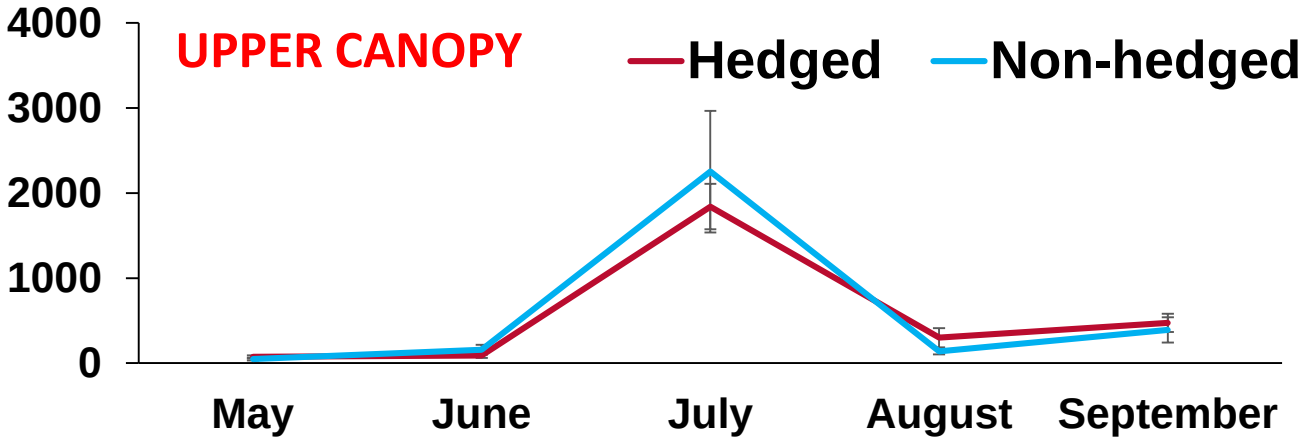
- More parasitized aphids in the lower canopy.
- Upper canopy: no difference between hedged and non-hedged trees.
- Lower canopy: more parasitized aphids on non-hedged trees.

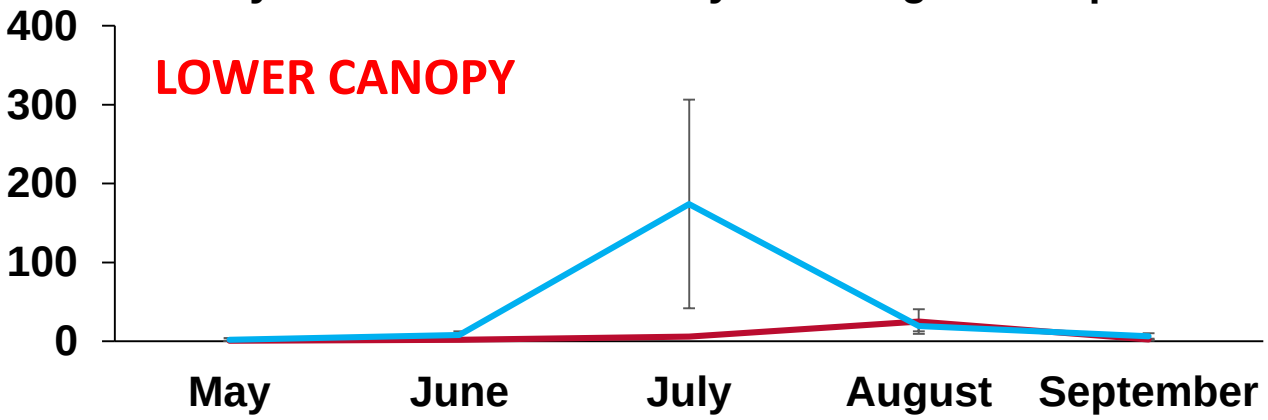
RESULTS: APHID PARASITIC WASPS (2018)

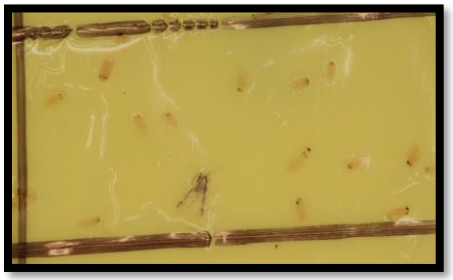


- Parasitoid numbers did NOT differ between hedged & non-hedged trees.
- Highest wasp population occurred in July.

RESULTS: APHID PARASITIC WASPS (2019)

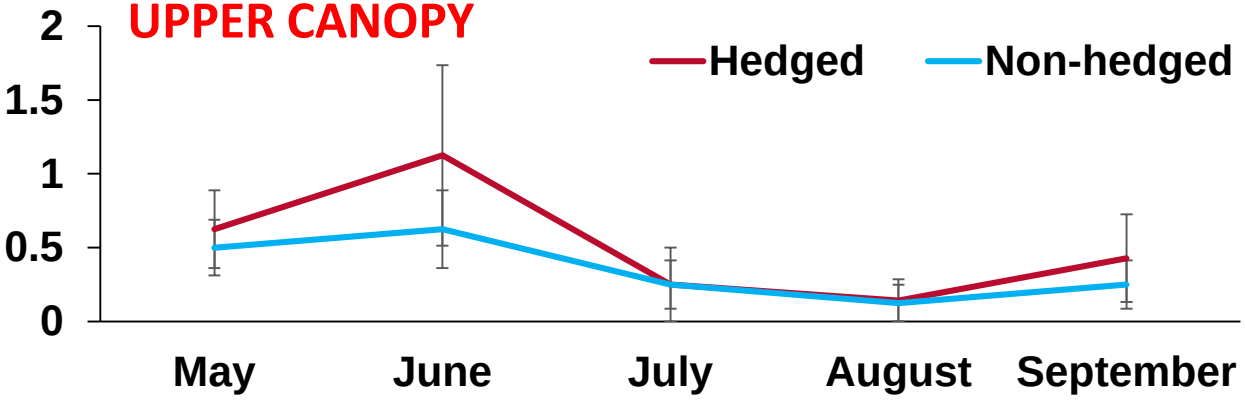


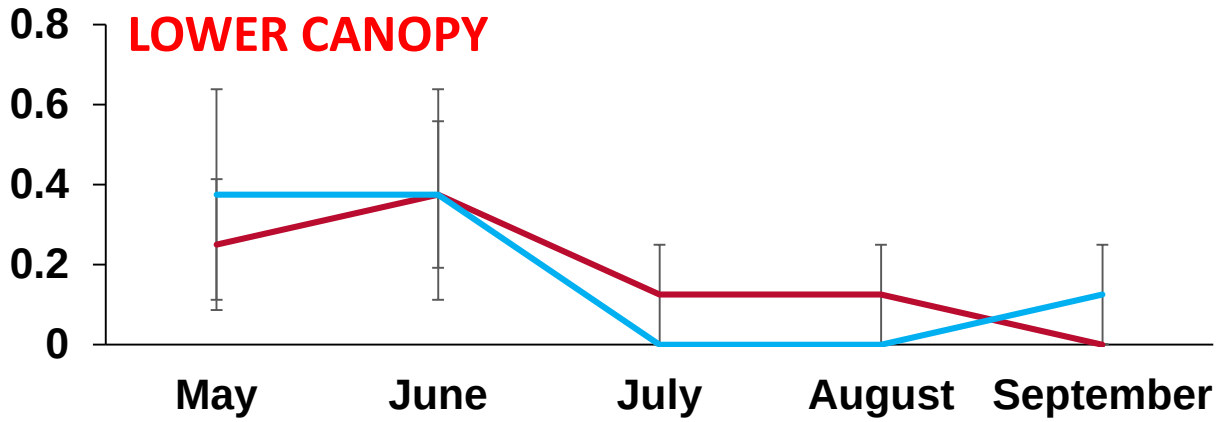




- Significantly more wasps were found in the upper canopy.
- Wasps did NOT differ between hedged & non-hedged trees.
- Highest wasp population occurred in July.

RESULTS: OTHER PREDATORS (2019)





- Significantly more predators were found in the upper canopy.
- Predator numbers did NOT differ between hedged & non-hedged trees.

RESULTS SUMMARY: 2018 versus 2019

2018: Hedging showed no effects on the populations of pests and natural enemies but it did show positive implications by way of reduced black aphid injury and early-season increased parasitism rates.

2019: Aphid populations were higher on hedged trees during mid-season. Mites were higher in lower canopy of hedged trees in Aug, and higher in the upper canopy of non-hedged trees in July. Black aphid injury was the same. Aphid parasitism was higher on non-hedged trees later in the season. Natural enemy populations did not vary between hedged and non-hedged trees.

Winter Pruning Program in Marshallville:

Year 1: West side of the trees pruned (2013, 2016, **2019**)

Year 2: East side of the trees pruned (2014, 2017)

Year 3: No pruning done (2015, **2018**)

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Effects of hedging on arthropod populations (pests and natural enemies) may differ depending on the cycle (timing) of the hedging program.

RESULTS SUMMARY: 2018 versus 2019

2018: Hedging showed no effects on the populations of pests and natural enemies but it did show positive implications by way of reduced black aphid injury and early-season increased parasitism.

2019: Aphid populations were higher on hedged trees during mid-season. Mites were higher in lower canopy of hedged trees in Aug, and higher in the upper canopy of non-hedged trees in July. Black aphid injury was the same. Aphid parasitism was higher on non-hedged trees later in the season. Natural enemy populations did not vary between hedged and non-hedged trees.

2018 and 2019: Injury on nutlets by PNC and insect-related injury at harvest did not differ between hedged and non-hedged trees.

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In general, our results imply that hedging do not make insect problems worst in a conventionally managed orchard.

FUTURE WORK

- Effects of hedging of older trees versus younger trees
- Summer versus winter hedging?

  - Diseases
  - Insects (Pests and Natural Enemies)
  - Belowground communities
  - Economic analysis

Acknowledgements

Georgia Pecans

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THANK YOU!!!