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Vine Mealybug: Damage

- Significant pest of grapes in North and South America, South Africa, Southern Europe, Middle East
  - Discovered in California mid-1990s and rapidly spread

- Damage
  - Produces copious amounts of honeydew
    - sooty mold and infests grape bunches making them unfit for consumption
  - Transmits grape leafroller virus complex
Vine Mealybug: Biology and Control

Vine Mealybug:

• Biology
  – Overwinter as nymphs/adults under bark at or below graft union/roots
  – 2 to 3 generations/year Coastal
  – 5 to 7 generations/year San Joaquin

• Biological Control
  – Anagyrus pseudococci
  – Ant control
Control of VMB in Grapes: Plot Design

- Pinot Grigio vineyard planted in 1990
- Escalon, California
- 16 treatments replicated 6 to 8 times in RCB
- Each rep 3 vines (two outside vine considered treated buffer, not sampled)
- Moderate vine mealybug population
Control of VMB in Grapes: Application Methods

• Imidacloprid applied through a secondary drip cup under drip system at first irrigation

• All other treatments applied with hand-held spray system
  – Spray volume 935 L/ha during spring increased to 1403 L/ha during summer
Control of VMB in Grapes: Evaluation Methods

- Ranked in 1 min search of the cordon or 5 fruit clusters per rep:
- Rank categories:
  0: no VMB or honeydew
  1: honeydew but no visible VMB
  2: honeydew and visible VMB
  3: honeydew and >10 VMB
# Control of VMB in Grapes

<table>
<thead>
<tr>
<th>Trade Name</th>
<th>Chemical Name</th>
<th>Rate form/ha</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Applaud 70WP&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Buprofezin</td>
<td>0.84 kg</td>
<td>13 Mar</td>
</tr>
<tr>
<td>Movento 2SC +</td>
<td>Spirotetramat</td>
<td>0.58 L</td>
<td>14 Jul</td>
</tr>
<tr>
<td>Sivanto 1.67SL&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Flupyradifurone</td>
<td>0.88 L</td>
<td></td>
</tr>
<tr>
<td>2) Applaud 70WP&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Buprofezin</td>
<td>1.68 kg</td>
<td>13 Mar</td>
</tr>
<tr>
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<td>Spirotetramat</td>
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<tr>
<td>3) Lorsban Advanced&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Chlorpyrifos</td>
<td>4.68 L</td>
<td>13 Mar</td>
</tr>
<tr>
<td>Movento 2SC +</td>
<td>Spirotetramat</td>
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<tr>
<td>Sequoia 2SC&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Sulfoxafllor</td>
<td>0.42 L</td>
<td></td>
</tr>
<tr>
<td>4) Untreated check</td>
<td>--</td>
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<sup>a</sup>Treatments included 0.023% V/V Latron B-1569

<sup>b</sup>Treatments included 0.0625% V/V Dyne-Amic
Control of VMB in Grapes

- Buprofezin (low) / Spirotetramat + Flupyradifurone
- Buprofezin (high) / Spirotetramat + Flupyradifurone
- Chlorpyrifos / Spirotetramat + Sulfoxaflor
- Untreated check

![Graph showing percent control and mean rank VMB in grapes over time]

- Cordon

- Fruit

- Percent Control
- Mean Rank VMB (Untreated Check)

Dates:
- 6.3.15
- 6.16.15
- 6.30.15
- 7.13.15
- 7.28.15
- 8.10.15
Control of VMB in Grapes:

Discussion

- Chlorpyrifos (standard - delay dormant treatment) provided superior control compared to buprofezin
- Chlorpyrifos provides secondary ant control
- No significant difference in low and high rates of buprofezin
- Addition of spirotetramat and sulfoxaflor to chlorpyrifos provided excellent season long control
- Addition of spirotetramat and flupyradifurone to buprofezin provided late season control
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<td>Imidacloprid</td>
<td>1.02L</td>
<td>1 Apr</td>
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<tr>
<td>Movento 2SC&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Spirotetramat</td>
<td>0.58L</td>
<td>17 Jun</td>
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<td>1.02L</td>
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</tr>
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<td>Spirotetramat</td>
<td>0.58L</td>
<td>17 Jun</td>
</tr>
<tr>
<td></td>
<td>Acetamiprid</td>
<td>0.37kg</td>
<td></td>
</tr>
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<td>5 May</td>
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<tr>
<td></td>
<td>Sivanto 1.67SL + Flupyradifurone</td>
<td>0.88L</td>
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Control of VMB in Grapes

- **Imidacloprid / Spirotetramat**
- **Imidacloprid / Spirotetramat + Acetamiprid**
- **Imidacloprid / Spirotetramat + Flupyradifurone / Sulfoxaflor**
- **Untreated check**

### Graph Details
- **X-axis:** Dates from 6.3.15 to 8.10.15
- **Y-axis:** Percent Control

**Legend:**
- **Cordon**
- **Fruit**

**Graph Description:**
- The graph shows the percent control of very berry mildew (VMB) in grapes treated with different insecticides over time.
- The x-axis represents the dates from June 3, 2015, to August 10, 2015.
- The y-axis represents the percent control of VMB.
- The different treatments are represented by different colors:
  - Blue: Imidacloprid / Spirotetramat
  - Red: Imidacloprid / Spirotetramat + Acetamiprid
  - Green: Imidacloprid / Spirotetramat + Flupyradifurone / Sulfoxaflor
  - Grey: Untreated check
Control of VMB in Grapes: Discussion

- Imidacloprid applied through the drip system provided marginal control

- Following an imidacloprid application the addition of acetamiprid to spirotetramat did not improve efficacy

- Following an imidacloprid application the addition of flupyradifurone to spirotetramat followed by sulfoxaflor did not improve efficacy as compared to imidacloprid followed by spirotetramat
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<td>4) Movento 2SC&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Spirotetramat</td>
<td>0.46 L</td>
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Control of VMB in Grapes

- Flupyradifurone
- Spirotetramat
- Flupyradifurone / Spirotetramat
- Spirotetramat / Flupyradifurone

Mean Rank VMB (Untreated Check)

Percent Control

Cordon

Fruit

Flupyradifurone

Spirotetramat

Flupyradifurone / Spirotetramat

Spirotetramat / Flupyradifurone

Spirotetramat
Control of VMB in Grapes: Discussion

- Flupyradifurone followed by spirotetramat provided excellent control
- Spirotetramat followed by flupyradifurone provided excellent control
- Spirotetramat followed by spirotetramat provided excellent control
- Flupyradifurone followed by flupyradifurone provided marginal control
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Control of VMB in Grapes

- Spirotetramat / Sulfoxaflor
- Sulfoxaflor / Spirotetramat
- Sulfoxaflor
- Untreated check

![Graph showing the control of VMB in grapes over time for different treatments.](image-url)
Control of VMB in Grapes: Discussion

- Sulfoxaflor followed by spirotetramat provided excellent control

- Spirotetramat followed by Sulfoxaflor provided excellent control

- Sulfoxaflor followed by Sulfoxaflor provided excellent control but control faded shortly before harvest
Control of VMB in Grapes:
Conclusions

- All experimental materials provided effective control and fruit was harvestable
- Chlorpyrifos provided excellent control and is the standard for delayed dormant treatment
- Spirotetramat is backbones of in season control with best timing about two months prior to harvest
- Sulfoxaflor is a more effective material compared to flupyradifurone
- Effective programs against moderate VMB population would be:
  - Chlorpyrifos at delayed dormant timing followed by spirotetramat combined with sulfoxaflor or flupyradifurone about 2 months prior to harvest
I gratefully acknowledge the following pest control advisors: Charlie Starr and Jerry Moyer and growers: Lange Twins and Lone Creek vineyards whose assistance and cooperation made the above studies possible. I also acknowledge the invaluable contributions of Ruth Poliakon, Alyssa Hernandez and Ben Wong whose hard work resulted in the successful completion of this research and presentation.
QUESTIONS ANYONE?