ET Scheduling of Romaine Lettuce

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UCCE Irrigation & Nutrient Mgmt Day, 2/23/17

California State University MONTEREY BAY Extraordinary Opportunity

UC CE University of California Cooperative Extension Monterey County

USDA ARS Agricultural Research Service

NASA

Objectives

- CropManage testbed, demonstration
- Provide data to help growers evaluate ET-based irrigation management practice
- State perspective: address state goals for expansion of best stewardship practices & natural resource conservation

Relevance

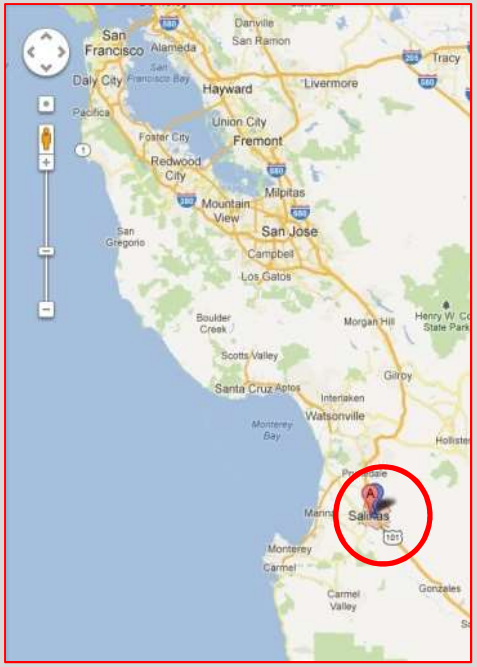
- Groundwater sustainability
- Compliance with Ag Discharge Order

Project activity

- Demonstrate ET-based irrigation scheduling using the CropManage decision-support tool
- Conduct replicated irrigation trials for romaine lettuce & during 2015, 2016
- Evaluate yield response to ET-based irrigation regimes ranging from 50%-150% of water replacement

Study site

Spence Ranch



USDA Agricultural Research Station,
Salinas, California

Methods

- Sun Valley (Central Valley seeds)
- 40” beds, 2 seedlines, 12” in-row spacing
- Crop establishment by sprinkler (~3”)
- Treatments applied by surface drip: 50%, 75%, 100%, and 150% of ET; CropManage guidance
- Equal inputs other than water (ie, fertilizer, herbicide, pesticide, etc.)

Methods (continued)

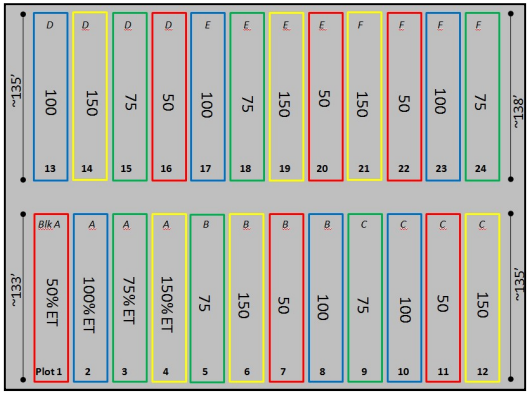
Crop establishment by sprinklers; wireless Cropmanage connection

<u>Experiment</u>: 4-way irrigation manifold with CropManage connection

Flowmeters

Layflat & drip lines

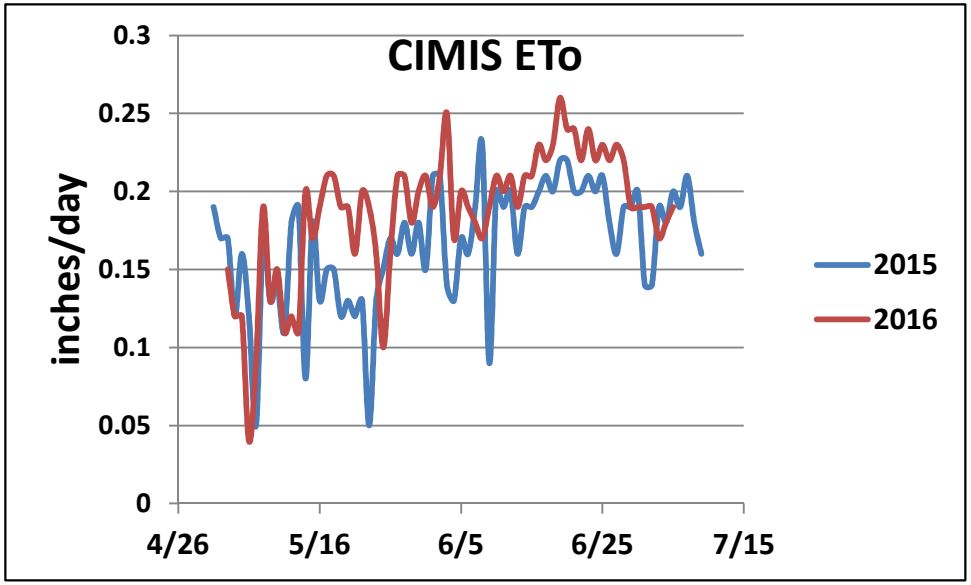
Randomized block design



replication, control, repeatability

Reference ET from CalDWR/CIMIS

(located onsite at USDA)



*Challenge: how to translate into “actionable” info?

CROPMANAGE

Help and User Instructions for Irrigation and N management tool

	Date	Irrigation Method	Irrigation Interval (days)	Recommended Maximum Irrigation Interval (days)	Recommended Water - in.	Applied Water - in.	Rainfall (inches)
	6/1/2016	Drip	6	13.9 days	0.3 in	0.3 in	0.0
	6/3/2016	Drip	2	9.0 days	0.1 in	0.1 in	0.0
	6/7/2016	Drip	4	7.5 days	0.4 in	0.3 in	0.0
	6/10/2016	Drip	3	6.5 days	0.3 in		
	6/14/2016	Drip	4	5.3 days	0.6 in		
	6/17/2016	Drip	3	4.2 days	0.6 in		
	6/21/2016	Drip	4	3.7 days	1.0 in		
	6/24/2016	Drip	3	3.6 days	0.7 in		
TOTALS					7.74 inches	9.6	

- UC Cooperative Extension
- Web-app for growers; water & nutrient management
- Crop fractional cover a main driver
- Incorporates CIMIS ETo

Currently supported: romaine, head lettuce, spinach, celery, broccoli, cauliflower, cabbage, strawberry

In development: almond, walnut, alfalfa

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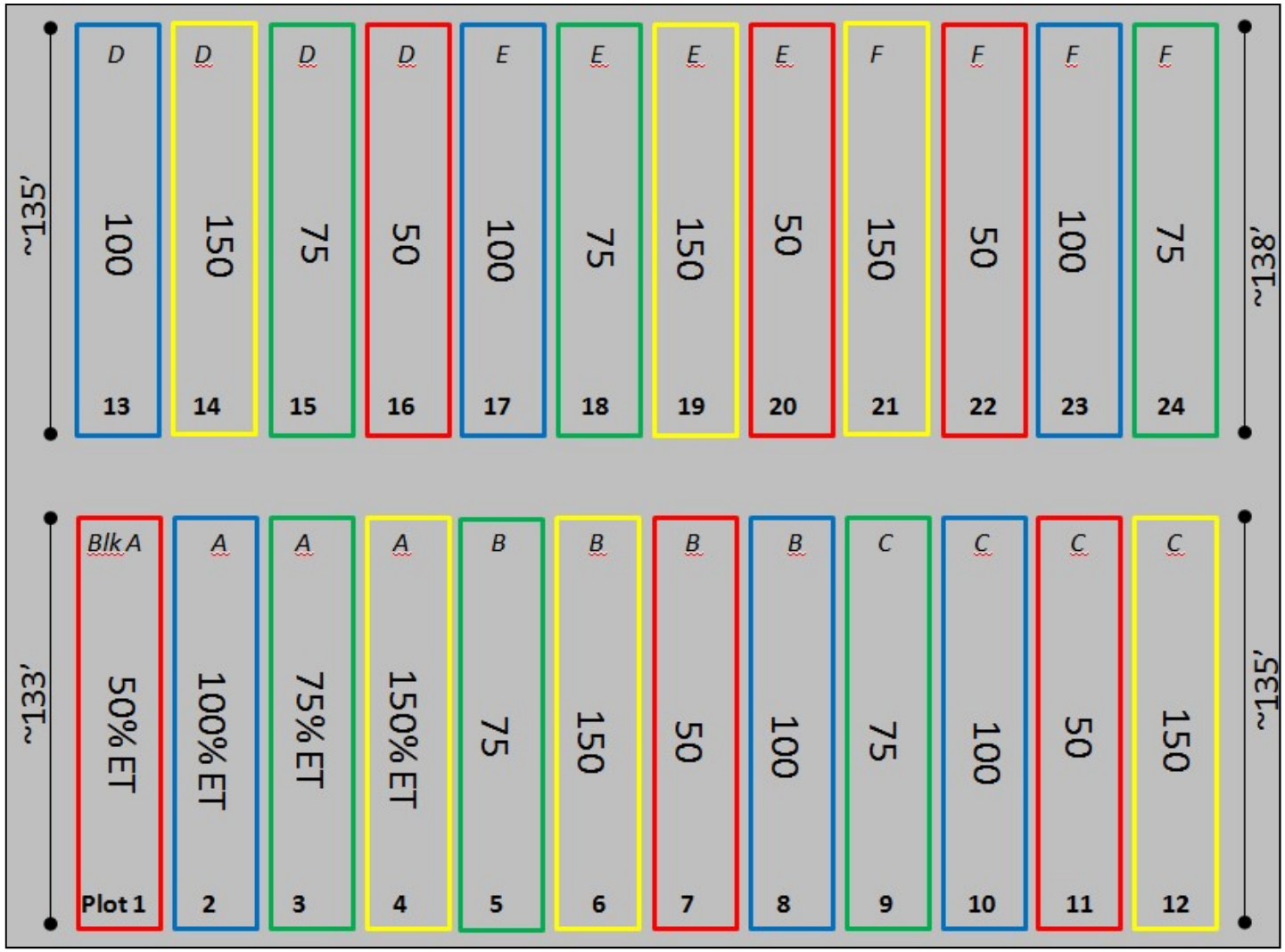
Trial #1

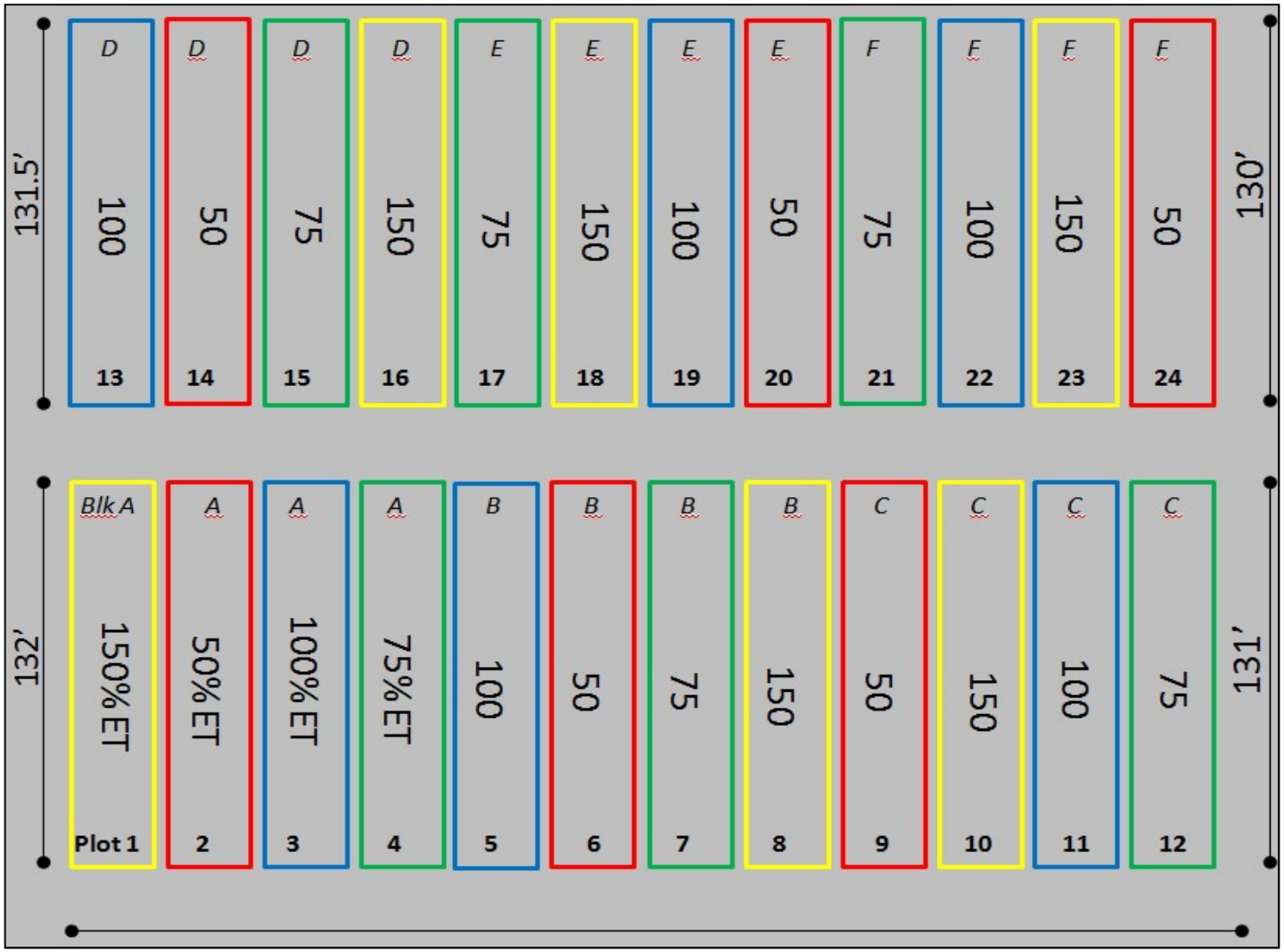
April 29-July 9, 2015



4 treatments, 6 reps, ~1.5 ac total, 6 beds/plot

Trial #2

May 3 -July 5, 2016



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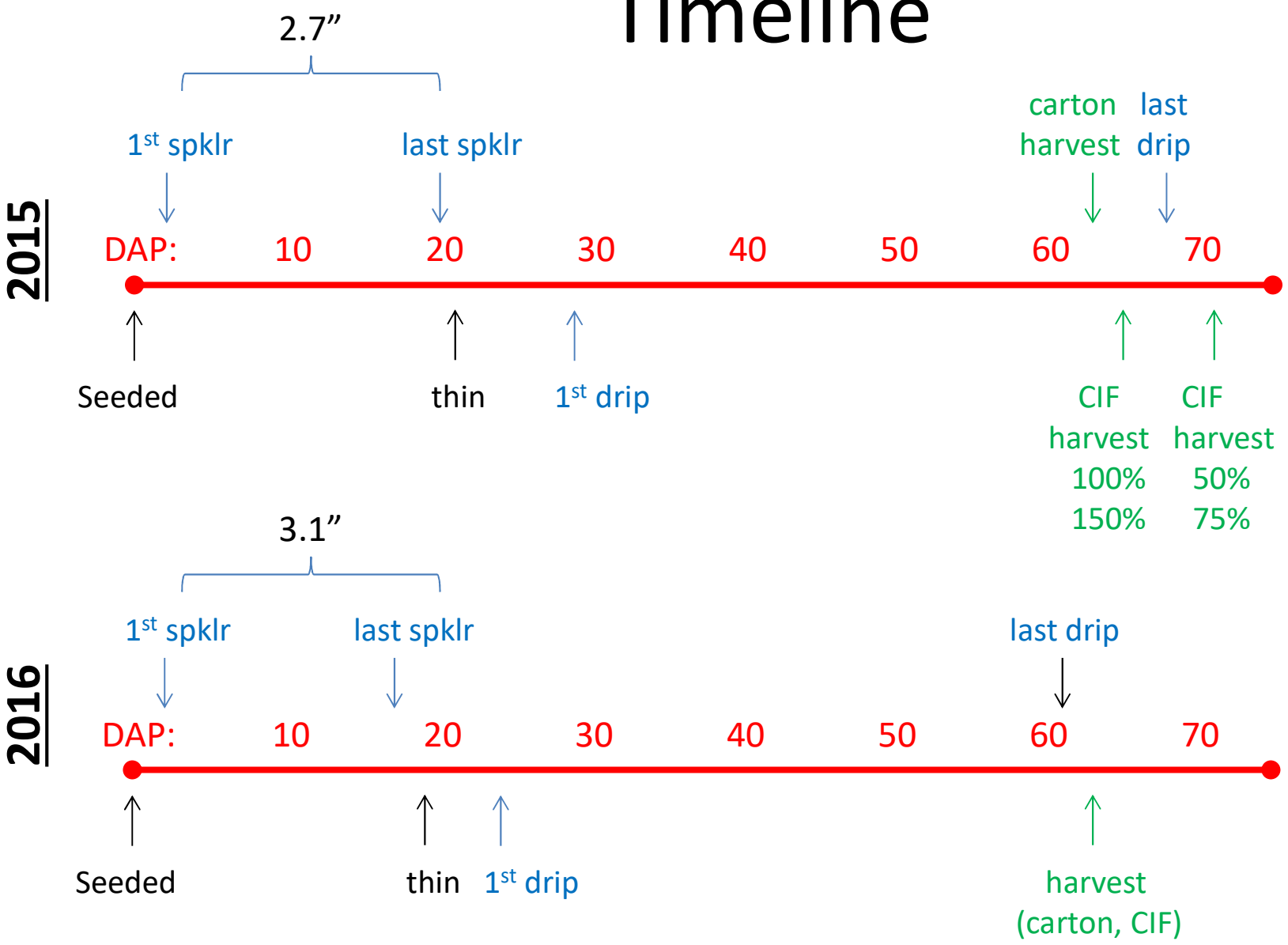
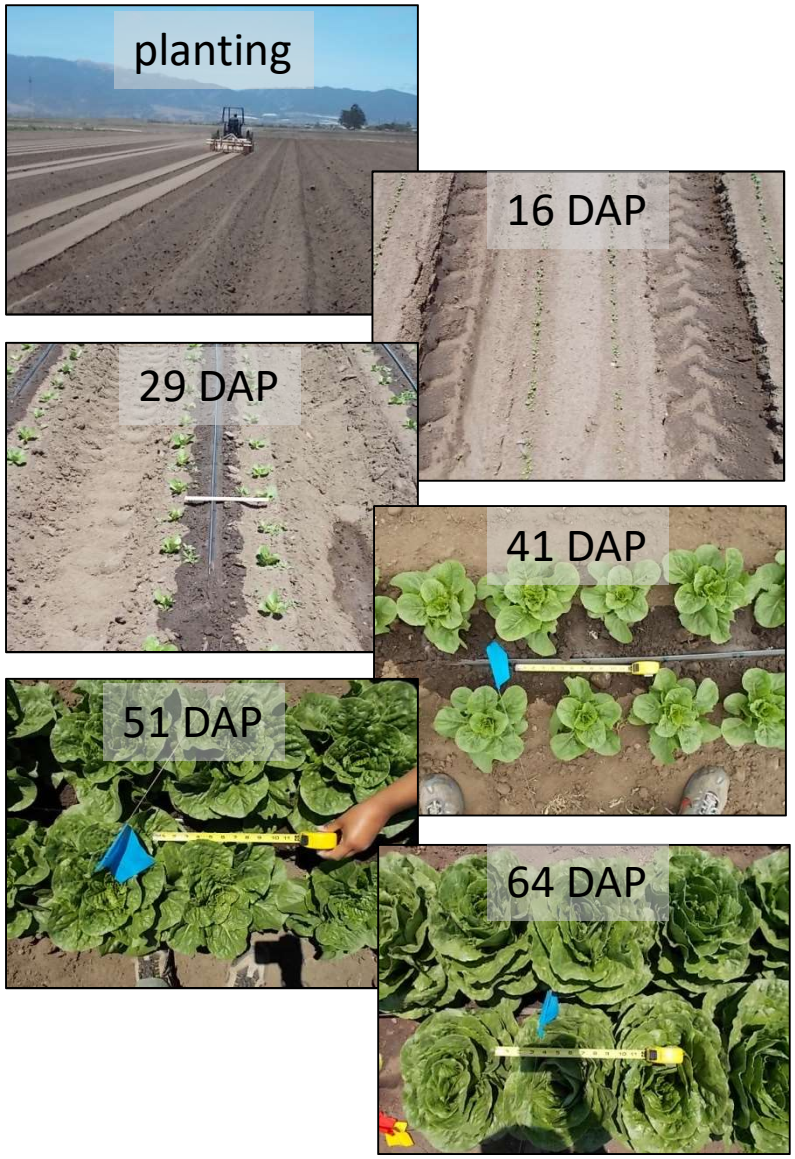
Timeline


2.7”
1st spklr
last spklr
carton harvest
last drip
2015
DAP:
10
20
30
40
50
60
70
Seeded
thin
1st drip
CIF harvest 100% 150%
CIF harvest 50% 75%
3.1”
1st spklr
last spklr
last drip
2016
DAP:
10
20
30
40
50
60
70
Seeded
thin
1st drip
harvest (carton, CIF)

Crop growth, 100% treatment (2015)



12” tape for reference

Harvest

Carton:

Outer leaves trimmed

Cored-in-field (CIF):

Top and tailed product for processing

Results

Carton yield

2015:

Treatment	Irrigation (in.)	Yield (tons/ac)	DAP
50ET	5.2	11.8[a]	63
75ET	6.2	14.9[b]	63
100ET	7.3	22.6[c]	63
150ET	9.2	21.4[c]	63

2016:

Treatment	Irrigation (in.)	Yield (tons/ac)	DAP
50ET	6.8	11.5[a]	63
75ET	8.3	21.2[b]	63
100ET	9.7	25.6[c]	63
150ET	12.6	25.5[c]	63

Note: typical applied water totals are 12"-18" for Central Coast drip-irrigated lettuce per UC-DANR Pub. 7216, “Leaf Lettuce Production in California,” 2011.

CIF yield

2015:

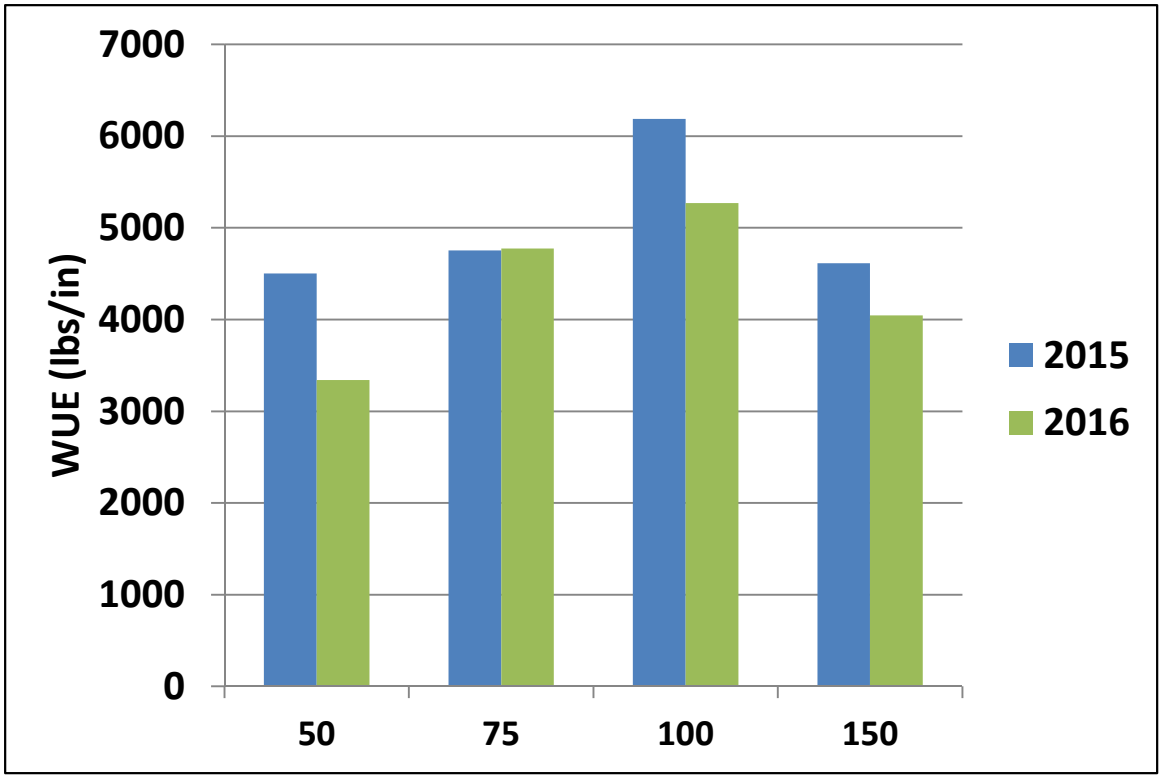
Treatment	Irrigation (in.)	Yield (t/ac)	DAP
50ET	5.9	7.1[a]	71
75ET	7.2	9.8[a]	71
100ET	7.7	14.3[b]	64
150ET	9.9	14.3[b]	64

2016:

Treatment	Irrigation (in.)	Yield (t/ac)	DAP
50ET	6.8	--	63
75ET	8.3	10.5[a]	63
100ET	9.7	13.9[b]	63
150ET	12.6	14.4[b]	63

Water use efficiency (WUE)

Pounds of marketable yield per inch of applied water



Shelf life

- The 100% and 150% treatments passed shelf life test; 50% and 75% failed.

Findings

- Carton yield:
  - Marketable yields from 100% and 150% treatments were not significantly different, and well exceeded romaine statewide industry average (~15 tons/ac[1,2]).
  - Yield for the 75% treatment was significantly lower than the 100% and 150% treatments, yet was equal to or above statewide average.
  - Yield for the 50% treatment was significantly below other treatments & statewide average.
  - The 100% treatment had highest WUE (and NUE) both years.

[1]UC-DANR Publication #7216 – Leaf lettuce production in California, 2011

[2]California Agricultural Statistics Review, 2014-15

Findings, continued

- CIF product:
  - Marketable yields from 100% and 150% treatments were not significantly different.
  - The 75% yield was significantly below the 100% and 150% treatments despite 7 additional days and 2 additional irrigations.
  - The 50% treatment was deemed not viable for harvest by our commercial cooperator (yet was harvested in 2015 for data purposes).

[1]Fresh Express, personal communication

Summary

- 2 years of trials demonstarted CropManage as a viable tool for water management/conservation in romaine.
- Irrigation above the 100% ET did not increase yields.
- Irrigation below 100% ET reduced yields, product quality and shelf life performance

Next steps

- Extend CropManage to new crops (ongoing)
- Conduct CropManage verification trials on additional, currently supported crops
- Investigate recovery from water deficit
- Evaluate irrigation effect on nutrient leaching
- Continued CropManage hands-on training
- *Recommend* add'l CIMIS station to better account for regional microclimate.

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