CropManage: An Online Decision Support Tool for Irrigation and Nutrient Management

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Nitrogen use reporting started October, 2014
Tools for making water and nitrogen fertilizer decisions at the field level

- **Soil nitrate quick test**
- **Weather-based irrigation scheduling**
Weather-based irrigation scheduling

Converting Reference ET to Crop ET:

\[ \text{ET}_{\text{crop}} = \text{ET}_{\text{ref}} \times K_{\text{crop}} \]

\( K_c \) can vary from 0.1 to 1.2
On-farm challenges in implementing tools for managing water and fertilizer:

- Multiple fields to manage and track
- Other decisions and activities to coordinate
- Calculations involved for N and water management decisions are time consuming
- Collected data needs to be available to the decision maker(s) and decisions need to be communicated to field staff
“Think Outside the Spreadsheet”
CropManage: online irrigation and N management decision support tool

https://cropmanage.ucanr.edu
Integrate information from multiple sources

Database driven web application

Soil and Ranch

CIMIS ETo

Soil nitrate test

Field sensors

Crop ET model

Crop N model

Watering Recommendation

N fertilizer Recommendation

Display and export water and fertilizer records

Decision support using crop models
Crops currently supported

Vegetables:
- Romaine (40 and 80-inch wide beds)
- Iceberg (40 and 80-inch wide beds)
- Broccoli (summer and winter plantings)
- Cauliflower (summer and winter plantings)
- Cabbage (red and green)
- Celery
- Spinach (baby, teen, bunch)
- Baby lettuce (red, green)
- Mizuna
- Cilantro

Berries
- Strawberry (UC and proprietary varieties)
Future developments...

New crops planned for 2017
- Leaf lettuce
- Bell Peppers
- Raspberry
- Strawberry (new varieties)

Crops under development
- Trees: almonds, walnuts
- Vegetables: processing tomato, Brussels sprouts
- Forage: alfalfa

CropManage steering committee formed
- Provide oversight on implementation of new features and crops
Clientele interest

> 1000 users
> 300 Ranches
> 10000 visits to CM blog since Dec 2013
CropManage use has steadily increased since 2011.
New version of CropManage released Nov 1, 2015

- Improved user-interface
- Faster speed
- Flexibility to support different types of commodities
- Web application protocol interface (API)
Identify when and who made entries

<table>
<thead>
<tr>
<th>Date</th>
<th>Irrigation Method</th>
<th>Irrigation Interval (days)</th>
<th>Recommended Maximum Irrigation Interval (days)</th>
<th>Recommended Water (in.)</th>
<th>Applied Water (in.)</th>
<th>Rainfall (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/7/2016</td>
<td>Drip</td>
<td>4</td>
<td>3.5 days</td>
<td>0.9</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>9/12/2016</td>
<td>Drip</td>
<td>5</td>
<td>4.2 days</td>
<td>0.9</td>
<td>0.8</td>
<td></td>
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<tr>
<td>9/18/2016</td>
<td>Drip</td>
<td>6</td>
<td>4.2 days</td>
<td>1.1</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>9/19/2016</td>
<td>Drip</td>
<td>1</td>
<td>3.8 days</td>
<td>0.2</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>9/26/2016</td>
<td>Michael Cahn</td>
<td>4</td>
<td>4.3 days</td>
<td>0.7</td>
<td>0.9</td>
<td>0.9</td>
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<tr>
<td>9/27/2016</td>
<td>Drip</td>
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<td>3.7 days</td>
<td>0.9</td>
<td>1.3</td>
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</tr>
<tr>
<td>10/3/2016</td>
<td>Drip</td>
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<td>4.4 days</td>
<td>1.1</td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>10/12/2016</td>
<td>Drip</td>
<td>9</td>
<td>4.7 days</td>
<td>1.5</td>
<td>1.0</td>
<td></td>
</tr>
</tbody>
</table>

**TOTALS**
- 14.50 inches
- 17.08 inches

In partnership with CDFA & FREP
Transparency on how recommendations are made

Irrigation Recommendation Summary

Rainfall Changed Description

Average ETo 0.17 inches/day
Average Crop Coefficient 1.09
Distribution Uniformity 85.00 %
Days Since Last Irrigation 4 days
Leaching Requirement 0.00 % / 100
Total Precipitation 0.00 inches

Base Amount = \frac{\text{Average ETo} \times \text{Average Crop Coefficient} \times \text{Days Since Last Irrigation} \times 100}{\text{Distribution Uniformity}}

0.86 inches = \frac{0.17 \text{ inches/day} \times 1.09 \times 4 \text{ days} \times 100}{85.00 \%}

Recommended Irrigation Amount = \frac{\text{Base Amount}}{(1 - \text{Leaching Requirement}) - \text{Total Precipitation}}

0.86 inches = \frac{0.86 \text{ inches}}{(1 - 0.00) - 0.00 \text{ inches}}

Date: 9/27/2016

Recommended Irrigation Amount: 0.86 inches
More intuitive user interface under development

- Simplify user interface
- Easy to read on smart phones and tablet computers
- Intuitive to navigate
- Simple for field staff to use (irrigators, foremen)
- Better designed for communicating between decision makers and field staff
Main menu
Plantings menu

Bondenson 🌱

Search Active Plantings

Filter Plantings

ACTIVE PLANTINGS

Planting A
Lot 1

Cauliflower-transplanted, 1 row, 40-inch bed, winter
1 Mar 2016 → 3 May 2016

Events
Upcoming | Past
18 Oct 2016 (Today)

Germination Sprinkler
0.42 in.

UAN28
4.7 gal/acre

Quick Nitrate Strip
1 ft

19 Oct 2016 (Tomorrow)

Germination Sprinkler
0.11 in.

UAN28
None

View all events by:

Planting B
Lot 2

Cauliflower-transplanted, 1 row, 40-inch bed, winter
1 Mar 2016 → 3 May 2016

Events
Upcoming | Past
18 Oct 2016 (Today)

Germination Sprinkler
0.42 in.

UAN28
4.7 gal/acre

Quick Nitrate Strip
1 ft

19 Oct 2016 (Tomorrow)

Germination Sprinkler
0.11 in.

UAN28
None

View all events by:

Planting C
Lot 2

Cauliflower-transplanted, 1 row, 40-inch bed, winter
1 Mar 2016 → 3 May 2016

Events
Upcoming | Past
18 Oct 2016 (Today)

Germination Sprinkler
0.42 in.

UAN28
4.7 gal/acre

Quick Nitrate Strip
1 ft

19 Oct 2016 (Tomorrow)

Germination Sprinkler
0.11 in.

UAN28
None

View all events by:

Planting D
Lot 3

Cauliflower-transplanted, 1 row, 40-inch bed, winter
1 Mar 2016 → 3 May 2016

Events
Upcoming | Past
18 Oct 2016 (Today)

Germination Sprinkler
0.42 in.

UAN28
4.7 gal/acre

Quick Nitrate Strip
1 ft

19 Oct 2016 (Tomorrow)

Germination Sprinkler
0.11 in.

UAN28
None

View all events by:
Potential Benefits for Clientele and ANR

- Extension tool for UCANR research
- Scientifically-based recommendations adapted for site-specific crop conditions (weather, soil, crop stage)
- Maintain and retrieve records on water and nutrients
- Useful for conducting irrigation and nutrient management trials
- Collaboration with other universities and institutions
Ways to become involved with CropManage

- Try using it
- Develop information needed for new crops
- Test/develop water and nutrient management algorithms (field trials)
- Adapt CropManage for new regions (soil types, crop production practices)
- Translate text into Spanish (and other languages)
- Lead or collaborate in trainings and workshops for growers/consultants
Acknowledgements:

- UCCE Advisors/Specialists
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- CA Dept. of Water Resources
- UC Division of Agriculture and Natural Resources
- Growers and Shippers