Goal: determine whether the popular mating disruption products on the market are lasting season-long in Utah
Mating Disruption

A
Normal mate location, where the female releases pheromone and the male flies towards the source.

B
In mating disruption, pheromone is released from dispensers that act as false sources, or pheromone is released at such a high rate that the male is disoriented or unable to detect the plume of the calling female.
Potential Problems

- High temperatures and UV exposure contribute to:
  - conversion of codlemone pheromone to other chemicals (isomerization)
  - weathering (degradation) of membrane material

- Ideally, dispensers should release enough pheromone consistently over the codling moths’ 2-3 generational life span (approximately 140-150 days) without pheromone depletion or dispenser degradation.
Application rates and cost/acre of codling moth mating disruption dispensers used in this study.

<table>
<thead>
<tr>
<th>Dispenser</th>
<th>Rate</th>
<th>Cost/ acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cidetrak CM</td>
<td>400/acre</td>
<td>$110 (approx.)</td>
</tr>
<tr>
<td>Isomate-C plus</td>
<td>400/acre</td>
<td>$100</td>
</tr>
<tr>
<td>Isomate-CTT</td>
<td>200/acre</td>
<td>$100</td>
</tr>
<tr>
<td>Checkmate CM-XL</td>
<td>200/acre</td>
<td>$110</td>
</tr>
</tbody>
</table>
Methods

- Hung dispensers May 5 in a commercial ‘Fuji’ block in Payson, which sits at approximately 4800 feet.

- Dispensers left for 140 days, and 6 dispensers of each brand were collected and sent to Michigan State University to determine pheromone content (residual analysis) and pheromone release rate (volatile trapping system) of each dispenser:

<table>
<thead>
<tr>
<th>Date</th>
<th>Days after deployment</th>
<th>Number of dispensers tested</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>residual analysis</td>
</tr>
<tr>
<td>May 5</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>May 19</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>August 4</td>
<td>90</td>
<td>6</td>
</tr>
<tr>
<td>September 1</td>
<td>120</td>
<td>6</td>
</tr>
<tr>
<td>September 22</td>
<td>140</td>
<td>6</td>
</tr>
</tbody>
</table>
Residual Analysis

- Conducted by Dr. Jim Miller’s lab at Michigan State University

- Measures amount of pheromone remaining within the dispenser.

  - dispensers cut into pieces, soaked in acetone, filtered into a vial for gas chromatography
Residual Analysis-GC

Gas chromatography separates and identifies compounds in a solution based on their size and chemical properties.
Residual Analysis-GC

A chromatogram is generated, showing amount and time at which material was detected. By running standards, compounds can be identified and quantified.
Volatile Trapping System

- Conducted by Dr. Larry Gut’s lab at MSU
- Measures release rate (per hour) of pheromone from dispensers
Results – Residual Analysis

Amount of pheromone within each dispenser product at start and end of study.

<table>
<thead>
<tr>
<th>Dispenser</th>
<th>Pheromone Day 0 (mg)</th>
<th>Pheromone Day 140 (mg)</th>
<th>Percent Remaining</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cidetrak CM</td>
<td>125</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>Isomate-C plus</td>
<td>147</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Isomate-CTT</td>
<td>290</td>
<td>93</td>
<td>32</td>
</tr>
<tr>
<td>Checkmate CM-XL</td>
<td>293</td>
<td>25</td>
<td>9</td>
</tr>
</tbody>
</table>
Results – Residual Analysis

The graph shows the codlemone pheromone remaining (mg) over days elapsed after dispenser deployment for different products:

- **CideTrak CM**
- **Isomate-C plus**
- **Isomate-CTT**
- **Checkmate CM-XL 1000**

The y-axis represents the amount of codlemone pheromone remaining in milligrams, ranging from 0 to 300 mg. The x-axis shows the days elapsed after dispenser deployment, categorized as 0, 90, 120, and 140 days.

The bars indicate the fluctuation of pheromone levels over time, with error bars showing variability. The graph visually compares the effectiveness of each product in maintaining the pheromone levels over the specified period.
Average release rate of pheromone within each dispenser product at start and end of study.

<table>
<thead>
<tr>
<th>Dispenser</th>
<th>Pheromone Day 0 (ug/hr)</th>
<th>Pheromone Day 14 (ug/hr)</th>
<th>Pheromone Day 140 (ug/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cidetrak CM</td>
<td>8.0</td>
<td>4.0</td>
<td>0.3</td>
</tr>
<tr>
<td>Isomate-C plus</td>
<td>17.5</td>
<td>7.0</td>
<td>2.5</td>
</tr>
<tr>
<td>Isomate-CTT</td>
<td>43.0</td>
<td>14.0</td>
<td>7.0</td>
</tr>
<tr>
<td>Checkmate CM-XL</td>
<td>52.0</td>
<td>8.00</td>
<td>0.5</td>
</tr>
</tbody>
</table>
Results by product

**Cidetrak**
- Release rate was lowest among the 4
- Average amount of codlemone with dispensers also lowest
- Previous studies have shown good results with this product

**Isomate-C plus**
- Constant release rate through 1st and 2nd generations
- Second highest in release rate after 140 days

**Isomate-CTT**
- Release rate 2x that of C plus, but became the same as C plus after 90 days
- By 140 days, release rate highest
- Greatest amount of codlemone remaining

**Check-mate**
- Starts as the highest release rate, and ends near the lowest
- Least efficient product—lost greatest amount of pheromone from dispensers, but lowest release rate
Final Conclusions

- All products still releasing pheromone after 140 days in the field, and lowest release rates still 41 times greater than release of individual females.

- Isomate products released the most.
  - Because we have high pest pressure and weather can be hot, products that release the greatest amount of pheromone consistently will provide the best results.

- No matter which product is used, all orchardists should carefully monitor all treated blocks using pheromone traps and injury inspection, particularly toward the end of the season when release rates are at their lowest.
new product from Pacific Biocontrol

2011

applied at 400/acre rate, but allows growers to set their own rate

50% faster to apply than Isomate-C plus, may save $10/acre

price of cm flex will be same as c-plus
THANK YOU

- Utah State Horticultural Association
- Utah Dept. of Agriculture and Food