Updates on Codling Moth Mating Disruption

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Mating Disruption
A proven technology
• So what’s new?

• Aerosols
  - Reduced rates
  - Reduced emission frequency
  - More economical

• Medium-density meso emitters
  - Suitable for smaller blocks
Reduced Rate Aerosols

- 100% load vs. 50% load vs. grower standard (GS)
  - 15 minute intervals
  - 12 hours (5pm – 5am)

- Dispenser density – 1 per 2 acres

- 8 orchards (average treatment plot size 25 A)

- 2 products
  - Suterra CheckMate® Puffer® (4 orchards)
  - Pacific Biocontrol Isomate® Mist (4 orchards)

- Evaluated:
  - Trap catches
  - Mid-season damage (July canopy counts)
  - Harvest damage
Reduced Rate Aerosols – Trap Catches

**2012 Walnuts: Oakdale (W)**
Codling Moth Capture in Combo-Baited Traps

- Grower Standard
- 50%
- 100%

**2012 Walnuts: Oakdale (W)**
Codling Moth Capture in 1x-Baited Traps

- Grower Standard
- 50%
- 100%
Reduced Rate Aerosols – Trap Catches

2012 Walnuts: Reduced Rate Aerosol Emitter Trial
Season Total CM Capture in COMBO -Baited Traps

- Site / Treatment
  - Pacific Biocontrol Mister
  - Glenn
  - West Sacramento
  - Oakdale
  - Butte
  - Lockeford
  - Average

- Treatments
  - GS
  - 100%
  - 50%

- Average Total CM Per Trap

Values range from 0 to 1500.
### Season Total CM Capture and Percent Shutdown for 1X Traps

<table>
<thead>
<tr>
<th>Site / Treatment</th>
<th>Average Total CM Per Trap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oakdale West S</td>
<td>99.7% 100% GS</td>
</tr>
<tr>
<td>Riverbank S</td>
<td>100% 99.8% GS</td>
</tr>
<tr>
<td>West Sacramento P</td>
<td>NA</td>
</tr>
<tr>
<td>Oakdale East P</td>
<td>100% 100% GS</td>
</tr>
<tr>
<td>Glenn P</td>
<td>86.5% 96.9% GS</td>
</tr>
<tr>
<td>Butte S</td>
<td>100% 100% GS</td>
</tr>
<tr>
<td>Farmington P</td>
<td>100% 100% GS</td>
</tr>
<tr>
<td>Lockeford S</td>
<td>100% 100% GS</td>
</tr>
<tr>
<td>Average</td>
<td>99.9% 99.9% GS</td>
</tr>
</tbody>
</table>

S = Suterra CheckMate® Puffer®

P = Pacific Biocontrol Isomate® Mist
Reduced Rate Aerosols – Canopy Counts

2012 Walnuts: Reduced Rate Aerosol Emitters
Codling Moth Damage in Canopy Samples

- Lockeford
  - 100%: 0.1%
  - 50%: 0.0%
- Sutter Puffer
  - Butte: 0.0%
  - Riverbank
    - 100%: 0.1%
    - 50%: 0.3%
    - 0.5%
- Oakdale
  - West
    - 100%: 1.3%
    - 50%: 0.3%
  - East
    - 100%: 0.1%
    - 50%: 0.0%
- Pacific Biocontrol Mister
  - Farmington: 0.0%
  - Glenn: 0.0%
  - Sacramento: 0.0%
  - Oakdale
    - West: 0.0%
    - East: 0.0%

Percent Damage
2012 Walnuts: Reduced Rate Aerosol Emitters
Average Codling Moth Damage at Harvest

Percent Nut Damage (±SE)

Grower Standard (GS) 50% + GS 100% + GS

Treatment
4 Sites, 2 in Butte County, 2 in San Joaquin County

2 CHANDLER (Butte)
2 VINA (San Joaquin)

22-25 A treatment plots

5 treatments, replicated across sites:
“Grower Standard”
GS + 50% load, 7 hr ON
GS + 50% load, 12 hr ON
GS + 100% load, 12 hr ON
UNTREATED (1-2 acres)

Suterra Puffers & Isomate MIST dispensers @ 1 per 2 acres

25-30 acre plots

Orange Pherocon wing traps
6 w/ L2 lure
2 w/ Trece CM-DA Combo lure

In-season & harvest damage

Grant et al. 2013
Reduced Emission Frequency – Trap Catches

San Joaquin County Site P – VINA

San Joaquin County Site T - Vina

Butte County Site B15 - Chandler

Butte County Site B1 - Chandler
Reduced Emission Frequency – Trap Catches

Total seasonal trap capture

- **L2**
- **COMBO**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Moths/trap</th>
</tr>
</thead>
<tbody>
<tr>
<td>GS</td>
<td>a</td>
</tr>
<tr>
<td>50% / 7 hr</td>
<td>b</td>
</tr>
<tr>
<td>50% / 12 hr</td>
<td>b</td>
</tr>
<tr>
<td>100% / 12 hr</td>
<td>b</td>
</tr>
</tbody>
</table>

Note: Moths/trap values are approximate and subject to error based on the error bars.
Sterile male moth releases at San Joaquin County sites confirm suppression of native field captures

3200 moths released per plot July 10, 18, and Aug. 18
Recapture after 7 days

% Recapture of sterile males in L2 traps, average of 3 releases

- Site P
- Site T

### Graph:

- **Avg. % Recapture, L2 traps**
- **% Recapture of sterile males in L2 traps, average of 3 releases**
- **Grower STD**
- **50% @12**
- **50% @7**
- **100% @ 12 hr**
Reduced Emission Frequency – Damage

Mid-season Canopy Counts

- GS
- 50% / 7 hr
- 50% / 12 hr
- 100% / 12 hr

Harvest

- 50% / 12 hr
- 100% / 12 hr
- Untreated

% CM damage

600 nuts

800 nuts

GS

0.06

0.05

0.38

0.40
• Effective suppression at reduced loads & shorter operating times = more economical options 😊
Medium-density Meso Emitters – 2012

- 5 sites (San Joaquin & Stanislaus Co.)
  - 5-8A treatment plots
- Pacific Biocontrol Isomate® CM Ring (20/A)
- Trece CideTrak® CM (20/A)
- Trece CideTrak® CMDA high & low rate (20/A)
- Grower standard

Pacific BioControl

Trece

Grant et al. 2012 – Walnut Research Reports
Meso Emitters – Female Mating Status 2012

The graph shows the proportion of CM caught under different conditions and mating statuses. The x-axis represents various conditions: No pheromone, PBC Ring, Trece CM, Trece CMDA High rate, and Trece CMDA Low rate. The y-axis represents the proportion of CM caught, ranging from 0.0 to 0.8. Different mating statuses are indicated by different symbols: Virgin, 1-Mated, 2-Mated, and 3-Mated. The graph includes error bars indicating variability.
Medium-density Meso Emitters – 2013

- 4 sites (Butte City & Stockton)
  - 8-10A treatment plots
- Pacific Biocontrol Isomate® CM Ring (40/A)
- Trece CideTrak® CMDA high & low rate (20/A)
- Grower standard

![Total seasonal trap capture, all sites diagram]

ANOVA P
L2 = 0.011
3-WAY = 0.0002

Moths/trap

GS | RING | TRECE High | TRECE Low
---|------|------------|------------
200 | 50   | 30         | 20         
150 | 60   | 40         | 20         
100 | 70   | 50         | 10         
50  | 80   | 70         | 50         
0   | 90   | 60         | 30         

L2 | 3-Way
- 3 sites (San Joaquin & Stanislaus Co.)
- Trece CideTrak® CMDA high rate (20/A)
- Grower standard
Meso Emitters – Female Mating Status 2014

Blue bars are Grower standard plots at the same three sites

Green bars are meso plots at three sites

Virgin

Single

Multiple

Legend:
- GS BC-S
- GS BC-N
- GS - St
- Meso BC-S
- Meso BC-N
- Meso - St
Medium-density Meso Emitters

- Effective trap catch suppression and multiple mating reduction
- An option for smaller orchards
Codling Moth Mating Disruption – Why?

- Flexibility in spray programs targeting other pests
  - Timing for each pest more critical with increasingly selective pesticides

- Good early CM control can reduce navel orangeworm damage
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