I. Colorado Potato Beetle, Neonicotinoid Insensitivity

Antigo Field Day
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# Chronology of Insecticide Resistance in Colorado Potato Beetle: Long Island, NY

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; Introduced</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; Failed</th>
<th>Chemical Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbaryl</td>
<td>1957</td>
<td>1958</td>
<td>Carbamate</td>
</tr>
<tr>
<td>Azinphosmethyl</td>
<td>1959</td>
<td>1964</td>
<td>OP</td>
</tr>
<tr>
<td>Phosmet</td>
<td>1973</td>
<td>1973</td>
<td>OP</td>
</tr>
<tr>
<td>Phorate</td>
<td>1973</td>
<td>1974</td>
<td>OP</td>
</tr>
<tr>
<td>Carbofuran</td>
<td>1974</td>
<td>1976</td>
<td>Carbamate</td>
</tr>
<tr>
<td>Oxamyl</td>
<td>1978</td>
<td>1978</td>
<td>Carbamate`</td>
</tr>
<tr>
<td>Fenvalerate</td>
<td>1979</td>
<td>1981</td>
<td>Pyrethroid</td>
</tr>
<tr>
<td>Permethrin</td>
<td>1979</td>
<td>1981</td>
<td>Pyrethroid</td>
</tr>
<tr>
<td>Fenvalerate + PBO</td>
<td>1982</td>
<td>1983</td>
<td>Pyrethroid + synergist</td>
</tr>
<tr>
<td>Esfenvalerate + PBO</td>
<td>1983</td>
<td>1984</td>
<td>Pyrethroid + synergist</td>
</tr>
<tr>
<td>Imidacloprid</td>
<td>1995</td>
<td>2000</td>
<td>Nicotinyl</td>
</tr>
</tbody>
</table>
**Beneficial Attributes**
- Effective on resistant CPB’s
- Broad spectrum
  - CPB, leafhoppers, aphids
- Flexible
  - In-furrow, seed, fertilizer
- Long residual
  - Rate dependant
  - Excessive rain may impact
- Low toxicity
  - “Healthy Grown”

**Disadvantages**
- Same chemical class (Group 4 MoA)
- Resistance likely
Reported Neo-nicotinoid Use
2003 = 13,330 acres (84% of total potato acres)
2004 = 12,786 acres (70% of total potato acres)
2005 = 12,238 acres (73% of total potato acres)
Mean 12,785 76%

Application(s):
One application = 13,727 acres
Two applications = 3992 acres
Three applications = 1102 acres (??)

Area-wide reliance on nicotinoid insecticide use: need to conserve the effectiveness!!
Michigan, 2005 Imidacloprid Bioassays

Byrne and Grafius (2006): 15 populations, LC_{50} range (0.03 – 4.06)

Reported field control
- Good
- Fair
- Poor

Note: * = significantly greater than LD_{50} for susceptible population
Wisconsin, 2007 Imidacloprid Bioassays

Survey Sites:
- Adams County (8)
- Langlade County (5)
- Oconto County (1)
- Portage County (7)
- Waushara County (9)
Total: (30)

CPB Populations:
- Over-wintered adult
- 2nd generation adult

Adult Topical Bioassays:
Wisconsin 2007, Imidacloprid Bioassays

Preliminary Assays (2007): 9 populations, $LC_{50}$ range (0.03 – 0.69)

Reported field control
- Good
- Fair
- Poor

LD$_{50}$ (µg/beetle)

Location

20X

10X Susceptible LD$_{50}$
Insecticide Resistance Management (IRM): Nicotinyl Insecticides

The Challenge!

Maintaining the effectiveness of nicotinyl insecticides:

- Admire, Provado, Gaucho, Genesis, Leverage, Platinum, Actara, Cruiser, Venom, Poncho, Belay
- All are in same MoA class = 4
- Represent the backbone of CPB management
- Resistance already reported in eastern production areas

Note: Under evaluation / unregistered
Reduced Risk Foliar Options (CPB) New Registrations 2007-08

- **Alverde™ (metaflumizone: BAS-320):**
  - Sodium channel blocker (MoA Group 22)
    - Use rate 4.5 oz a.i./a (CPB) and 16 oz (Lepidoptera)
    - Control of CPB **adults and larvae**
  - 8-12 days persistence
  - Very low impact on beneficials
  - Very low mammalian toxicity (Tox. units ca. 20-30)
  - Section 3 Registration (Nov 2007)
Altacor™ *(rynaxypyr: DPX-E2Y45)*

- Anthranilic diamide (chitin inhibitor: MoA group 28)
  - Use rate 3.5 - 5 oz a.i./a (CPB)
  - Control of CPB *adults and larvae* and Leps
- 14+ days persistence
- Very low impact on beneficials
- Low mammalian toxicity (Tox. units ca. 20-30)
- Section 3 Registration (2008)
Full Season Insect Control
Hancock, WI (2007)

I. Cruiser 5FS (0.16 oz/cwt) + Altacor 35 WG (3.0 fl oz/A)

II. Admire Pro 4.6SC (7.0 fl oz/A) + Alverde 2SC (4.5 fl oz/A)

III. Agri-Mek 0.15EC (8.0 fl oz/A) + Endigo 2SC (4.0 fl oz/A)

IV. Altacor 35 WG (3.0 fl oz/A) + Actara 25WG (3.0 oz/A)

V. Actara 25WG (3.0 oz/A) + Agri-Mek 0.15EC (8.0 fl oz/A)

VI. Assail 70 WP (4.0 oz/A) + Altacor 35 WG (3.0 fl oz/A)

VII. SpinTor 2SC (6.0 fl oz/A) + Altacor 35 WG (3.0 fl oz/A)

VIII. Rimon 0.83EC (12.0 fl oz/A) + Alverde 2SC (4.5 fl oz/A)

IX. Alverde 2SC (4.5 fl oz/A) + Radiant 2SC (4.5 fl oz/A)
Potato virus Y (PVY) reemergence in the United States and Canada

Asymptomatic varieties and imported seed

Improve diagnostics for PVY detection in seed
- DAS-ELISA
- RT-PCR assays (inconsistent results)

**Objective:** Examine how the timing of PVY infection can influence:
1.) frequency of tuber infection
2.) distribution within tubers
QUESTIONS??