OP Alternatives in Apple Arthropod Management

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Azinphosmethyl Scheduled Phase-out Timetable

- Apples, Pears
  - 2008-09: total of 6 lb product/A
  - 2010: total of 4 lb product/A
  - 2011-12: total of 3 lb product/A

- 60-ft buffer from permanent bodies of water & occupied buildings
- Scaled PHI of 33-44 days for Pick-Your-Own, according to rate
- REI is now 14 (apples, pears) or 15 days (cherries)

- Cherries: 2008-09, 3 lb product/A; 2010-12: 1.5 lb product/A

- Peaches, Nectarines, Plums, Apricots - gone
Currently Registered Alternative Materials - OPs

- Imidan 70WS - 3-day REI on all tree fruit crops

- Lorsban 4EC - Dormant/delayed dormant use only

- Lorsban 75WDG - replaces 50WP
  - Dormant/delayed dormant use through Petal Fall
  - Effective against PC
  - Possible use for OBLR overwintered gen; maybe WAA?
  - Supplemental label (both formulations): post-bloom trunk application to apples for borer control

- Dimethoate - Voluntarily withdrawn on apples; pears remain a registered use

- Diazinon - Apples: only SJS (prebloom) or WAA in summer
  - REI now 4 days for all tree fruit crops

- Malathion - Moderate efficacy; short residual field life
Currently Registered Alternative Materials - Pyrethroids

- Most have similar spectrum of (nominal) activity: plum curculio, apple maggot, internal leps, leafminers, leafhoppers, leafrollers, TPB, aphids, pear psylla, etc.
- Asana (esfenvalerate) - industry standard
- Danitol (fenpropathrin) - also has activity on ERM
- Warrior/Proaxis/Taiga Z (lambda/gamma-cyhalothrin) - microencapsulated
- Baythroid (cyfluthrin)
- Ambush/Pounce (permethrin) - not after PF on apples
- Brigade (bifenthrin) - pears only, BUT not for pear psylla; efficacy on mites
Currently Registered Alternative Materials - “OP Replacements”, etc.

- Actara (neo-nicotinoid) - PC, LH, RAA, psylla
- Assail (neo-nicotinoid) - AM, Aphids, Int Leps, LH, RAA
- Avaunt (oxadiazine) - PC, LH, (AM, Int Leps)
- Calypso (neo-nicotinoid) - PC, AM, Int Leps, Aphids, LH, PPs, STLM
- Rimon (benzoylurea) - Int Leps, OBLR, STLM

Other Chemistries/Uses

- Agri-Mek (microbial) STLM
- B.t. - (microbial) OBLR, other leps
- Provado - (imidacloprid / neo-nicotinoid) - foliar pests
- Intrepid - (insect growth regulator) - OBLR
- Esteem - (insect growth regulator) - SJS
- Spintor - (microbial) - OBLR, STLM
- Proclaim - (microbial) OBLR, STLM
ASSAIL
(Acetamiprid) - UPI

• Neonicotinoid (same class as Provado, Actara, Calypso)
• Rapid leaf absorption
• Translaminar activity
  – Controls pests on the sprayed and unsprayed leaf surface
  – Important for insects that feed on the underside of leaves
• Interrupts insect’s nervous system
• Causes restlessness and convulsions
• Inhibits feeding; kills fairly quickly
• Low toxicity to bees; may flare mites
• REI = 12 hrs; PHI = 7 days
• Formulation: 30SG (soluble granule); 70WP is gone
ACTIVITY OF ASSAIL AGAINST KEY ORCHARD PESTS

TARGETED PEST(S)
- Oriental fruit moth
- Codling moth
- Lesser appleworm

OTHER PESTS CONTROLLED
- WALH
- Apple maggot
- European Apple Sawfly
- STLM
- Rosy Apple Aphid
- Pear Psylla
INSECT PESTS NOT CONTROLLED BY ASSAIL

Plum curculio

Obliquebanded leafroller
# Comparison of % Oriental Fruit Moth damage at different sampling times

<table>
<thead>
<tr>
<th>Material</th>
<th>Sep. 10</th>
<th>Oct. 14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diamond</td>
<td>9.4 ab</td>
<td>12.3 bc</td>
</tr>
<tr>
<td>Calypso</td>
<td>11.6 ab</td>
<td>17.3 bc</td>
</tr>
<tr>
<td>Avaunt 30WG</td>
<td>16.1 bc</td>
<td>22.6 cde</td>
</tr>
<tr>
<td>Esteem 35WP</td>
<td>31.8 d</td>
<td>44.4 fg</td>
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<tr>
<td>Intrepid 2F</td>
<td>15.7 bc</td>
<td>29.7 de</td>
</tr>
<tr>
<td>Warrior 1CS</td>
<td>8.7 ab</td>
<td>10.6 ab</td>
</tr>
<tr>
<td>Assail 70WP</td>
<td>4.0 a</td>
<td>3.5 a</td>
</tr>
<tr>
<td>Guthion 50W</td>
<td>6.1 a</td>
<td>16.3 bcd</td>
</tr>
<tr>
<td>Imidan 70W</td>
<td>8.9 ab</td>
<td>15.7 bc</td>
</tr>
<tr>
<td>Deliver</td>
<td>24.0 cd</td>
<td>35.0 ef</td>
</tr>
<tr>
<td>Untreated Control</td>
<td>49.7 e</td>
<td>59.4 g</td>
</tr>
</tbody>
</table>

Means within a column followed by the same letter are not significantly different (Fisher's Protected LSD Test, P<0.05).
Comparison of Assail and Other Insecticides Against Apple Maggot
Hudson Valley, NY, 2004
Comparison of Seasonal (PF-7C) Activity of Assail and Guthion, NY 2003
Comparison of Early Season (PF-1C) Activity of Assail and Guthion, NY 2002
CALYPSO
(Thiacloprid) - Bayer

• Neonicotinoid (same class as Provado, Actara, Assail)
• Rapid leaf absorption
• Systemic/Translaminar activity
  – Controls chewing and sucking insects
• Long residual activity (10-14 days)
• Safe to birds, bees, fish; toxic to aquatic invertebrates
• REI = 12 hrs; PHI = 30 days
• Formulation: 4F
ACTIVITY OF CALYPSO AGAINST KEY ORCHARD PESTS

TARGETED PESTS
Oriental fruit moth
Codling moth
Lesser appleworm

OTHER PESTS CONTROLLED
Plum curculio
Apple maggot
Eur. Apple Sawfly
STLM
WALH
Pear Psylla

INSECT PESTS NOT CONTROLLED BY CALYPSO

Rosy apple aphid

Obliquebanded leafroller
COMPARISON OF SEASONAL PROGRAMS OF CALYPSO & GUTHION AGAINST PC & INT. LEP. 2000-01, NY

% Damaged Fruit

- Calypso
- Guthion
- Check

Curculio 00
Curculio 01
Int. Lep. 00
Int. Lep. 01
COMPARISON OF EFFECTIVENESS OF CALYPSO & OTHER INSECTICIDES FOR APPLE MAGGOT AND PLUM CURCULIO, HV, 2002

% Damaged Fruit

Plum Curculio
Apple Maggot

Warrior 1.1 oz
Calypso 2.0 oz
Guthion 10 oz
Spintor 2.5 oz
Check

AMA Feb. 2008
Active Ingredient: Spinetoram

- New spinosyn, related to spinosad (‘next generation’)
- Translaminar activity
- Mode of action: contact and ingestion
- Affects insect nervous system, but works at a binding site not known to be shared by other insecticides
- Primary targets: OBLR, Codling Moth, Oriental Fruit Moth, Leafminers, European corn borer
- Secondary targets: Apple Maggot, Cherry Fruit Fly, Thrips, Pear Psylla (exception to sap-feeder inactivity)
- Labeled on apples & pears (7d PHI), stone fruit (1-14d PHI)
- EPA Reduced-Risk product, REI 4 hr
  - low impact on beneficial insects
  - does not flare mites or secondary pests
  - toxic to honey bees when sprayed directly, but 3-hr residues non-toxic
2006 Field Trials
Obliquebanded Leafroller Management
(H. Reissig and D. Combs)

- 3-tree handgun treatments
- Cortland commercial orchard with history of high OBLR pressure
- Heavy pyrethroid use in the past
- Three applications: June 21 (1st hatch), July 6 (50% hatch) and July 24 (100% hatch)
- New chemistries tested: Altacor (DuPont), Delegate & Spintor (Dow), and Rimon (Chemtura)
Internal Worm Control With Delegate 25WG, 2007

- Delegate 4.5 oz/A: 3.3 a
- Delegate 6 oz/A: 1.7 a
- Guthion 1.5 lb/A: 2.3 a
- Altacor 2.5 oz/A: 2.0 a
- Untreated: 49.0 b
Altacor 35WG

Active Ingredient: Rynaxypyr

- Novel anthranilic diamide insecticide
- Translaminar activity
- Primary mode of action: ingestion
- Affects insect ryanodine receptors (calcium regulation), causes paralysis
- Primary targets: Lepidoptera - OBLR, Codling Moth, Oriental Fruit Moth, European Apple Sawfly, Leafminers
- Registration anticipated on apples & pears April-May 2008, other crops to come
  - Short PHIs and REIs
- Favorable environmental profile
  - low impact on beneficial insects
  - does not flare mites or secondary pests
  - low toxicity to bees, birds, fish and mammals

AMA Feb. 2008
Active Ingredient: Flubendiamide
- Novel phthalic acid diamide insecticide
- Translaminar activity, strong rainfast characteristics
- Primary mode of action: ingestion
- Affects insect ryanodine receptors (calcium regulation), causes cessation of feeding, paralysis
- Primary targets: Lepidoptera - OBLR, Codling Moth, Oriental Fruit Moth, Leafminers
- Registration anticipated on apples & pears April-May 2008, other crops to come
  - Short PHIs and REIs
- Favorable environmental profile
  - minimal risk to beneficial insects, honey bees
Internal Lep Damage at Harvest with an Altacor Program, 2007

- Trts A, B, C: 3 Altacor sprays plus 1 Assail
- Check: 3 Calypso sprays plus 1 Assail

Trt A: 2.2 ab
Trt B: 1.3 a
Trt C: 1.0 a
Check: 3.3 b

Fruit Injury %

Altacor 2.0 oz/A
Altacor 2.5 oz/A
Altacor 3.0 oz/A
Grower Std
Movento 150SC

Active Ingredient: Spirotetramat

- Tetramic acid insecticide
- 2-way systemic activity, moves to all areas of the plant, including new shoot, leaf and root tissues
- Primary mode of action: ingestion
- Lipid biosynthesis inhibitor active against immatures; also, reduced egg-laying and offspring survival when adults treated
- Primary targets: sucking insect pests - Scales, Aphids, Pear Psylla, Mealybugs, Thrips
- Registration anticipated on apples & pears April-May 2008; - Short PHIs and REIs
- Favorable environmental profile - minimal risk to beneficial insects

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Treatments

1. Ultor 150SC 14.0 oz/A + 1.0% Oil @ Petal Fall
   Belt 480 SC @ 2C-6C

2. Ultor 150SC 14.0 oz/A + 1.0% Oil @ Petal Fall + 1C
   Belt 480 SC @ 2C-6C

3. Calypso 4F 3.0 oz/A @ Pink
   Ultor 150SC 14.0 oz/A + 1.0% Oil @ Petal Fall
   Belt 480 SC @ 2C-6C

4. Esteem 35WP 5.0 oz/A @ Pink
   Belt 480 SC @ 2C-6C

5. Guthion 50WSP 1.5 lb/A @ Petal Fall-6C

6. Untreated Check
Damage from Over-Wintering SJS

% of Fruit w/ SJS Damage

Ultor/Oil@ PF 0.3 a
Ultor/Oil@ PF+1C 2.0 ab
Calypso @ Pink, Ultor/Oil@ PF 0.3 a
Esteem @ Pink 18.3 b
Guthion PF-6C 0.7 a
Untreated 2.3 ab
Damage from SJS 1st Summer Gen

% of Fruit w/ SJS Damage

- Ultor/Oil@ PF: 1.0 ab
- Ultor/Oil@ PF+1C: 3.7 abc
- Calypso @ Pink, Ultor/Oil@ PF: 5.7 abc
- Esteem @ Pink: 17.0 bc
- Guthion PF-6C: 0.3 a
- Untreated: 17.7 c
Damage from SJS at Harvest

% of Fruit w/ SJS Damage

- Ultor/Oil@ PF
- Ultor/Oil@ PF+1C
- Calypso @ Pink, Ultor/Oil@ PF
- Esteem @ Pink
- Guthion PF-6C
- Untreated

Values with different letters indicate significant differences.
Where is Ultor on the ‘Scale Scale’?

- Heavy SJS pressure in test block: 2006 - trace levels, 2007 - uniform
- Ultor applied at PF or PF+1C, both with oil, provided excellent season long SJS control
- The addition of Calypso at pink did not improve efficacy against SJS
- No significant difference found between the 1 vs. 2 application programs on any of the sample dates
- Single applications of Ultor at PF out-performed the single application of Esteem at pink
- Damage counts are cumulative from previous generations; fruit drop and thinning accountable for #’s decreasing at harvest
- 7 applications of Guthion not typical
- No further applications made specifically against SJS for remainder of season
Ultor 150SC Against Green Apple Aphid

- Sporadic GAA infestation in test block over last several years; in 2007, uniformly high pressure throughout orchard

- GAA counted and rated on 29 Jun
  1 - % Terminal Infestation
  2 - Infestation Rating (# of GAA/terminal)

- Rating Key:
  0.0 = 0/terminal
  1.0 - 1.9 = 1-25/terminal
  2.0 - 2.9 = 25-50/terminal
  3.0 - 3.9 = 50-75/terminal
  4.0 - 4.9 = 75-100/terminal
  5.0 = 100+/terminal
Green Apple Aphid Infestation and Rating

<table>
<thead>
<tr>
<th>Treatment</th>
<th>% GAA Infestation</th>
<th>Infestation Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultor/Oil@ PF</td>
<td>47.3 bc</td>
<td>-</td>
</tr>
<tr>
<td>Ultor/Oil@ PF+1C</td>
<td>6.0 a</td>
<td>-</td>
</tr>
<tr>
<td>Calypso @ Pink, Ultor/Oil@ PF</td>
<td>1.3 a</td>
<td>-</td>
</tr>
<tr>
<td>Esteem @ Pink</td>
<td>46.7ab</td>
<td>4.3 b</td>
</tr>
<tr>
<td>Guthion PF-6C</td>
<td>84.0 cd</td>
<td>4.0 b</td>
</tr>
<tr>
<td>Untreated</td>
<td>83.3 bcd</td>
<td>4.7 b</td>
</tr>
</tbody>
</table>
Ultor 150SC Against Green Apple Aphid

• Single applications of Ultor+Oil reduced GAA colonies by half from the number found in the Esteem, Guthion and UTC plots

• 2 applications of Ultor+Oil had even better control and almost completely kept colonies from forming

• Infestations in all Ultor plots were below 25 aphids/colony while the others were 75-100 aphids/colony

• No other materials were applied for GAA control
Potential Seasonal Programs Using Reduced-Risk or OP-Replacement Products

- **Rosy Apple Aphid**: Actara, Assail, Calypso, (Movento)
  **Leafminers**: Actara, Altacor, Assail, Calypso

- **Plum Curculio**: Actara, Avaunt, Calypso
  **Internal Leps**: Assail, Avaunt, Calypso, Delegate, Intrepid, Rimon, (Altacor, Belt)

- **OBLR**: B.t., Delegate, Intrepid, Proclaim, Rimon, (Altacor, Belt)

- **European Apple Sawfly**: Actara, Assail, Avaunt, Calypso, (Altacor)

- **Leafminers, Leafhoppers, Aphids**: Assail, Avaunt, Calypso, Provado, (Movento)

- **Internal Leps**: same as Petal Fall

- **OBLR**: same as Petal Fall

- **Apple Maggot**: Assail, Calypso, Delegate

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