Organic Codling Moth Management in Washington State and the World

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Organic Production Around the World

Hectares organic apples

USA
Italy
Turkey
Argentina
France
UK
Chile
The Beast

• What makes it so hard to control:
  – Eggs laid individually on or near fruit
  – Larvae feed inside fruit
  – Zero tolerance for worm-infested fruit
  – Populations can grow 10-fold between generations
  – Moths are highly mobile
Achieving an Organic Balance

Organic growers have learned to be tolerant of some pest damage.

Organic growers rely more heavily on tactics which effectively control the direct pests and maintain adequate biological control of secondary pests.
What we did organically in 1990 that we no longer do …

• Spray ‘non-profit home-grown’ virus
• Spray grounded bark from a tropical tree
• Spray diatomaceous earth
• Release *Trichogramma* wasps
• *Give up!*
Unfair International Practices

• No CM in Brazilian orchards

SIT in British Columbia

BUT, we don’t have Summer rains, OFM, apple maggot, plum curculio
Around the World

- Exclusion cages (Alt’carpo) developed in southern France in 2007.
- Justified under high pest pressure, virus resistance, and by only adding walls to existing hail netting.

Covering full plot  
Covering single rows
Outstanding Results To Date

2006 trials

2009 Studies:
✓ Tested in 41 conv., integrated, and organic orchards.
✓ Only 12% of orchards had any CM injury, < 0.5%.
✓ Set up date is important.
✓ Mesh size is a factor.
✓ Impact on other pests and NE.
The Organic ‘Wheel of Fortune’

- 1st Location of the orchard.
- 2nd Not allowing the problem to start.
- 3rd Maintaining vigilance.
Tools in the Tool Box

Physical
Cultural
Toxicological
Behavioral
Avoid Reinfestation

Bin management

Removed orchards

Infested orchards

Dirty conventional orchards are an organic growers worst nightmare!
Reduce OW Larvae

- **Modernizing**: younger trees have fewer suitable diapausing sites.
- **Banding trees** (also good monitoring tool)
- **Removing props and bins**
- **Spraying nematodes** (moisture and temperature are keys)
- **Praying for woodpeckers and weather**
Reduce Eggs

✓ **Delay mating with sex pheromones:** Older females lay fewer viable eggs.

✓ **Suffocate with oil:** Helpful for CM and a number of other pest problems, such as mites, scale, leafhoppers, and aphids.

✓ **Wash off with overhead watering and rainfall:**

✓ **Pray for weather:** Cool spring weather!
Kill Neonates

• **Granulosis virus**
  – Expensive, deactivated by sunlight, slow killing allows stings, resistance in Europe.
  – Effective population reduction, vertical transmission, increased OW mortality.
  – Cut rates, spray more frequently, and add oil.

• **Bt (var aizawai used in Argentina, Turkey)**

• **Entrust**
  – Effective but can disrupt biological control. Limited amount allowed per season (9 oz) and not allowed on imports by some countries, i.e. Germany, UK.

• **Removing injured fruits**
Kaolin

Overall Effect: **Mildly Suppressive**

- Disrupts adult flight into border-treated orchard (Jones)
- Disrupts oviposition on treated surfaces (Knight)
- Disrupts larval orientation on treated surfaces (Unruh)
Messing w’ the Moths

- Mating disruption
- Mass trapping: (Spain: 60 bottles per acre w’ sugar, cinnamon, clove, and fruit juice)
- Making a barrier
  - Kaolin
  - Border insecticide sprays
CM-MD

75% of all acreage and ca. 95% of Organic

• Hand-applied dispensers
  (500 – 1,000 / ha)

• Aerosol puffers
  (1 per 0.4 – 0.8 ha)

• Sprayables not allowed

• Dual dispensers for leafrollers and CM and OFM and CM are also available.
Understanding the *Sexual* Behavior of the Beast

- Pupae are aggregated.
- Males emerge on average earlier.
- Females can mate first night.
- Males can mate more than once.

**Under MD**

- Moths get mated
- Delay of mating occurs
- Reduction in multiple mating
- Can’t Stop Supermales
Developed I.-H.E.L.P w’ PUFFERS

Internal grid of puffers with border treated with dispensers

Level of Disruption
100 90 75 50 25 0

Upwind edge                     Center                     Downwind edge
Developed Meso-Dispensers (20 – 40 / acre)

The Pheromone Mop

Clean Up Your Orchard With

Potential Source of Moths

Idealized 40 Acre Plot
Developing CideTrak® CM COMBO
Shuts down Virgin Female Traps BEST!

Proportion female-baited traps catching male

2006 - 2010

Untreated | Isomate | Cidetrak CM | Combo
---|---|---|---
1st Gen. | 2nd Gen.

*Legend: a, b, c represent statistically significant differences.*
Monitoring is a Key
Organic growers need the best information about pest seasonality and numbers

Spray over there, I see a moth

- Combo lure
- Pear ester (Combo) plus acetic acid
Adding Acetic Acid Improves Monitoring of CM

![Graph showing moth catch per week for males and females in 2009 and 2010. The graph compares moth catch in three different settings: Pear ester + AA, Combo, and Combo + AA.](image-url)
Site-Specific Monitoring and Management of Codling Moth

- **Subdivide orchard** *(spray tank size)*
- **Increase monitoring** *(more traps)*
- **Use action thresholds** *(1 female and variable # male moths)*

7 ha organic pear
MD: Puffers
Organic pears

48% savings

$ per acre

Monitoring  Labor & equipment  Insecticides

Standard 2  Precision 2
A Precision Approach in Apples 2010

Low pest pressure, large $$ savings

High pest pressure, small $$ savings
Consider the Impact of CM Management on

• Other pests
• Natural enemies

- Adding oil to sprays can help for other pests.
- Surround can be disruptive of mites, SJS, leafminers
- Entrust can disrupt BC of aphids.
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