Peach Orchard Ground Cover Management Mitigates Bug Damage

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Presentation overview

• Present results from replicated studies that demonstrate how peach orchard floor vegetation management influences pest abundance and damage

• Integration of results into commercial peach orchard production practices

• Peach extrafloral nectaries may be a key for enhanced biological control in “simplified” orchard floor management systems

• Other considerations for using groundcover for pest management
Problems associated with poor orchard floor management

- Weedy orchards harbor insect pests,
- Weedy orchards harbor plant nematodes and viruses,
- Weedy orchards precipitate bee kills,
- Weedy orchards can reduce yields,
- Vigorous ground cover can reduce yields,
- Bare soil can erode,
- Bare soil facilitates sub-soil compaction,
- Bare soil loses organic matter.
A previous study has shown that weedy ground cover in orchards contribute to insect, disease, and nematode problems and that removal of alternate host plants can reduce arthropod incidence and damage to peach.

Peach Arthropod Pests Associated with Orchard Ground Cover in NJ

- Tarnished plant bug
- Stink bugs
- Green peach aphid
- Tufted apple budmoth
- Two spotted spidermite
- False chinch bug
- Leafhoppers
- Thrips
Tarnished plant bug

- Causes the most damage to NJ peaches
- Season long pest in Mid-Atlantic: Prebloom - harvest
“Cat-facing damage”

Caused by:

- Tarnished plant bug (*Lygus lineolaris*)
- Stink bugs
  - Green stink bug (*Acrosternum hilare*)
  - Brown stink bug (*Euschistus servus*)
  - Dusky stink bug (*E. tristigmus*)
Peach Orchard Ground Cover Management to Reduce Arthropod Damage

P.W. Shearer
Rutgers University

Funded by NE Sustainable Agricultural Research & Education (SARE) Grant (1997)
Peach orchard ground cover study: Objectives:

1. Determine suitability of selected ground covers for use in integrated crop production strategies for peaches.

2. “Demonstrate” how ground cover management in commercial orchards affects arthropod abundance and damage to peaches.
Tarnished plant bug and orchard floor management

1. Evaluate tarnished plant bug abundance in relation to ground cover management.

Treatments (4 replicates)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Ground Cover Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>White clover</td>
<td>Naturalized vegetation</td>
</tr>
<tr>
<td>Kentucky 31 tall fescue</td>
<td>Naturalized vegetation w/o broadleaf's</td>
</tr>
<tr>
<td>SR3100 Hard fescue</td>
<td>Bare soil: disk</td>
</tr>
<tr>
<td>SR Tall turf fescue</td>
<td>Bare soil: herbicides</td>
</tr>
</tbody>
</table>

2. Evaluate and demonstrate effects of ground cover management on commercial scale.

Treatments (4 replicates)

<table>
<thead>
<tr>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard fescue: mow</td>
</tr>
<tr>
<td>Naturalized vegetation: mow</td>
</tr>
<tr>
<td>Clean cultivation: disk</td>
</tr>
</tbody>
</table>
Seasonal occurrence of *Lygus* in various peach orchard ground covers
Orchard floor management impacts lygus abundance in the absence of insecticides
Tarnished plant bug damage to peach fruit grown with different ground covers and no insecticides: 1998
Tarnished plant bug and orchard floor management

1. Evaluate tarnished plant bug abundance in relation to ground cover management.

   **Treatments (8 replicates)**
   - White clover: Naturalized vegetation
   - Kentucky 31 tall fescue: Naturalized vegetation w/o broadleaf's
   - SR3100 Hard fescue: Bare soil: disk
   - SR Tall turf fescue: Bare soil: herbicides

2. Evaluate and demonstrate effects of ground cover management on commercial scale.

   **Treatments (4 replicates)**
   - Hard fescue: mow
   - Naturalized vegetation: mow
   - Clean cultivation: disk
Impact of orchard floor management on catfacing insect abundance and damage to commercially grown peach: 1997-8

• 4 commercial peach blocks (10-20 acres)

• Growers worked up orchard floor
  – Planted sod
  – Mowed sod and weeds
  – Cultivated the disk plots

• Trees treated the same
Impact of orchard floor management on catfacing insect damage to peach: 1997-8

- 4 commercial peach blocks
- Growers worked up orchard floor
  - Planted sod
  - Mowed sod and weeds
  - Cultivated the disk plots
- Trees treated the same
Impacts on other pests
Conclusions

• Removing broadleaf weeds from orchard floor reduces tarnished plant bug abundance and damage.

• Some evidence that different groundcovers impact other pests
Comparison of a Reduced Risk vs. conventional peach arthropod management program: NJ

**Experimental design**

- 4 study sites; cultivar ‘Encore’.

- Each block was divided in half and designated as Reduced Risk or conventional.

- The Reduced Risk blocks utilized OFM mating disruption and managed sod in the drive rows.

- The conventional blocks received standard grower spray programs and had weedy drive rows.
Weed-free sod ground cover delays detection of Lygus in the orchard by a month.
Dates and applications of OP and carbamate sprays, 2000

• OFM MD and sod ground cover allowed growers to spray fewer times
## Percent Damaged Fruit at Harvest

<table>
<thead>
<tr>
<th>Program</th>
<th>Catfacing damage</th>
<th></th>
<th></th>
<th>Oriental fruit moth</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1999</td>
<td>2000</td>
<td></td>
<td>1999</td>
<td>2000</td>
</tr>
<tr>
<td>Reduced Risk</td>
<td>0.8 b</td>
<td>3.4 ns</td>
<td></td>
<td>0.2 ns</td>
<td>0.3 ns</td>
</tr>
<tr>
<td>Conventional</td>
<td>1.6 a</td>
<td>3.9</td>
<td></td>
<td>0.2</td>
<td>0.1</td>
</tr>
</tbody>
</table>
In 2001, we expanded the program to 12 orchards with side-by-side comparisons

• We went from research mode to Extension Outreach

• Conventional: Standard OP and carbamate program
  -versus-

• Reduced Risk: OFM mating disruption and sod ground cover
  – We observed similar pest control and insecticide reductions in Reduced Risk peach orchards

Funded by USDA Pest Management Alternatives Program and EPA Environmental Stewardship program
Total mean seasonal catfacing insects per 50 sweeps - all varieties

Polk, et al.
At harvest mean % catfacing damage - encore

Polk, et al.
Lygus Adults and Stink Bugs Collected in Sweep Net Samples from Groundcover Plots: Pear 2001

Insects per 25 sweeps

- Lygus Adults
- Stink Bugs

R. Hilton SOREC
Orius, Nabis, and Coccinellid Adults Collected in Sweep Net Samples from Groundcover Plots: Pear 2001

Insects per 25 sweeps

- Orius
- Nabis
- Coccinellids

<table>
<thead>
<tr>
<th></th>
<th>grass</th>
<th>clover</th>
<th>trefoil</th>
<th>mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orius</td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Nabis</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Coccinellids</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
</tbody>
</table>

R. Hilton SOREC
True Bug Damage—Pear: 1998
Total Mowing vs. Alternate Row Mowing

% fruit damage

Mid Season
Harvest

0 0.2 0.25 0.67
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7

Total Mowing  Alternate Row Mowing
Most of peach varieties, *Prunus persica* (L.) have leaf gland at the base of the leaf blade that are reniform or globose shaped (Okie 1998).
*Trichogramma minutum* parasitoids were provided with OFM eggs and:

- Water (Control)
- Water and Nectar (Trmt)
Longevity (Mean ± SEM) in Days of *T. minutum*

<table>
<thead>
<tr>
<th>Trmt</th>
<th>Longevity (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab strain: with nectar</td>
<td>9.9 ± 0.2a</td>
</tr>
<tr>
<td>Lab strain: no nectar</td>
<td>2.0 ± 2.1c</td>
</tr>
<tr>
<td>Wild strain: with nectar</td>
<td>11.6 ± 2.5a</td>
</tr>
<tr>
<td>Wild strain: no nectar</td>
<td>3.3 ± 2.0b</td>
</tr>
</tbody>
</table>

*P* < 0.05
### Number (Mean ± SEM) of Host Fed Eggs

<table>
<thead>
<tr>
<th>Trmt</th>
<th>Avg. no. host fed eggs ± SEM&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab strain: with nectar</td>
<td>6.5 ± 1.5ab</td>
</tr>
<tr>
<td>Lab strain: no nectar</td>
<td>1.5 ± 1.7c</td>
</tr>
<tr>
<td>Wild strain: with nectar</td>
<td>13.7 ± 2.2a</td>
</tr>
<tr>
<td>Wild strain: no nectar</td>
<td>4.5 ± 0.7b</td>
</tr>
</tbody>
</table>

P < 0.05
## Number (Mean ± SEM) of OFM Parasitized Eggs

<table>
<thead>
<tr>
<th>Trmt</th>
<th>Avg. no. parasitized eggs ± SEM&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab strain: with nectar</td>
<td>61.0 ± 21.7b</td>
</tr>
<tr>
<td>Lab strain: no nectar</td>
<td>24.4 ± 23.7c</td>
</tr>
<tr>
<td>Wild strain: with nectar</td>
<td>105.2 ± 15.1a</td>
</tr>
<tr>
<td>Wild strain: no nectar</td>
<td>52.8 ± 7.4bc</td>
</tr>
</tbody>
</table>

P<0.05
Impact of peach extrafloral nectar on *Grapholita molest*a fecundity

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Fertile</th>
<th>Sterile</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provided nectar and water</td>
<td>245.0 ± 21.0 a</td>
<td>10.9 ± 3.9 a</td>
<td>255.9 ± 18.8 a</td>
</tr>
<tr>
<td>Provided only water</td>
<td>117.2 ± 17.6 b</td>
<td>2.1 ± 1.1 b</td>
<td>119.3 ± 17.7 b</td>
</tr>
</tbody>
</table>

(P < 0.05)
Additional considerations
Plant the right groundcover and plant it correctly
Vector of several nepoviruses that affect peaches
Border effect: Catfacing damage

Will border sprays and/or trap crops outside orchard reduce damage even further?
Conclusions:
Orchard floor management

- Research at RAREC and on growers farms demonstrated the importance of removing broad leaf weeds to minimize damage from several key pests.
- Managed sod drive rows and weed-free tree-rows reduces catfacing insect abundance and damage.
  - Rutgers Fruit IPM database has documented a 60% reduction in damage in “clean” orchards.
- Subsequent research in Oregon (pears) and Canada (apples) validates this approach in other crops.
- It should work in organic systems, too.