Cherry RAMP I & the "Had To's"
Mark Whalon

- Had to work as a team.
- Had to learn how Guthion worked.
- Had to learn PC biology and ecology.
- Had to learn how Guthion replacements worked.
- Had to "think out of the box" & attack PC with a "diversified" approach.
- Had to develop a PARTNERSHIP with the USEPA.

Guthion (AZM) Used for 35+ Years!

- It worked, that's all we needed to know...
- Well, it's a different world today!
- In the absence of AZM we will have to know much, much more to control PC...
  1. Biology, movement and reproductive ecology
  2. Tailor control strategy to PC's Biology in it's Environment at the time we spray/treat...
  3. Understand how our insecticide interacts with the environment, the targeted substrate and PC's life-stage biology and its location in the environment

Guthion Reregistration: the Final Decision
Came from EPA on October 28th, 2006...
USEPA: Has a specific and well oiled Re-registration Process

Technically Guthion (AZM) Has Lots of Very Significant Reregistration Problems.
Key Considerations:
- Worker Protection
- Residues
- Eco- Impacts
- Cost vs Benefits
- Alternatives

Sweet and Tart Cherries
AZM Rate Reduction Phase Out Plan

<table>
<thead>
<tr>
<th>Season</th>
<th>Max Rate</th>
<th>Min Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007-2009</td>
<td>1.5 lbs</td>
<td>.75 lbs</td>
</tr>
<tr>
<td>2010-2012</td>
<td>ai/acre/year</td>
<td>ai/acre/year</td>
</tr>
</tbody>
</table>

- Aerial Applications Prohibited
- 60 ft Buffer Zone – Dwellings
- 60 ft Buffer – Water
- Pick Your Own – Prohibited

Using Insecticides: 101

Answers start with Biology & Insecticides

Key Question
- What’s your target?
- Where is your target?
- Best way to "hit" or deplete your insecticide on the target?
- Characteristics of the delivered material & your target in its environment or setting?
- OR, How does the “hit” you get deliver into the target before achieving a desired outcome?
- NO WORMS in Fruit!

Plum Curculio Developmental Stages:

- Egg
- 1st Instar
- 2nd Instar
- 3rd Instar
- 4th Instar
- Summer generation adult

Target Overwintering Adults
- PKID Adult
- Prevent Egg Laying Traditional AZM Use
- Target Larvae as they crawl into soil 3rd Instar

Post Harvest Target Summer Adults
- 1-Kill items or
- 2- Break Diapause & Prevent Over-Winter Survival

Other Compounds
- Synthetic Pyrethroids
- Carbamates
- Many other New compounds

Gavin Love, NCA Hot Topic of the Year 2007
Timing Sprays: The PC Phenology Model

- Still Refining
- Much improved
- New Targets
  - Eggs
  - Larvae
  - Prepupa
  - Eclosed young adults
  - Summer adults

PC Phenology: Timing New Tools

- Spring Feeding
- Mating
- Egg Laying
- Larval Development
- Larvae Exit Fruit
- Pupation
- Summer Adult Emergence

Plum Curculio Developmental Stages:

- Egg
- 1st instar Larvae
- 2nd instar Larvae
- 3rd instar Larvae
- 4th instar Larvae
- Pupa

Post Harvest Target Summer Adults

- 1m Kill them or
- 2m Break Diapause & Prevent Overwinter Survival

Lethal Time: AZM Vs RR & OP Alts

What AZM Does:

- TOXIC ACTION
  - Fumigant
  - Contact Toxicant
  - Ingested Toxin

Kill larvae in fruit at 2ppm with no residue at harvest if timed well

Covers the surface
Penetrates the Fruit, Leaves, Stems and Bark…

Adult Feeding Patterns During Cherry Production Season

A Critical Issue For RR Compounds = Ingestion Uptake
Plum Curculio Developmental Stages:

**Target Overwintering Adults**

- Target Adult Prevent Egg Laying Traditional AZM Use
- Target Adult Prevent Egg Laying Novel AZM

**Post Harvest Target Summer Adults**

- AVAUNT
- ACTARA
- ASSAIL
- Imidan
- Pyrethroid

**Plum Curculio Control Targets:**

Woods edge, Soil, Bark, Scaffold, Branch, Leaf, Blossom, Stem, Fruit Surface, Fruit Interior?

**IGR’s Present a New Set of Ecological Challenges**

Subtle Endocrine-Like Effects & Vertical Transmission

- Esteem (pyriproxifen): will break diapause
- Esteem treated females produced eggs = use fat body & don’t survive winter
- Therefore, Esteem treatment caused reduced fat reserves = winter mortality...
- Novaluron (Rimon): vertical transmission to offspring... eggs don’t live

M. Whalon, K. Kim, S. Kim & D. Norton

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**AZM Alternative’s in Cherry**

- New Research:
  - MRL’s
  - Economic
  - Sustainable?
  - Vertical Transmission

- AZM
  - GFW, LR, PC, CFF

- New Tool’s
  - Indoxacarb (2005)
  - Thiamethoxam (2006)
  - Acephate (2006)
  - Thimet (2007)
  - Imidacloprid (2007)

- MRL’s
  - Economically Sustainable?

**Plum Curculio Efficacy**

<table>
<thead>
<tr>
<th>Year</th>
<th>PC Efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>low</td>
</tr>
<tr>
<td>2005</td>
<td>moderate</td>
</tr>
<tr>
<td>2006</td>
<td>High</td>
</tr>
<tr>
<td>2007</td>
<td></td>
</tr>
</tbody>
</table>

John Wise & Chris Vandervort
USEPA & AZM Outcome? Better than Good! Considering the alternatives!

USEPA Wash. DC
Jim Guilford
Nikhil Mallampalli
Katie Hall
USEPA Region 5
Margaret Guarriero
Barbara VanTill

The Data That Kept AZM Alive

Natural Enemy Sampling Summary for 2007

- Shannon Diversity Index (H) measures diversity using species richness and evenness.
- H' = ln(S/n!)
- S = Number of different species observed
- n = Number of individuals observed

| 2007 RAMP | 
|---|---|---|---|---|---|
| Grower | H' | Richness | Evenness |
| 4 | 1.78 | 4 | 1.00 |
| 5 | 1.31 | 4 | 0.86 |
| 5 | 1.15 | 3 | 1.00 |
| 1 | 0.55 | 2 | 1.00 |
| 6 | 0.00 | 1 | 0.01 |
| 7 | 0.00 | 1 | 0.01 |

| 2007 COMP |
|---|---|---|---|---|---|
| Grower | H' | Richness | Evenness |
| 3 | 1.84 | 6 | 0.92 |
| 7 | 1.84 | 6 | 0.92 |
| 8 | 1.92 | 6 | 0.95 |
| 4 | 1.31 | 4 | 0.943 |
| 5 | 1.00 | 4 | 0.79 |
| 2 | 0.90 | 3 | 0.62 |
| 9 | 0.00 | 1 | 0.01 |

OP Alternatives More Damaging to the Environment than AZM?

EPA Must Consider
- Worker Protection
- Residues
- Hormonal Effects
- Environmental Impact
- Ecological Impact

FQPA Ushered Changes Yields New Insight!

Acute vs Chronic Effects of Various RR Insecticides

AZM Orchard Ecosystem
- Neonicotinoid or IGR Orchard Ecosystem

Time
- Deep & Short Disruption
- Shallow & Long Disruption

Figure 1. An illustration of the chronic ecological effects of different insecticides upon an orchard ecosystem.

Natural Enemy Biodiversity Indicators

<table>
<thead>
<tr>
<th>Bees</th>
<th>Leaf Guilds - Mites</th>
<th>Phytoseids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parasitoids</td>
<td>Litter Guilds</td>
<td>Coccinellids</td>
</tr>
<tr>
<td>Aphid Predator Guilds</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data that kept AZM Alive: Natural Enemy Indexes

Cherry RAMP vs. COMP Blocks

Table 3: Average Shannon Index (H) by grower for the Yellow Sticky Method across 3 sample periods (pre-, post bloom & pre-harvest) during the season. The grower codes are ranked from greatest to least average H'.

<table>
<thead>
<tr>
<th>Grower</th>
<th>Average RAMP Block</th>
<th>Average COMP Block</th>
<th>Total Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5</td>
<td>1.93</td>
<td>3.53</td>
<td>5.46</td>
</tr>
<tr>
<td>4-B</td>
<td>1.51</td>
<td>2.49</td>
<td>3.98</td>
</tr>
<tr>
<td>5-A</td>
<td>1.46</td>
<td>0.98</td>
<td>2.44</td>
</tr>
<tr>
<td>3-A</td>
<td>1.57</td>
<td>1.75</td>
<td>3.32</td>
</tr>
<tr>
<td>4-A</td>
<td>1.59</td>
<td>1.23</td>
<td>2.82</td>
</tr>
<tr>
<td>4-W</td>
<td>0.99</td>
<td>1.16</td>
<td>2.15</td>
</tr>
<tr>
<td>2-C</td>
<td>0.62</td>
<td>0.91</td>
<td>1.53</td>
</tr>
<tr>
<td>5-M</td>
<td>0.53</td>
<td>0.64</td>
<td>1.17</td>
</tr>
</tbody>
</table>

S.Ave: 10.53 vs. 13.44 (p=0.00)

AZM Blocks Rated Better Than Reduced Risk Blocks

(Diversity = Number of Good Guys : Bad Guys)
**Bottom Line: RAMP DATA had a very Significant Impact**

1. AZM or Guthion has many problems
   - FQPA: Residues- Infants, Children, Preg. Mothers
   - Worker Protection
   - Pesticide Drift
   - Water Issues
   - Ecological Impacts & History of “incidents”
2. Exceedingly unlikely that Cherry industry will get another reprieve!
3. Therefore, we must forge ahead into the Reduced Risk Pesticide world!

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**RAMP-II Management Team Meeting Tomorrow 9-12**

“2008 & Beyond:”

1. Successful competed for and won a new 3-year (2008-2010) Cherry RAMP-II Grant
2. Will require an unprecedented push from the cherry industry...to adopt new chemistries and practices
3. Cherry Industry will require new registrations & MRLs from USEPA
4. Growing Cherries will cost more $