Organic Codling Moth Management in Washington State and the World

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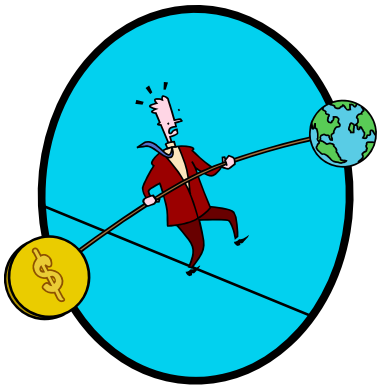
Organic Production Around the World

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

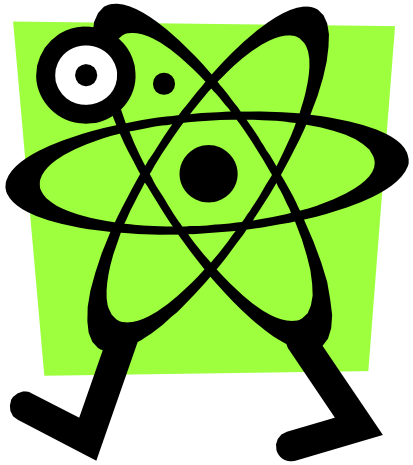
What we did organically in 1990 that we no longer do …

- 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

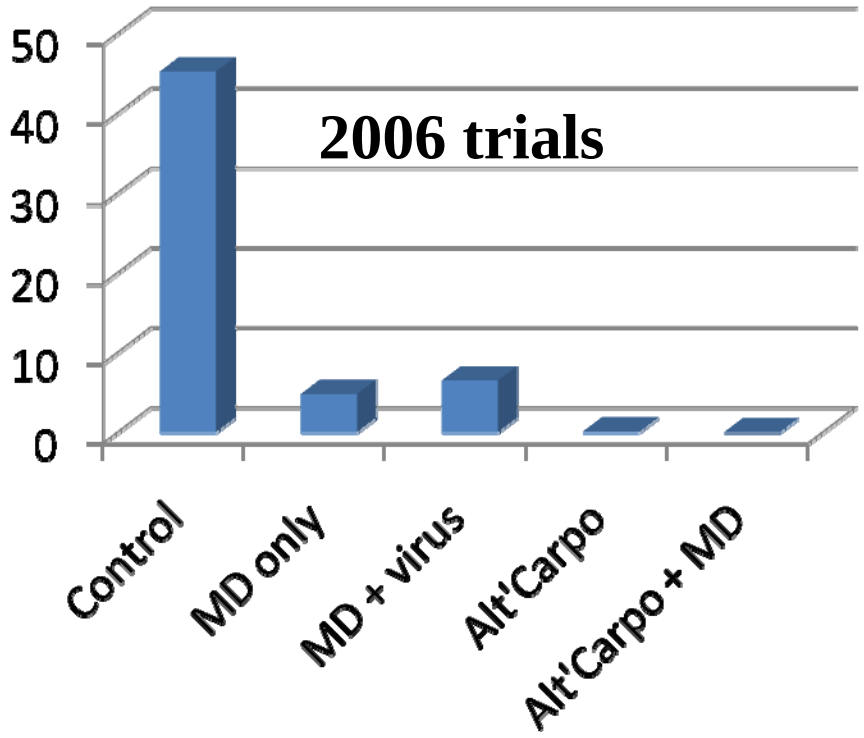
Around the World

- 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



2009 Studies:

✓Tested in 41 conv., integrated,

✓and organic orchards.

✓Only 12% of orchards had any CM injury, < 0.5%.

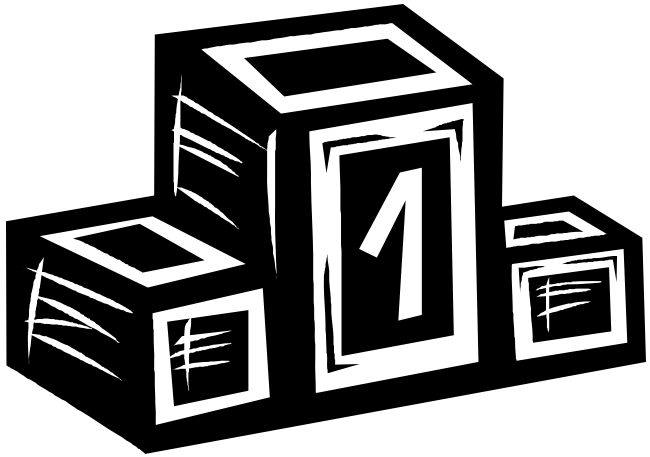
✓**Set up date is important.**

✓**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

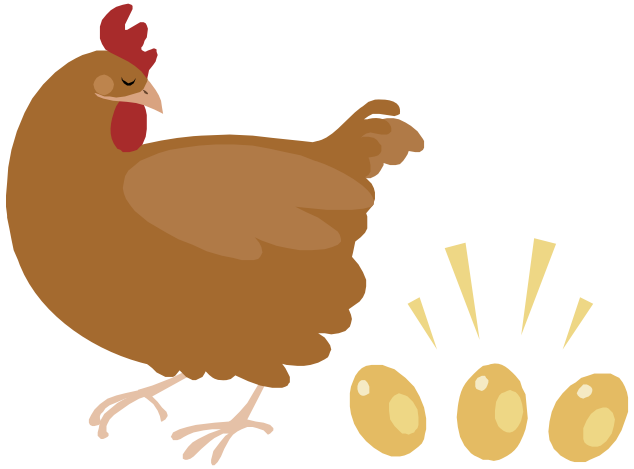
Infested orchards

*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



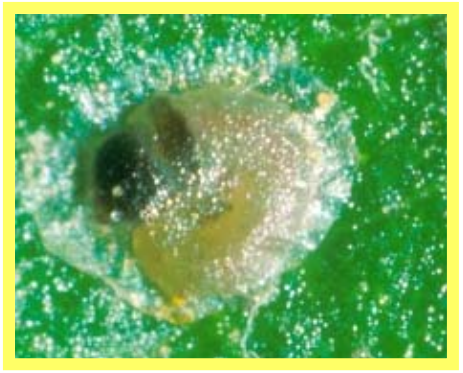
✓**Delay mating with sex pheromones**: Older females lay fewer viable eggs.

✓**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

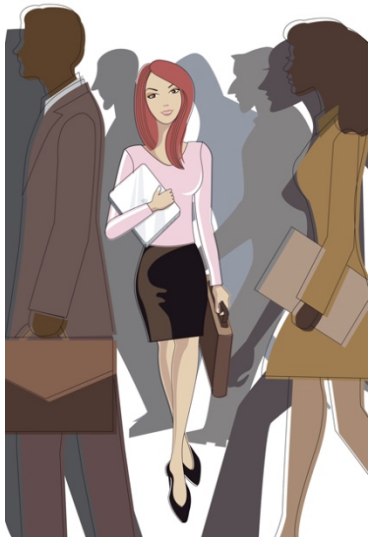
  (1 per 0.4 – 0.8 ha)

- 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.



<u>Under MD</u>

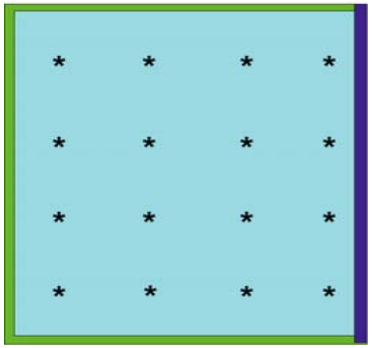
Moths get mated

Delay of mating occurs

Reduction in multiple mating

Can’t Stop Supermales

Developed I.-H.E.L.P w' PUFFERS

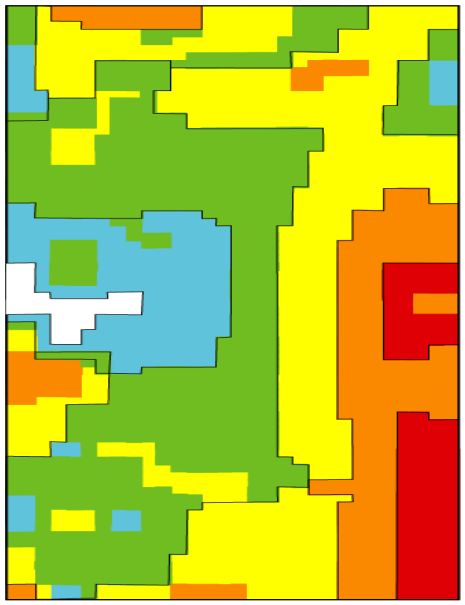


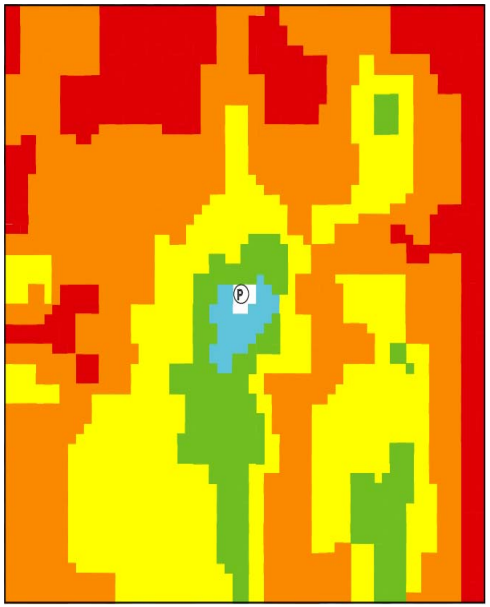
Internal grid of puffers with border treated with dispensers

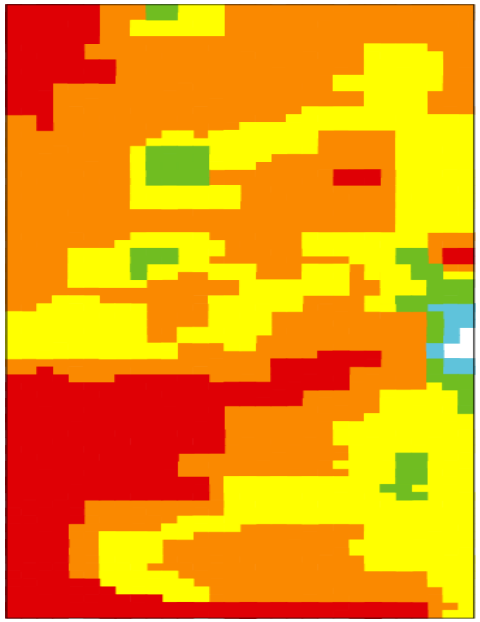
Level of Disruption

100 90 75 50 25 0

Wind



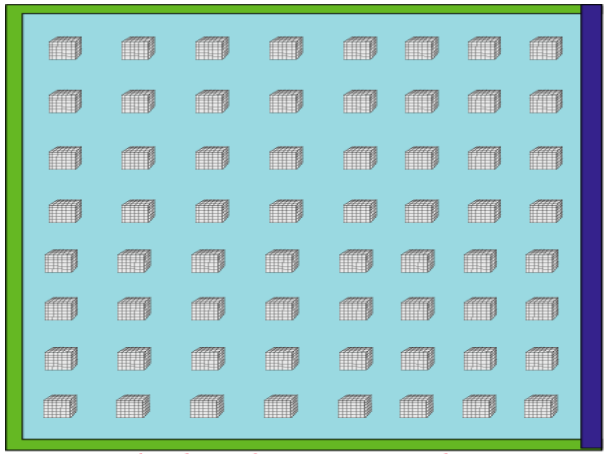




Wind

Upwind edge **Center** **Downwind edge**

Developed Meso-Dispensers
(20 – 40 / acre)

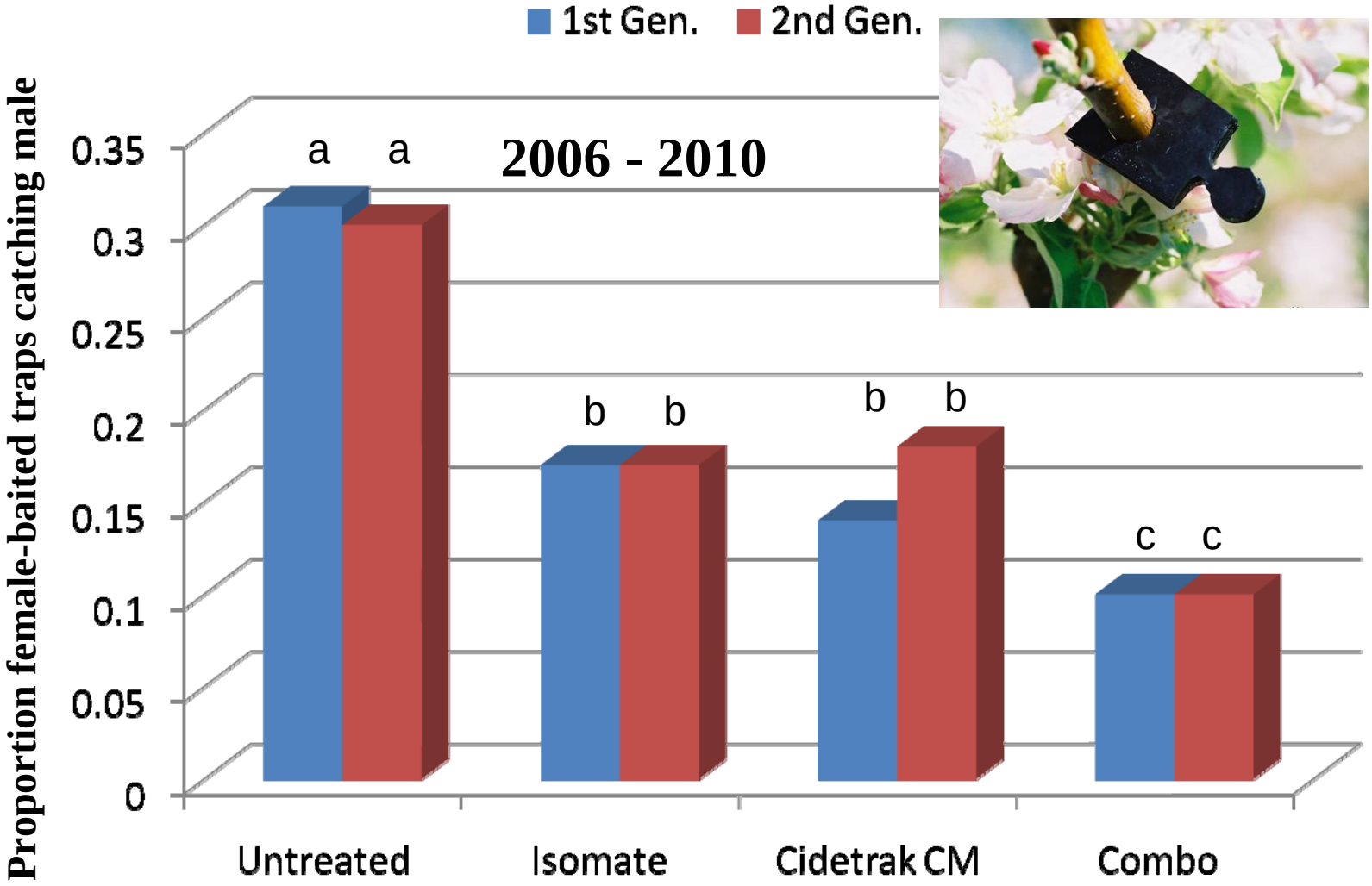


Idealized 40 Acre Plot

The Pheromone Mop

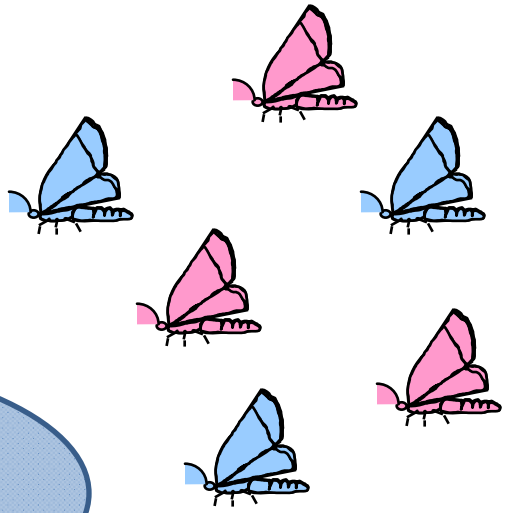
Developing CideTrak® CM COMBO

*Shuts down Virgin Female Traps **BEST!***



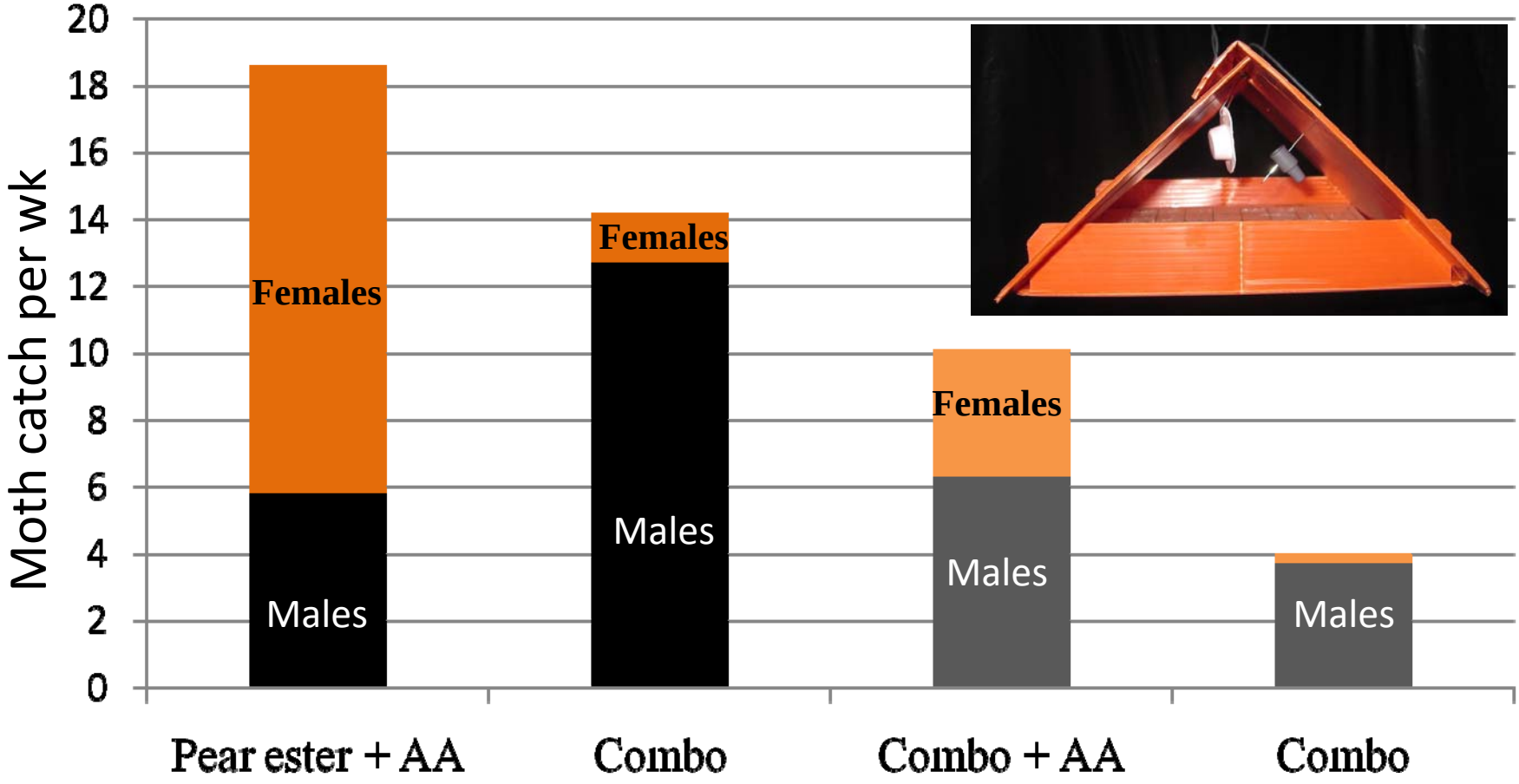
Monitoring is a Key

Organic growers need the ***best*** information about pest seasonality and numbers

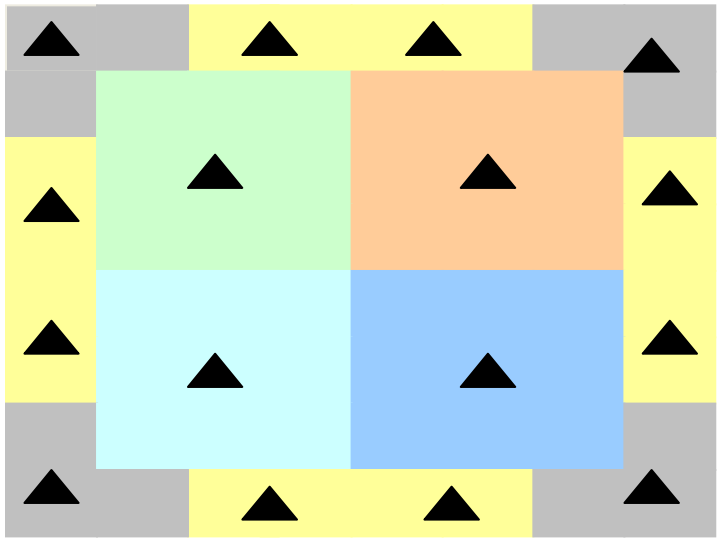


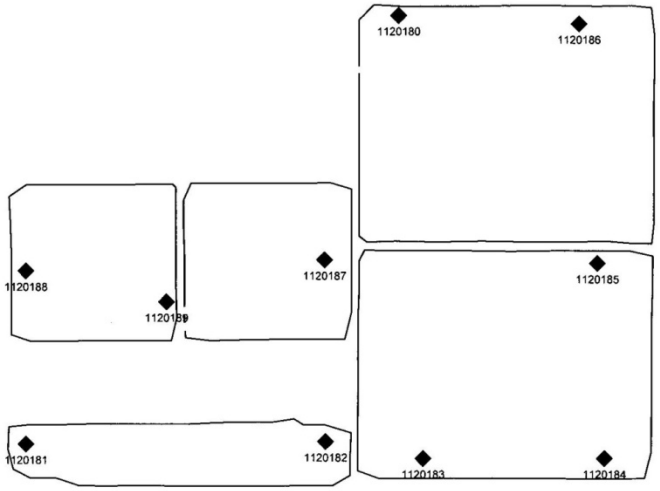
- Combo lure
- Pear ester (Combo) plus acetic acid

Adding Acetic Acid Improves Monitoring of CM



Site-Specific Monitoring and Management of Codling Moth

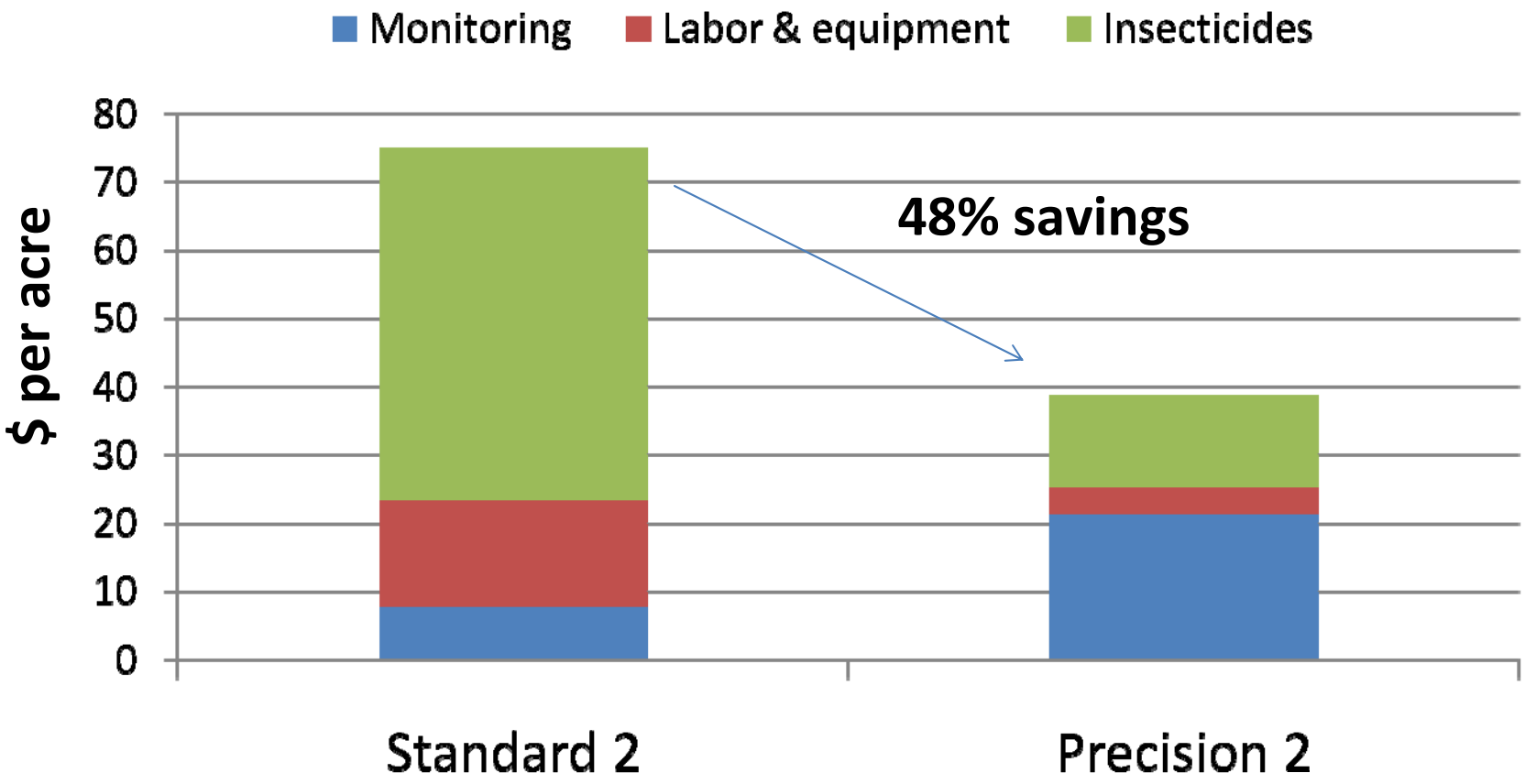




7 ha organic pear
MD: Puffers

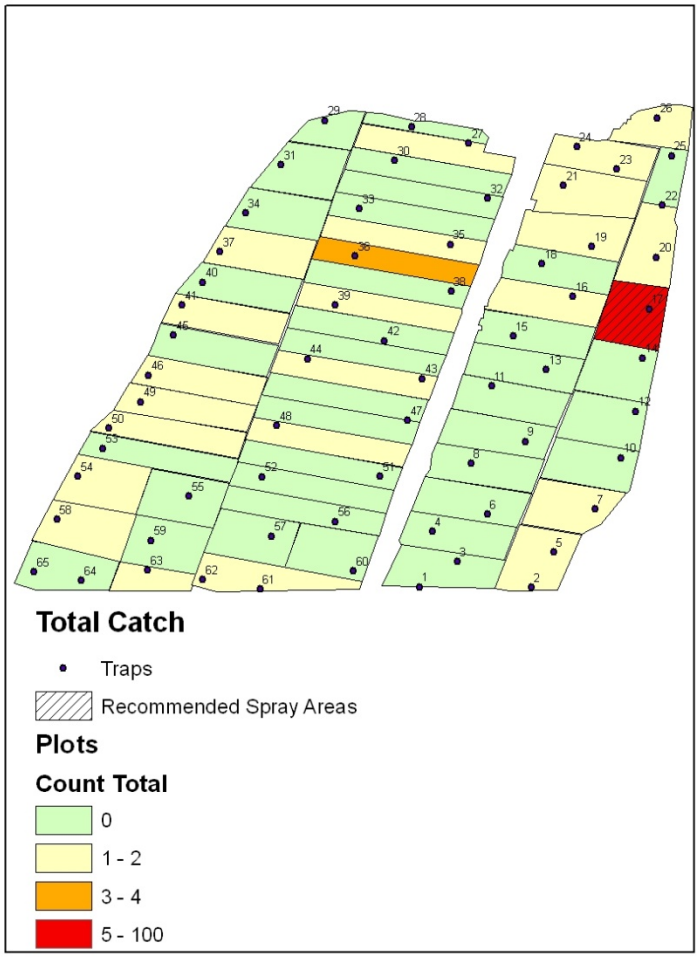
- ***Subdivide orchard*** *(spray tank size)*
- ***Increase monitoring*** *(more traps)*
- ***Use action thresholds*** *(1 female and variable # male moths)*

Organic pears

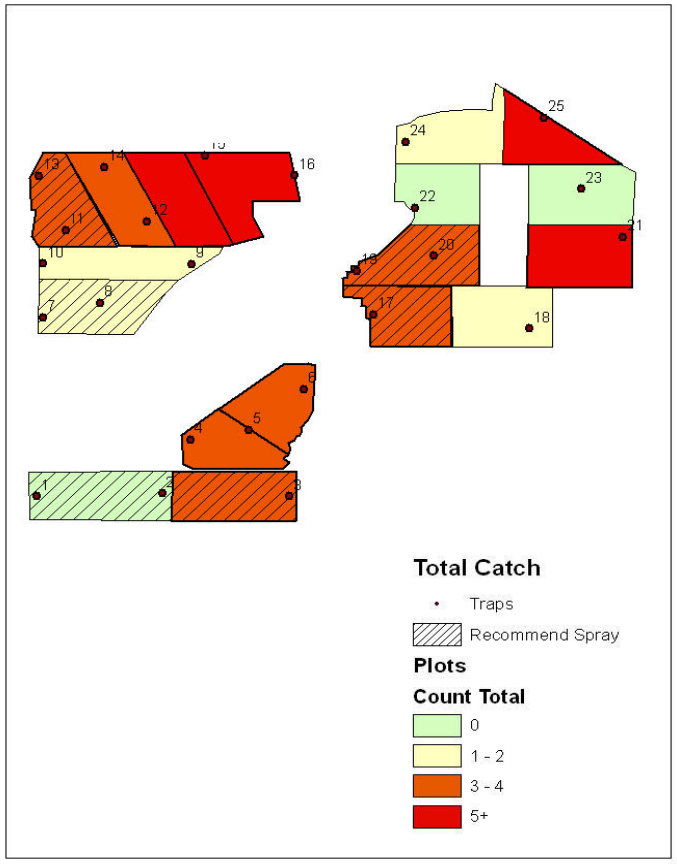


A Precision Approach in Apples 2010

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 .

Eduardo Fuentes and Esteban Basoalto, **Chile**
Liliana Cichon, **Argentina**
Aldalecio Kovaleski, **Brazil**
Claudio Ioratti, and Edison Pasqualini, **Italy**
Jesus Avilla, **Spain**
Benoit Sauphanor, **France**
Hristina Kutinkova, **Bulgaria**
Miklos Toth, **Hungary**
Orkun Kovanci, **Turkey**
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