

Using CropManage for Irrigation and Nutrient Management in Strawberry



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- **UCCE Advisors/Specialists**
- **UC ANR programming staff**
- **CDFA-Fertilizer Research Education Program**
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- **UC Division of Agriculture and Natural Resources**
- **Growers and Shippers**



University of California

Agriculture and Natural Resources

Nitrogen Use Reporting

TIER 2/TIER 3 FARMS WITH HIGH NITRATE LOADING RISK

TOTAL NITROGEN APPLIED REPORT - RANCH/RISK UNIT & FIELD/BLOCK

Page 1 of 3 - September 26, 2016 Version

EMAIL FORM AS AN ATTACHMENT: Attach completed and saved form to an email and send to AgNOI@waterboards.ca.gov

Reporting Period: to

Any changes to the reporting period must be approved or form will not be accepted.

CONDITIONAL WAIVER OF WASTE DISCHARGE REQUIREMENTS FOR DISCHARGES FROM IRRIGATED LANDS - REGIONAL BOARD ORDER R3-2012-0011

Annually by October 1st, Tier 2 and Tier 3 dischargers with High Nitrate Loading Risk must report total nitrogen applied and present in the soil.

[Click below to clear the corresponding section of the form.](#)

[Hover over the cells/boxes with your mouse for more information on what is required. Refer to instructions for further detail.](#)

[Section I](#) [Section II](#) [Section III](#) [Section IV](#) [All](#)

SECTION I: GENERAL RANCH INFORMATION (Space for more parcels and multiple counties available on page 2)

AW#: <input type="text"/>	Ranch Global ID: <input type="text"/>	Ranch/Risk Unit or Field/Block Name: <input type="text"/>	Physical Ranch Acres Reporting: <input type="text"/>
County: <input type="text"/>	APN(s): <input type="text"/>	<input type="text"/>	Fallow Acres: <input type="text"/> <small>(If fallow entire report period)</small>
If ranch is a greenhouse, nursery, or hydroponic, select from the dropdown: <input type="text"/>			Sum of Total Crop Acres: <input type="text" value="0.0"/> <small>(Auto-calculates from Section IV)</small>

SECTION II: NITROGEN APPLIED WITH IRRIGATION WATER (Include all uses, e.g. leaching; and all sources, e.g. CSIP or PVWMA delivered water)

Section II-A: PVWMA/CSIP water use	Section II-B: PVWMA/CSIP water	Section II-C: Well/city water (or other non-PVWMA/CSIP source)	Section II-D: Nitrogen applied	Section III: NITROGEN APPLIED WITH COMPOST & AMENDMENTS
Was PVWMA/CSIP water used during the reporting period? <input type="text"/>		Average Nitrate Concentration in Well/City Water (mg/L) <input type="text"/> <input type="checkbox"/> as Nitrate (NO3) <input type="checkbox"/> as Nitrogen (NO3-N or N)	Estimated Total Volume of Well/City Water Applied to Entire Reporting Acres During Reporting Period (gallons) <input type="text"/> <small>This field can be erased before submittal. Do not include volume of PVWMA/CSIP water applied.</small>	Nitrogen Applied with Irrigation Water (lbs/ranch-ac) <input type="text"/> Section II-E: Volume check <small>This field auto-calculates. After completing Sections I-IV, check the estimated average acre-feet of water applied to each crop-acre grown</small>
		<small>To calculate the weighted average concentration if more than one sample from one or more sources of irrigation water was used, use the Excel tool 'weighted_avg_conc'</small>	<small>To convert from acre-feet or acre-inches to gallons, use the Excel tool 'convert_to_gallons'</small>	Physical Acres Receiving Compost & Amendments <input type="text"/> Nitrogen Applied in Compost & Amendments (total lbs) <input type="text"/> <small>Applications of nitrogen from compost and amendments (not fertilizers) made to improve soil properties, and/or as a source of nitrogen to ALL crops grown during the reporting period may be reported here. Alternatively, the nitrogen may be distributed accordingly between the crops and reported in Section IV. Do not report this information in both sections.</small>

SECTION IV: NITROGEN APPLIED WITH FERTILIZERS & OTHER MATERIALS AND NITROGEN PRESENT IN SOIL (The Excel tool 'N_from_fertilizers' assists with calculations in this section)

	Specific Crop(s) Grown and Harvested During Reporting Period <small>(Select from List on Page 3)</small>	Total Crop Acres	Nitrogen Present in Soil <small>(lbs/ac)</small>	Nitrogen Applied in Fertilizers and Other Materials <small>(lbs/crop-ac)</small>	O/C	Additional Information	Specific Crop(s) Grown and Harvested During Reporting Period <small>(Select from List on Page 3)</small>	Total Crop Acres	Nitrogen Present in Soil <small>(lbs/ac)</small>	Nitrogen Applied in Fertilizers and Other Materials <small>(lbs/crop-ac)</small>	O/C	Additional Information
1.	<input type="text"/>					<input type="text"/>	11.					
2.							12.					
3.							13.					
4.	<input type="text"/>						14.					
5.							15.					
6.							16.					
7.							17.					
8.							18.					

Tools for making water and nitrogen fertilizer decisions at the field level

- Soil nitrate quick test
- Weather-based irrigation scheduling



Weather-based irrigation scheduling



CIMIS station 209

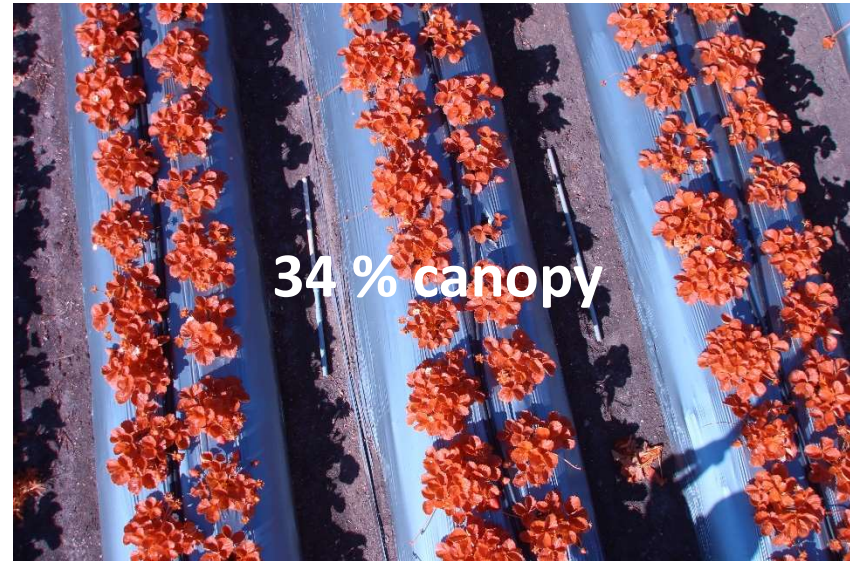
Evapotranspiration of a grass reference crop is estimated from:

- ✓ Solar radiation
- ✓ Wind speed
- ✓ Air temperature
- ✓ Relative Humidity

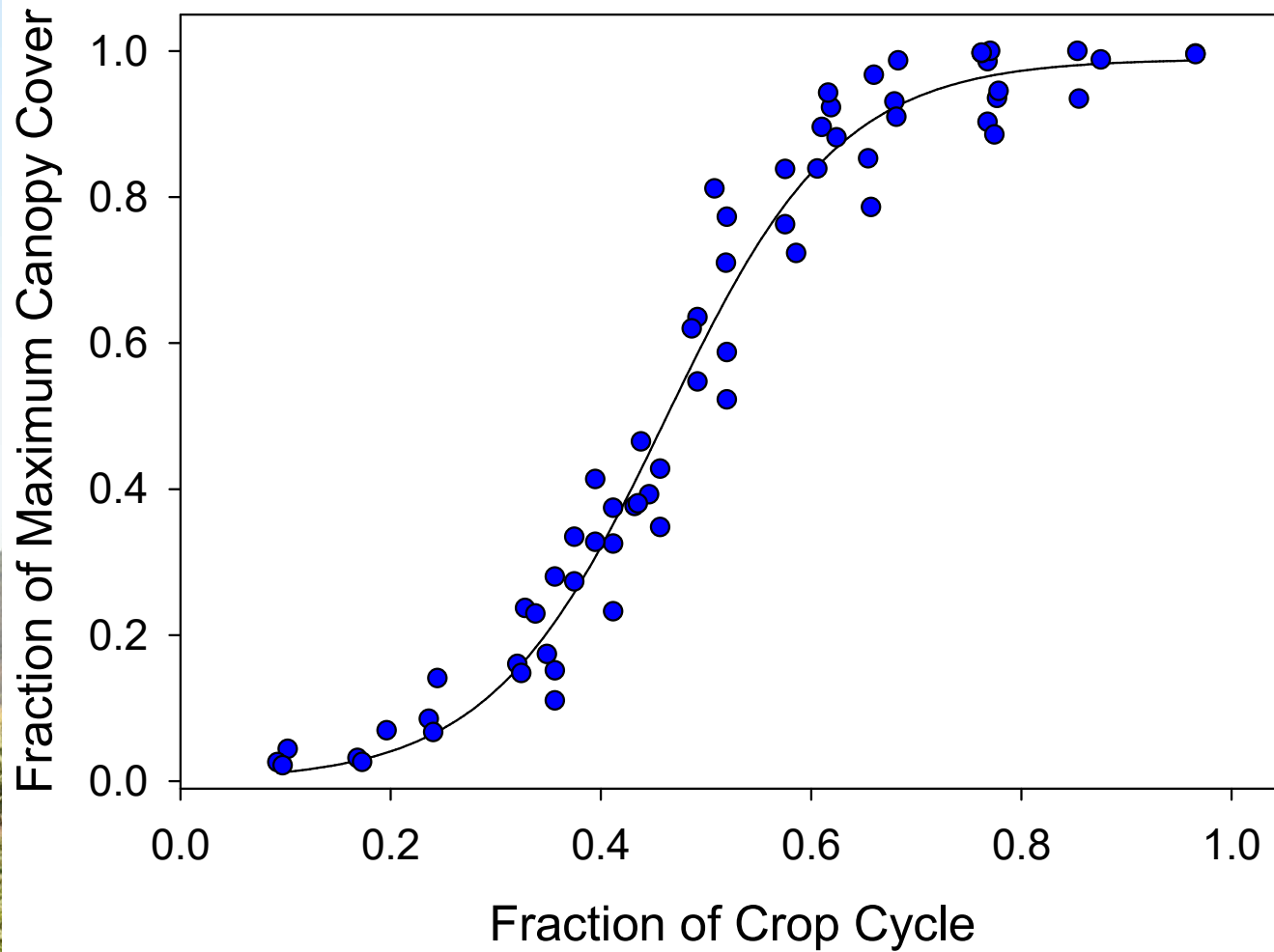
**Crop coefficients are
needed to calculate
crop ET**

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

K_c varied from 0.05 to 0.95

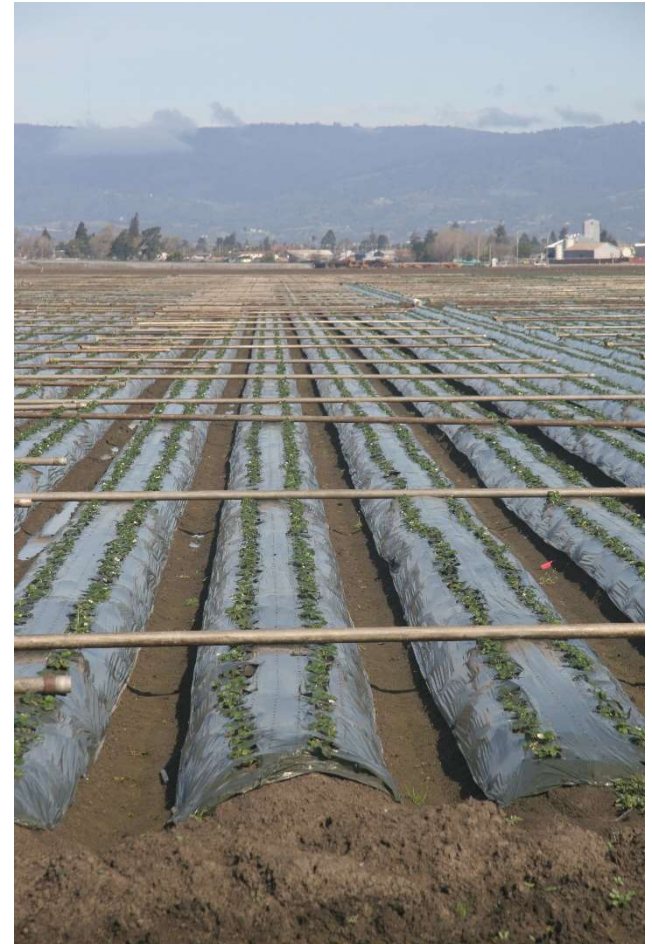


Albion, 52-inch wide beds



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”

166	172	94	45	73	38	99	25	73		
10	30	62	49	32	31	43	182	10		
33	896	2.132	2.390	3.850	2.175	1.389	2.833	3.928	2.160	2.460
870	2.845	1.001	1.920	1.748	2.387	2.930	1.389	1.253	999	2.364
2.427	1.133	1.308	3.928	3.176	2.514	2.835	2.119	1.373	2.984	1.510
2.424	2.697	1.710	1.287	1.272	2.303	2.738	2.115	2.391	2.948	1.510
1.692	1.844	1.725	2.110	1.928	1.902	1.821	2.738	2.363	2.702	1.510
.199	1.903	1.442	3.292	3.393	2.980	2.117	2.517	2.391	2.702	1.510
.032	1.198	2.453	1.272	1.928	1.897	2.119	2.319	3.585	2.702	1.510
290	92	266	110	383	272	284	58	58	58	58
43	430	158	859	184	75	75	75	75	75	75
9	277	324	718	524	58	58	58	58	58	58
	175	304	825	78	78	78	78	78	78	78



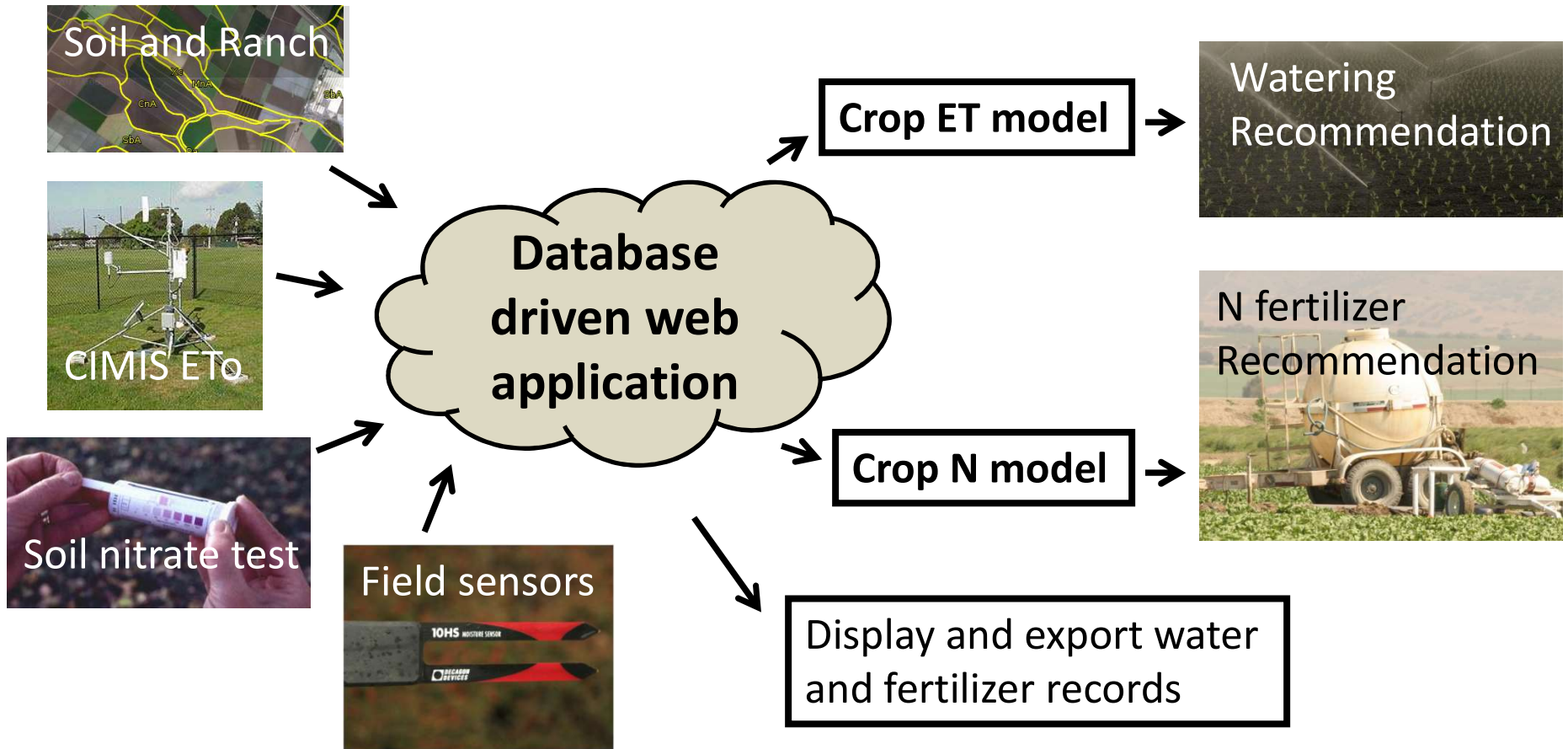
CropManage: online irrigation and N management decision support tool

<https://cropmanage.ucanr.edu>

The screenshot shows the CropManage web application interface. At the top left is the CropManage logo. At the top right, there are links for 'Bondesen' (with a dropdown arrow), 'Español', and 'Log out'. On the left side, there is a dark blue sidebar with a menu icon, the user's name 'Michael D Cahn' and title 'Ranch User', and navigation options: 'Home', 'Ranch', and 'Profile'. The main content area displays a 'Welcome to CropManage' message and a 'Ranch List' table.

Ranch	Active Plantings	Total Plantings	
Bondenson	0	17	<input type="button" value="v"/>
Bondesen	0	39	<input type="button" value="v"/>
Callaghan Ranch	0	82	<input type="button" value="v"/>
DaRosa	0	1	<input type="button" value="v"/>

Integrate information from multiple sources



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)

Steps to Using CropManage

1. Establish user login (free)
2. Request access to a ranch or set up a new ranch
3. View a planting within ranch or add a new planting
4. View or enter soil tests, fertilizer, or irrigation events



Scheduling and irrigation

Edit Irrigation Event ✕

New Watering

Watering Date



Irrigation Method

- Germination Spr
- Sprinkler
- Drip
- Rainfall

« May 20			
Su	Mo	Tu	We
24	25	26	27
1	2	3	4
8	9	10	11
15	16	17	18
22	23	24	25
29	30	31	1

Create

Close

Watering Date

05/23/2016



Irrigation Method

- Germination Sprinkler
- Sprinkler
- Drip
- Rainfall

Recommended Water

0.27 in, 1.80 hours

Water Applied

0.00

in.

0.00

hours.

Manager Amount Recommendation

0.00

in.

0.00

hours.

CIMIS Precipitation

0.00 in

Rainfall Applied

0.00

in.

Save

Save and Close

Close

Delete



Irrigation Summary Table

Current View: **Irrigation** ▾ Add... ⊕

	Date ▾	Irrigation Method □	Irrigation Interval (days) □	Recommended Maximum Irrigation Interval (days)	Recommended Water - in. ⇄ □	Applied Water - in. ⇄ □	Rainfall (inches) □
	5/11/2016	Drip	2	6.8 days	0.1 in	0.1 in	0.0
	5/13/2016	Drip	2	9.4 days	0.1 in	0.1 in	0.0
	5/14/2016	Drip	1	6.9 days	0.1 in	0.1 in	0.0
	5/16/2016	Drip	2	2.8 days	0.3 in	0.2 in	0.0
	5/17/2016	Drip	1	3.1 days	0.1 in	0.1 in	0.0
	5/18/2016	Drip	1	2.6 days	0.1 in	0.1 in	0.0
	5/21/2016	Drip	3	2.6 days	0.4 in	0.3 in	0.0
	5/24/2016	Drip	3	2.6 days	0.4 in	0.2 in	0.0
TOTALS					24.65 inches	20.62 inches	20.69 inches

Transparency on how recommendations are made



Irrigation Recommendation Summary ×

Average ETo ⓘ	0.20 inches/day
Average Crop Coefficient ⓘ	0.58
Distribution Uniformity ⓘ	85.00 %
Days Since Last Irrigation ⓘ	3 days
Leaching Requirement ⓘ	0.00 % / 100
Total Precipitation ⓘ	0.00 inches

$$\begin{aligned}
 \text{Base Amount} &= \frac{\text{Average ETo} * \text{Average Crop Coefficient} * \text{Days Since Last Irrigation} * 100}{\text{Distribution Uniformity}} \\
 0.41 \text{ inches} &= \frac{0.20 \text{ inches/day} * 0.58 * 3 \text{ days} * 100}{85.00 \%}
 \end{aligned}$$

$$\begin{aligned}
 \text{Recommended Irrigation Amount} &= \text{Base Amount} / (1 - \text{Leaching Requirement}) - \text{Total Precipitation} \\
 0.41 \text{ inches} &= 0.41 \text{ inches} / (1 - 0.00) - 0.00 \text{ inches}
 \end{aligned}$$

Date: 5/21/2016

Recommended Irrigation Amount: 0.41 inches

Close

Flowmeters can be used to evaluate irrigation application



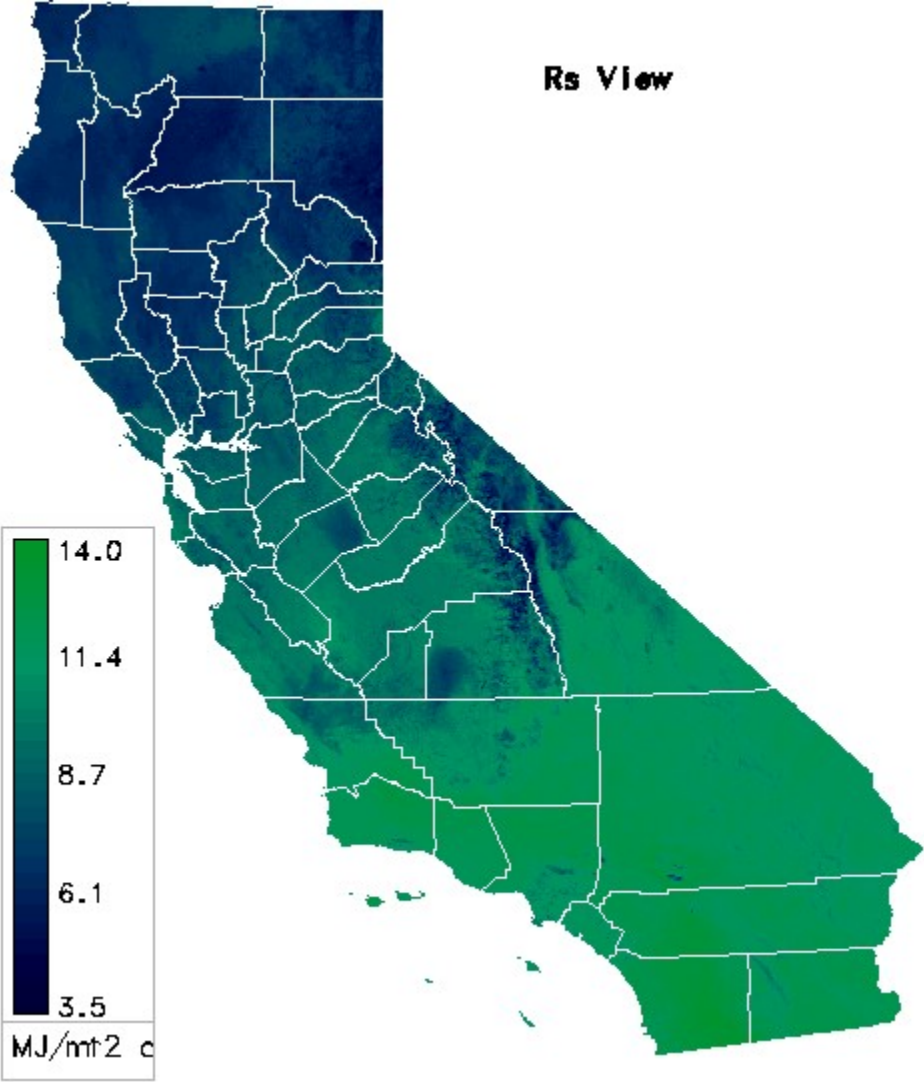
Flowmeter Data

Crop Manage Pink Flowmeter Data Detail



← Go Back

Spatial CIMIS ETo Reporting



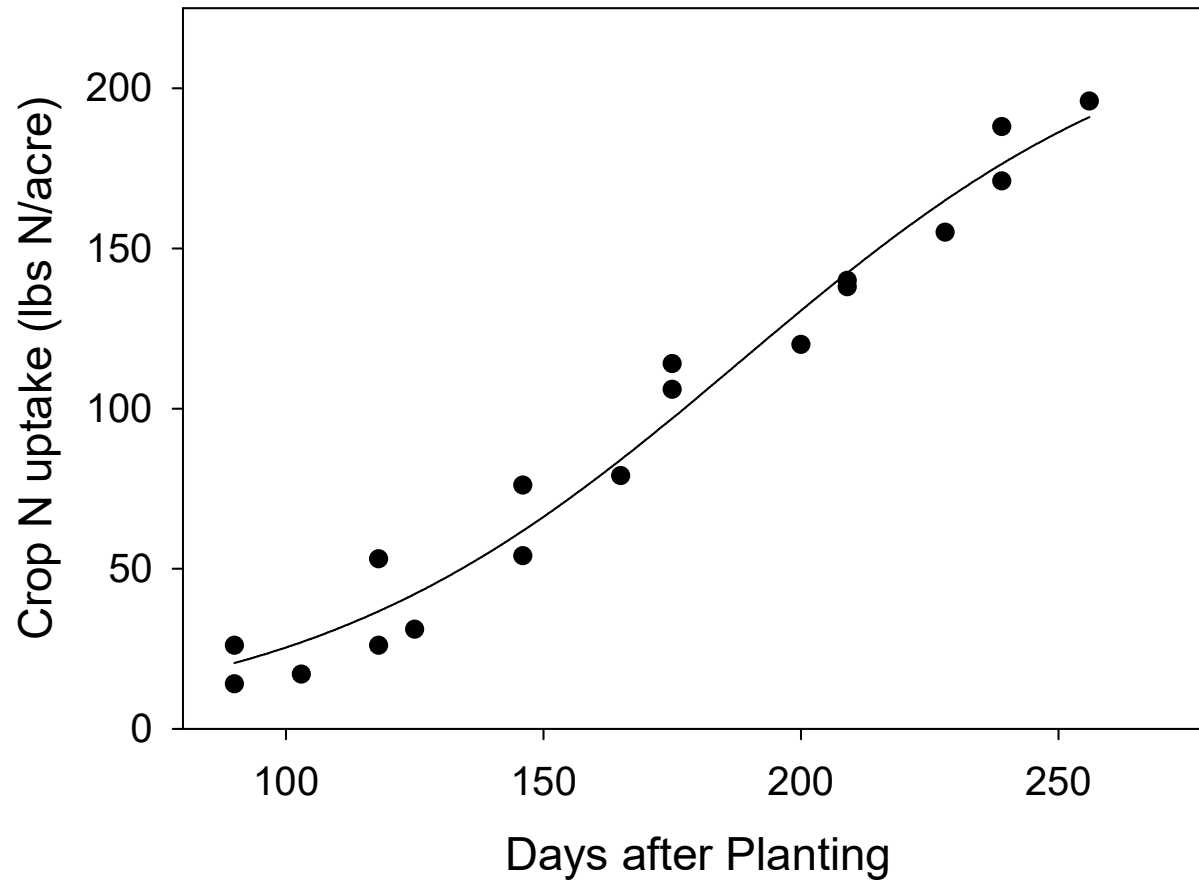


Fertilizer Summary Table

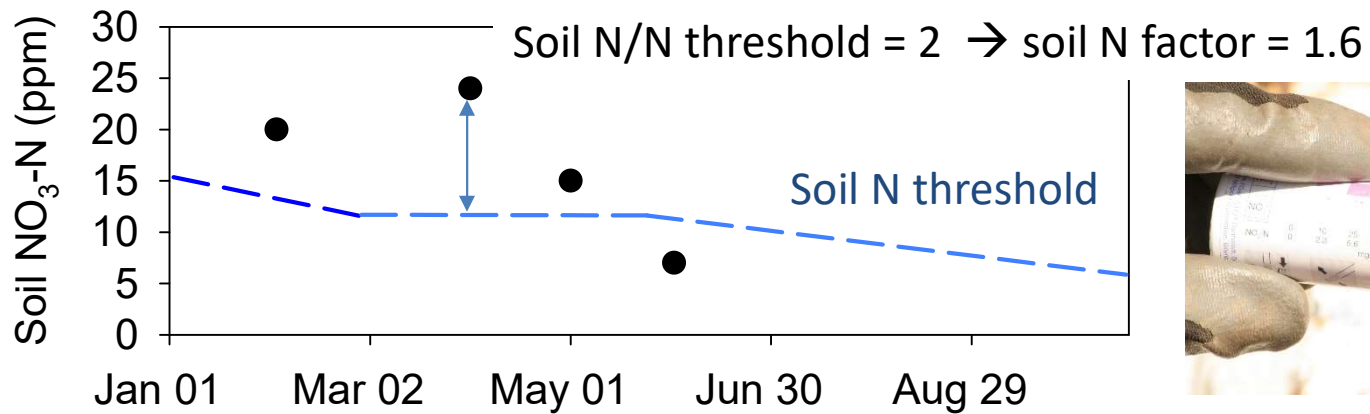
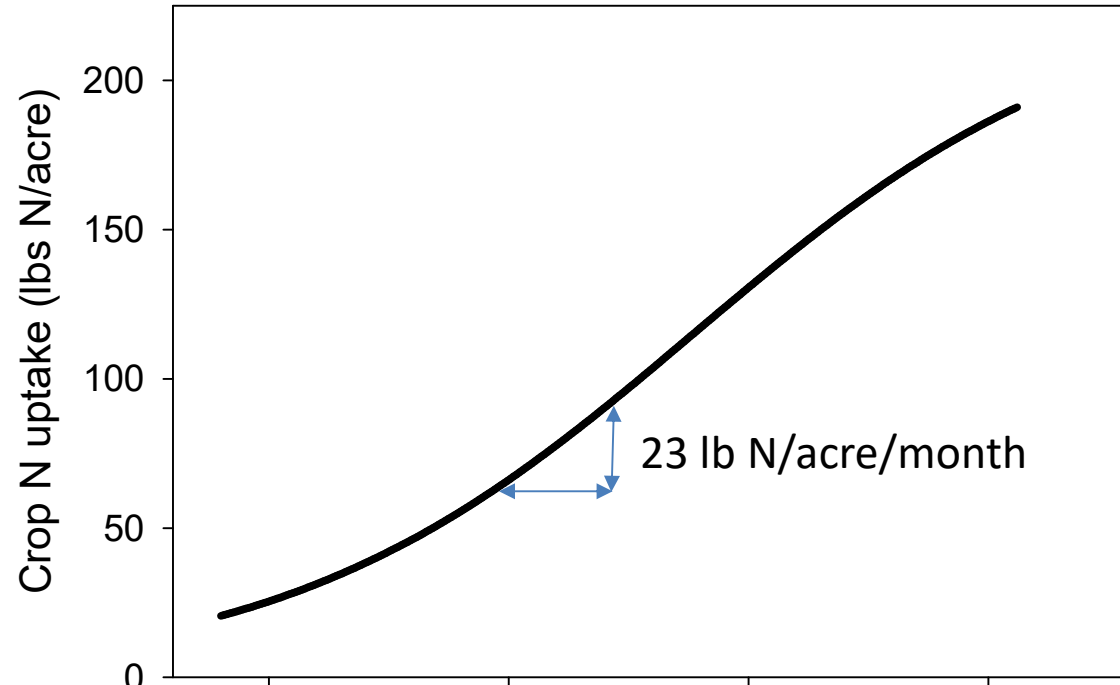
	Date	Crop Stage	Soil NO ₃ -N (ppm)	Fertilizer N Recommended (lbs N/acre)	Cummulative N Uptake (lbs N/acre)	Fertilizer	Fertilizer Amount - Fertilizer Units
	5/17/2016	fertigation midseason	12.5	11.1	69.4	CN9	8.0 gal/acre
	6/3/2016	fertigation midseason	12.5	18.3	93.0	CN9	8.0 gal/acre
	6/3/2016	fertigation midseason	N/A	N/A	93.0	4-16-0	4.0 gal/acre
	6/20/2016	fertigation midseason	12.5	12.7	119.2	4-16-0	4.0 gal/acre
	6/22/2016	fertigation midseason	12.5	12.5	122.4	CN9	7.7 gal/acre
	6/29/2016	fertigation midseason	12.5	11.9	133.5	CN9	3.0 gal/acre
	7/13/2016	fertigation midseason	50.0	7.2	155.1	4-16-0	3.0 gal/acre
	7/23/2016	fertigation midseason	15.0	5.9	169.5	MultiPlex	10.0 gal/acre
TOTALS				103.15 lbs N/acre			90.40 lbs N/acre

	Date	Crop Stage	Soil NO ₃ -N (ppm)	Fertilizer N Recommended (lbs N/acre)	Cummulative N Uptake (lbs N/acre)	Fertilizer	Fertilizer Amount - Fertilizer Units
	5/17/2016	fertigation midseason	12.5	11.1	69.4	CN9	8.0 gal/acre
	6/3/2016	fertigation midseason	12.5	18.3	93.0	CN9	8.0 gal/acre
	6/3/2016	fertigation midseason	N/A	N/A	93.0	4-16-0	4.0 gal/acre
	6/20/2016	fertigation midseason	12.5	12.7	119.2	4-16-0	4.0 gal/acre
	6/22/2016	fertigation midseason	12.5	12.5	122.4	CN9	7.7 gal/acre
	6/29/2016	fertigation midseason	12.5	11.9	133.5	CN9	3.0 gal/acre
	7/13/2016	fertigation midseason	50.0	7.2	155.1	4-16-0	3.0 gal/acre
	7/23/2016	fertigation midseason	15.0	5.9	169.5	MultiPlex	10.0 gal/acre
TOTALS				103.15 lbs N/acre			90.40 lbs N/acre

N uptake of strawberry evaluated in commercial fields



Crop N uptake and soil NO₃ quick test





Fertilizer N recommendation

Fertilization Recommendation Summary



Crop N uptake ⓘ	35.91 lbs N/acre	
N Fertilizer Factor ⓘ	1.60	
Soil N ⓘ	134.33 lbs N/acre	(30.00 ppm N)
Soil N threshold ⓘ	53.73 lbs N/acre	(12.00 ppm N)
Total mineralized N ⓘ	10.40 lbs N/acre	
Fertilizations Per Month ⓘ	4.00	

Fertilizer N Recommendation = $((\text{Crop N uptake} / \text{N Fertilizer Factor}) - \text{Total mineralized N}) / \text{Fertilizations Per Month}$

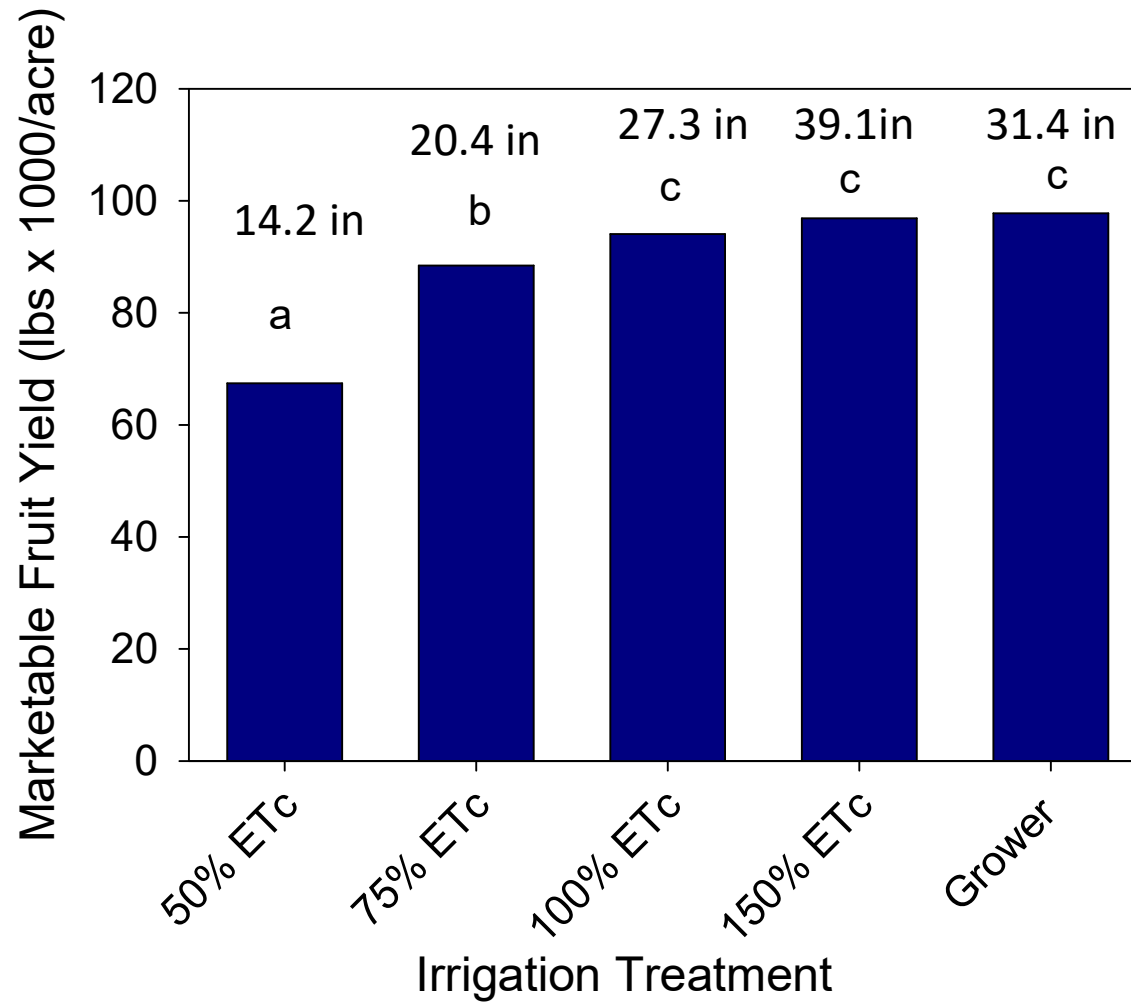
3.01 lbs N/acre = $((35.91 \text{ lbs N/acre} / 1.60) - 10.40) / 4$

Date: 4/27/2016

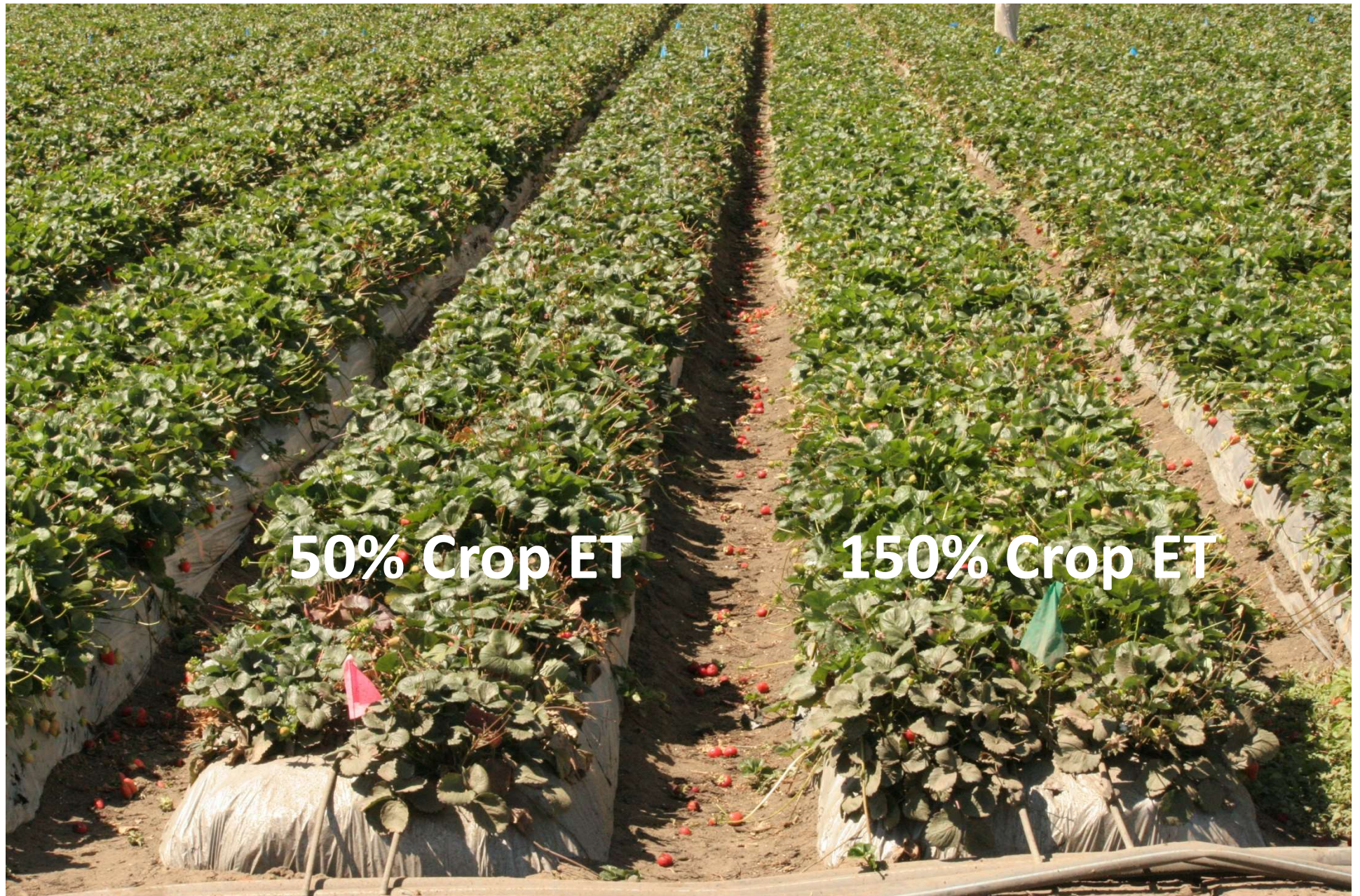
Fertilizer N Recommendation: 3.01 lbs N/acre

Close

Irrigation Effects on Marketable Fruit Yields



Difficult to identify water stress early



Nitrogen Treatment: Yield Summary (2016 Watsonville Trial)

Nitrogen treatment	Applied N	Marketable Yield	Total Yield	Fruit wt.	Culls
	-----	lbs/acre	-----	g/fruit	%
70% CM	159	81608	110350	20.4	26.1
100% CM	240	85356	115980	20.4	26.4
130% CM	320	79484	109787	20.2	27.7
LSD _{0.05}		4467	4556	NS	NS

Nitrogen Treatment: Yield Summary (2016 Oxnard Trial)

	GS	CM
Total yield (lbs/A)	48,364(a)	59,171(b)
Cull (Avg %)	28	27
Albino (%)	2	1
Water use (AF)	2.1	2.4
N fertilizer use (lbs N /A)	130	175
Veg biomass in June (g/plant)	542	1,047

More intuitive user interface under development

The screenshot displays the CropManagement web application interface. At the top, the header includes the CropManagement logo, the user name 'Dominic Stathos', and the language 'English'. Below the header, the main navigation bar shows 'Bondenson' with a settings gear, and three tabs: 'ACTIVE PLANTINGS', 'FAVORITES PLANTINGS', and 'ALL PLANTINGS'. A '+ ADD A PLANTING' button is located on the right side of the navigation bar.

On the left side, there is a search bar labeled 'Search Active Plantings' and a 'Filter Plantings' dropdown menu. The main content area is divided into four panels, each representing a different planting:

- Planting A (Lot 1):** Cauliflower-transplanted, 1 row, 40-inch bed, winter. Dates: 1 Mar 2016 to 3 May 2016. Events include Germination Sprinkler (0.42 in.), UAN28 (4.7 gal/acre), and Quick Nitrate Strip (1 ft) on 18 Oct 2016 (Today). Recommendations for 19 Oct 2016 (Tomorrow) include Germination Sprinkler (0.11 in.), UAN28 (None), and UAN28 (4.7 gal/acre). Quick Nitrate Strip (1 ft) is also recommended.
- Planting B (Lot 2):** Cauliflower-transplanted, 1 row, 40-inch bed, winter. Dates: 1 Mar 2016 to 3 May 2016. Events include Germination Sprinkler (0.42 in.), UAN28 (4.7 gal/acre), and Quick Nitrate Strip (1 ft) on 18 Oct 2016 (Today). Recommendations for 19 Oct 2016 (Tomorrow) include Germination Sprinkler (0.11 in.), UAN28 (None), and UAN28 (4.7 gal/acre). Quick Nitrate Strip (1 ft) is also recommended.
- Planting C (Lot 2):** Cauliflower-transplanted, 1 row, 40-inch bed, winter. Dates: 1 Mar 2016 to 3 May 2016. Recommendations for 19 Oct 2016 (Tomorrow) include Germination Sprinkler (0.11 in.) and UAN28 (None).
- Planting D (Lot 3):** Cauliflower-transplanted, 1 row, 40-inch bed, winter. Dates: 1 Mar 2016 to 3 May 2016. Recommendations for 19 Oct 2016 (Tomorrow) include Germination Sprinkler (0.11 in.) and UAN28 (None).

Each panel includes a 'View all events by:' section with icons for list, grid, and calendar views.

Summary

- **Web applications can be useful for repackaging research into simple to use decision support tools**
- ***CropManage* is designed to help growers improve water and N management practices**
- **UC will continue to adapt CM to strawberry varieties and add new features**
- ***CropManage* hands-on workshop scheduled at UCCE Santa Cruz on March 29th**