Alternative Pesticides and New Developments in Pesticide Usage in Orchard Crops

Helmut Riedl
MCAREC / Oregon State University
Alternative Pesticides and New Developments in Pesticide Usage in Orchard Crops

- Old vs. new control alternatives on apples & cherries
- Results of field trials: new products
- Codling moth
- Leafroller
- Cherry fruit fly
- San Jose scale
- Spider mites
Consequences of FQPA Implementation

### OPs under scrutiny !!

- **Lorsban:** no post-bloom use on apples & pears
- **Parathion:** cancelled on apples, pears
- **Guthion:** use requirements drastically changed; completely phased out by 2013
- **Imidan:** review not yet completed

What are the alternatives and how effective are they?
CODLING MOTH CONTROL TARGETS

ADULT

EGG

NEONATE
Codling Moth Control Alternatives: Old Chemistries

OPs: Guthion, Imidan

Carbamates: Sevin (carbaryl)

Pyrethroids: Asana, Danitol, Warrior

Horticultural Mineral Oil (HMO)
Codling Moth Control Alternatives: New Chemistries

<table>
<thead>
<tr>
<th>Category</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neonicotinyls:</td>
<td>Assail, Calypso, Clutch</td>
</tr>
<tr>
<td>IGRs:</td>
<td>Dimilin, Rimon</td>
</tr>
<tr>
<td></td>
<td>Esteem</td>
</tr>
<tr>
<td></td>
<td>Intrepid</td>
</tr>
<tr>
<td>Others:</td>
<td>Success, AgriMek, Avaunt</td>
</tr>
<tr>
<td>Clay products:</td>
<td>Surround</td>
</tr>
<tr>
<td>Microbials:</td>
<td>CpGV (Cyd-X, etc.)</td>
</tr>
</tbody>
</table>
...the other codling moth OP insecticide!

Test results provided by J. Brunner (WSU-Wenatchee), H. Riedl (OSU-Hood River), and R. Britt (Yakima). Products were tested at labeled rates.
Effects of pH on IMIDAN Half Life

<table>
<thead>
<tr>
<th>pH</th>
<th>Half Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0</td>
<td>178 hours</td>
</tr>
<tr>
<td>5.5</td>
<td>92 hours</td>
</tr>
<tr>
<td>6.0</td>
<td>36 hours</td>
</tr>
<tr>
<td>6.5</td>
<td>14 hours</td>
</tr>
<tr>
<td>7.0</td>
<td>neutral 10 hours</td>
</tr>
<tr>
<td>7.5</td>
<td>2 hours</td>
</tr>
<tr>
<td>8.2</td>
<td>33 minutes</td>
</tr>
</tbody>
</table>
Pyrethroids:

Asana, Danitol, Warrior

- True broad-spectrum insecticides
- Effective against codling moth
- Demonstrated cross-resistance to OPs
- Disruptive to natural enemies
- Spider mite outbreaks after use
## Insect Control on Apples with Omni Supreme Oil (Orchex 796E)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>% Damaged Fruit at Harvest</th>
<th>Mines/Leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CM</td>
<td>OBLR</td>
</tr>
<tr>
<td>Omni oil(^a)</td>
<td>21.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Omni oil(^b)</td>
<td>17.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Guthion</td>
<td>4.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Untreated check</td>
<td>42.5</td>
<td>5.0</td>
</tr>
</tbody>
</table>

\(^a\) 6 sprays of 1%
\(^b\) 8 sprays

H. Riedl, OSU/MCAREC, Hood River
Codling Moth: Prerequisites for Mating Disruption

- Initial population low (1-2%)
- If moderate-high, supplemental control
- Border treatments unless isolated
- Block of minimum size, uniform shape
- Problems: wind, sloping terrain
CM Control: Neonicotinyl Insecticides

Assail, Calypso, Clutch*

Lab studies with Calypso

- **Eggs:** no topical activity, but eggs die when laid on residue
- **Young larvae:** good activity
- **Moths:** some activity
Codling Moth Control Alternatives

IGRs – Insect Growth Regulators:

• Chitin-synthesis inhibitors: Dimilin, Rimon*
• Juvenile hormone mimics: Esteem
• Molt-accelerating compounds: Intrepid

*labeled for apples; no pear label yet!
Chitin-synthesis inhibitors:

**Dimilin**

- Primarily ovicidal
- Selective
- Not very effective in recent field tests
- Cross-resistance to OPs
Molt Accelerating Compounds (MAC):

**Intrepid**

Effects on eggs →

↓ Young larvae with double head capsule

Ovicidal
Larvicidal
Sub-lethal effects on moths
Selective, cross-resistance?
Codling Moth Control on Apples
OSU/MCAREC; Hood River, OR - 2002

Application Timings (except Intrepid):
1st Generation: 250DD, 21 d
2nd Generation: 1250DD, 21 d

Intrepid Timing:
1st Generation: 200DD, 21 d
2nd Generation: 1200DD, 21 d

Rates: Imidan at 4lbs/acre; Danitol at 21.3 fl oz/acre; Assail at 3.4 oz/acre with 0.25% HMO; Intrepid at 16 oz/acre with Latron B-1956

Conducted by: H. Riedl et al. OSU/MCAREC
Codling Moth Control in Apples
Handgun Trial, Wenatchee, WA - 2002

*Conducted by:* Granger et al., WSU/TFREC, Wenatchee, WA

**Average % CM Injury**

- Untreated check: 72%
- Guthion 1.5 lbs: 2.2%
- Assail 3.4 oz + 1% HMO: 9.6%
- Assail 3.4 oz + 0.25% HMO: 7.6%
- Assail 3.4 oz: 13.6%
- Assail 1.2 oz: 22.2%

Assail and Guthion applied four times
Codling Moth Control on Apples
Hand Gun Trial, OSU/MCAREC - 2004

Application Timings:
1st Generation: 200DD, 21 d
2nd Generation: 1200DD, 21 d

% CM Injury at Harvest

- Untreated check: 49%
- 4x Imidan: 1%
- 2x Calypso + HMO & 2x Guthion: 0.5%
- 1x Calypso + Intrepid + HMO & 2x Guthion: 11%

Rates: Calypso 4SC at 6 fl oz/acre; Intrepid at 16 oz/acre; HMO (0.5%) 2 gal/acre; Guthion at 2 lbs/acre; Imidan at 5 lbs/acre

Conducted by: A. Walston & H. Riedl OSU/MCAREC
Codling Moth Control on Pears
OSU/MCAREC - 2002

Untreated check 76.7
3x Imidan 10
3x Intrepid 15
4x Dimilin 8.8
4x Rimon High 6.7
5x Rimon High 1.7
5x Rimon Low 0

Rates:
- Rimon low at 54 oz/acre with 0.25% HMO;
- Rimon high at 71 oz/acre with 0.25% HMO;
- Dimilin at 16 oz/acre with 0.25% HMO;
- Intrepid at 16 oz/acre with Latron B-1956;
- Imidan at 4lbs/acre

Conducted by: H. Riedl et al. OSU/MCAREC
Codling Moth Damage on Apples
Hand Gun Trial, OSU/MCAREC - 2006

% CM Damage at Harvest

Untreated check 79a
5x Assail 70WP 15b
5x Assail 30SG 6c
5x Calypso 11bc
2x Rimon, Calypso, Calypso 11bc
2x Rimon, Assail, Assail 5c
2x Rimon+Assail, Rimon, Rimon 12.5b
6x Rimon 14b
7X Rimon 14b

Application Timings (5x Programs):
1st Generation: 50DD, 21d, 21d
2nd Generation: 1000DD, 21d

Application Timings (Rimon, Assail or Calypso):
1st Generation: 50DD, 250DD, 21d
2nd Generation: 1000DD, 21d

Application Timings (Rimon+Assail, Assail, Assail):
1st Generation: 250DD, 21d, 21d
2nd Generation: 1200DD, 21d

Application Timings (6x Rimon):
1st Generation: 50DD, 21d, 21d
2nd Generation: 1000DD, 21d

Application Timings (7x Rimon):
1st Generation: 50DD, 14d, 14d, 14d
2nd Generation: 1000DD, 14d, 14d

Rates: Assail 70WP @ 3.4 oz, Assail 30SG @ 8 oz, Calypso @ 6 fl oz, Rimon @ 30 fl oz

Horticultural Mineral Oil: Assail with 0.5% and Rimon with 0.25%

Conducted by: H. Riedl and A. Walston, OSU/MCAREC
Codling Moth Control in Apples
Airblast Trial in Commercial Orchard
Wenatchee, WA - 1998

Conducted by: Granger et al., WSU/TFREC, Wenatchee, WA
### Spider Mite Levels (Eggs plus Mobiles) on Apples, MCAREC, Gibson Block, 2000

<table>
<thead>
<tr>
<th>Material &amp; formulation*</th>
<th>Rate form./acre</th>
<th>Spider mites /leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calypso 42%SC*</td>
<td>4 oz</td>
<td>34.4</td>
</tr>
<tr>
<td>Baythroid 20W**</td>
<td>0.11 lbs</td>
<td>90.7</td>
</tr>
<tr>
<td>Baythroid 20W**</td>
<td>0.55 lbs</td>
<td>55.7</td>
</tr>
<tr>
<td>Guthion 50WP**</td>
<td>2 lbs</td>
<td>25.7</td>
</tr>
<tr>
<td>Untreated</td>
<td>---</td>
<td>12.5</td>
</tr>
</tbody>
</table>

*6 sprays: 200 DD, 2 wks, 2 wks, 1200 DD, 2 wks, 2 wks

**4 sprays: 250 DD, 3 wks, 1250 DD, 3 wks
Do We Need to Change the Timing of CM Sprays?

- Current timing strategy leaves large gap between 2\textsuperscript{nd} and 3\textsuperscript{rd} codling moth spray.
- Egg-laying activity continuous, often peaks toward end of 1\textsuperscript{st} generation.
- Fruit is unprotected for several weeks.
- Need to close gap by increasing frequency of sprays against 1\textsuperscript{st} generation.
- Example: Imidan at 250\textdegree D, then 3 wks, 3 wks
Obliquebanded Leafroller: Biology & Control in Sweet Cherries

Timing and control with selective insecticides
Obliquebanded Leafroller on Pears
OBLR Field Trial Summary on Cherries

- **Avaunt**
  - Labeled on apples & pears (NOT cherries)
  - Class: oxadiazines
  - Toxic when ingested by insects, gradual

- **DPX E2Y45** (rynaxypyr, Altacor) 35WG
  - Class: anthranilic diamide or anthranilamide
  - MOA: uncontrolled release of calcium
  - Results: feeding cessation, lethargy, paralysis and death
  - Registration in 2008/09

- **Intrepid**

- **Success**
Cherry Trials - 2003

OBLR Trial
The Dalles, 2003

July 22 = products applied

Graph showing the number of live larvae per 3 minutes per tree over time. The x-axis represents dates from 21-Jul to 4-Aug, and the y-axis represents the number of live larvae per 3 minutes per tree, ranging from 0 to 6. The graph includes the following treatments:

- **DPX - E2Y45 35WG 1.25 oz**
- **DPX - E2Y45 35WG 2.06 oz**
- **DPX - E2Y45 35WG 3.06 oz**
- **Success 2L**
- **Intrepid + Latron B-1956**
- **Untreated control**

A vertical arrow indicates July 22, the date the products were applied.
Cherry Trials - 2005

OBLR Control
The Dalles, OR - 2005

Larvae & pupae / 5 min

- Avaunt 5 oz
- Avaunt 6 oz
- Intrepid 2L + Latron B-1956
- Untreated control

July 26 = products applied
Control Options for Cherry Fruit Fly

**Old**

Carbamates
- carbaryl

Organophosphates
- azinphosmethyl
- diazinon
- dimethoate
- malathion

Pyrethroids
- Asana

**New**

Macrocyclic lactones
- Success
- Entrust
- GF-120

Neonicotinyls
- Actara
- Provado

Pyrethroids
- Baythroid
- Warrior
San Jose Scale

Spray timing:
Delayed dormant to pink
Crawler emergence
San Jose Scale Control on Apple with Esteem
OSU-MCAREC; 2002

% Infested fruit

Untreated
Lorsban-DD
Esteem-100DD
Esteem-PF
Esteem-Pink
Esteem-DD

0 10 20 30 40 50

Rates: Esteem applied at 5 oz/A; Lorsban applied at 64 oz/A
Timing: Delayed D. = 3/22; Pink = 4/5; PF = 4/30; 100ºD from CM Biofix = 5/23

Conducted by: A. Walston & H. Riedl, OSU/MCAREC
San Jose Scale Trial on Apple
OSU-MCAREC, 2006

Crawlers per tape

- Green triangle: Assail 30SG + 1% oil @ DD
- Blue cross: Centaur 70DF + 0.25% oil @ 1st crawler
- Red square: Lorsban 4E + 1% oil @ DD
- Black circle: Untreated check

Rates: Assail 30SG @ 8 oz, Centaur 70DF @ 34.5 oz, Lorsban 4E @ 4 pts

Conducted by: H. Riedl and A. Walston, OSU/MCAREC
Spider Mites on Apples & Cherries:

- Normally under biological control
- Controlled by predatory mites
- Usually induced problem
- Pyrethroids, carbamates, neonicotinyls can cause mite build-up
Anjou Pear: Mite Trial
OSU-MCAREC, Hood River, 2005

- Acramite 50WS* 1 lb
- Acramite 75WG* 0.67 lb
- Envidor 2SC** 16 fl oz, 18 fl oz
- FujiMite 5EC*** 16 fl oz, 32 fl oz
- Kanemite 15SC 21 oz, 31 oz
- Zeal 72WDG 2 oz, 3 oz

Treatments applied on 8/30-31/05
With handgun to drip

*Silwet L-77 added 3 oz/ 100 gal, **0.5% oil added, ***0.25% oil added
Miticide Trial on Pears, 2005
OSU-MCAREC

TSSM motiles / leaf

- Acramite 50WS + Silwet L-77
- Acramite 75WG + Silwet L-77
- Envidor + HMO (0.5%) 16 fl oz
- Envidor + HMO (0.5%) 18 fl oz
- Zeal 72WDG 2 oz
- Zeal 72WDG 3 oz
- Untreated check

Miticide Trial on Pears, 2005
OSU-MCAREC

TSSM motiles / leaf

- Red: Acramite 50WS + Silwet L-77
- Blue: FujiMite 5EC + HMO (0.25%) 1 pt
- Dark Blue: FujiMite 5EC + HMO (0.25%) 2 pts
- Yellow: Kanemite 21 fl oz
- Orange: Kanemite 31 fl oz
- Black: Untreated check

Dates:
- 8/25
- 8/29
- 9/2
- 9/6
- 9/10
- 9/14
- 9/18
- 9/22
- 9/26

8/25: TSSM motiles / leaf for treated and untreated groups.
Western Flower Thrips

Egg-laying Punctures

Ring like surface blemishes
Shothole Borer Gumming on Cherry, The Dalles, Sept 2002
Redhumped caterpillar
Lacebug Damage on Sweet Cherries

The Dalles, Aug 2001
Take Home Message!

There is life after Guthion!!
Acknowledgements

A. Walston, OSU/MCAREC, Hood River
J. Brunner et al., WSU/TFREC, Wenatchee

Funding:
Agricultural Chemical Industry
Agricultural Research Foundation
Hood River Grower Shipper Association
Thank You for Your Attention!

http://oregonstate.edu/dept/mcarec/

Click on ‘Presentations’: ‘Alternative Pesticides and New Developments…..’
## New IGR Chemistries For CM Control

<table>
<thead>
<tr>
<th>Trade name</th>
<th>CM suscept. stage</th>
<th>Effectiveness against CM</th>
<th>Other pests affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimilin</td>
<td>E, L, ?</td>
<td>+ (+)</td>
<td>PP, PRM?</td>
</tr>
<tr>
<td>Rimon</td>
<td>E, L, ?</td>
<td>+++</td>
<td>PP, ?</td>
</tr>
<tr>
<td>Esteem</td>
<td>E, L, A</td>
<td>++</td>
<td>LR, TLM, PP, SJ scale, etc.</td>
</tr>
<tr>
<td>Intrepid</td>
<td>E, L, A</td>
<td>++</td>
<td>LR, other Lepidoptera</td>
</tr>
</tbody>
</table>

E = egg, L = larva, A = adult; + poor, ++ moderately effective, +++ effective
# New ‘Other’ CM Controls

<table>
<thead>
<tr>
<th>Trade name</th>
<th>CM suscept. stage</th>
<th>Effectiveness against CM</th>
<th>Other pests affected</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical Mode of Action</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HMO</td>
<td>E</td>
<td>+(+)</td>
<td>PP, TSSM, PRM, etc.</td>
</tr>
<tr>
<td>Surround</td>
<td>L, A</td>
<td>+</td>
<td>PP, etc.</td>
</tr>
<tr>
<td><strong>Microbials</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BT</td>
<td>L</td>
<td>+</td>
<td>LR, other Lepidoptera</td>
</tr>
<tr>
<td>CpGVirus</td>
<td>L</td>
<td>++(+)</td>
<td>none</td>
</tr>
</tbody>
</table>

E = egg, L = larva, A = adult; + poor, ++ moderately effective, +++ effective
## Timing of CM Sprays

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Target stage</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; generation</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt; generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPs</td>
<td>Larva</td>
<td>250°D; 3 wks</td>
<td>1,250°D; 3 wks</td>
</tr>
<tr>
<td>Carbamates</td>
<td>Larva</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pyrethroids</td>
<td>Larva</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HMO (oil)</td>
<td>Egg**</td>
<td>200°D, then every 150°D</td>
<td></td>
</tr>
<tr>
<td>Neonicotinyls</td>
<td>E* &amp; L</td>
<td>200°D; 3 wks</td>
<td>1,200°D; 3 wks</td>
</tr>
<tr>
<td>IGRs: Rimon</td>
<td>Egg*</td>
<td>75°D; 3 wks</td>
<td>1,075°D; 3 wks</td>
</tr>
<tr>
<td>IGRs: Intrepid</td>
<td>E* &amp; L</td>
<td>200°D; 3 wks</td>
<td>1,200°D; 3 wks</td>
</tr>
</tbody>
</table>

*egg laid on residue  ** topical, after egg laid