New Tools and Delivery Systems: Water Soluble Insecticides

Hancock Agricultural Experiment Station Field Day

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Factors Influencing Insect Pest Management
‘Water Quantity and Quality’

- Decreasing availability of water for agriculture
  - Agriculture is the overwhelming user of fresh water.
  - Increasing urban demand will drive irrigation efficiency.

- Drip irrigation, micro-sprinklers, hydroponics.

- Targeted application of water increases opportunity to use irrigation as a delivery system.
Systemic Neonicotinyl Insecticides

Beneficial Attributes

- Effective on pyrethroid resistant CPB’s
- Broad spectrum
  - CPB, leafhoppers, aphids
- Flexible
  - Row mark, furrow, seed, layby
- Long residual
  - Rate dependant
- Low toxicity
  - “Healthy Grown”

Disadvantages

- Same chemical class
- Resistance likely
Wisconsin, 2008
Imidacloprid Bioassays

Preliminary Assays (2008): 31 populations, LC$_{50}$ range (0.018 – 1.33)
Reduced Risk Foliar and In-Furrow Options (CPB) New Registrations

- **Coragen™ (rynaxypyr)**
  - Anthranillic diamide (MoA group 28)
    - Use rate 3.5 - 5 oz / ac (CPB)
    - Control of CPB adults and larvae and Leps

- **HGW86 (cyazypyr)**
  - Anthranillic diamide (MoA group 28)
    - Use rate 3.5 - 5 oz / ac (CPB)
    - Control of CPB adults and larvae, leafhoppers, aphids, and Leps

* Water soluble, systemically mobile insecticides
Wisconsin groundwater quality

- Atrazine and atrazine TCR
- Alachlor and ESA/OA metabolites
- Metolachlor and metabolites
- Acetochlor and metabolites
- Cyanazine
- Metribuzin
- Simazine
- Nitrate-nitrogen
- Glyphosate and metabolite
- Mesotrione and metabolites
- Dimethenamid and metabolites
- Prometone
- EPTC
- Pendimethalin
- Bentazon
- Clopyralid
- 2,4-D
- Dicamba
- Chlorpyrifos
- Carbamates
- Neonicotinoids
## Wisconsin groundwater quality: Insecticide detections 2008-09

<table>
<thead>
<tr>
<th>Well</th>
<th>Date(s)</th>
<th>Thiamethoxam Concentration Range (parts per billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private well near Lone Rock</td>
<td>6/23/09 &amp; 6/9/09</td>
<td>0.693-1.26</td>
</tr>
<tr>
<td>Private Well near Arena</td>
<td>6/23/08</td>
<td>0.656</td>
</tr>
<tr>
<td>Private well near Edgerton</td>
<td>11/2/09</td>
<td>1.61</td>
</tr>
<tr>
<td>Monitoring well Adams County</td>
<td>2008 and 2009*</td>
<td>0.82-8.93</td>
</tr>
<tr>
<td>Monitoring well Grant County</td>
<td>4/7/08</td>
<td>1.25</td>
</tr>
<tr>
<td>Monitoring well Iowa County</td>
<td>2008 and 2009*</td>
<td>0.784-2.04</td>
</tr>
<tr>
<td>Monitoring well Iowa County</td>
<td>2008 and 2009*</td>
<td>0.671-2.85</td>
</tr>
<tr>
<td>Monitoring well Sauk County</td>
<td>2008 and 2009*</td>
<td>1.47-3.66</td>
</tr>
<tr>
<td>Monitoring well Waushara County</td>
<td>8/19/08 &amp; 12/1/08</td>
<td>0.638-0.704</td>
</tr>
</tbody>
</table>

- All monitoring wells in the results table are in areas with sandy soil and shallow depth to groundwater.
- The monitoring well sites in Grant, Iowa, and Sauk Counties are located in the Lower Wisconsin River Valley.
- The monitoring wells listed in the table are screened at or near the water table and adjacent to agric. fields.
- The level of detection for thiamethoxam at the DATCP lab is 0.50 ug/l (parts per billion).
- There is no groundwater enforcement standard for thiamethoxam in Wisconsin.
Research Goals: Insect Pest Management in Potato

- Extend the interval of control of current, water-soluble insecticide registrations
- Reduce (eliminate) the need for subsequent foliar applications ($$$)
- Reduce (optimize) the amount of active ingredient required for adequate control
- Limit the potential for leaching and ground-water contamination
- Promote resistance management “high dose strategy”
Increasing the Interval of Control - Minimizing Sub-lethal Effects

Increased interval of control can help minimize sub-lethal effects. The graph shows the decrease in imidacloprid concentration over time, with two curves indicating the current and hypothetical in-plant imidacloprid levels. The laboratory susceptible LD$_{50}$ is 0.031 ppm, while the field strain LD$_{50}$ is 1.691 ppm. The days post-application are marked from 0 to 90.
Pesticide - Polyacrylate Impregnation

Polymers Inc.

Sand Suppression Polymers

Hydro-seeding polymers

Horticultural Polyacrylate
Neonicotinoid - Polyacrylate Impregnation Trials: HAES, 2008 - 2009

Insecticide Impregnated Polyacrylate (vacuum-dried)

Vacuum Oven
Neonicotinoid - Polyacrylate Impregnation Trials
HAES, 2008 - 2009

In-furrow Application
Vacuum Dried

Impregnated Polyacrylamide (in-furrow)
# Reduced Risk Pesticide Options: HAES 2008-2009

<table>
<thead>
<tr>
<th>Treatment Number</th>
<th>Product</th>
<th>Active Ingredient</th>
<th>Rate</th>
<th>Application Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Belay 2.13 SC</td>
<td>clothianadin</td>
<td>9.6 fl oz / A</td>
<td>In-furrow</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td>9.6 fl oz / A</td>
<td>Impregnated</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>4.8 fl oz / A</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>AdmirePro</td>
<td>imidacloprid</td>
<td>8.7 fl oz / A</td>
<td>In-furrow</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>8.7 fl oz / A</td>
<td>Impregnated</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td>4.4 fl oz / A</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Platinum 2SC</td>
<td>thiamethoxam</td>
<td>8.0 fl oz / A</td>
<td>In-furrow</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td>8.0 fl oz / A</td>
<td>Impregnated</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td>4.0 fl oz / A</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Coragen</td>
<td>rynaxypyr</td>
<td>5.0 fl oz / A</td>
<td>In-furrow</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td>5.0 fl oz / A</td>
<td>Impregnated</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td>2.5 fl oz / A</td>
<td></td>
</tr>
</tbody>
</table>
### CPB, In-Furrow and Impregnations

**HAES (2009)**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Appl. Type</th>
<th>Rate fl oz/A</th>
<th>Large Larvae/10 plants</th>
<th>% Defoliation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>7/3 73 dap</td>
<td>7/10 80 dap</td>
</tr>
<tr>
<td>7. Platinum</td>
<td>IF</td>
<td>8.0</td>
<td>2.2 a</td>
<td>6.9 a</td>
</tr>
<tr>
<td>8.</td>
<td>IMP</td>
<td>8.0</td>
<td>0.2 b</td>
<td>0.0 b</td>
</tr>
<tr>
<td>9.</td>
<td></td>
<td>4.0</td>
<td>1.9 ab</td>
<td>4.2 a</td>
</tr>
<tr>
<td>10. Coragen</td>
<td>IF</td>
<td>5.0 a</td>
<td>0.7 a</td>
<td>2.3 a</td>
</tr>
<tr>
<td>11.</td>
<td>IMP</td>
<td>5.0 a</td>
<td>0.0 a</td>
<td>0.4 b</td>
</tr>
<tr>
<td>12.</td>
<td></td>
<td>2.5 a</td>
<td>0.5 a</td>
<td>1.3 ab</td>
</tr>
</tbody>
</table>

**Note:** At-plant treatments applied 29 April 2009  
Application Type: IF = In-furrow; IMP = polyacrylate impregnated
Future Plans

- **Wisconsin Institute for Sustainable Agric.**

  *Water Quantity and Water Quality of the Central Sand Areas of Wisconsin under the Influence of Climate Change*

- **USDA - RAMP**

  *Reduced-Risk Insect Management for Fruiting Vegetables, Cucurbits, And Potatoes in the Eastern US*
Future Plans

- Document the potential for reduced leaching and ground-water contamination associated:

  1) drip injection systems

  2) modified delivery systems