Implementing Pest Management through Drip Irrigation Approaches

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Wisconsin Vegetable Pest Management

Options for Insect Pest Management – More than ever before!

- Cultural controls
- Natural enemies
- Baits and baiting systems
- Host plant resistance
- Population disruption
- Transgenic plants IR traits
- Reduced-Risk Chemical Insecticides
- Entomopathogens

Vegetable IPM
Factors Influencing Insect Pest Management
‘Food Safety’

– Major food retailers are setting acceptable residue levels below those set by government regulatory agencies.

“No detectable residues” will be a competitive advantage for food retailers.

– Older insecticides that do not meet these requirements are not being re-registered, resulting in increased use of novel insecticides (bio-pesticides).
Factors Influencing Insect Pest Management

‘Environmental Concerns’

– With increasing affluence reaching the developing world, there will be increasing concerns about pesticide usage and perceived environmental effects.

– This will accelerate the shift to “softer” products and technologies.
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.
Drip Application for Insect Control (Cucurbits, Fruiting Vegetables, Brassicas)

- Why use drip irrigation for insecticide applications?
- What insects are controlled with drip application?
- Regulations and tips for best results of drip chemigation.
Pesticide Drift

- Amount of pesticide lost due to drift estimated at 5 to 65%.
- Less than 0.1% of pesticide reaches target insect.
- Consequences of pesticide drift
  - Exposure of humans
  - Exposure of water resources
  - Exposure of wildlife
Limitations of Spraying Insecticides

- Weather conditions
  - Wind
  - Rain
  - Wash-off

- Re-entry intervals

- Pre-harvest intervals
Advantages of Drip Application of Insecticides

- Reduced risk to environment and farm workers
  - Drift to non-target areas is eliminated
  - Farm workers do not come into contact with residues on exterior of plant
  - Beneficial organisms not directly exposed

- Longer residual activity
  - Not subject to loss from rain and UV light
  - Not subject to plant growth dilution effects

- More cost-effective
Drip Application for Insect Control (Cucurbits, Fruiting Vegetables, Brassicas)

- Why use drip irrigation for insecticide application?

- What insects are controlled with drip irrigation applications?

- Regulations and tips for best results of drip chemigation.
What Insecticides Can Be Applied in Drip Irrigation Systems

- Must move systemically through plant.
- Label must specifically state that product can be applied via drip irrigation

<table>
<thead>
<tr>
<th>Neonicotinoids</th>
<th>Diamides</th>
<th>Carbamates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admire</td>
<td>Coragen</td>
<td>Vydate</td>
</tr>
<tr>
<td>Platinum</td>
<td>Synapse</td>
<td></td>
</tr>
<tr>
<td>Venom</td>
<td><strong>HGW86</strong></td>
<td></td>
</tr>
<tr>
<td><strong>HGW86</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Durivo</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### MoA Classification Chart
#### Insecticide Resistance Action Committee (IRAC)

<table>
<thead>
<tr>
<th>Mode of Action</th>
<th>Group</th>
<th>Chemical group</th>
<th>Chemicals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetylcholine esterase inhibitors</td>
<td>1A</td>
<td>Carbamates</td>
<td>Carbaryl (Seven), Methomyl (Lannate), Oxamyl (Vydate)</td>
</tr>
<tr>
<td>Nicotinic acetylcholine receptor agonist/antagonists</td>
<td>4A</td>
<td>Neonicotinoids</td>
<td>Acetamiprid (Assail), Dinotefuran (Scorpion), Imidacloprid (Admire, Provado), Thiamethoxam (Actara, Platinum)</td>
</tr>
<tr>
<td>Ryanodine receptor modulator</td>
<td>28</td>
<td>Diamides</td>
<td>Chlorantraniliprole (Coragen), Cyantraniliprole (Verimark)</td>
</tr>
</tbody>
</table>
Thiamethoxam & Imidacloprid

- **Platinum 75SG – Admire Pro**
  - Brassicas, Cucurbits, Fruiting Veg, Leafy Veg, Potato

- **Spectrum of Activity**
  - Cucumber beetles, squash bug, flea beetle, seed maggots, & CPB
  - Suppression of aphids, thrips, whiteflies

- **Systemic activity**
  - Labeled for foliar and drip irrigation application
Chlorantraniliprole (Rynaxypyr)

- **Coragen 1.67SC**
  - Brassicas, Cucurbits, Fruiting Veg, Leafy Veg, Potato

- **Spectrum of Activity**
  - Lepidopterans, some beetles (CPB)
  - Whitefly suppression at higher rates

- **Systemic activity**
  - Labeled for foliar and drip irrigation application
Chlorantraniliprole + Thiamethoxam

- **Durivo 1.67SC**
  - 2:1 mixture of thiamethoxam & chlorantraniliprole
  - Brassicas, Cucurbitis, Fruiting Veg, Leafy Veg

- **Spectrum of Activity**
  - Lepidopterans, leafhoppers, cucumber beetle
  - Aphids, Beetles, Plant & Stink Bug, Thrips, Mealybug, Whitefly

- **Drip application only, 1 application/year.**
- **5-day REI for honeybees.**
Drip Irrigation of Insecticides
## Potato Insect Pest Management Drip Irrigation Injection Trials, HAES 2010

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Insecticide</th>
<th>Rate</th>
<th>Application Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>chlorantraniliprole (Coragen®)**</td>
<td>5.5 &amp; 3.0 fl oz / A</td>
<td>Foliar</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>3.5 &amp; 3.5 fl oz / A</td>
<td>Injection</td>
</tr>
<tr>
<td>3</td>
<td>Imidacloprid (AdmirePro®)</td>
<td>2.5 &amp; 3.8 fl oz / A</td>
<td>Foliar</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>5.0 &amp; 3.7 fl oz / A</td>
<td>Injection</td>
</tr>
<tr>
<td>5</td>
<td>thiamethoxam (Platinum®)</td>
<td>1.5 &amp; 3.0 fl oz / A</td>
<td>Foliar</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>1.67 &amp; 1.0 fl oz / A</td>
<td>Injection</td>
</tr>
<tr>
<td>7</td>
<td>Dinotefuran (Scorpion®)</td>
<td>6.0 &amp; 6.0 fl oz / A</td>
<td>Injection</td>
</tr>
<tr>
<td>8</td>
<td>chlorantraniliprole + thiamethoxam (Durivo®)**</td>
<td>6.0 &amp; 7.0 fl oz / A</td>
<td>Injection</td>
</tr>
<tr>
<td>9</td>
<td>Untreated Control</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Note: not currently registered**
Colorado Potato Beetle Control (2010 - Potato)

Larvae / 10 plants

2, injections (2 and 16 June) - HAES

- Coragen (8.5 oz)
- Admire Pro (8.7 oz)
- Platinum (2.67 oz)
- Scorpion (12 oz)
- Durivo (13.0 oz)
- Control
Potato Leafhopper Control (2010 - Potato)

2, injections (2 and 16 June) - HAES

- Coragen (8.5 oz)
- Admire Pro (8.7 oz)
- Platinum (2.67 oz)
- Scorpion (12 oz)
- Durivo (13.0 oz)
- Control

Adult PLH / 10 plants
Potato Aphid Control (2010 - Potato)

2, injections (2 and 16 June) - HAES

- Coragen (8.5 oz)
- Admire Pro (8.7 oz)
- Platinum (2.67 oz)
- Scorpion (12 oz)
- Durivo (13.0 oz)
- Control
Cucumber Insect Pest Management
Drip Irrigation Injection Trials, HAES 2010

<table>
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<tr>
<th>Treatment</th>
<th>Insecticide</th>
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<th>Application Type</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>chlorantraniliprole (Coragen®)**</td>
<td>5.5 &amp; 3.0 fl oz / A</td>
<td>Injection</td>
</tr>
<tr>
<td>2</td>
<td>Imidacloprid (AdmirePro®)</td>
<td>5.5 &amp; 5.0 fl oz / A</td>
<td>Injection</td>
</tr>
<tr>
<td>3</td>
<td>thiamethoxam (Platinum®)</td>
<td>2.67 &amp; 1.0 fl oz / A</td>
<td>Injection</td>
</tr>
<tr>
<td>4</td>
<td>dinotefuran (Scorpion®)</td>
<td>5.5 &amp; 5.0 fl oz / A</td>
<td>Injection</td>
</tr>
<tr>
<td>5</td>
<td>Untreated Control</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Note: not currently registered**
Cucumber Beetles: Damage

- Defoliation
- Feeding Scars
- Pollination Interference
- Rindworms
Striped Cucumber Beetle Control (2010 - Cucumber)

2, injections (18 May and 4 June) - HAES
Cucumber Beetles – Bacterial Wilt

- Most damage is from bacterial wilt, *Erwinia tracheiphila*
- Closely associated with beetle, vectored via posterior-station
- No cure for bacteria, control through vector
- Susceptibility:
  - Melons (not watermelon) > cucumbers > butternut and Hubbard squash

Avoidance of bacterial wilt is accomplished through effective cucumber beetle control.
Limiting Bacterial Wilt
(2010 - Cucumber)

Mean Percent Symptomatic Plants

2, injections (19 May and 4 June) - HAES

Coragen (8.5 oz)
Admire Pro (10.5 oz)
Platinum (3.67 oz)
Scorpion (10.5 oz)
Control
Drip Application for Insect Control

- Why use drip irrigation for insecticide application?
- What insects are controlled with Drip Application?
- Regulations and tips for best results of drip chemigation.
Drip Application System Requirements of Injection of Insecticides (READ LABEL)

- Check valve, vacuum relief valve, and low pressure drain.
- Automatic, quick closing check valve in injection pipeline.
- Solenoid-operated valve on intake side of injection pump.
- Interlocking controls to shut off injection pump when water pump stops.
- Irrigation or water pump must contain pressure switch to stop water pump when pressure drops.
Example Fertigation – Chemigation Assembly

www.agriculturesolutions.com

www.amiad.com/filters
Example Fertigation – Chemigation Assembly

http://www.reinders.com/rescomirr
Example Backflow Prevention

‘Air Gap’

‘Backflow Preventer’
For Best Results with Drip-Applied Insecticides

- Repair all leaks before chemigating.
- Before injection of insecticide begins, system must be fully pressurized.
- Minimum injection time should be time for water to move from injection point to most distant emitter.
- Water solubility and soil texture affects movement in soil, and timing of injection.
  - Low solubility = limited movement
  - High solubility = readily moves in soil
<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Water solubility (g/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coragen (chlorantraniliprole)</td>
<td>0.001</td>
</tr>
<tr>
<td>Imidacloprid (AdmirePro)</td>
<td>0.58</td>
</tr>
<tr>
<td>Platinum (thiamethoxam)</td>
<td>4.1</td>
</tr>
<tr>
<td>Venom (dinotefuran)</td>
<td>39.83</td>
</tr>
<tr>
<td>Vydate (oxamyl)</td>
<td>229.0</td>
</tr>
</tbody>
</table>
### Durivo Conversion Chart for Drip Linear Application

<table>
<thead>
<tr>
<th>Rate (oz./A)</th>
<th>20”</th>
<th>30”</th>
<th>34”</th>
<th>36”</th>
<th>38”</th>
<th>40”</th>
<th>46”</th>
<th>60”</th>
<th>72”</th>
<th>78”</th>
<th>80”</th>
<th>84”</th>
<th>Row Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>0.38</td>
<td>0.69</td>
<td>0.73</td>
<td>0.77</td>
<td>0.88</td>
<td>1.15</td>
<td>1.38</td>
<td>1.49</td>
<td>1.53</td>
<td>1.61</td>
<td>0.195</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>0.46</td>
<td>0.63</td>
<td>0.72</td>
<td>0.84</td>
<td>0.97</td>
<td>1.26</td>
<td>1.52</td>
<td>1.64</td>
<td>1.68</td>
<td>1.77</td>
<td>0.215</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>0.5</td>
<td>0.69</td>
<td>0.83</td>
<td>0.92</td>
<td>1.06</td>
<td>1.38</td>
<td>1.65</td>
<td>1.79</td>
<td>1.84</td>
<td>1.93</td>
<td>0.234</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Rate in ounces of product per 1,000 linear feet for specified row spacing and rate per acre.
Conclusions

- Drip application of insecticides offers several advantages over foliar application, including safety, flexibility and longer residual control.

- Combinations of several insecticides with different MoA can achieve broad spectrum insect control.

- Be sure irrigation system is legal for chemigation, and provides uniform distribution of water.
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QUESTIONS