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

‘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
(Cucurbita, 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.

Vegetable IPM Resources

- Cornell University, Organic Guide for Vegetables
  http://nysipm.cornell.edu/organic_guide/veg_org_guide.asp

- Vegetable Disease Mgmt Web-page
  http://www.omri.org/omri_lists/download

- UWEX Learning Store
  http://learningstore.uwex.edu/

- WFFVGA
  http://www.wisconsinfreshproduce.org

- Wisconsin Pest Bulletin
  http://datcpservices.wisconsin.gov/pb/index.jsp
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

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

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>Vermark</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>2B</td>
<td>Diamides</td>
<td>Chloranthrin (Coragen) Cyantraniliprole (Penmark)</td>
</tr>
</tbody>
</table>

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.

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, Cucurbits, 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.

Tomato Insect Pests

Common Pests
- Tomato fruitworm
- Tomato hornworm
- Potato aphid
- Cutworms - armyworms
- Thrips

Intermittent Pests
- Flea beetles
- Whiteflies
- Two-spotted spider mites
- Colorado potato beetle
- Vegetable leafminer

Calendar of Tomato Insect Pests

Phenology of Insect Infestations

Early season – planting to 1st flower
- Flea beetles
- Tobacco thrips
- Potato aphids

Neonicotinoid in-line injections

Tomato Fruitworm (corn earworm)

Adult
- Does not overwinter
- Adults migrate from the south
- 2 generations / year

Egg
- Laid singly on leaves
- Hatch in 5-7 days
- Feed externally on leaf and then bore into fruit

Larva
- Develop inside fruit
- Brownish or green in color (morphs)
**Tomato Fruitworm Damage**

**Occurrence**
- 2nd generation only – Aug/Sept

**Damage**
- Small larvae feed on leaves
- Larger bore into fruit
- Develop internally
- Infested fruit may color early or rot
- Major pest in CA and FL

**Tomato Fruitworm Monitoring and Control**

**Cultural**
- Plant early: avoidance in time
- Discard infested fruit

**Biological**
- Effective parasites
- But will not prevent damage

**Chemical**
- Coragen in-line injection
- Must be very well-timed, product will not move into fruit.

**Sweet corn insect control**

- Major canning crop in Wisconsin
- Fresh market acreage increasing
- Insect pests primarily ear feeders

**Sweet corn – key insect pests**

- European corn borer (mid/late)
- Corn earworm (late)
- Fall armyworm (occasional)

**European corn borer**

Major pest of sweet corn, processing and fresh

**Occurrence**
- Native to Wisconsin
- Broad host range
- Beans, sweet corn, field corn, potatoes, peppers
- 2-3 generations/year

**European corn borer life cycle**

**Adult**
- Night flyers
- 2 normal flight peaks June-August
- 600 HU and 1700 HU
- Live in grass “action sites”

**Eggs**
- Laid in masses (20-50)
- Overlap like scales
- White – yellow
- Black dots at hatch
- 5-7 days

**Larva**
- Overwinter in corn stalks
- 5 instars (2-4 weeks)
- Large larvae are damaging borers

**Pupae**
- Inside stems
- 10-14 days
European corn borer damage

- 1st generation (June) feeds in whorl and stalk
- 2nd generation (August-Sept) feeds directly on ear
- Provide direct protection to the silking ears (diamides very effective)

Corn Earworm – life cycle

Adult
- Does not overwinter in WI
- Moths fly in on storms from South
- Early infestation not a problem usually
- 2 generations

Eggs
- Laid singly on silks
- Hatch 5-7 days

Larva
- Brown or green with stripe
- Feed primarily on ear tips
- Late season

Sweet corn insects: managing worms

Cultural
- Early plantings avoid damage

Biological
- Effective parasites are present, but do not protect ears

Chemical
- Protect only vulnerable crop stage (July-Sept) when pests present
- Systemically mobile insecticides will not provide sufficient protection

Managing “worms” on sweet corn

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.
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

Water Solubility of Insecticides Registered for Drip Chemigation

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Water solubility (g/L)</th>
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</thead>
<tbody>
<tr>
<td>Coragen (chlorantraniliprole)</td>
<td>0.001</td>
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<tr>
<td>Imidacloprid (AdmirePro)</td>
<td>0.58</td>
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<td>Platinum (thiamethoxam)</td>
<td>4.1</td>
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<td>Venom (dinotefuran)</td>
<td>39.83</td>
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<td>Vydate (oxamyl)</td>
<td>229.0</td>
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Application Rates for Drip Chemigation

<table>
<thead>
<tr>
<th>Rate (oz./A)</th>
<th>20&quot;</th>
<th>30&quot;</th>
<th>34&quot;</th>
<th>36&quot;</th>
<th>38&quot;</th>
<th>40&quot;</th>
<th>46&quot;</th>
<th>60&quot;</th>
<th>72&quot;</th>
<th>78&quot;</th>
<th>80&quot;</th>
<th>84&quot;</th>
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<tbody>
<tr>
<td>Durivo</td>
<td>0.195</td>
<td>0.38</td>
<td>0.57</td>
<td>0.65</td>
<td>0.69</td>
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</table>

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.
Acknowledgements

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QUESTIONS ??