Using CropManage to help with Ag Order compliance

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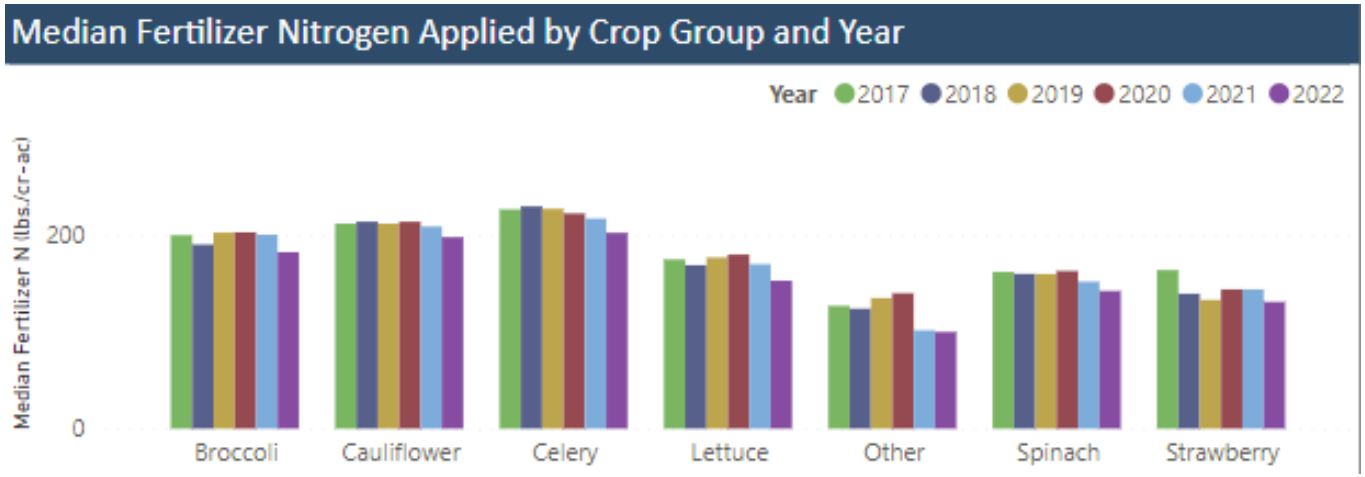
Ag Order 4.0: Applied (A) minus removed (R) calculation

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

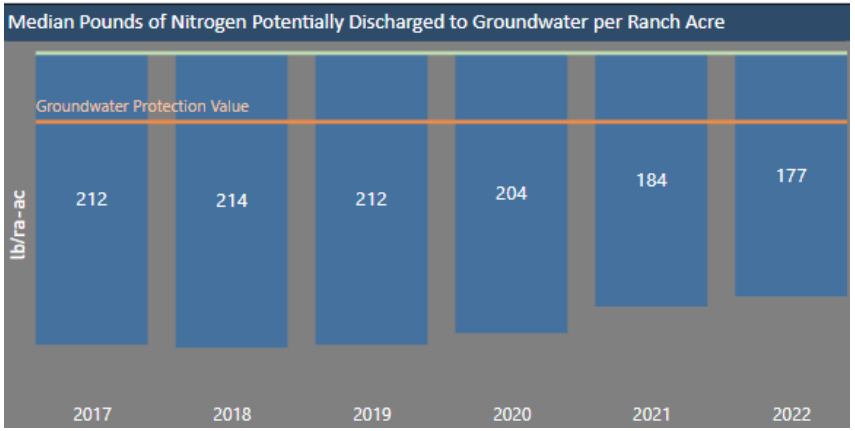
A_{FER} is the amount of fertilizer nitrogen applied in pounds per acre.
C is the compost discount factor used to represent the amount of compost nitrogen mineralized during the year that the compost was applied.
A_{COMP} is the total amount of compost nitrogen applied in pounds per acre.
O is the organic 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

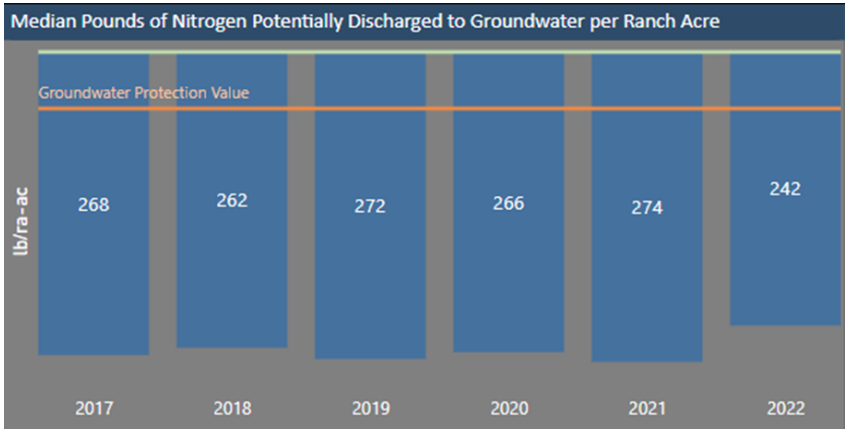


Potential discharge based on A-R estimates

All crops

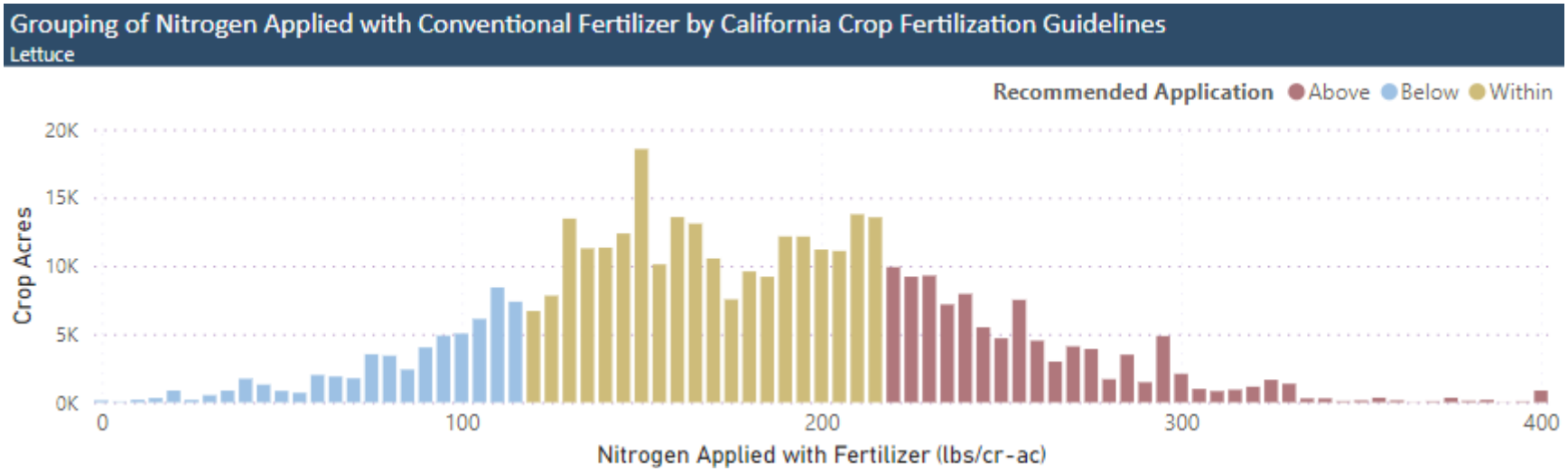


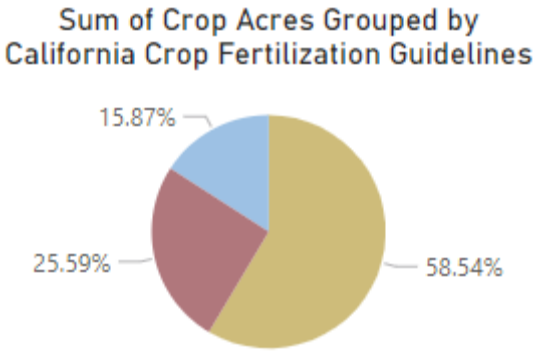
Lettuce



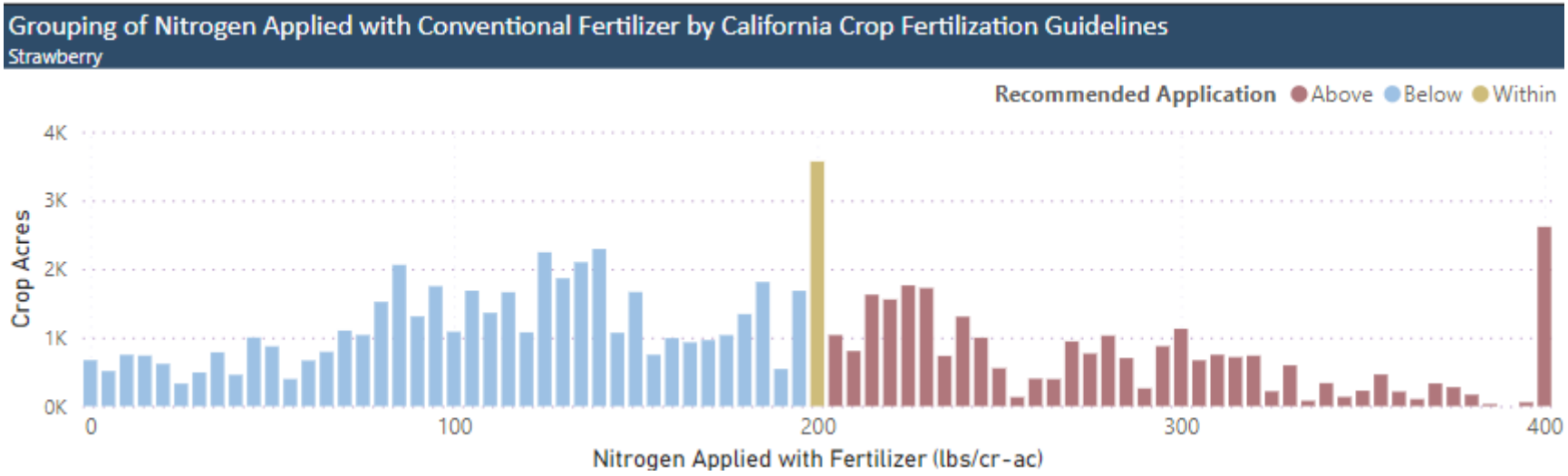
N fertilizer applications for lettuce (2020-2022)

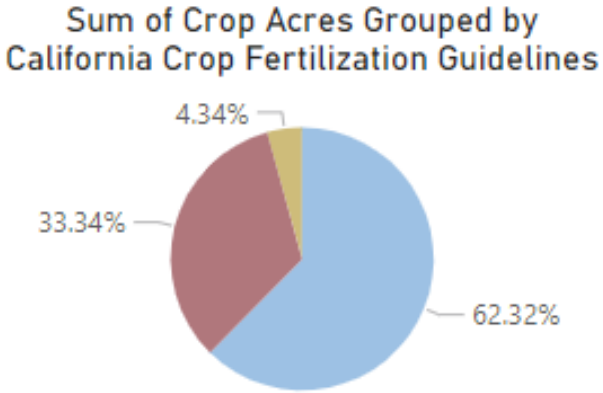
Based on recommendation of 120 to 220 lb N/acre





N fertilizer applications for strawberry (2020-2022)





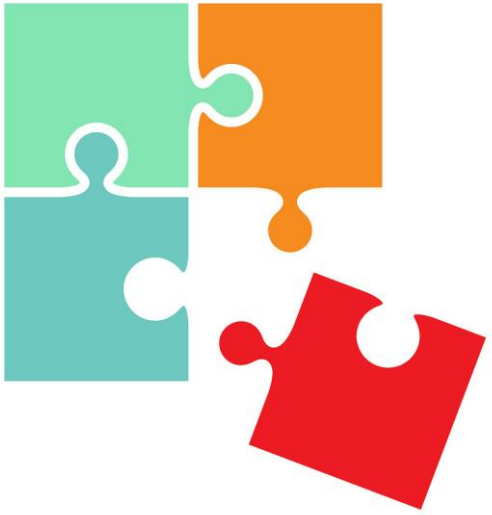
Account for all sources of nitrogen

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

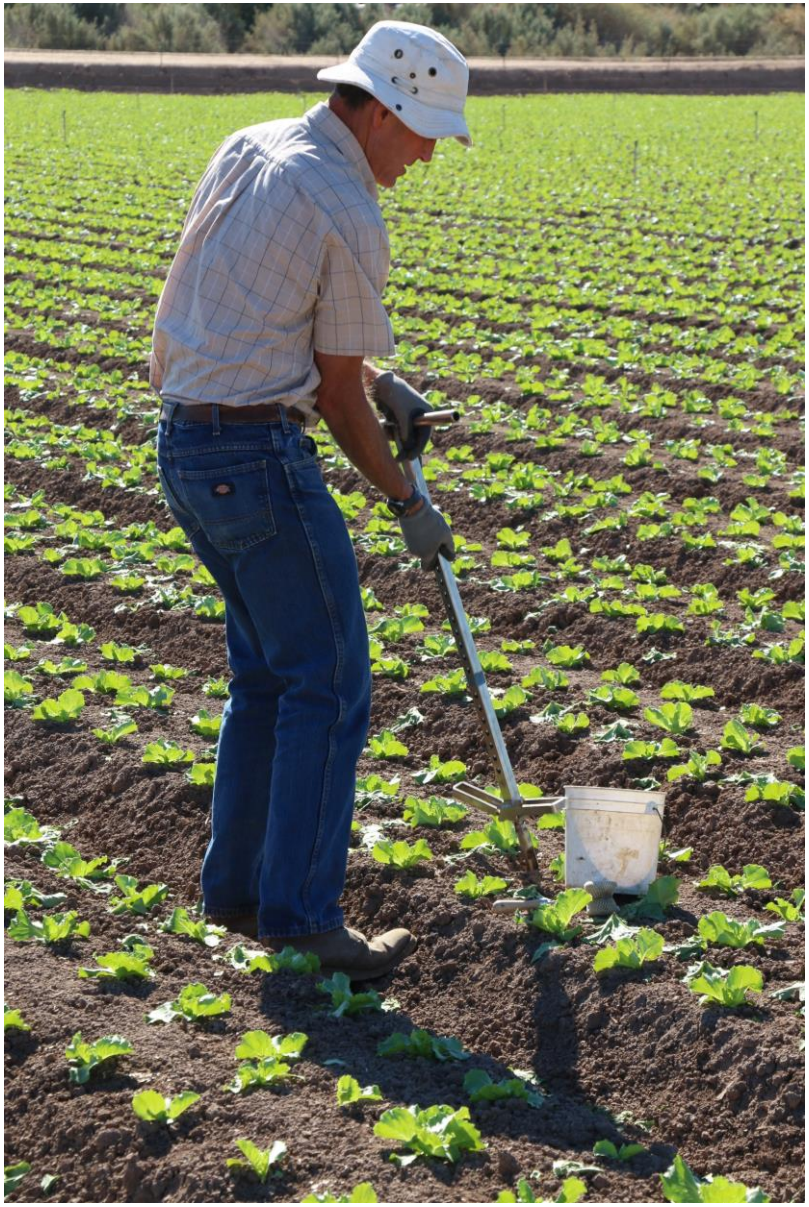
soil

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)

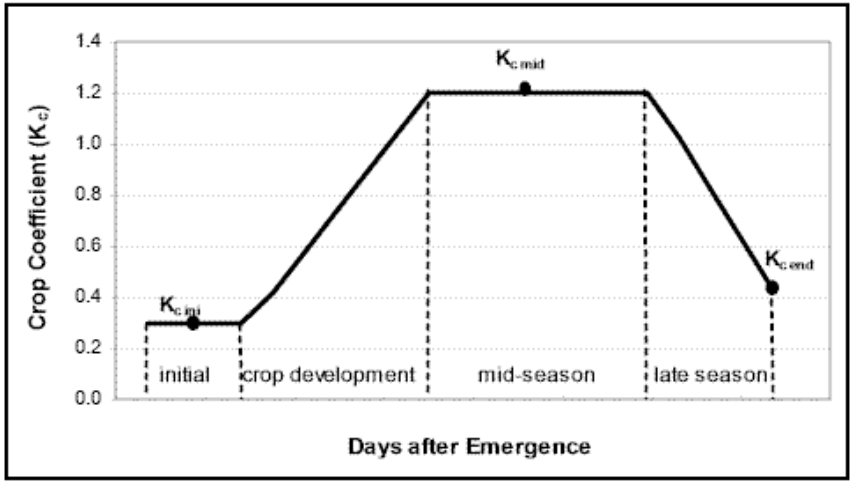
Water management is critical for using N efficiently

Weather-based irrigation scheduling

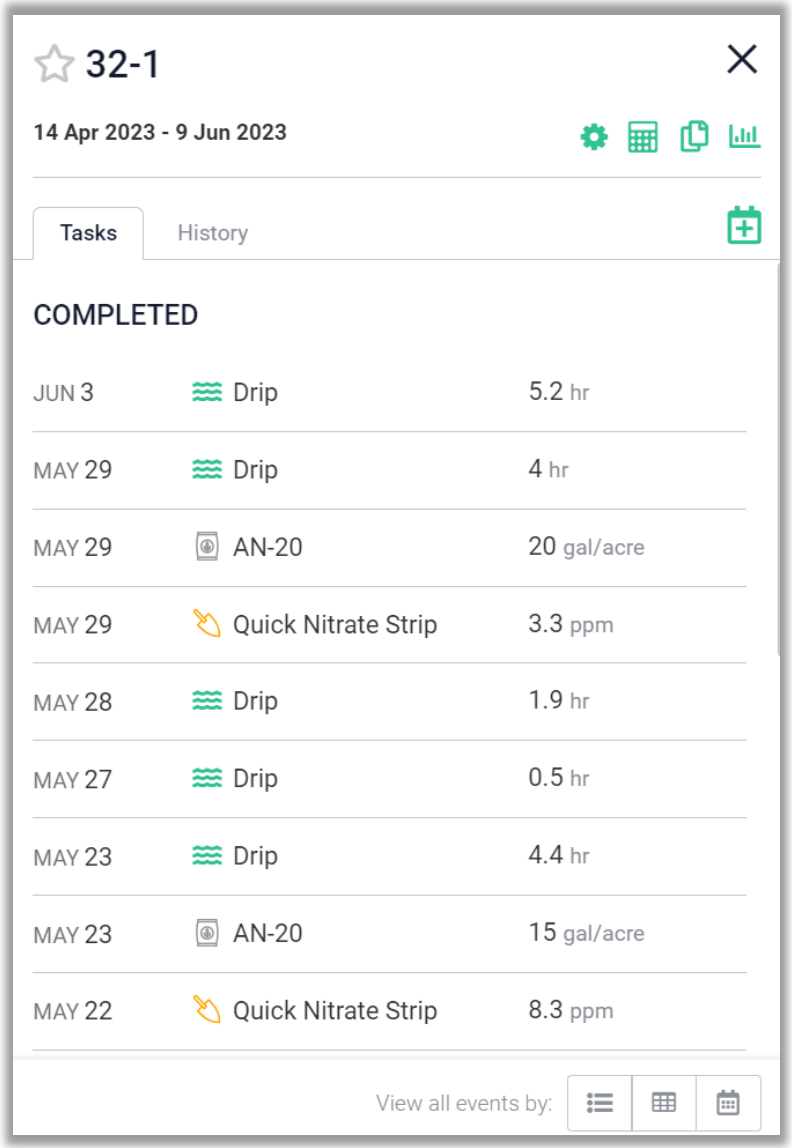
Converting Reference ET to Crop ET:

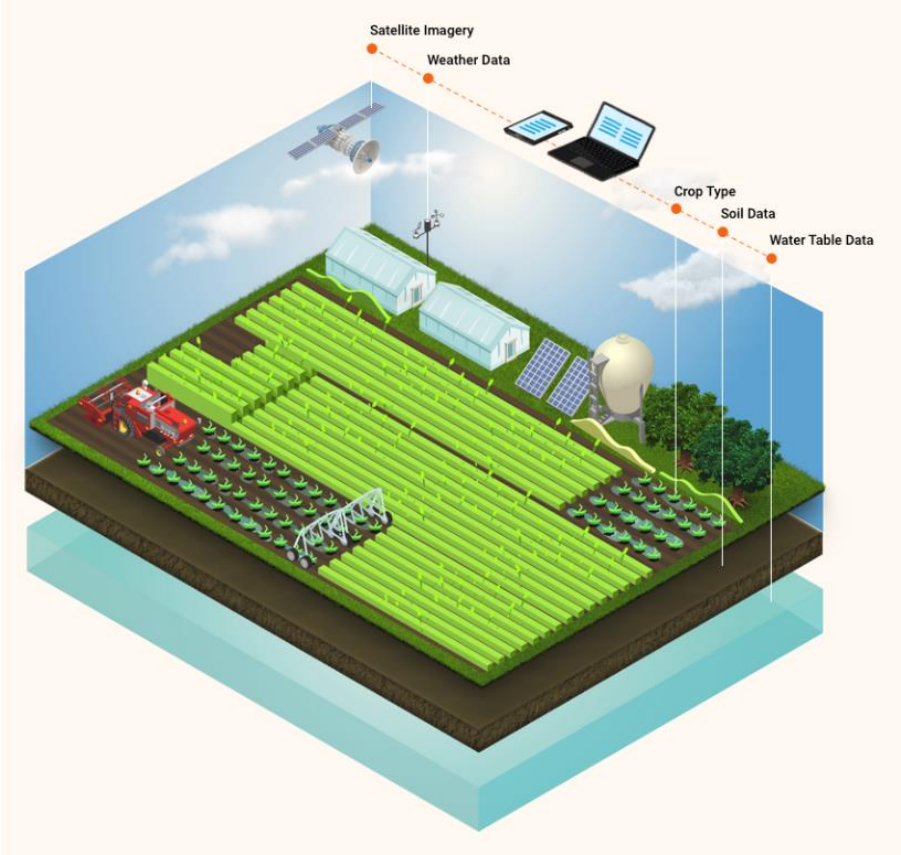
$$ET_{crop} = ET_{ref} \times K_{crop}$$

K_c can vary from 0.1 to 1.2



CropManage: Online irrigation and nitrogen management decision support

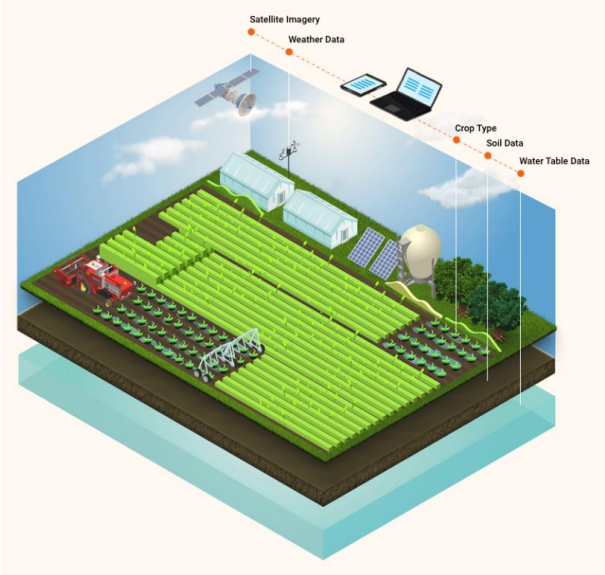




cropmanage.ucanr.edu

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)



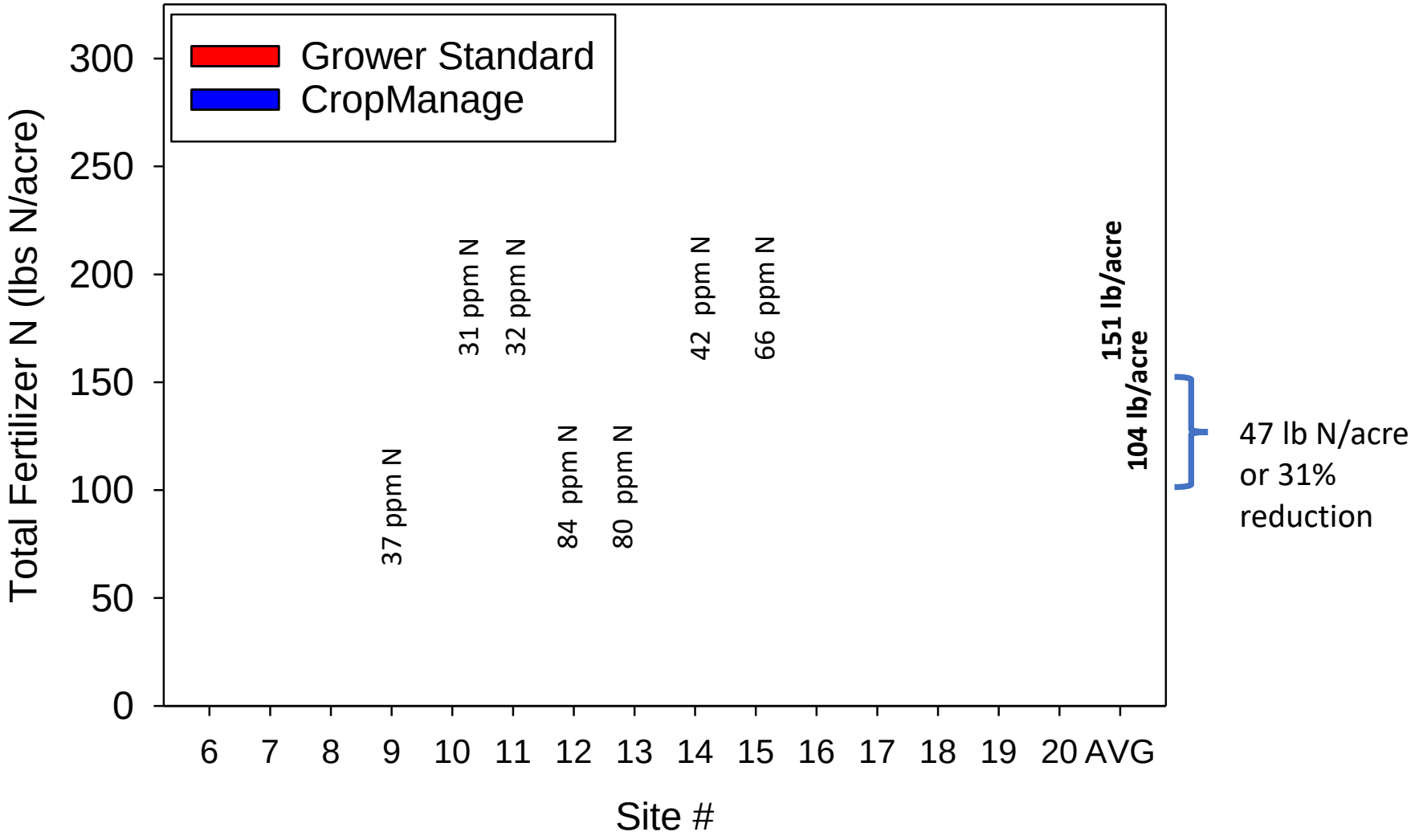
Crops currently supported

- 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)

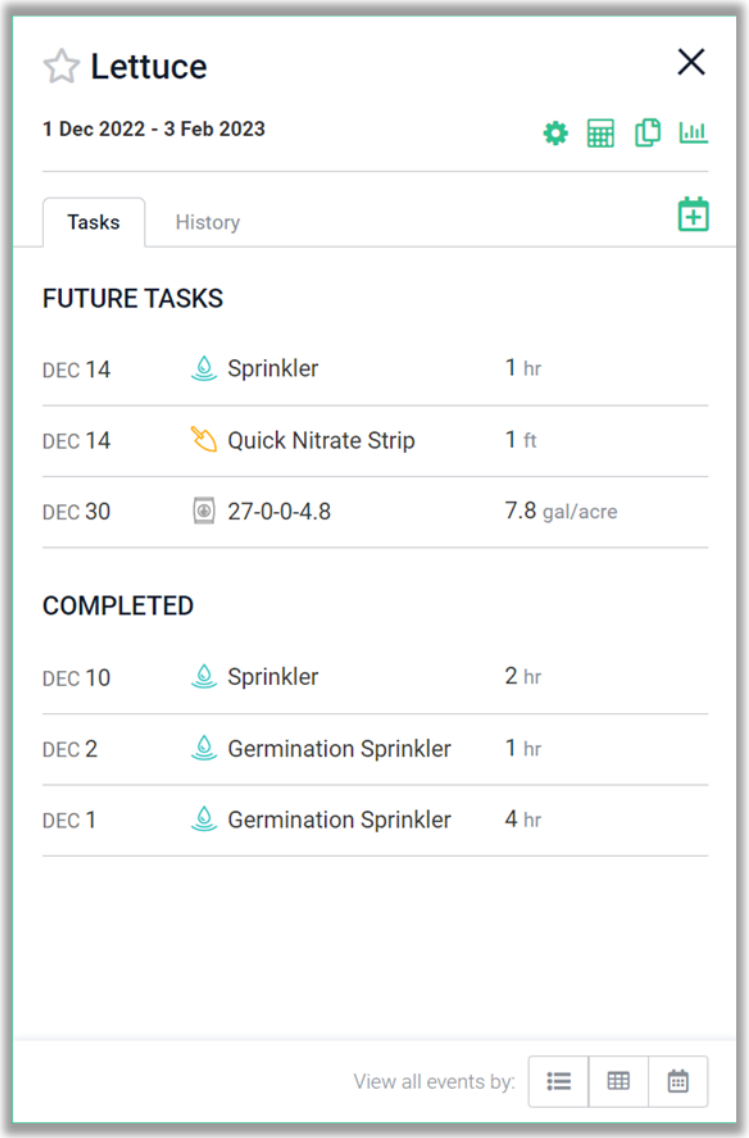
Vegetable Crops currently supported

- ✓ 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



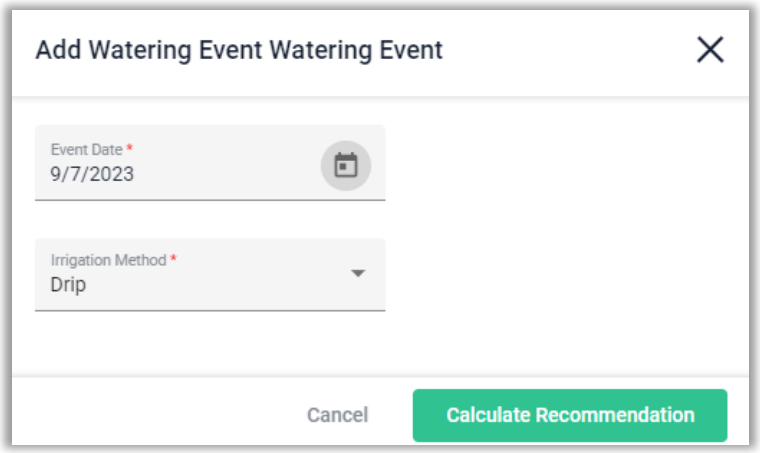
CropManage is ready to use in the field with a smartphone or tablet computer

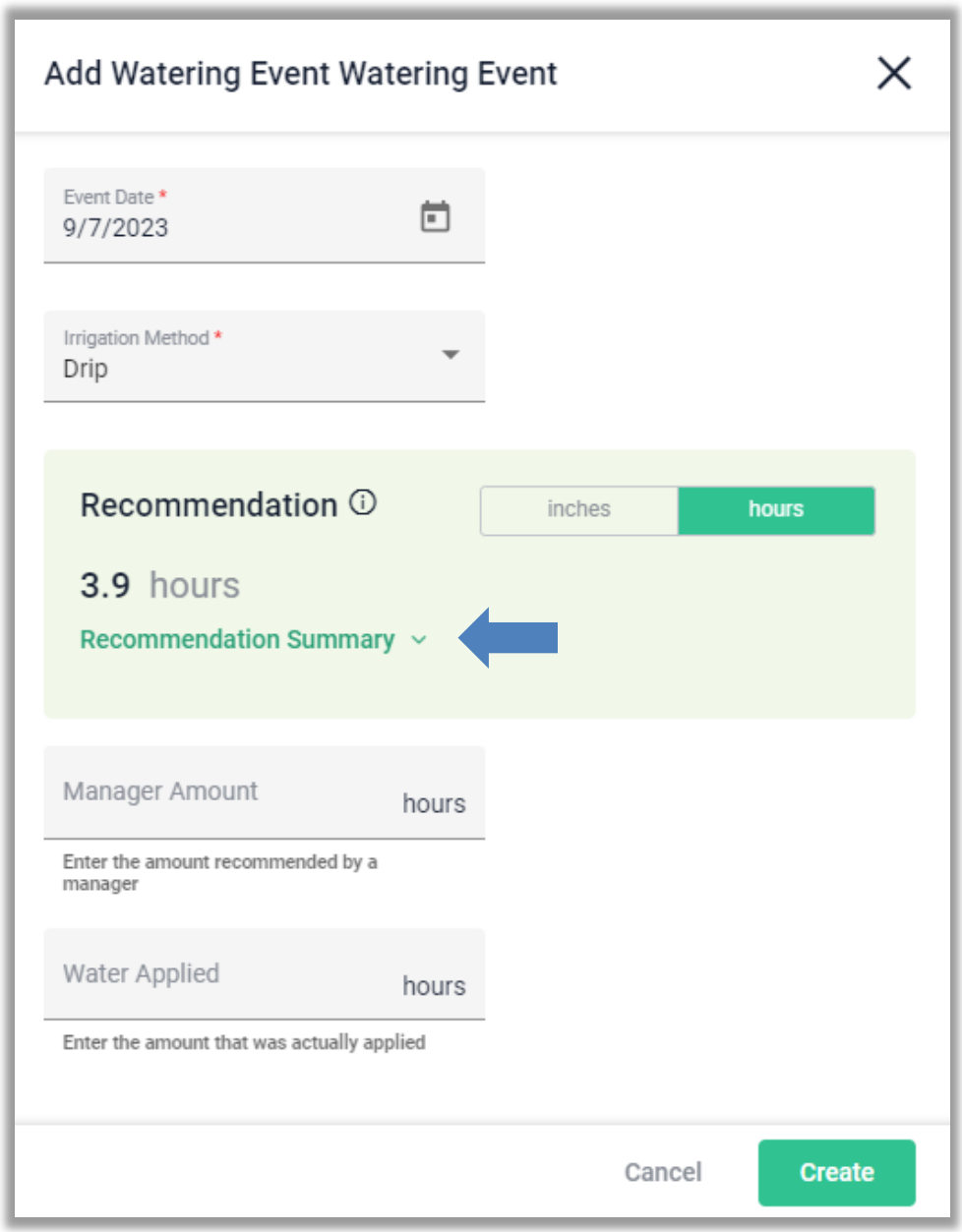


CropManage also supports third party software through the application programming interface (API)

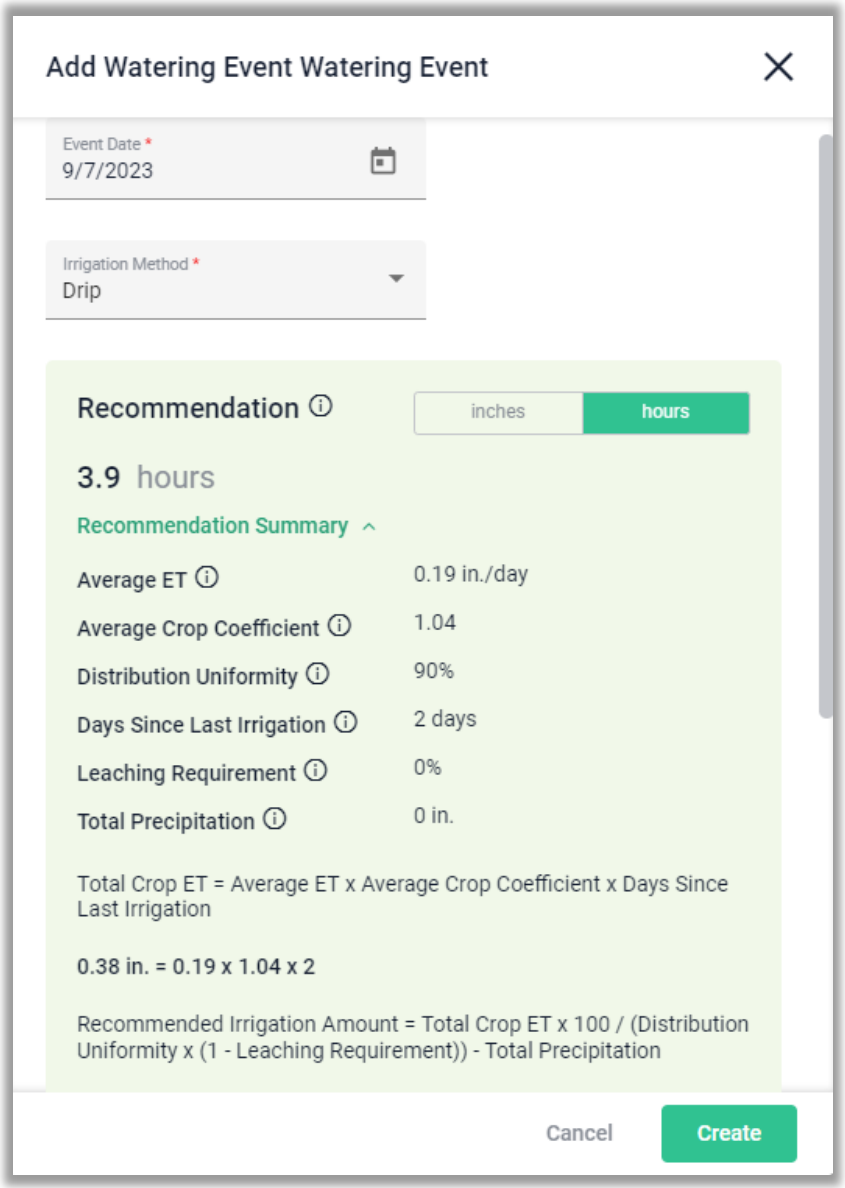
- Simplify user interface for irrigators and foremen
- Integrate with other data being collected
- store data and records only on the company's computer database

Determining how long to irrigate using ET data



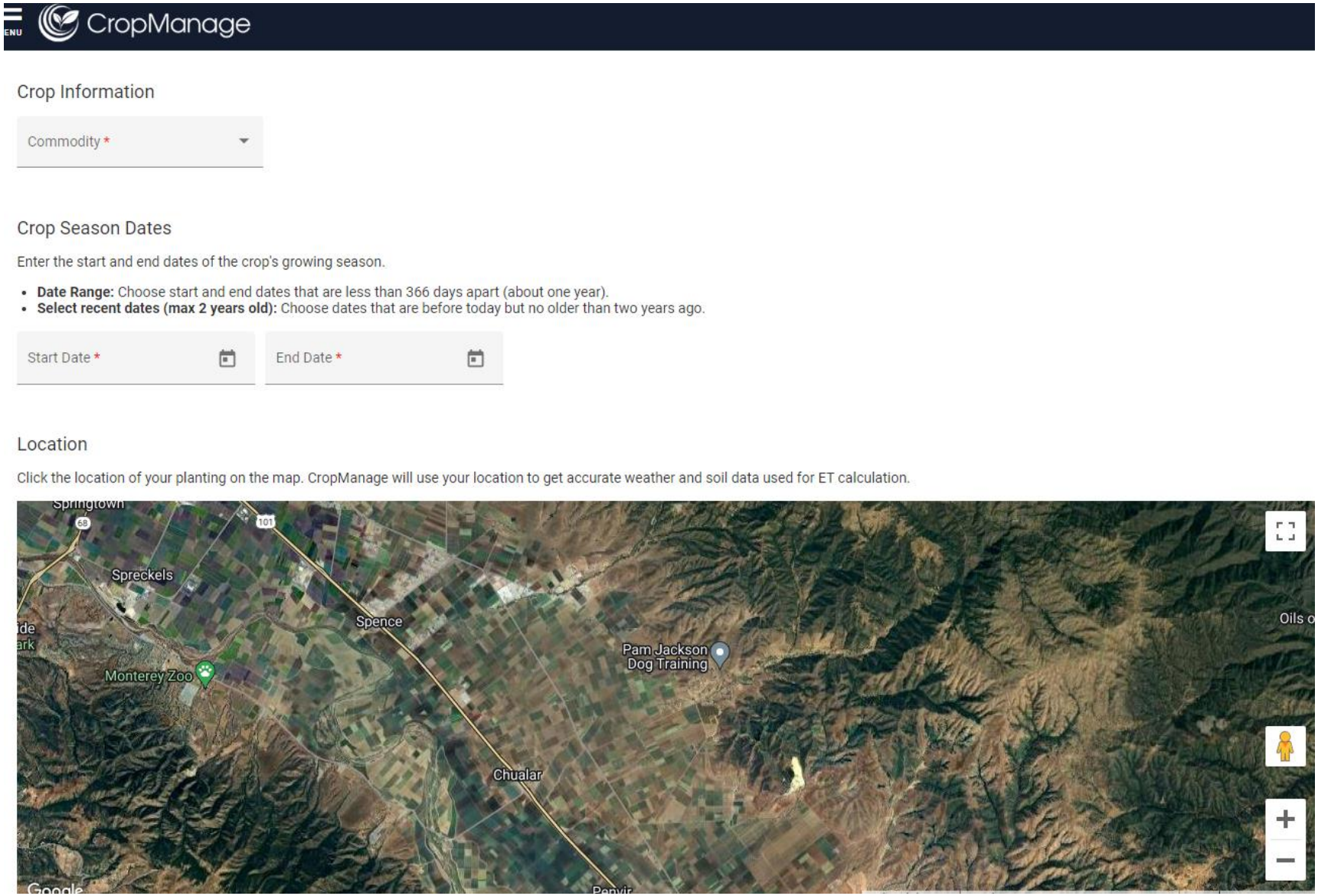


Irrigation Recommendation Summary



Online ET calculator

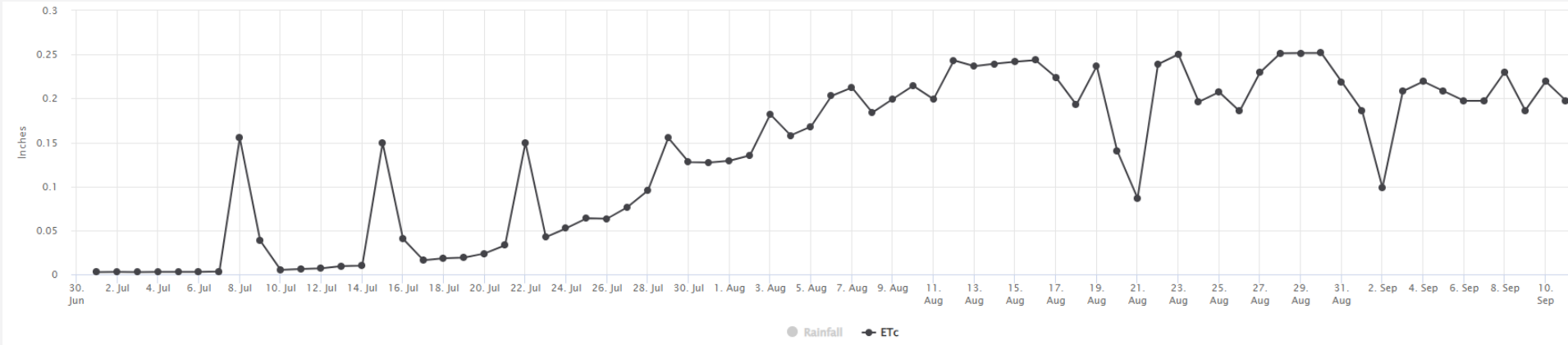
https://dev.cropmanage.ucanr.edu/et-calculator



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**

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Total Rain (in.)	0.06
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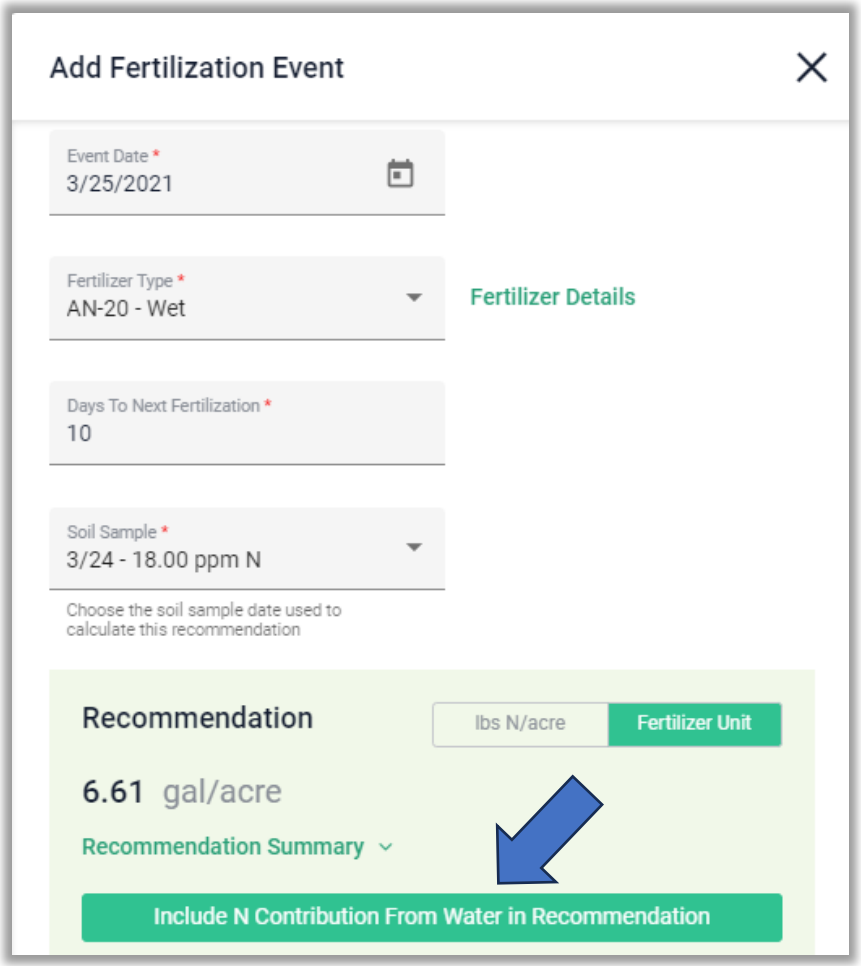
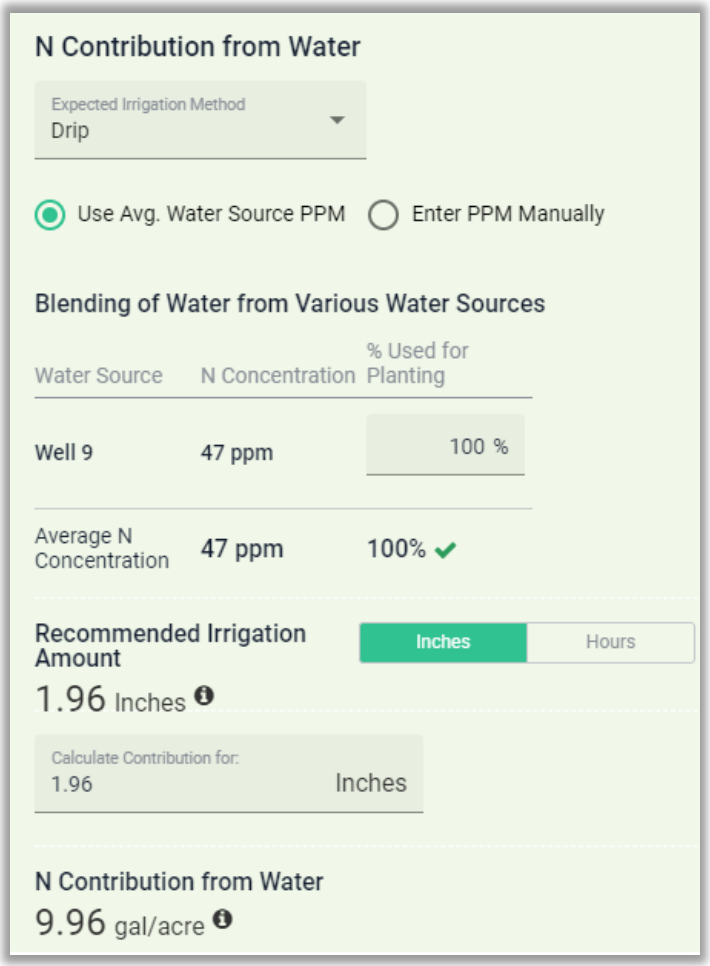
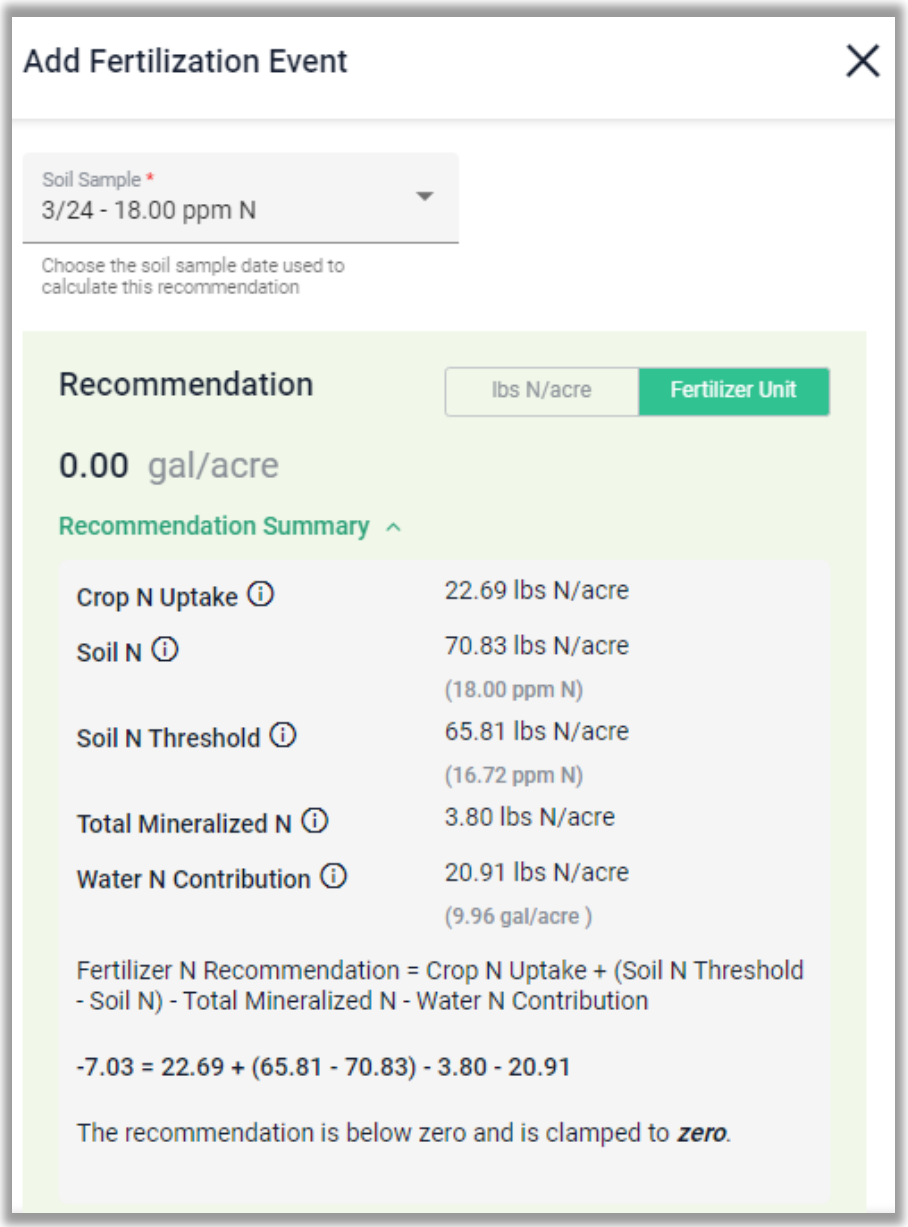
N Fertilizer Recommendation

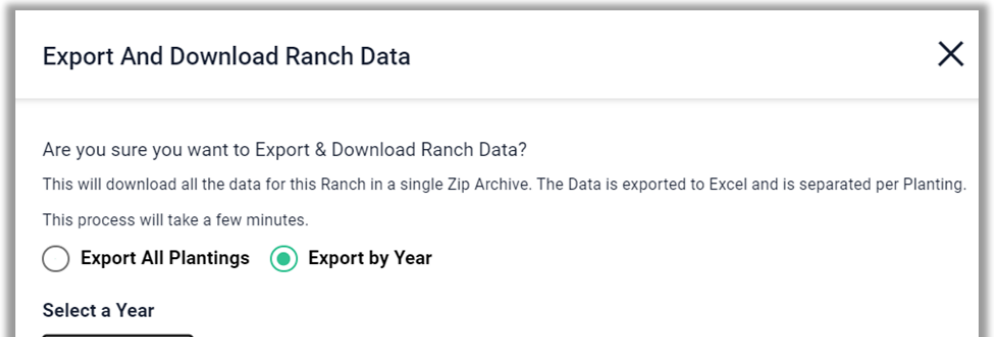




Update N recommendation and view summary

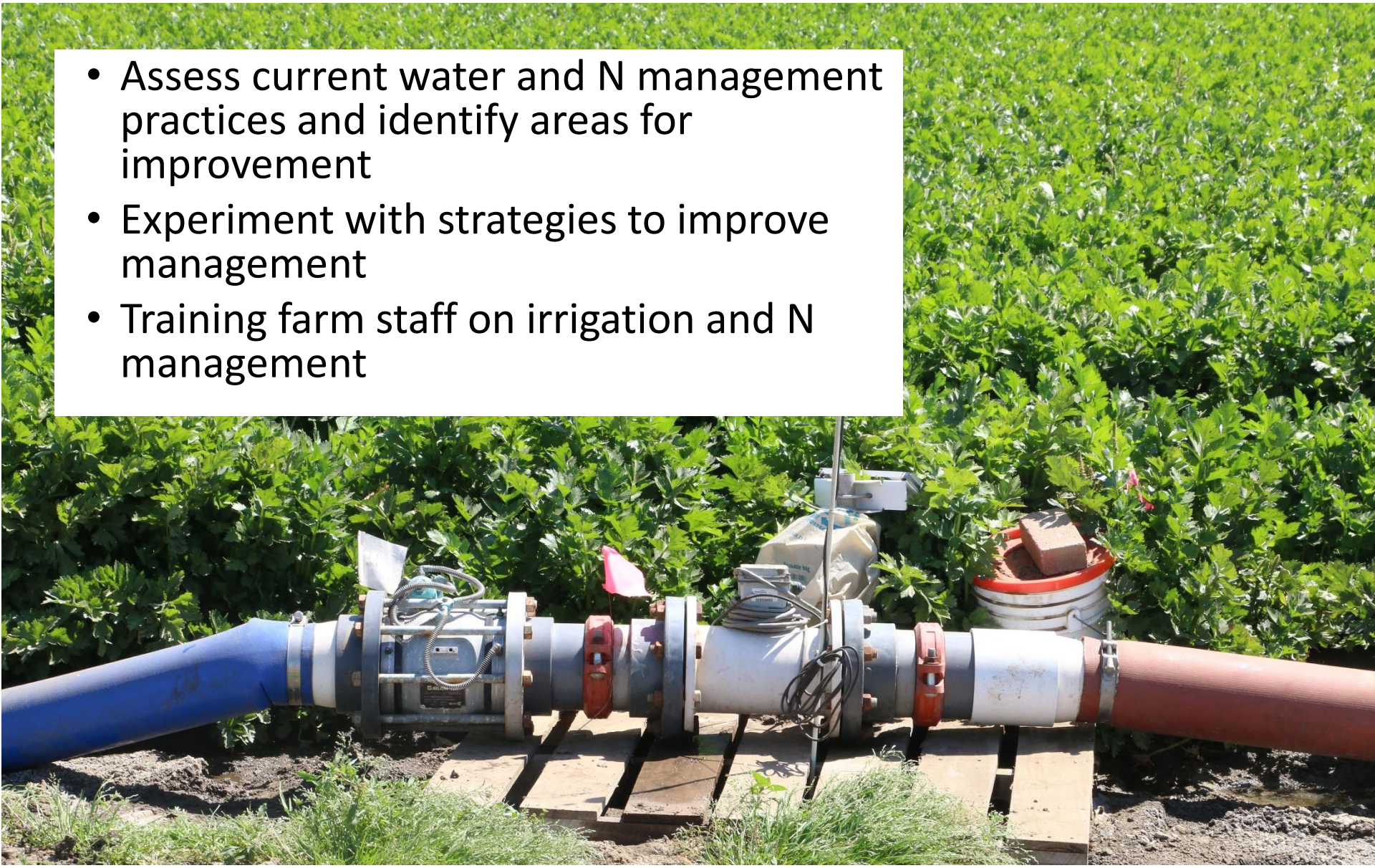


Exporting records of water and N use



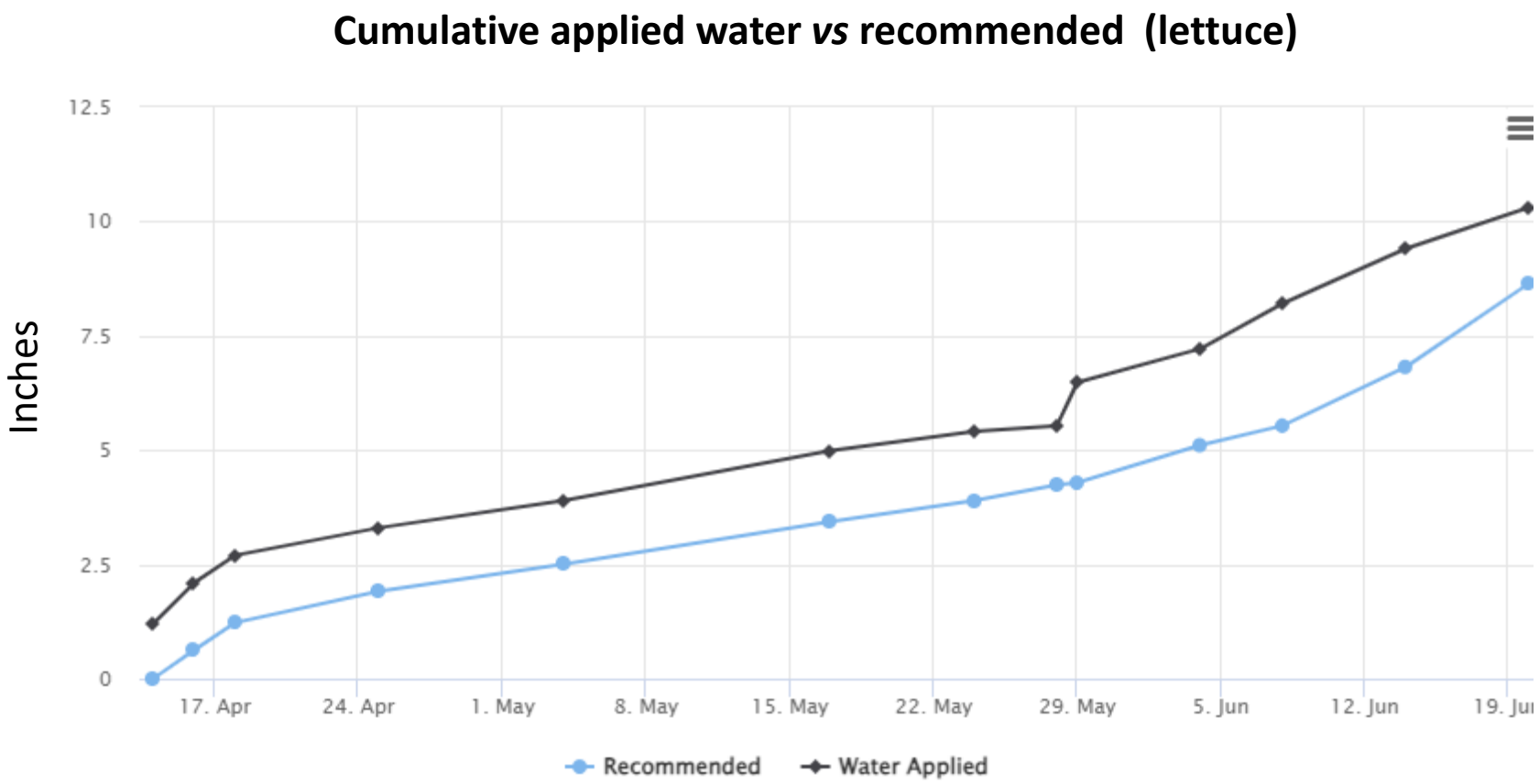
Planting Name	Commodity	Crop Type	Start Date	End Date	Acres	Applied N (lbs N/acre)	N in Water (lbs N/acre)
29-1	Lettuce	Lettuce-Iceberg, 2 row, 40-inch bed	12/13/2021	4/5/2022	9.0	157.1	47.64
29-2	Lettuce	Lettuce-Iceberg, 2 row, 40-inch bed	12/20/2021	4/10/2022	9.0	144.5	52.23
29-3	Lettuce	Lettuce-Iceberg, 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

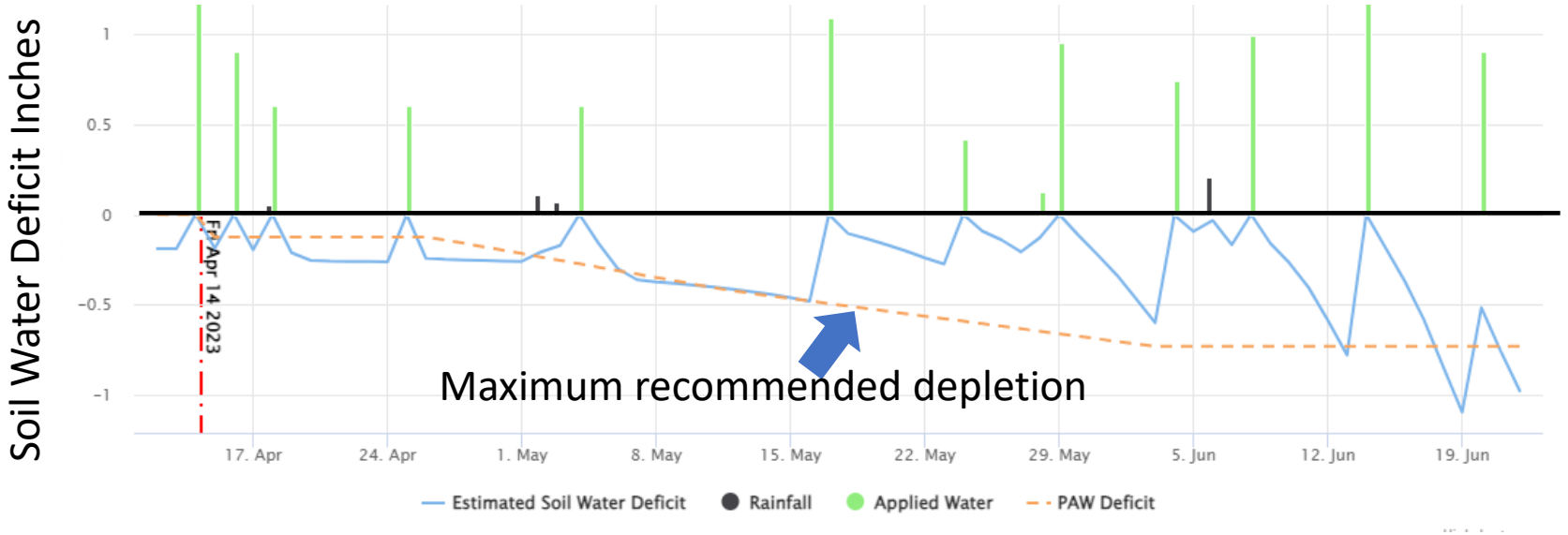


- Assess current water and N management practices and identify areas for improvement
- Experiment with strategies to improve management
- Training farm staff on irrigation and N management

Visualization charts help understand seasonal management



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