Codling moth management in Washington pear

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Pear pest management

• Key pests
  ▪ Pear psylla
  ▪ Spider mites
  ▪ Codling moth
  ▪ Pear rust mite
  ▪ Others
    • Leafrollers
    • Grape mealybug
    • True bugs

Codling moth is relatively low
Pear IPM

• Many tools
  - For many pests
  - Most new tools control more than one pest

• Problem of plenty
  - IPM system is:
    • More complex
    • More considerations
    • More decisions
    • (more cost?)
Hard or soft?

• Mating disruption
  ▪ Is an important option
  ▪ Esp. in soft programs

• Chemical management
  ▪ Remains most important
  ▪ Even in soft programs

• Biocontrol is a good goal
  ▪ But tough to rely on

• Integrate
  ▪ Use the best of both chemical and biological controls
CM Biology

• Overwinter as mature larvae
• Pupate in ground or on-tree
• Susceptible to predators, nematodes
CM Biology

• Sting-first instar larvae chews through skin and dies
• Entry- larvae successfully colonizes fruit

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CM Sampling

• **Information is necessary**
  - Product choice based on pressure
  - New insecticides have specific timing requirements

• **Traps, pheromone lures**
  - Reliable for measuring relative density
  - Important for understanding DD prediction

• **Visual inspection**
  - Necessary for detecting hot spots, immigration
Degree-Day Models

- Predict events that are difficult to observe
  - CM egg deposition
- Necessary to optimize timing
- Must be used in conjunction with traps
  - Trap data takes precedence over mathematical models
Why use traps?

Atypical flight activity/Immigration

traps detect this

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3rd Generation/Late Flight

*DD models predict this*

Unprotected

10 Aug

21 d residual

Predicted hatch

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CM Thresholds

• Most difficult decision in IPM—“When to Spray”

• Trap catch affected by
  ▪ Mating disruption products
  ▪ Lure choice
  ▪ Trap maintenance
  ▪ Trap placement

• Your experience is most important!
  ▪ Use your past history of damage
    • Hot spots, borders, etc.
  ▪ Look for damage when walking through
    • Check thousands of fruit
Best Chance for Success

Interrupt life cycle at all stages

- Adulticides or Pheromones
- Nematodes
- Parasites
- Predators
- Virus

Interrupt the life cycle

- Ovicides or Larvicides
- CM protected in fruit - virus and delayed mortality

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Codling moth control

• Chemical control is the key

• Mating disruption is the base

• Economics are important
  ▪ Population pressure lower in pear
  ▪ Fewer applications often necessary in pear
Materials for codling moth

• **OPs** - the standard
  - Guthion and Imidan
  - OPs = problems

• **IGRs**
  - Intrepid
  - Esteem, Dimilin
  - Rimon (Novaluron)
    - First year on apple
    - Not on pear yet

• **Neonicotinyls**
Neonicotinyls

- Less problems than OPs
- Assail
  - Several years now
- Calypso
  - New last year
- Clutch
  - Coming in the future

  - Other neonicotinyls for pear psylla and GMB only
    - Provado
    - Actara
## Neonicotinyl - bioassays

### Bioassay

<table>
<thead>
<tr>
<th>Method</th>
<th>Field Rate</th>
<th>$\text{LC}_{50}$</th>
<th>Toxicity Ratio</th>
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High toxicity ratio = High acute toxicity (works better)
# Neonicotinyl - bioassays

## Assail Bioassay – ovicide

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<td>44.1</td>
<td>34.9$^b$</td>
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<td>44.1</td>
<td>0.50$^a$</td>
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## Calypso Bioassay – ovicide

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<td>Residual</td>
<td>75.0</td>
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## Clutch Bioassay – ovicide

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High toxicity ratio = High acute toxicity (works better)

Dunley - Pear Day, Jan. 20, 2005
Assail - field trials 2004

Apple

Lower rate at 14d interval is an effective alternative

Pear

No difference between formulations relative to CM efficacy

Dunley - Pear Day, Jan. 20, 2005
Calypso - field trials 2004

% CM Injured Fruit

Apple

- Calypso 250dd, +21
- Guthion 1250dd, +21

Replace a Guthion application with neonic when worker safety is important.

Low end of rate range can be effective on pear in low-mod pressure.

95% reduction

Dunley - Pear Day, Jan. 20, 2005
Clutch - field trial 2004

Clutch has not provided adequate CM control in trials conducted over the past two seasons.

Larvicidal activity in bioassays still gives some hope.

Avg. 28-48% reduction in % CM injured fruit.
# Neonicotinyl - bioassays

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High toxicity ratio = High acute toxicity

Dunley - Pear Day, Jan. 20, 2005
Diamond/Rimon - field trials 2004

**Apple**

No difference between formulations relative to CM efficacy

**Pear**

No difference between rates relative to CM efficacy

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Rimon - Fruit Marking on D’Anjou

Rimon 0.83EC applied at 2 X the suggested use rate (80 fl oz/a) marked fruit on developing D’Anjou pears

More research will be necessary to determine the significance of fruit marking noted in 2004 trials

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Rimon

Rimon kills CM eggs laid on top of residues – oil kills eggs topically – Assail kills eggs topically and kills CM larvae

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Codling Moth Management:
NO-OP Tank mixes

1st generation

April  May  June

DD from biofix 0 100 300 500 700 900

adult flight

eggs laid

oil

eggs hatch

Tank mixes of different modes

Dunley - Pear Day, Jan. 20, 2005
Codling Moth Management: NO-OP Tank mixes

1st generation

April May June

DD from biofix 0 100 300 500 700 900

adult flight

eggs laid

oil

eggs hatch

Larvicide + ovicidal Activity

Assail + Rimon

Tank mixes of different modes

Dunley - Pear Day, Jan. 20, 2005
Codling Moth Management: NO-OP Tank mixes

1st generation

- Eggs laid
- Eggs hatch
- Adult flight
- Assail + Rimon
- Residual ovicidal Activity

Tank mixes of different modes

DD from biofix

April 0 100 300 500 700 900 May June

Dunley - Pear Day, Jan. 20, 2005
NO-OP Tank Mix Trials - Apple

- **Oil (1%)** @ 200/1200dd
- **Neonic + IGR** @ 350/1350dd

85-90% reduction

Same timing

No tank-mix

No significant difference

85-90% reduction

Tank-mix

6 apps

4 apps

Airblast application
The tank-mix program performed at least as good as programs where the materials were applied separately.
Resistance management

• Do not use the same class of product against more than one generation.

• Use mating disruption to reduce use of new insecticides.

• Monitor orchards and only apply insecticides when necessary.
Why resistance management?

- Resistance is in Washington
Why resistance management?

• Resistance is in Washington
• Cross-resistance is there for many chemicals
  ▪ Guthion
  ▪ Intrepid
  ▪ Neonicotinyls?
    • Probably
The Peshastin Ck. Areawide Project

• The Peshastin Creek Growers Association
  ▪ Association of local growers and fieldmen

• Pest Management Program
  ▪ Based on Organic insect management practices
    • Areawide techniques to control Pear psylla and Codling moth
    • Reduce non-selective pesticide use
    • Increase potential migration of beneficial insects
Areawide Organic – Codling moth

- Population was greatly reduced
  - Following scare of spring 2003

![Codling moth flight graph]

Dunley – Pear Day, Jan. 20, 2005
Areawide Organic – codling moth damage

• Damage kept very low
  ▪ 2 locations in 2003 raised the means

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<tbody>
<tr>
<td>Conv</td>
<td>0.54%</td>
<td>0.01%</td>
</tr>
<tr>
<td>Org</td>
<td>0.73%</td>
<td>0.10%</td>
</tr>
<tr>
<td>Soft</td>
<td>0.01%</td>
<td>0.03%</td>
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Cumulative moth catch per generation

% CM infested fruit

Dunley – Pear Day, Jan. 20, 2005
Benefits of the new materials?

- **Worker safety issues**
  - Eliminate cholinesterase testing
- **Worker management**
  - Re-entry periods short (4-12 hours)
- **Environment**
  - Conservation of bio-control agents
  - Avoid stream buffer zone issues
  - No or negligible effects of wildlife
- **Prepare for a NO organophosphate future**