Cover crops: Inviting Natural Enemies into Your Orchard

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Possible Roles of Cover Crops

• Soil Erosion/Stability
• Nitrogen source
• Habitat for Natural Enemies (nectar & pollen, alternate prey, refuge)
Cover Crops – A Mixed Blessing?

- Harbors pest arthropods (e.g., Horton et al., Lygus, stink bugs, spider mites)
- Increases disease or vole problems
- Interferes with orchard operations (irrigation, weed spraying, mowing, harvest)
- Compete with trees for water and nutrients
Some potential experimental difficulties

- Ground cover fails to establish
- No increase in predators
- No decrease in pest
- Plot size adequate?
- Study period adequate?
- Sampling method representative?
- Microclimate changes?

***In most commercial orchards, must limit pest damage
Tree Fruit Cover Crops: Case Histories

- Fye 1983: cover crops in pear
  - Sampled 9 pear orchards, compared cover crop (sweep net) arthropods to trees (beating tray)
  - Planted wheat or barley in a 0.4 ha pear block (difficulty with establishment; too much growth or didn’t survive)
  - Ashfall from Mt. St. Helen’s eruption in May of 1981 may have influenced experiment
  - Lots of predators in cover crops, but not pear psylla predators
  - Pesticides used in the blocks may have reduced predators
Tree Fruit Cover Crops: Case Histories

- Meagher & Meyer 1990 – peach ecosystem
  - Tree growth, yield better in bare ground plots
  - Higher injury from catfacing insects in weedy plots
Tree Fruit Cover Crops: Case Histories

- Horton et al.: 2009: Immunomarking in pear orchards
  - 1 ha ‘Bartlett’ orchard; three cover crops; plots 4 aisles x 40 m long
  - Egg white marker sprayed with a boom sprayer
  - >90% of insects from cover crop were marked
  - About 20% of the tree-collected Heteroptera were marked; overall % marking for specimens was 17-29%
## Habitat preference

Table 1. Number of generalist predators collected in cover crop (by sweep net) and tree canopy (by beating tray), and apparent habitat preferences based upon numbers in each habitat

<table>
<thead>
<tr>
<th>TAXON</th>
<th>No. collected in</th>
<th>Apparent habitat preference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cover crop</td>
<td>Tree</td>
</tr>
<tr>
<td>HETEROPTERA</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Orius tristicolor</em></td>
<td>662*</td>
<td>24*</td>
</tr>
<tr>
<td><em>Geocoris spp.</em></td>
<td>329*</td>
<td>0</td>
</tr>
<tr>
<td><em>Nabis sp.</em></td>
<td>99*</td>
<td>8</td>
</tr>
<tr>
<td><em>Deraeocoris brevis</em></td>
<td>59*</td>
<td>1159*</td>
</tr>
<tr>
<td><em>Anthocoris tomentosus</em></td>
<td>10*</td>
<td>459*</td>
</tr>
<tr>
<td>CHRYSOPIDAE</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Chrysopa oculata</em></td>
<td>194*</td>
<td>3</td>
</tr>
<tr>
<td><em>Chrysoperla plumula</em></td>
<td>132*</td>
<td>155*</td>
</tr>
<tr>
<td><em>Eremochrysa sp.</em></td>
<td>33</td>
<td>111</td>
</tr>
<tr>
<td><em>Chrysopa coloradensis</em></td>
<td>13</td>
<td>5*</td>
</tr>
<tr>
<td><em>Chrysopa nigricornis</em></td>
<td>4</td>
<td>47*</td>
</tr>
<tr>
<td>COCCINELLIDAE</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Hippodamia convergens</em></td>
<td>382*</td>
<td>15*</td>
</tr>
<tr>
<td><em>Coccinella septempunctata</em></td>
<td>127*</td>
<td>118*</td>
</tr>
<tr>
<td><em>Coccinella transversoguttata</em></td>
<td>116*</td>
<td>36</td>
</tr>
<tr>
<td><em>Hyperaspis lateralis</em></td>
<td>112</td>
<td>95</td>
</tr>
<tr>
<td><em>Harmonia axyridis</em></td>
<td>11*</td>
<td>159*</td>
</tr>
</tbody>
</table>

*, asterisks indicate that the samples included immatures (identified to species by rearing in the laboratory, as necessary).
The “Shotgun” Approach

Plant a bunch of stuff, hope something does some good
The scalpel approach

Determine key natural enemy for important prey species, and a missing resource in a predator/prey (or host/parasitoid) system, and supply it.
WAA Natural Enemies - Survey

*Syrphids, 62.7%
*Lacewings, 23.6%
*Lady Beetles, 8.9%
*Other, 4.8%

*Aphelinus mali only parasitoid found

2006
- Lacewings, 12.0%
- Lady Beetles, 24.0%
- Syrphids, 62.0%
- Other, 3.0%

2007
- Lacewings, 6.0%
- Lady Beetles, 13.0%
- Syrphids, 81.0%

2008
- Lacewings, 6.0%
- Lady Beetles, 13.0%
- Syrphids, 81.0%
Relative impact of predators and parasitoids

Mid-summer

Fall

![Graph comparing mean WAA/tree over time with different treatments](image-url)
Screening of flowering plants to attract syrphids

Sweet Alyssum  Buckwheat  Mustard

Cosmos  Marigold  Zinnia
Attractiveness of different flowering plants species

Number of syrphid flies + SE

- mustard
- buckwheat
- cosmos
- zinnia
- sweet alysson
- marigold

Legend:
- b
- c
- a
- bc
Alyssum Field Experiment

Control (grass)  

Sweet Alyssum
Results

Number of syrphid flies observed in a 2-minute count

![Graph showing the number of syrphid flies observed over a period from Sep. 13 to Oct. 25. The graph compares control and sweet alyssum treatments. The control group shows minimal variation, while the sweet alyssum group has a peak on Oct. 11.](image-url)
Alyssum – does it improve biocontrol of woolly apple aphid?

**Exp. 1**

- Dates: 06 Sep, 13 Sep, 20 Sep, 27 Sep
- Woolly apple aphids per tree
- Control (grass) vs. Alyssum
- **WAA - CID**

**Exp. 2**

- Woolly apple aphids per tree
- Control (grass) vs. Alyssum
- **WAA - CID**