


Using CropManage to help with Ag Order compliance

The logo for the University of California Agriculture and Natural Resources. It features a vertical orange bar to the left of the text. The text is in a dark blue, serif font. The first line reads "University of California" and the second line reads "Agriculture and Natural Resources".

University of California
Agriculture and Natural Resources

A wide-angle photograph of an agricultural landscape. In the foreground, there are neat rows of young green plants, likely lettuce, growing in dark brown soil. The rows are separated by white plastic mulch. In the middle ground, there is a line of trees and a dirt road. The background consists of rolling green hills under a blue sky with some light clouds.

Michael Cahn
Irrigation and Water Resources Advisor
Monterey, San Benito, and Santa Cruz Counties

Ag Order 4.0: Applied (A) minus removed (R) calculation

$$A_{\text{FER}} + (C \times A_{\text{COMP}}) + (O \times A_{\text{ORG}}) + A_{\text{IRR}} - R = \text{Nitrogen Discharge}$$

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.

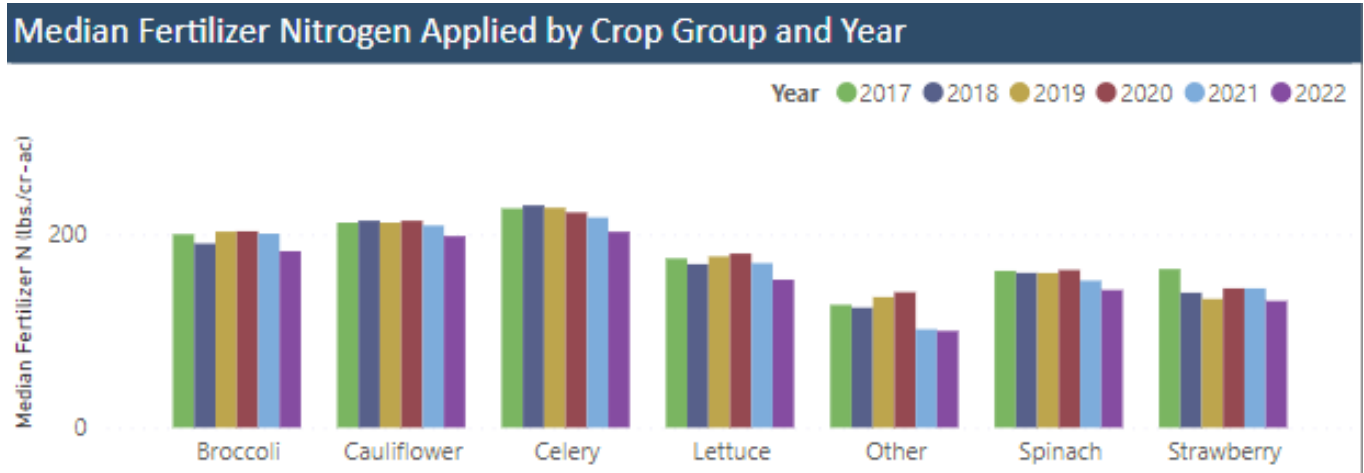
O is the organic fertilizer discount factor used to represent the amount of nitrogen mineralized during the first 12 weeks in the year it was applied.

A_{ORG} is the total amount of organic fertilizer or amendment nitrogen applied in pounds per acre.

A_{IRR} is the amount of nitrogen in pounds per acre applied in the irrigation water estimated from the volume required for crop evapotranspiration (ET) or volume of water applied.

R is the amount of nitrogen removed from the field through harvest, sequestration, or other removal methods, in pounds per acre

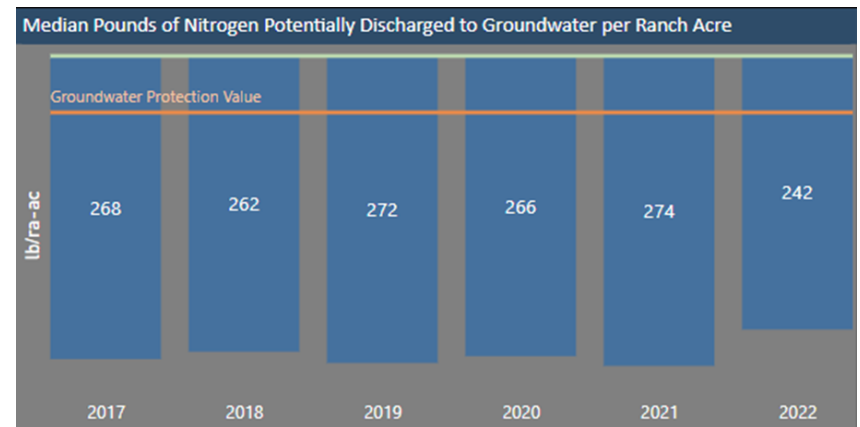
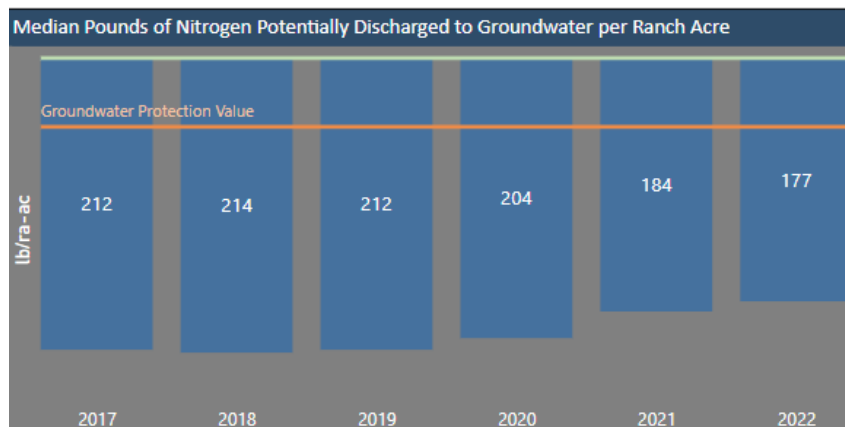
Central Coast Regional Water Quality Control Board Irrigated Lands Program Dashboard



Potential discharge based on A-R estimates

All crops

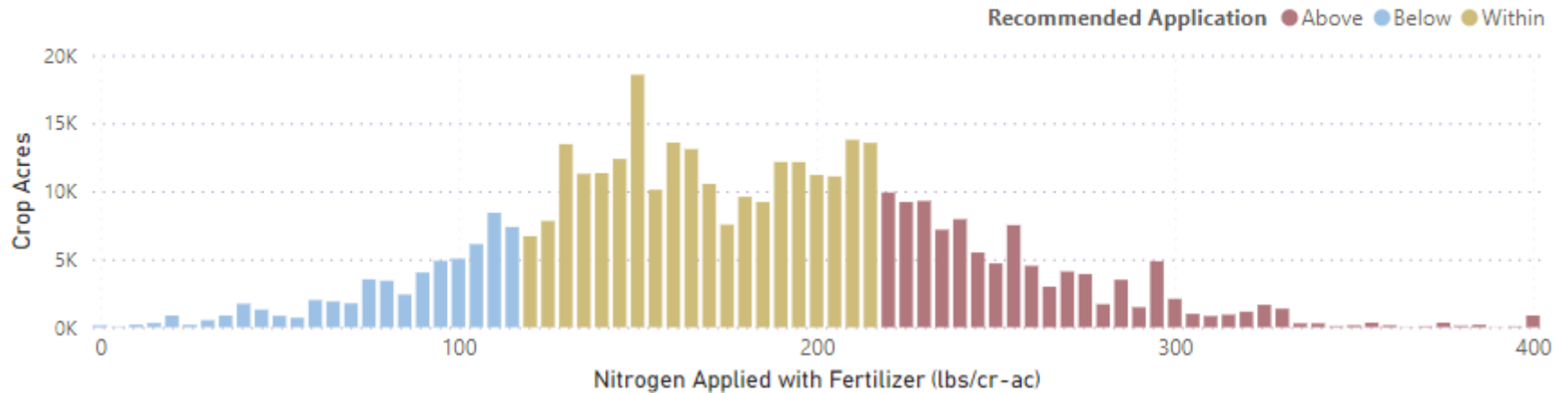
Lettuce



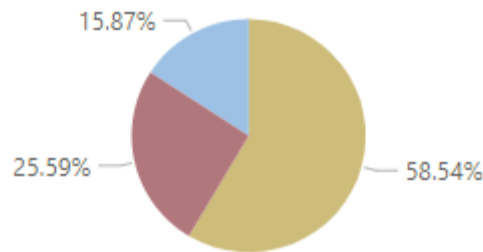
N fertilizer applications for lettuce (2020-2022)

Based on recommendation of 120 to 220 lb N/acre

Grouping of Nitrogen Applied with Conventional Fertilizer by California Crop Fertilization Guidelines
Lettuce

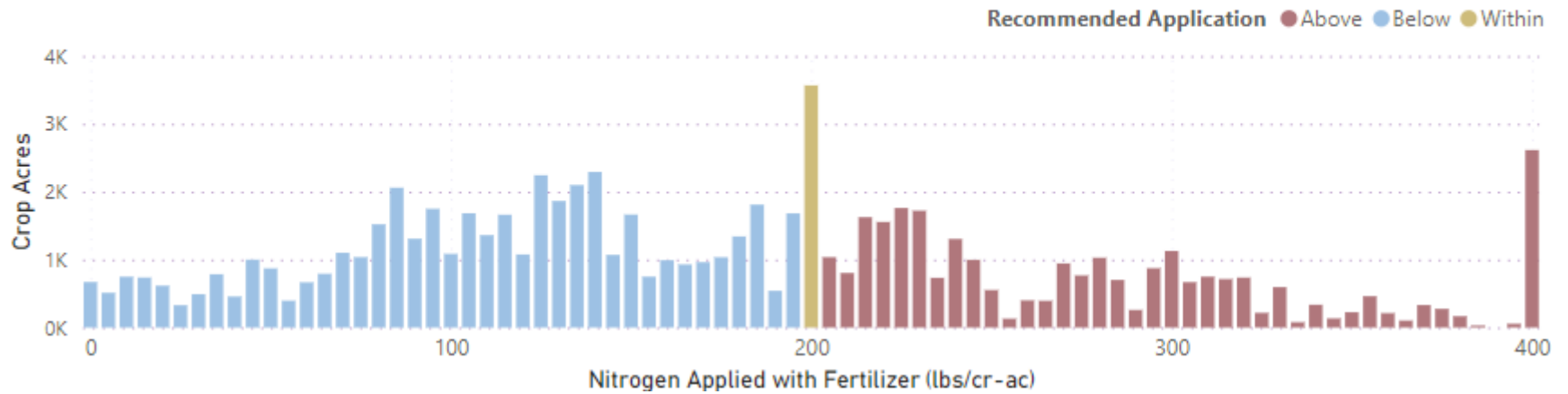


Sum of Crop Acres Grouped by California Crop Fertilization Guidelines

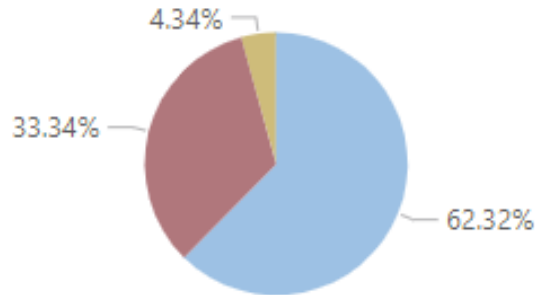


N fertilizer applications for strawberry (2020-2022)

Grouping of Nitrogen Applied with Conventional Fertilizer by California Crop Fertilization Guidelines
Strawberry



Sum of Crop Acres Grouped by California Crop Fertilization Guidelines



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

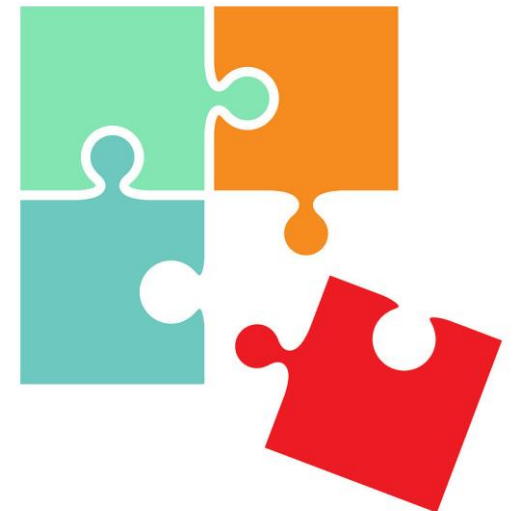
soil



water



crop residue



The soil nitrate quick test has helped growers use less nitrogen fertilizer



Nitrogen in irrigation water is available for plant uptake



Well water
(2 to 70 ppm Nitrate-N)



Recycled water
(15 to 30 ppm N as Ammonium + Nitrate)

Water management is critical for using N efficiently



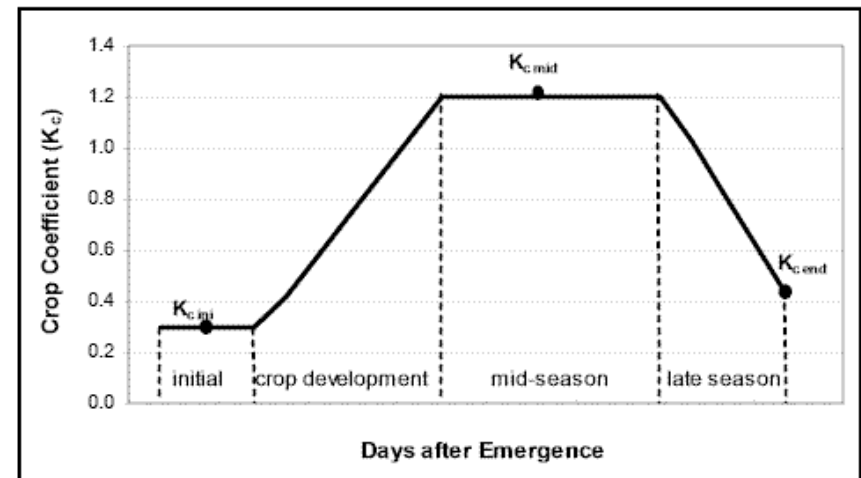
Weather-based irrigation scheduling



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



CropManage: Online irrigation and nitrogen management decision support

☆ 32-1 ✕

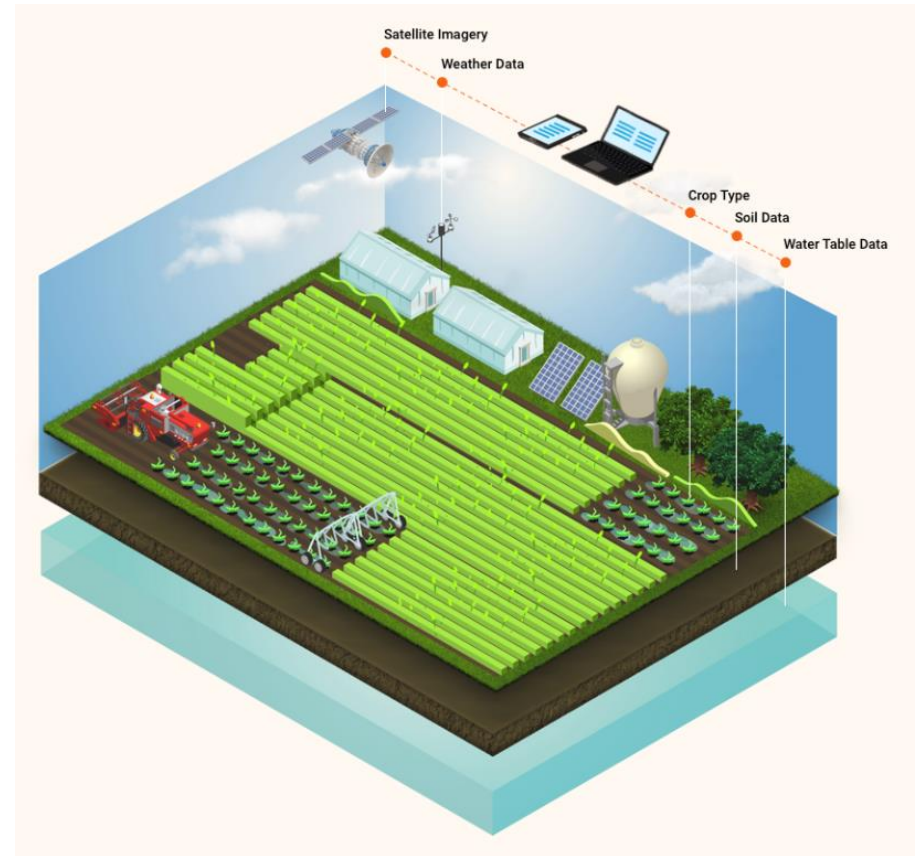
14 Apr 2023 - 9 Jun 2023

Tasks History

COMPLETED

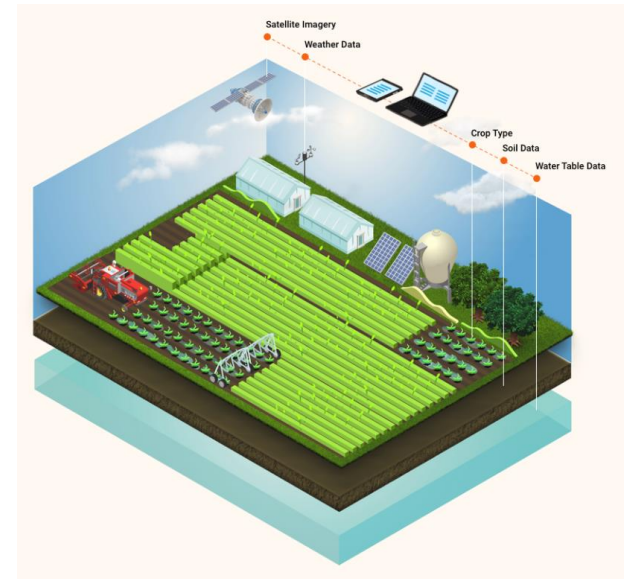
JUN 3	Drip	5.2 hr
MAY 29	Drip	4 hr
MAY 29	AN-20	20 gal/acre
MAY 29	Quick Nitrate Strip	3.3 ppm
MAY 28	Drip	1.9 hr
MAY 27	Drip	0.5 hr
MAY 23	Drip	4.4 hr
MAY 23	AN-20	15 gal/acre
MAY 22	Quick Nitrate Strip	8.3 ppm

View all events by:



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)



Crops currently supported

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

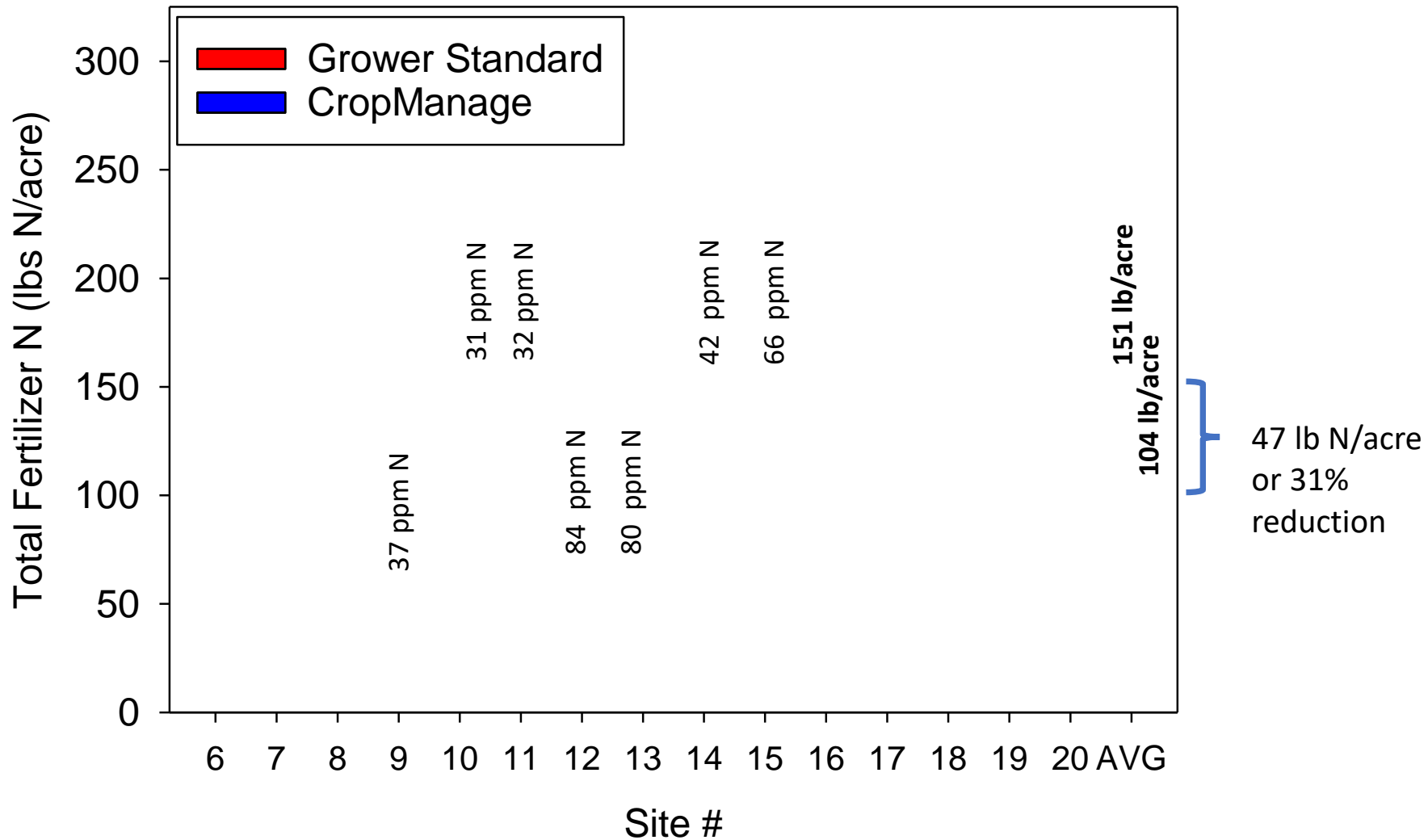


Vegetable Crops currently supported

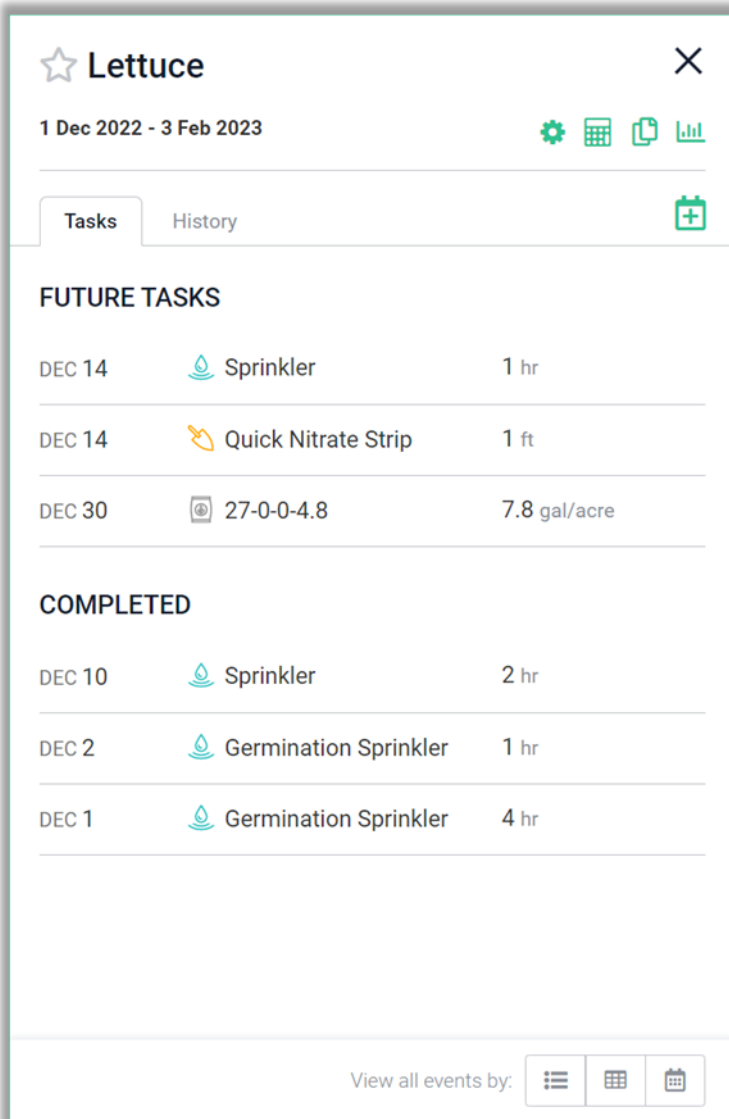
- ✓ Artichoke
- ✓ Bok choy
- ✓ Broccoli
- ✓ Brussels sprout
- ✓ Cauliflower
- ✓ Carrot
- ✓ Cilantro
- ✓ Celery
- ✓ Cabbage (red, green)
- ✓ Fennel
- ✓ Lettuce (head, leaf, romaine, baby)
- ✓ Napa cabbage
- ✓ Pepper (bell)
- ✓ Spinach
- ✓ Tomato (processing)



15 Large scale lettuce trials: N fertilizer rates



CropManage is ready to use in the field with a smartphone or tablet computer




CropManage also supports third party software through the application programming interface (API)

- Simplify user interface for irrigators and foremen
- Integrate with other data being collected
- store data and records only on the company's computer database

Determining how long to irrigate using ET data


Add Watering Event Watering Event ✕

Event Date *
9/7/2023 

Irrigation Method *
Drip ▼

Cancel Calculate Recommendation


Add Watering Event Watering Event ✕

Event Date *
9/7/2023 

Irrigation Method *
Drip ▼

Recommendation ⓘ inches hours

3.9 hours

Recommendation Summary ▼ 

Manager Amount hours
Enter the amount recommended by a manager

Water Applied hours
Enter the amount that was actually applied

Cancel Create

Irrigation Recommendation Summary

Add Watering Event Watering Event

Event Date *
9/7/2023

Irrigation Method *
Drip

Recommendation ⓘ inches **hours**

3.9 hours

Recommendation Summary ^

Average ET ⓘ	0.19 in./day
Average Crop Coefficient ⓘ	1.04
Distribution Uniformity ⓘ	90%
Days Since Last Irrigation ⓘ	2 days
Leaching Requirement ⓘ	0%
Total Precipitation ⓘ	0 in.

Total Crop ET = Average ET x Average Crop Coefficient x Days Since Last Irrigation

0.38 in. = 0.19 x 1.04 x 2

Recommended Irrigation Amount = Total Crop ET x 100 / (Distribution Uniformity x (1 - Leaching Requirement)) - Total Precipitation

Cancel **Create**

Online ET calculator

<https://dev.cropmanage.ucanr.edu/et-calculator>



Crop Information

Commodity *

Crop Season Dates

Enter the start and end dates of the crop's growing season.

- **Date Range:** Choose start and end dates that are less than 366 days apart (about one year).
- **Select recent dates (max 2 years old):** Choose dates that are before today but no older than two years ago.

Start Date *



End Date *



Location

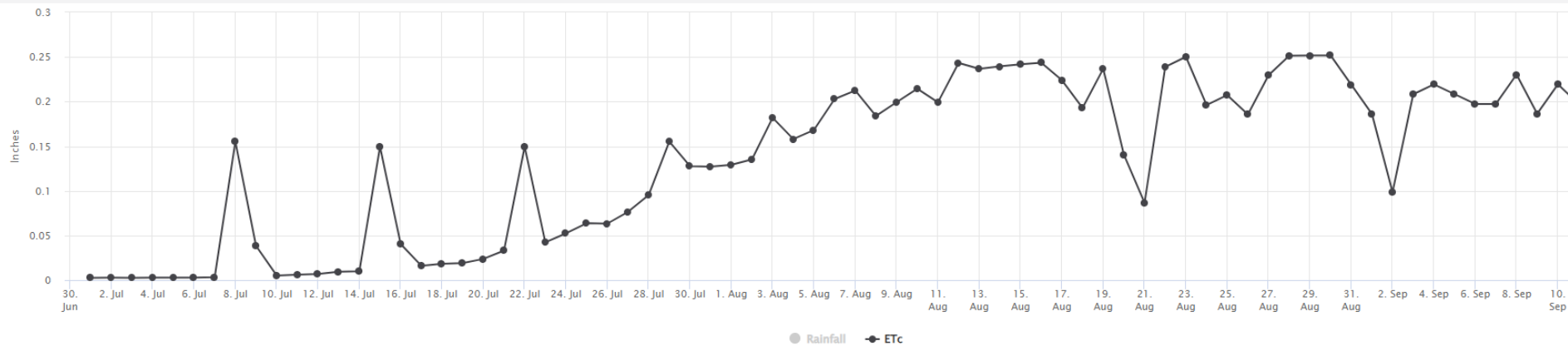
Click the location of your planting on the map. CropManage will use your location to get accurate weather and soil data used for ET calculation.



Online ET calculator

ET Calculation Results

Start Date Jul 1, 2023 **End Date** Sep 15, 2023
Crop Type Broccoli 2 row, 40-inch bed, summer, sprinkler
Weather Station Soledad II




Total Reference ET (in.)	16.93
Total Rain (in.)	0.06
Total Crop ET (in.)	10.70



Total Reference ET (in.)	16.93
Total Rain (in.)	0.06
Total Crop ET (in.)	10.70

N Fertilizer Recommendation

Add Fertilization Event ✕

Event Date *
3/25/2021 

Fertilizer Type *
AN-20 - Wet Fertilizer Details

Days To Next Fertilization *
10

Soil Sample *
3/24 - 18.00 ppm N

Choose the soil sample date used to calculate this recommendation


Recommendation

lbs N/acre Fertilizer Unit

6.61 gal/acre

[Recommendation Summary](#) ∨

[Include N Contribution From Water in Recommendation](#)



N Contribution from Water

Expected Irrigation Method
Drip

Use Avg. Water Source PPM Enter PPM Manually

Blending of Water from Various Water Sources

Water Source	N Concentration	% Used for Planting
Well 9	47 ppm	100 %
Average N Concentration	47 ppm	100% ✓

Recommended Irrigation Amount

Inches Hours

1.96 Inches ⓘ

Calculate Contribution for:
1.96 Inches

N Contribution from Water

9.96 gal/acre ⓘ

Update N recommendation and view summary

Add Fertilization Event ✕

Soil Sample *
3/24 - 18.00 ppm N

Choose the soil sample date used to calculate this recommendation

Recommendation lbs N/acre **Fertilizer Unit**

0.00 gal/acre

Recommendation Summary ^

Crop N Uptake ⓘ	22.69 lbs N/acre
Soil N ⓘ	70.83 lbs N/acre (18.00 ppm N)
Soil N Threshold ⓘ	65.81 lbs N/acre (16.72 ppm N)
Total Mineralized N ⓘ	3.80 lbs N/acre
Water N Contribution ⓘ	20.91 lbs N/acre (9.96 gal/acre)

Fertilizer N Recommendation = Crop N Uptake + (Soil N Threshold - Soil N) - Total Mineralized N - Water N Contribution

$-7.03 = 22.69 + (65.81 - 70.83) - 3.80 - 20.91$

The recommendation is below zero and is clamped to **zero**.

Exporting records of water and N use

Export And Download Ranch Data ✕

Are you sure you want to Export & Download Ranch Data?

This will download all the data for this Ranch in a single Zip Archive. The Data is exported to Excel and is separated per Planting.

This process will take a few minutes.

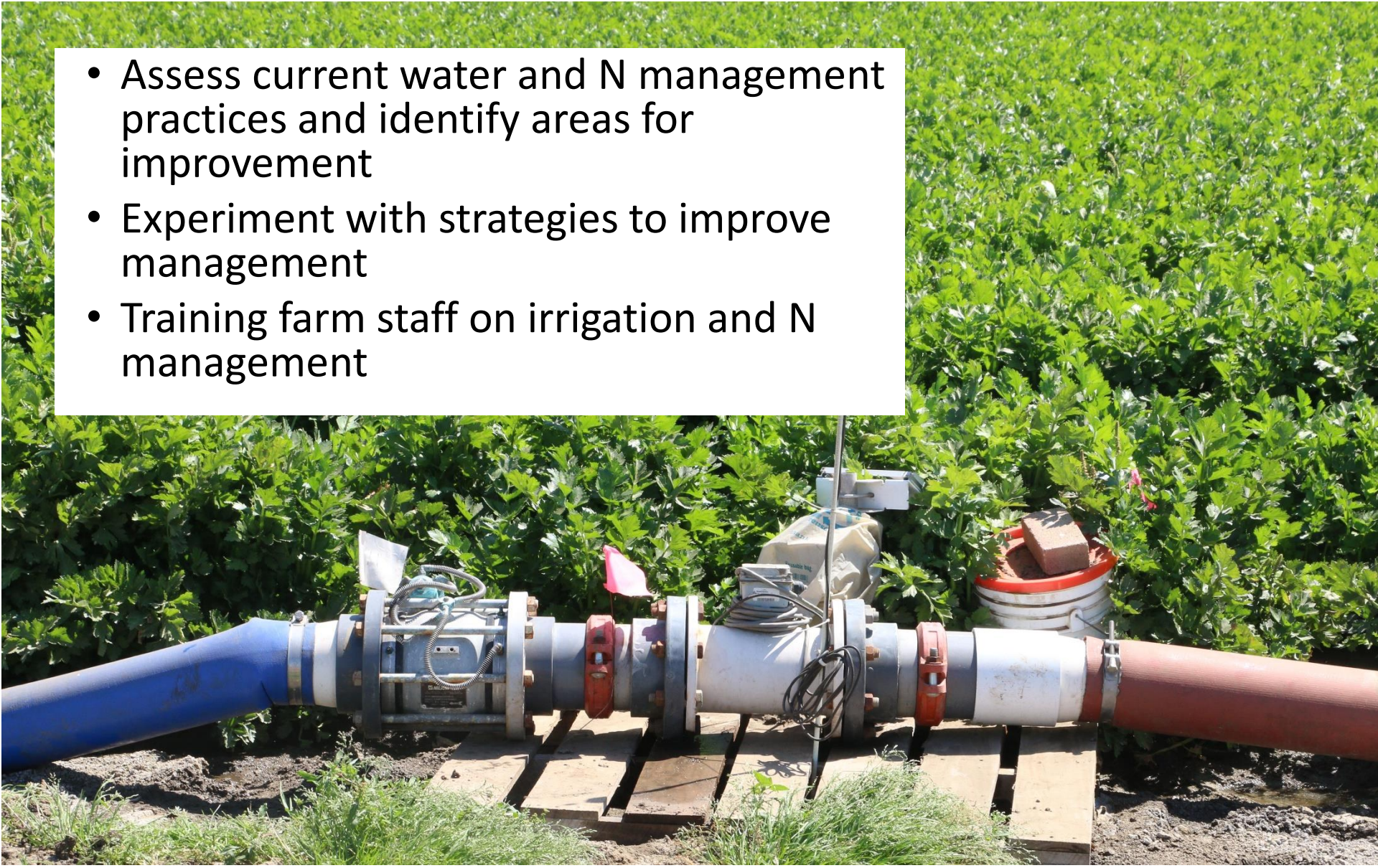
Export All Plantings
 Export by Year

Select a Year

Planting Name	Commodity	Crop Type	Start Date	End Date	Acres	Applied N (lbs N/acre)	N in Water (lbs N/acre)
29-1	Lettuce	Lettuce-Iceberg, 2 row, 40-inch bed	12/13/2021	4/5/2022	9.0	157.1	47.64
29-2	Lettuce	Lettuce-Iceberg, 2 row, 40-inch bed	12/20/2021	4/10/2022	9.0	144.5	52.23
29-3	Lettuce	Lettuce-Iceberg, 2 row, 40-inch bed	1/2/2022	4/17/2022	9.0	113.0	56.38
29-4	Lettuce	Lettuce-Iceberg, 2 row, 40-inch bed	1/17/2022	4/25/2022	9.4	113.0	58.00
29-1	Lettuce	Lettuce-Romaine, 2 row, 40-inch bed	12/18/2022	4/8/2023	10.0	154.5	24.66
29-2	Lettuce	Lettuce-Romaine, 2 row, 40-inch bed	12/22/2022	4/11/2023	10.0	152.4	22.14
26-1	Lettuce	Lettuce-Romaine, 6 row, 80-inch bed	12/8/2021	3/27/2022	9.0	159.3	38.74
26-2	Lettuce	Lettuce-Romaine, 6 row, 80-inch bed	12/13/2021	4/1/2022	17.6	165.9	45.84
26-3	Lettuce	Lettuce-Romaine, 6 row, 80-inch bed	12/25/2021	4/10/2022	17.6	105.3	56.67
26-4	Lettuce	Lettuce-Romaine, 6 row, 80-inch bed	12/31/2021	4/15/2022	17.6	102.3	62.05
26-1	Lettuce	Lettuce-Iceberg, 5 row, 80-inch bed	12/27/2022	4/14/2023	10.0	176.1	19.83
Average					13.6	140.3	44.06
Weighted Average						137.5	45.7

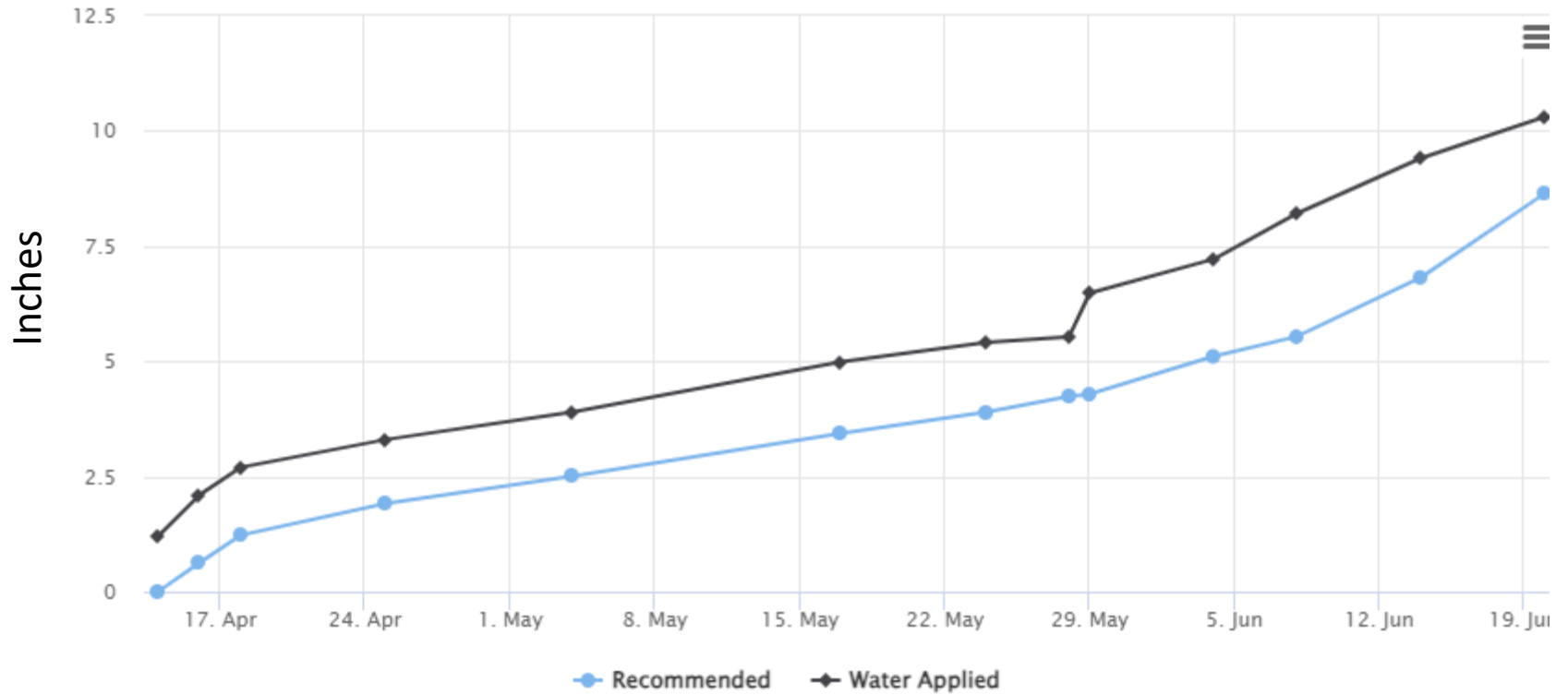
Tool to help farm managers and irrigators with irrigation and N management

- Assess current water and N management practices and identify areas for improvement
- Experiment with strategies to improve management
- Training farm staff on irrigation and N management

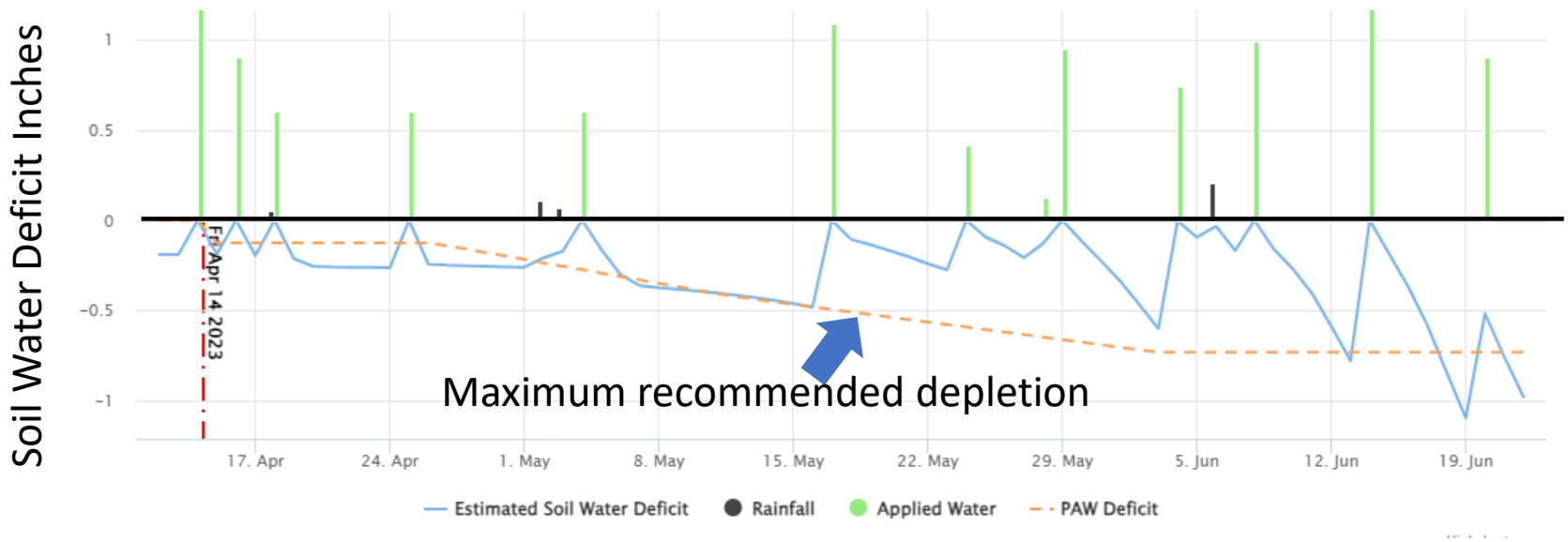


Visualization charts help understand seasonal management

Cumulative applied water vs recommended (lettuce)



Visualization of soil water balance over the season



Summary

- CropManage can be used to guide fertilization and irrigation management
- Can be used to evaluate current practices and determine potential to be more efficient with water and N fertilizer
- Designed to be used in the field and has capacity for keeping track of all plantings during the year
- Can quickly determine water requirements based on weather data (ET) and fertilizer N requirements based on all sources of N available to the crop and N uptake rates
- Export feature helps quickly summarize N and water applications by ranch and commodity for regulatory reporting

How to learn more:



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

Next hands-on CropManage training:

March 7, Watsonville library

Register at:



Limited to 35
participants