Nitrogen fertilizer and irrigation interactions

Field 1

- Grower practice
- Quick Nitrate Test

94% of Crop ET (5.1 inches)

Field 2

198% of Crop ET (17.4 inches)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Applied N fertilizer (lb/Acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grower</td>
<td>192</td>
</tr>
<tr>
<td>QNT</td>
<td>135</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Applied N fertilizer (lb/Acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grower</td>
<td>302</td>
</tr>
<tr>
<td>QNT</td>
<td>160</td>
</tr>
</tbody>
</table>
Average Applied Water = 176% of Crop ET
What’s new in irrigation scheduling?

- Soil moisture sensors
- Flow meters
- Crop ET
- Irrigation scheduling software
- Irrigation Mobile Lab Services
Dataloggers improve ease of data collection:

- View trends in data
- Interface with multiple sensors
- Built in connectivity
Data Connectivity has improved:

Radio
Cell phone
Satellite
Internet
Data Connectivity: Commercial services

- Hortau
- ClimateMinder
- Ranch Systems
- Puresense
- CropSense (John Deere)
- Decagon
- Irrometer
- Onset Computer
- Spectrum Technology
Approaches to Irrigation Scheduling

Plant-based

Soil-based

Weather-based
Coastal crops: berries and vegetables

Moderate soil moisture deficits can cause yield loss
Tensiometers monitor the matric potential (tension) of the soil.

Measurement of soil moisture that is most related to water status in a plant.
ClimateMinder with Irrometer tensiometers
Hortau tensiometer system
Watermark granular matrix blocks:
Soil moisture tension: 0 to 200 cbars
Don’t give up your soil probes and shovels yet:

- Soil moisture sensors monitor a few locations within a field
- Soil moisture sensors are probably not affordable to use in every field
- Ground truthing is still needed
Volumetric soil moisture sensors

- Many manufacturers and models
- Most interface with dataloggers
- Most useful for evaluating relative changes in soil moisture
Decagon 10HS
Volumetric Soil Moisture Sensor
How much water did you apply?
Flow meters are not just for wells
Seametric magnetic flow meter
Applied Water vs. Crop Evapotranspiration

Cumulative Applied Water + Rain (inches)

Days after Transplanting

Crop ET
Applied Water

Cumulative Crop ET (inches)
Evapotranspiration

Ranch System

CIMIS weather station

Atmometer
Evapotranspiration can be estimated using CIMIS weather stations:

- Solar Radiation
- Wind Speed
- Relative Humidity
- Air Temperature

Active CIMIS Stations:
- Watsonville West II (209)
- Pajaro (129)
- Green Valley Rd (111)
- Castroville (19)
- North Salinas (116)
- South Salinas (89)

www.cimis.water.ca.gov
Comparison of different methods of estimated ETo (Gilroy Ca)
\[ \text{ET}_{\text{crop}} = \text{ET}_{\text{ref}} \times K_{\text{crop}} \]

\( K_c \) can vary from 0.1 to 1.2

Canopy cover as a function of days after planting.
Web-based Irrigation and N management software for lettuce

ucanr.org/cropmanage
CropManage Web-based software:

Assist growers in managing water and nitrogen fertilizer using information from multiple sources

- Soil tests
- Weather data (CIMIS ETo)
- Soil physical characteristics
- Crop models
- Flow meter
- Soil moisture sensors
Main features:

- Maintain and share irrigation, fertilizer, and soil test records within a farming operation.
- Manage information for multiple fields and ranches.
- Guide irrigation schedule using CIMIS evapotranspiration data and crop models.
- Guide nitrogen fertilization decisions based on crop uptake model and quick nitrate test.
Ranch List

Select a Ranch to work in from the list below.

- Bondenson
- Fanoe
- Gabilan Ranch
- Home
- Ikeda Bros Ranch 37
- Martella UC trial
- Molera
- Test Ranch
- Whalebone Ranch
## Plantings

Showing ALL Plantings

<table>
<thead>
<tr>
<th>Planting</th>
<th>Wet Date</th>
<th>Lot</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Romaine</td>
<td>6/8/2011</td>
<td>1</td>
<td>edit planting</td>
</tr>
<tr>
<td>bondenson 1</td>
<td>8/1/2011</td>
<td>1</td>
<td>edit planting</td>
</tr>
<tr>
<td>bondenson 2</td>
<td>8/1/2011</td>
<td>1</td>
<td>edit planting</td>
</tr>
<tr>
<td>Romaine 2</td>
<td>6/1/2011</td>
<td>2</td>
<td>edit planting</td>
</tr>
<tr>
<td>Molera planting 1</td>
<td>6/14/2011</td>
<td>4</td>
<td>edit planting</td>
</tr>
</tbody>
</table>

- [New Planting](#)
- [View Current Plantings](#)
- [Import Export Options](#)
Ranch/Field: TEST Bondenson, Lot 1, clay loam
Planting: 1 Romaine, 14 acres
Crop: Romaine 6 row, 80 inch bed, 6/8-8/24/11

Planting

Soil Summary

<table>
<thead>
<tr>
<th>Sample Date</th>
<th>Crop Stage</th>
<th>Soil N (ppm)</th>
<th>Soil Mineral N (lb/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/8/11</td>
<td>Pre-irrigation</td>
<td>37.50</td>
<td>111.94</td>
</tr>
<tr>
<td>6/30/11</td>
<td>Pre-thinning</td>
<td>22.50</td>
<td>67.16</td>
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<tr>
<td>7/4/11</td>
<td>Post-thinning</td>
<td>15.00</td>
<td>44.78</td>
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</table>

New Soil Sample
# Fertilizer Summary

<table>
<thead>
<tr>
<th>Fertilizer Date</th>
<th>Crop Stage</th>
<th>Soil Test N (ppm)</th>
<th>Fertilizer N Recommended (lb N/acre)</th>
<th>Cumulative Uptake N</th>
<th>Fertilizer</th>
<th>Applied N (lb N/acre)</th>
<th>Applied Fertilizer</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/8/11</td>
<td>Pre-irrigation</td>
<td>37.50</td>
<td>0.0</td>
<td>0.00</td>
<td>18-0-0 Dry</td>
<td>0.0</td>
<td>0.0 lbs/acre</td>
</tr>
<tr>
<td>7/5/11</td>
<td>Pre-thinning</td>
<td>22.50</td>
<td>0.0</td>
<td>7.60</td>
<td>UAN28</td>
<td>2.8</td>
<td>0.9 gallons/acre</td>
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<tr>
<td>7/12/11</td>
<td>Post-thinning</td>
<td>15.00</td>
<td>21.7</td>
<td>12.00</td>
<td>UAN30</td>
<td>25.0</td>
<td>7.7 gallons/acre</td>
</tr>
</tbody>
</table>

New Fertilizing

# Watering Summary

<table>
<thead>
<tr>
<th>Water Date</th>
<th>Irrigation Method</th>
<th>Irrigation Interval (days)</th>
<th>Recommended Irrigation Interval (days)</th>
<th>Recommended Irrigation Time (hrs)</th>
<th>Recommended Irrigation Amount (in)</th>
<th>Water Applied (in)</th>
<th>Cumulative Water Applied (in)</th>
<th>Cumulative ETc (in)</th>
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</thead>
<tbody>
<tr>
<td>6/8/11</td>
<td>Sprinkler</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
<td>1.00 in</td>
<td>1.00 in</td>
<td>0.14</td>
<td></td>
</tr>
<tr>
<td>6/10/11</td>
<td>Sprinkler</td>
<td>2</td>
<td>2.3</td>
<td>0.70 hrs</td>
<td>0.21 in</td>
<td>0.75 in</td>
<td>1.75</td>
<td>0.27</td>
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<tr>
<td>6/12/11</td>
<td>Sprinkler</td>
<td>2</td>
<td>2.5</td>
<td>0.63 hrs</td>
<td>0.19 in</td>
<td>1.00 in</td>
<td>2.75</td>
<td>0.43</td>
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<tr>
<td>6/22/11</td>
<td>Sprinkler</td>
<td>10</td>
<td>7.2</td>
<td>1.11 hrs</td>
<td>0.33 in</td>
<td>0.00 in</td>
<td>2.75</td>
<td>0.63</td>
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<tr>
<td>7/2/11</td>
<td>Sprinkler</td>
<td>10</td>
<td>8.1</td>
<td>0.33 hrs</td>
<td>0.10 in</td>
<td>0.50 in</td>
<td>3.25</td>
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<tr>
<td>7/8/11</td>
<td>Drip</td>
<td>6</td>
<td>5.8</td>
<td>4.15 hrs</td>
<td>0.42 in</td>
<td>1.00 in</td>
<td>4.25</td>
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<tr>
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<td>0.80 in</td>
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<td>7/18/11</td>
<td>Drip</td>
<td>6</td>
<td>7.3</td>
<td>3.90 hrs</td>
<td>0.39 in</td>
<td>0.40 in</td>
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<td>1.74</td>
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<tr>
<td>Water Date</td>
<td>Water Date</td>
<td>Irrigation Method</td>
<td>Water Applied (in)</td>
<td>Cumulative Water Applied (in)</td>
<td>Cumulative ETc (in)</td>
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<tr>
<td>------------</td>
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<td>--------------------</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>9/3/11</td>
<td>9/3/11</td>
<td>Sprinkler</td>
<td>0.70 in</td>
<td>0.70</td>
<td>0.13</td>
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<tr>
<td>9/4/11</td>
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<td>0.20 in</td>
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<td>0.26</td>
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<tr>
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<tr>
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<tr>
<td>9/8/11</td>
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<tr>
<td>9/9/11</td>
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<td>Sprinkler</td>
<td>0.19 in</td>
<td>1.75</td>
<td>0.97</td>
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</tr>
<tr>
<td>9/10/11</td>
<td>9/10/11</td>
<td>Sprinkler</td>
<td>0.20 in</td>
<td>1.95</td>
<td>1.10</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>9/12/11</td>
<td>9/12/11</td>
<td>Sprinkler</td>
<td>0.19 in</td>
<td>2.14</td>
<td>1.32</td>
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<tr>
<td>9/14/11</td>
<td>9/14/11</td>
<td>Sprinkler</td>
<td>0.25 in</td>
<td>2.39</td>
<td>1.51</td>
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<td>0.19 in</td>
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<td>1.70</td>
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<tr>
<td>9/18/11</td>
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<td>0.24 in</td>
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<td>1.95</td>
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<tr>
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<td>9/20/11</td>
<td>Sprinkler</td>
<td>0.34 in</td>
<td>3.16</td>
<td>2.23</td>
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<tr>
<td>9/24/11</td>
<td>9/24/11</td>
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<td>3.86</td>
<td>2.37</td>
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<tr>
<td>9/30/11</td>
<td>9/30/11</td>
<td>Drip</td>
<td>0.77 in</td>
<td>4.63</td>
<td>2.48</td>
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</tr>
</tbody>
</table>
Irrigation Efficiency Program (mobile irrigation lab)

- Distribution uniformity evaluation
- System design and operation review
- Scheduling evaluation
Summary

- Water management plays a critical role in managing N fertilizer in shallow rooted vegetables.

- Connectivity using radios, cell phones and the internet facilitates monitoring crop water use in real-time.

- The combination of ET and soil moisture monitoring are the best approaches to evaluate irrigation scheduling in cool season vegetables and berries.