Evaluating Environmental Impact in Reduced Risk IPM Apple & Peach Orchards

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Biglerville, Pennsylvania
THE GOOD, THE BAD, & THE UGLY BUGS
F = Food

Q = Quality

P = Protection

A = Act

F = Frequent

Q = Questions about

P = Pests without

A = Answers

OR
## Organophosphates Currently Registered on Tree Fruits

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Trade Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azinphosmethyl</td>
<td>Guthion®</td>
</tr>
<tr>
<td>Chlorpyrifos</td>
<td>Lorsban®</td>
</tr>
<tr>
<td>Diazinon</td>
<td>Diazinon</td>
</tr>
<tr>
<td>Dimethoate</td>
<td>Dimethoate®</td>
</tr>
<tr>
<td>Methidathion</td>
<td>Supracide®</td>
</tr>
<tr>
<td>Phosmet</td>
<td>Imidan®</td>
</tr>
<tr>
<td>Methyl Parathion</td>
<td>Penncap M®</td>
</tr>
</tbody>
</table>

The Future Picture ??
Investigators

Harvey Reissig
Art Agnello
Jan Nyrop
Dick Straub

Peter Shearer
Atanas Atanassov

David Biddinger
Larry Hull
Greg Krawczyk

$ Jay Harper
$ Lynn Kime

7 States - $1.9 Million over 4 years.

Eastern U.S. Risk Assessment & Mitigation Project
Species of insect killed.

Broad-spectrum Insecticides

OPs, Carbamates Pyrethroids

Reduced Risk

Avaunt, IGR’s Assail, Bts etc.

Mating Disruption

↑ = Species of insect killed.
“Soft” or Selective insecticides

Species of pests and natural enemies not impacted

Broad spectrum insecticides

“Windows of opportunity”
Green Stink Bug (*Acrosterum hilare*) - Peach

- **Nymph w/ Tachinid Eggs**
- **Fruit Damage**
- **Hatching Eggs**

**Green SB**

**Southern Green SB**
2004 Apple Acres X 1,000

- Represent 73% of 138,000 Eastern apple acres worth $450 million.

- Av. lb ai/A for all states 6.06 lb of which 84% are OPs & 6% are CBs.

- Av. ai/A reduction of 83.1%.

- Total tons ai/A for insecticides /miticides in East – 614 tons.

- Potential ai/A reduction of 381 tons in RAMP states; potentially 513 tons in all Eastern states.
• Represent 30% of 61,000 Eastern peach acres worth $157 million.

• Av. lb ai/A for all states 4.39 lb - 83% are OPs & 13% CBs.

• Av. ai/A reduction of 77.7%.

• Total tons ai/A for insecticides/miticides in East – 128 tons.

• Potential ai/A reduction of 37 tons in RAMP states; potentially 97 tons in all Eastern states.
Environmental Impact Quotient (EIQ)

- Developed by Cornell to measure environmental benefits from IPM practices that resulted in pesticide reductions.
- Uses toxicity data on potential for ground water contamination, residual half life on plants, human health, impacts on fish, birds, aquatics, bees, and beneficials.
- Takes into account the toxicity of individual pesticides, their field use rates, and number of applications.
- Many problems, but best evaluation currently. Used in IPM labeled food products in NY.
Apple 2005

Lb ai/A of Pesticide

- MI
- NC
- NY
- PA
- VA
- WV

Types of Pesticides:
- Botanical
- Microbial
- Nicitinoid
- Oxadiazine
- IGR
- Miticide
- Antibiotic
- Pyrethroid
- Cyclodiene
- Carbamate
- OP
Relative Ecological Toxicity (EIQ) In RAMP Apple Programs
PA 7 Orchard Average
Relative Ecological Toxicity (EIQ) In RAMP Peach Programs
PA 5 Orchard Average

Cumulative Seasonal EIQ Value

- 2002: 3.8X
- 2003: 18.3X
- 2004: 5.6X
- 2005: 5.3X

Standard
RAMP 5.6X 18.3X 5.3X
Multi-State Apple RAMP 2002-5
Insecticide/Miticide/Pheromone Disruption Costs ($/A)

Av. % Higher Cost/A

PA (7/7)  +45%
VA (2/2)  +64%
WV (7/5)  +61%
NC (8/8)  +54%
MI (6/6)  +115%
NY (34/17) +57%
### NRCS – Agricultural Management Assistance (EQUIP)

**Barry Frantz**

<table>
<thead>
<tr>
<th>Practice</th>
<th>Comp Units</th>
<th>Comp Cost</th>
<th>Cost-Share Type</th>
<th>Cost-Share Rate</th>
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</thead>
<tbody>
<tr>
<td><strong>Pest Management</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>✔ Adv PM Tree Fruit-area-wide mating disruption 1-spe</td>
<td>Ac.</td>
<td>$38.00</td>
<td>FR</td>
<td>100</td>
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<tr>
<td>✔ Adv PM Tree Fruit-area-wide mating disruption 2-spe</td>
<td>Ac.</td>
<td>$90.00</td>
<td>FR</td>
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<tr>
<td>✔ Adv PM Tree Fruit-intensive disease monitoring</td>
<td>Ac.</td>
<td>$23.00</td>
<td>FR</td>
<td>100</td>
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<tr>
<td>✔ Adv PM Tree Fruit-intensive insect monitoring &amp; trapping</td>
<td>Ac.</td>
<td>$45.00</td>
<td>FR</td>
<td>100</td>
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<tr>
<td>✔ Adv PM Tree Fruit-reduced risk pesticides</td>
<td>Ac.</td>
<td>$56.00</td>
<td>FR</td>
<td>100</td>
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<tr>
<td>✔ Avoidance techniques-plant resistant varieties, trap</td>
<td>Ac.</td>
<td>$15.00</td>
<td>FR</td>
<td>100</td>
</tr>
<tr>
<td>✔ Basic Pest Management for Tree Fruit</td>
<td>Ac.</td>
<td>$35.00</td>
<td>FR</td>
<td>100</td>
</tr>
<tr>
<td>✔ Field Crops</td>
<td>Ac.</td>
<td>$8.00</td>
<td>FR</td>
<td>100</td>
</tr>
<tr>
<td>✔ Nonchemical control methods-increase beneficial ins</td>
<td>Ac.</td>
<td>$6.00</td>
<td>FR</td>
<td>100</td>
</tr>
<tr>
<td>✔ Use of precision application technology</td>
<td>Ac.</td>
<td>$15.00</td>
<td>FR</td>
<td>100</td>
</tr>
<tr>
<td>✔ Weather and Growing Degree Days Monitoring</td>
<td>No.</td>
<td>$375.00</td>
<td>FR</td>
<td>100</td>
</tr>
<tr>
<td>✔ Weather plus use of Predictive Models (per season)</td>
<td>No.</td>
<td>$394.00</td>
<td>FR</td>
<td>100</td>
</tr>
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</table>
Natural Enemy Abundance: Peach (All states):

- No real differences in NE levels despite different IPM programs.
Secondary Pests

Aphids

Leafminers

Leafhoppers
Conservation & Augmentation of the Predatory Mite, T. pyri, in Pennsylvania Apple Orchards
Confirm & Intrepid Internal Lep
Spray Trials In Apple
Hull & Biddinger & Hull 1994

Av. % Parasitism

Charmon extensor
Macrocentrus delicatus
OFM
CM

38%
42%
40%
15%
36%

Confirm 10 spray
Intrepid 10 spray
Confirm 6 spray
Guthion 10 spray
Unsprayed

Total Individuals Reared
Mortality of Sentinel Leafroller Egg Masses To *Trichogramma* In 2003 Apple Ramp Trials

*Replicated 4 times by orchard location and over 2 different dates: (8/15 & 8/20/03. A total of 128 TABM/OBLR egg masses were placed in each treatment.*
Biodiversity Assessment In Agro-Ecosystems

- In general, much simpler systems w/ fewer plant & animal species than natural systems.
  - Pest and beneficial species often better known than in natural systems – non-targets??
  - Provides a baseline for future assessment of changes brought about by future IPM practices.
  - Always changing with different pesticides use patterns, cultural controls, cultivars, and introduction of exotic pest species.
Ecotoxicology of Trangenic Maize in Northeastern Agroecosystems
S. Fleischer, C. Mullin, D. Biddinger & P. Blum
**Community Analysis**

Corn

Isoline

Insecticide Treatment on Isoline

Transgenic

Insecticide Treatment on Transgenic

P = predator,  H = herbivore,  D = detritivore,  O = omnivore
Biological Control & Indicator Species

- Amblyseius fallacis
- Zetzellia mali
- Lacewing
- Cecidomyiid Fly
- Assassin Bug
- Parasitic Hymenoptera
- Ground Beetles
- Ants
- Spiders
PA RAMP Peach Ecotoxicology –2002

- 5 RAMP sites and 4 standards sampled 6 times from June-August.
- 10 trees sampled from each block. A sample collected from the canopy of each tree & from ground cover adjacent to tree.
- Ramp – 5 sites x 6 dates x 10 trees x 2 samples/tree = 600 samples.
- Standard - 4 sites x 6 dates x 10 trees x 2 samples/tree = 480 samples.
- 1,080 vials!
### RAMP Peach Ecotoxicology –2002

**Seasonal Average of Non-Target Insects/Site (+/- SE)**

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<th>A. aphidimyza adults</th>
<th>Spiders</th>
<th>Ants</th>
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<th>Chalcidoidea</th>
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<td>RAMP</td>
<td>51.4 (20.0)</td>
<td>23.0</td>
<td>40.6</td>
<td>15.4 (3.6)</td>
<td>9.2 (1.9)</td>
<td>6.8 (2.7)</td>
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<tr>
<td>Standard</td>
<td>34.5 (17.4)</td>
<td>12.3</td>
<td>12.0</td>
<td>4.5 (0.9)</td>
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*Increase of 2-3 fold in first season.*

DJB-03
Macrocentrus ancylivorus vs. Macrocentrus delicatus

- Stigma not uniformly pale yellow

- Stigma uniformly pale yellow

M. instabilis
Ascogaster quadridentata
Colpoclypeus florus - Eulophidae

- New larval ecto-parasitoid of leafrollers in Pennsylvania.

- Introduced into Canada in 1968, disappeared until about 13 years ago to show up in WA.

- Found in MI, NY & PA in the last 2-3 years.

- Very effective in controlling OBLR & TABM.

- Susceptible to most insecticides.
Future of IPM In Fruit?

- Insecticide/Fungicide Resistance
- Environmental Impact
- FQPA Losses
- Human Health Concerns
- Increased Competition
- Quality Standards
- New Pests

Integrated Crop Management (ICM) → IPM → Organic

Next Level of IPM
- Biologically or Ecologically Intensive IPM

Sustainable Agriculture