2014 Update Mtg: Potential Water and Energy Savings in Cranberry Frost Cycling

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Potential Water and Energy Savings in Cranberry Frost Cycling

Peter Jeranyama, Faith Ndlovu, Jesica Sack, Alex Ward, Miles Hegedus, Bongani Jeranyama & Casey Kennedy
Water Management in Cranberry

- Over-watering: shallow roots, loss of fruit quality, root rot diseases, etc.
- Under-watering: decreased fruit size, plant death, poor plant cover
- Growers have suggested 1 inch H₂O / week
Average evaporation ("/week)

1999

High = 1.65
Low = 0.47
Average = 0.92

2000

High = 1.21
Low = 0.28
Average = 0.82

deficit or surplus following 1"/week rule
Too wet

Adequate
Water Retention Curve in the top 6 inches

\[ y = -9.692 \ln(x) + 30.188 \]

\[ R^2 = 0.9141 \]
Observations - Lampinen

- Most MA cranberry beds appear to be too wet during much of the season
- Evaporative demand study - for many weeks in the season, cranberries require less than 2.5 cm applied as irrigation
(i) To evaluate the effects of Automated Intermittent Cycling (AI) & Conventional (CONV) Methods in frost protection, &

(ii) Quantify water & fuel usage with each method
Automated Intermittent Cycling

- Pump starts automatically, based on temperature settings

- Pumps then cycle on and off as temperature fluctuates
Materials and Method

• About 500 cranberry buds were collected from each cultivar under AI & CONV.

• Buds were dissected under a microscope and assessed for damage.
Materials and Method

• flowering and fruiting were also measured throughout the season
Bog temperature changes: April 15-17 in Carver, MA
Amount of Water Used in Frost Protection
## Comparison of two systems

<table>
<thead>
<tr>
<th>Input</th>
<th>Conventional</th>
<th>Cycling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Water Use (Gallons/Acre/night)</td>
<td>30,000</td>
<td>18,500</td>
</tr>
<tr>
<td>Average Fuel Use (Gallons/Acre/Season*)</td>
<td>53</td>
<td>21</td>
</tr>
<tr>
<td>Cost of Fuel ($/Acre/Season)</td>
<td>$164</td>
<td>$80</td>
</tr>
</tbody>
</table>

*Season = 24 frost nights
Bud damage on April 15

Percentage Damage (%)
Bud damage on April 26

<table>
<thead>
<tr>
<th></th>
<th>Early Black</th>
<th>Howes</th>
<th>Stevens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage Bud Damage (%)</td>
<td>4.0 ± 0.2</td>
<td>1.5 ± 0.1</td>
<td>5.5 ± 0.3</td>
</tr>
</tbody>
</table>
Vegetative meristem

Outer bud scales

Floral initial

Source: DeMoranville
Frost Protection Method and Cultivar Effect on Fruit Yield in 2013

![Graph showing fruit yield (BBL/Acre) for different cultivars and protection methods.](image-url)
Summary

1. Cultivars were sensitive to frost protection methods especially Early Black and Stevens.
2. Frost damage was up to 12% under AI & less than 5% damage under CONV.
3. Most of the damage were on 1 or 2 floral initials.
4. Cultivars produce 4-6 floral initials so damage on 2 floral initials will likely have no noticeable impact on fruit yield.
5. Water savings of up to 33% are possible with cycling.
Acknowledgments

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