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BMSB in Pennsylvania
Pre-2011 stink bug control recommendations (examples)

<table>
<thead>
<tr>
<th>Product</th>
<th>PSU '10</th>
<th>Cornell '10</th>
<th>Rutgers '09</th>
<th>WSU '09</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Apple, sb/tpb (scale 1-4)</td>
<td>Apple, tpb only (scale 1-3)</td>
<td>Peach, tpb only (scale 1-4)</td>
<td>Apple, tpb, sb (scale 1-4)</td>
</tr>
<tr>
<td>Actara</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Asana</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Assail</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>4 (sb)</td>
</tr>
<tr>
<td>Avaunt</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>NR</td>
</tr>
<tr>
<td>Baythroid</td>
<td>1</td>
<td>1</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Beleaf</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Calypso</td>
<td>2</td>
<td>3</td>
<td>NR</td>
<td>4 (sb)</td>
</tr>
<tr>
<td>Danitol</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Imidan</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>NR</td>
</tr>
<tr>
<td>Lannate</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Warrior</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Delegate/Altacor</td>
<td>NR/NR</td>
<td>NR/3</td>
<td>1/-</td>
<td>NR/NR</td>
</tr>
</tbody>
</table>

Ranking based on apple recommendations (except NJ); the lower the number the better efficacy.

Grower 1 Orchard,
BMSB case study/observation, 2010 season

Orchard surrounded by field crop (corn, soybean), woods, school and housing developments
Adults and nymphs of *H. halys* in peach orchard.

(Grower 1)

![Graph showing number of mobile forms/tree over time with treatments listed: Belay @ 6 oz/ac, Danitol @ 12 oz/ac, and Standard.]

Visual fruit evaluation on 3 x 10 x 100 fruit (3000 fruit per treatment/evaluation); all injured fruit harvested during each evaluation.

**Belay** – clothianidin; **Danitol** – fenpropathrin; **Imidan** – phosmet; **Lannate** – methomyl

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Percentage of fruit injured by *H. halys* in peach orchard.

(Grower 1)

![Graph showing percentage of injured fruit over time with treatments listed: Belay @ 6 oz/ac, Danitol @ 12 oz/ac, and Standard.]

Visual fruit evaluation on 3 x 10 x 100 fruit (3000 fruit per treatment/evaluation); all injured fruit harvested during each evaluation.

**Belay** – clothianidin; **Danitol** – fenpropathrin; **Imidan** – phosmet; **Lannate** – methomyl

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Seasonal insecticide applications; peaches
Grower 2

Insecticides:
- Im. – phosmet
- As. – acetamiprid
- Ln. – methomyl
- Pr. – γ-cyhalothrin
- Dz. – diazinon
- Dn. – fenpropathrin
- Ba. – β-cyfluthrin
- Av. – indoxycarb
- Wa. – λ-cyhalothrin

2009

April May June July August September

- BMSB - Complete spray
- BMSB – ARM spray
- Other pests – ARM spray

2010

April May June July August September

- PC
- OFM/LR
- BMSB

- BMSB - Complete spray
- BMSB – ARM spray
- Other pests – ARM spray

5.5 insecticide appl.
6 products

13 insecticide appl.
9 products

5.5 insecticide appl.
6 products
Seasonal insecticide applications; apple Grower 1.

### 2009
- **April**: Im. Im.
- **May**: Im. Im.
- **June**: Im. As.
- **July**: Ln. Tb.
- **August**: Ln.
- **September**: Tb.

### Insecticides:
- **Im.**: phosmet
- **As.**: acetamiprid
- **In.**: methoxyfenozide
- **Ln.**: methomyl
- **Tb.**: cyfluthrin
- **Del.**: spinetoram
- **Alt.**: rynaxypyr

### 2010
- **April**: PC
- **May**: PC
- **June**: Aphids
- **July**: LR
- **August**: BMSB
- **September**: BMSB

### Insecticides:
- **PC**: BMSB - Complete spray
- **Aphids**: BMSB – ARM spray
- **LR**: Other pests – ARM spray

**Case study, BMSB fruit injury and trapping Grower 1**

- **10 trees x 100 fruit per tree evaluated per sample during each date.**

**Percent injured fruit**

- **10-Aug**: Apple 1, Apple 2, Apple 3, Apple 4
- **17-Aug**: Apple 1, Apple 2, Apple 3, Apple 4
- **9-Sep**: Apple 1, Apple 2, Apple 3, Apple 4
- **16-Sep**: Apple 1, Apple 2, Apple 3, Apple 4
- **21-Sep**: Apple 1, Apple 2, Apple 3, Apple 4
- **7-Oct**: Apple 1, Apple 2, Apple 3, Apple 4
- **15-Oct**: Apple 1, Apple 2, Apple 3, Apple 4
- **Oct 16**: Apple 1, Apple 2, Apple 3, Apple 4

**Number of BMSB per trap**

- **6-Sep**: Apple 1, Apple 2, Apple 3, Apple 4
- **13-Sep**: Apple 1, Apple 2, Apple 3, Apple 4
- **20-Sep**: Apple 1, Apple 2, Apple 3, Apple 4
- **27-Sep**: Apple 1, Apple 2, Apple 3, Apple 4
- **4-Oct**: Apple 1, Apple 2, Apple 3, Apple 4
- **11-Oct**: Apple 1, Apple 2, Apple 3, Apple 4
- **18-Oct**: Apple 1, Apple 2, Apple 3, Apple 4
- **25-Oct**: Apple 1, Apple 2, Apple 3, Apple 4
BMSB management solutions.....

Short term
- Insecticidal control
- Cultural management
- Better monitoring tools

Medium term
2-3 years
- Behavioral control (deterrents, attractants, etc...)
- Biological control (natural enemies, pathogens, etc...)

Long term goal
3-5 years
- System approach
- Host plant resistance

Coordinated research involving USDA and Land Grant Universities

Short term solution - insecticides

BMSB management: insecticides
- Direct contact activity
- Effect on biological control agents
- Other crops registrations
- Residual activity
- Sub-lethal effect (e.g., ovicidal activity, etc...)

BMSB management solutions.....
Insecticide activity against BMSB
Direct contact topical bioassays

Subject
• BMSB from overwintering colony
• Male and female adults tested separately, 6x5 per gender (60 total per product)

Test
• Commercial grade insecticide solutions at equivalent of field rate (100 gal/acre), surfactant added;
• Each individual bug treated directly with 2 μl of solution

Results
• Mortality assessed at 4, 24, 48, 72, 96 and 120 hours after treatment
• Surviving individuals kept for further observation

Average BMSB adults mortality
Scale: 0 (no mortality)- 5 (100 percent mortality)
BMSB Direct contact topical bioassays Neonicotinoids

4h

Dead plus moribund insects

Belay - clothianidin;
Assail - acetamiprid;
Venom - dinotefuran;
Scorpion - dinotefuran;
Actara - thiametoxam;
Admire – imidacloprid.

Average BMSB adults mortality
Scale: 0 (no mortality) - 5 (100 percent mortality)

BMSB Direct contact topical bioassays, thiamethoxam and dinotefuran

Average BMSB adults mortality
Scale: 0 (no mortality) - 5 (100 percent mortality)
BMSB Direct contact topical bioassays, various products

Scale: 0 (no mortality) - 5 (100 percent mortality)

Vydate – oxamyl; Acephate – acephate; Carzol – formetanate hydrochloride; Imidan – phosmet; Guthion – azinphos-methyl; Lorsban – chlorpyrifos; Delegate – spinetoram; Penncap-M – methyl parathion; Lannate – methomyl.

Average BMSB adults mortality

BMSB Direct contact topical bioassays, methomyl, rate response

Scale: 0 – no mortality; 5 - 100 percent mortality
Plethora of available host plants
Unrestricted movement ability
Undefined biology/monitoring issues
Inconspicuous initial injury on fruit
Each instar (except eggs) can cause damage
No effective biological control

Brown marmorated stink bug (aka Asian stink bug) is not your usual insect pest

Monitoring
- Start early during the season
- Monitor inside / outside
- Do not forget late season

Insecticides
- Use effective but the least disruptive products to BC
- Rotate chemistries
- Evaluate impact on other pests
- Consider PHI’s

Applications
- Only when and where needed
- Alternate row middle applications
- Border rows only applications
- Applications at surrounding vegetation
- Early season applications are important

BMSB management suggestions for the 2011 season