CropManage Irrigation and Nitrogen Management Decision Support Tool

University of California
Agriculture and Natural Resources

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Acknowledgements:

- UCCE Advisors and Specialists
- CDFA-Fertilizer Research Education Program
- UC Division of Agriculture and Natural Resources
- Growers and Shippers

Drivers for better management of water and nitrogen

OPTIMIZING YIELD AND QUALITY

WATER QUALITY REGULATIONS

SUSTAINABLE GROUND WATER MANAGEMENT ACT

SUSTAINABILITY METRICS

Water quality regulations in California are becoming stricter and will require improvements in water and nitrogen management

Table C.1-2. Time Schedule for Nitrogen Discharge Targets and Limits

Compliance Pathway 1 $A_{FER} + C \times A_{COMP} + A_{IRR} - R =$	Compliance Pathway 2	Year	Target or Limit
500	$A_{FER} + C \times A_{COMP} = R$	2022	Target
400		2024	Target
300		2026	Limit
200		2030	Limit
150		2035	Limit
100		2040	Limit
50		2050	Limit

Note: All units are in pounds of nitrogen per acre per year and represent all crops grown and harvested on the entire ranch.

A_{FER} is the amount of fertilizer nitrogen applied in pounds per acre.
C is the compost discount factor used to represent the amount of compost nitrogen mineralized during the year that the compost was applied.
A_{COMP} is the total amount of compost nitrogen applied in pounds per acre.
A_{IRR} is the amount of irrigation water nitrogen applied in pounds per acre.
R is the amount of nitrogen removed from the field through harvest, sequestration, or other removal methods, in pounds per acre.

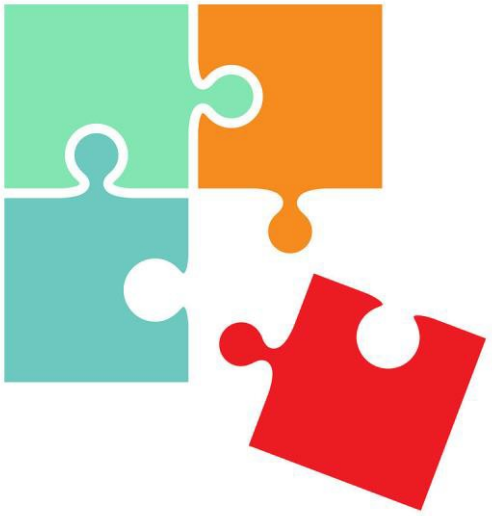
Account for all sources of nitrogen

- Residual mineral N in soil (Nitrate and ammonium)
- N in irrigation water
- Nitrogen mineralization from soil, amendments, and previous crop residues

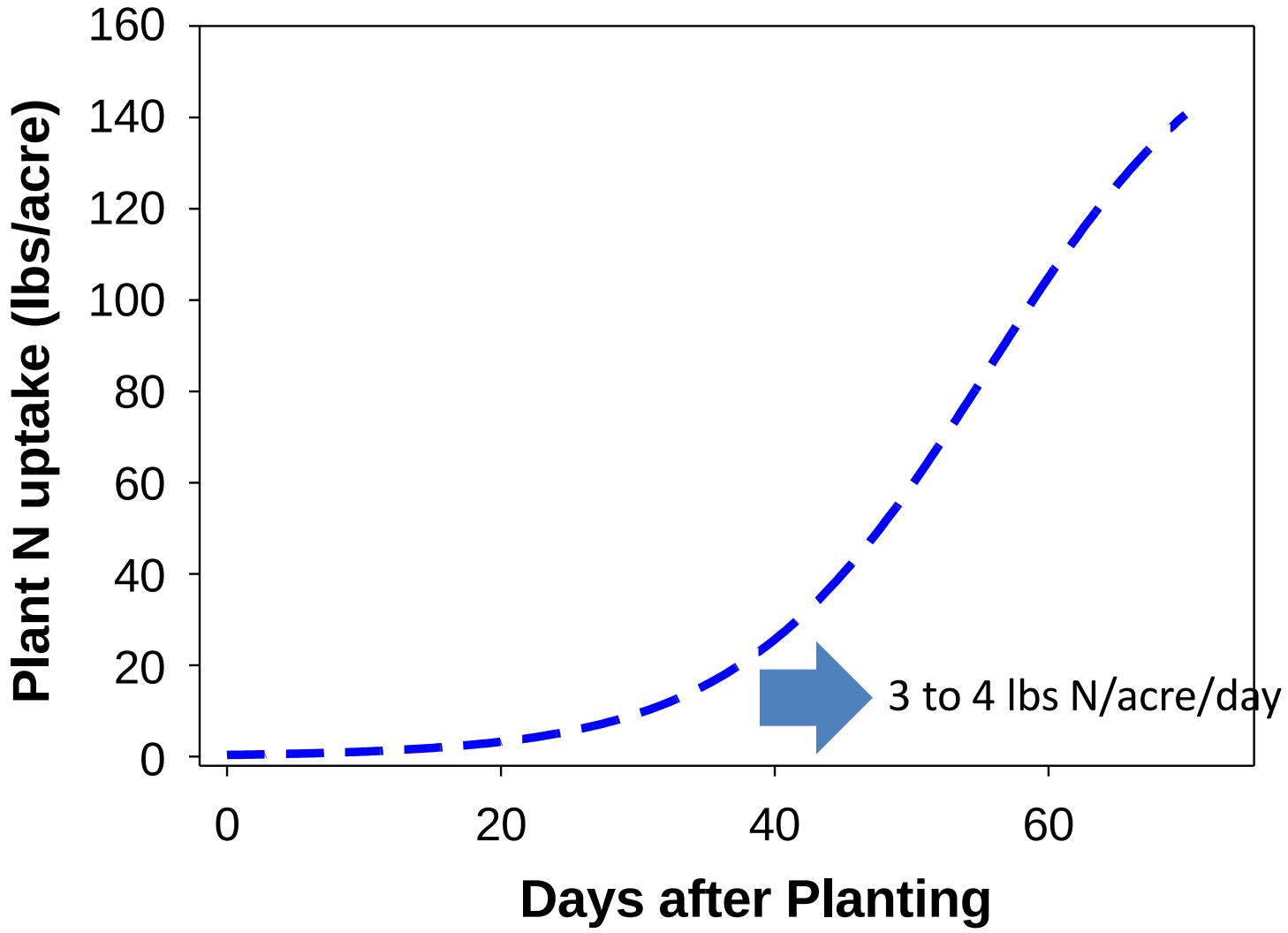
soil

water

crop residue



Match N fertilizer applications with crop uptake



Various Approaches to Irrigation Scheduling

Weather (ET)-based

Plant-based

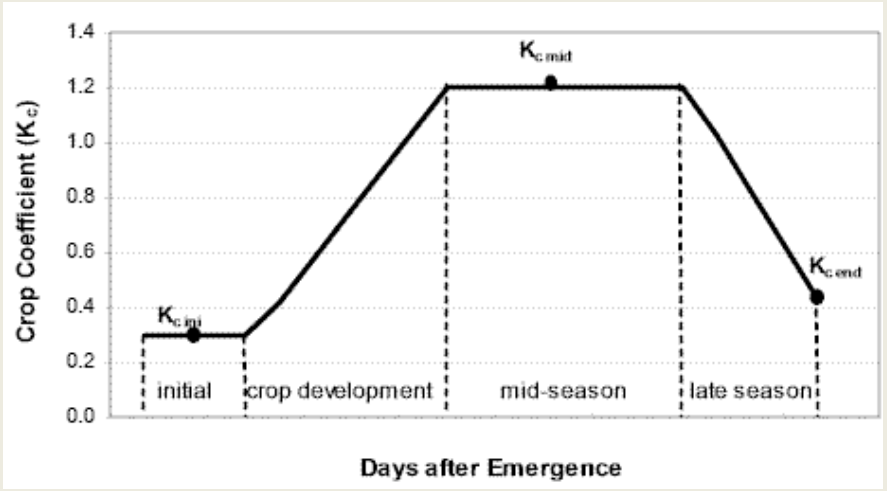
Soil-based

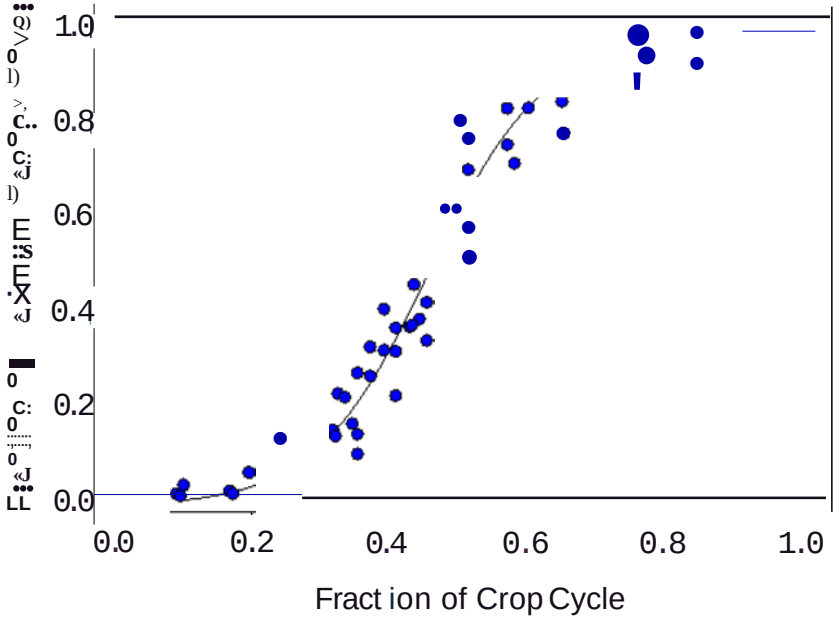
Weather-based irrigation scheduling

Converting Reference ET to Crop ET:

$$ET_{crop} = ET_{ref} \times K_{crop}$$

K_c can vary from 0.1 to 1.2




1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0
Fraction of Crop Cycle

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

Calculate Crop ET since the last irrigation

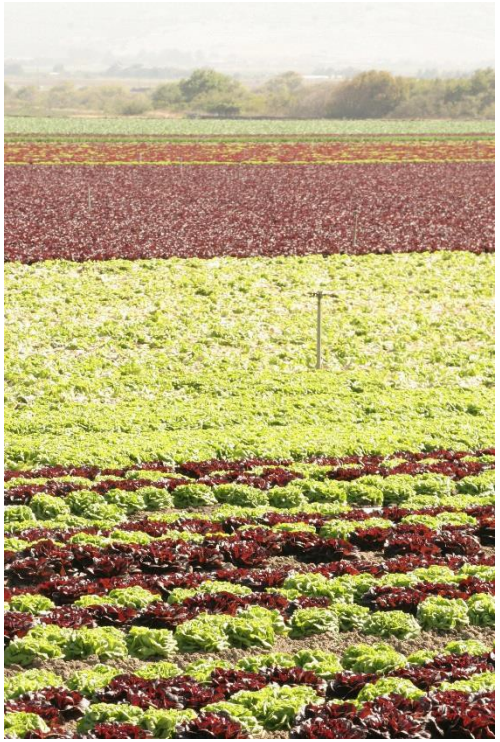
Adjust for application uniformity

Adjust for leaching fraction and crop development stage

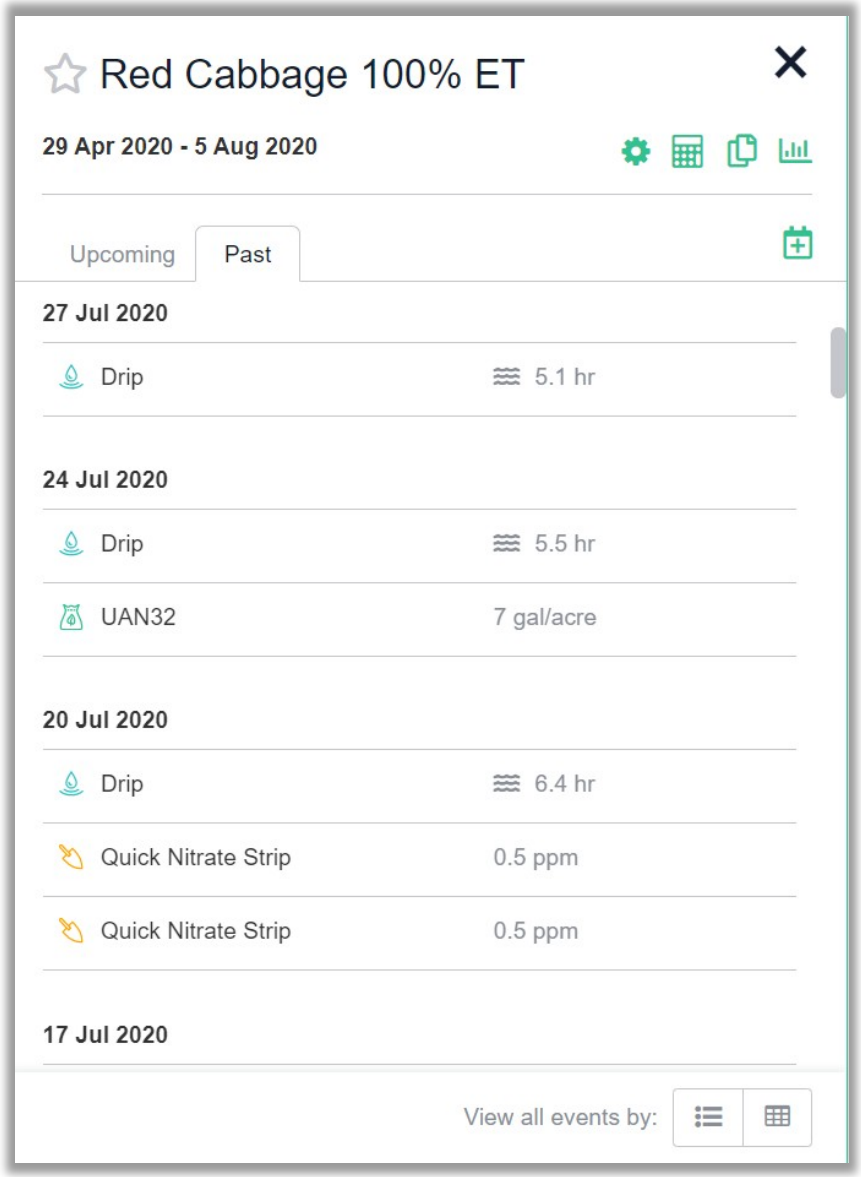
Convert to hours based on system application rate

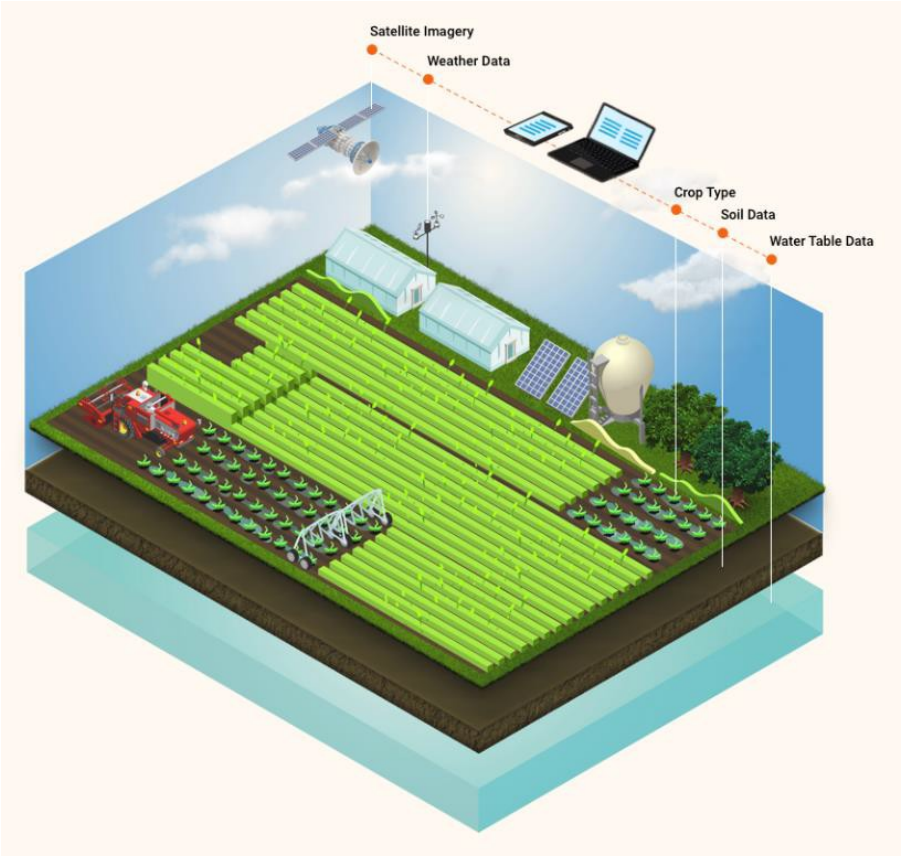
On-farm challenges in implementing field specific water and nitrogen recommendations

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



CropManage: Online irrigation and nitrogen management decision support

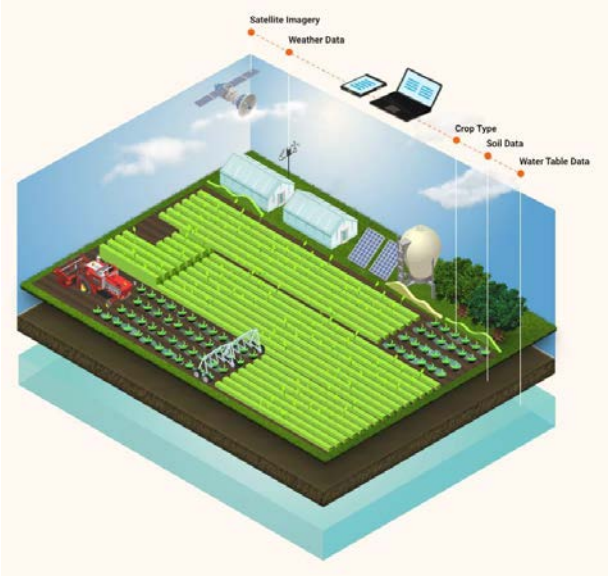




cropmanage.ucanr.edu

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 (export for regulatory compliance)**



Steps to Using CropManage

1. Open web browser to cropmanage.ucanr.edu
2. Establish user login (free)
3. Set up a ranch
4. Add a planting
5. Enter soil tests, fertilizer, or irrigation events

CropManage Background

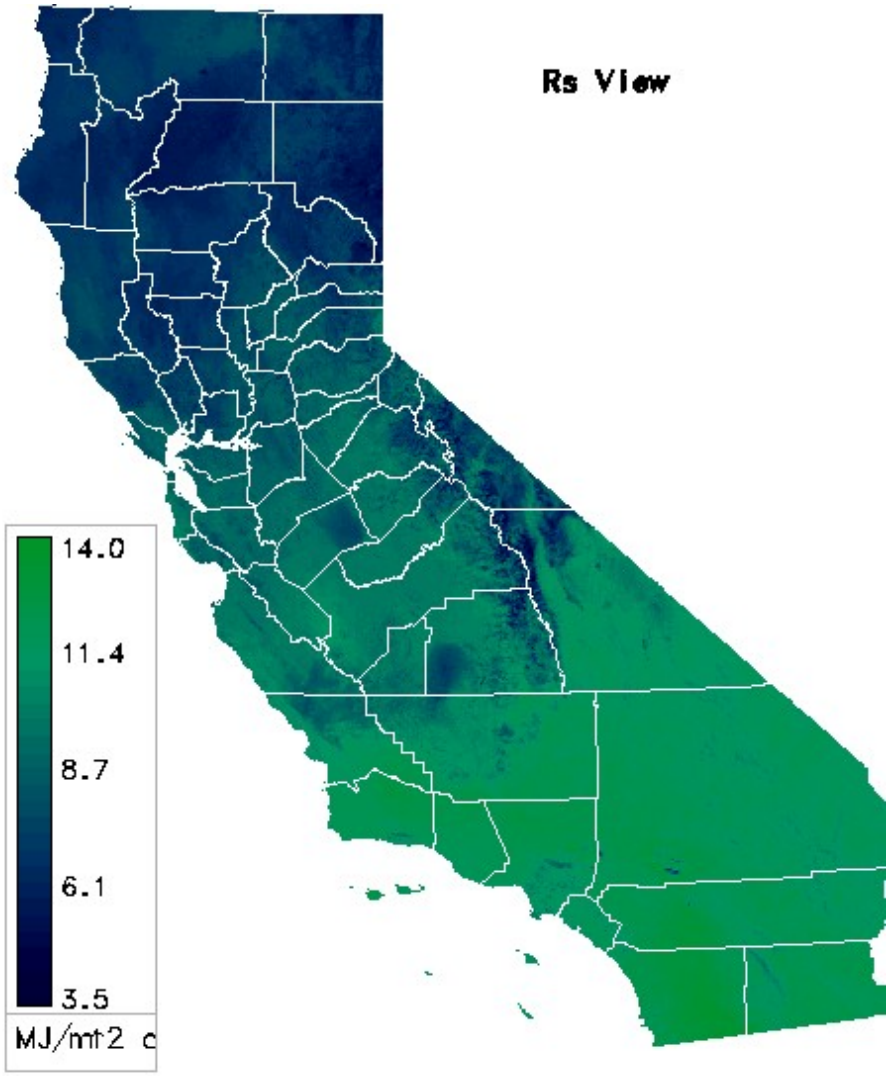
- CM platform launched in 2011
- >2500 users
- Field trial tested during the past 8 years
- Free to use (no equipment needed)
- Web browser application
- Strict privacy/data security protocols
- Recently adapted for perennial crops

Crops currently supported

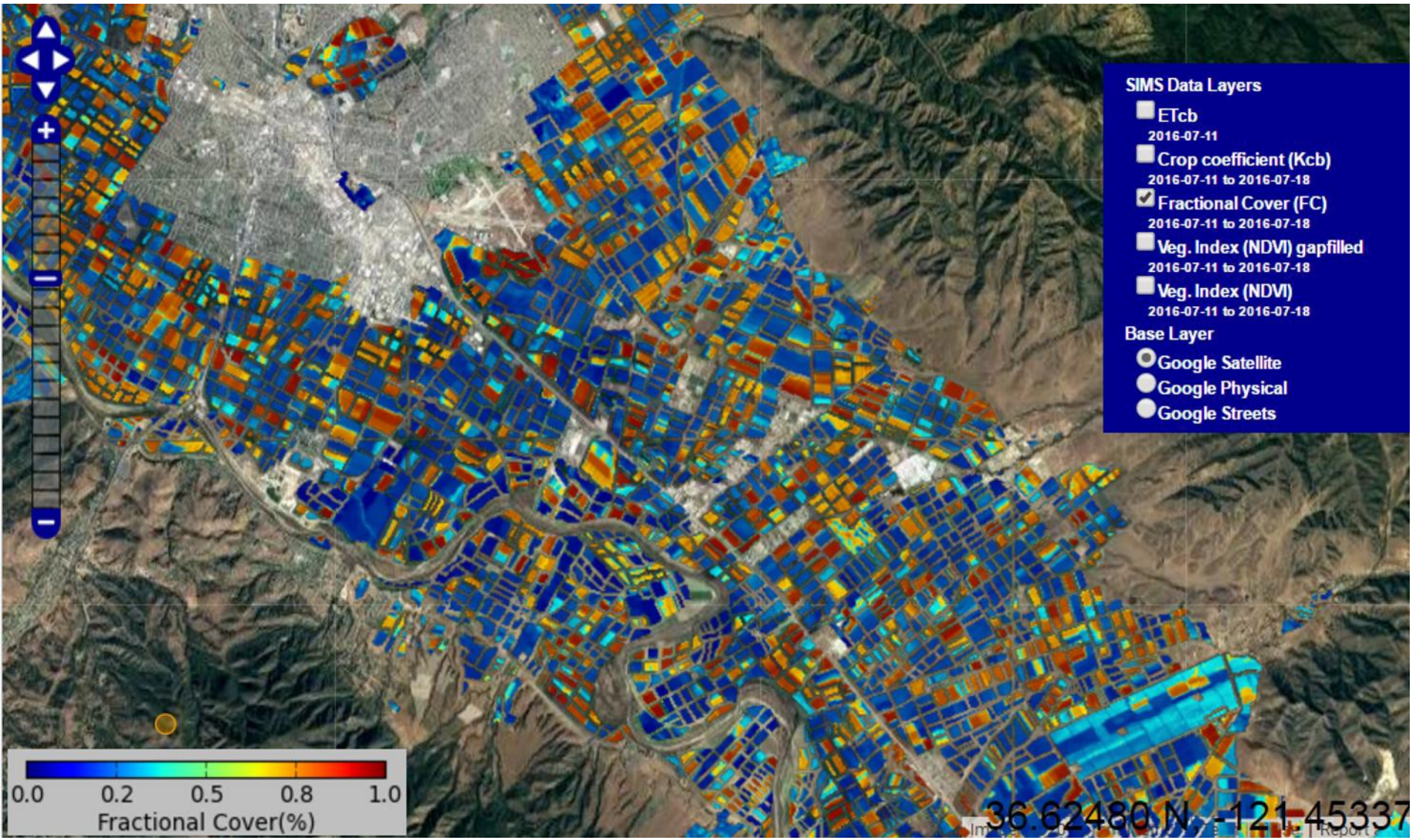
- Vegetables (artichoke, broccoli, cabbage, cauliflower, celery, lettuce, pepper, spinach, tomato, etc.)
- Berry crops (raspberry, strawberry)
- Tree crops (almond, walnut, pistachio)
- Field crops (alfalfa, corn)

CropManage reference ET data

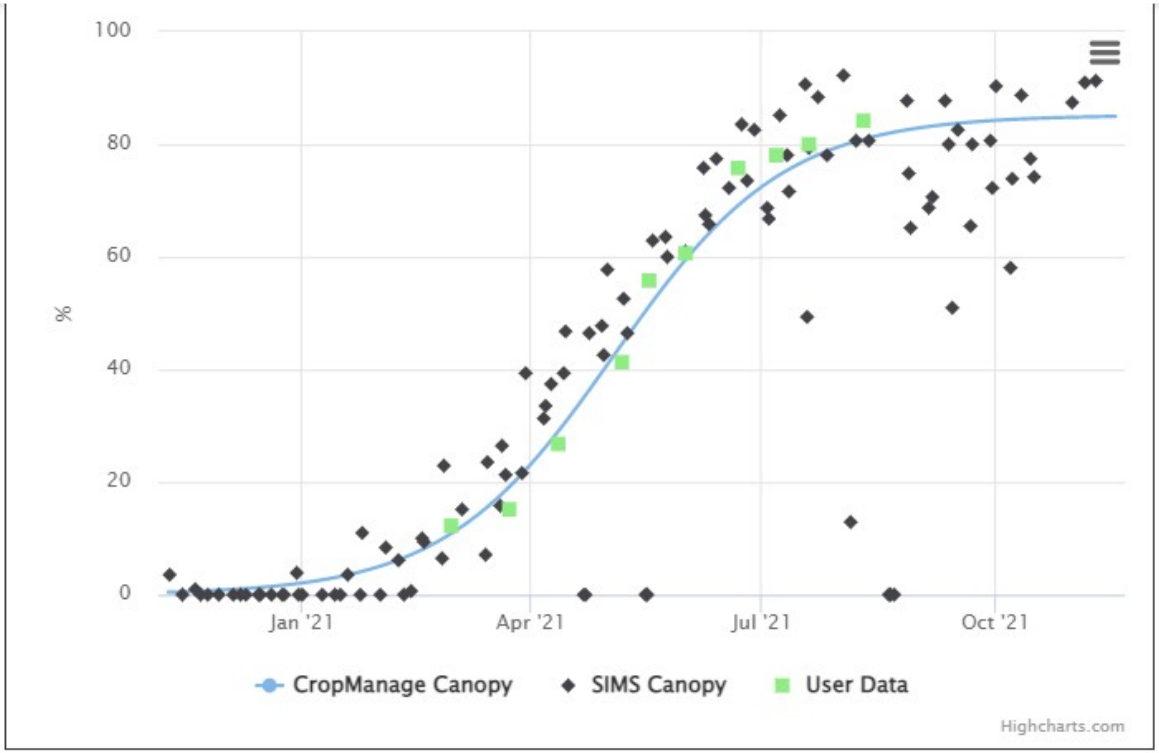
- Includes 150 CIMIS stations
- Option to use multiple stations
- Spatial CIMIS option
- Historical ETo data (for future irrigations)
- Access to OpenET coming



CropManage interfaces with Satellite Irrigation Management Support (SIMS)



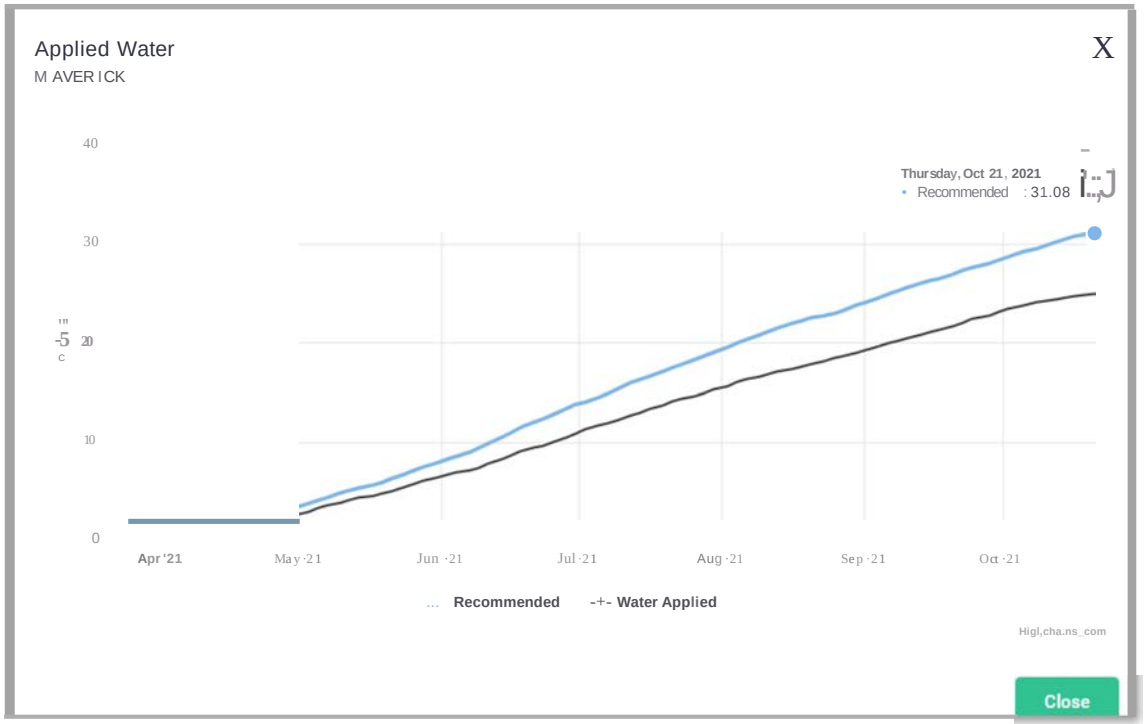
Satellite data can be used to confirm canopy development model

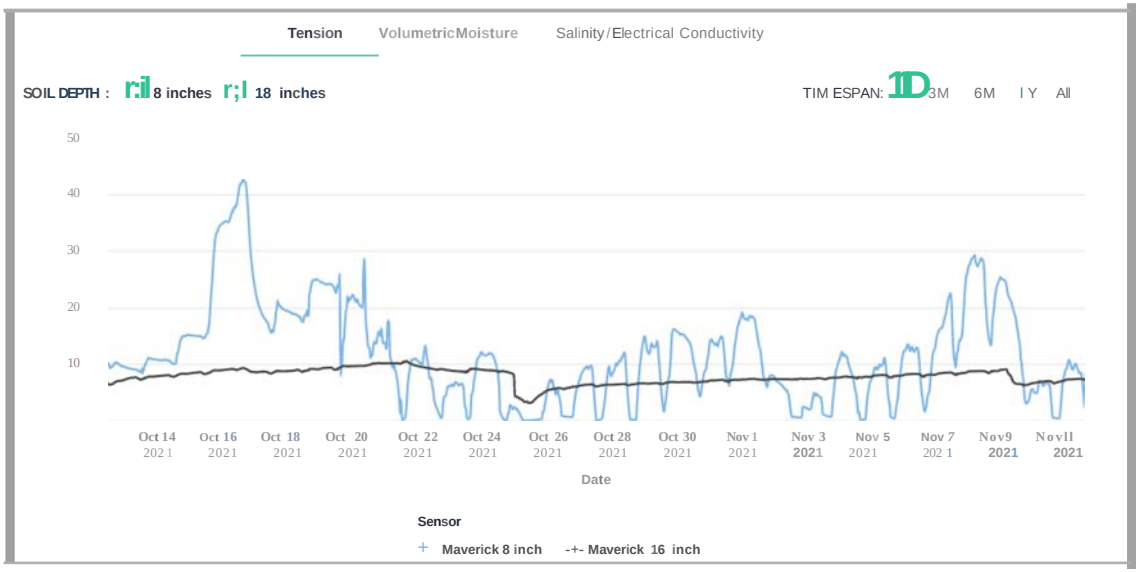


CropManage Canopy Parameters Reset to Default Parameters

Max. Canopy	Max. Fraction	Canopy A	Canopy B
85.2	0.79	5.2877	-8.8449

CropManage can be used to monitor irrigation and soil moisture


Applied Water
M AVER ICK
X
40
30
20
10
0
Thursday, Oct 21, 2021
Recommended : 31.08
Apr '21
May ·21
Jun ·21
Jul ·21
Aug ·21
Sep ·21
Oct ·21
Recommended
-+- Water Applied
Higl,cha.ns_com
Close


Tension
VolumetricMoisture
Salinity/Electrical Conductivity
SOIL DEPTH :
8 inches
18 inches
TIM ESPAN:
1D
3M
6M
I Y
All
50
40
30
20
10
Oct 14 2021
Oct 16 2021
Oct 18 2021
Oct 20 2021
Oct 22 2021
Oct 24 2021
Oct 26 2021
Oct 28 2021
Oct 30 2021
Nov 1 2021
Nov 3 2021
Nov 5 2021
Nov 7 2021
Nov9 2021
Nov11 2021
Date
Sensor
Maverick 8 inch
-+- Maverick 16 inch

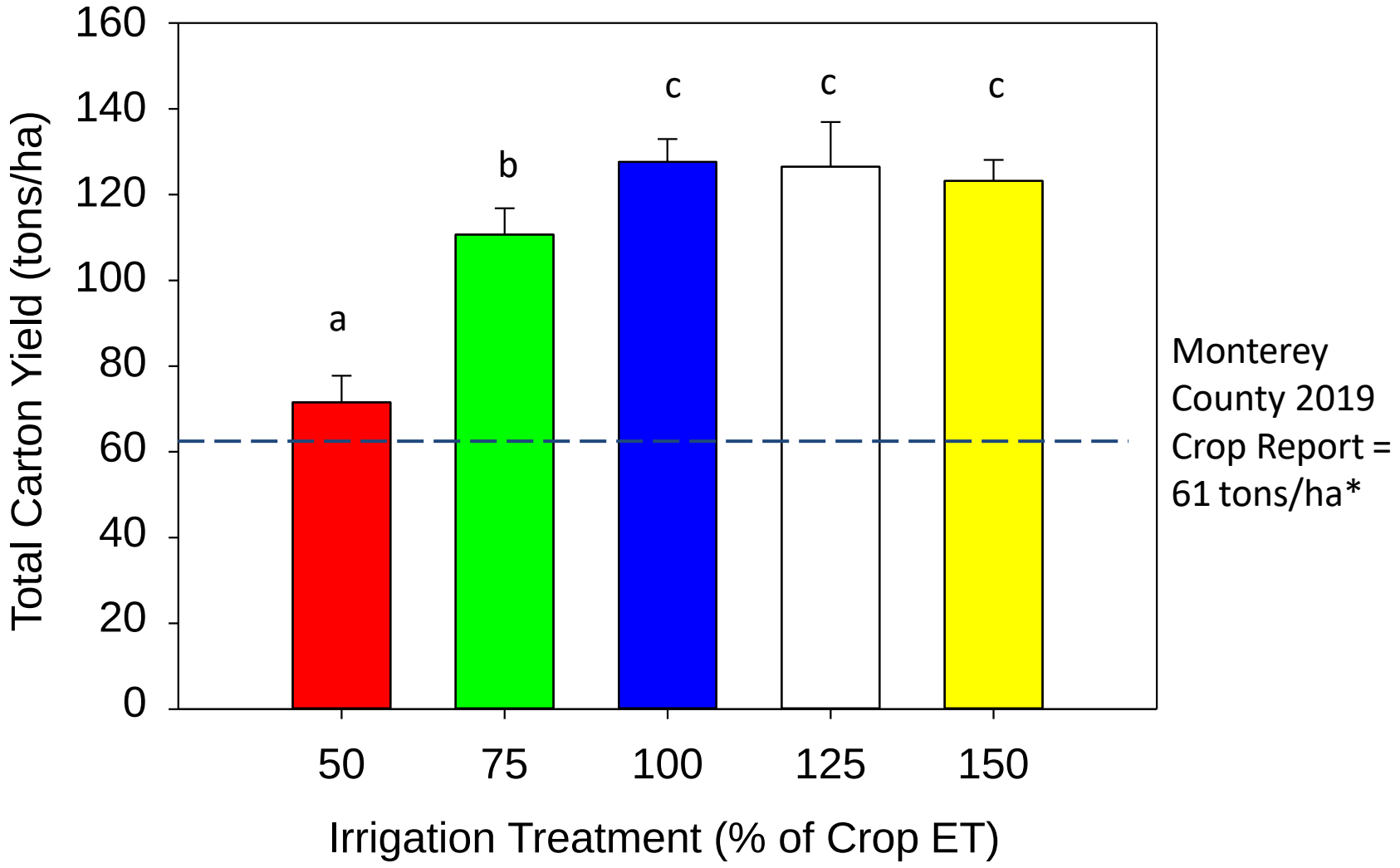
CropManage has been extensively field trialed

- Artichoke
- Head lettuce
- Romaine lettuce
- Green cabbage
- Red cabbage
- Broccoli
- Cauliflower
- Celery
- Strawberry
- Raspberry

Irrigation treatments of 50% to 150% of recommended water

100% ET (Blue) 150% ET (Yellow)

Carton yield was maximized with the 100% ET treatment



Clientele interest

(since 2016)

> 9200 soil samples

> 14,000 Fertilizer recommendations

> 59,000 Irrigation 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

- Additional commodities (vineyards, Asian vegetables, carrots, agronomic crops)
- Visualization tools (soil water balance, applied vs recommended water and fertilizer)
- CropManage help (tutorials, FAQ, videos)
- Improve compatible with farm management software
- Task management

Summary

- **CropManage repackages UC research into simple to use decision support tools**

- ***CropManage* is designed to support growers and crop consultants in water and N management decisions.**

- **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

CropManage

CropManage Hands-on Workshop

Bringing Irrigation and Nutrient Management Decision-Support Tool to the Field

Date: Wednesday, January 26, 2022

1pm – 5pm

Location: University of California Cooperative Extension-Stanislaus County

Harvest Hall, Room E

3800 Cornucopia Way, Modesto, CA 95358

- *Learn how to use CropManage to support irrigation and nutrient management decisions and record-keeping for your crops*
- *Learn about the latest updates to CropManage*