Updating Water and Nutrient Management Guidelines for Caneberries

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Acknowledgements:

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   Oleg Daugovish

Grower Participants
Water resources are limited in many production regions

Lake San Antonio, Monterey County, CA (7% capacity)
Lower Pajaro Valley Basin

Groundwater Below Sea Level
Fall 2011
(hatched area)

Seawater Intrusion

Explanation
- Cities & Towns
- Highway 1
- Pajaro River
- San Andreas Fault
- Groundwater below Sea Level - Fall 2011
- Extent of Seawater Intrusion as of 2011
- PVWMA Boundary
Nitrate contamination of Ground Water is resulting in stricter water quality regulations.
Tools for Managing Water and Nitrogen Fertilizer

- Soil nitrate quick test
- Weather-based irrigation scheduling
Evapotranspiration = Evaporation + Transpiration
1st year Raspberry:  
Applied Water vs Relative Fruit Yield  
(Fall Crop, 2004, Trials 5-7)  

Applied Water (inches)  
6  8  10  12  14  16  18  20  22  24  26  28  
Relative Seasonal Yield (%)  
75  80  85  90  95  100  

Trial 5  
Trial 6  
Trial 7  
Regression  
$R^2 = 0.54$  

100% ETc
Weather-based irrigation scheduling

Converting Reference ET to Crop ET:

\[ ET_{crop} = ET_{ref} \times K_{crop} \]

\( K_c \) can vary from 0.1 to 1.2
Crop Coefficient ($K_c$) can be related to Canopy Cover ($C$)

$$0.63 + 1.5C - 0.0039C^2$$

Canopy Cover (%) vs. $K_c$ graph with equations and data points.
CropManage: online irrigation and N management decision support tool

https://cropmanage.ucanr.edu

<table>
<thead>
<tr>
<th>Ranch</th>
<th>Active Plantings</th>
<th>Total Plantings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bondenson</td>
<td>0</td>
<td>17</td>
</tr>
<tr>
<td>Bondesen</td>
<td>0</td>
<td>39</td>
</tr>
<tr>
<td>Callaghan Ranch</td>
<td>0</td>
<td>82</td>
</tr>
<tr>
<td>DaRosa</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
Developing a web-based application for caneberries:

• Crop model development
• Software development
• Field testing and outreach
Developing a web-based application for caneberries:

Decision support algorithms needed:

- Canopy and root development model
- Nutrient (nitrogen) uptake model
- Soil moisture tension threshold
- Soil nitrate threshold
- Integrate effects of cultural practices (macro-tunnels, trellising, pruning)
Data collection for northern district (2012-2016)

2012: 1st year raspberry and blackberry
2013: 2nd year raspberry and blackberry
2015: 1st year raspberry (early and late plantings)
2016: 1st and 2nd year raspberry
Canopy Cover Development
Canopy Cover
Early-Planting Raspberry Canopy (2015)
Late-Planting Raspberry Canopy (2015)

% Canopy cover (average)

DAP

site 1
site 2
site 3
2nd year Raspberry Canopy (2015)
Nutrient Uptake of Raspberries
Fresh Biomass Raspberry Early Planting - Site 1 (2015)

Cumulative Fresh Biomass (lb/acre)

Fruit
Leaf
Cane

Days after Planting

Plant population (plants/acre)

Days after Planting
Average N uptake Raspberry Late Plantings (2015)
Total N uptake Raspberry 2\textsuperscript{nd} year (2013)
## Total Nutrient Uptake Raspberry 1st Year Plantings (2015)

<table>
<thead>
<tr>
<th>Site</th>
<th>N</th>
<th>P</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lbs/acre</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early Plantings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>124</td>
<td>16</td>
<td>107</td>
</tr>
<tr>
<td>2</td>
<td>147</td>
<td>17</td>
<td>96</td>
</tr>
<tr>
<td>3</td>
<td>136</td>
<td>18</td>
<td>116</td>
</tr>
<tr>
<td>Average</td>
<td>135</td>
<td>17</td>
<td>106</td>
</tr>
<tr>
<td>Late Plantings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>179</td>
<td>21</td>
<td>159</td>
</tr>
<tr>
<td>2</td>
<td>136</td>
<td>21</td>
<td>118</td>
</tr>
<tr>
<td>3</td>
<td>211</td>
<td>29</td>
<td>184</td>
</tr>
<tr>
<td>Average</td>
<td>175</td>
<td>24</td>
<td>153</td>
</tr>
</tbody>
</table>
Soil was sampled monthly and analyzed for mineral N.
Applied N fertilizer and soil N (Early Plantings)

**Site 1**

- Applied Fertilizer N (lbs/acre)
- Soil N (ppm)

**Site 2**

- Applied Fertilizer N (lbs/acre)
- Soil N (ppm)
## Applied N fertilizer, Crop N uptake, and soil N (1st Year Raspberry, 2015)

<table>
<thead>
<tr>
<th>Site #</th>
<th>Applied N fertilizer</th>
<th>Crop N uptake</th>
<th>Soil mineral N concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lbs N/acre</td>
<td>0 - 1 ft</td>
<td>1 - 2 ft</td>
</tr>
<tr>
<td></td>
<td></td>
<td>early plantings</td>
<td>late plantings</td>
</tr>
<tr>
<td>1</td>
<td>320</td>
<td>124</td>
<td>51</td>
</tr>
<tr>
<td>2</td>
<td>269</td>
<td>147</td>
<td>39</td>
</tr>
<tr>
<td>3</td>
<td>180</td>
<td>136</td>
<td>35</td>
</tr>
<tr>
<td>Average</td>
<td>256</td>
<td>135</td>
<td>42</td>
</tr>
<tr>
<td>1</td>
<td>298</td>
<td>179</td>
<td>38</td>
</tr>
<tr>
<td>2</td>
<td>269</td>
<td>136</td>
<td>32</td>
</tr>
<tr>
<td>3</td>
<td>237</td>
<td>211</td>
<td>62</td>
</tr>
<tr>
<td>Average</td>
<td>268</td>
<td>175</td>
<td>44</td>
</tr>
</tbody>
</table>
Rooting depth of caneberries
Rooting depth of raspberry (1st year)

Days after Planting

Root Depth (inches)

Site 1
Site 2
Site 3
Average
Rooting depth of blackberry (1st year)

Days after Planting
120 140 160 180 200 220 240 260
Root Depth (inches)
0 10 20 30 40
Site 4
Site 5
Site 6
Average
# 1st Year Raspberry, Watsonville CA

<table>
<thead>
<tr>
<th>Lateral Distance (inches)</th>
<th>Depth (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>25</td>
<td>50</td>
</tr>
</tbody>
</table>

**Root Numbers**
- **0**: 0
- **1**: 1
- **2**: 2
- **5**: 5
- **10**: 10
- **20**: 20
- **40**: 40
- **80**: 80
- **160**: 160
- **>320**: >320

88-inch spaced beds
2nd Year Raspberry, Watsonville CA

88-inch spaced beds
2\textsuperscript{nd} Year Blackberry, Watsonville CA

88-inch spaced beds
Summary

Regulatory pressure for growers to conserve water and protect water quality will continue to increase.

Updating guidelines on the nutrient and water requirements of caneberries can help growers efficiently use these inputs and protect water quality.

We will continue to need grower participation to develop an accurate understanding of current nutrient and water management practices in caneberries.