Netting as a BMSB Exclusion Barrier

Jim Hepler, Adrian Marshall, & Elizabeth Beers

WSU-TFREC

1100 N. Western Ave.
Wenatchee, WA

This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, Specialty Crop Research Initiative under award number 2016-51181-25409.
History of Nets in Orchards

✓ Hail nets
✓ Shade nets
Types of Net Structures

- Top-cover only
- Drive-in enclosure
- Tree wrap
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 in Eastern WA Tree Fruit

BMSB not yet established as landscape-level agricultural pest in north-central WA
Natives used as proxies for BMSB

Red-Shoulder Stink Bug
* Thyanta pallidovirens

Conchuela Bug
* Chlorochroa ligata

Consperse Stink Bug
* Euschistus conspersus

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

May-July
14-40 eggs/cluster

June-Aug (5 instars)

Aug-July
Dormant: Oct-April

(McGhee, 1997)
Habitat

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

(Bordon et al., 1951)
Behavior

Migration into orchards is associated with vegetation senescence.

(McGhee, 1997)
Objectives

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

Avg. Stink Bug CID/Plot

Height

0.00 0.75 2.00 3.25 4.50 5.83 7.00 8.25 (ft)
0.00 0.23 0.61 0.99 1.37 1.78 2.13 2.51 (m)

C BC AB A A A AB
2018 Results

Orch-Veg Migration Height

Average Stink Bug CID/Plot

<table>
<thead>
<tr>
<th>Height (ft)</th>
<th>Avg. CID/Plot</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.75</td>
<td>1.92</td>
</tr>
<tr>
<td>0.23</td>
<td>3.08</td>
</tr>
<tr>
<td>1.38</td>
<td>4.25</td>
</tr>
<tr>
<td>1.65</td>
<td>5.42</td>
</tr>
<tr>
<td>2.01</td>
<td>6.58</td>
</tr>
<tr>
<td>2.36</td>
<td>7.75</td>
</tr>
<tr>
<td>2.71</td>
<td>8.92</td>
</tr>
<tr>
<td>3.07</td>
<td>10.08</td>
</tr>
<tr>
<td>3.43</td>
<td>11.25</td>
</tr>
<tr>
<td>3.78</td>
<td>12.42</td>
</tr>
</tbody>
</table>
Physical Exclusion

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

**Orchard:**
- Beat sheet sample 10 trees, 4 times each, in each sample area.
- Sum all stink bugs by life stage and species.
2018 Results

Stink Bug Adults

- Deltamethrin: -86%
- Plain Netting: -89%
- Control: -39%

Vegetation vs. Orchard
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

- Cage
- Airblast
- Check

2016 and 2017 data for Stink bug damage reduction.
Codling Moth Exclusion

Photo: S. Schoof

Photo: J. Brunner

Photo: A. Marshall
Codling Moth Damage Reduction

![Graph showing the reduction of codling moth damage in different conditions over two years. The graph compares 'Cage', 'Conventional', and 'Control' conditions with data from 2016 and 2017. The 'Control' condition shows a significant increase in damage compared to the other two conditions.]

- **2016**
  - Cage: Lower damage
  - Conventional: Moderate damage
  - Control: Higher damage

- **2017**
  - Cage: Lower damage
  - Conventional: Moderate damage
  - Control: Higher damage

The graph indicates that the 'Control' condition had the highest mean 1st gen. % codling moth damage, followed by the 'Conventional' condition, and the 'Cage' condition had the lowest damage.
This work was supported in part by grants from USDA-NIFA (2016-51181-25409), the Washington Tree Fruit Research Commission (CP-16-101), and the Washington State Commission on Pesticide Registration (18AN011).
Acknowledgements


