Water use efficiency for fruit quality, ecosystem benefits and resilience in fresh market tomato production

Deficit Irrigation in Fresh Market Tomatoes

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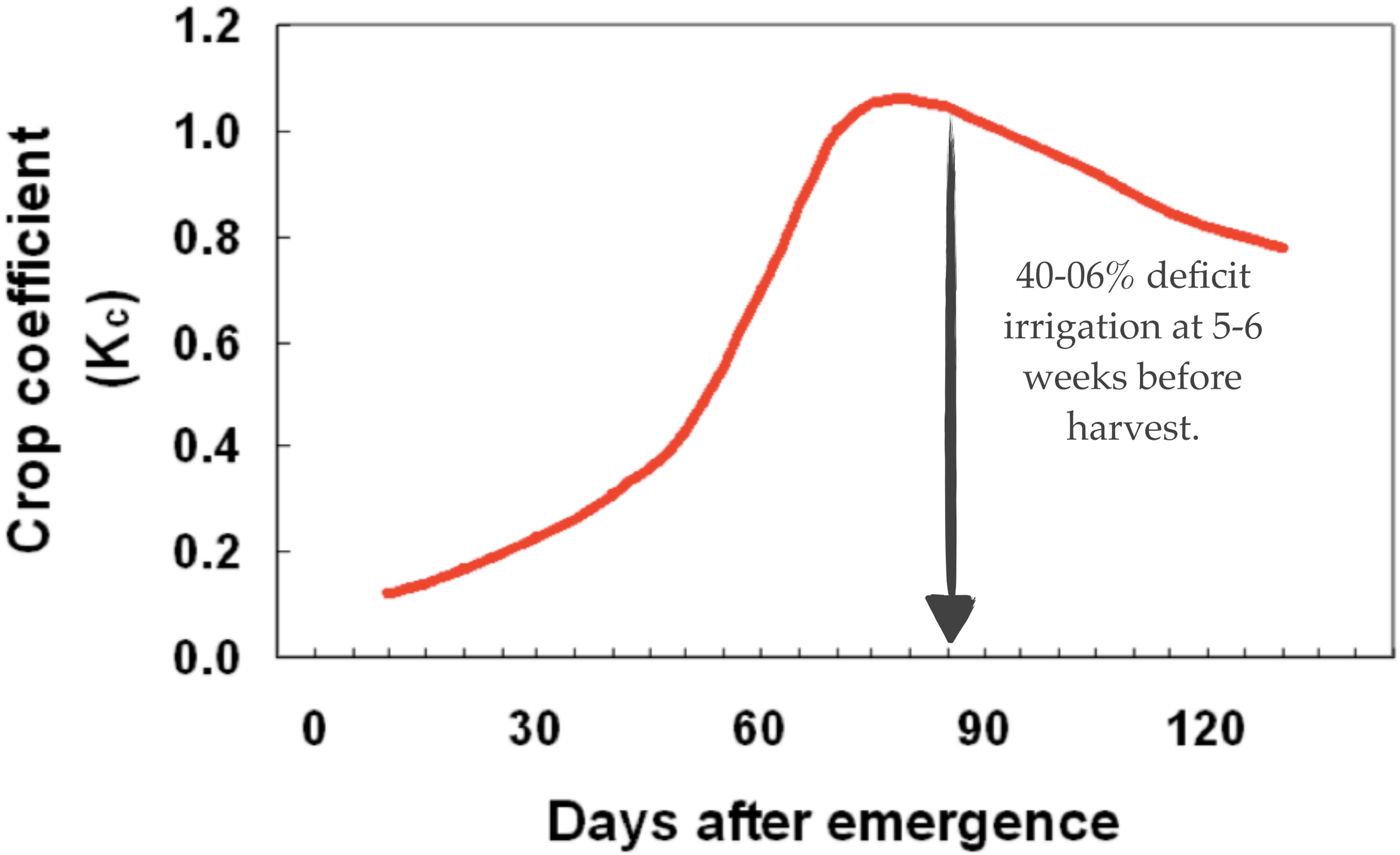
Introduction

- Deficit irrigation guidelines have been developed for processing tomatoes (Hartz and Hanson, 2009).
- No information for impacts on fresh market tomato production.
- 2013 - 15 serious drought.

Processing Tomatoes



The focus of these experiments will be to 1) examine effects of plant density and deficit irrigation management on the yield and fruit quality of mature green tomatoes; 2) monitor how the treatments affect insect, weed, and pathogen pressure in each system

Scoto Bros.
Merced area
Early furrow irrigation

Treatments:

1. skip-row
2. skip-row 80
3. full irrigation

Transplant March 3, 2015
Treatments start April 25
Harvest June 12

Live Oak Farms
Le Grand area
mid-season drip irrigation

Treatments:

1. irrigate 7 days
2. irrigate 6-5 days/week
3. irrigate 5-4 days/week

Transplant May 20, 2015
Treatments start July 7
Harvest August 10

Merced College Farm
north Merced area
late drip irrigation

Treatments:

1. 100% of ETc
2. 80% of ETc
3. 60% of ETc
4. 40% of ETc

Transplant June 4, 2015
Treatments start July 20
Harvest Sept 10

2016 Trials:

Scoto Bros (furrow)

1. full irrigation
2. 3 rows on, 1 off (25% reduction)
3. 2 rows on, 1 off (33% reduction)

Live Oak Farms (drip)

1. full irrigation
2. 15% reduction (6 days/week)
3. 30% reduction (5 days/week)

Merced College (drip)

1. 100% ETc
2. 90% ETc
3. 80% ETc
4. 70% ETc

all locations begin ~ 42 DAT

2017 Trials:

Scoto Bros (furrow)

1. ———
2. ———-
3. ————

Live Oak Farms (drip)

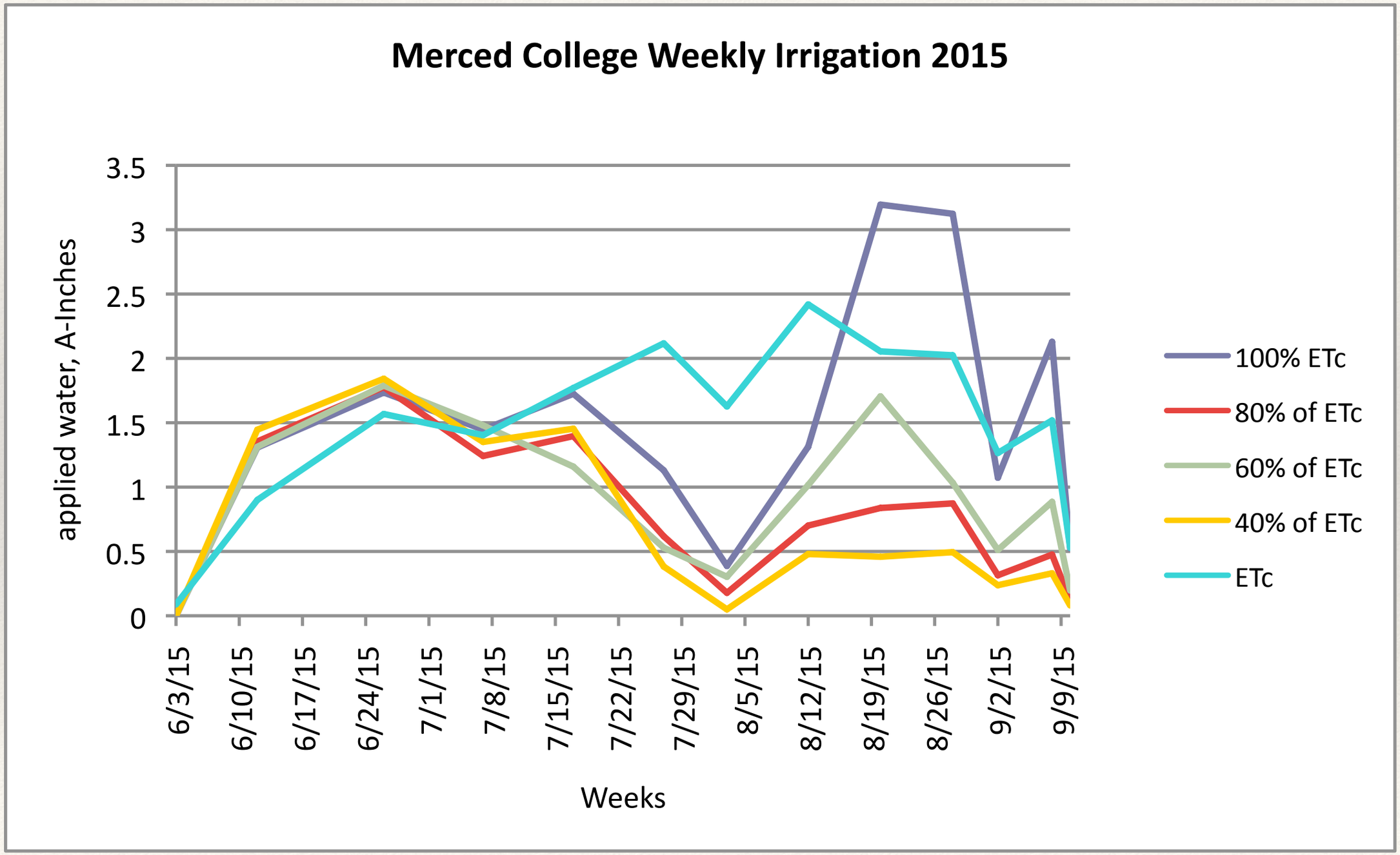
1. full irrigation
2. 15% reduction (6 days/week)
3. 30% reduction (5 days/week)

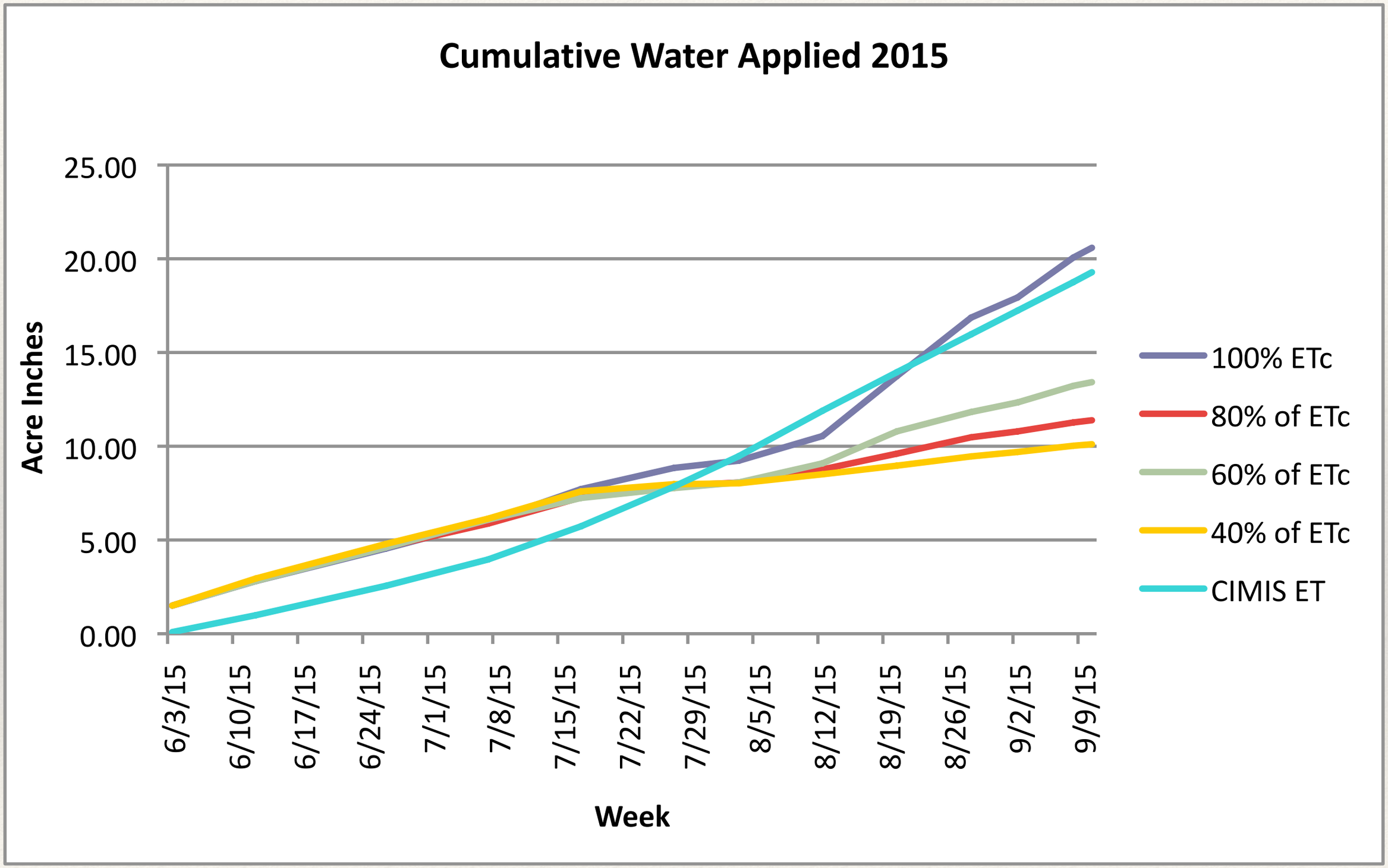
Merced College (drip)

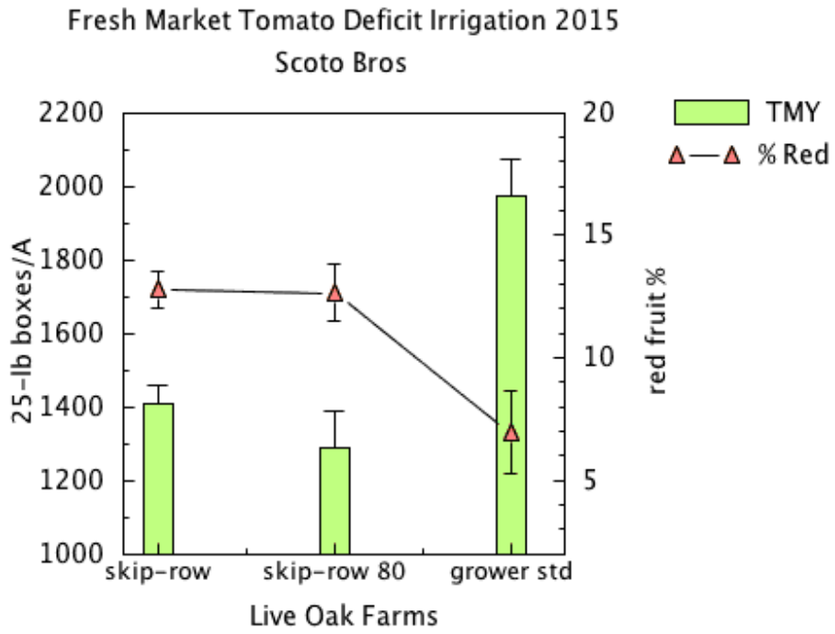
1. 100% ETc
2. 90% ETc
3. 80% ETc
4. 70% ETc

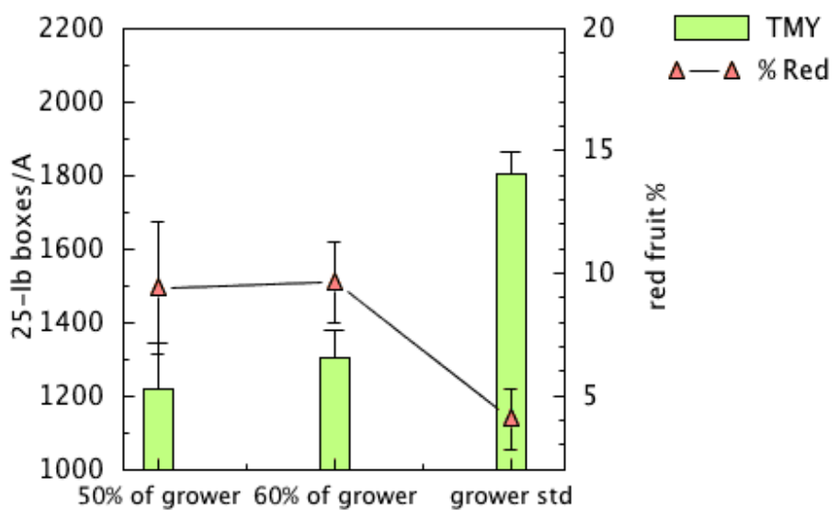
all locations begin ~ 42 DAT

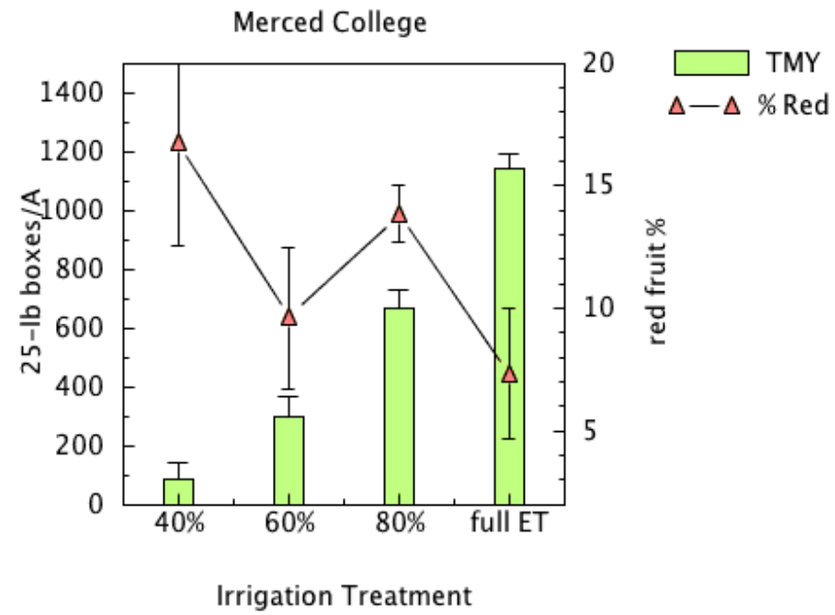
Results


Merced College Weekly Irrigation 2015
applied water, A-Inches
3.5
3
2.5
2
1.5
1
0.5
0
6/3/15
6/10/15
6/17/15
6/24/15
7/1/15
7/8/15
7/15/15
7/22/15
7/29/15
8/5/15
8/12/15
8/19/15
8/26/15
9/2/15
9/9/15
Weeks
100% ETc
80% of ETc
60% of ETc
40% of ETc
ETc


Cumulative Water Applied 2015
Acre Inches
25.00
20.00
15.00
10.00
5.00
0.00
6/3/15
6/10/15
6/17/15
6/24/15
7/1/15
7/8/15
7/15/15
7/22/15
7/29/15
8/5/15
8/12/15
8/19/15
8/26/15
9/2/15
9/9/15
Week
100% ETc
80% of ETc
60% of ETc
40% of ETc
CIMIS ET







All deficit irrigation treatments significantly reduced yield

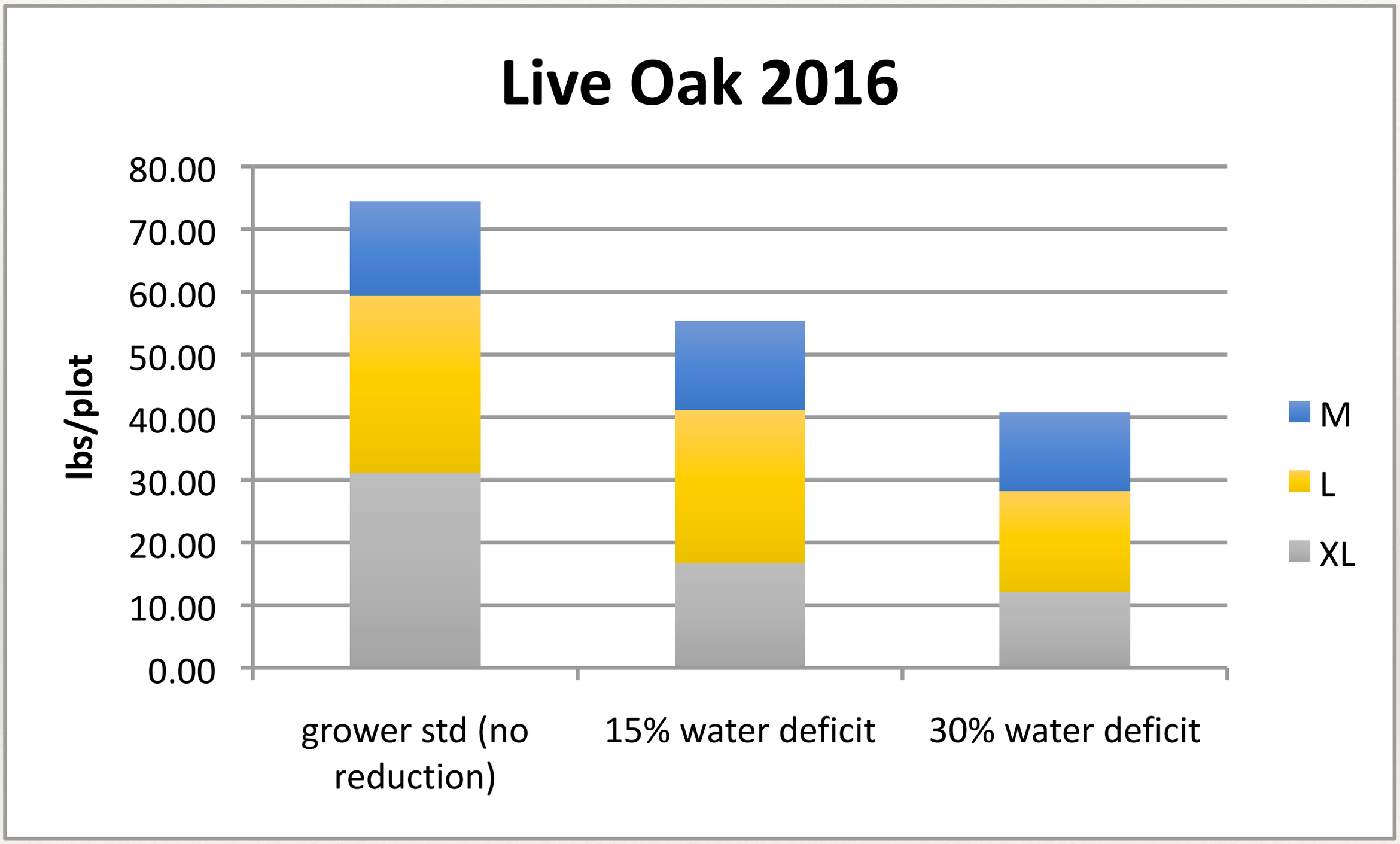
Red% and sunburn fruit increased in all deficit irrigation treatments.

Results 2016

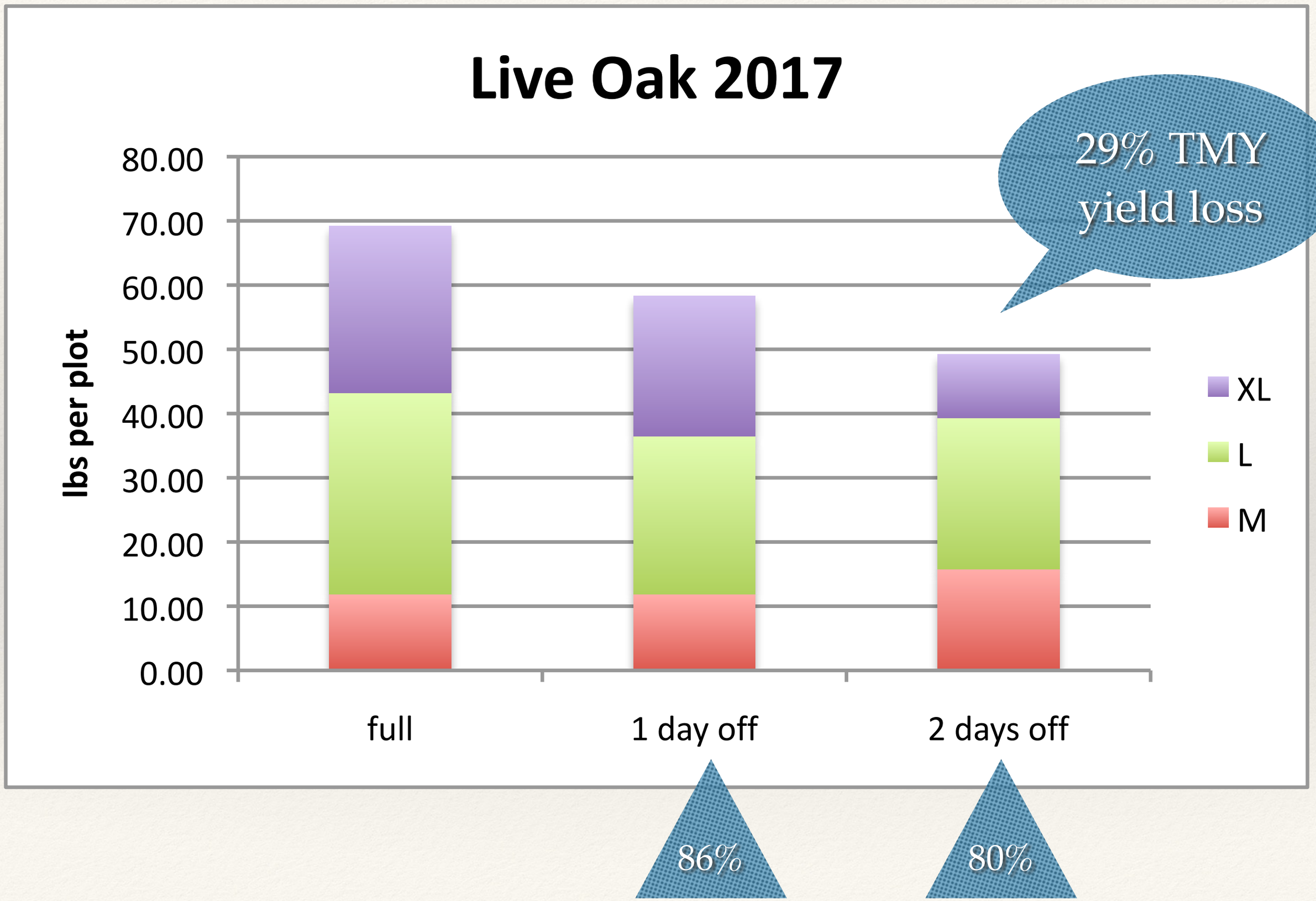
Table 4. Yield and sunburn results at the Scoto Bros location (furrow irrigation) as affected by irrigation treatments, 2016.

	treatment	total yld lbs/plot	TMY lbs/plot	estimated boxes/A	% XL	% red	Culls (%) Sunburn	Worms	other	BER
1	full	67.1	46.7	1626.3	14.5%	6.9%	0.4%	0.5%	30.0%	1.1%
2	25% deficit	62.4	39.3	1370.8	20.3%	10.4%	2.0%	2.1%	26.7%	4.6%
3	33% deficit	56.3	35.6	1239.2	24.0%	9.3%	10.2%	1.3%	28.1%	6.1%

Live Oak 2016

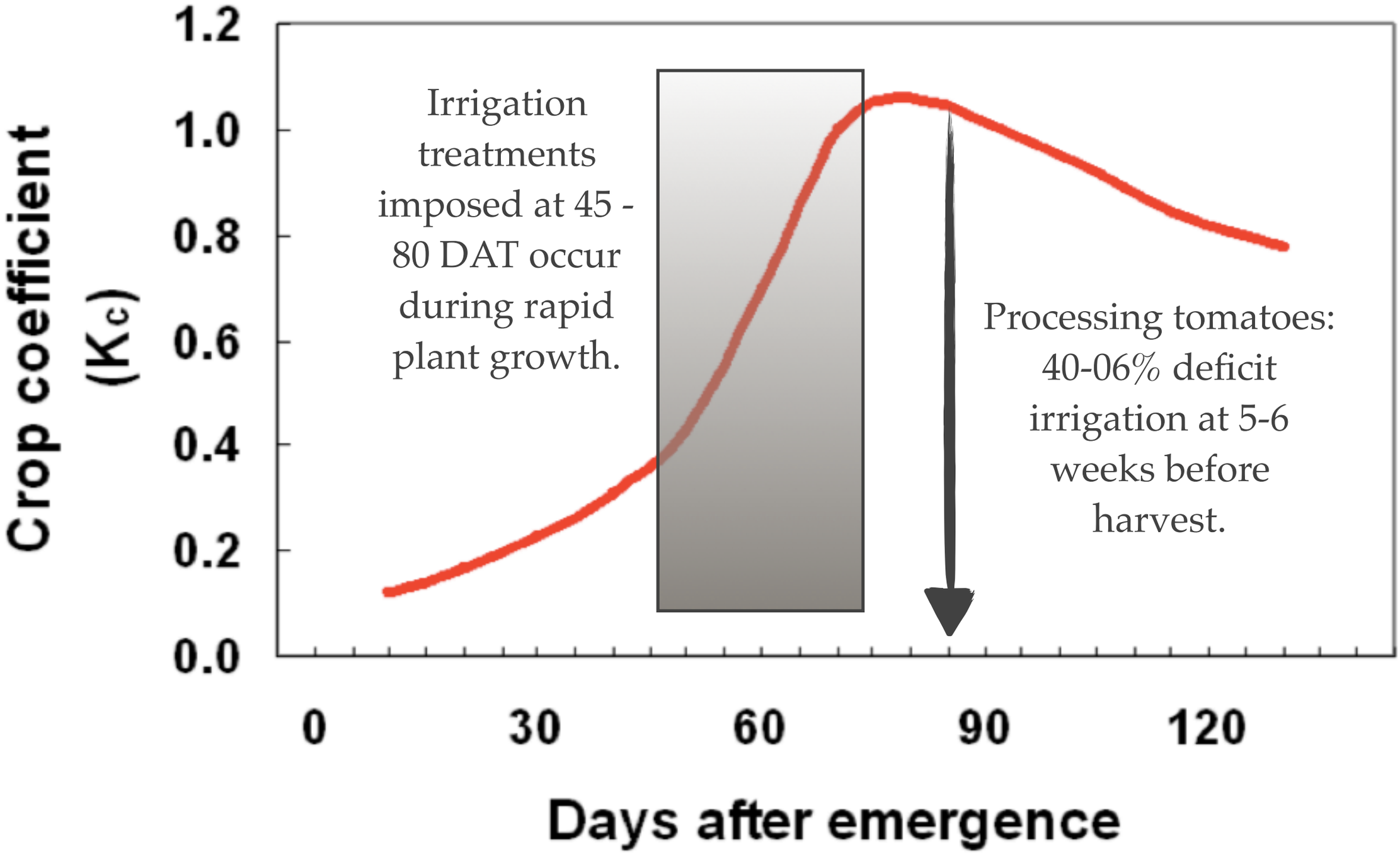


Live Oak 2017



Summary

- Deficit irrigation treatments in last 6 weeks of the season (42-84 DAT) significantly reduced yield in all years and locations.
- S fruit, red%, and cull% all increased with deficit irrigation.


Crop coefficient (Kc)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
30
60
90
120
Days after emergence
Irrigation treatments imposed at 45 - 80 DAT occur during rapid plant growth.
Processing tomatoes: 40-06% deficit irrigation at 5-6 weeks before harvest.

University of California
Agriculture and Natural Resources

Making a Difference for California

Thank you.

Joe Scoto
Bob Giampaoli
Beaver (Merced College)