Netting as a BMSB Exclusion Barrier

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History of Nets in Orchards

- Hail nets
- Shade nets

Hail-damaged fruit
Sunburned fruit
Types of Net Structures

- Top-cover only
- Tree wrap
- Drive-in enclosure
Net Enclosures Expand in Washington
Multiple Functions

✓ Reduce heat stress
✓ Eliminate overhead cooling
✓ Improve fruit size, skin color
✓ Reduce worker exposure to UV
✓ Reduce worker heat stress
✓ Equipment-accessible
✓ Exclude birds
✓ Exclude deer

Exclude insects?
BMSB not yet established as landscape-level agricultural pest in north-central WA
Washington Species

Natives used as proxies for BMSB

Red-Shoulder Stink Bug
*Thyanta pallidovirens*

Conchuela Bug
*Chlorochroa ligata*

Conspersse Stink Bug
*Euschistus conspersus*

*(Zack et al., 2012; McGhee, 1997)*
Life Cycle

May-July
14-40 eggs/cluster

Aug-July
Dormant: Oct-April

Jun-Aug (5 instars)

(McGhee, 1997)
Habitat

Washington native stink bugs remain in natural vegetation for the majority of their lives.

(Bordon et al., 1951)
Migration into orchards is associated with vegetation senescence.

( McGhee, 1997 )
Obj. 1: Determine when and how stink bugs migrate into orchard.

Obj. 2: Examine physical exclusion as a control tactic.
Obj. 1: Determine timing, directionality, and height of stink bug migration.

- 2017: Constructed 5 - 6 x 9 ft sticky barriers.
  *2018: Increased sticky barriers to 13 ft.
- Recorded stink bugs weekly by height from 5 Jun – 13 Sep.
2018 Results

Stink Bug Seasonal Direction

- Veg-Orch
- Orch-Veg
- Spray Date

Avg. Stink Bugs/Barrier:
- 04-Jun
- 18-Jun
- 02-Jul
- 16-Jul
- 30-Jul
- 13-Aug
- 27-Aug
- 10-Sep
2017 Results

**Migration Height**

<table>
<thead>
<tr>
<th>Height (ft)</th>
<th>Avg. Stink Bug CID/Plot</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>C</td>
</tr>
<tr>
<td>0.75</td>
<td>BC</td>
</tr>
<tr>
<td>2.00</td>
<td>AB</td>
</tr>
<tr>
<td>3.25</td>
<td>A</td>
</tr>
<tr>
<td>4.50</td>
<td>A</td>
</tr>
<tr>
<td>5.83</td>
<td>A</td>
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<tr>
<td>7.00</td>
<td>A</td>
</tr>
<tr>
<td>8.25</td>
<td>AB</td>
</tr>
</tbody>
</table>

Note: Heights in meters: 0.00, 0.23, 0.61, 0.99, 1.37, 1.78, 2.13, 2.51.
2018 Results

Orch-Veg Migration Height

Avg. Stink Bug CID/Plot

Height

0.75 1.92 3.08 4.25 5.42 6.58 7.75 8.92 10.08 11.25 12.42 (ft)
0.23 0.58 0.94 1.30 1.65 2.01 2.36 2.71 3.07 3.43 3.78 (m)

A
Obj.2: Evaluate efficacy of shade net barriers to exclude migrating stink bugs.
Experimental Design

- Constructed 3 - 150 x 12 ft (45.72 x 3.65 m) shade net barriers with flaps in 2016.
Experimental Design

3 treatments: 1. Netting with deltamethrin-infused flaps
   2. Netting with non-insecticidal flaps
   3. No net control.

Sampled vegetation and orchard weekly from Jun 1 – Sep 13

Photo: A. Marshall

Photo: A. Marshall
**Orchard:**
- Beat sheet sample 10 trees, 4 times each, in each sample area.
- Sum all stink bugs by life stage and species.

**Vegetation:**
- Beat sheet sample for 8 minutes.
- Sum all stink bugs by life stage and species.
2018 Results

Stink Bug Adults

- Deltamethrin
- Plain Netting
- Control

-86%
-89%
-39%
Shade Netting Enclosures

3 treatments:
1. Cage
2. Conventional
3. Control (no treatment)

4 replications
48 trees/plot

Photo: A. Marshall
Stink Bug Damage Reduction

% Fruit Damage

Stink bug

- 2016
- 2017

- Cage
- Airblast
- Check

A
AB

b
b

a
Codling Moth Exclusion

Photo: S. Schoof

Photo: J. Brunner

Photo: A. Marshall
Codling Moth Damage Reduction

Mean 1st gen. % codling moth damage

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<tr>
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<th>2017</th>
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<td>Cage</td>
<td>c</td>
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<td>Control</td>
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Acknowledgements

The Beers Lab - Summer 2018


