Using CropManage for ET-based irrigation scheduling of Tree Crops

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Why is irrigation management important?

Regulations and water availability

• Periodic droughts
• Sustainable Groundwater Management Act
• Irrigated Lands Regulatory Program
• Increased acres of permanent crops
Micro-irrigation has improved application uniformity in trees.

What is Irrigation Scheduling?

1. WHEN to irrigate?
2. HOW MUCH to irrigate?

Various Approaches to Irrigation Scheduling

Weather-based  Plant-based  Soil-based
Weather-based irrigation scheduling

Converting Reference ET to Crop ET:

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

\( K_c \) can vary from 0.1 to 1.2

Crop coefficient (\( K_c \)) for pistachio can be related to canopy cover:

\[ K_c = 0.3271 + 0.0107 \times \text{fPAR} - 4.31 \times 10^{-5} \times \text{fPAR}^2 \]

\( R^2 = 0.84 \)

Zaccaria et al. 2020

But getting from a crop coefficient to how long to irrigate requires a few steps:

- Calculate Crop ET since the last irrigation
- Adjust for application uniformity
- Adjust for leaching fraction and crop development stage
- Convert to hours based on system application rate
On-farm challenges to implementing field specific water recommendations

- Multiple fields and crops to manage and track
- Other decisions and activities to coordinate
- Calculations involved are time consuming

CropManage: Online irrigation and nitrogen management decision support tool

cropmanage.ucanr.edu

What CropManage does:

- Provides site-specific recommendations for irrigation and nitrogen management based on soil type, climate, crop type, and crop development stage
- Uses science-based algorithms for developing recommendations
- Maintains records on water and nutrient management
Steps to Using CropManage

1. Establish user login (free)
2. Set up a ranch (farm)
3. Add a planting (crop, orchard)
4. Enter soil and tissue tests, fertilizer, or irrigation events

Vegetable Crops Currently Supported

- Broccoli
- Brussels sprout
- Cabbage (red and green)
- Cauliflower
- Celery
- Cilantro
- Lettuce (Romaine, iceberg, leaf, baby)
- Mizuna
- Pepper (Red bell pepper)
- Spinach (baby, teen, bunch)
- Tomato (processing tomato)
Perennial Crops Currently Supported

- Strawberry
- Raspberry
- Almonds
- Walnut
- Pistachio
- Alfalfa

Irrigation event demo

CropManage Terms

- Ranch (Farm)
- Planting Area (block, lot, field, orchard)
- Event (soil sample, tissue sample, irrigation, etc)
- Commodity (tomato, walnut, etc)
- Crop Type (processing tomato, pistachio san joaquin)
Privacy/data sharing

• Latest security and privacy protocols in place (Amazon Web Service)
• CropManage is designed to allow multiple users view and update information for a planting/crop
• Ranch “Owner” designates which users have access to data and sets level of access

Interface with UCD SoilWeb Tool

CropManage reference ET data

• Includes ~150 CIMIS stations
• Option to use multiple stations
• Sequential and averaging mode
• Spatial CIMIS option
• Historical ETo data (for future irrigations)
Canopy development model for trees

CropManage interfaces with Satellite Irrigation Management Support (SIMS)

SIMS satellite estimates of fraction cover can be used to customize the canopy curve
CropManage also provides support for N management in trees

**Seasonal N Requirement Calculator**

<table>
<thead>
<tr>
<th>Component Name</th>
<th>Winter N</th>
<th>Spring N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen (N)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phosphorus (P)</td>
<td></td>
<td></td>
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<tr>
<td>Potassium (K)</td>
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</tbody>
</table>

**Soil moisture monitoring**

**Display for soil moisture sensors**
Tools for automating flow measurements

Clientele interest
> 2000 Users
> 1600 Ranches
> 7,200 Plantings
> 11,000 soil samples
> 70,000 Recommendations

How are Clientele using CropManage?
- Irrigation scheduling
- Nitrogen fertilizer management
- Training farm staff on irrigation and N management
- Seasonal estimates of crop water use or needs
- Regulatory compliance (record keeping)
- Training students
- Research trials
Looking Ahead

- Add reporting capability (regional board)
- Regionalize (other weather station networks)
- Develop native app version
- Increase API capacity to interface with other commercial software
- Add task management (irrigator, farm manager, fertilizer foreman)
- Increase user support capabilities

Summary

- CropManage repackages University research into simple to use decision support tools
- CropManage is designed to support growers and crop consultants in water and N management decisions.
- CropManage provides scientifically-based recommendations adapted for site-specific crop conditions (weather, soil, crop stage)
- UC is pursuing opportunities for expanding CM to additional commodities and add new features and data sources.

How to learn more:

- Attend a CropManage Workshop
- Targeted trainings
- Help links and comments
- CropManage hotline 831-759-7377