Are We Reducing Risk?
Insights from implementing a reduced-risk IPM program in Michigan blueberry

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Highbush blueberry and insect pest complex

Michigan has ~18,000 acres worth $75m

Nationally, worth ~ $178m

Harvested by machine and by hand for fresh and processed food markets
Primary insect pests of Michigan blueberry

Cranberry fruitworm
Acrobasis vaccinii

Blueberry maggot
Rhagoletis mendax

Japanese beetle
Popillia japonica
Changing patterns of insecticide use
Michigan blueberry (USDA-NASS)

- Greater overall insecticide use.
- Increase in long-lasting, beetle-active compounds.
Reduced-risk pesticides
US-EPA definition

A reduced risk pesticide is one which may reasonably be expected to accomplish one or more of the following:

- Reduce pesticide risks to human health
- Reduce pesticide risks to non-target organisms
- Reduce potential for contamination of valued environmental resources
- Broaden adoption of IPM or makes it more effective

*www.epa.gov/oppfead1/fqpa/rripmpp.htm*
Insecticide efficacy trials, 2001

Cranberry fruitworm

% cluster infestation
July 12, 2001

- Untreated
- Guthion 50W
- SpinTor 2SC
- Dipel DF
- Confirm 2F

Blueberry maggot

pupae/1000 berries
31 Aug, 2001

- Untreated
- Imidan 70W
- Surround
- SpinTor 2SC
- Provado 1.6F
- Calypso 480S

Japanese beetle

% beetles alive
After 4h on 4d-old residue

- Untreated
- Guthion 50W
- Provado 1.6F
- Actara 25 WG
- Aza-direct 1
Can blueberries be grown in Michigan (Maine and New Jersey) without OP’s or carbamates?

1. Is the Blueberry RAMP program as effective as growers’ standard insect control program?

2. Will it cost more to adopt a Reduced-Risk IPM Program?

3. Does the Blueberry RAMP program increase abundance of natural enemies, pollinators, or secondary pests?

4. Does the Blueberry RAMP Program reduce the risk of worker and consumer exposure to broad-spectrum insecticide residues?
The Blueberry RAMP Project
Comparison of Standard and RAMP IPM Programs

- 6 Michigan farms, with 3-10 acre fields
- **Standard** and RAMP program on each farm
- Weekly monitoring of pests and beneficials
- Decisions for RAMP field based on scouting
- Fruit sampled for infestation by key pests
- Long term response of pests, natural enemies and pollinators
- Worker exposure collaboration (Larry Olsen)
## Conventional and reduced-risk insecticide programs for control of key insect pests in Michigan blueberry fields

<table>
<thead>
<tr>
<th>Month</th>
<th>Crop stage</th>
<th>Target Pest</th>
<th>Conventional</th>
<th>Reduced-risk (RAMP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>April</td>
<td>Pre bloom</td>
<td>Leafrollers</td>
<td>Methomyl, esfenvalerate</td>
<td>Tebufenozide (Confirm)</td>
</tr>
<tr>
<td>May</td>
<td>Bloom</td>
<td>Cran. Fruitworm</td>
<td><em>Bacillus thuringiensis</em></td>
<td>Tebufenozide</td>
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<tr>
<td></td>
<td></td>
<td>Cherry fruitworm</td>
<td><em>Bacillus thuringiensis</em></td>
<td>Tebufenozide</td>
</tr>
<tr>
<td>June-July</td>
<td>Post bloom</td>
<td>Cran. Fruitworm</td>
<td>Azinphosmethyl, esfenv.</td>
<td>Tebufenozide</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Obliq. leafroller</td>
<td>Phosmet, methomyl</td>
<td>Tebufenozide</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blueberry aphid</td>
<td>Methomyl</td>
<td>Imidacloprid (foliar, Provado)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>White grubs</td>
<td>-</td>
<td>Imidacloprid (soil, Admire)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Esfenvalerate (Asana)</strong></td>
</tr>
<tr>
<td>July-August</td>
<td>Mid-season</td>
<td>Japanese beetle</td>
<td>Phosmet, carbaryl</td>
<td>Imidacloprid</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blueberry maggot</td>
<td>Malathion, phosmet</td>
<td>Spinosad (SpinTor), imidacl.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blueberry aphid</td>
<td>Methomyl, imidacloprid</td>
<td><strong>Esfenvalerate</strong></td>
</tr>
<tr>
<td>July-Sept.</td>
<td>Pre-harvest</td>
<td>Japanese beetle</td>
<td>Phosmet, carbaryl</td>
<td>Spinosad</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blueberry maggot</td>
<td>Phosmet, malathion</td>
<td>Spinosad, imidacloprid</td>
</tr>
</tbody>
</table>

Program adapted in Year 3, to include Asana for fruitworm, maggot, beetle control
Does adoption of a RAMP program affect control of key pests?
Infestation by cranberry fruitworm

- 100 clusters sampled each field before each harvest
- Samples held to assess larval survival (hibernaculae)
Density of Japanese beetle grubs

- Admire® (16 oz/acre) applied to grassy areas around RAMP fields in late June 2003 and 2004

- Field perimeters sampled before and after treatments

<table>
<thead>
<tr>
<th>Sample</th>
<th>Grubs per ft²</th>
<th>% control</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard</td>
<td>RAMP</td>
<td></td>
</tr>
<tr>
<td>Spring 2003</td>
<td>0.98 ± 0.42</td>
<td>1.24 ± 0.21</td>
<td>-</td>
</tr>
<tr>
<td>Fall 2003</td>
<td>2.33 ± 0.50</td>
<td>0.11 ± 1.20</td>
<td>95.3</td>
</tr>
<tr>
<td>Fall 2004</td>
<td>0.39 ± 0.14</td>
<td>0.03 ± 0.03</td>
<td>92.3</td>
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<tr>
<td>Fall 2005</td>
<td>2.50 ± 0.88</td>
<td>0.67 ± 0.42</td>
<td>73.2</td>
</tr>
</tbody>
</table>
Abundance of adult Japanese beetles, 2005

**Beetles on bushes**

- **Interior, P=0.05**
- **Perimeter, P=0.8**

**Damaged berries**

- **Std**
- **RAMP**
Infestation by blueberry maggot

- 100 clusters collected before harvest, held 4 weeks
- Number of pupariae recorded per sample

<table>
<thead>
<tr>
<th>Farm</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Std</td>
<td>RAMP</td>
<td>Std</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
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<tr>
<td>4</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Does adoption of the RAMP program change economic risk?
Comparison of applications and cost

# insecticides applied

- Std
- RAMP

# broad-spectrum insecticides applied

- Std
- RAMP

Cost per acre

- Std
- RAMP
Does adoption of a RAMP program change the risk to natural enemies?
Samples of natural enemies on bushes, 2005

* P<0.05
Focus on indicator groups of natural enemies

Aphid parasitoids
- Aphids per branch counted on 20 bushes per field
- 3-4 samples/season
- Number parasitized aphids recorded
- All mummies collected and reared to parasitoid/hyperparasitoid

Ground beetles
- Six pitfall traps per field
- Emptied once each week from May to October
- Carabids identified to species
Delayed response of aphid parasitoids to reduced-risk insecticide program

Year 1
2003

Year 2
2004

Collection date

Percent parasitism (S.E.)

Std
RAMP

June 5
July 2
July 11
Aug 6
July 9
July 29
Aug 9

*
Similar carabid community in the two management programs

<table>
<thead>
<tr>
<th>Carabid species</th>
<th>Proportion of beetles captured (%)</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Std</td>
<td>RAMP</td>
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<tr>
<td><em>Harpalus pensylvanicus</em></td>
<td></td>
<td>79.9</td>
<td>58.8</td>
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<tr>
<td><em>Harpalus erraticus</em></td>
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<td>2.8</td>
<td>19.5</td>
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<tr>
<td><em>Amara aenea</em></td>
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<td>5.2</td>
<td>6.7</td>
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<tr>
<td><em>Pterostichus mutus</em></td>
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<td>6.1</td>
<td>4.9</td>
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<tr>
<td><em>Patrobis longicornis</em></td>
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<td>0.9</td>
<td>1.2</td>
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<tr>
<td><strong>Total beetles captured</strong></td>
<td></td>
<td>5780</td>
<td>5542</td>
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</tbody>
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32 species total
Two species responded to implementation of the RAMP insecticide program

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<th>2003</th>
<th></th>
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<td></td>
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<td>2.8</td>
<td>19.5</td>
<td>6.6</td>
<td>17.3</td>
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<td><em>Amara aenea</em></td>
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<td>5.2</td>
<td>6.7</td>
<td>3.6</td>
<td>10.8</td>
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<td><em>Pterostichus mutus</em></td>
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<td>5780</td>
<td>5542</td>
<td>3738</td>
<td>3894</td>
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</tbody>
</table>

32 species total
Response of carabids to different insecticide programs

**2003**

**Amara aenea**

Average capture per month

**2004**

**Harpalus erraticus**

Average capture per month

*Std* and *RAMP*
Summary

• Risk of pest infestation in blueberry can be minimized with a RAMP IPM Program, but this will increase economic risk for producers.

• Combining new insecticides with conventional insecticides will be the most effective adoption strategy.

• Risk to some natural enemies is reduced, but the significance for pest control is not well understood.
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