Improving Irrigation and Nutrient Management in Ventura County Strawberry

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Objectives

- Better understand plant growth and needs for water and N
- Create a practical and efficient tool for water and N fertilizer management

✓ 6 + 6 field studies between 2014 and 2017

Previous Years Measurements

2014 - 2017:

(4 sampling locations per field)

- Canopy cover (7 fields)
- Root depth (7 fields)

2014-15:

- Aboveground biomass N (6 fields; 4)

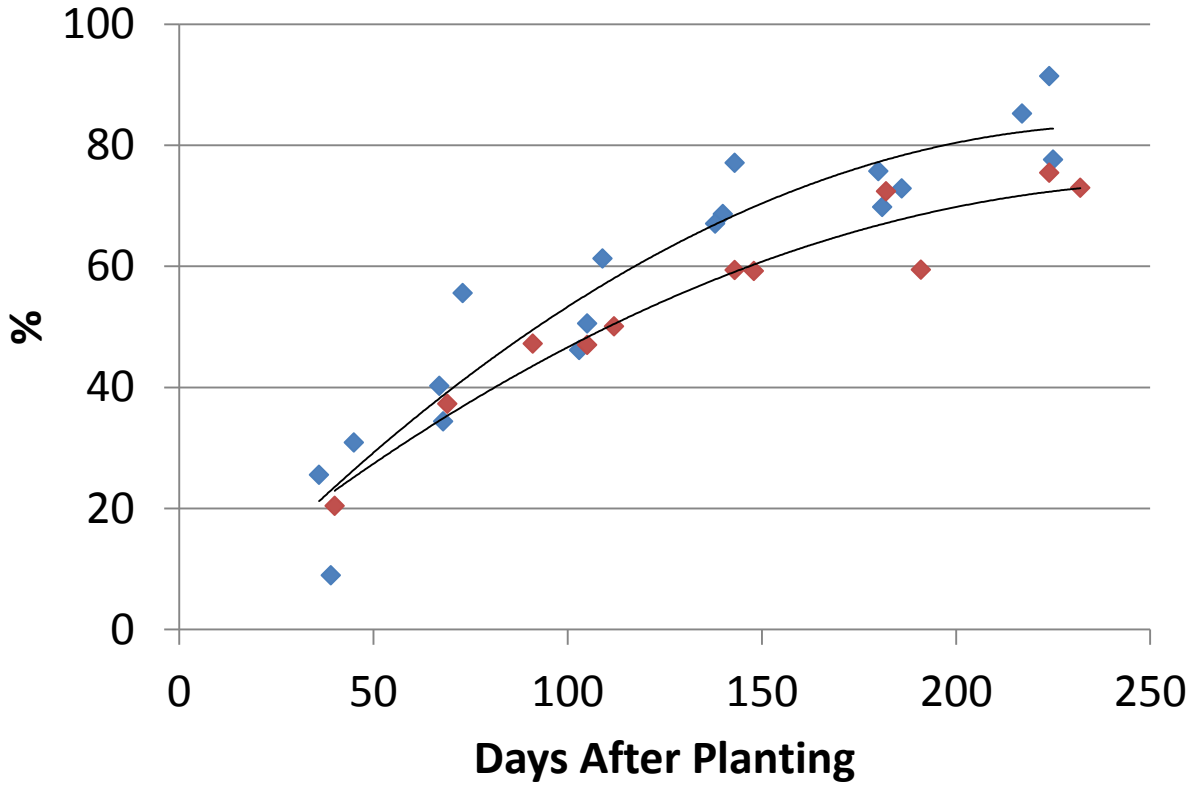
Canopy Cover

20%

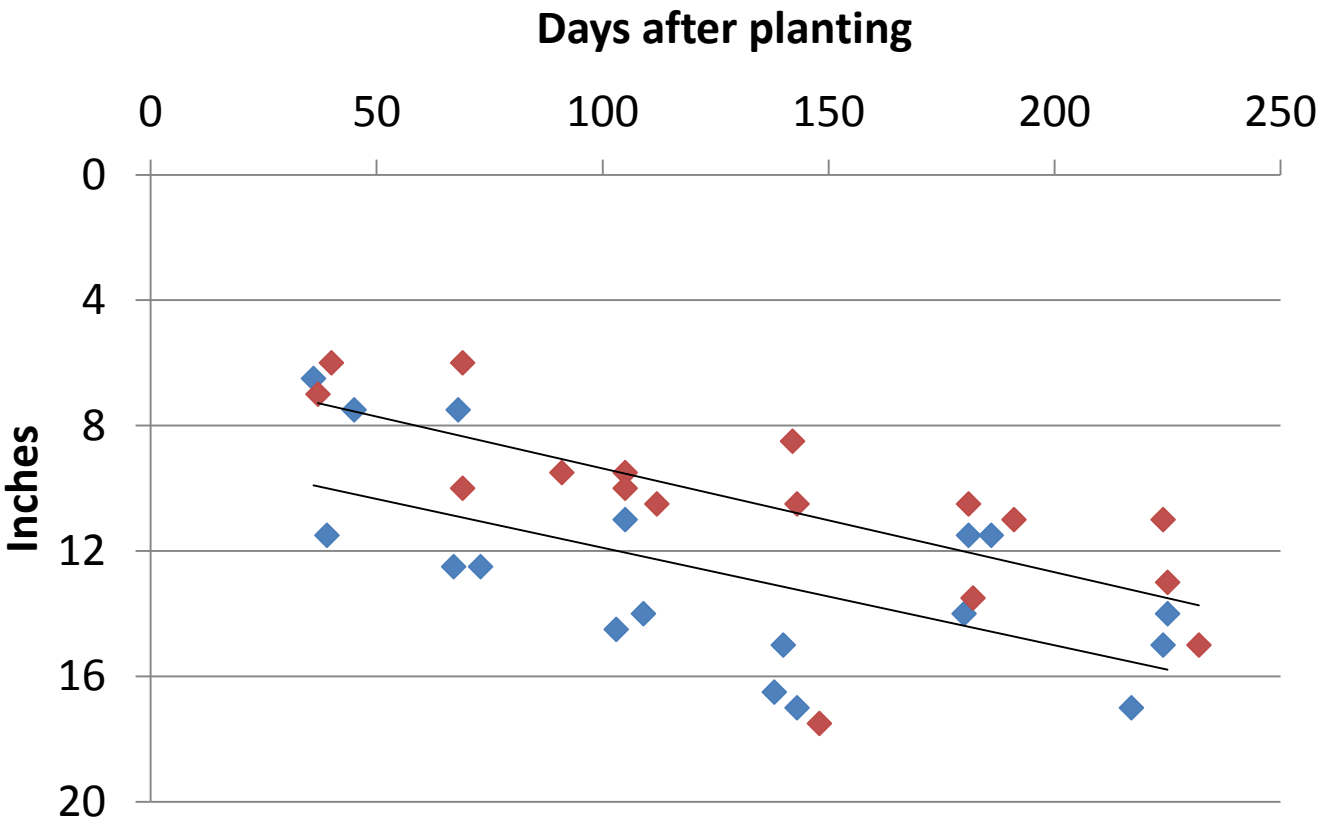
60%

80%

Canopy Cover

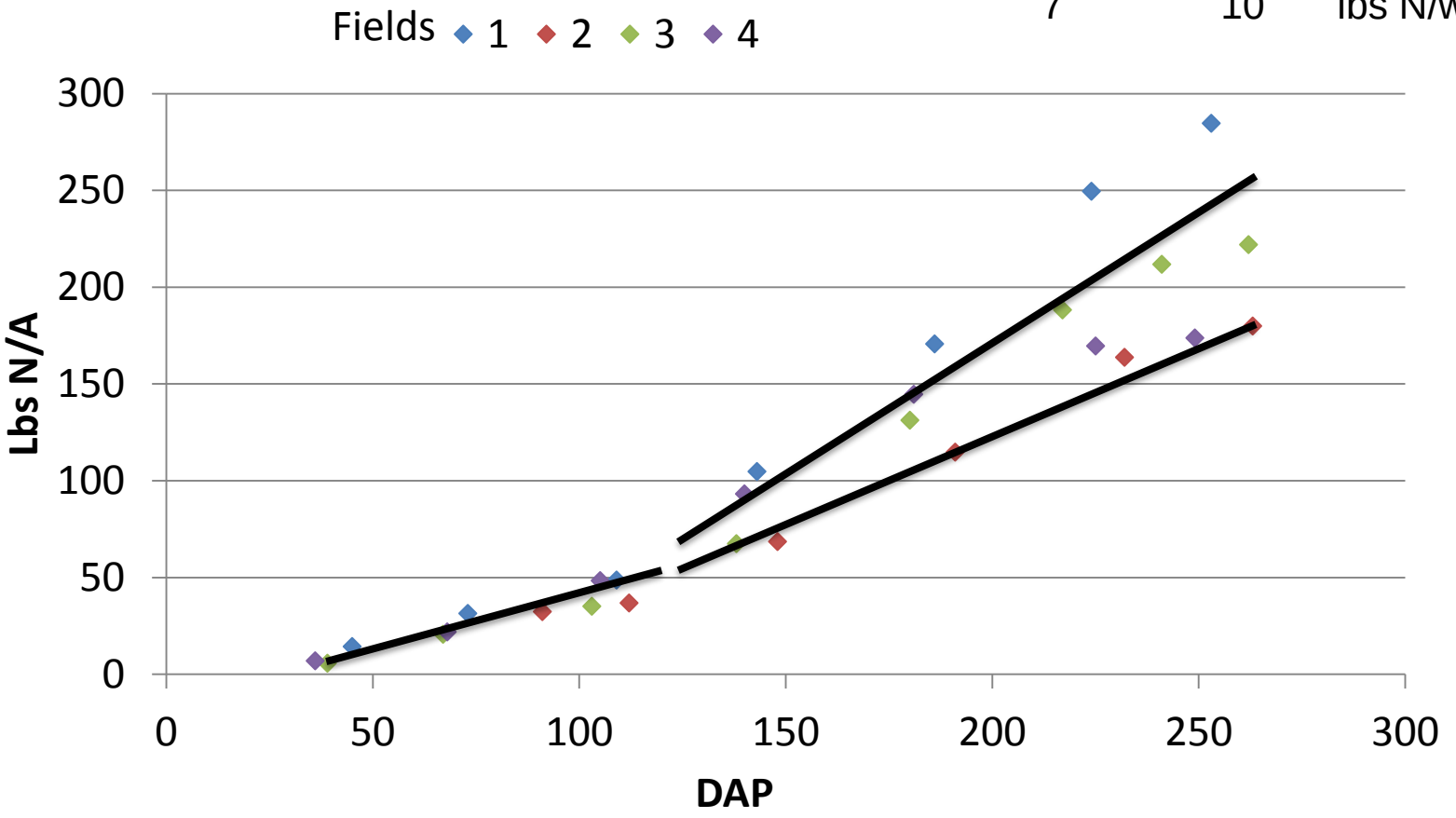


Root Depth



Aboveground Biomass N Uptake

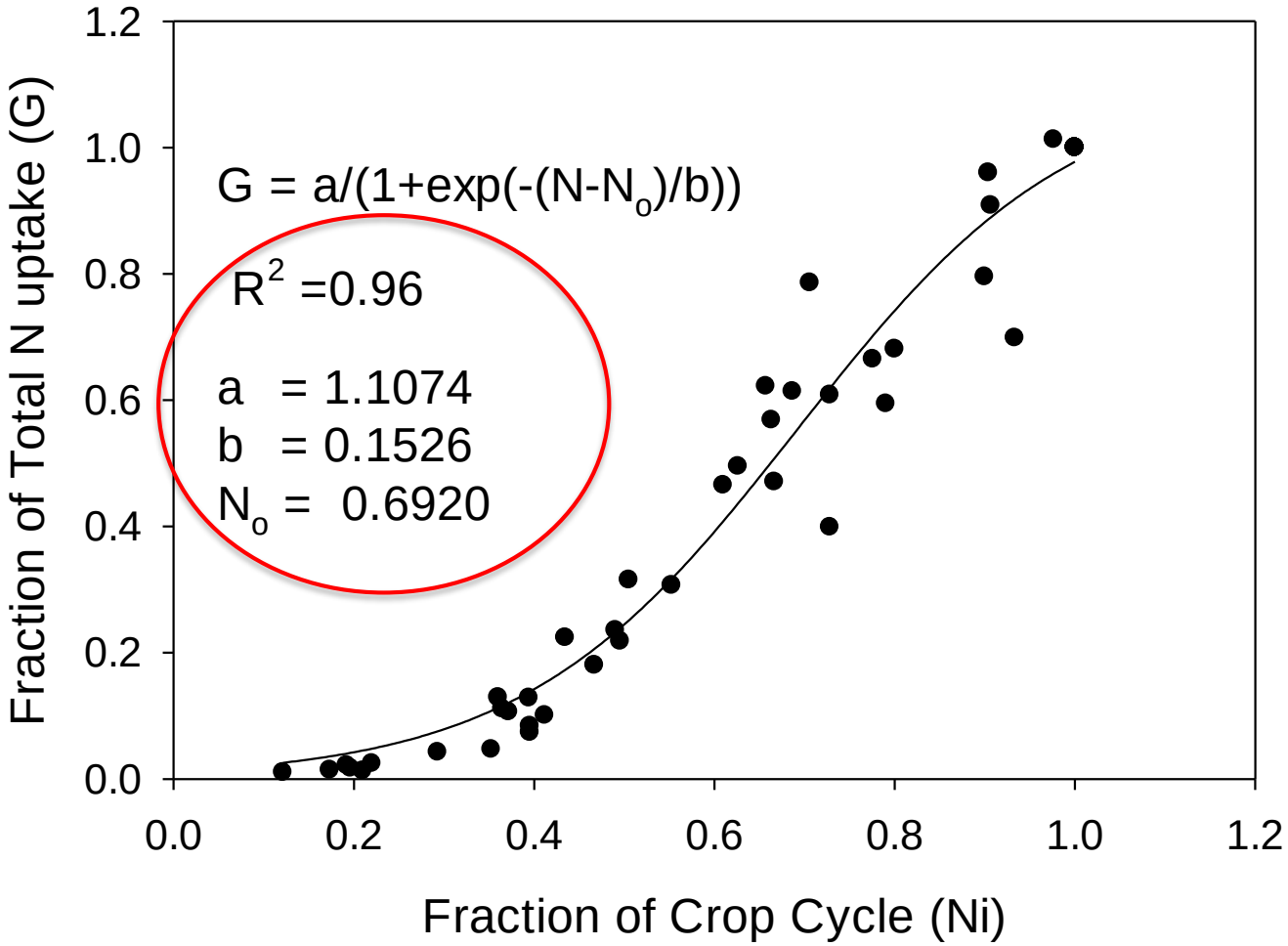
Low	High	
1.0	1.5	lbs N/day
7	10	lbs N/week



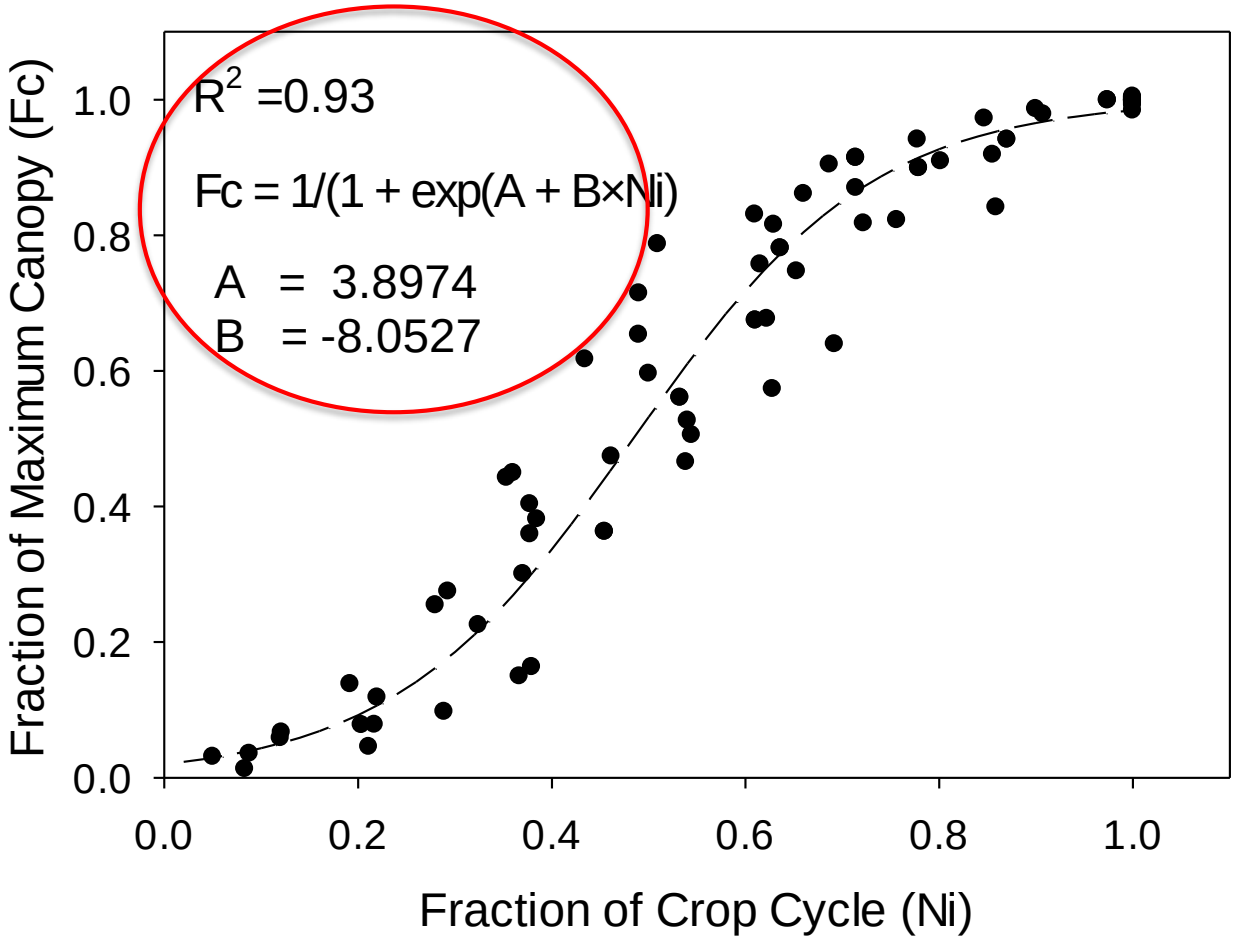
Challenges with N management:

- Transition from low to high uptake rates may not be very clear
- Concern with fruit quality may lower yields
- Differences among cultivars
- Irrigation efficiency (leaching nitrate)
- Use of pre-plant fertilizer

Nitrogen Uptake



Canopy Cover



CropManage

Database driven web application

Crop ET model

Crop N model

www.cropmanage.ucanr.edu

University of California
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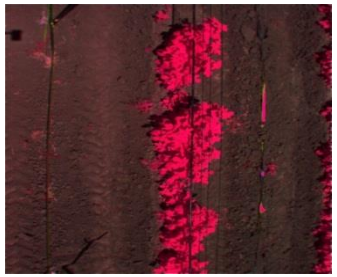
How Much Water?

ETo

x

Kc



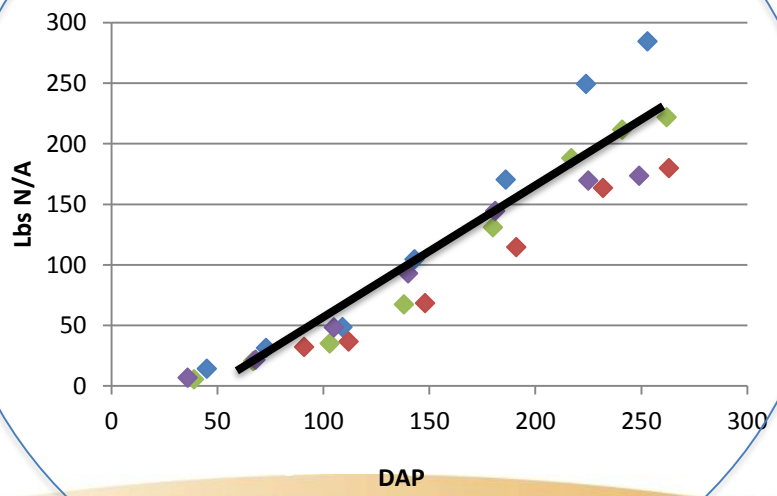
Water recommendation

- ✓ Irrigation system application rate
- ✓ Irrigation system application uniformity (DU)
- ✓ Leaching fraction (water salinity)

How is N fertilizer rate determined?

Fertilizer N = Crop N uptake (weekly lbs N/acre) and Soil N threshold (ppm NO3-N)

UC Studies



Soil N:

Quick Test

Field Assessments

6 fields total:

✓3 replicated

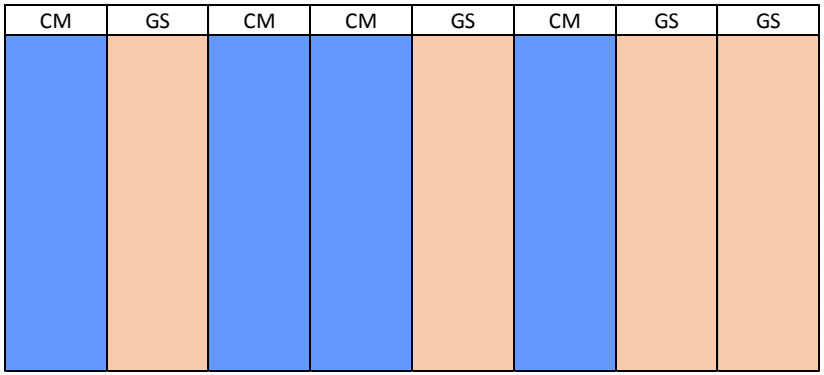
✓3 non-replicated (block comparisons)

2 treatments:

Water and N fertilizer managed according to

CropManage (CM) vs Grower Standard (GS)

Replicated (4 times)



Block comparison

When irrigate?

- Tensiometers

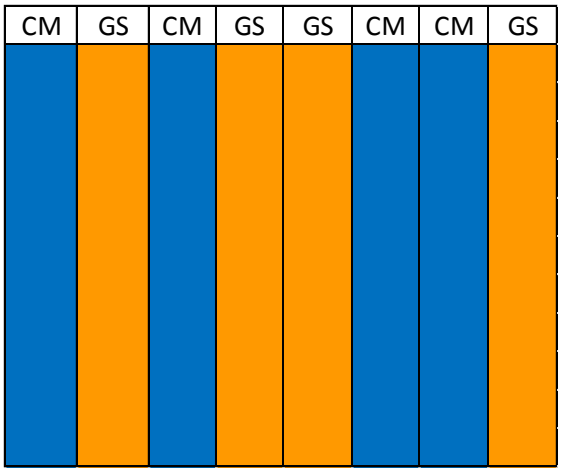
Results Summary

Study #	County	Study type	Marketable yield	Water use	Fertilizer use
			relative to grower standard:		
1	Ventura	Replicated	22% higher*	14% higher	34% higher
2	Ventura	Block comparison	2% higher	Same	35% lower
3	Ventura	Replicated	27% higher*	32% higher	26% higher
4	Ventura	Block comparison	Same	22% lower	Same
5	Monterey	Bock comparison	Non-representative**	21% higher	11% higher
6	Monterey	Replicated	2% higher	29% lower	10% lower

* Difference is statistically significant

** Irregular lygus damage between comparison blocks

2017 Example



Field details

- ✓ Location: Oxnard, CA
- ✓ Cultivar: Fronteras
- ✓ 64” bed, two high flow tapes
- ✓ 25ft long plots
- ✓ Soil: Hueneme loamy sand (6% clay, 83% sand and 11% silt)
- ✓ Water: EC = 1.6 dS/m
- ✓ Pre-plant fertilizer (controlled release): 176 lbs N/acre
- ✓ Main in-season N fertilizer source: CN9

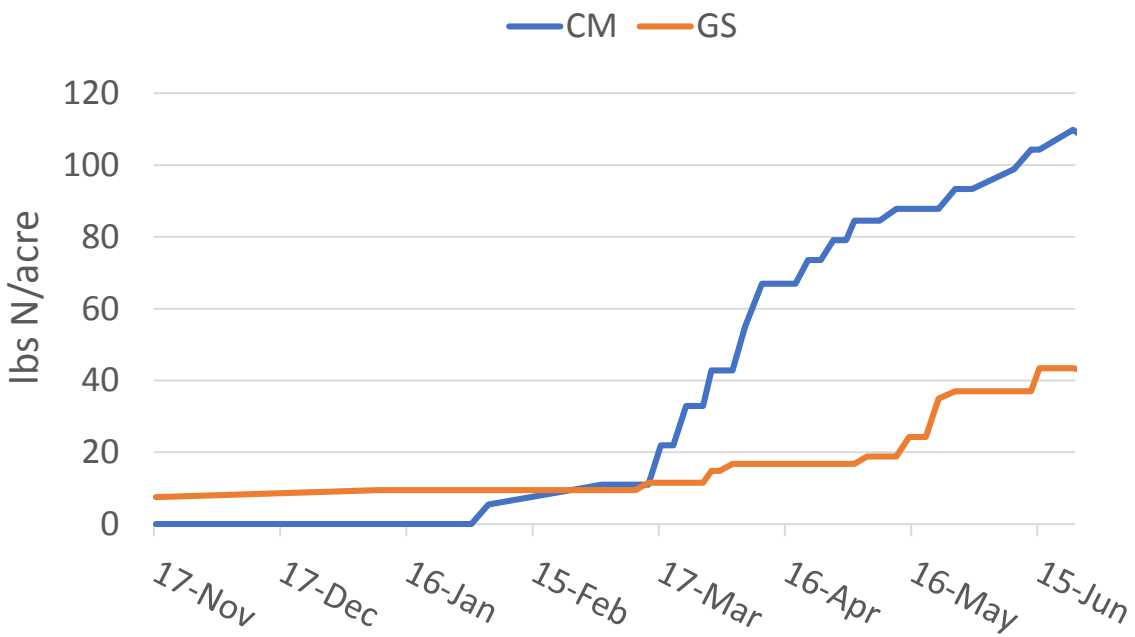
Flow meters

Weekly soil sample for nitrate

Soil Moisture Sensors

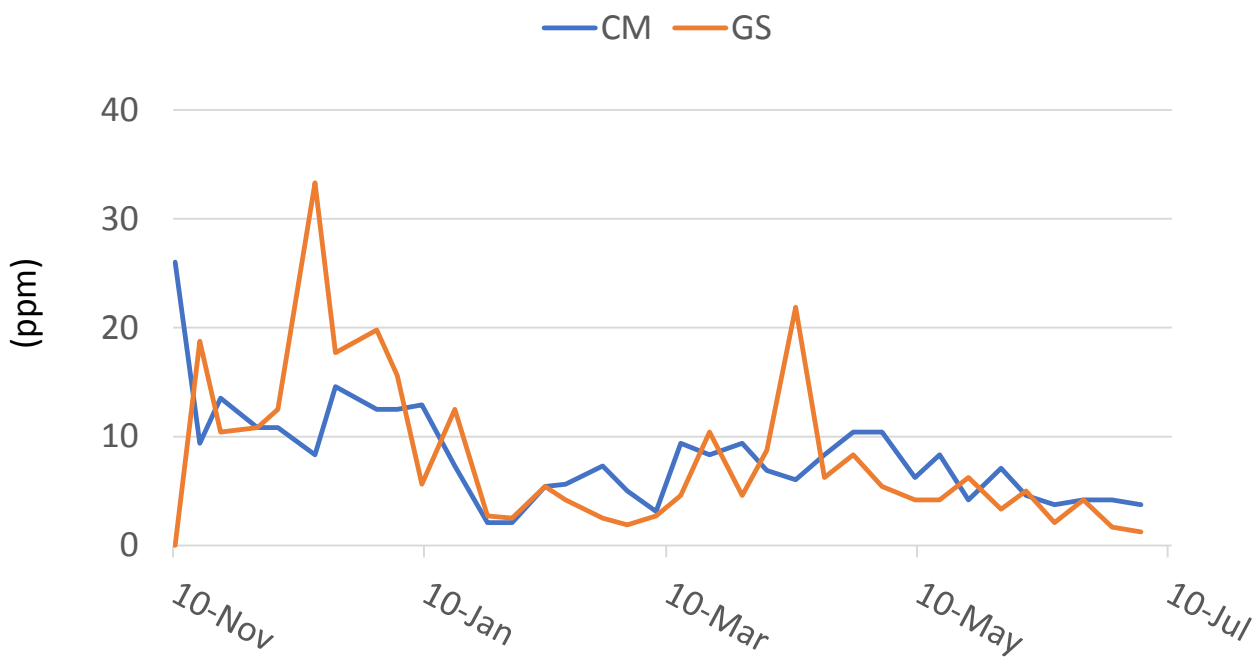
Results

In-Season N Fertilizer Applied

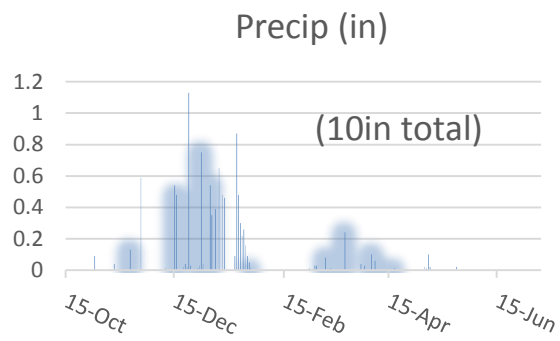


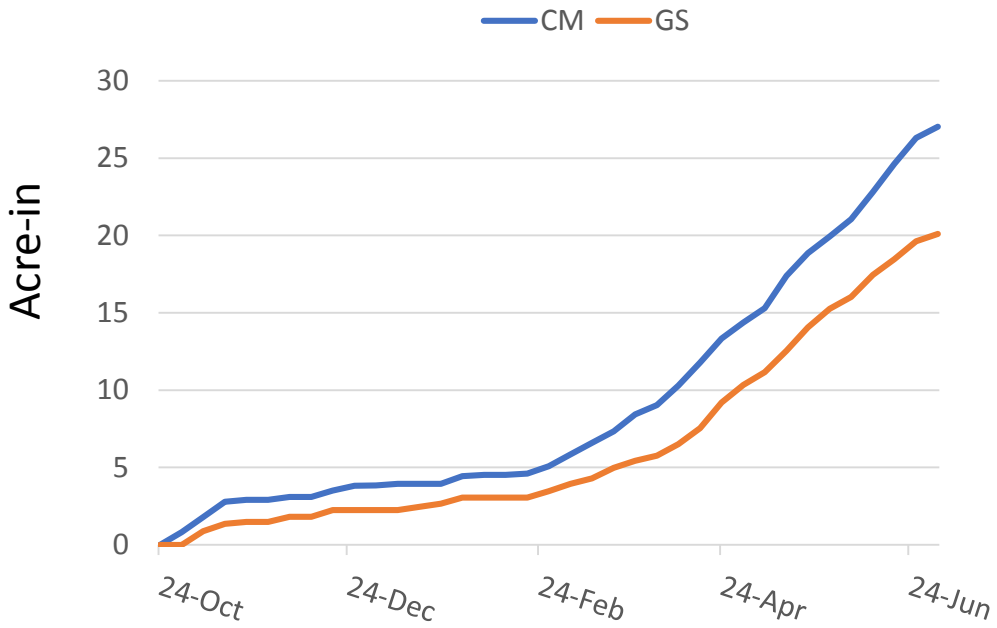
*Pre-plant fertilizer (controlled release): 176 lbs N/acre

Soil NO_3-N (0-12in)

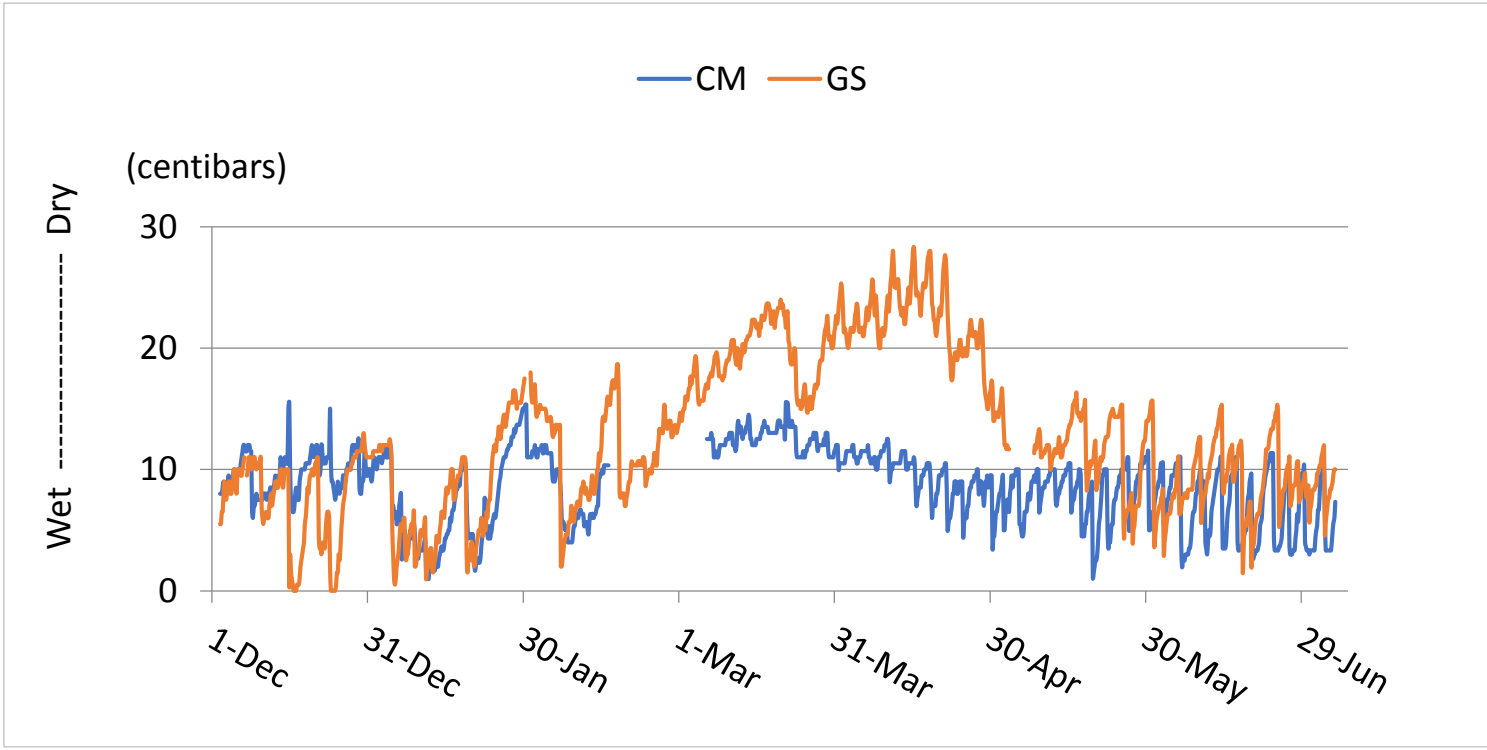


Cumulative Drip-Applied Water

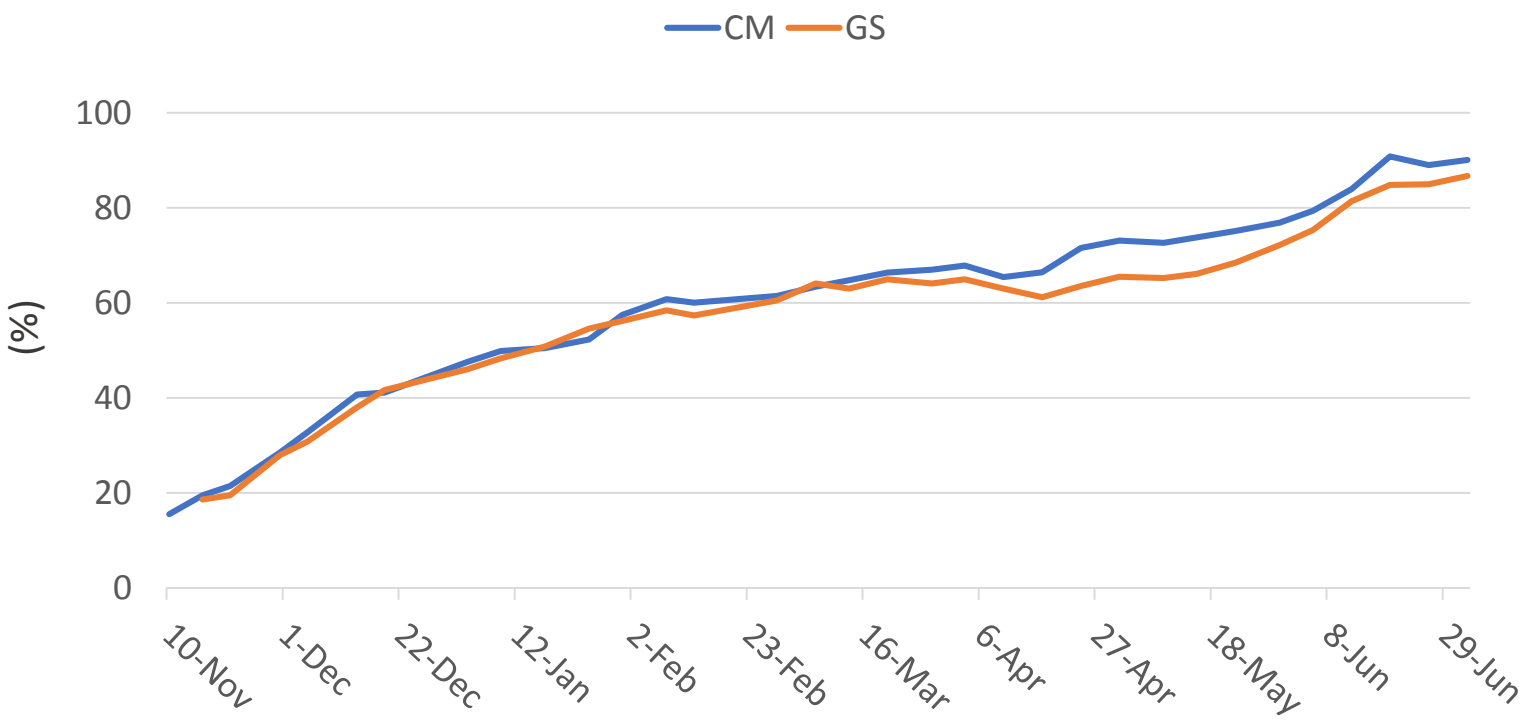




Soil Moisture at 6” depth

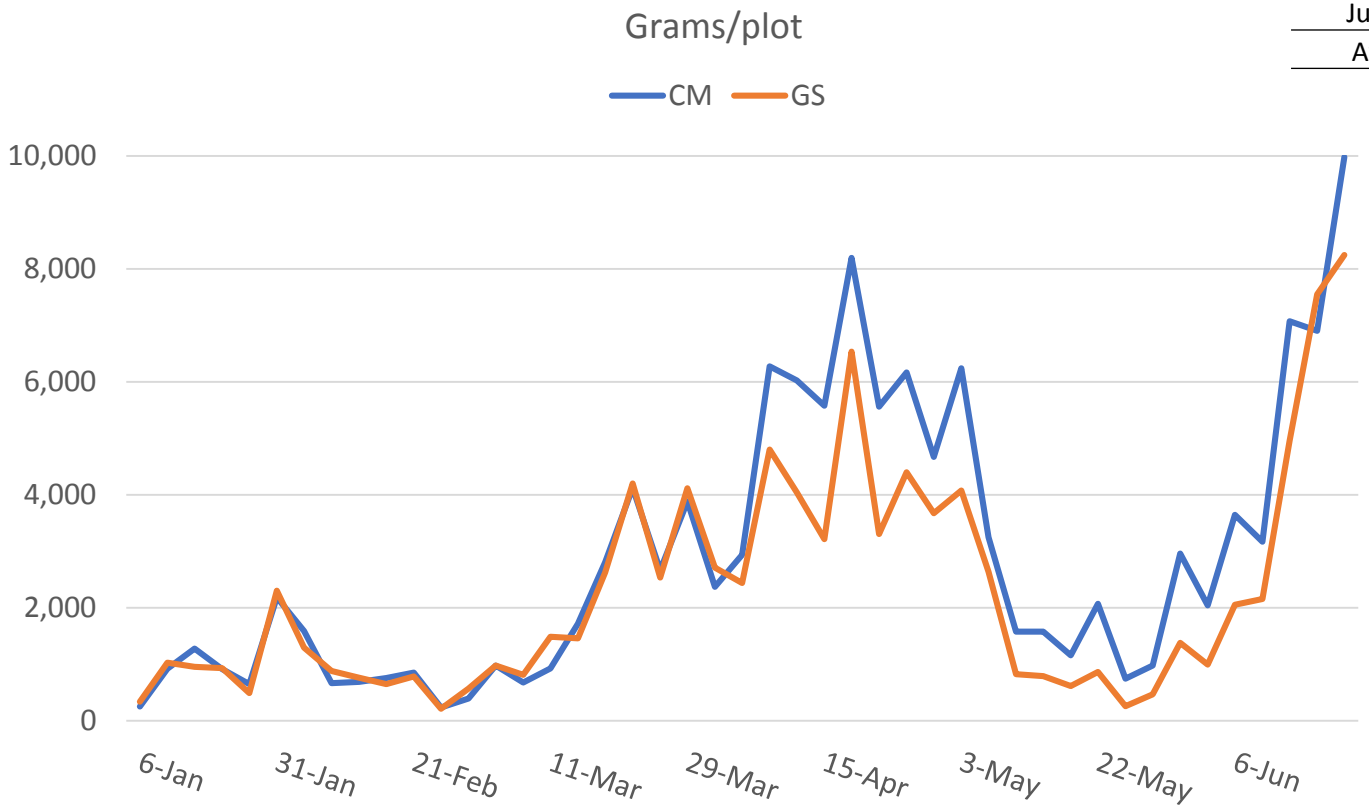


Canopy Coverage

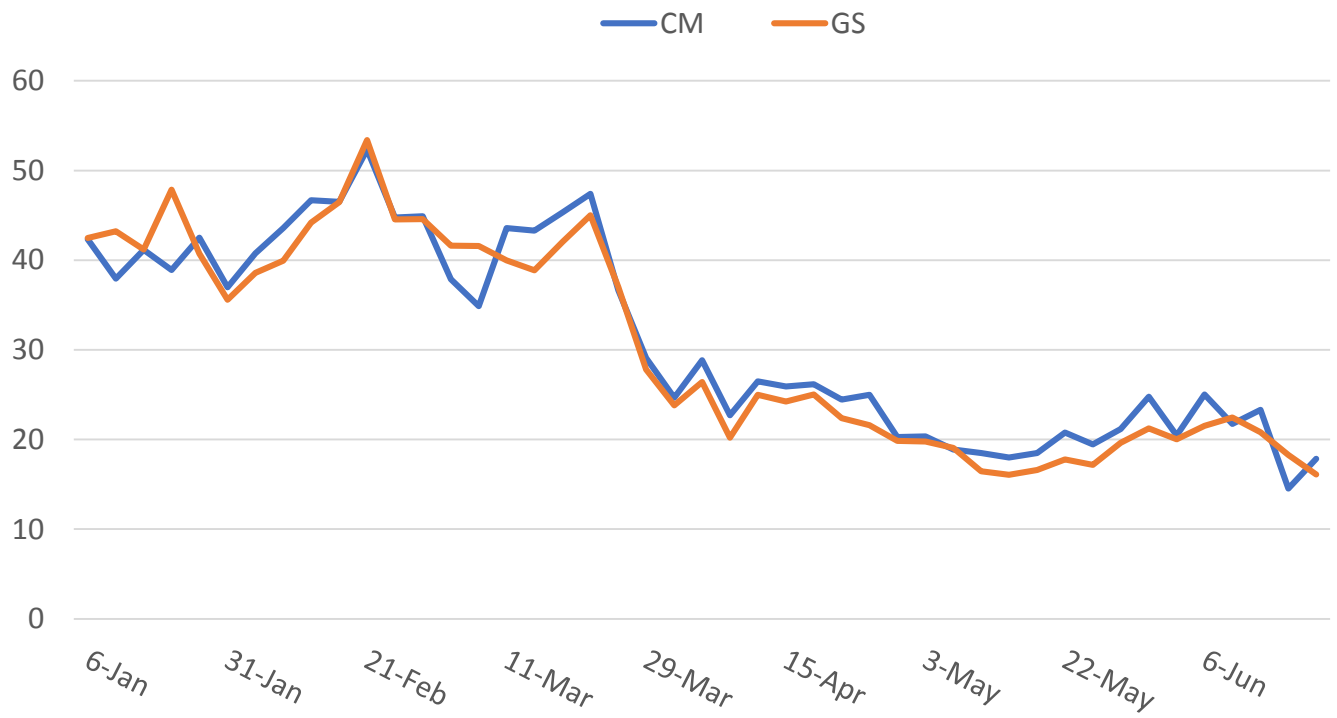


Marketable Yield

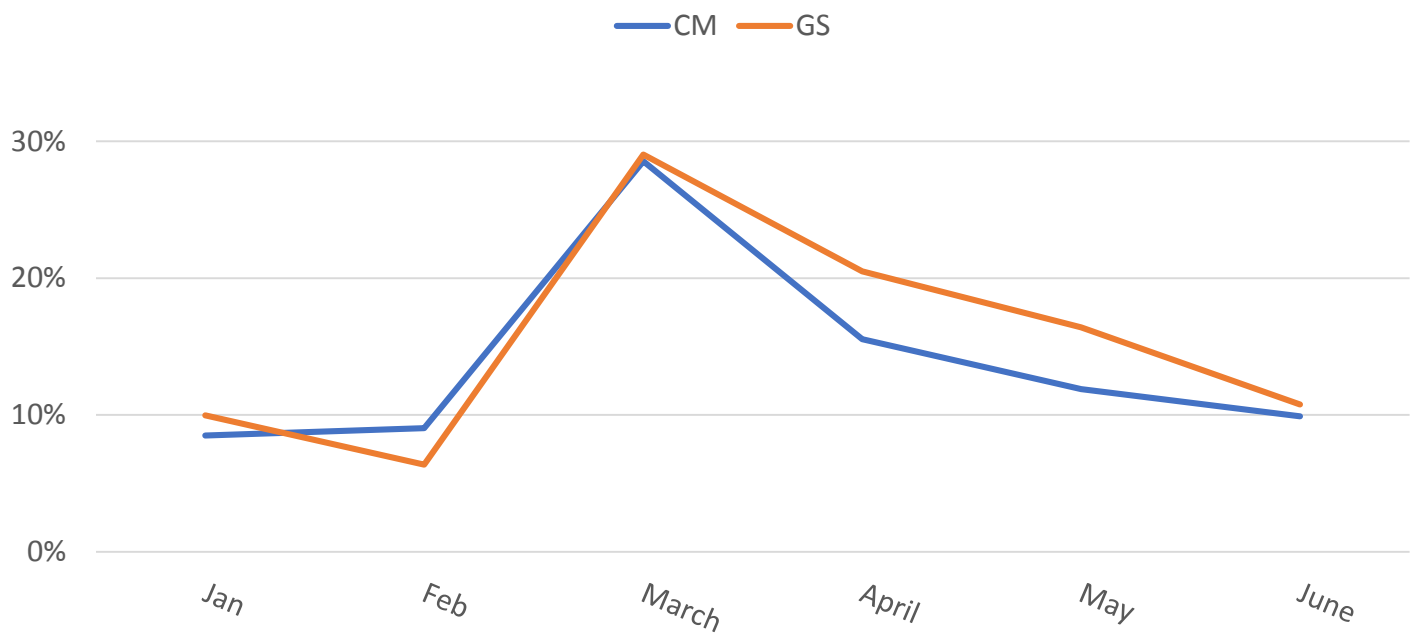
	CM/GS
Jan	2%
Feb	0%
March	-2%
April	36%
May	73%
June	26%
Avg	27%



Grams per fruit



Cull rate (%)



Results Summary

	CM	GS	CM vs GS
Drip-applied water (acre-ft)	2.3	1.7	35% more
Total N fertilizer use (lbs N/acre) (Pre-plant + in-season)	286 (176 + 110)	219 (176 + 43)	30% more
Total marketable yield (fruits/plot)	5,417 (a)	4,334 (b)	25% more
Total marketable yield (grams/plot)	130,308 (a)	102,241 (b)	27% more
Cull rate (%)	15 (a)	18 (b)	3% less

(Different letters indicate statistically significant differences between treatments)

Water Use Efficiency (WUE)

	CM	GS
lbs/plot	287	226
acre-in	27.0	20.1
WUE (lbs/acre-in)	10.6	11.2

Results Summary

	CM vs GS	
	2017	2016
Water	35% more	14% more
N fertilizer	30% more	34% more
Yield	27% more	22% more
Cull rate	3% less	1% less

2017 Field Day

2016 Field Day

Final Thoughts

- CropManage showed to be efficient in guiding irrigation and N fertilization
- Algorithms for water and N need improvement/fine-tuning + more research
- Although not perfect, it's a comprehensive approach

Final Thoughts

Answers to other pertinent issues:

- High N rates = low fruit quality? No.
- High N rates in the soil = low fruit quality? Most likely, but data doesn't answer that
- Bigger plants (due to higher N rates) = lower yield? No.
- Bigger plants + higher yields = slow down harvesting crew?
  Yes. 27% more yield = 25-30% more time to harvest

Acknowledgements

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Questions/comments?

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