Use of insecticide netting for IPM strategies

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VIRGINIA TECH

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Specialty Crop Research Initiative

Collaborating Institutions

NC State University, PennState, OSU Oregon State, University of Maryland, University of Georgia, Washington State University, Northeastern IPM Center, Cornell University, Utah State University, Rutgers University, The Ohio State University, University of Kentucky, UC Davis, University of Minnesota, VirginiaTech, Berkeley, Michigan State University, UC Riverside

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Research contributors

- Hayley Bush
- Chris Bergh, Angel Acebes-Doria, Nicole Quinn
- Peter Jentsch
- John Pote, Chris Adams, and Larry Gut
- Grzegorz (Greg) Krawczyk
- Tracy Leskey

Long-lasting insecticide nets

Product name	Product type	Status of WHO recommendation
DawaPlus 2.0	Deltamethrin coated on polyester	Interim
Duranet	Alpha-cypermethrin incorporated into polyethylene	Full
Interceptor	Alpha-cypermethrin coated on polyester	Full
LifeNet	Deltamethrin incorporated into polypropylene	Interim
MAGNet	Alpha-cypermethrin incorporated into polyethylene	Full
MiraNet	Alpha-cypermethrin incorporated into polyethylene	Interim
Olyset Net	Permethrin incorporated into polyethylene	Full
Olyset Plus	Permethrin and PBO incorporated into polyethylene	Interim
Panda Net 2.0	Deltamethrin incorporated into polyethylene	Interim
PermaNet 2.0	Deltamethrin coated on polyester	Full
PermaNet 3.0	Combination of deltamethrin coated on polyester with strengthened border (side panels), and deltamethrin and PBO incorporated into polyethylene (roof)	Interim
Royal Sentry	Alpha-cypermethrin incorporated into polyethylene	Full
SafeNet	Alpha-cypermethrin coated on polyester	Full
Yahe	Deltamethrin coated on polyester	Interim
Yorkool	Deltamethrin coated on polyester	Full

Alpha-cypermethrin incorporated netting

- Royal Sentry Mosquito Net – alpha-cypermethrin

https://buzzoff.org/product-category/mosquito-nets/ (16 x 15 x 12.5 ft) $25

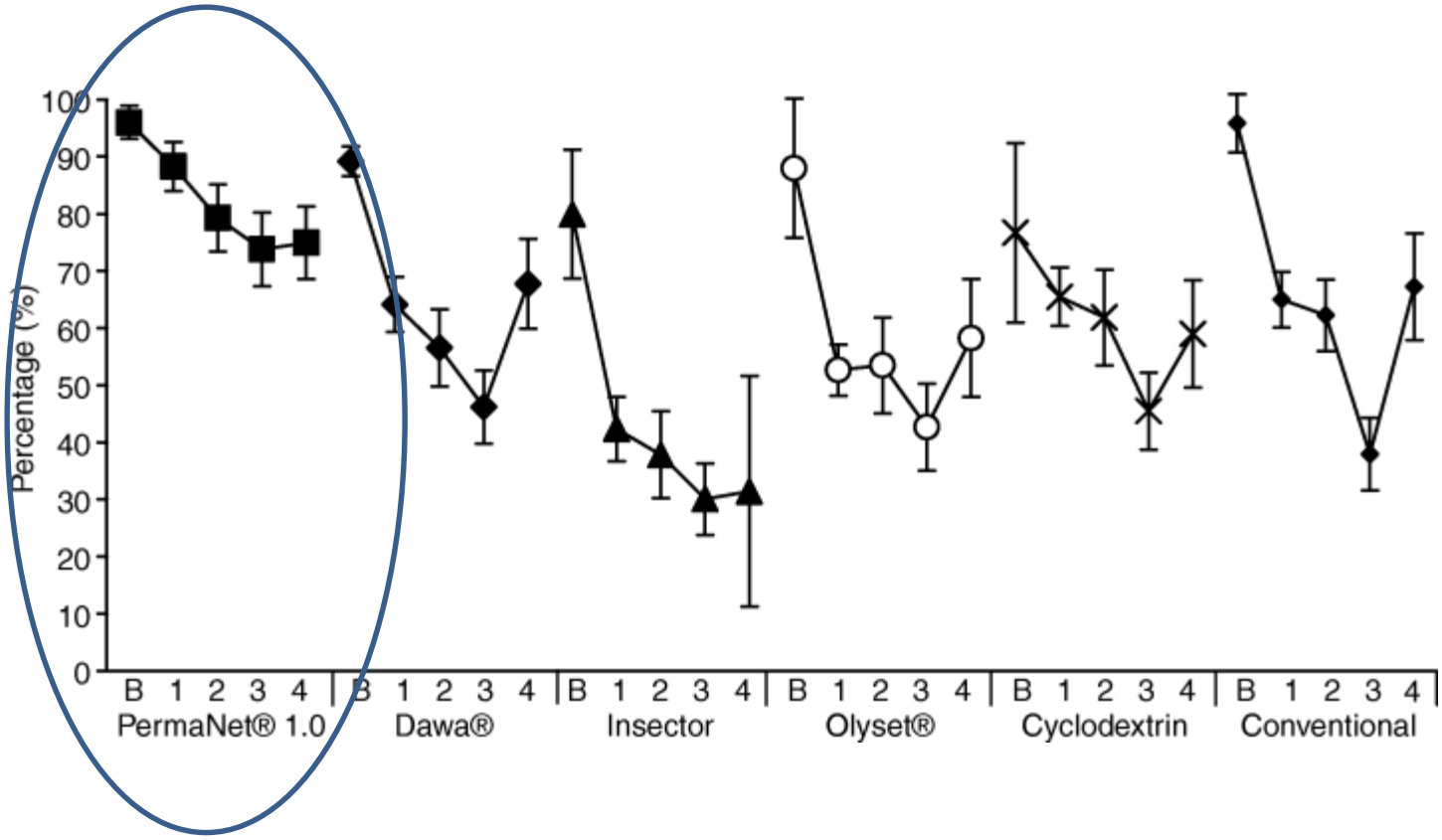
- BASF Interceptor® Long-Lasting Insecticidal Nets – alpha-cypermethrin

Deltamethrin-incorporated netting

VESTERGAARD
IMPACTING PEOPLE

- **D-Terrence® = Zerofly®** (mesh size = 32 holes/cm^2) Deltamethrin 0.4% w/w incorporated Polyethylene Screen)
- low mammalian toxicity (need to wear gloves though when handling)
- Available for research through: Dr. Jan Meneley <agbio@agbio-inc.com>, AgBio, Inc., 303-469-9221; www.agbio-inc.com

Efficacy of long-lasting insecticidal nets on *Anopheles* mosquitoes after years of household use and washings



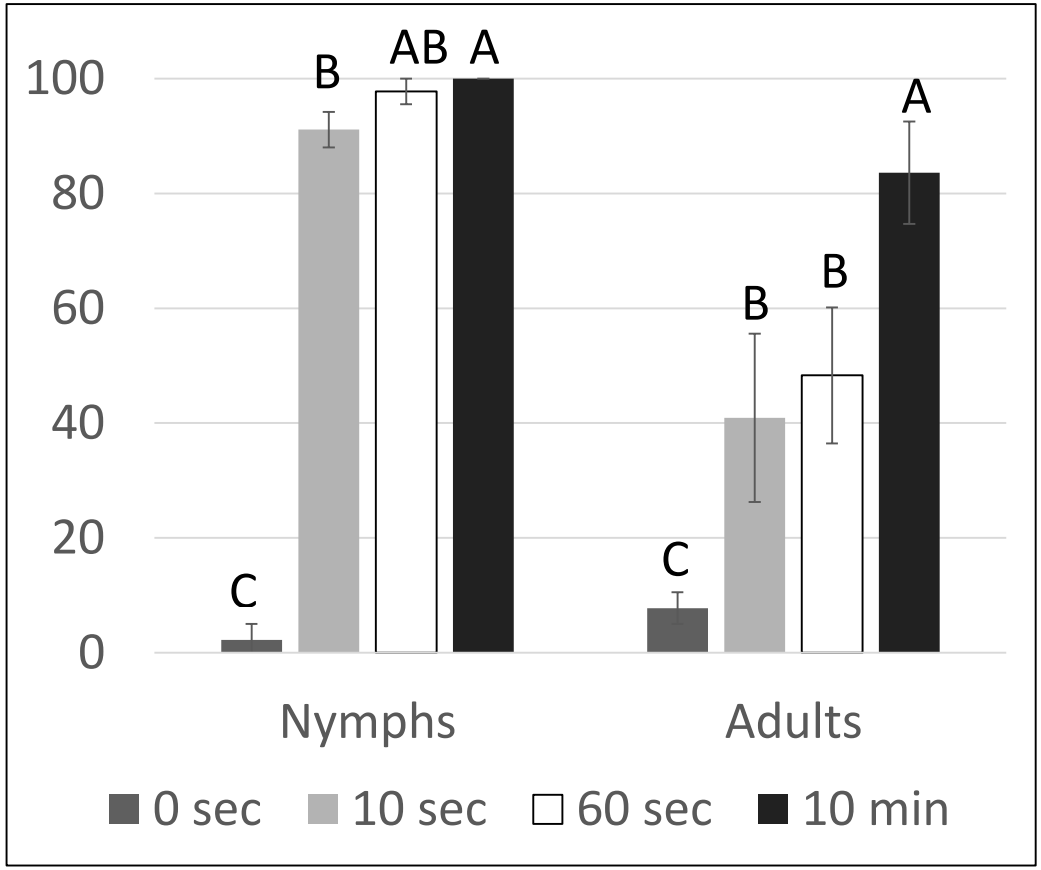
Tropical Medicine & International Health
Volume 10, Issue 11, pages 1141-1150, 18 OCT 2005 DOI: 10.1111/j.1365-3156.2005.01501.x
http://onlinelibrary.wiley.com/doi/10.1111/j.1365-3156.2005.01501.x/full#f1

Deltamethrin-Incorporated Nets as an Integrated Pest Management Tool for the Invasive *Halyomorpha halys* (Hemiptera: Pentatomidae)

T. P. Kuhar,[1,2] B. D. Short,[3] G. Krawczyk,[4] and T. C. Leskey[3]

Journal of Economic Entomology, 110(2), 2017, 543–545
doi: 10.1093/jee/tow321
Advance Access Publication Date: 6 March 2017
Research article

% mortality of BMSB after brief exposure to **D-Terrence®**



Can the screens replace the dichlorvos NoPest™ kill strip in trap tops? (Leskey and Short – USDA-ARS)

Percentage (Mean ± SEM) of *H. halys* adults escaping after being placed in commercial Dead-Inn stink bug trap jars

Treatment	% BMSB escaped[1]
dichlorvos kill strip	16.7 ± 7.8 a
lambda-cyhalothrin-dipped net	0.0 ± 0.0 b
deltamethrin-incorporated net	0.0 ± 0.0 b
Control	29.2 ± 9.5 a

DOI: 10.1111/jen.12428

Accepted: 19 July 2017

ORIGINAL CONTRIBUTION

WILEY JOURNAL OF APPLIED ENTOMOLOGY

Lethal and sublethal effects of long-lasting insecticide-treated nets on the invasive bug *Halyomorpha halys*

G. Sabbatini Peverieri | F. Binazzi | L. Marianelli | P. F. Roversi

Alpha-cypermethrin
BASF Interceptor nets

TABLE 1 Lethal effects of LLINs on *Halyomorpha halys* after different exposure times (Chi-squared test; $^{*}p < .05$; $^{**}p < .001$; $^{***}p < .0001$) (pooled data)

	% of mortality	
LLIN exposure time (min)	Treated	Control
Females		
5	40***	0
15	48***	0
30	78***	0
45	86***	2
60	92***	0
Males		
5	50***	0
15	68***	4
30	80***	6
45	94***	0
60	100***	0

Insecticide nets as row covers

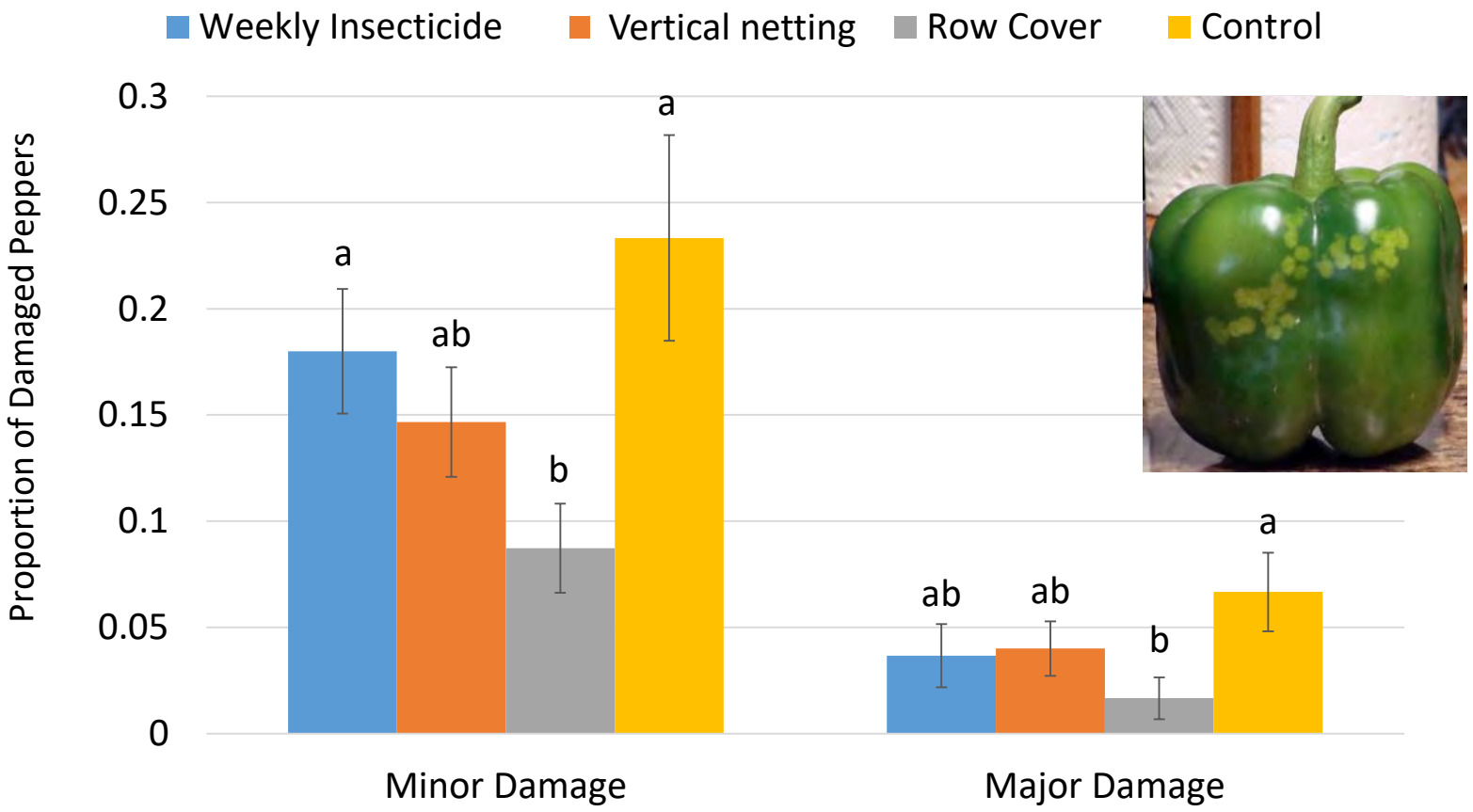
D-Terrence® nets to control BMSB in Peppers

- Conducted on 3 farms
- Latin Square Design

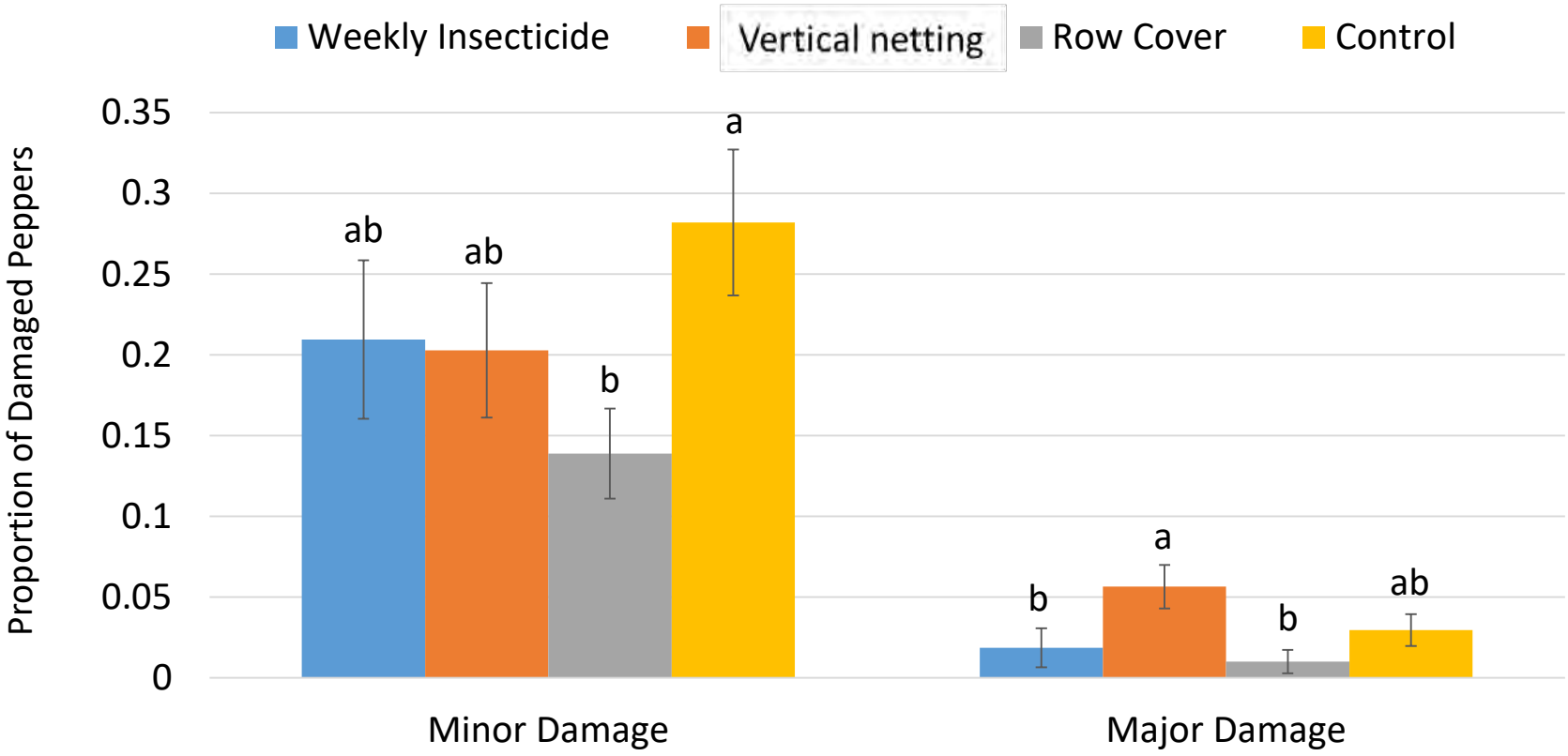
Treatments:

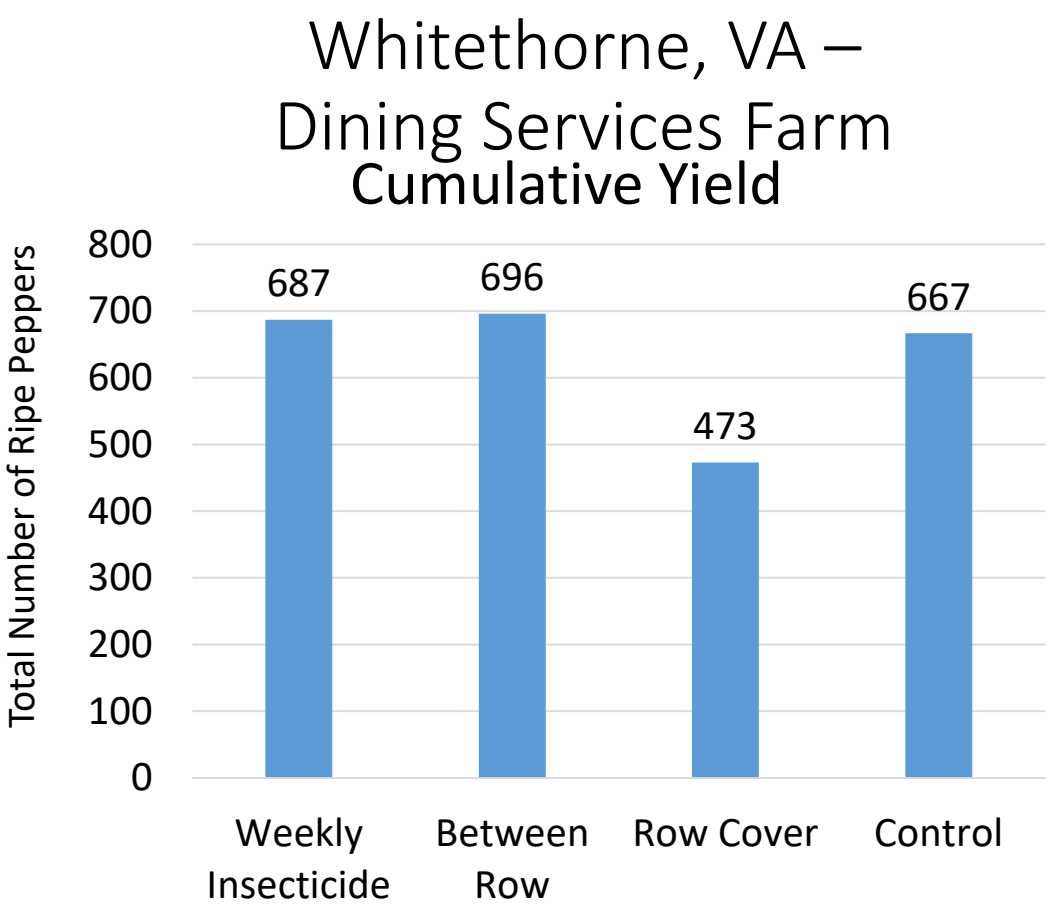
1. Untreated control
2. Weekly bifenthrin spray
3. **D-Terrence®** row cover
4. **D-Terrence®** between staggered pepper plants (far right)

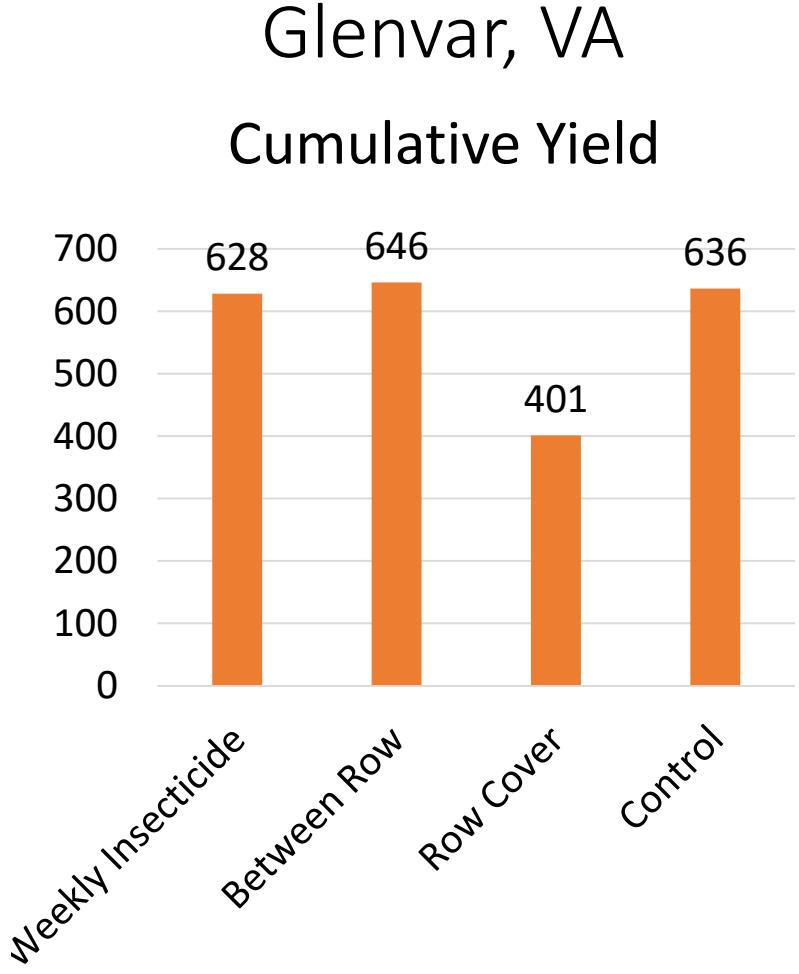
Whitethorne, VA – Dining Services Farm



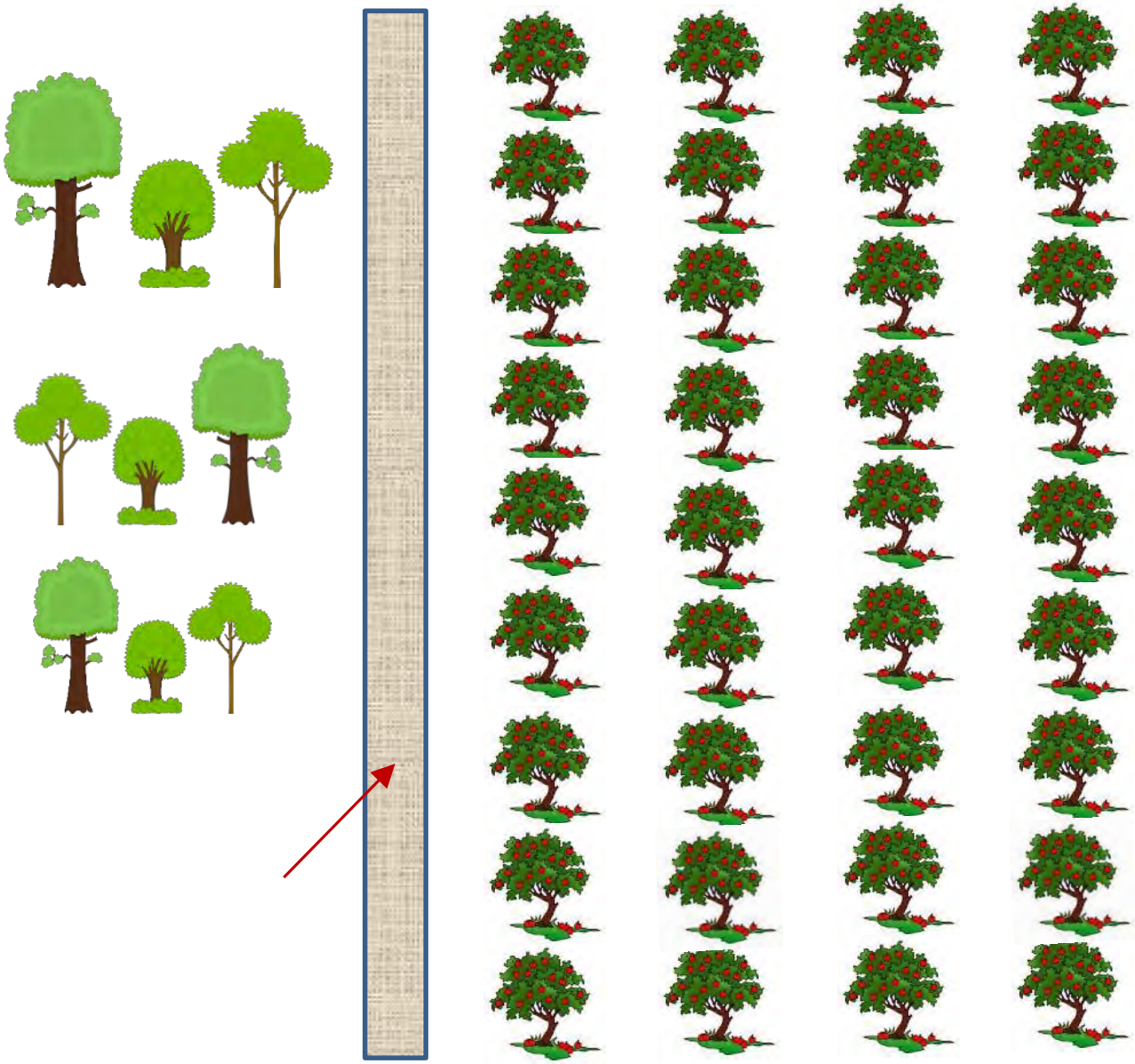
Whitethorne, VA – Kentland Farm




Whitethorne, VA –
Dining Services Farm
Cumulative Yield
Total Number of Ripe Peppers
800
700
600
500
400
300
200
100
0
687
696
473
667
Weekly Insecticide
Between Row
Row Cover
Control


Glenvar, VA
Cumulative Yield
700
600
500
400
300
200
100
0
628
646
401
636
Weekly Insecticide
Between Row
Row Cover
Control

How can we incorporate the screens into pest management?



Can pheromone-baited pyramid traps lined with treated net serve as attract-and-kill stations? – Chris Bergh study 2017

- 3 treatments:
  - Trap lined with treated net
  - Trap lined with untreated net
  - Trap with no net
- Baited with Trece Dual lure
- n = 3/site x 3 sites (2 VA, 1 WV)
- Live, moribund, and dead BMSB and non-targets in trap base and collection jar collected 2X/week
- Aug 23 – Oct 5

Results not promising based on present design:

- Stronger pheromone signal?
- Speed of intoxication?

What % of BMSB that get on the screen end up dead and counted on the catch sheet below?

- Bugs were marked with a water-based Sharpie pen
- 4 reps (trees)
- Total # marked BMSB observed = 241
- % recovered on sheet = 33.6 ± 11.5%

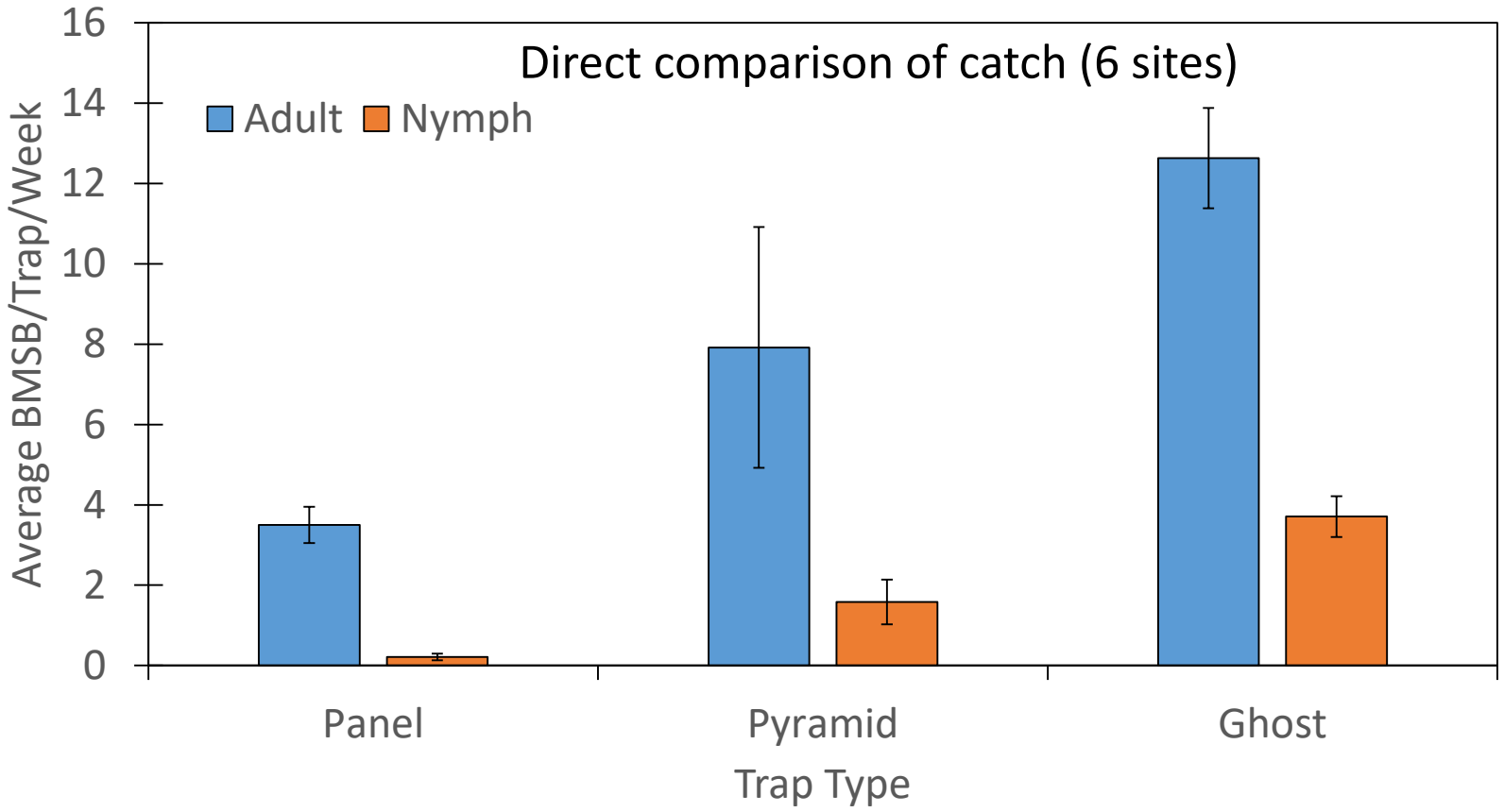
Peter Jentsch Research

Hudson Valley Research Laboratory

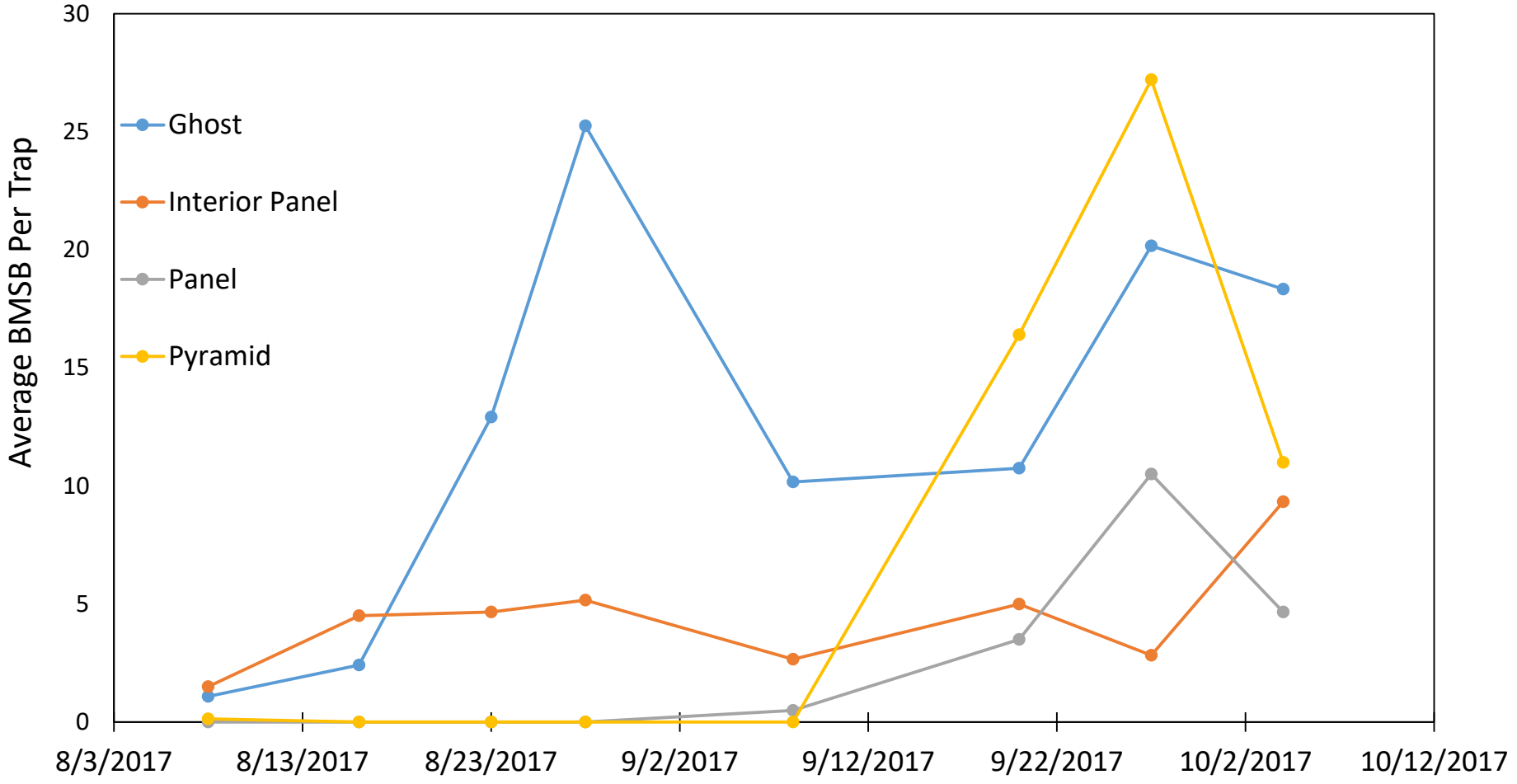
AtK traps were checked weekly and compared to Sticky Traps and Tedders Traps

6 ft

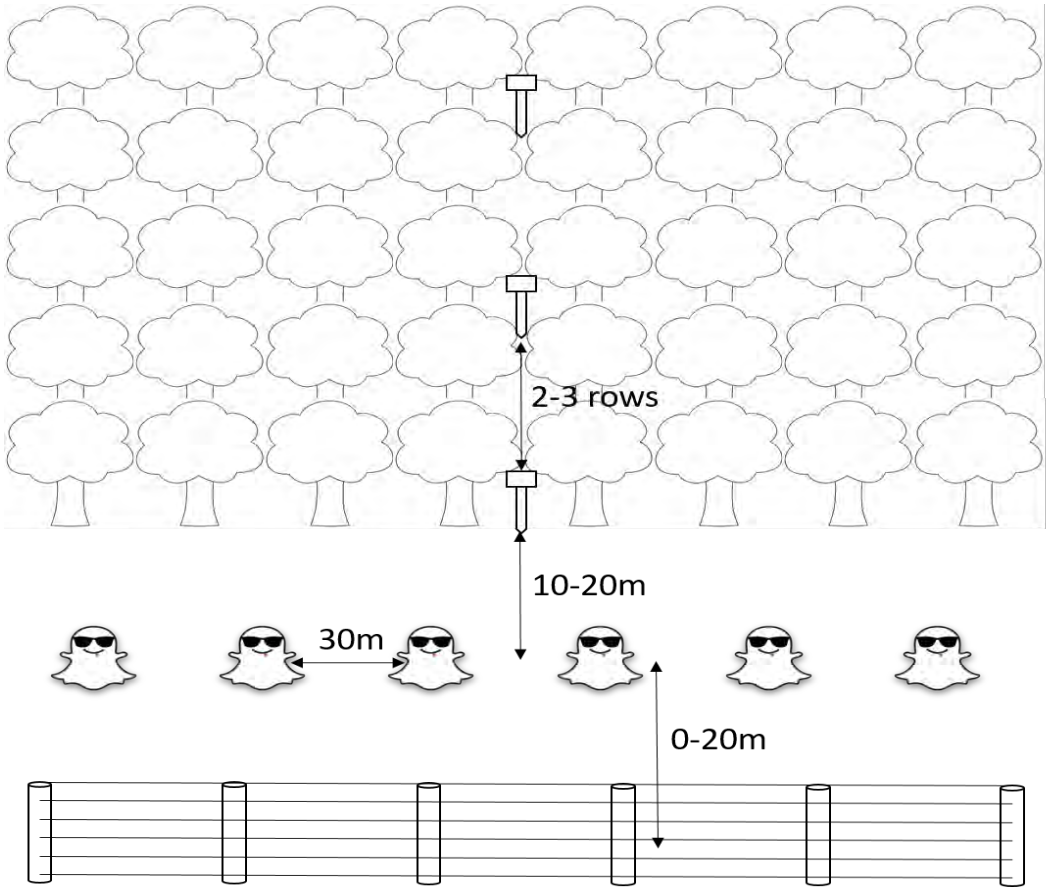
Research by: John Pote, Chris Adams, and Larry Gut


Direct comparison of catch (6 sites)
Adult
Nymph
Average BMSB/Trap/Week
16
14
12
10
8
6
4
2
0
Panel
Pyramid
Ghost
Trap Type

Ghost Traps Captured BMSB Consistently



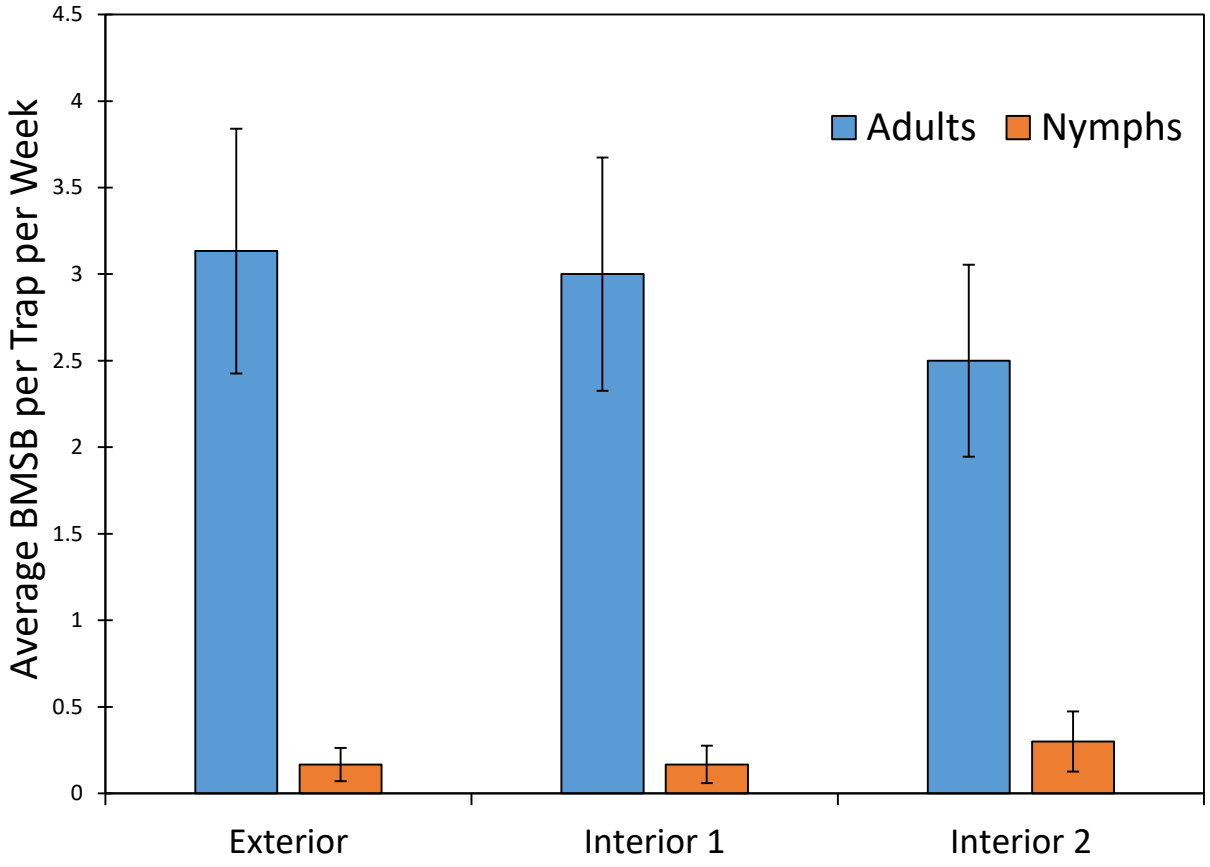
Perimeter Ghost Trap Experimental Layout

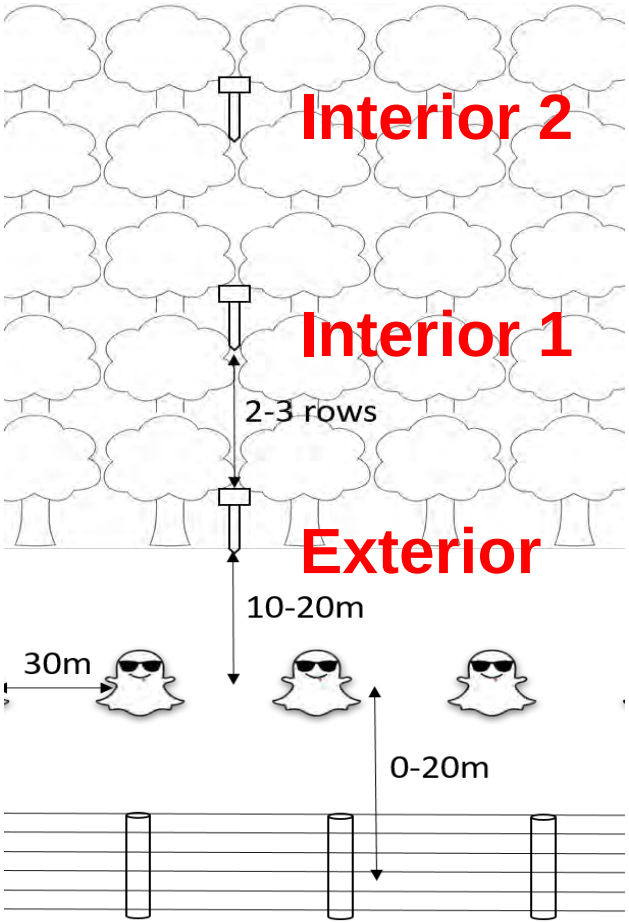


= ghost trap

= clear panel trap

Ghost Traps Failed to Prevent BMSB Infiltration





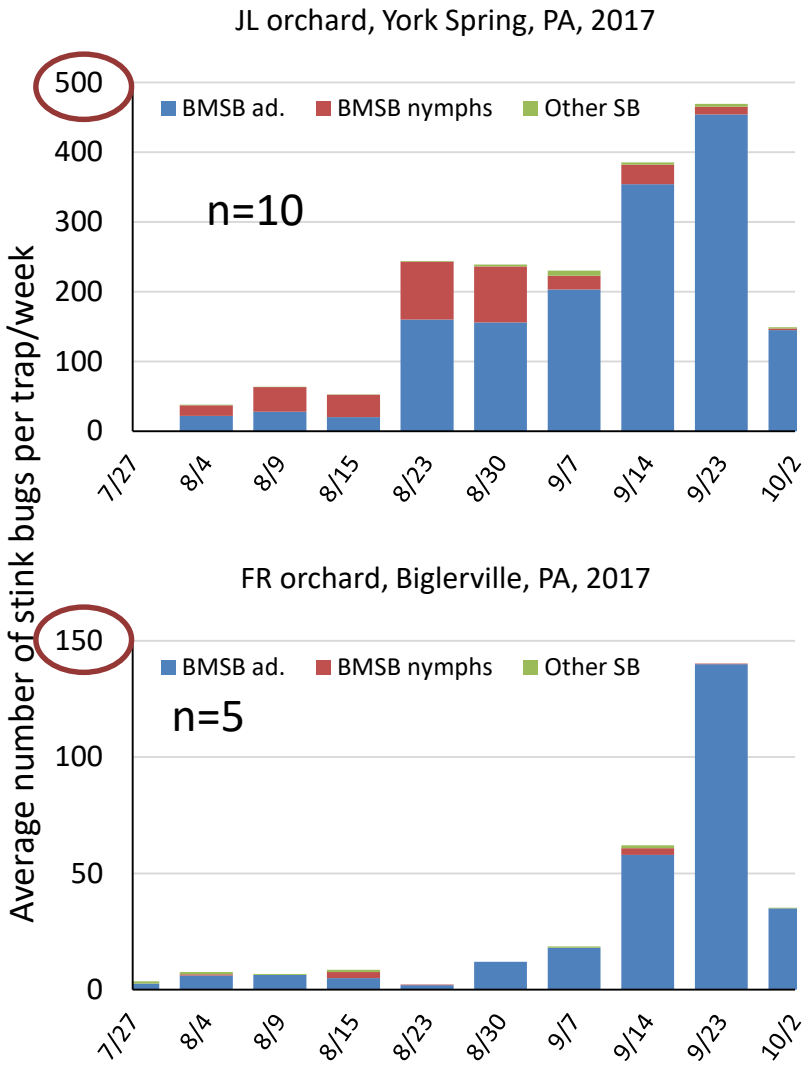
PennState
College of Agricultural Sciences

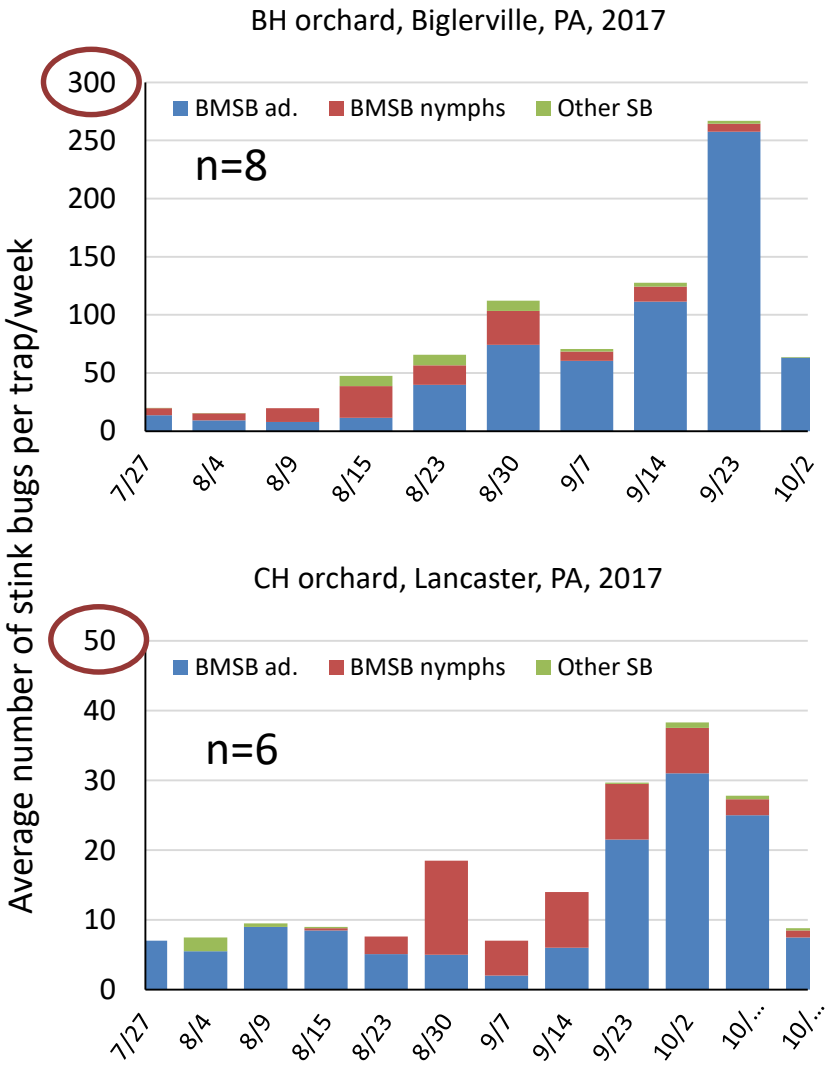
Orchards with BMSB ghost traps Pennsylvania, 2017 season

Location	Block size/ # of G. traps	Ghost trap lures	Monitoring lures/trap	Tarp/no tarp
Adams (BH)	≈ 20 ac 10 traps	Trece 3x/Gt	Trece/ Trece sticky	Yes/no
Adams (JL)	≈ 20 ac 8+4 traps	Trece 3x/Gt	Rescue/ Ag-Bio	Yes/yes
Adams (FR)	≈ 2 ac 5 traps	Ag-Bio HD 5x/Gt	Trece Ag-Bio/Trece	Yes/no
Lancaster (TH)	≈ 20 ac 6+6 traps	Ag-Bio HD 5x/Gt	Ag-Bio/ Ag-Bio	Yes/yes
Allegheny (RS)	≈ 10 ac 5+4 traps	Ag-Bio HD 5x/Gt	Ag-Bio/ Trece	Yes/yes

Ghost traps placed during the week of July 20, 2017

Average SB captures in ghost traps



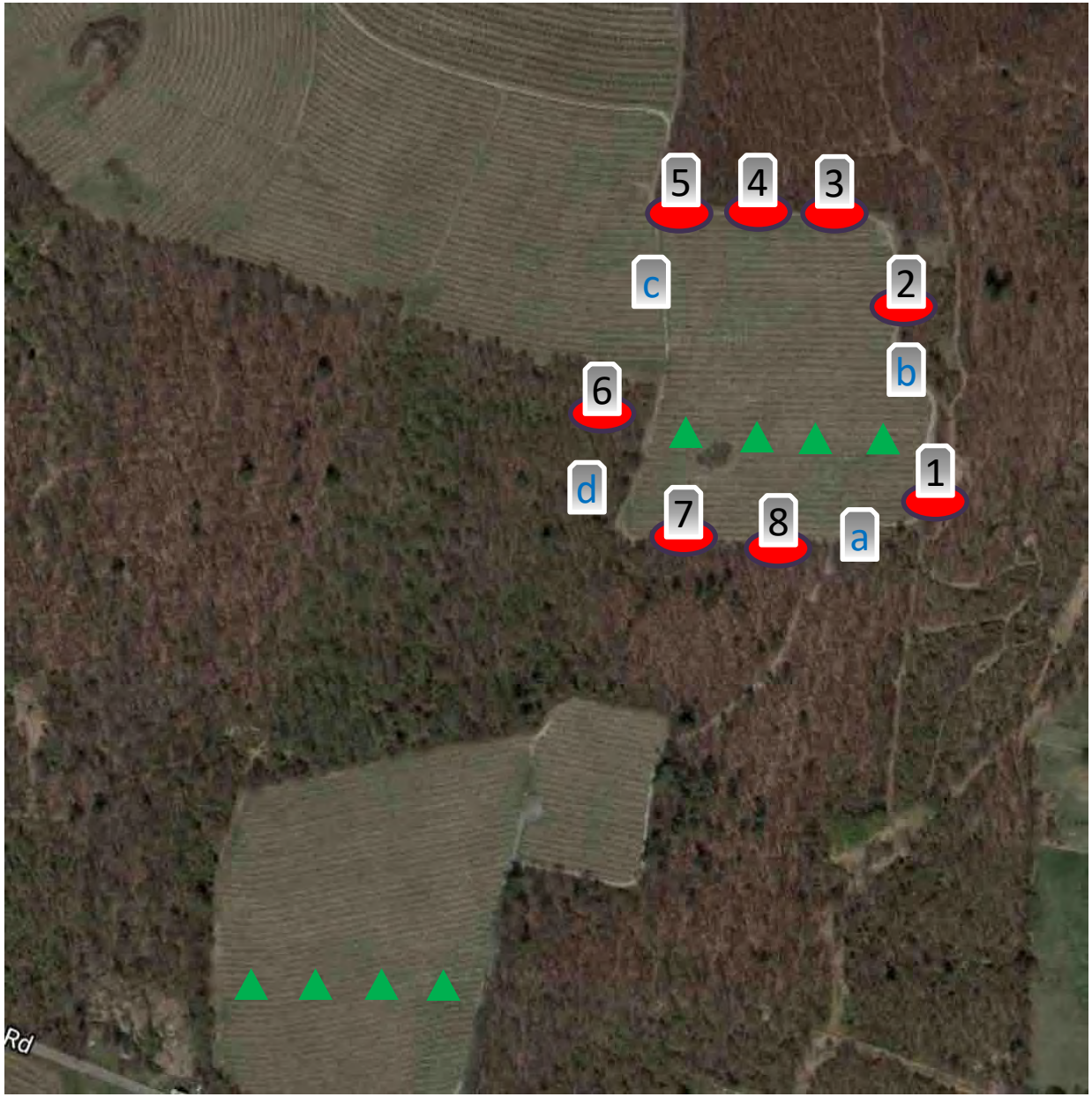


BMSB captures in monitoring traps

JL Orchard, 2017

BMSB	Ghost traps	Control
Adults	**0.58 a**	**2.86 b**
Nymphs	**0.31 a**	**1.28 b**

Average BMSB captures per trap/week. Rescue traps baited with Ag Bio lures. Four traps per treatment



Attract-and-Kill Refinement

- **Horizontal black deltamethrin-impregnated nets (D-Terrence)**
- **Three high dose Trece BMSB lures per tree**
- **Baited trees spaced every 50 m around orchard perimeter**
- **Compared fruit harvest injury with grower standard management plot**

How can we incorporate the screens into urban control?

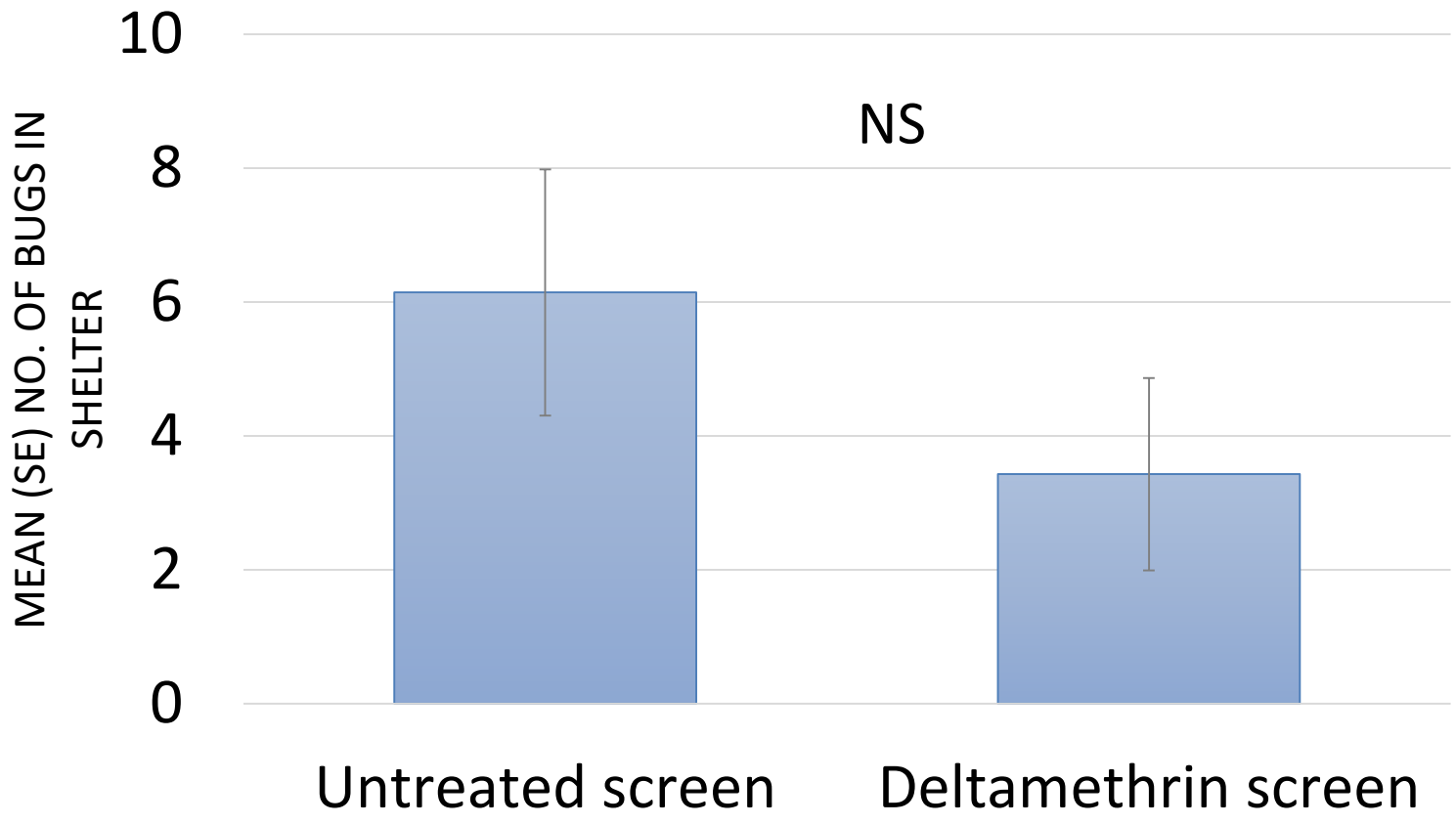
BMSB aggregate on tree trunks in Sept

Blacksburg, VA

Sacramento, CA

Can the treated netting help reduce the numbers of BMSB entering structures in the fall?

Total numbers of BMSB entering pyramids covered with treated vs. untreated screen (n = 7 locations)

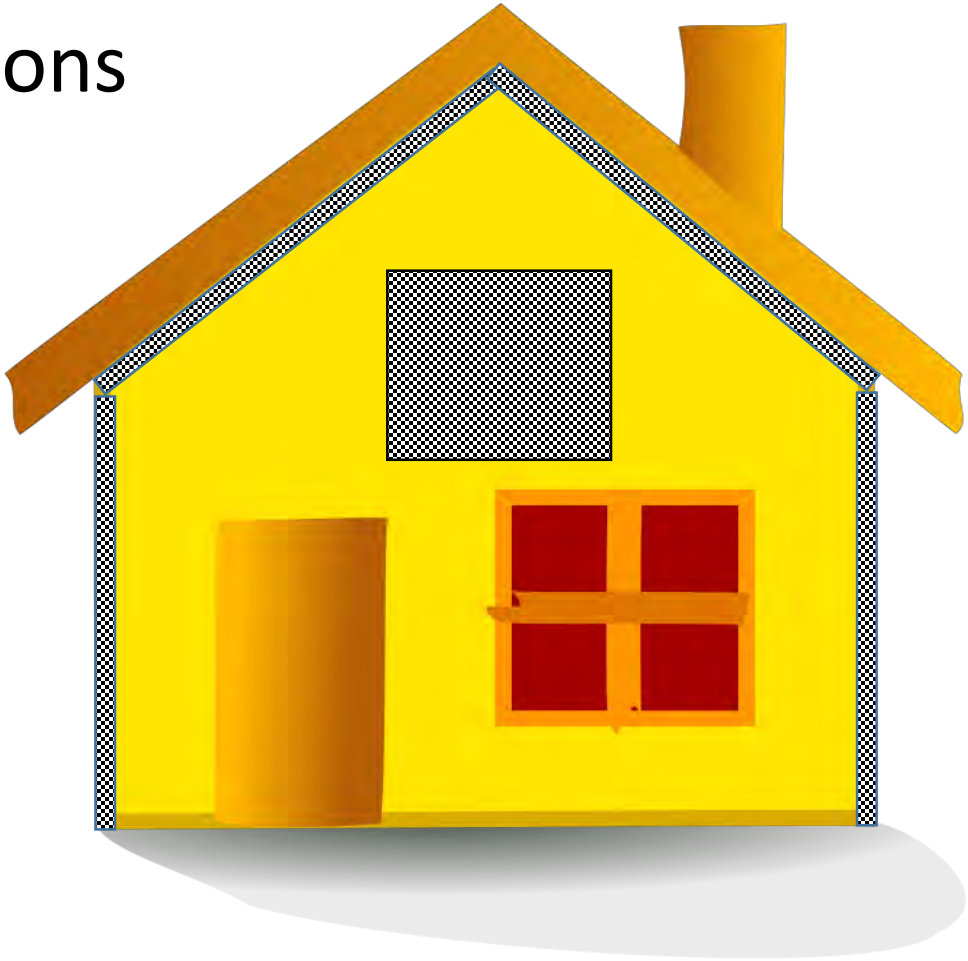


Can panels of insecticide-treated net mitigate BMSB issues for homeowner?

- Do BMSB alight more frequently on a black panel of untreated net than on the wall within a frame? **Yes**
- Does insecticide-treated net affect the frequency of alightment? **No**
- Does the time spent on panels with treated vs untreated net differ? **Yes, shorter on treated**
- What is the mean time spent on a panel with treated net? **~4.25 min**
- Do BMSB walk or fly from panels with treated or untreated net? **Most walk off**
- Is the time spent on treated net sufficient to kill adult male and female BMSB? **No**

Possible future directions

- Increased exposure duration
  - Larger panel(s)?
  - Folds to guide walking bugs?
  - Additional sources for exposure?
  - LED light for night attraction?
    - Likely significant non-target effects
- Do moribund bugs survive in the field?
  - Predation
  - Exposure to the elements



How long do the nets remain effective?

- In VA, the netting was used in the field for experiments and stored in an outdoor shed during the winter, then re-used again for the next 2 yrs
- Each yr, the aged screens were cut into strips and placed in Petri dishes along with BMSB adults for 24 hr
- Fresh (new) screen killed 100% of BMSB adults in 24 hr, and 3-yr old field-aged screen killed 80%

Where do we go from here?

- Further evaluate attract-and-kill strategies with the netting
- Further explore use as a barrier or crop cover
- Further explore use as a tool to reduce invasions in human dwellings

Concerns with using pyrethroid-treated netting

- How do we assess efficacy?
- Non-target effects
- Pyrethroid resistance development in BMSB