Insecticide Options for Successful Management of Emerald Ash Borer

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Emerald Ash Borer: 
*Agrilus planipennis*
Cooperators:

Joe Doccola: Arborjet
Nate Royalty, John Smith, Bruce Monke: Bayer Environmental Science
Stephanie Darnell: Bayer Crop Science
Chuck Silcox: I.E. DuPont
Shawn Bernick: Rainbow Treecare Scientific Advancements
David Cox, Renee Keese, Steve Sanborn: Syngenta Crop Protection
Jason Fausy, Joe Chamberlin: Valent U.S.A.
Summary Conclusions:

1. Insecticides effective on large trees even under intense pest pressure.

2. Imidacloprid soil drenches most effective on large trees when applied at the 2X (2.8 g ai / inch DBH) rate. Xytect is labeled for this rate.

3. Other imidacloprid formulations would need to be applied twice (e.g. fall and spring; twice in spring)

4. Most treatments must be applied annually. Spring better than fall.

5. Emamectin Benzoate provides 2-3 years of control.

6. Emamectin benzoate also controls banded ash clearwing borer.
Known Distribution of EAB

Cooperative Emerald Ash Borer Project

EAB locations in Illinois, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Missouri, New York, Ohio, Pennsylvania, Tennessee, Virginia, Wisconsin, West Virginia and Canada

October 1, 2010

Map Key
- USA: United States boundaries
- State boundaries
- County boundaries
- Urbanization boundaries
- Source: U.S. Department of Agriculture, Forest Service, Cooperative Forest Pest Management Program
A Toledo street before and after EAB

June 2006

August 2009
Host Impact:

Larvae feed under bark; disrupt transport of water, nutrients, carbohydrates.

Healthy trees killed within 2-3 years of first symptoms.
EAB management options:

1. Do nothing, let nature take its course.
2. Removal, replacement.
3. Persistent insecticide treatments.
Insecticide options for EAB:

Systemic Soil Injections / Drenches:
• Imidacloprid (e.g. Merit, Xytect, Bayer Advanced Tree & Shrub Insect Control)
• Dinotefuran

Systemic Trunk Injections:
• Imidacloprid (IMA-jet, Imicide)
• Emamectin benzoate (TREE-äge)

Systemic Trunk Sprays
• Dinotefuron (Safari)

Bark and canopy sprays: Astro, Onyx
Soil Treatments: Drench / Injections
Trunk Injections
Systemic Basal Trunk Sprays
Key questions:

Will systemic treatments work on larger trees?
What are optimal application rates?
Are fall treatments effective?
How long will treatments remain effective?
Soil Drench Studies
Multi-year evaluation of systemic insecticides for control of EAB on street trees

- Imidacloprid soil drenches

- Imidacloprid and Emamectin Benzoate trunk injections
Imidacloprid Soil Drenches

1. Merit 2F, 1.4 g ai / inch DBH, spring
2. Merit 2F, 1.4 g ai / inch DBH, fall
3. Xytect 75WP, 1.4 g ai / inch DBH, fall
4. Xytect 75WP, 2.8 g ai / inch DBH, spring
5. Xytect 75WP, 2.8 g ai / inch DBH, fall
Treatment evaluation:

- Canopy decline rating using photographic scale
  (Smitley et al. 2008. *J. Econ. Entomol.* 101:1643-1650)
Four years of imidacloprid soil drenches
(D. Smitley, MSU)
Placement? Fine root density is highest adjacent to the trunk.
24" tree: 12 injections, each 1 qt
How much water to apply? Balancing the trade-off.

• Not enough water: poor distribution

• Too much water: dilutes the soil solution, which may reduce uptake rate and concentration in the plant
Trunk Injections
Emamectin Benzoate: duration of control at different rates (DBH: 20-25”)

Emamectin benzoate (Tree-äge)

0.1 g ai / inch DBH    (2.5 ml / inch - low)
0.2 g ai / inch DBH    (5 ml / inch – med)
0.4 g ai / inch DBH    (10 ml / inch – med / high)
0.8 g ai / inch DBH    (20 ml / inch)

Treat in 2006 and see how long they work.
Treatment evaluation:

• Canopy decline rating using photographic scale (Smitley et al. 2008. *J. Econ. Entomol.* 101:1643-1650)

• Exit hole density in canopy branches.
# Effect of Emamectin Benzoate Applied in 2006 for Control of EAB

<table>
<thead>
<tr>
<th>Treatment</th>
<th>% Canopy Decline</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2006</td>
</tr>
<tr>
<td>Untreated</td>
<td>0</td>
</tr>
<tr>
<td>Emamectin benzoate</td>
<td></td>
</tr>
<tr>
<td>0.1 g ai / inch DBH</td>
<td>0</td>
</tr>
<tr>
<td>0.2 g ai / inch DBH</td>
<td>0</td>
</tr>
<tr>
<td>0.4 g ai / inch DBH</td>
<td>0</td>
</tr>
<tr>
<td>0.8 g ai / inch DBH</td>
<td>0</td>
</tr>
</tbody>
</table>
Tree-äge rate study
(20-25 inch DBH)

% Canopy Decline

2006 2007 2008 2009 2010

Untreated
0.2 g ai / in (5 ml / in)
0.4 g / ai in (10 ml / in)
0.1 g ai / in (2.5 ml / in)
0.8 g ai / in (20 ml / in)
## Effect of Emamectin Benzoate Applied in 2006 for Control of EAB

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Exit Holes / m²</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2008</td>
<td>2009</td>
<td></td>
</tr>
<tr>
<td>Untreated</td>
<td>19.2 a</td>
<td>24.6 a</td>
<td></td>
</tr>
<tr>
<td><strong>Emamectin benzoate</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.1 g ai / inch DBH</td>
<td>0.2 b</td>
<td>2.9 c</td>
<td></td>
</tr>
<tr>
<td>0.2 g ai / inch DBH</td>
<td>0.5 b</td>
<td>10.1 ab</td>
<td></td>
</tr>
<tr>
<td>0.4 g ai / inch DBH</td>
<td>1.4 b</td>
<td>3.3 c</td>
<td></td>
</tr>
<tr>
<td>0.8 g ai / inch DBH</td>
<td>0.0 b</td>
<td>0.5 c</td>
<td></td>
</tr>
</tbody>
</table>
Systemic trunk injections: comparison of treatment schedule (avg DBH = 19 inch)

Emamectin benzoate (Tree-âge)
Rate: 0.4 g ai / inch DBH
1. 2006
2. 2006 & 2008

Imidacloprid (Ima-jet),
Rate: 0.4 g ai / inch DBH
1. 2006 & 2007
2. 2006 & 2008
## Systemic Trunk Injections for Control of EAB

<table>
<thead>
<tr>
<th>Treatment</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>0</td>
<td>6</td>
<td>51 a</td>
<td>90 a</td>
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<tr>
<td>Tree-älle, 2006</td>
<td>0</td>
<td>0</td>
<td>0 b</td>
<td>13 c</td>
</tr>
<tr>
<td>Tree-älle, 2006 &amp; 2008</td>
<td>0</td>
<td>0</td>
<td>3 b</td>
<td>6 c</td>
</tr>
<tr>
<td>Ima-jet, 2006 &amp; 2007</td>
<td>0</td>
<td>0</td>
<td>0 b</td>
<td>33 b</td>
</tr>
<tr>
<td>Ima-jet, 2006 &amp; 2008</td>
<td>0</td>
<td>0</td>
<td>9 b</td>
<td>20 bc</td>
</tr>
</tbody>
</table>
## Systemic Trunk Injections for Control of EAB

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<tr>
<th>Treatment</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>0.6 a</td>
<td>15.3 a</td>
<td>34.7 a</td>
</tr>
<tr>
<td>Tree-äge, 2006</td>
<td>0.1 b</td>
<td>0.1 b</td>
<td>1.9 c</td>
</tr>
<tr>
<td>Tree-äge, 2006 &amp; 2008</td>
<td>NA</td>
<td>0.1 b</td>
<td>0.6 c</td>
</tr>
<tr>
<td>Ima-jet, 2006 &amp; 2007</td>
<td>0.1 b</td>
<td>0.1 b</td>
<td>3.8 c</td>
</tr>
<tr>
<td>Ima-jet, 2006 &amp; 2008</td>
<td>NA</td>
<td>4.4 b</td>
<td>11.9 b</td>
</tr>
</tbody>
</table>
Safari (Dinoflufen) Trials in Bowling Green

• Basal trunk sprays
• Low volume soil injection
Insecticide failures associated with:

Application rate: not using the highest rate

Placement: grid to dripline rather than basal treatment

Injecting too deep (below feeder roots): inject no more than 4 inches

Initial degree of infestation too high

Soil moisture: treatment during drought

Size of tree: large trees

Pest pressure trajectory
Optimal Timing of Treatments

• **Soil treatments**: in spring allowing time for uptake before adults begin feeding and eggs begin to hatch. Fall treatments can also be effective.

• **Trunk injections**: in spring just after the canopy has fully developed
EAB adult emergence begins when black locust blooms.

Black locust, *Robinia pseudoacacia*
Banded Ash Clearwing Borer
Emamectin Benzoate Controls Banded Ash Clearwing Borer
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5. Emamectin Benzoate provides 2-3 years of control.

6. Emamectin benzoate also controls banded ash clearwing borer.
Ash is pollinated by wind, not bees

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Special thanks to:

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Dave Bienemann, City of Bowling Green

Ron Howell, Howell Tree Service

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