Update on Fumigation Alternatives in Berries

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The Situation

• Use of methyl bromide suspended for berry production in 2016.
How do we avoid train wrecks like this?
Or this?
Alternatives Remaining

• High rates of chloropicrin under TIF
• Field rotation
• Plant resistance
• Chemical alternatives
• Non-chemical alternatives
Theme of Current UC and UCCE research

- Integration of methods can make up the loss of yield presented by the use of fumigants which are less effective than methyl bromide.
Introduction

- Chemical alternative (TRX58)
- Chemical alternative (Dominus)
- Non-chemical alternative (Mustard seed meal)
- Non-chemical alternative (Biofungicidal root dips)
TRX58 Trial - 2016

Albion Sweet Ann Monterey Cabrillo San Andreas

b cd f a ef def a bc def a d def a b de

- Triform 80
- TRX58
- UTC
Dominus (purified mustard seed oil)

- UCCE fumigant specialist Husein Ajwa

“...strawberry trials, he found that Dominus controlled or suppressed soil-borne pathogens, nematodes, and weeds.”
Integration of weaker fumigants with other farming practices
Fumigant comparison including mustard seed meal (MSM) and variation of chill.

• Is mustard seed beneficial to strawberry when used in combination with alternative fumigants?
• Does length of supplemental chill benefit strawberry when used in combination with alternative fumigants?
• Straight comparison of two novel fumigants with methyl bromide/chloropicrin.
Fumigant comparison including mustard seed meal (MSM) and variation of cold conditioning length

- UTC (var. Monterey + 3, 7 and 16 days chill)
- UTC + MSM (var. Monterey + 3, 7 and 16 days chill)
- TRX- 58 (var. Monterey + 3, 7 and 16 days chill)
- TRX- 58 + MSM (var. Monterey + 3, 7 and 16 days chill)
- TRX- 58 + Pic (var. Monterey + 3, 7 and 16 days chill)
- TRX- 58 + Pic + MSM (var. Monterey + 3, 7 and 16 days chill)
- Dominus (var. Monterey + 3, 7 and 16 days chill)
- Dominus + MSM (var. Monterey + 3, 7 and 16 days chill)
- Dominus + Pic (var. Monterey + 3, 7 and 16 days chill)
- Dominus + Pic + MSM (var. Monterey + 3, 7 and 16 days chill)
- MB + Pic (var. Monterey + 3, 7 and 16 days chill)
- MB + Pic + MSM (var. Monterey + 3, 7 and 16 days chill)
Mustard Seed Meal

- 1 ton per acre
Comparison of fumigants without mustard seed meal

Straight comparison of fumigants without MSM

- 1 UTC: 6758.03
- 2 TRX Pic: 8394.31
- 3 TRX: 7422.81
- 4 Dominus Pic: 8283.15
- 5 Dominus: 7835.34
- 6 Methyl Bromide: 8408.30
Comparison of fumigants with mustard seed meal

Straight comparison of fumigants with MSM

1 UTC: 7812
2 TRX Pic: 8352
3 TRX: 8299
4 Dominus Pic: 8706
5 Dominus: 8029
6 Methyl Bromide: 8166

Trial ID: [Details]
### Estimated total #11 crates per acre by fumigant by mustard treatment

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Dominus Mean Total Yield</th>
<th>Dominus + Pic Mean Total Yield</th>
<th>TRX + Pic Mean Total Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mustard: 7,041</td>
<td>Mustard: 7,431</td>
<td>Mustard: 7,041</td>
<td></td>
</tr>
<tr>
<td>No Must: 6,551</td>
<td>No Must: 6,858</td>
<td>No Must: 7,023</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment</th>
<th>MB Mean Total Yield</th>
<th>TRX Mean Total Yield</th>
<th>Untreated Control Mean Total Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mustard: 7,073</td>
<td>Mustard: 7,027</td>
<td>Mustard: 6,527</td>
<td></td>
</tr>
<tr>
<td>No Must: 6,956</td>
<td>No Must: 6,200</td>
<td>No Must: 5,632</td>
<td></td>
</tr>
</tbody>
</table>
Mean Total Yield
10/30/2015 - 6,778
11/04/2015 - 6,870
11/13/2015 - 6,691
Effect of Chill Length on Yield in Variety 'Monterey' Across 6 Regimes of Fumigation

1 3 days chill
2 7 days chill
3 16 days chill

Trial ID:
Average fruit weight over time by planting date

- **Planting Date**
  - 10/30/2015
  - 11/04/2015
  - 11/13/2015

**Average fruit weight (grams)**

**Harvest Date**

1-17
**November 18, 2014 soil sample**

<table>
<thead>
<tr>
<th></th>
<th>No MSM</th>
<th>MSM</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO-3-N</td>
<td>6.6*</td>
<td>32.7*</td>
</tr>
<tr>
<td>Olsen P</td>
<td>51</td>
<td>56</td>
</tr>
<tr>
<td>X-K</td>
<td>145</td>
<td>168</td>
</tr>
<tr>
<td>pH</td>
<td>7.0**</td>
<td>6.7**</td>
</tr>
</tbody>
</table>

* = Averages are significantly different at the 0.05 level (p=0.03)  
** = Averages are very significantly different at 0.05 level (p=0.004)
2016 Dominus (AITC) Trial

• How does Dominus perform in comparison to an untreated check and a grower standard when used in combination with a soil amendment and/or a biological fungicide?
2016 Dominus Comparison
Treatment List (1)

- Untreated control (UTC)
- Untreated control + Actinovate
- Untreated control + mustard seed meal (MSM)
- Untreated control + mustard seed meal (MSM) + Actinovate.
Treatment list (2)

- Dominus + mustard seed meal
- Dominus + mustard seed meal + Actinovate
- Dominus alone (425 #)
- Dominus + Actinovate
- Methyl bromide- chloropicrin standard
- Methyl bromide – chloropicrin + Actinovate
April Yield Totals

1 UTC: 297.75
2 UTC + Act: 366.25
3 UTC + MSM: 377.50
4 UTC + MSM + Act: 558.50
5 Dominus 425# + MSM: 492.50
6 Dominus 425# + MSM + Act: 668.75
7 Dominus 425#: 655.25
8 Dominus 425# + Act: 624.75
9 MB: 481.25
10 MB + Act: 563.50

Trial ID: 002
April Fruit Size

- 1 UTC: 37.93
- 2 UTC + Act: 36.43
- 3 UTC + MSM: 34.31
- 4 UTC + MSM + Act: 38.42
- 5 Dominus 425# + MSM: 37.71
- 6 Dominus 425# + MSM + Act: 38.85
- 7 Dominus 425#: 41.80
- 8 Dominus 425# + Act: 40.81
- 9 MB: 43.91
- 10 MB + Act: 43.36

Trial ID: 002
First Half of Season thru May

- 1 UTC: 1116.50
- 2 UTC + Act: 1332.75
- 3 UTC + MSM: 1422.00
- 4 UTC + MSM + Act: 1730.75
- 5 Dominus 425# + MSM: 1829.25
- 6 Dominus 425# + MSM + Act: 1712.00
- 7 Dominus 425#: 1597.25
- 8 Dominus 425# + Act: 1495.50
- 9 MB: 1481.25
- 10 MB + Act: 1535.75

Trial ID: 002
Yield Totals thru September
Projects for 2016-17

• Dominus used in combination with crop termination
• Dominus used in combination with mustard seed meal
• Dominus used in combination with mustard seed meal + crab meal.
2016-17 Project – Crop Termination with Dominus
Concluding Remarks