Celery Water Demand and Crop Coefficient Update

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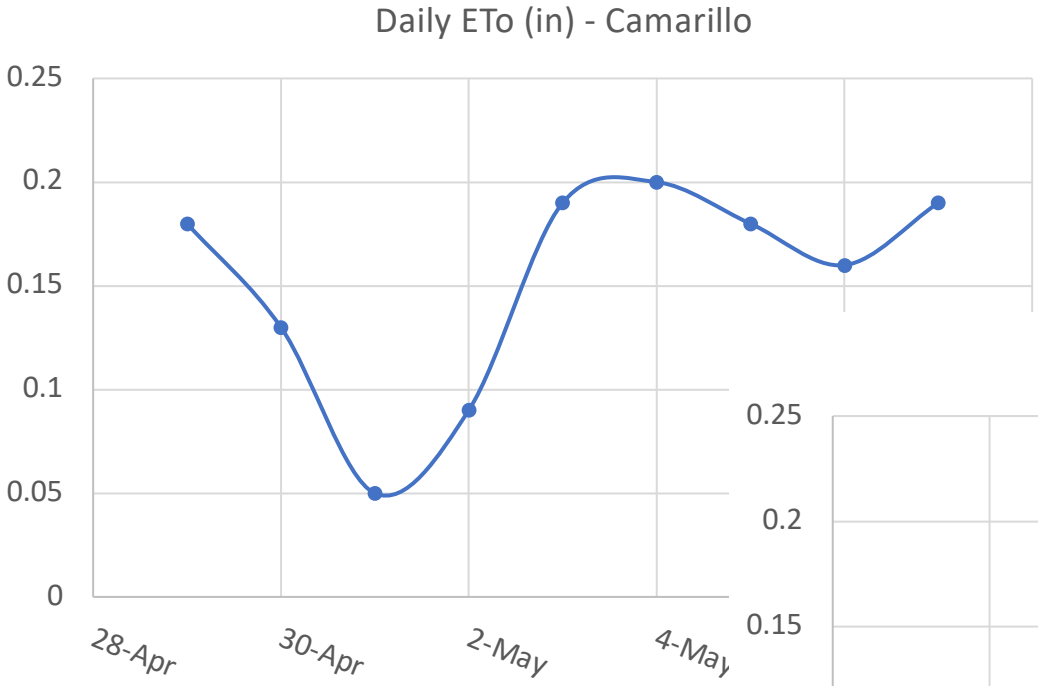
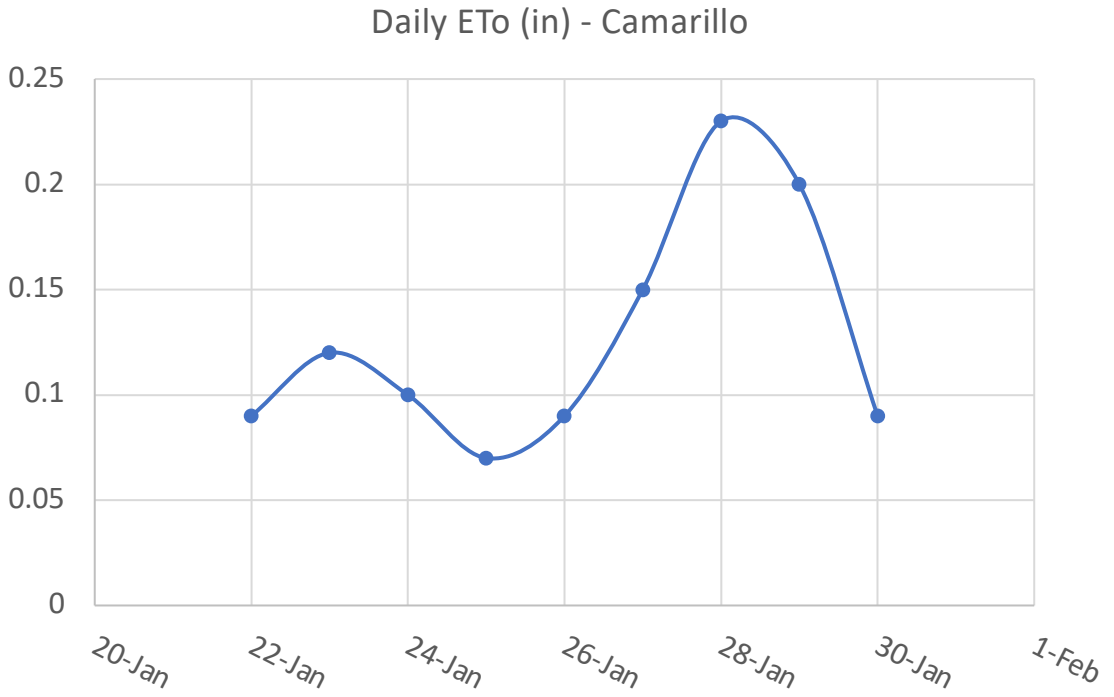
Outline

- Challenges with irrigation management
- Soil moisture threshold project
- Soil moisture data
- Crop coefficient (Kc) project
- Data discrepancy
- Summary

Why is irrigation scheduling challenging?





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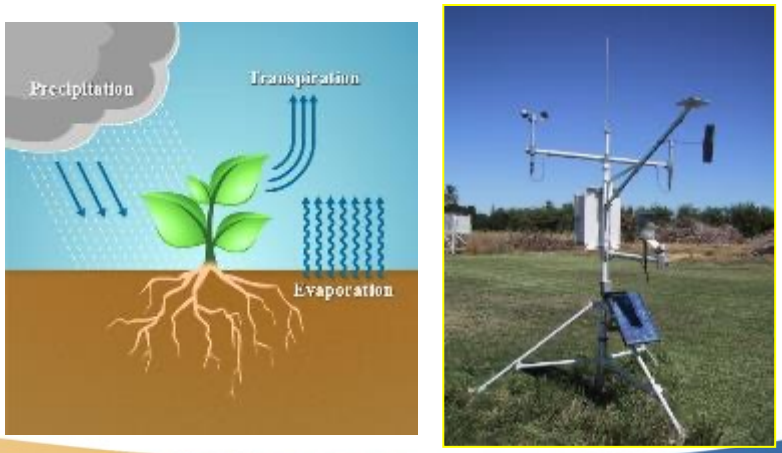
Irrigation Scheduling

1. Deciding when to irrigate

2. Deciding how much to irrigate



BMP Project

- Irrigation based on soil moisture sensors (Hortau)
- Amounts of irrigation based on crop ET calculations (ETc = ETo*Kc)

Results:

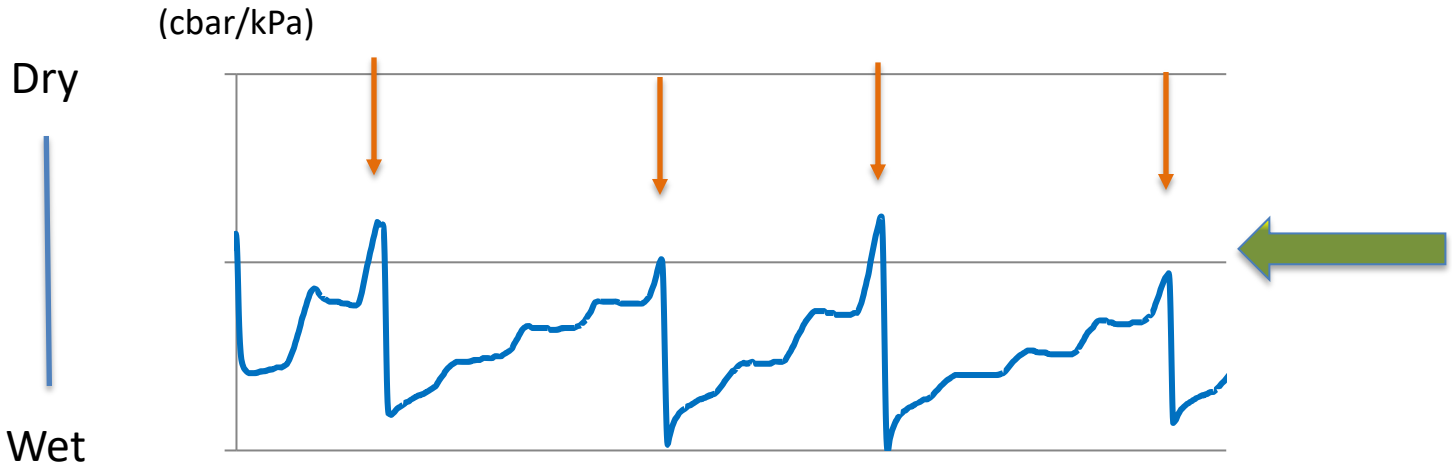
- ✓ Soil moisture was quickly depleted after irrigations
- ✓ If soil moisture sensors data were ignored, the crop would wilt quickly

Soil Moisture Threshold Study

Treatments:

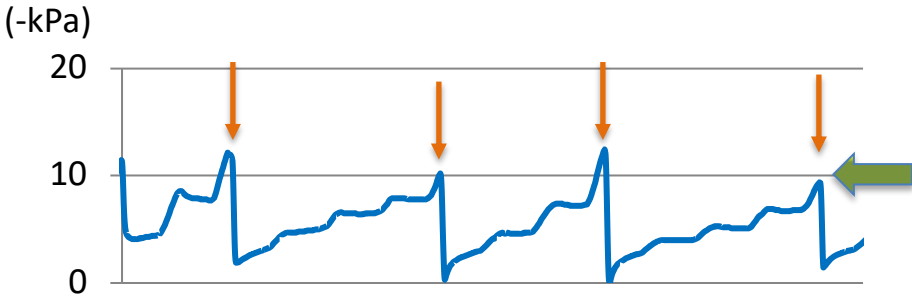
T-20 = 20 cbar
T-30 = 30 cbar
T-40 = 40 cbar
T-50 = 50 cbar

at 8in depth



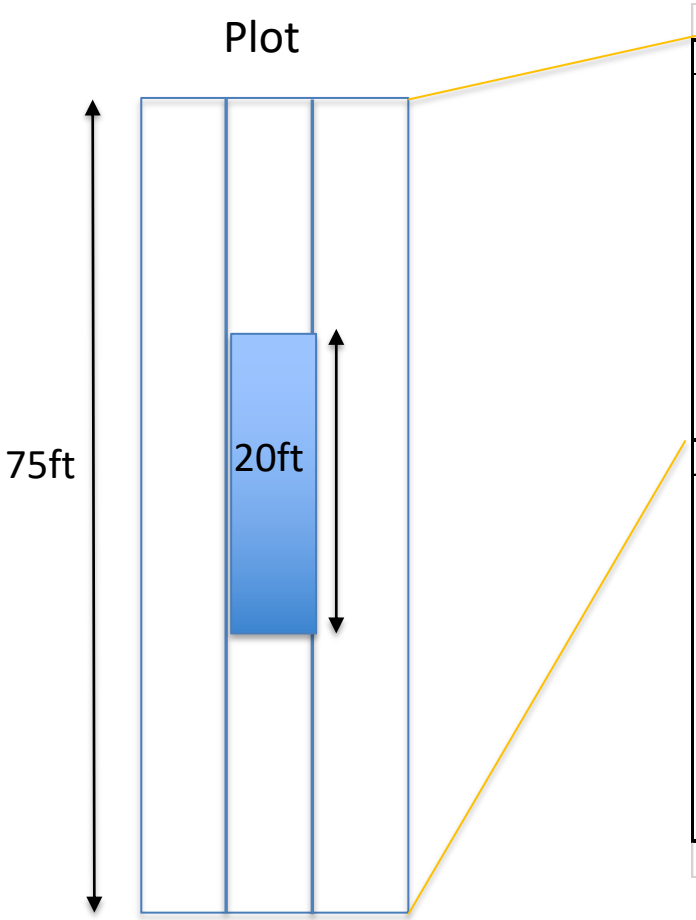
Irrigation amounts: ETc (ETo x Kc) + 30% LR

Soil Water Potential Thresholds

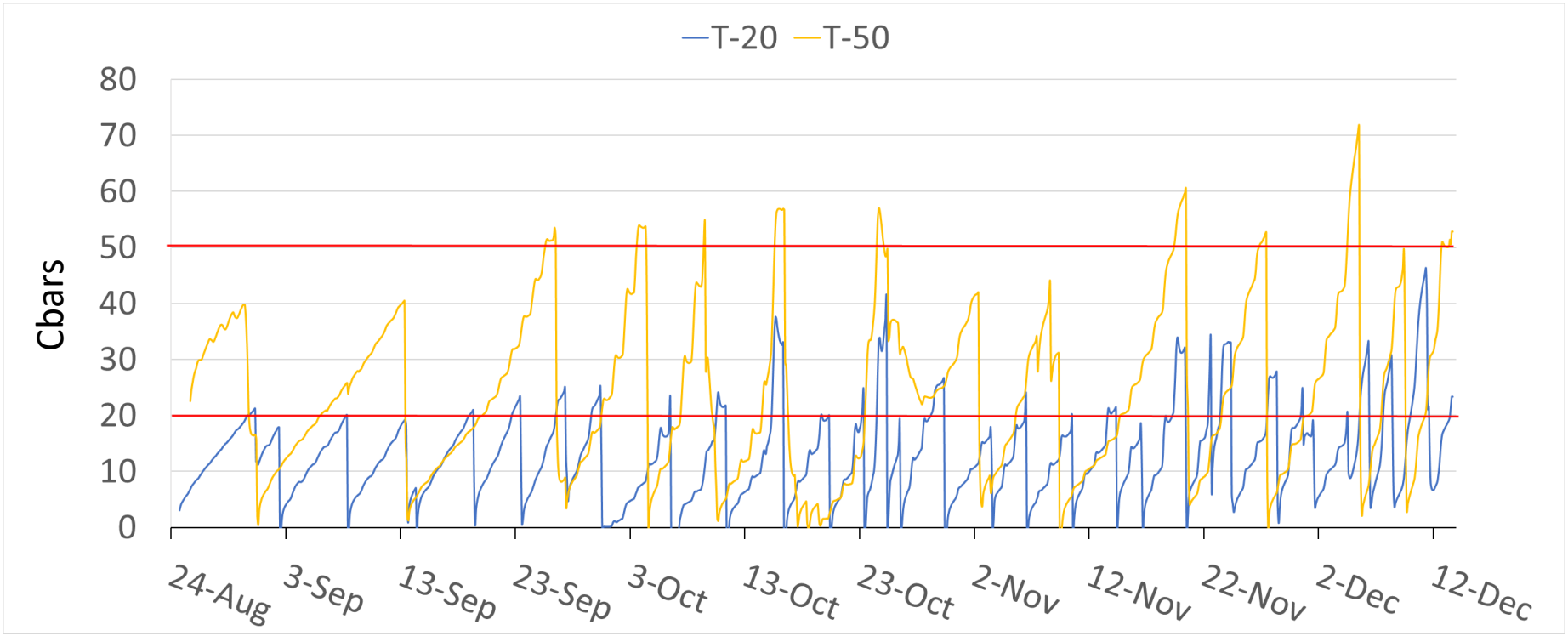


Study Design

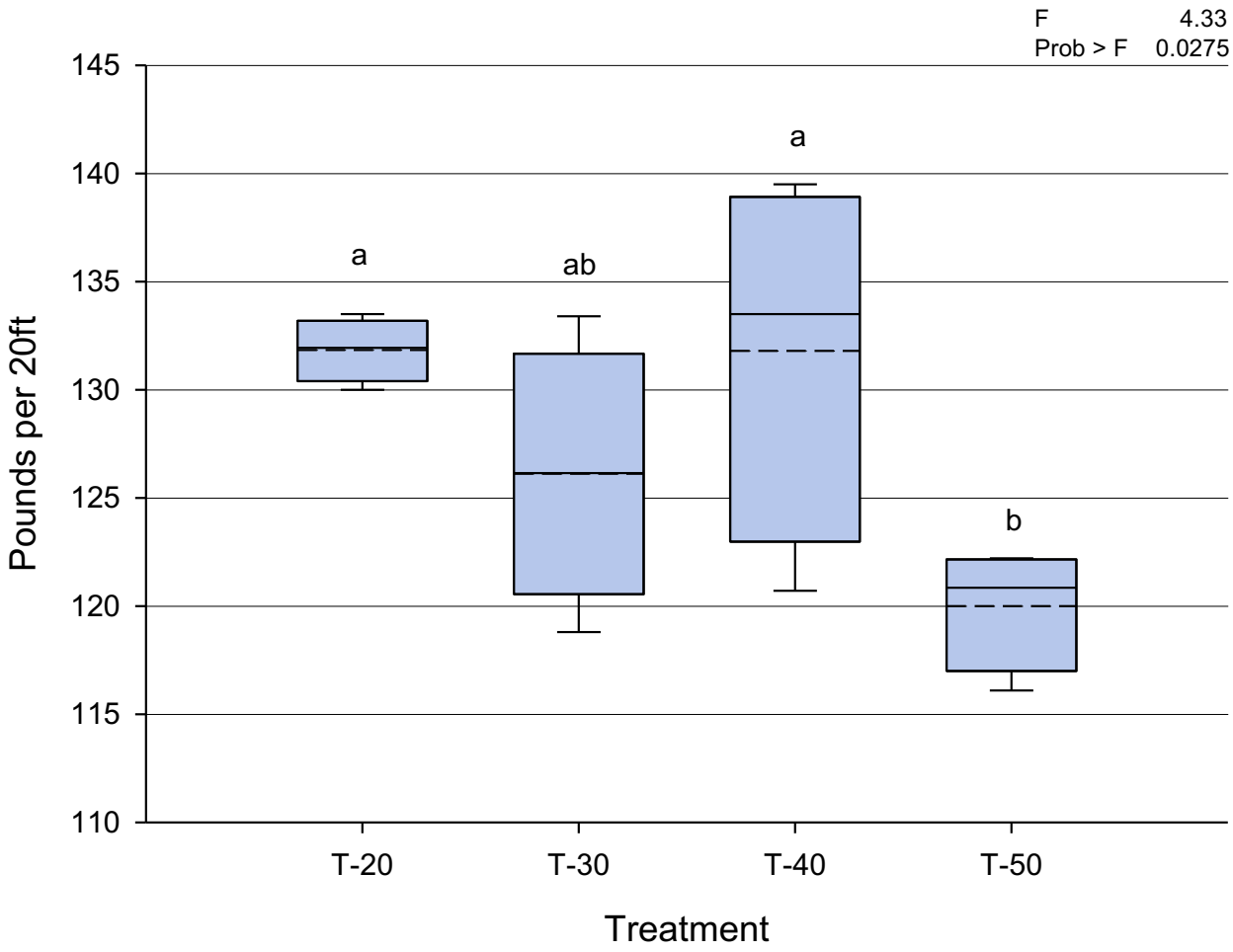
- Treatments were replicated four times within a randomized complete block design



B1				B2			
1	2	3	4	5	6	7	8
T30	T40	T20	T50	T20	T30	T40	T50
9	10	11	12	13	14	15	16
T40	T30	T20	T50	T30	T50	T20	T40
B3				B4			

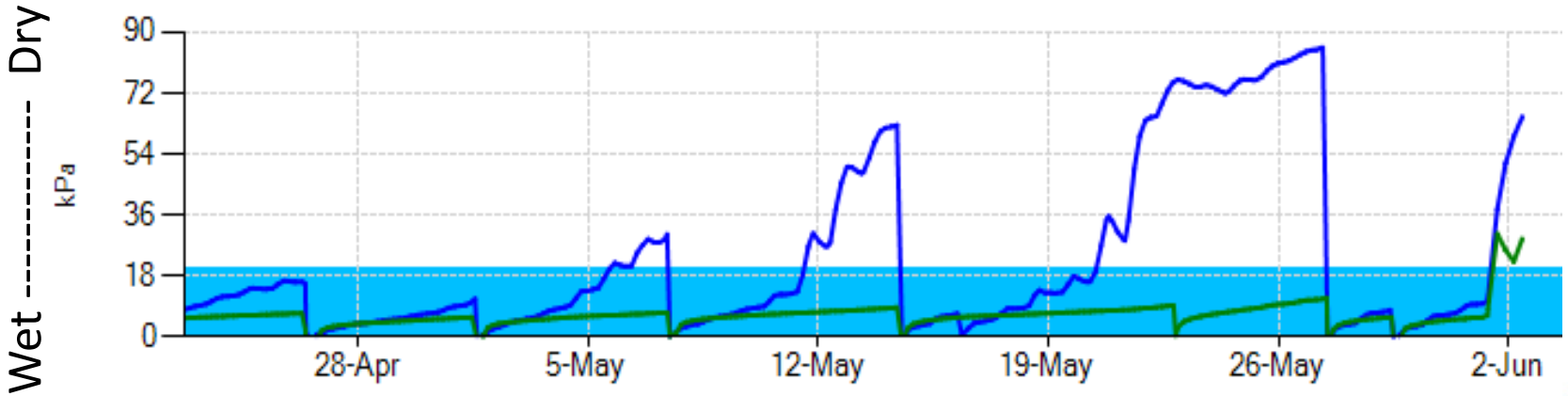

T-20
T-50
Cbars
80
70
60
50
40
30
20
10
0
24-Aug
3-Sep
13-Sep
23-Sep
3-Oct
13-Oct
23-Oct
2-Nov
12-Nov
22-Nov
2-Dec
12-Dec

Marketable Yield

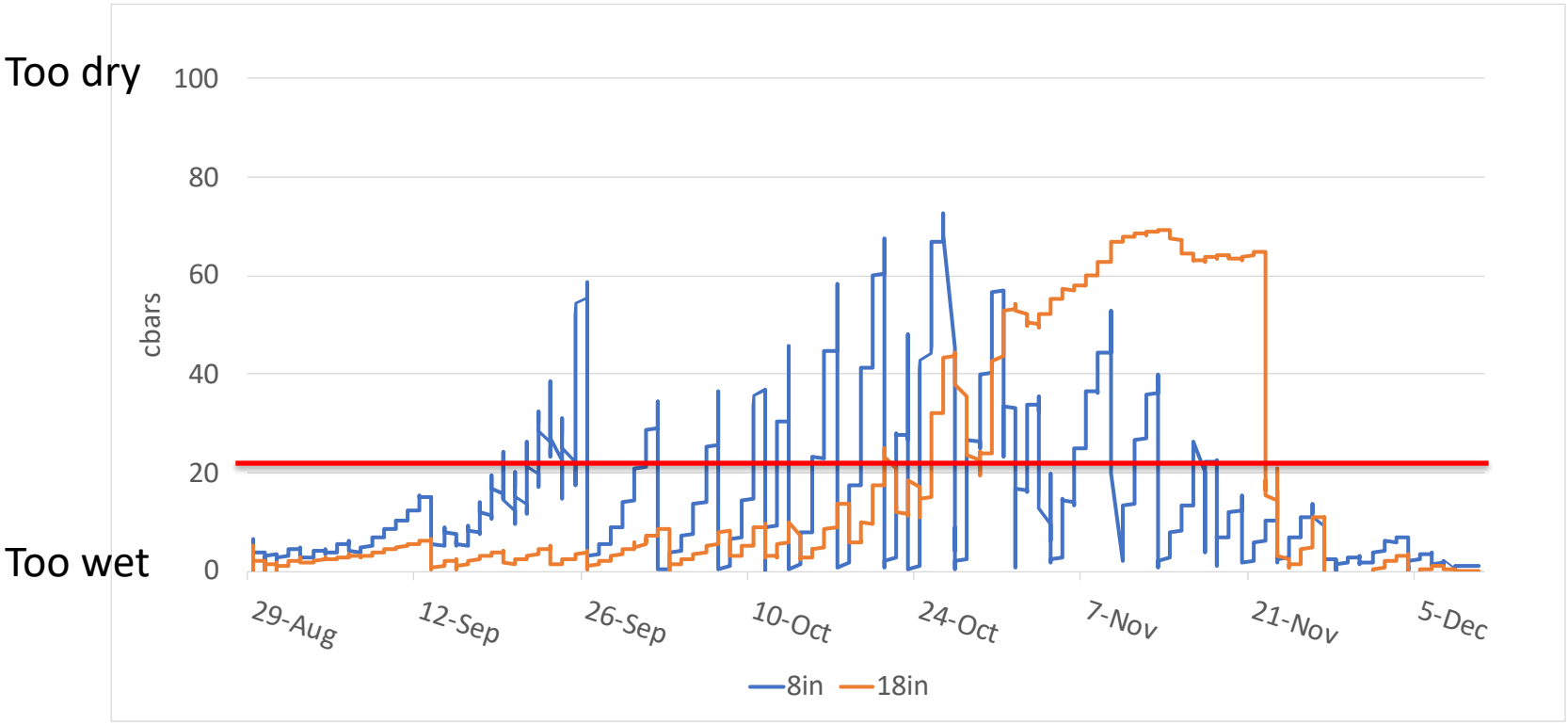


Irrigation Management Context

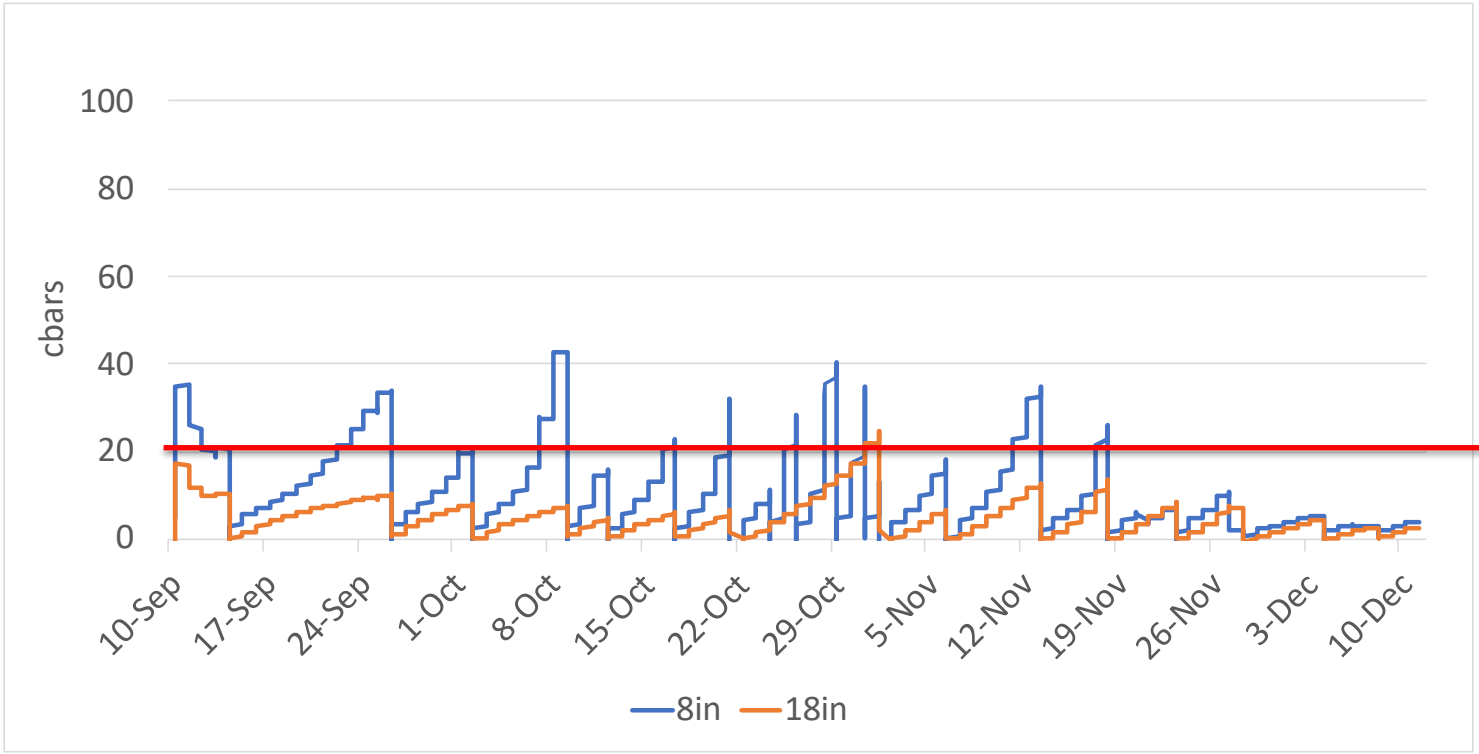
- Overall, most irrigators over-irrigate early in the season and under-irrigate later
- Why? Mostly lack of information



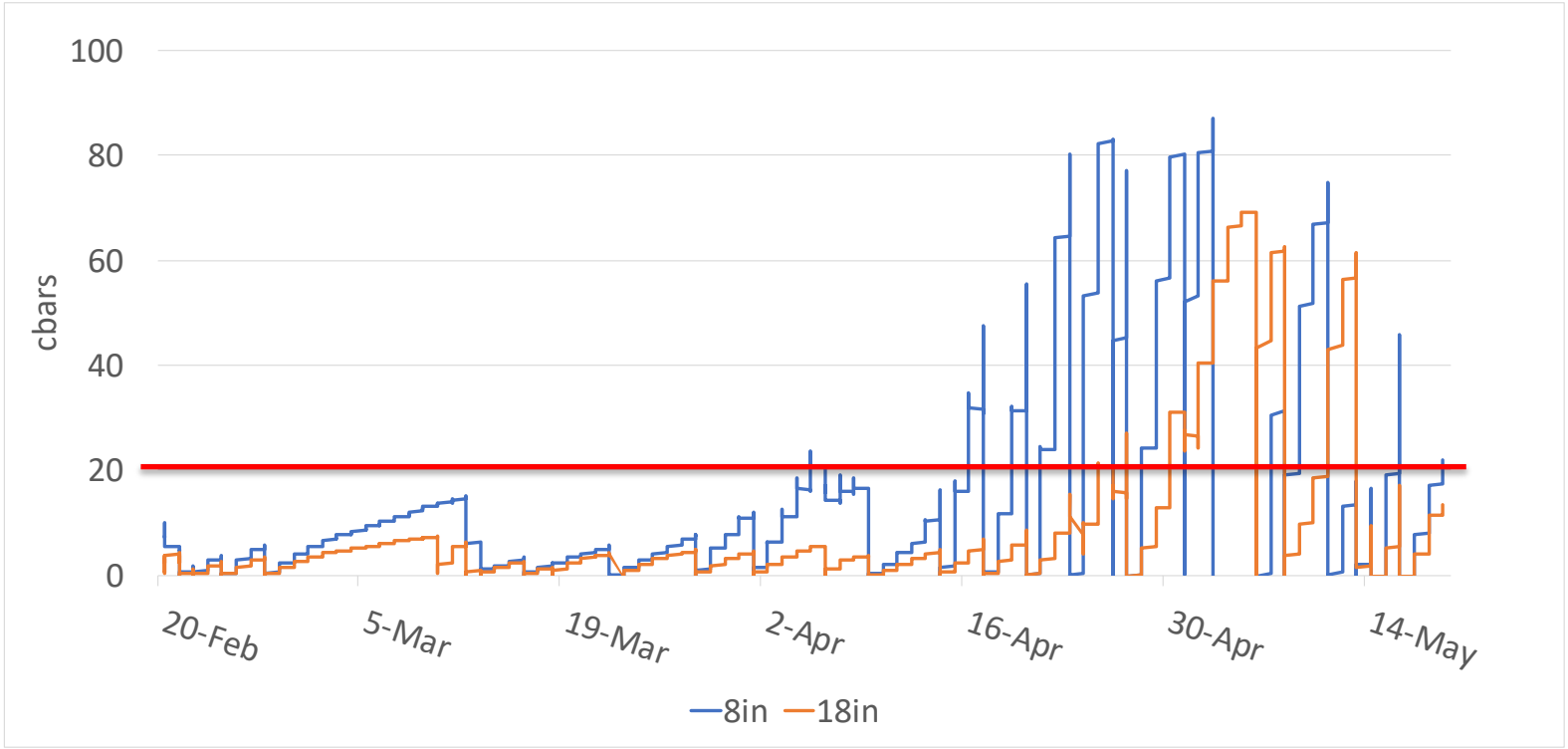
Summer-Planted



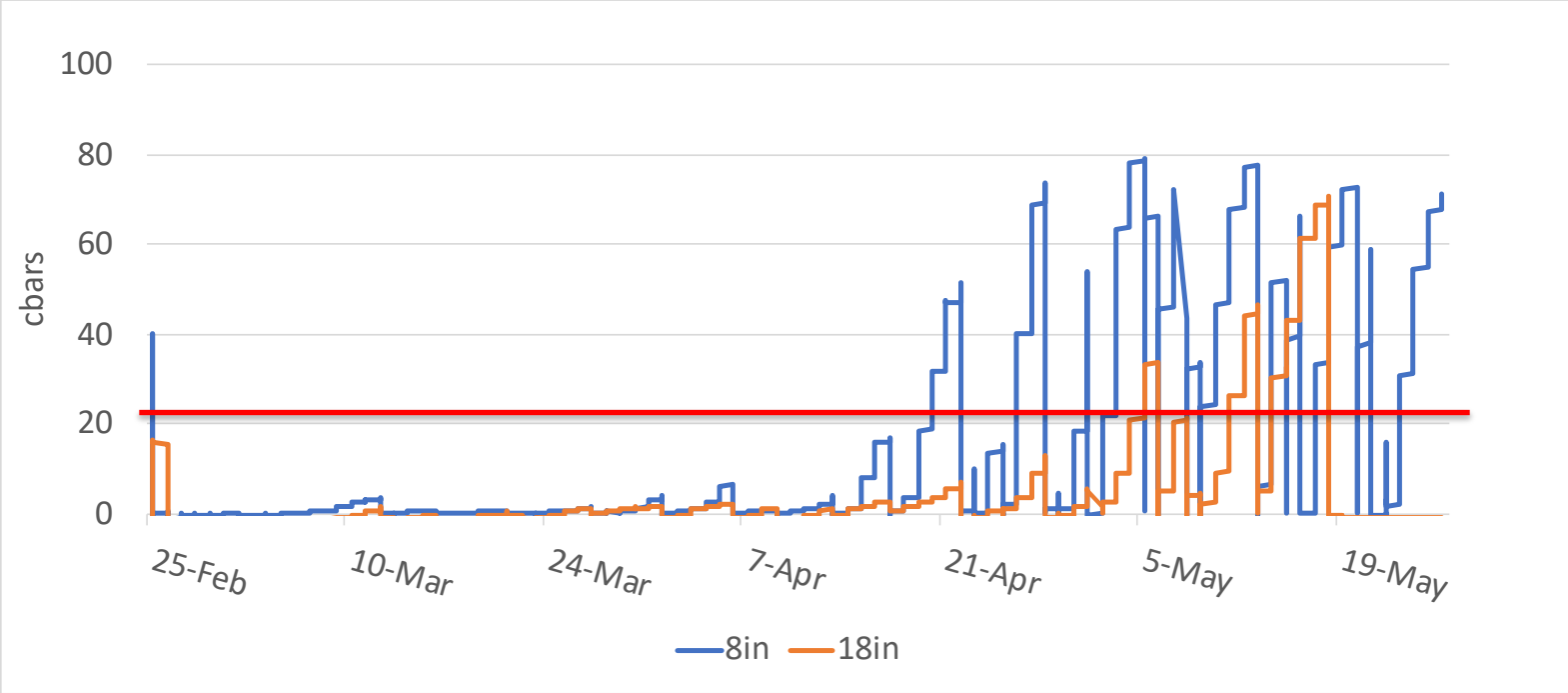
Summer-Planted



Spring-Planted



Spring-Planted



Crop Evapotranspiration (ETc)
ETc = ETo x Kc

Kc modified based on canopy growth

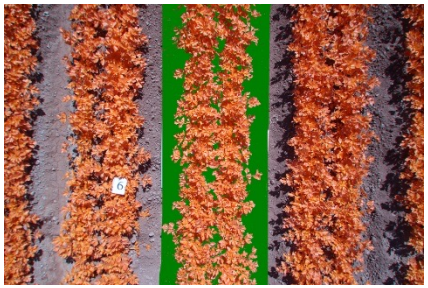
ETo

https://cimis.water.ca.gov

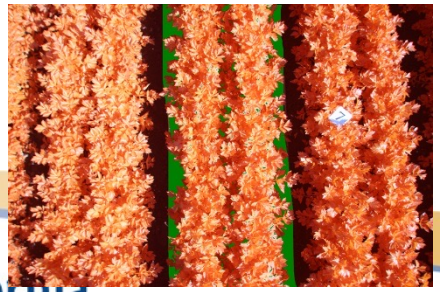
x

20%

60%

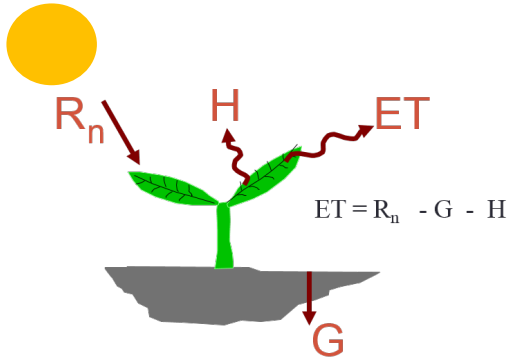


90%

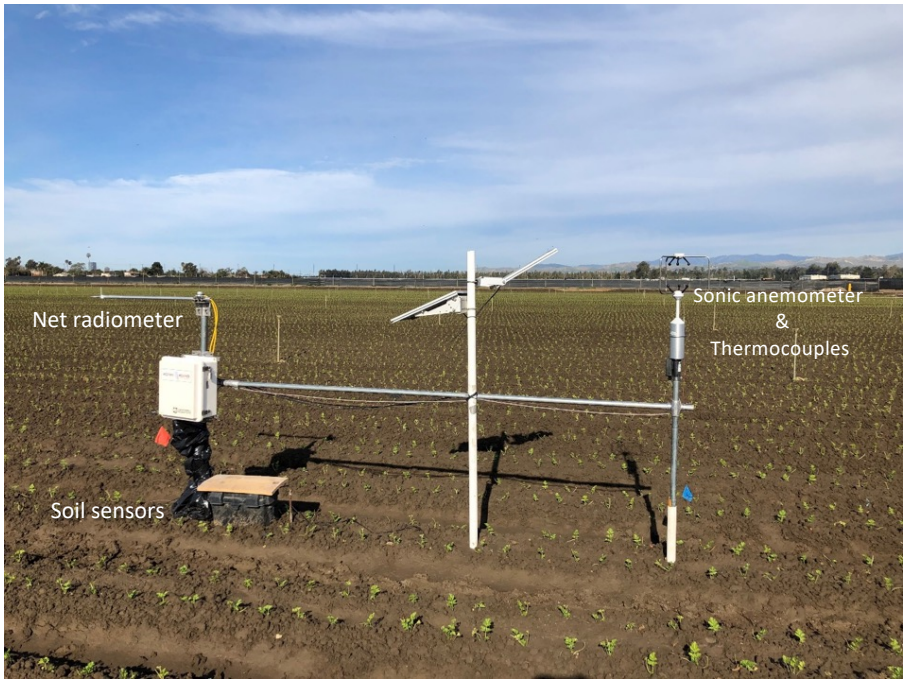


Water recommendation

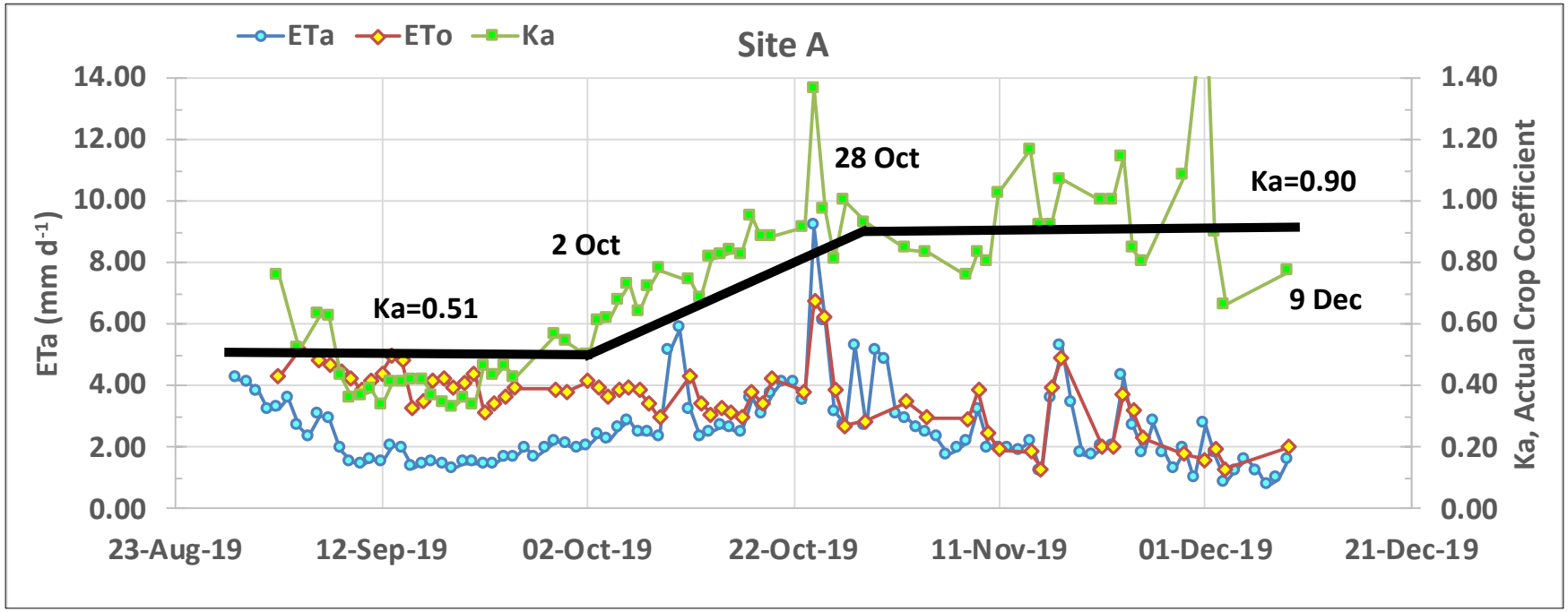
ET Stations

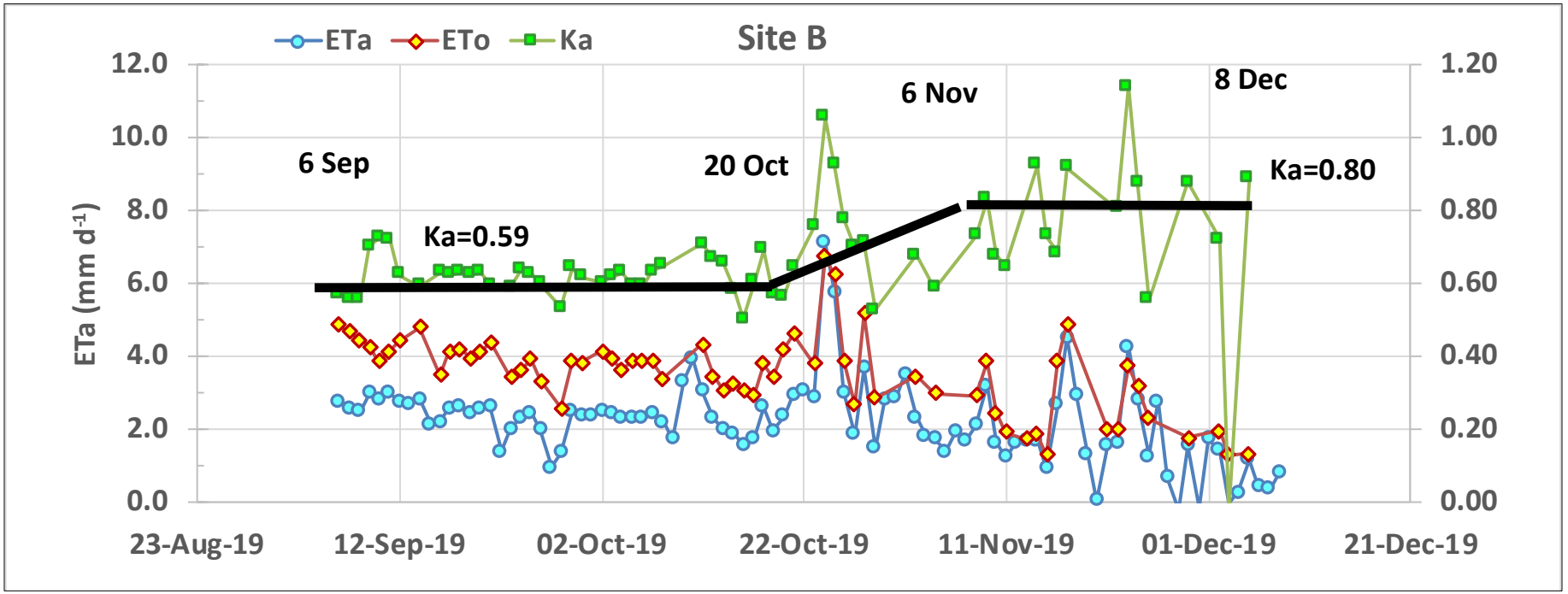


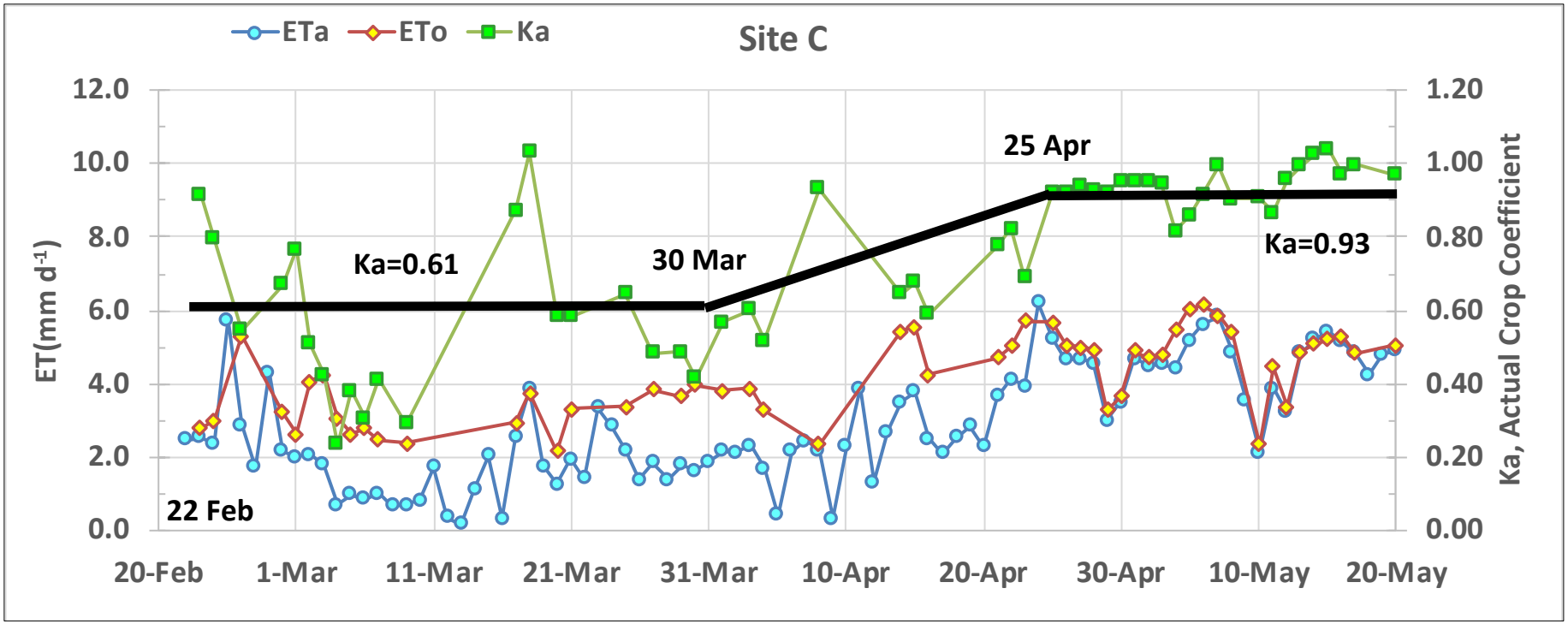
Station 1 – Full (Sonic anemometer with TC)

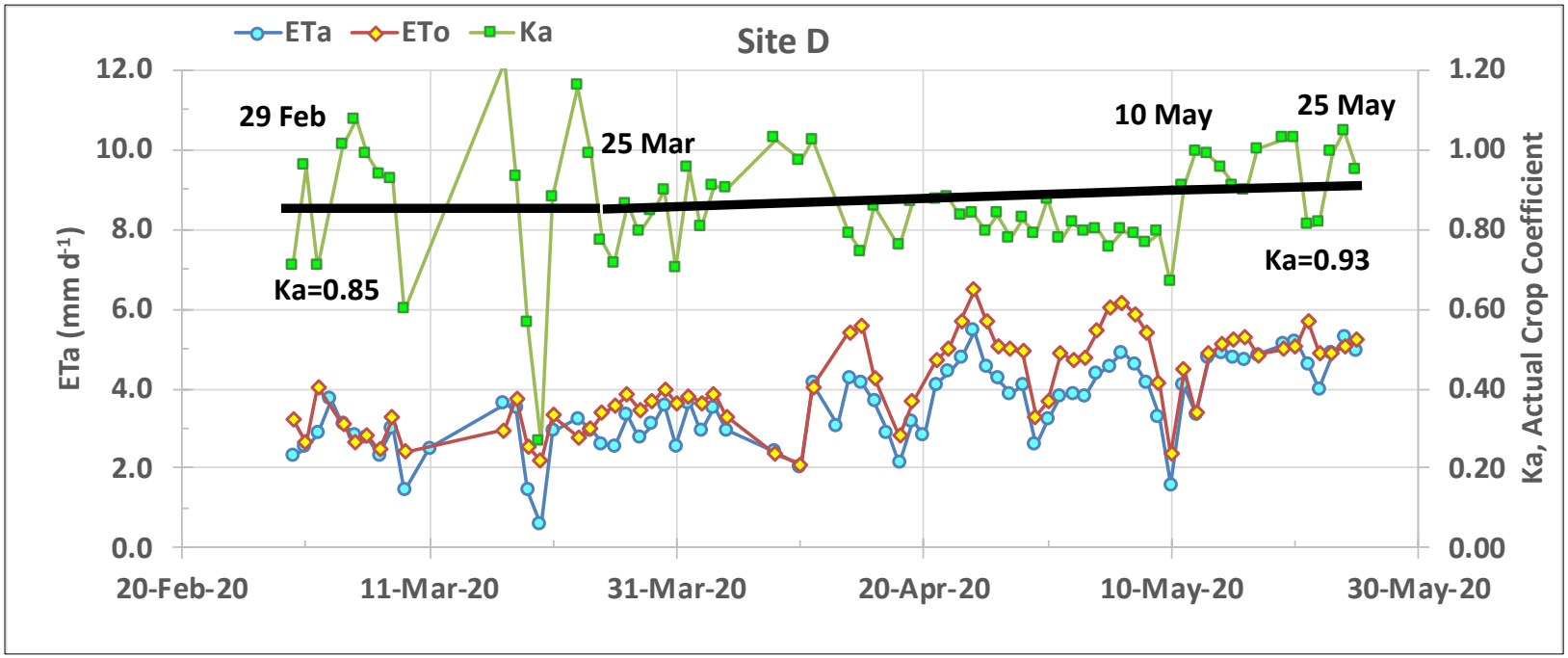


Station 2 – Lite (2 TCs)


ETa
ETo
Ka
Site A
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
ETa (mm d-1)
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Ka, Actual Crop Coefficient
28 Oct
Ka=0.90
2 Oct
Ka=0.51
9 Dec
23-Aug-19
12-Sep-19
02-Oct-19
22-Oct-19
11-Nov-19
01-Dec-19
21-Dec-19


ETa
ETo
Ka
Site B
12.0
10.0
8.0
6.0
4.0
2.0
0.0
ETa (mm d-1)
1.20
1.00
0.80
0.60
0.40
0.20
0.00
6 Sep
20 Oct
6 Nov
8 Dec
Ka=0.59
Ka=0.80
23-Aug-19
12-Sep-19
02-Oct-19
22-Oct-19
11-Nov-19
01-Dec-19
21-Dec-19


ETa
ETo
Ka
Site C
12.0
10.0
8.0
6.0
4.0
2.0
0.0
ET(mm d-1)
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Ka, Actual Crop Coefficient
Ka=0.61
30 Mar
25 Apr
Ka=0.93
22 Feb
20-Feb
1-Mar
11-Mar
21-Mar
31-Mar
10-Apr
20-Apr
30-Apr
10-May
20-May

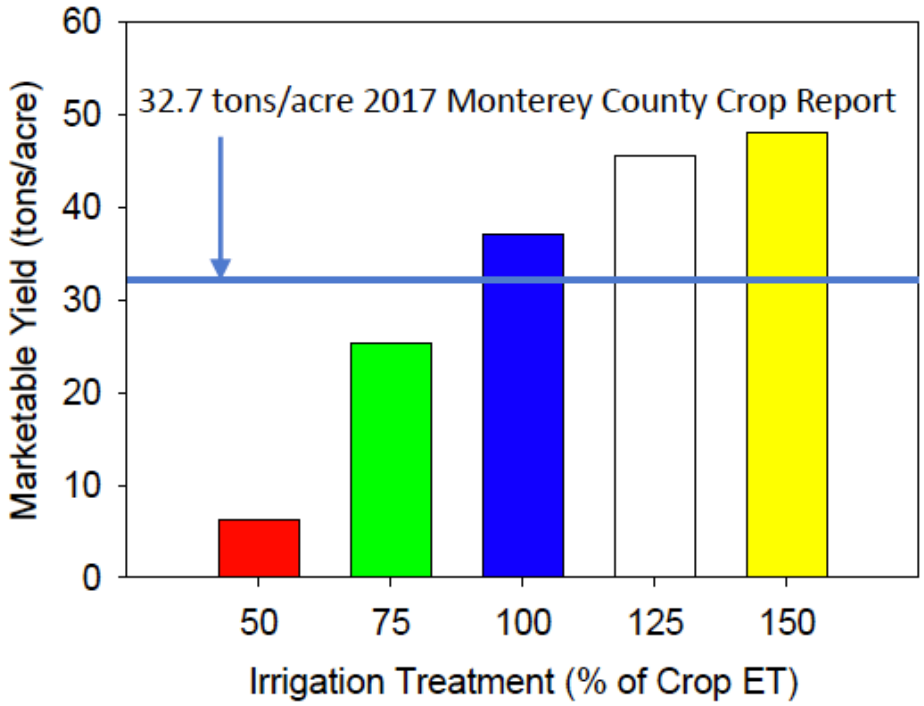

ETa
ETo
Ka
Site D
29 Feb
25 Mar
10 May
25 May
Ka=0.85
Ka=0.93
ETa (mm d-1)
Ka, Actual Crop Coefficient
12.0
10.0
8.0
6.0
4.0
2.0
0.0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
20-Feb-20
11-Mar-20
31-Mar-20
20-Apr-20
10-May-20
30-May-20

Reflections

- We found a big discrepancy between our results and the what we expected (results: Kc = 0.80-0.93, expected: Kc = 1.35)
- There are several ways to look at this, but the bottom line is that you will lose yield and quality if you irrigate with a Kc of 1.05* and lower
- I suggest using a Kc of 1.05 with 30% more:
  ETc = ETo*Kc*1.30

*FAO 56 (https://www.fao.org/3/x0490e/x0490e0b.htm)

Marketable Yield for 2nd Harvest Evaluation (October 25)



Courtesy of Michael Cahn, 2021.

https://cropmanage.ucanr.edu/

Benefits to Growers

Based on a few simple inputs, CropManage can provide any level of irrigation and fertilization decision support in order to validate or improve your existing operation' production—and increase your overall confidence.

20% to 40% Reduction in Water and Fertilizer With Same Yields

CropManage is ground-truthed in more than 30 field trials and has produced consistent, or in many cases, improved crop yields.

Supports Irrigation AND Fertilization Recommendations

CropManage combines irrigation and fertilization recommendations that, when used together, significantly improve yields while reducing costs.

Steeped in Deep Research

CropManage is the result of years of ongoing, in-depth University of California agricultural research and crop modeling algorithms.

No Extra Equipment Required

CropManage allows growers to leverage their existing infrastructure and does not require operational changes or purchase/implementation of new equipment.

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CropManage

Database driven web application

Crop ET model

CropManage accounts for that by adding a factor to increase irrigation amounts by 25%

Summary

- ✓ Kc found (0.8 to 0.93) are significantly lower than expected, and could lead to major yield reduction
- ✓ We don't really know how to solve that discrepancy at this time, but we know how to get optimal yield while optimizing water
- ✓ Increasing the Kc by 30% has shown to provide the right amount of water for optimal yield

Summary

- ✓ We've come a long way from 2014: defined soil moisture threshold, have a better understanding of how the Kc works, have CropManage and an irrigation calculator
- ✓ Some of these projects have been challenging; e.g. Kc project.

Acknowledgements

- Rick Snyder and Kosana Suvocarev, UC Davis
- Cooperating growers
- Celery Board
- Hortau®

Thank you!

Questions/comments?

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