2016

Fruit Rot Management

Erika Saalau Rojas

*UMass Amherst Cranberry Exp Station, esaalau@umass.edu*

Follow this and additional works at: [https://scholarworks.umass.edu/cranberry_extension](https://scholarworks.umass.edu/cranberry_extension)

Part of the [Horticulture Commons](https://scholarworks.umass.edu/cranberry_extension)

---

**Recommended Citation**
Retrieved from [https://scholarworks.umass.edu/cranberry_extension/226](https://scholarworks.umass.edu/cranberry_extension/226)

---

This Article is brought to you for free and open access by the Cranberry Station Outreach and Public Service Activities at ScholarWorks@UMass Amherst. It has been accepted for inclusion in Cranberry Station Extension meetings by an authorized administrator of ScholarWorks@UMass Amherst. For more information, please contact scholarworks@library.umass.edu.
FRUIT ROT MANAGEMENT

A year without Bravo

ERIKA SAALAU ROJAS
PLANT PATHOLOGY
UMASS CRANBERRY STATION
WINTER 2016
TOPICS

• Fungicide field trials
  • Timing of applications
  • Efficacy trials
• Fungicide resistance screening
• Fruit quality
• Conclusions
Determine the impact of delayed applications on field rot.

- Early Black
- 8 treatments
- Manzate Max 4.8 qt/A

### Timing of Fungicide Applications

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

Untreated
TIMING OF FUNGICIDE APPLICATIONS

In Bloom
Out of Bloom
Pods

% Bloom

12-Jun 19-Jun 26-Jun 3-Jul 10-Jul 17-Jul 24-Jul
Treatment 1 (5 Appl.)

% Bloom

- In Bloom
- Out of Bloom
- Pods

12-Jun, 19-Jun, 26-Jun, 3-Jul, 10-Jul, 17-Jul, 24-Jul
Treatment 2 (5 Appl.)

Graph showing the percentage of bloom (% Bloom) over time from 12-Jun to 24-Jul. The graph indicates the progression of blooms and out of bloom periods, with specific markers for different stages such as In Bloom, Out of Bloom, and Pods.
Treatment 3 (4 Appl.)
Treatment 4 (4 Appl.)
Treatment 7 (2 Appl.)
USABLE WEIGHT

![Bar chart showing usable weight in bbl/A for various categories labeled from 1 to 8. Categories 1, 2, 3, 4, 6, 7 are labeled 'a', and category 8 is labeled 'b'.]
## SUMMARY

<table>
<thead>
<tr>
<th>TRT</th>
<th>FUNGICIDE # Appl.</th>
<th>DATE 1st Appl.</th>
<th>PERCENTAGE (%)</th>
<th>DATE 1st Appl.</th>
<th>PERCENTAGE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>12-Jun</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>17-Jun</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>22-Jun</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>27-Jun</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>2-Jul</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>4-Jul</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>10-Jul</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### In Bloom
- TRT 1: > 10
- TRT 2: 17
- TRT 3: 40
- TRT 4: 43
- TRT 5: 54
- TRT 6: 50
- TRT 7: 48
- TRT 8: N/A

### Out Bloom
- TRT 1: 0
- TRT 2: 0
- TRT 3: 0
- TRT 4: 9
- TRT 5: 14
- TRT 6: 25
- TRT 7: 42
- TRT 8: N/A

### Field rot
- TRT 1: 4.7 c
- TRT 2: 5.3 bc
- TRT 3: 5.6 bc
- TRT 4: 4.3 c
- TRT 5: 9.3 bc
- TRT 6: 5.6 bc
- TRT 7: 18.3 b
- TRT 8: 59.0 a

### Storage rot
- TRT 1: 4.0 b
- TRT 2: 3.0 b
- TRT 3: 3.1 b
- TRT 4: 2.7 b
- TRT 5: 5.4 ab
- TRT 6: 3.0 b
- TRT 7: 5.8 ab
- TRT 8: 8.6 a
How long can I delay the first fungicide application?
Treatment 7 (2 Appl.)

Too late!
Critical period

1st fungicide application
~50% in bloom
FUNGICIDE EFFICACY TRIAL

- Stevens
- 3 fungicide applications
- Fungicide resistance management
  - Rotate/alternate chemicals
  - Mix modes of action
  - Broad spectrum end of season
# FUNGICIDE EFFICACY

<table>
<thead>
<tr>
<th>TREATMENT</th>
<th>19-Jun</th>
<th>29-Jun</th>
<th>9-Jul</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Indar/Abound</td>
<td>Indar/Abound</td>
<td>Manzate</td>
</tr>
<tr>
<td>2</td>
<td>Proline/Abound</td>
<td>Proline/Abound</td>
<td>Manzate</td>
</tr>
<tr>
<td>3</td>
<td>Proline/Abound</td>
<td>Proline/Abound</td>
<td>Oso</td>
</tr>
<tr>
<td>4</td>
<td>Proline/Abound</td>
<td>Oso</td>
<td>Oso</td>
</tr>
<tr>
<td>5</td>
<td>Proline/Abound</td>
<td>Proline/Abound</td>
<td>ManKocide</td>
</tr>
<tr>
<td>6</td>
<td>Oso</td>
<td>Oso</td>
<td>Oso</td>
</tr>
<tr>
<td>7</td>
<td>Manzate</td>
<td>Manzate</td>
<td>Manzate</td>
</tr>
<tr>
<td>8</td>
<td>Untreated</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Rate (per Acre)

- Indar: 12 oz
- Abound: 15.5 oz
- Manzate: 14.8 qt
- Proline: 5 oz
- Oso: 13 oz
- ManKocide: 7 lb
FIRST LESSON OF THE SEASON...

Blighted flowers
Scalded berries
Oso + surfactant (Silwet 77)
FIELD ROT

% Rot

1
2
3
4
5
6
7
8

ab
b
ab
ab
b
b
a
<table>
<thead>
<tr>
<th>TRT</th>
<th>FUNGICIDE PROGRAM</th>
<th>Field rot (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Indar/Abound + Indar/Abound + Manzate</td>
<td>20.7 ab</td>
</tr>
<tr>
<td>2</td>
<td>Proline/Abound + Proline/Abound + Manzate</td>
<td>15.8 b</td>
</tr>
<tr>
<td>3</td>
<td>Proline/Abound + Proline/Abound + Oso</td>
<td>20.6 ab</td>
</tr>
<tr>
<td>5</td>
<td>Proline/Abound + Proline/Abound + ManKocide</td>
<td>17.3 ab</td>
</tr>
<tr>
<td>7</td>
<td>Manzate + Manzate + Manzate</td>
<td>13.5 b</td>
</tr>
<tr>
<td>8</td>
<td>No Fungicide</td>
<td>29.1 a</td>
</tr>
</tbody>
</table>
## SUMMARY

<table>
<thead>
<tr>
<th>TRT</th>
<th>FUNGICIDE PROGRAM</th>
<th>Field rot (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Indar/Abound + Indar/Abound + Manzate</td>
<td>20.7 ab</td>
</tr>
<tr>
<td>2</td>
<td>Proline/Abound + Proline/Abound + Manzate</td>
<td>15.8 b</td>
</tr>
<tr>
<td>3</td>
<td>Proline/Abound + Proline/Abound + Oso</td>
<td>20.6 ab</td>
</tr>
<tr>
<td>5</td>
<td>Proline/Abound + Proline/Abound + ManKocide</td>
<td>17.3 ab</td>
</tr>
<tr>
<td>7</td>
<td>Manzate + Manzate + Manzate</td>
<td>13.5 b</td>
</tr>
<tr>
<td>8</td>
<td>No Fungicide</td>
<td><strong>29.1 a</strong></td>
</tr>
</tbody>
</table>
# SMALLER TRIAL

<table>
<thead>
<tr>
<th>TRT</th>
<th>FUNGICIDE PROGRAM</th>
<th>Field rot (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Indar/Abound + Indar/Abound + Manzate + Manzate + Manzate</td>
<td>14.5 b</td>
</tr>
<tr>
<td>5</td>
<td>Indar/Abound + Indar/Abound + Manzate + Manzate</td>
<td>14.5 b</td>
</tr>
<tr>
<td>7</td>
<td>Indar/Abound + Indar/Abound + ManKocide + ManKocide</td>
<td>10.7 b</td>
</tr>
<tr>
<td>8</td>
<td>No Fungicide</td>
<td>28.8 a</td>
</tr>
<tr>
<td>TRT</td>
<td>FUNGICIDE PROGRAM</td>
<td>Field rot (%)</td>
</tr>
<tr>
<td>-----</td>
<td>-------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>1</td>
<td>Indar/Abound + Indar/Abound + Manzate + Manzate + Manzate</td>
<td>14.5 b</td>
</tr>
<tr>
<td>5</td>
<td>Indar/Abound + Indar/Abound + Manzate + Manzate</td>
<td>14.5 b</td>
</tr>
<tr>
<td>7</td>
<td>Indar/Abound + Indar/Abound + ManKocide + ManKocide</td>
<td>10.7 b</td>
</tr>
<tr>
<td>8</td>
<td>No Fungicide</td>
<td>28.8 a</td>
</tr>
</tbody>
</table>

WHAT’S WITH ALL THESE FUNGICIDE COMBINATIONS?
FUNGICIDE RESISTANCE IN VITRO ASSAYS
F. CARUSO, 2012

- 2 different locations in MA
- Indar and Abound
- 4 major fruit rot pathogens

Low concentration  
High concentration
Fungicide resistance monitoring

- *Colletotrichum* sp.
  - Bitter rot
- >40 isolates (2014)
- High risk sites
- Baseline sensitivity
Abound (Azoxystrobin)

Resistance can develop in 2-3 seasons.

*In vitro* screening of isolates (from rotten fruit).

**Fungicide-amended media**

- 0 to 2.5 µg/ml fungicide
- Measure growth on plate
Fungicide resistance: Inhibition of > 50% growth
FUNGICIDE RESISTANCE?
FUNGICIDE RESISTANCE?

Reduced sensitivity (Abound)

• 9 isolates
• 2 sites
<table>
<thead>
<tr>
<th>Group</th>
<th>FRAC Code</th>
<th>Risk Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMI Indar, Proline</td>
<td>3</td>
<td>Med</td>
</tr>
<tr>
<td>QoI Abound</td>
<td>11</td>
<td>High</td>
</tr>
<tr>
<td>Poly Oso, Ph-D</td>
<td>19</td>
<td>Med</td>
</tr>
<tr>
<td>Chloro Bravo, Manzate</td>
<td>M5</td>
<td>Low</td>
</tr>
<tr>
<td>Dithioc M3</td>
<td></td>
<td>Low</td>
</tr>
</tbody>
</table>
FRUIT QUALITY

• Sweetened Dried Cranberries (SDC)
• Berry firmness = fruit quality parameter
• Incentive?
How do harvest practices affect berry firmness?
How do harvest practices affect berry firmness?

Collaborators:
Rod Serres
David Nolte
Sampling

- Pre reel
- Post reel
Sampling

Post cleaning

Pre cleaning
Sampling

Post cleaning

- Low (~ 45 psi)
- Medium (65-80 psi)
- High (> 80 psi)

Pre cleaning
Post cleaning

% Rot
Berry firmness

Pre cleaning

% Rot
Berry firmness
Berry firmness
Healthy berries
n = 100 berries/sample
PRELIMINARY RESULTS- HARVEST

State Bog

- Scoop: 852
- Reel: 813
- Elevator: 699
- Postclean: 610

4.6% loss of firmness
13.4% loss of firmness
10.4% loss of firmness

DATA ANALYSES AND SUMMARY CREDIT: JOE DEVERNA AND ROD SERRES, OCEAN SPRAY
PRELIMINARY RESULTS - HARVEST

Site T

25% loss of firmness

Firmness Measure

Scoop 793
Preclean 597
Postclean 595

DATA ANALYSES AND SUMMARY CREDIT: JOE DEVERNA AND ROD SERRES, OCEAN SPRAY
CLEANING

Large fruit
Early-mid season harvest

Firmness Measure

Preclean
Postclean

100psi

530
541

% Defect

Preclean
Postclean

15.7%
9.4%

DATA ANALYSES AND SUMMARY CREDIT: JOE DEVERNA AND ROD SERRES, OCEAN SPRAY
CLEANING

*over-ripe EB

Firmness Measure

100psi

<table>
<thead>
<tr>
<th>Preclean</th>
<th>Postclean</th>
</tr>
</thead>
<tbody>
<tr>
<td>530</td>
<td>541</td>
</tr>
</tbody>
</table>

6.8% loss of firmness

<table>
<thead>
<tr>
<th>Firmness Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>preclean</td>
</tr>
<tr>
<td>postclean</td>
</tr>
</tbody>
</table>

% Defect

100psi

<table>
<thead>
<tr>
<th>Preclean</th>
<th>Postclean</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.7%</td>
<td>9.4%</td>
</tr>
</tbody>
</table>

21.9%   22.0%

DATA ANALYSES AND SUMMARY CREDIT: JOE DEVERNA AND ROD SERRES, OCEAN SPRAY
PRESSURE

Site SL

State Bog

Site SL

State Bog

DATA ANALYSES AND SUMMARY CREDIT: JOE DEVERNA AND ROD SERRES, OCEAN SPRAY
TAKE-HOME MESSAGES

• 1st fungicide appl. no later than 50% in bloom

• Accurate % bloom may help save 1-2 sprays?
TAKE-HOME MESSAGES

• Bravo alternatives = adequate control
• Oso = feasible option to control fruit rot
  • In combination with other fungicides
• Fungicide resistance is a serious threat.
• Make every spray count!
TAKE-HOME MESSAGES

• Future of fruit rot management?
  Cultural practices
  Irrigation, canopy management, sanding, trash flood, late water, etc.
  Understanding pathogen biology
TAKE-HOME MESSAGES

• Fruit firmness= this is just the beginning!
  • Fruit maturity, size, environmental conditions, harvest practices and equipment.

• Need to improve sampling method (2016).

• Preliminary study= firmness can be managed
ACKNOWLEDGEMENTS

2015 Summer Crew
• Tom Giorgio
• Abby Zammitti
• Emma Stratton
• Ma. Fernanda Cubero
• Colman Burns-Takki
• Jessica Braley
• Chris Copeland

Collaborators Fruit Firmness
• Matt Beaton
• Peter Beaton
• Rob Rubini
• Gary Garretson and John Mason
• Keith Mann
• Glenn Reid & A.D. MakePeace
• Rod Serres, David Nolte, Joe DeVerna (OS)

Cranberry Station team

Funding and Resources

[Logos and images of sponsors]