



# Managing Cover Crops in Orchards: A Case Study of Aphid Populations in a Pecan Orchard with Cover Crops

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# Acknowledgements



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**Pacific Gold Agriculture LLC** and Ben King for hosting this work in his orchard

# Project goals

-  Develop cover crop mix to attract beneficials, including monarch butterflies.
  -  Monitor and ID beneficials coming to the cover crop, and those going into the pecan canopy.
  -  Monitor aphid populations and ID primary natural enemies.
  -  Develop a better understanding of the dynamics of beneficials relative to cover crop management and aphid populations in pecans.
-  Note: no controls (non-cover cropped areas) were used in this project.

# Sampling Map, Total Acreage: 277 acres

Cover crop was sampled every two weeks at 10 locations noted. Eight 180-degree sweeps at each location.

Sticky traps hung in pecan canopy between 6 and 10 feet, were changed every two weeks

Aphid counts were done weekly, 3 compound leaves were taken from each of 2 trees at each location (60 compound leaves), and all aphids and beneficials counted.

The grower was informed of the aphid counts that day or the following day.



Block	Crop	Spacing	Acres	Varieties
1	Pecan	35'x30'	55.3	Pawnee - 80%, Lakota - 10%, Nacono - 10%
2	Pecan	35'x30'	55.4	Pawnee - 80%, Lakota - 10%, Nacono - 10%
3	Pecan	35'x30'	64.7	Pawnee - 80%, Lakota - 10%, Nacono - 10%
4	Pecan	35'x30'	64.7	Pawnee - 80%, Lakota - 10%, Nacono - 10%
5	Pecan	35'x30'	37	Pawnee - 80%, Lakota - 10%, Nacono - 10%



# Sampling cover crop and leaves



Leaf samples (6 compound leaves) from one location on cooler. Mason jars were put in cooler, then put in freezer for 2-4 days, then insects identified later the same week.

Photos: Rex Dufour, NCAT



# Cover crop mix: 4 species drilled and 8 broadcast

Didn't work as a cover crop. No emergence

Name	Comments
Persian Clover	Seed mix <u>drilled</u> @ 15lbs/acre on 197 acres. Persian clover (an annual) dominated late spring, and came on after crimson clover.
Crimson Clover	Seed mix <u>drilled</u> @ 15lbs/acre on 197 acres. Crimson clover (an annual) dominated early spring, and went to seed earlier than Persian clover.
Red Clover	Seed mix <u>drilled</u> @ 15lbs/acre on 197 acres. Red clover (an annual clover) flowered after first mowing in early/mid June. I suspect that we were sold white clover.
Cayuse Oats	Seed mix <u>drilled</u> @ 15lbs/acre on 197 acres. Oats only appeared occasionally.
Narrow leaf milkweed	Seed mix <u>broadcast</u> @ 12lbs/acre on 197 acres. Neither milkweed species were observed at PacGold, but did grow at Bypass farms.
Showy milkweed	Seed mix <u>broadcast</u> @ 12lbs/acre on 197 acres. Some did grow at Bypass farms.
Common yarrow	Seed mix <u>broadcast</u> @ 12lbs/acre on 197 acres. Yarrow was rarely observed.
Lacy phacelia	Seed mix <u>broadcast</u> @ 12lbs/acre on 197 acres
California phacelia	Seed mix <u>broadcast</u> @ 12lbs/acre on 197 acres. California phacelia bloomed early spring in some patches, but was not widespread.
California poppy	Seed mix <u>broadcast</u> @ 12lbs/acre on 197 acres. California poppy was seen at the edges of dense legume cover crop, and in some of the sparser cover crop mid-spring.
Creeping Wild Rye	Seed mix <u>broadcast</u> @ 12lbs/acre on 197 acres. Did not observe this growing at PacGold.
Sweet alyssum	Seed mix <u>broadcast</u> @ 12lbs/acre on 197 acres. Sweet alyssum was able to grow at the border of the alley and tree row, where herbicides controlled weeds.





Cover crop April 28 2019

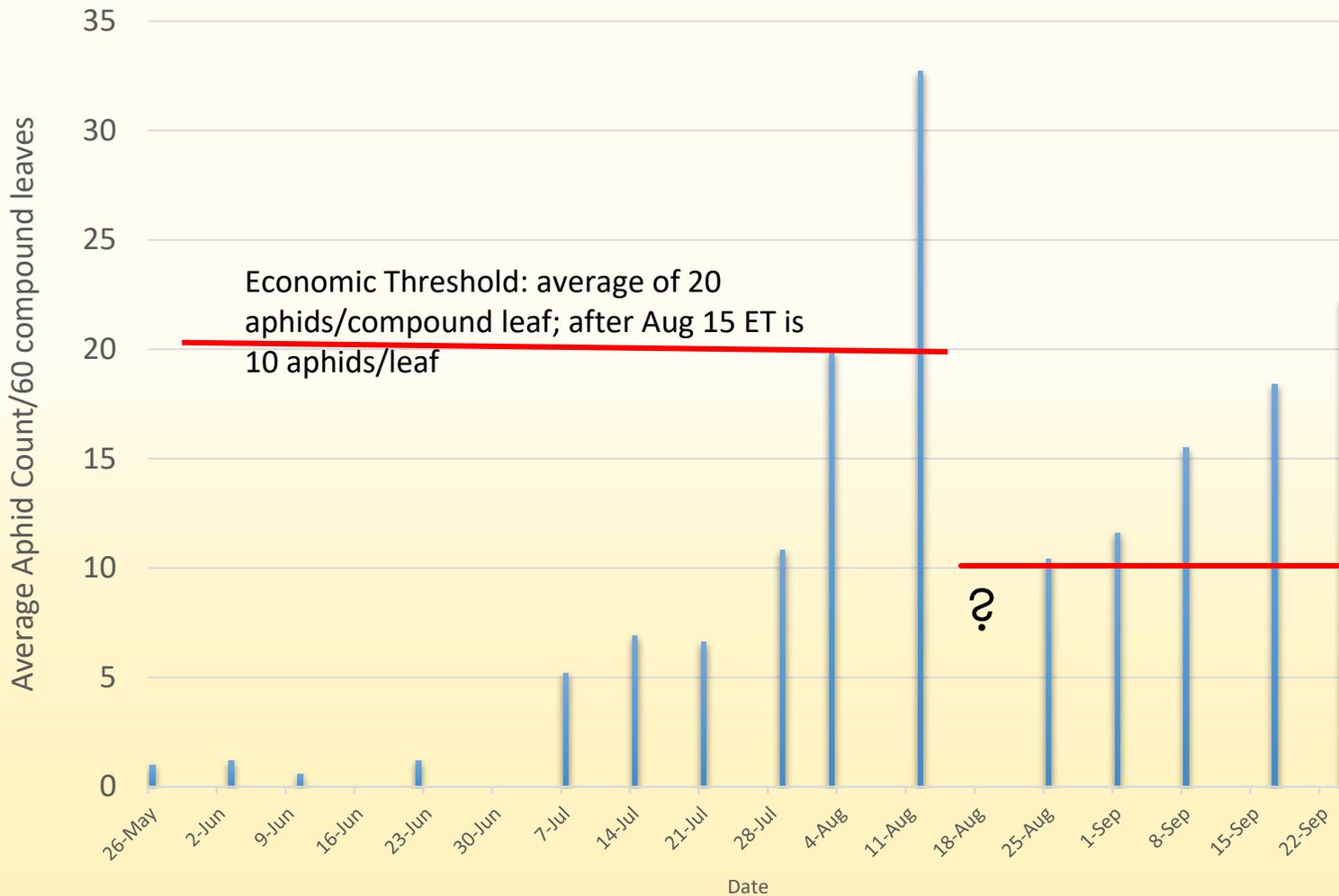
Cover crop June 3, 2019



Alternate row mowing preserved some habitat, and also provided an opportunity for some plants to regrow, or germinate from seeds.



## Aphid Counts on Pecan Leaves



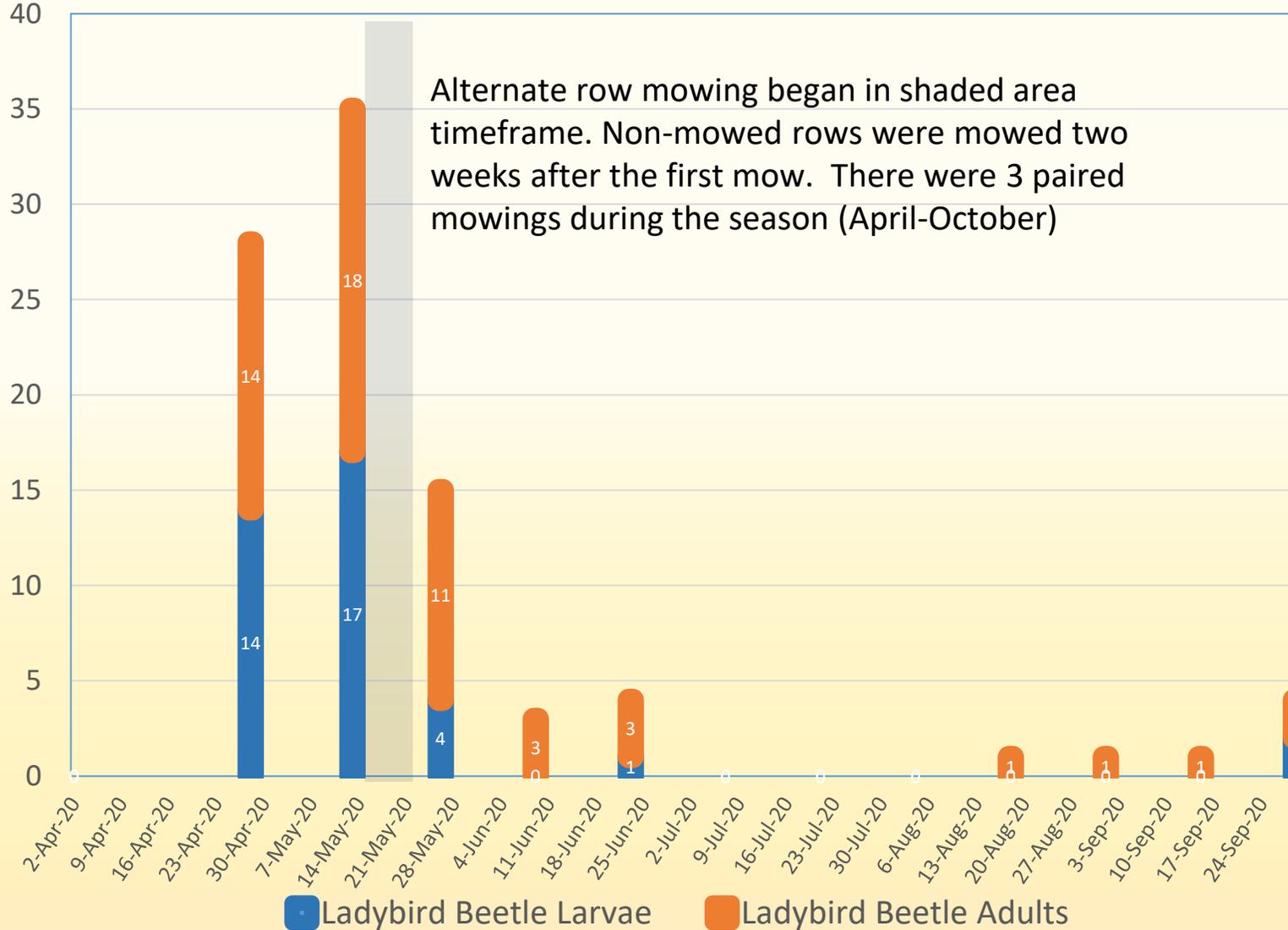
We estimate the cover crop saved the grower at least one spray out of the 3 they would typically do over a season.

One of the sprays used would likely be a neonicitinoid (airblast sprayed), which is very hard on beneficials.

Because pecan prices were so low, the grower didn't spray any insecticides during the whole season, but did do a water air blast spray in late September for honeydew.



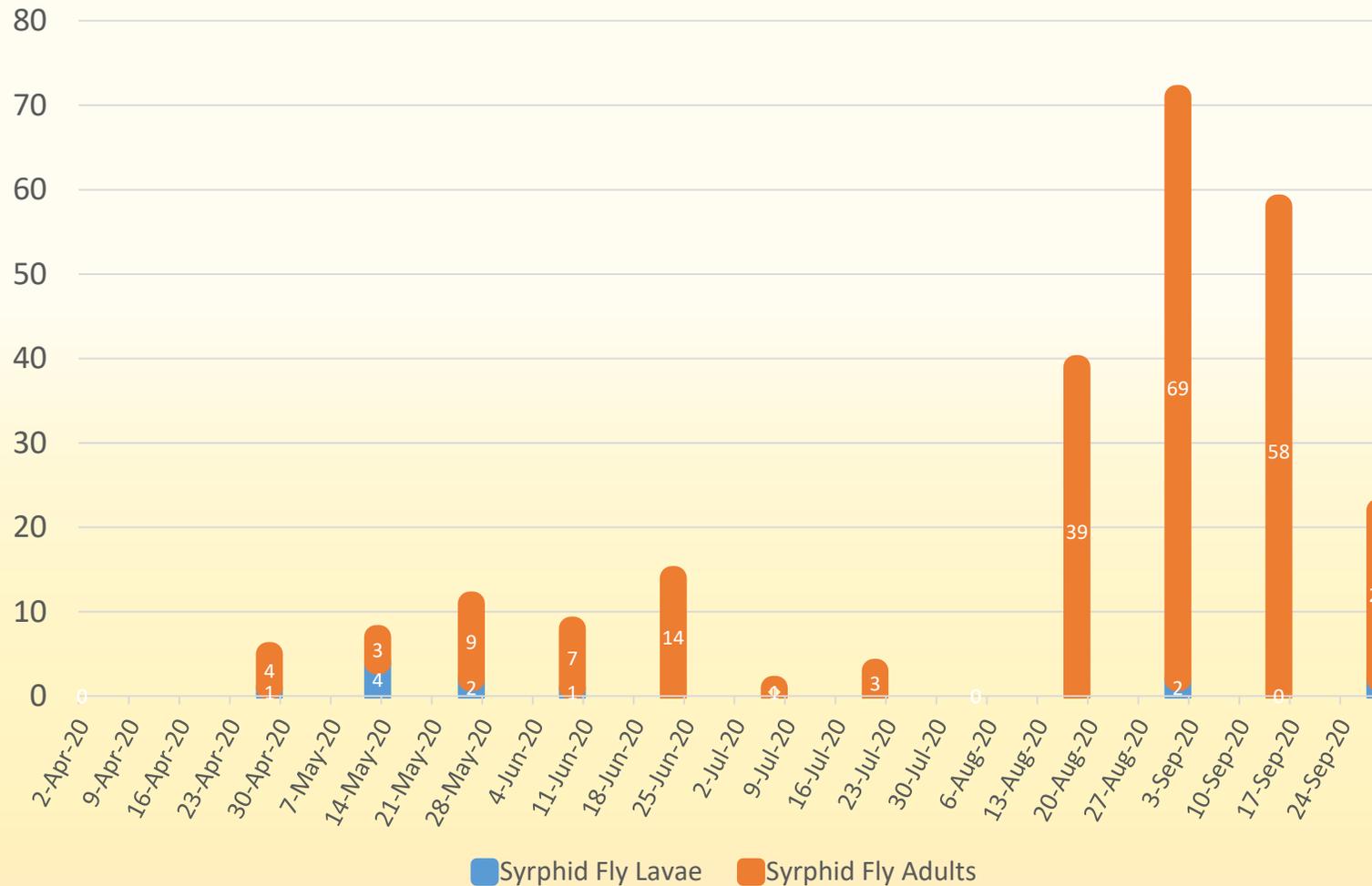
# Ladybird Beetle Populations in the Cover Crop



Beneficial graveyard: sample from one of 10 locations on 13 May, 2020

# Syrphid Populations in the Cover Crop and Leaves

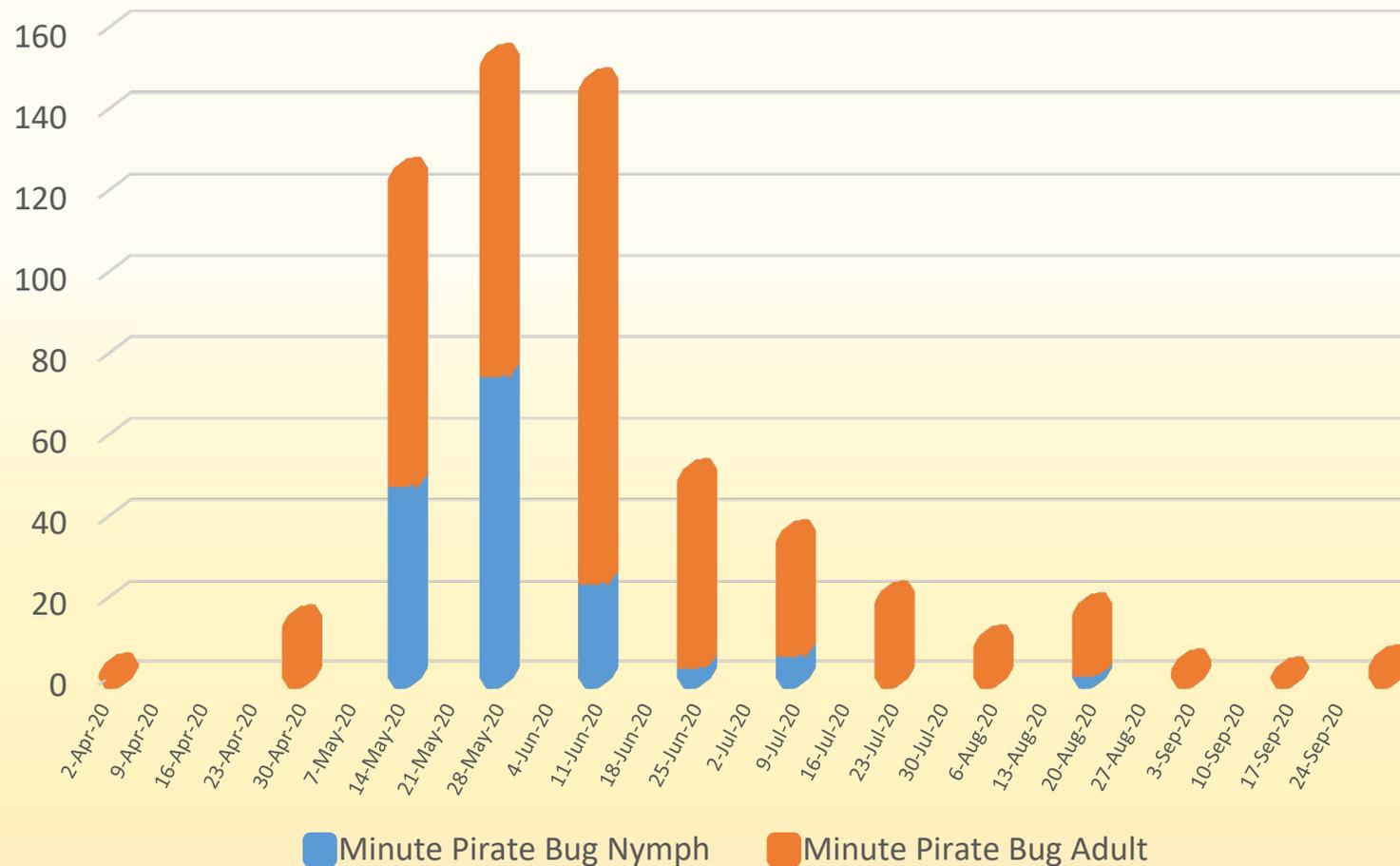
Syrphid Populations in Cover Crop only



Syrphid fly larvae (which are aphid predators), eggs or pupae were not abundant in leaf samples, although their numbers did increase at the end of the season.

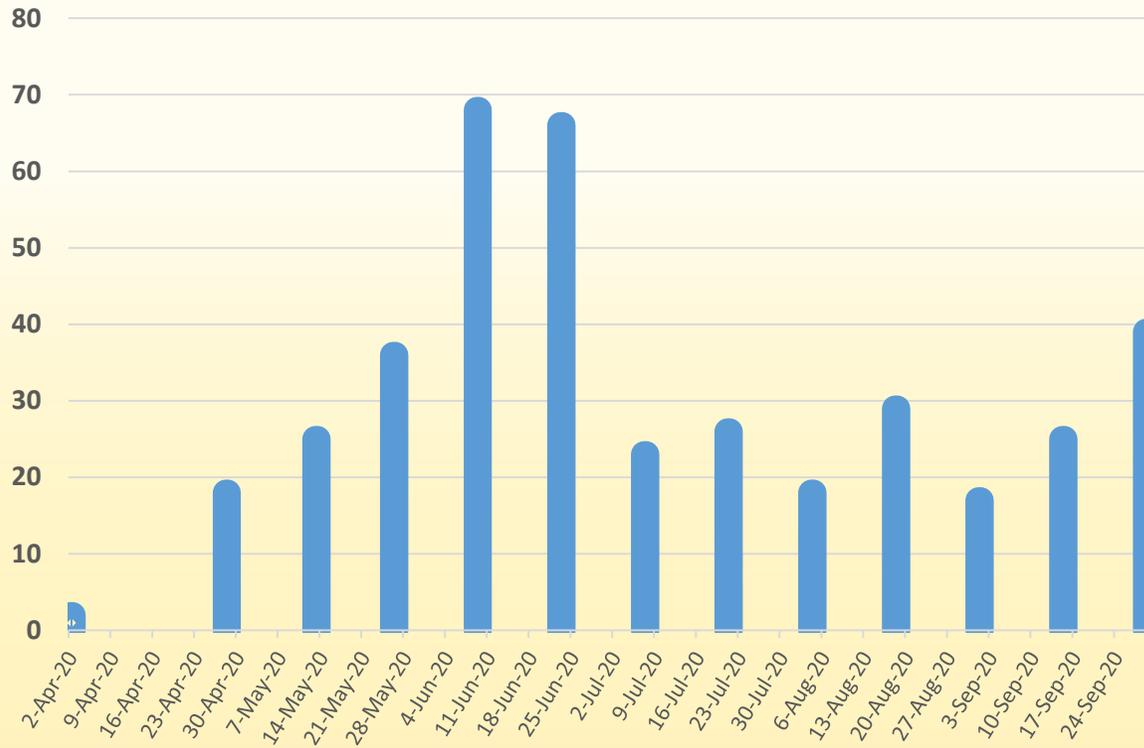
# Minute Pirate Bug Populations in the Cover Crop

Minute Pirate Bugs in the Cover Crop

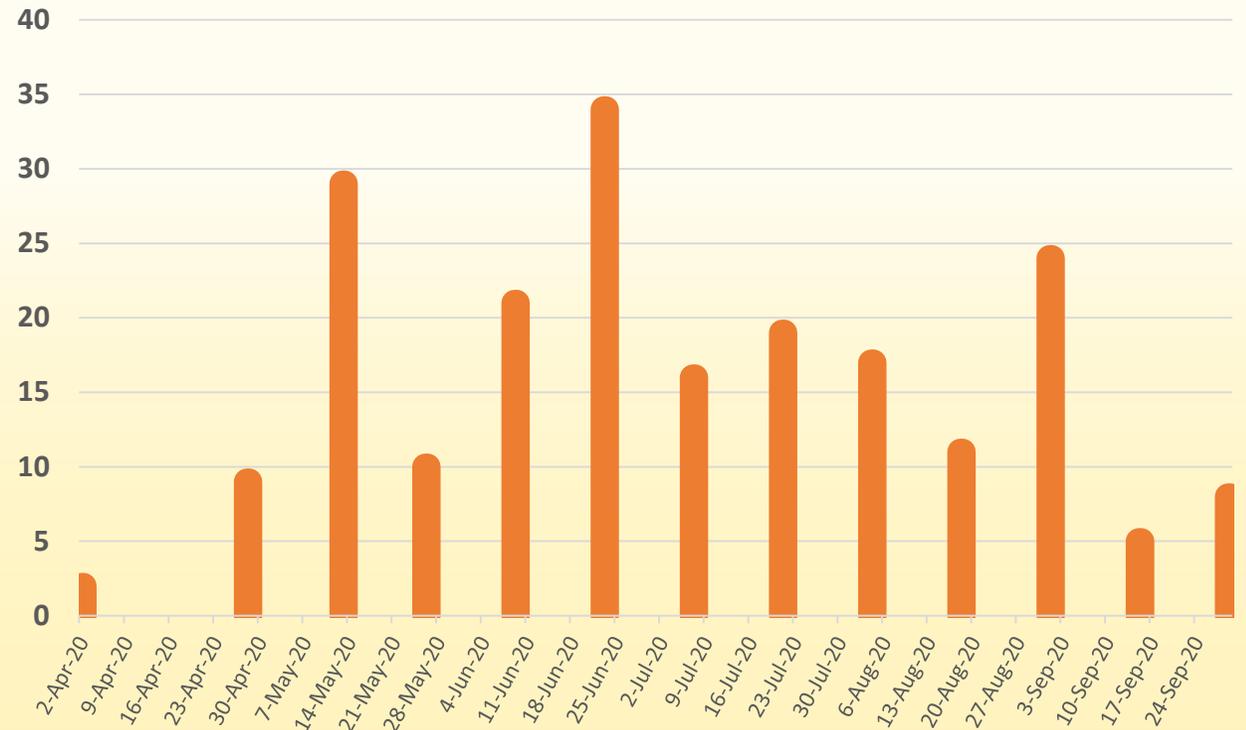


# Spider & Microhymenop Populations in the Cover Crop

### Spiders

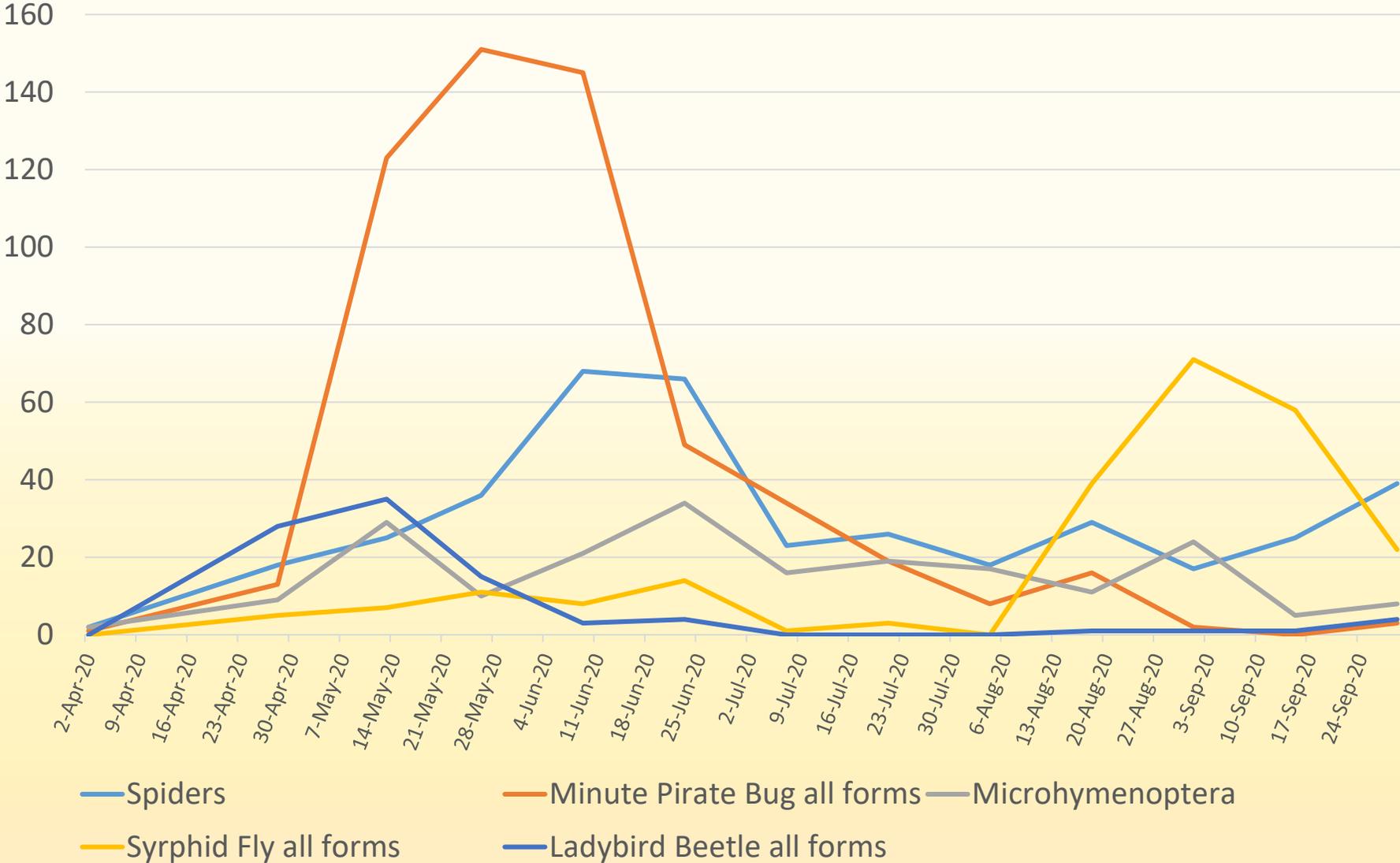


### Microhymenoptera

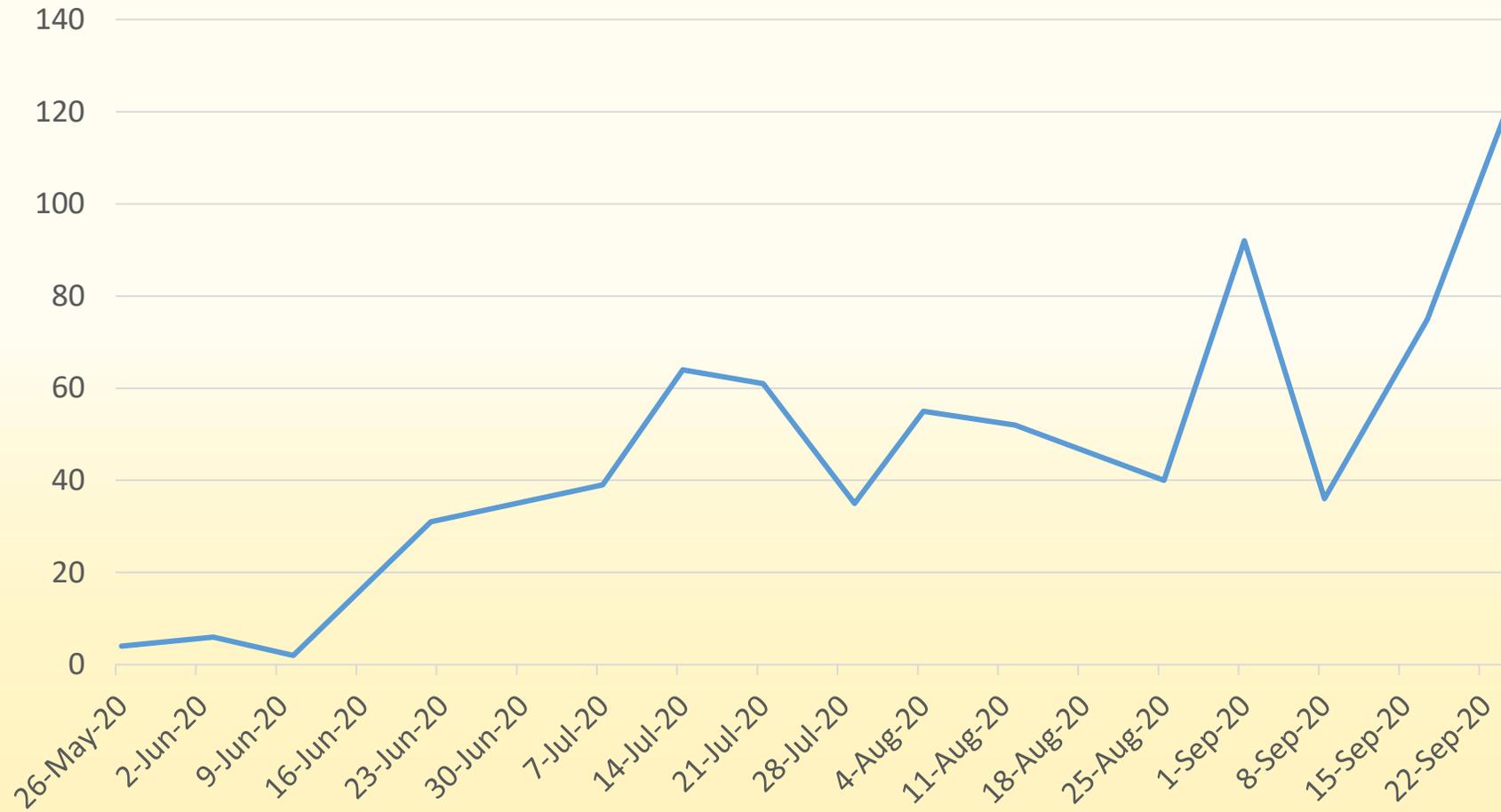


# Beneficial Populations in the Cover Crop

Beneficial Populations



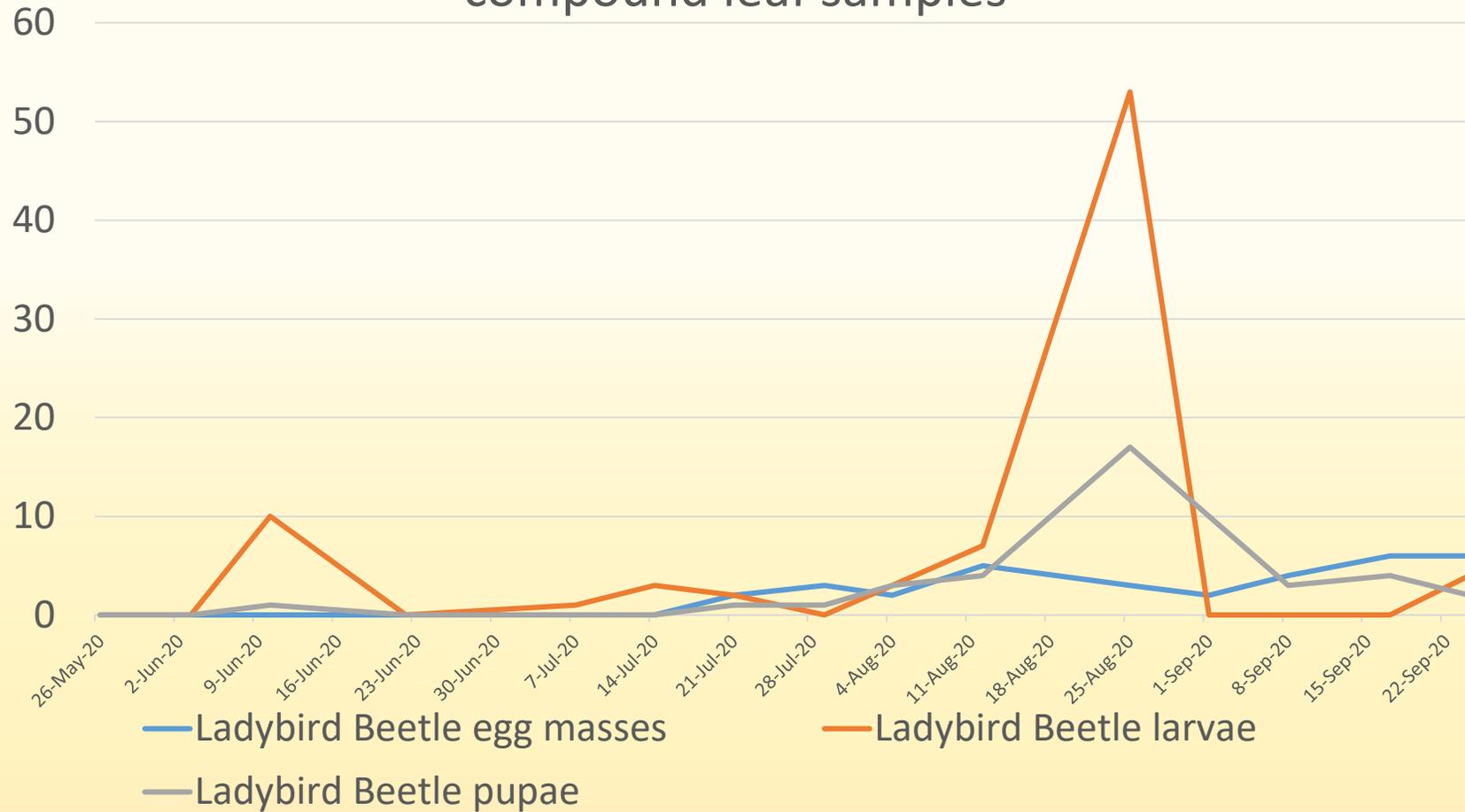
# Greenlacewing eggs\* per 60 compound leaves



One portion of a sticky trap, set 6/3, collected 6/10 with several green lacewings and a brown lacewing.

\*Egg counts included all eggs that were visible, green, light green and white.

## Ladybird Beetle Egg masses, Larvae and Pupae per 60 compound leaf samples



# Some conclusions and speculations about a very dynamic system

- ▶ These cover crops provided significant habitat for a range of beneficial insect species
- ▶ Some of the beneficials migrated into the canopy (ladybird beetle adults, green lacewing adults, syrphid fly adults, microhymenops) and some did not (notably minute pirate bug)
- ▶ We observed very few aphid mummies resulting from wasp parasitism, which may indicate a high rate of predation and turnover in aphid populations

# Some conclusions and speculations about a very dynamic system

- ▶ The most effective predators were the ladybird beetles and lacewing larvae.
- ▶ Secondary predators were spiders, syrphid fly larvae, and perhaps assassin bugs.
- ▶ We only found one minute pirate bug in the leaf samples, and very few in the sticky traps.
- ▶ We will conduct year two of cover crops and hope to reduce the number of mowings, as we believe that will conserve beneficial habitat.
- ▶ More research on honeydew impacts on pecan production is needed





Small spider with captured yellow pecan aphid



Third instar ladybird larvae devouring alate pecan aphid



Just-hatched ladybird larvae and spider



Yellow aphid, and black margined aphid



Black pecan aphid

# Resources

- ▶ ATTRA Publications
  - [attra.ncat.org](http://attra.ncat.org)
- ▶ Michael Smith\_Evaluation of Low Input Pecan Orchard Floor Management Systems\_SARE LS 91-36-63
- ▶ <https://cdn.sare.org/wp-content/uploads/20171204124014/1037LS91-036.003.pdf>
- ▶ Joe Bradford, Organic Pecan Field Day 2005
- ▶ [https://www.dirtdoctor.com/garden/Joe-Bradford-Organic-Pecan-Field-Day-Slide-Show\\_vq1212.htm](https://www.dirtdoctor.com/garden/Joe-Bradford-Organic-Pecan-Field-Day-Slide-Show_vq1212.htm)
- ▶ Joe Bradford, Organic Pecan Field Day 2008
- ▶ [https://www.texasorganicresearchcenter.org/organic-research-page/Bradford-Joe-Pecan-Production-Research\\_vq4522.htm](https://www.texasorganicresearchcenter.org/organic-research-page/Bradford-Joe-Pecan-Production-Research_vq4522.htm)



Thank you!



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