



Netting Applications for Direct Apple Pest Control



Orchard Pest and Disease Management
Invasive Species
Thursday, 11 Jan. 2018, 2:45pm
Portland, Oregon

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Fruit Disorder



(Racsko and Schrader, 2012)

- Sunburn is one of the leading causes of culled apples in Washington State (Schrader et al., 2006).
- Sunburn occurs when fruit skin temperatures reach 115F, which can happen at ambient temperatures of 86F or higher (Schrader et al., 2001).
- To counteract sunburn, orchardists use evaporative cooling, kaolin clay sprays, and shade netting.



Netting Over Orchards

- Currently the most effective method for reducing sunburn (Gindaba and Wand, 2005).



Tree wrap

- Reduces wind up to 40%, and acts as a barrier to wildlife (Kalcsits et al., 2017)



Top-cover only

- Can exclude both pests and natural enemies (Ben-Yakir et al., 2008; Dobson, 2015).



Drive-in enclosure



Multiple Functions



- ✓ Minimize heat stress
- ✓ Eliminate overhead cooling
- ✓ Equipment Access
- ✓ Reduces worker exposure to UV and heat stress
- ✓ Excludes vertebrate (birds/deer)
- ✓ Exclude insects

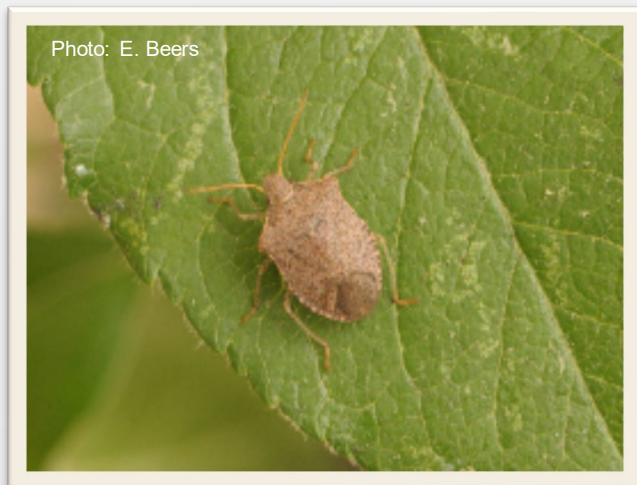


Obj. 1: Ability to exclude direct pests

Codling moth



Conspense stink bug





Obj. 2: Effects on indirect pests and natural enemies

- Does netting affect predator/prey population dynamics?
- Indirect Pests: Woolly apple aphid
- Natural Enemies: *Aphelinus mali*, Lacewings, Syrphids, Earwigs



Photo: E. Beers



Photo: A. Marshall



Photo: E. Beers



Materials and Methods

Small Cage:
10- 10'x10'x5' Cages
3 trees/plot

3 treatments:

1. Cage+ Airblast
2. Airblast
3. Control (no treatment)

Large Cage:
4- 40'x50'x15' Cages
48 trees/plot





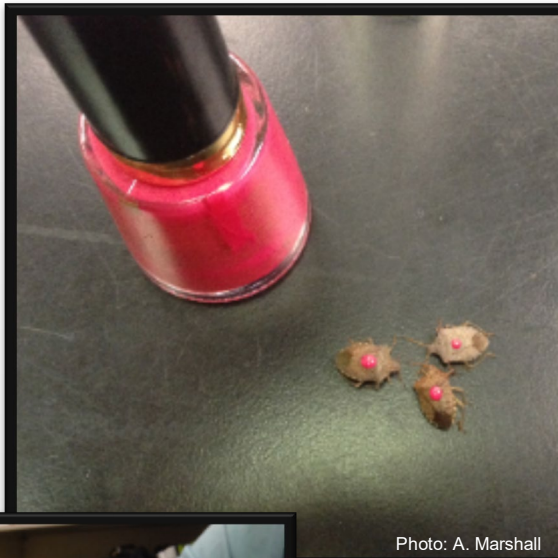
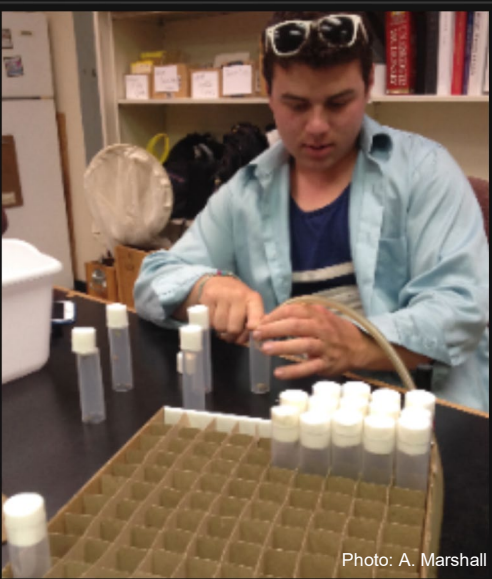
Moth Exclusion

- Large resident population
- Pheromone traps deployed in all treatment plots
- Replaced every week from 26 Apr-11 Oct





Mark and Recapture





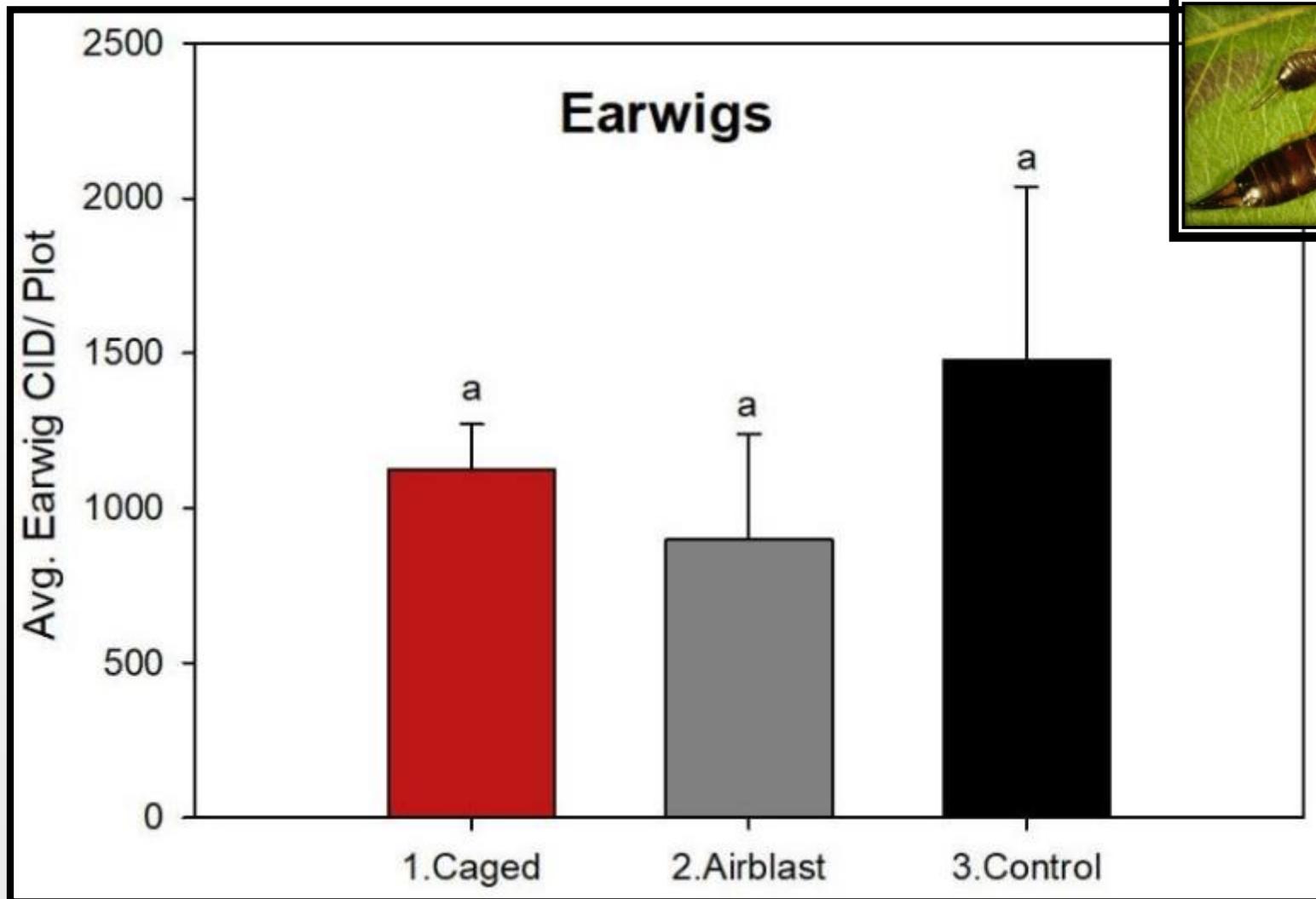
Density Tracking

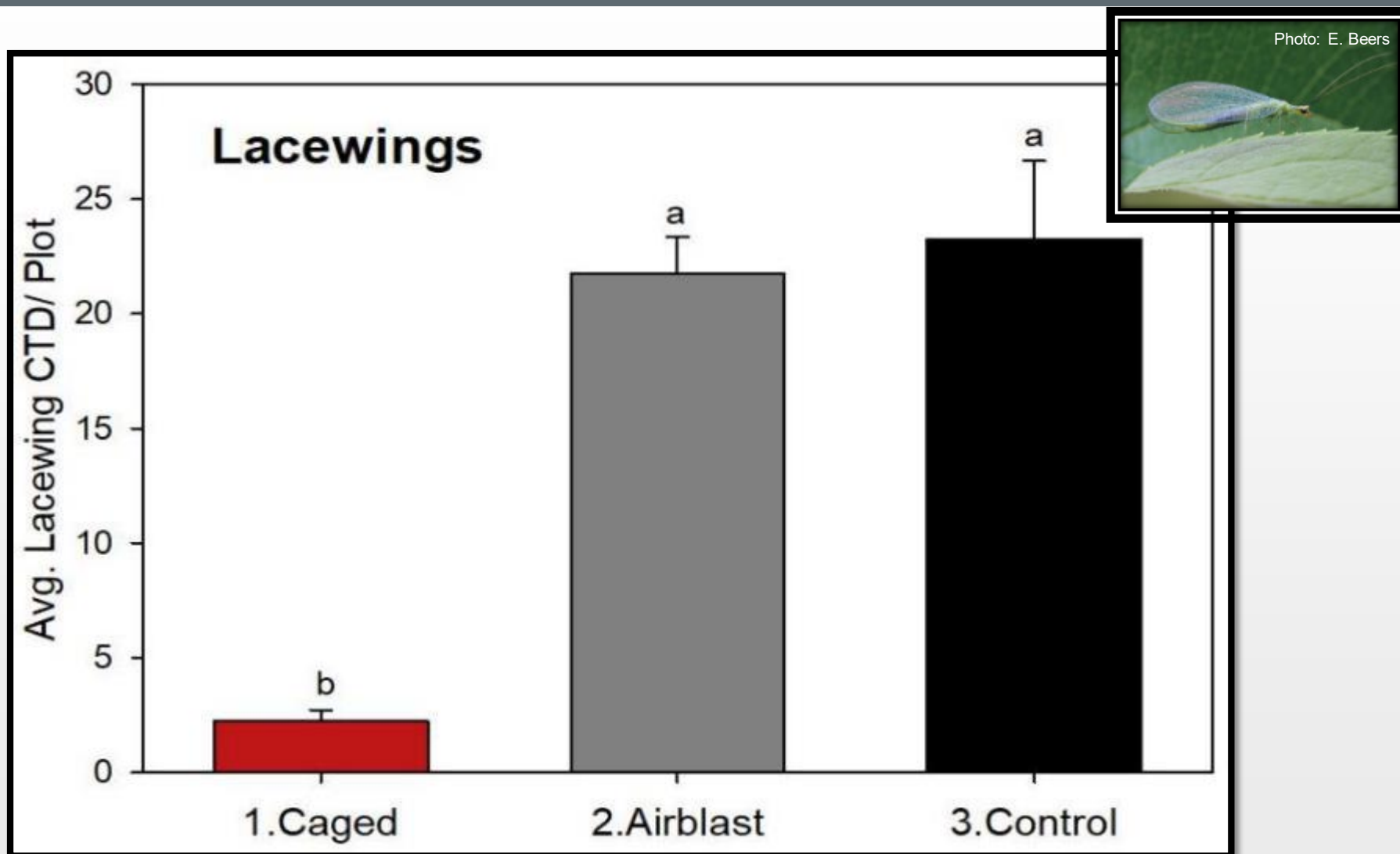
- Determine treatment effects on seasonal abundance of pests and natural enemies
- Traps deployed and replaced every two weeks from 3 May – 11 Oct, 2017
 - *Time counts were conducted for woolly apple aphids

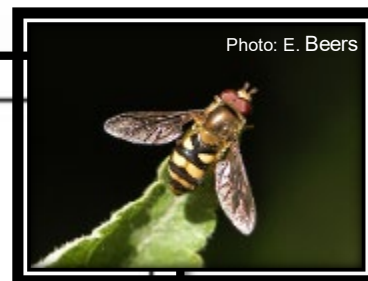
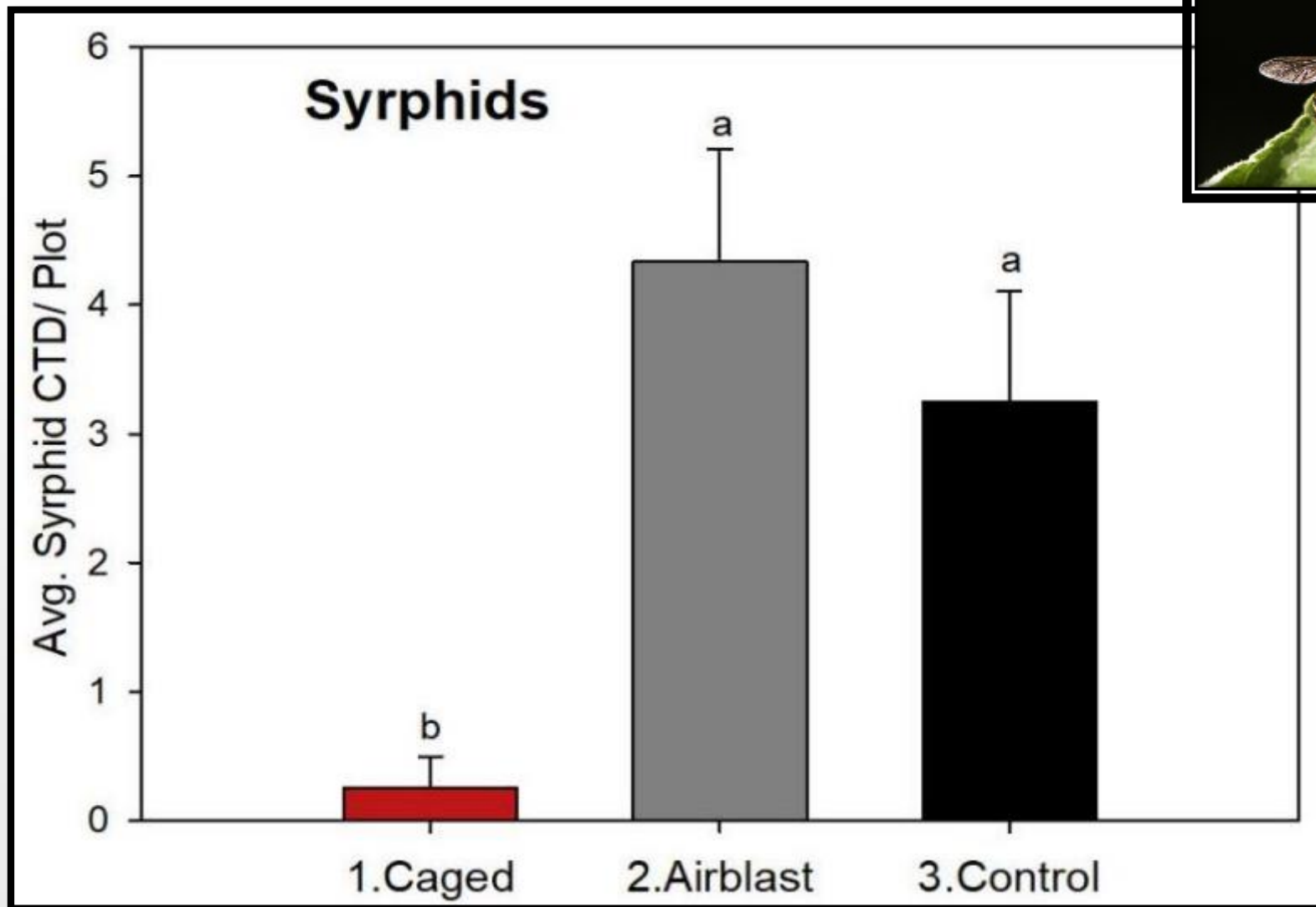


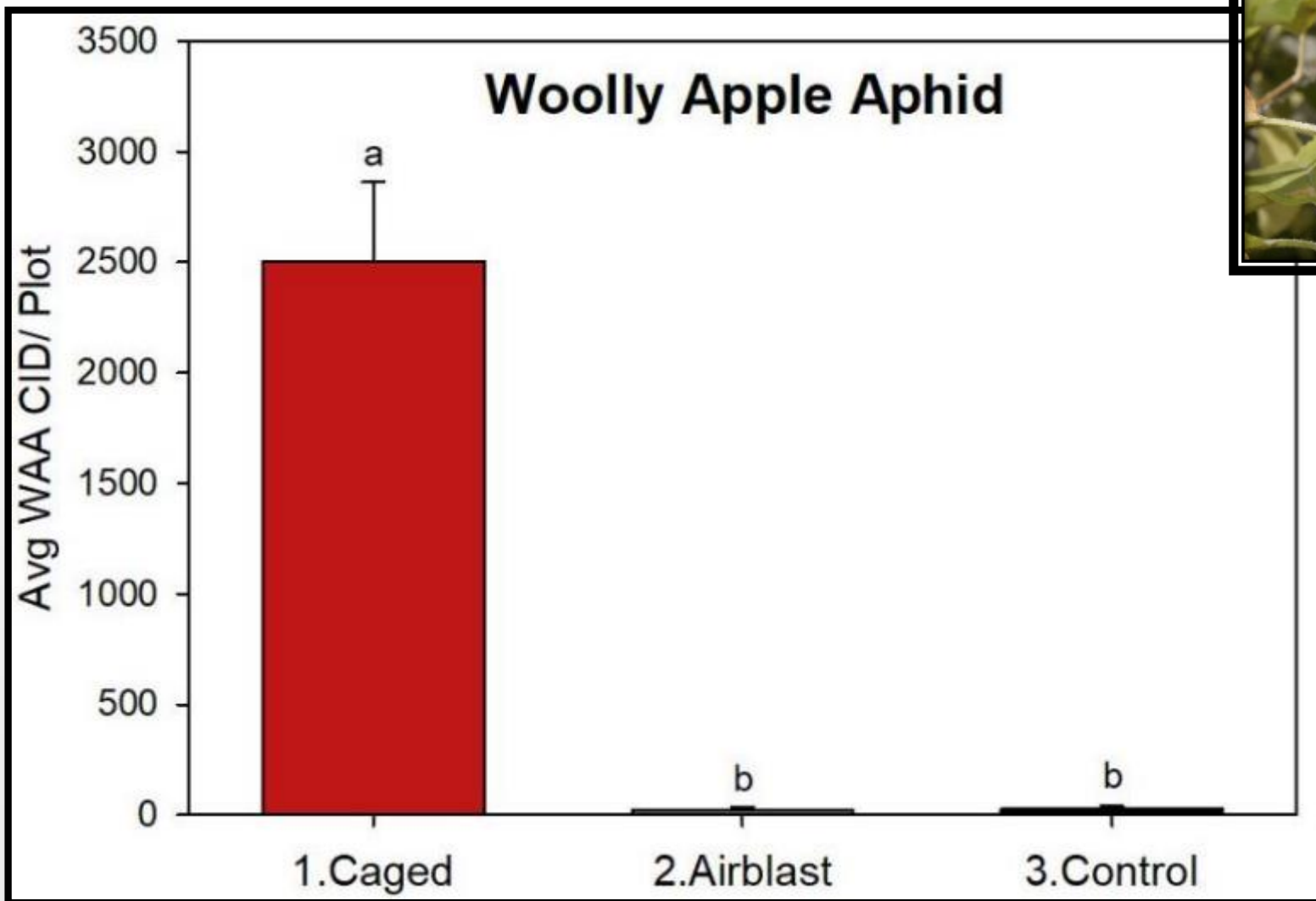


2017 Results









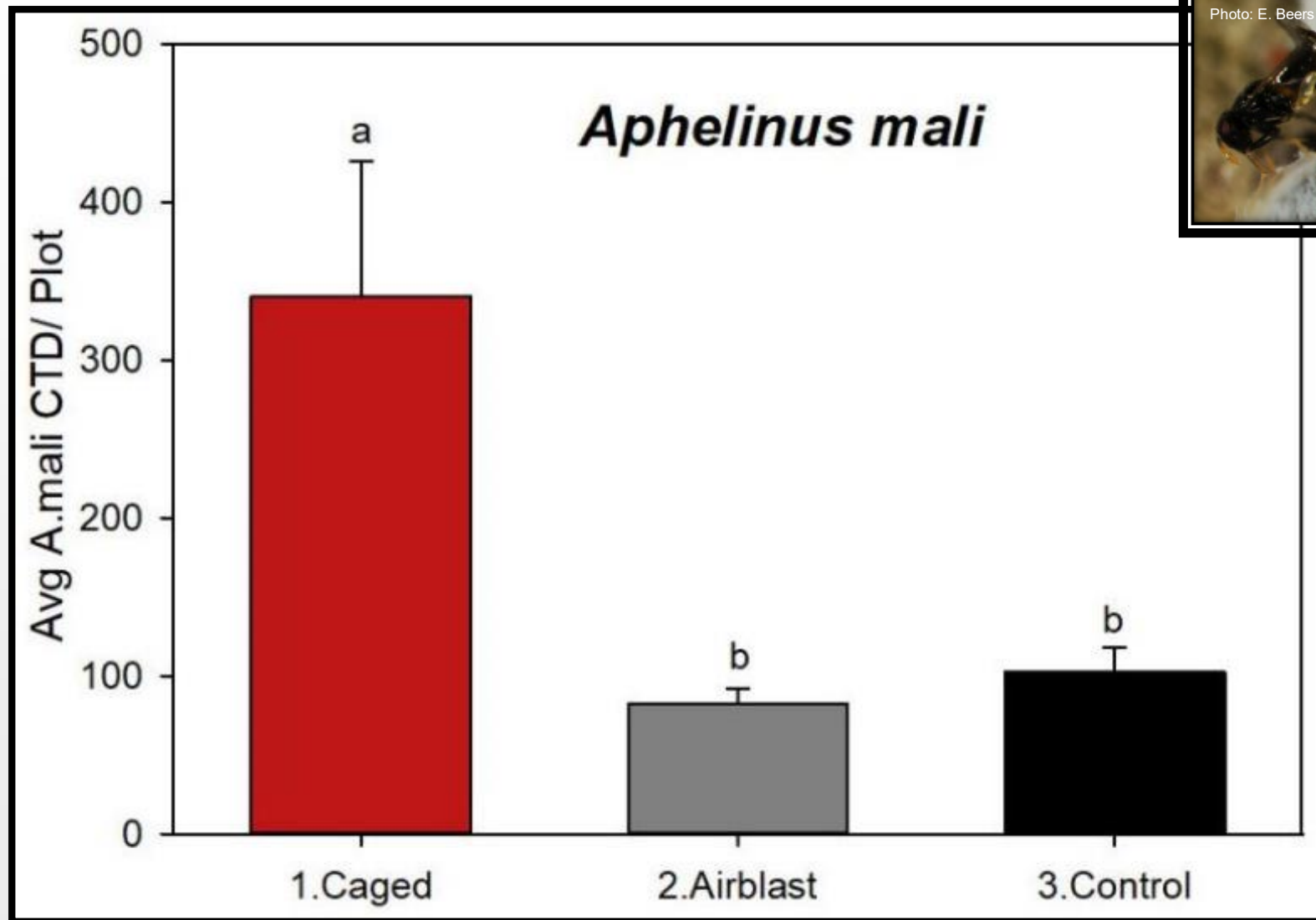


Photo: E. Beers



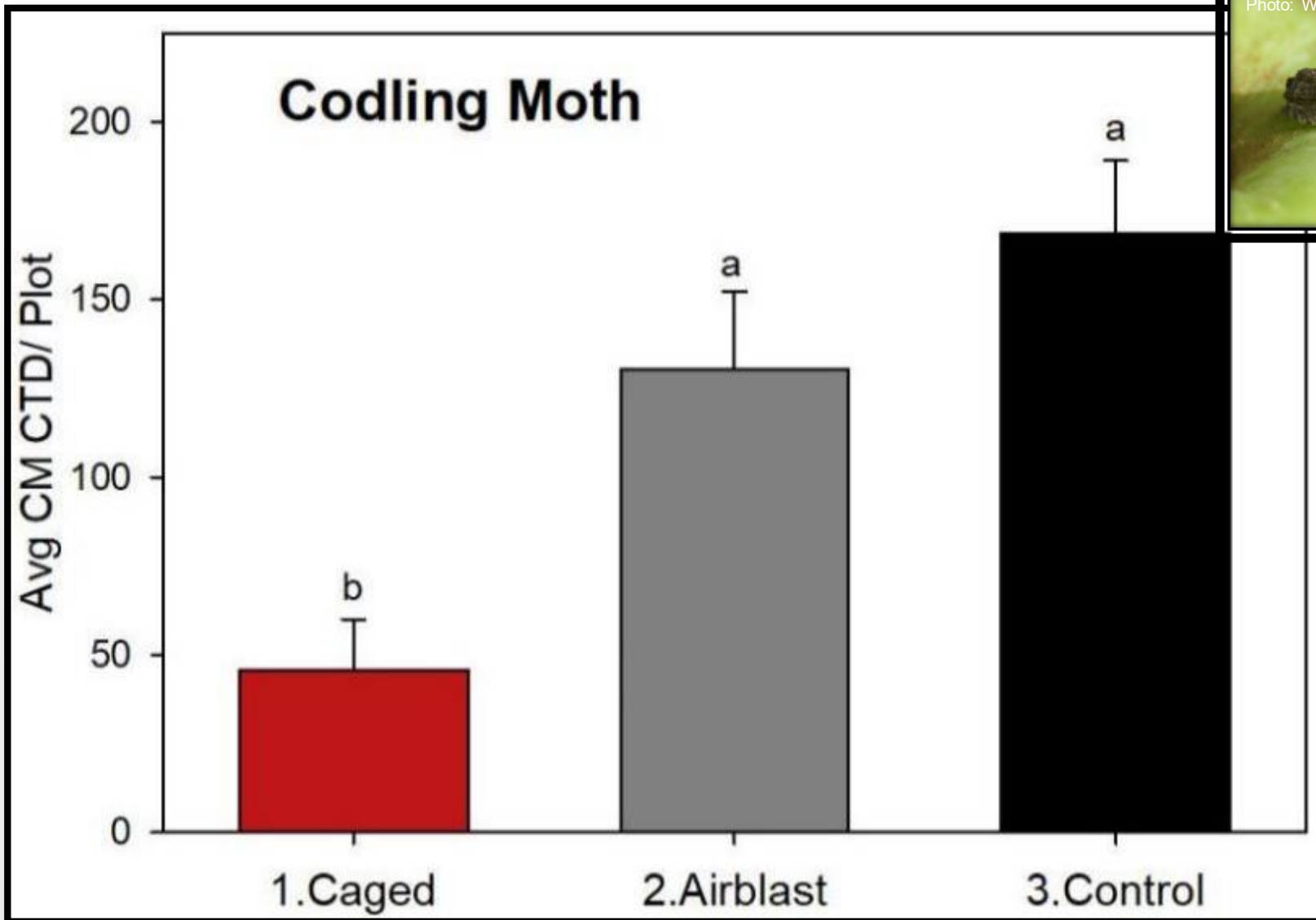
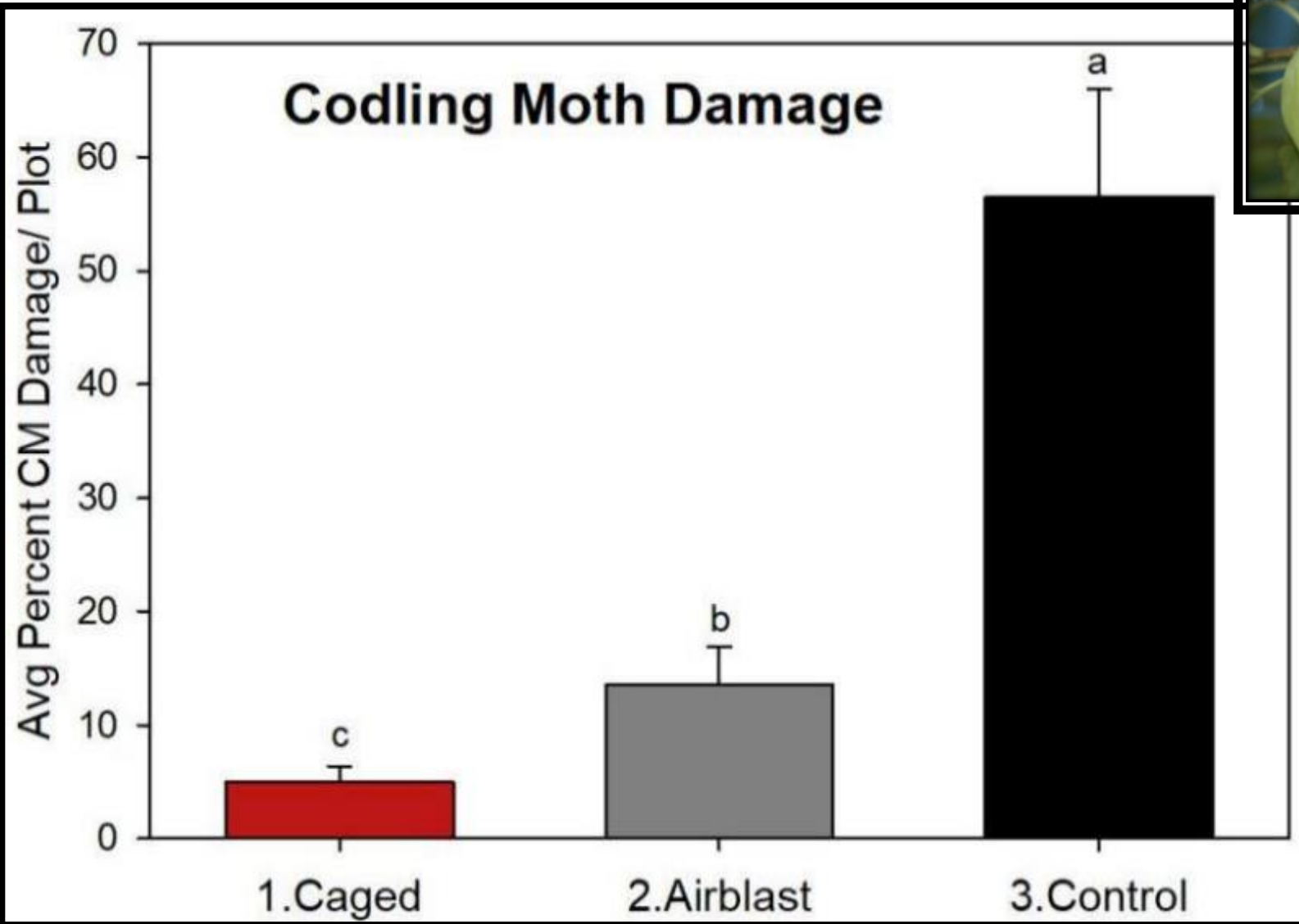


Photo: W. Cranshaw





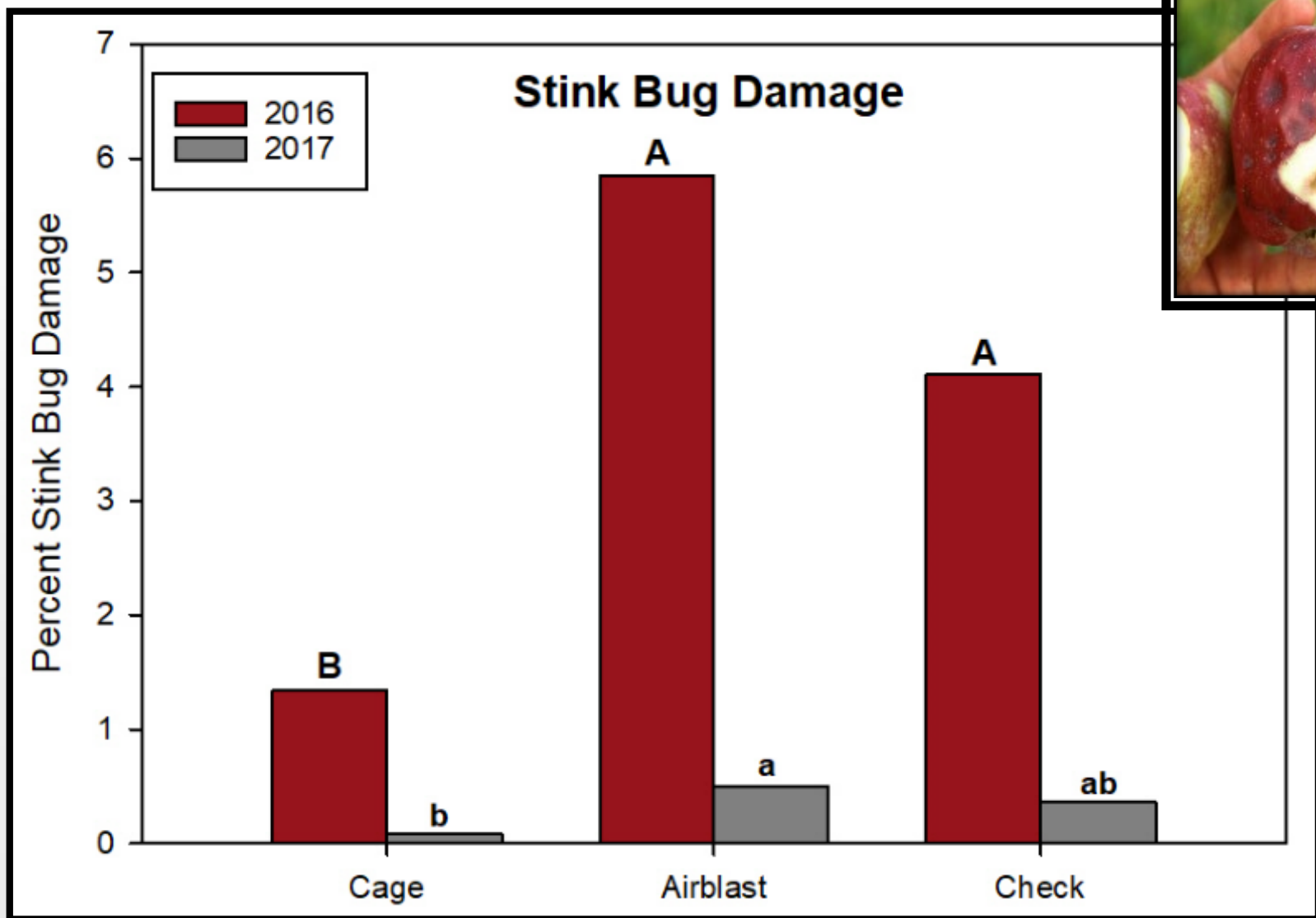


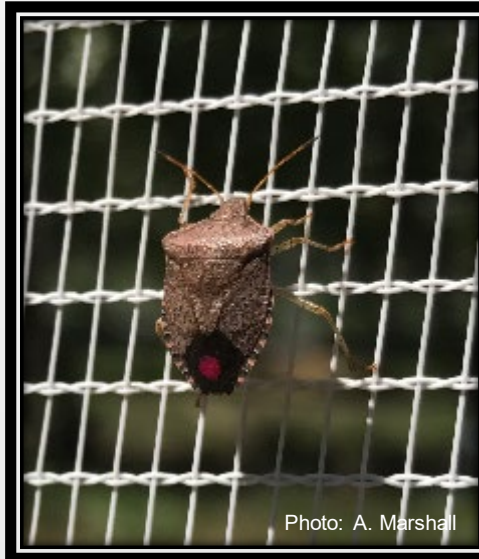
Photo: T. Alway





Conclusions

- Full enclosures significantly reduced direct pest damage two years in a row.
- They also resulted in large outbreaks of woolly apple aphids.





Drawbacks

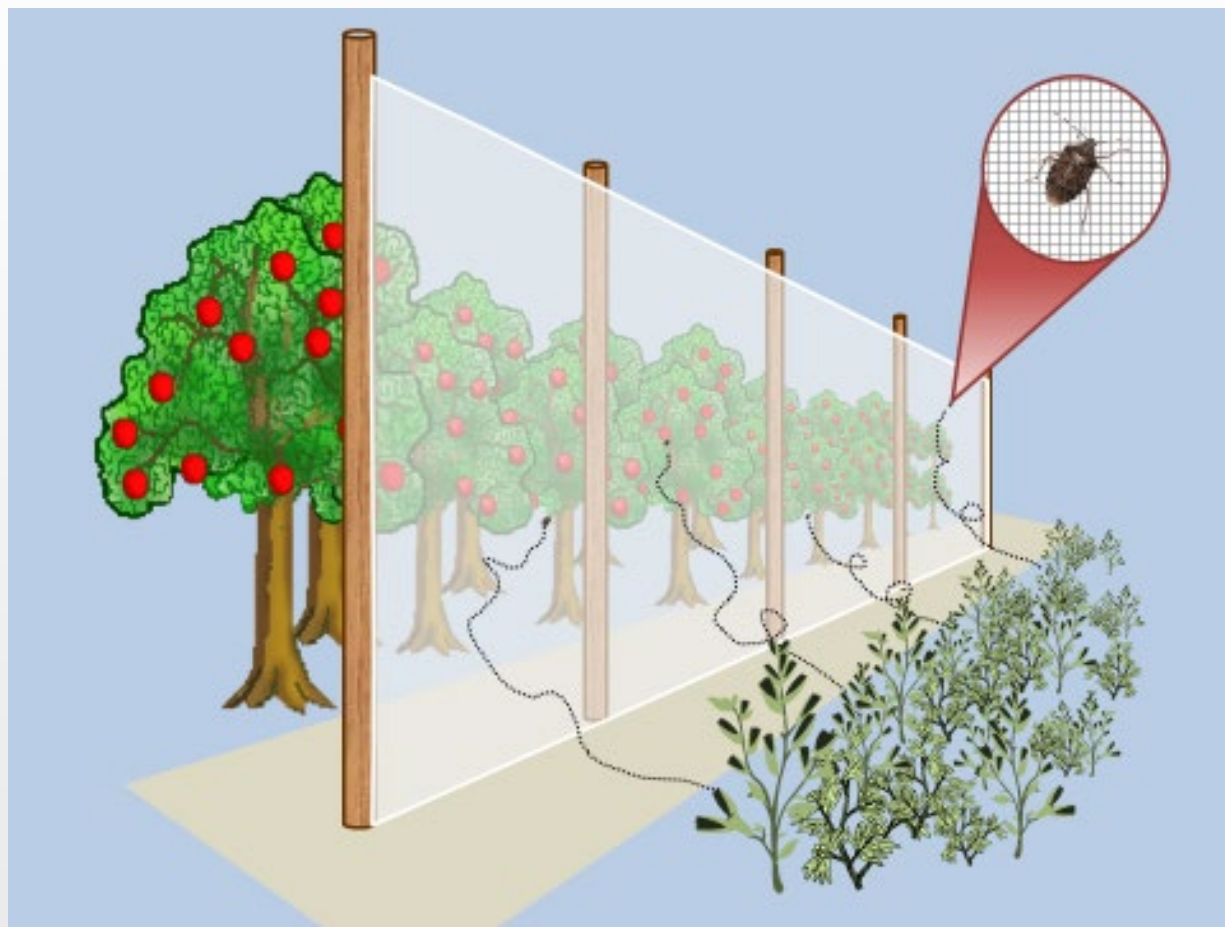
- Requires a significant installation investment





Efficacy of a barrier at orchard border

- Only net the border of an orchard.
- Still a partial barrier to wildlife.
- May disrupt stink bug movement.





Biology

Washington native stink bugs stay on natural vegetation for the majority of their lives.

Photo: J. Hepler



Photo: J. Hepler



Photo: J. Hepler





Behavior

Migration into orchards is associated with vegetation senescence.





Objectives

Obj. 1: Determine when and how stink bugs migrate into orchard.



Photo: Capital Press



Obj. 2: Examine mechanical exclusion as a control tactic.



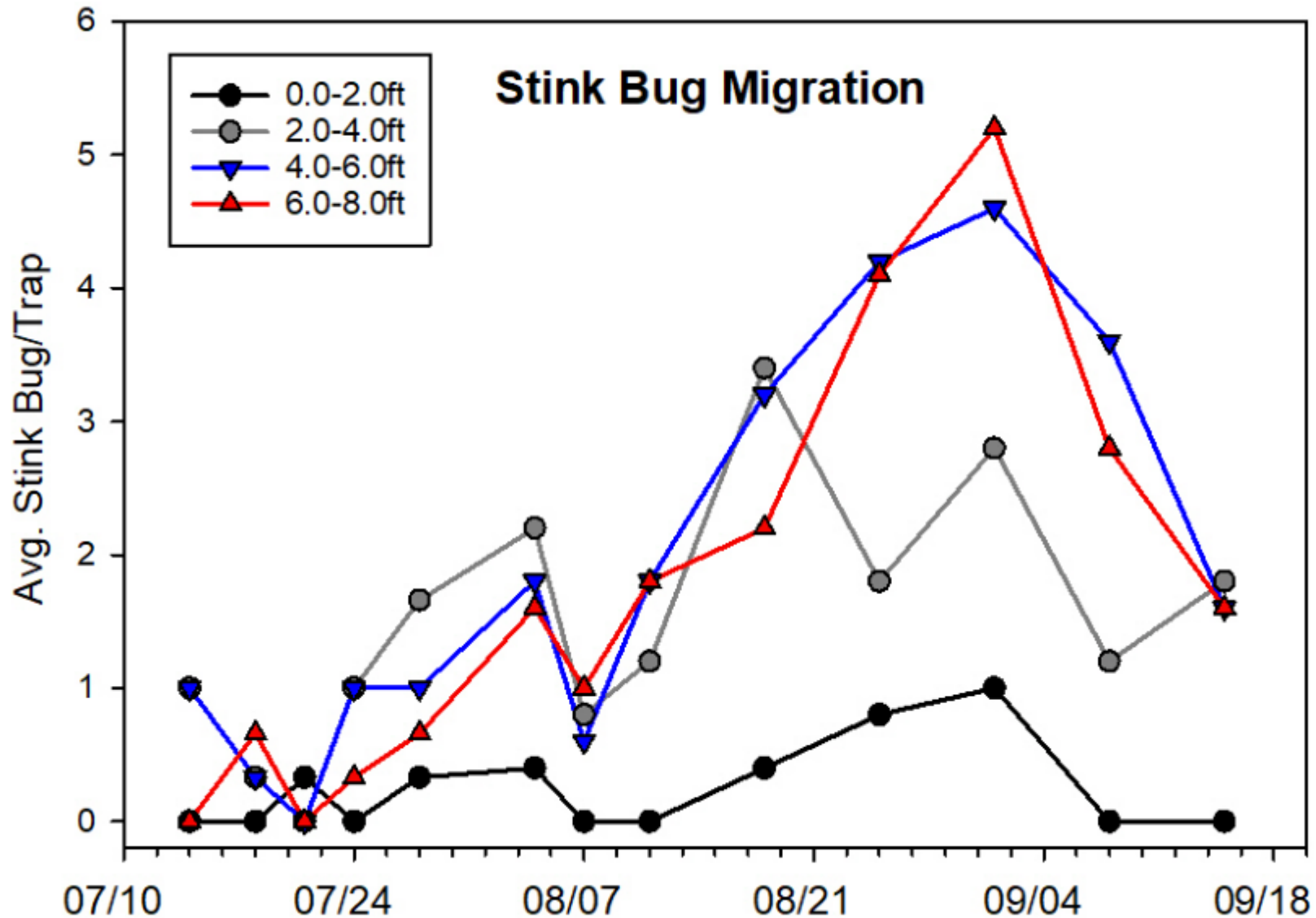
Materials and Methods

Obj.1: Assembled 5 (6 x 10 ft) sticky barriers.
Recorded and removed stink bugs every 4 days
Analyze height data





Materials and Methods

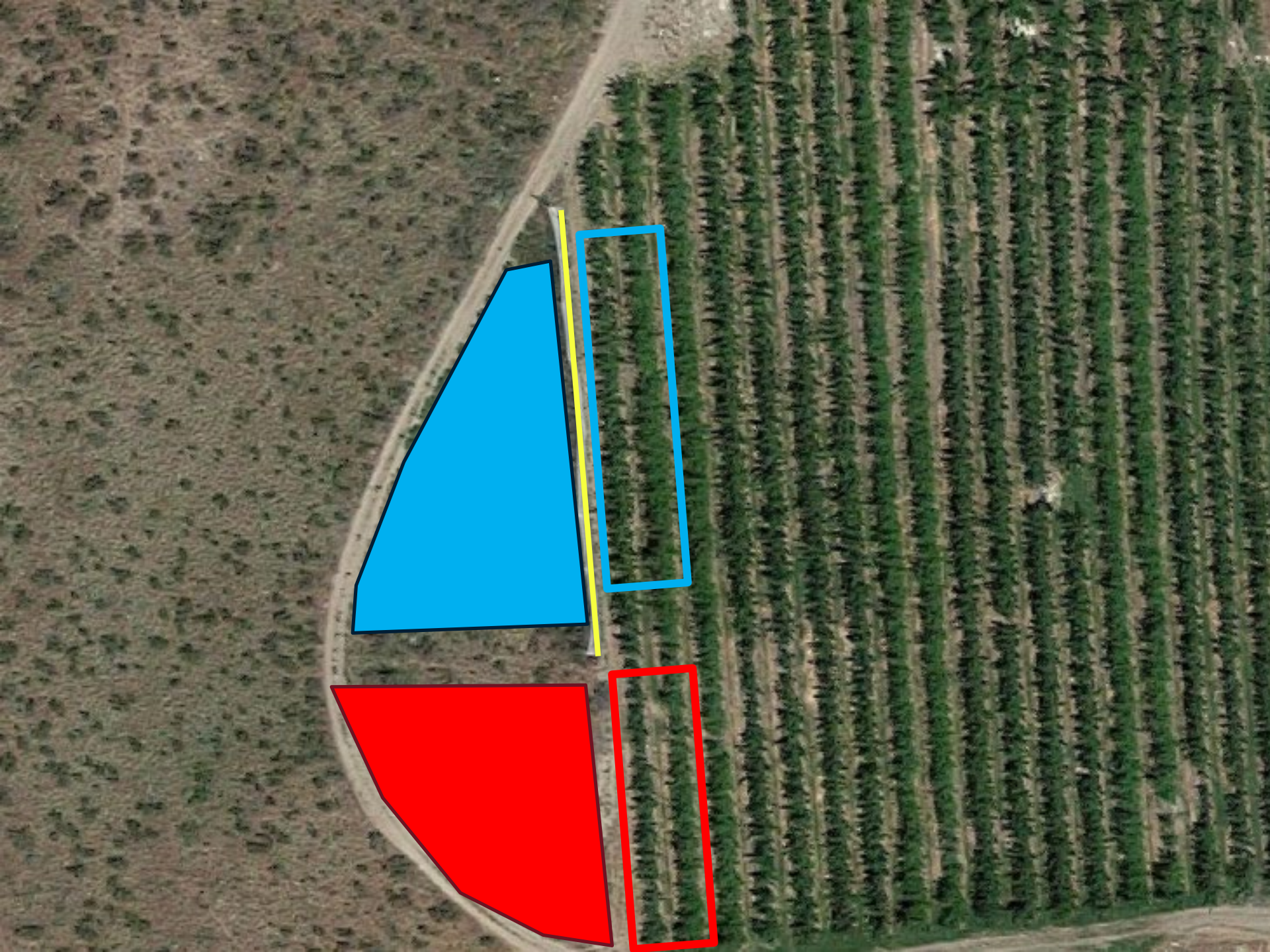


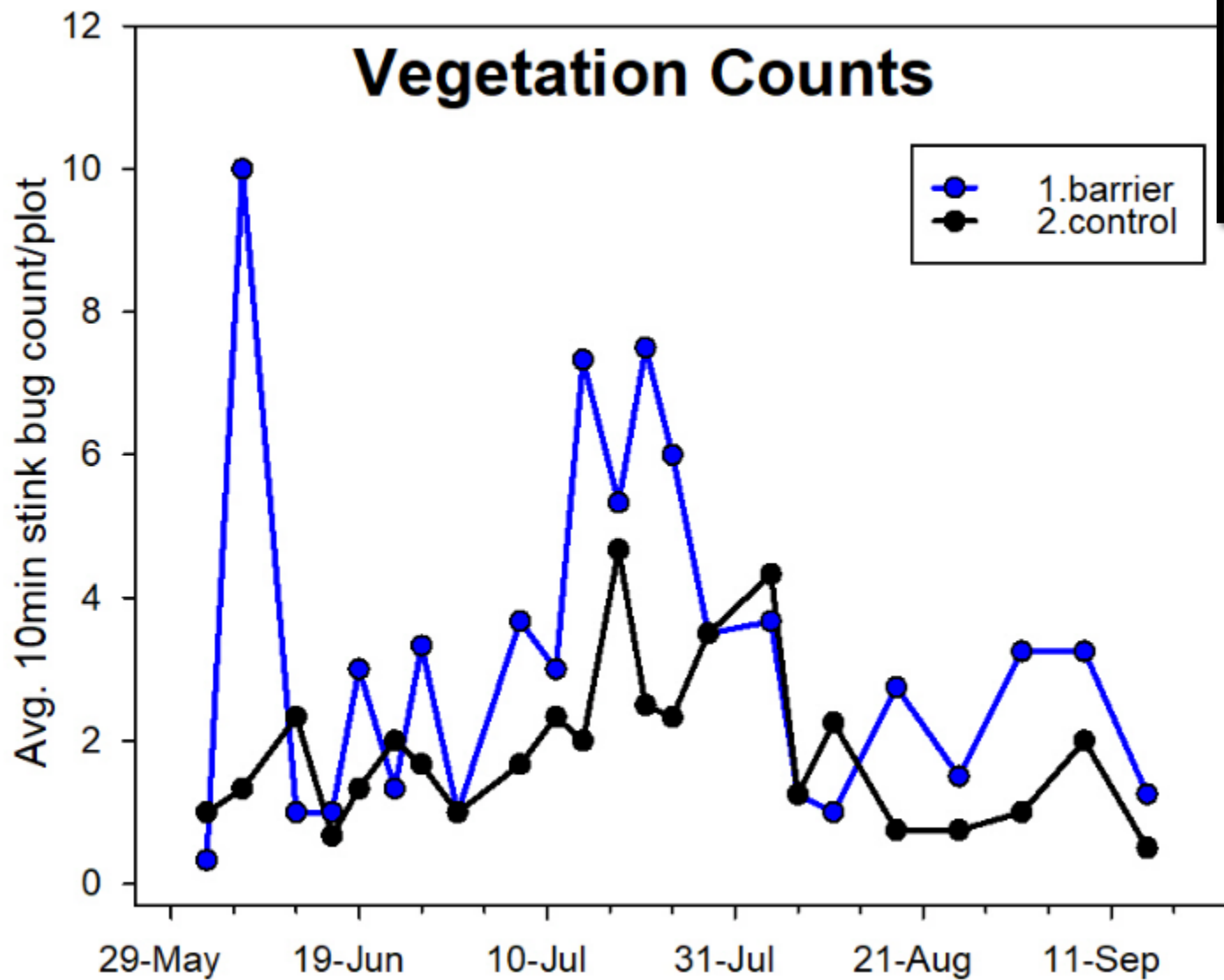


Experimental Design

Obj.2: Constructed 4 (150 x 15 ft) shade net barriers.
Recorded stink bugs on each side of net every 4 days.
Analyzed seasonal migration habits.

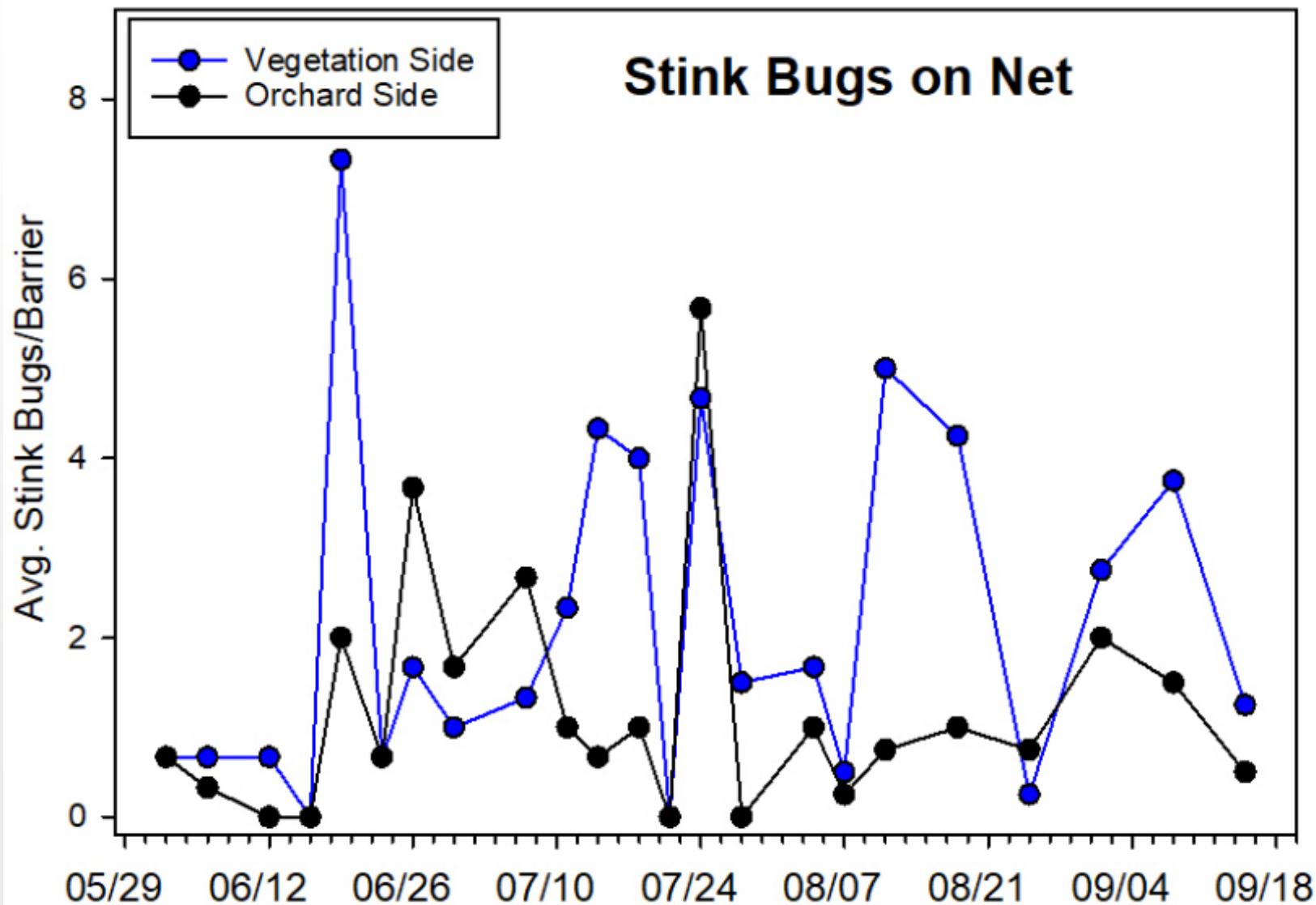


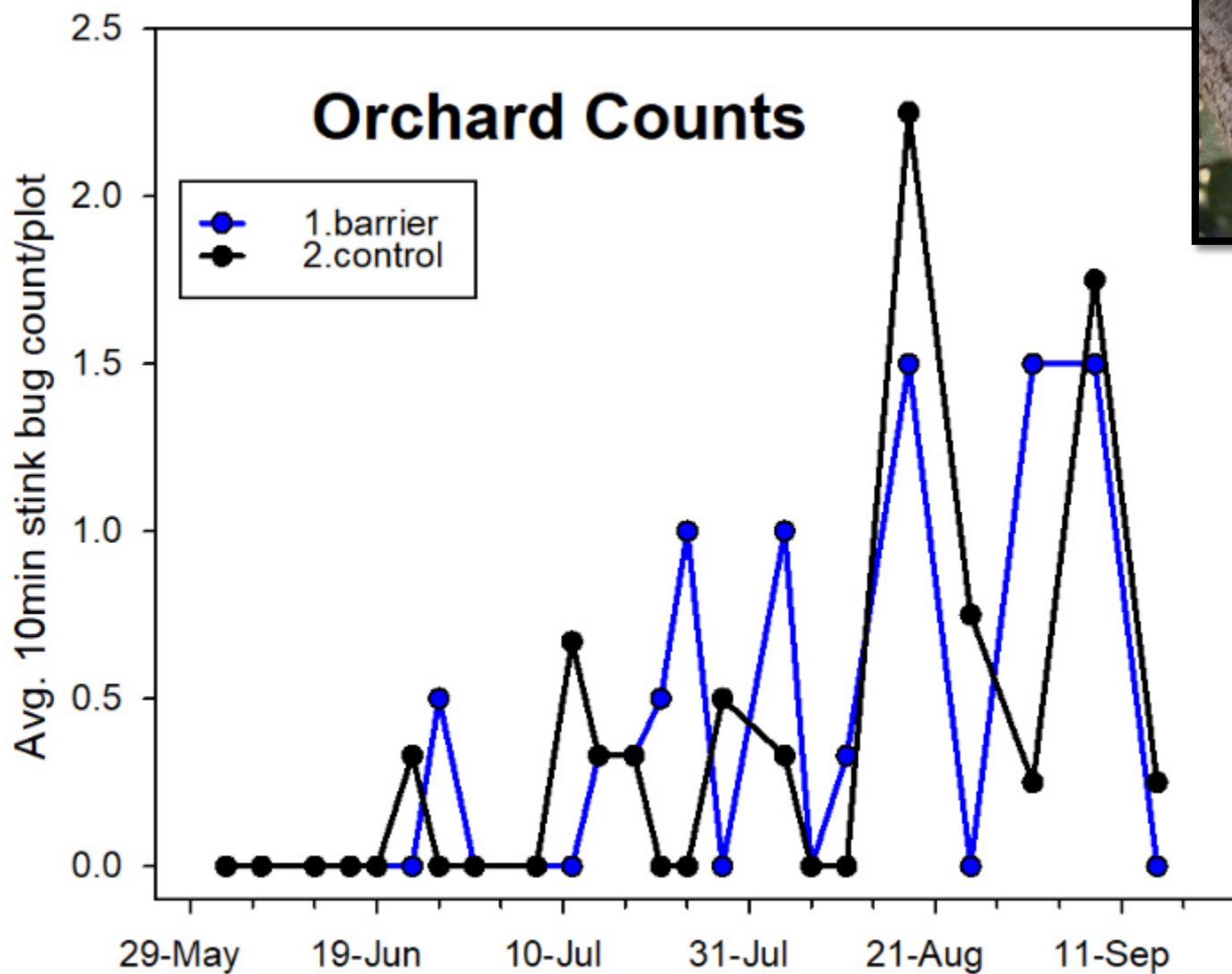






Results







Discussion

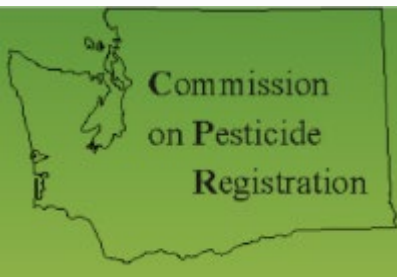
Overall the barrier study was inconclusive as very few stink bugs were captured in orchards. Stink bugs were present in orchards as early



Photo: A. Marshall



Acknowledgements



Crew of 2017

L to R, back: Chris Sater, Peter Smytheman, Bruce Greenfield, Jim Hepler, Josh Milnes, Adrian Marshall, Lonic Nottingham, Molly Darr
Front: Thomas Smytheman, Brooklyn xxxxx, Allie xxxx, C.J. Squires, Kayla xxxx, Betsy

Questions

