Where does Raspberry Yield Potential Go?

Miguel Ahumada
Sun Belle Inc.
## CA Raspberry Economics

<table>
<thead>
<tr>
<th>County</th>
<th>Acres</th>
<th>Crop Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santa Cruz</td>
<td>2,590</td>
<td>$142,424,000</td>
</tr>
<tr>
<td>Monterey</td>
<td>742</td>
<td>$43,791,000</td>
</tr>
<tr>
<td>Santa Maria</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Ventura</td>
<td>4,286</td>
<td>$196,370,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>7618</td>
<td><strong>$323,585,000</strong></td>
</tr>
</tbody>
</table>

- #3 berry in US per capita consumption
- $10K-$40K potential profit per acre
- 3x higher winter prices for Ventura
LA Terminal Market Prices USDA 2014
Where Does Yield Potential Go?

• Genotype + Environment = Phenotype

• Genotype = Genetic material

• Environment = Protected culture
  • Soil
  • Temperature
  • Water
  • Fertilization
Where Does Yield Potential Go?

Pacific Northwest Hypothetical Model
Open field raspberries

Cameron 1993
Where Does Yield Potential Go?

- Insect: 5%
- Disease: 9%
- Harvest: 16%
- Weather: 4%
- Cultural: 16%
- Yields: 50%
Yields in raspberries

• # canes/ft.

• # fruiting laterals/cane

• # berries/lateral

• Fruit weight/size of berry
Plant Environment

- 70% of roots in upper 12”
- 90% of roots in upper 18”
- 6% of roots at 30” depth

Cool Shoots 59º - 68º F

Warm Roots 75º F
Figure 6.2. Cross-section view of root distribution of first-year (A, B) and second-year (C, D) primocane raspberry. Roots were spray painted white to enhance contrast in photos. Units are root number per 15.6 square inches. Photos: Michael Cahn.
Loss to Insects and mites: 5 %

- Mite threshold per leaf 10 to 50
- Cost of control $ 100-400/ac (Prevatt 1991)
- predator: prey ratio of 1:4  cost similar to chemical control
Loss to Insects and mites: 5%

Life Cycle of the Spotted Wing Drosophila
*Drosophila suzukii* (Matsumura)

- **Eggs**: 12-72 hours, 350+ eggs in a lifetime
- **Three Larval Instars**: 5-7 days
- **Pupation**: 4-15 days, inside or outside of fruit
- **Adults**: 20-30 days
Loss to Diseases: 9%

- Cane botrytis
- Sprur blight: Didymella
Loss to Diseases: 9%

Botrytis on fruit

Yellow rust
Loss to Cultural Practices: 16%

Temperature management

- Use of tunnels significantly increase yields.
- Guaranteed harvest days.
- Reductions in pesticides use.
- Improved ability to deliver marketing programs.
Environment = Protected Culture
High Tunnels

Wind
• Reduces plant growth and development.
• Fruit damage like rubbing, abrasion, punctures.

Rain/Humidity
• Increased fungus: Botrytis (canes, flower and fruit), Yellow rust, powder mildew

Temperature
• Increase 2 to 6 F depending of the time of the year.

Sun
• Sun burn, white drupelets (40F for 4 hours)
<table>
<thead>
<tr>
<th>Met forecast (Air temperature, 1.5m)</th>
<th>°F</th>
<th>Tunnels can remain</th>
<th>Tunnels can remain</th>
<th>Closed</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;50</td>
<td></td>
<td>closed</td>
<td>closed</td>
<td></td>
</tr>
<tr>
<td>59-68 day</td>
<td></td>
<td>closed</td>
<td>Open doors. For tunnels &gt; 100m, window vent hoops every 50m. <strong>Close</strong> at night.</td>
<td>Closed</td>
</tr>
<tr>
<td>&lt; 46 night</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>➤ 68 day</td>
<td></td>
<td>Open doors.</td>
<td>Open doors. Vent lee-ward side of tunnels to stage 1. <strong>Close</strong> at night.</td>
<td>Closed if likely leaves will remain wet for &lt; 10 hours or risk</td>
</tr>
<tr>
<td>&lt; 46 night</td>
<td></td>
<td><strong>Close</strong> at night.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;77 day</td>
<td></td>
<td>Vent tunnels</td>
<td>Vent tunnels</td>
<td>Closed if likely leaves will remain wet for &lt; 2 hours or risk of wet fruit for picking</td>
</tr>
<tr>
<td>&gt; 46 night</td>
<td></td>
<td></td>
<td>Shadenet/cooling systems should be considered.</td>
<td></td>
</tr>
</tbody>
</table>

[http://www.haygrove.com/]
Loss to Cultural Practices: 16%
Loss to Temperature & Relative humidity: 10%
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Tunnels ventilation
Telescopic movement

http://www.haygrove.com
Loss to Cultural Practices: 16%
Trellising: 6%

Support system
- Protect and support the plant wind
- Heavy load
- Breakage
- Training

Effect on
- Plant density
- Light penetration, higher photosynthesis
- Insect pest and diseases
- Control sprays
- Human access to the plants
- Faster and timely harvest
Trellising: 6%

Close V

Open V
Comparison of 2 trellis; open V & closed V with 2, 3, 4 rows of plants

Strawberry bed/2 rows
Loss to Harvest: 16 %
Loss to Harvest: 16 %
Productivity & savings $$$

Labor saving

- Chemical defoliation for cut backs
- Use of mulch for weed control
- Tunnel management mechanical doors and sidings
## Chemical defoliation AN 20

<table>
<thead>
<tr>
<th>Date sampled</th>
<th>Hand defoliation</th>
<th></th>
<th>Defoliation with AN- 20%</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Canes</td>
<td>Roots</td>
<td>Canes</td>
<td>Roots</td>
</tr>
<tr>
<td>11/21/2013</td>
<td>0.80</td>
<td>-</td>
<td>1.10</td>
<td>-</td>
</tr>
<tr>
<td>1/2/2014</td>
<td>1.10</td>
<td>2.46</td>
<td>1.30</td>
<td>2.60</td>
</tr>
<tr>
<td>1/14/2014</td>
<td>1.71</td>
<td>1.48</td>
<td>2.80</td>
<td>2.50</td>
</tr>
</tbody>
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Innovation
Where Does Yield Potential Go?

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