2011-2012 Strawberry irrigation trials

Evaluation of irrigation regimes in Oxnard and Watsonville strawberry fields

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2011-2012 Strawberry irrigation trials

yields, water use and leaching

Evaluation of irrigation regimes in Oxnard and Watsonville strawberry fields

- Background
- Effect on yields
- Water and energy savings
- Leaching control and reduction
- Next steps

How water moves from the soil to the plant

- Water moves according to laws of physics from low tension (wet spot) to high tension (dry spot)
- Tension measures the amount of energy that a plant has to exert to pull the water from the soil
  - Initiate irrigation based on plant needs
  - Tool to detect leaching (tension reaches 0 at lower depths)

Using tension or suction forces to drive irrigation decisions

Stopping irrigation: tension drops

Initiating irrigation: threshold reached

Background

- Technology has improved (buried type, self adjusting, wireless tensiometers now available, low maintenance, very accurate)
- Good relationships with plant yield for several crops
- Performances and water savings associated with accurate tension management

Background

- Mandate:
  - Research contract to my research group
  - Find critical tension thresholds for different crop, soil type and agricultural environment
  - Help growers equipped with such technology in US and Canada to get the best use of their wireless tension systems to use water more efficiently, increase yields through real time irrigation management

2011-2012 Strawberry irrigation trials

yields, water use and leaching

Conducted by

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Three growers from Watsonville, Salinas and Oxnard

Effects of real time irrigation management on strawberry production:

	Watsonville	Salinas	Oxnard
Soil series	Clear Lake clay	Salinas Clay and Mocho silty loam	Hueneme sandy loam
Tension setpoints (cbars) Based on texture	20, 10, irrigator	18, 13, 8	15, 11, 8
Harvest period	April-October 2011	April-July 2012	February 6-June 13 2012

Effects of real time irrigation management on strawberry production:

Parameters Measured

Soil sampling and soil analysis (3 soil samples/plot)

Initial properties

- Texture
- Saturated Hydraulic Conductivity (Ksat)
- Soil Water Retention Curves
- Salinity (Electrical Conductivity (EC)) and pH

Weekly determination

- Soil salinity from SSE method (1: 1 suspension)
- Soil salinity (EC) using suction lysimeter
- Amount of water/ha using flowmeters

Effects of real time irrigation management on strawberry production:

Parameters Measured

Plant performance and hydric stress measurements (Weekly measurements)

- Yield in sub-sampling sites
- Size of the fruits (caliber)
- Fruit quality using Brix index
- Plant size (canopy area)
- Leaf Water Potential (SWP) using pressure chamber
- Leaf temperature with infrared thermometer

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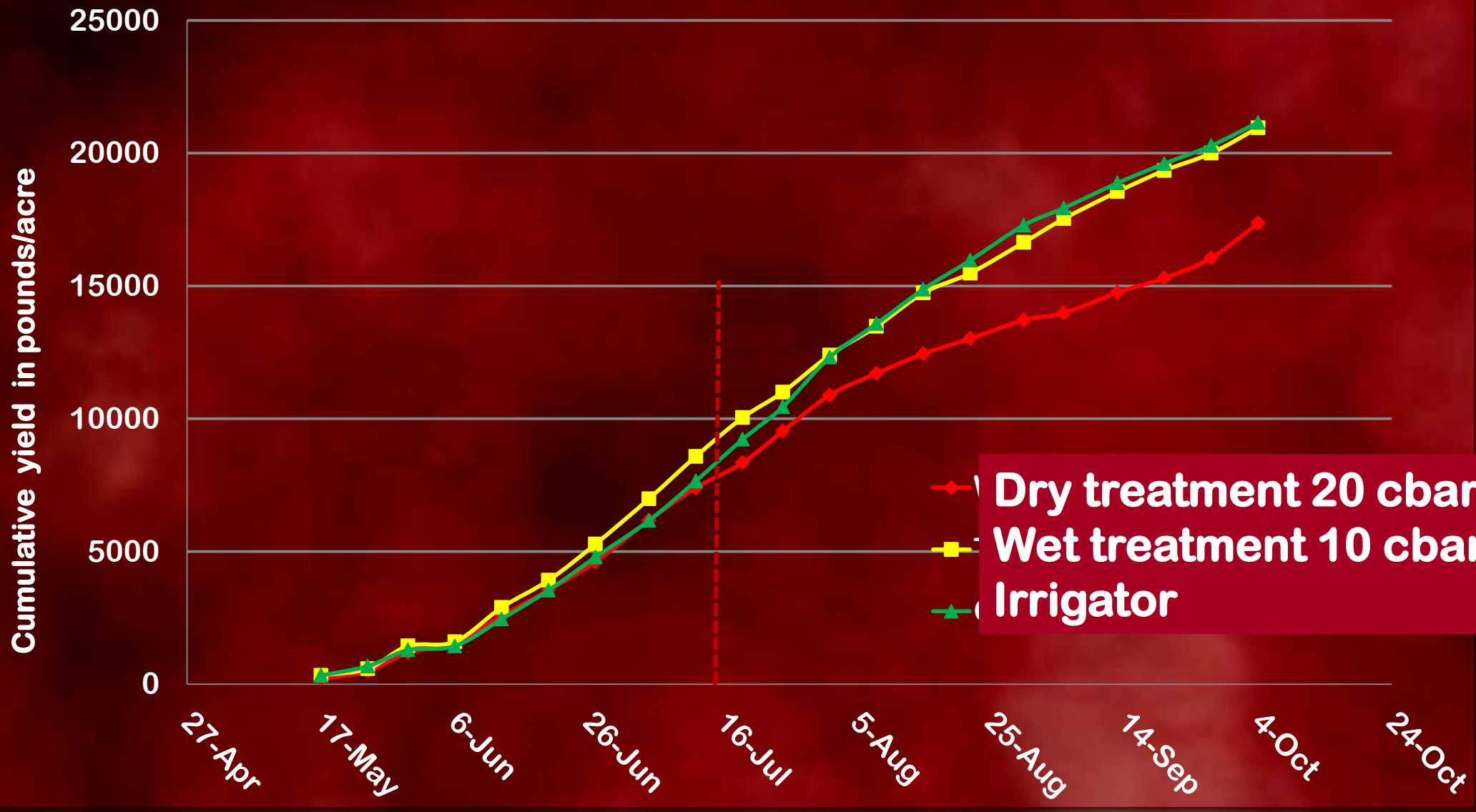
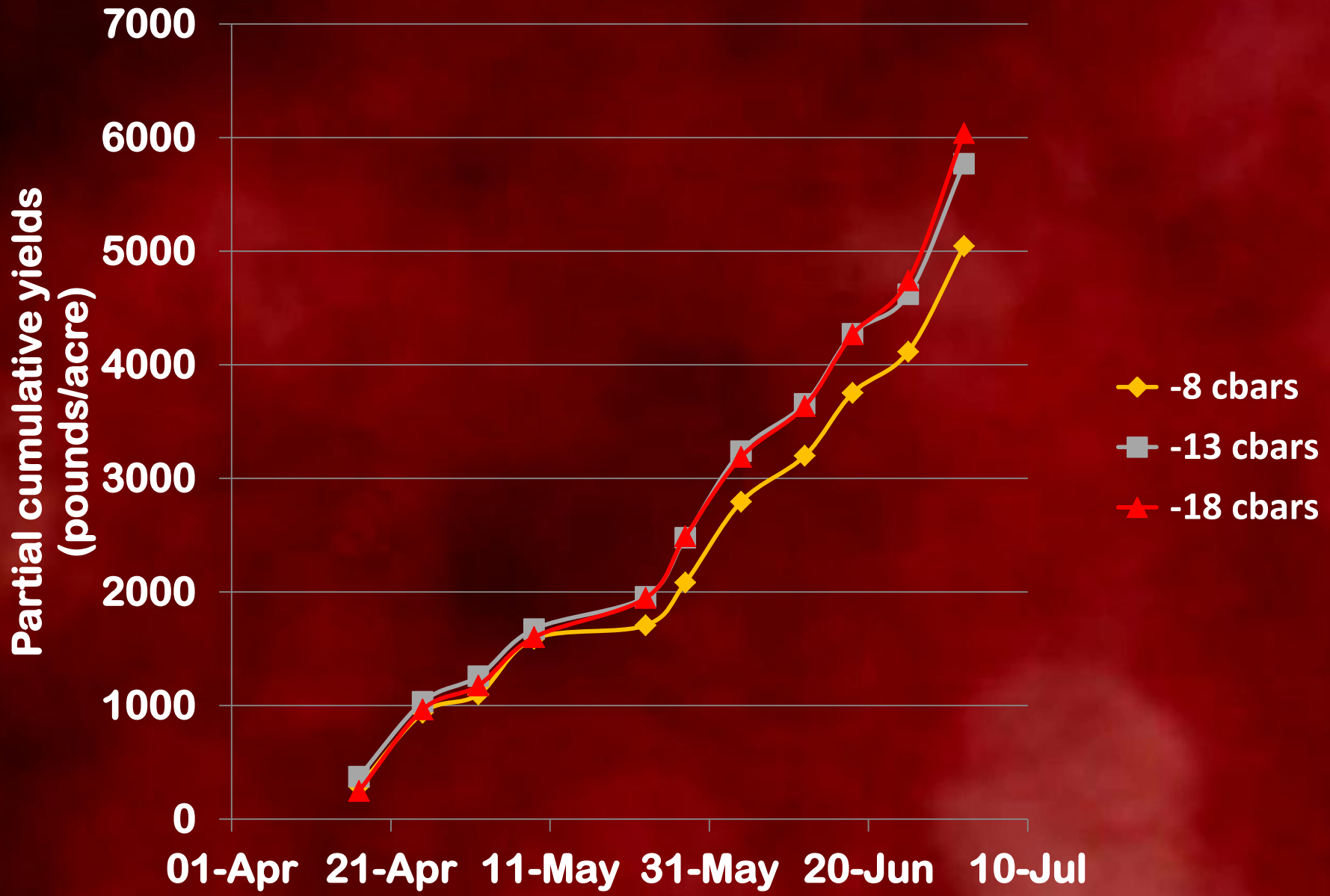
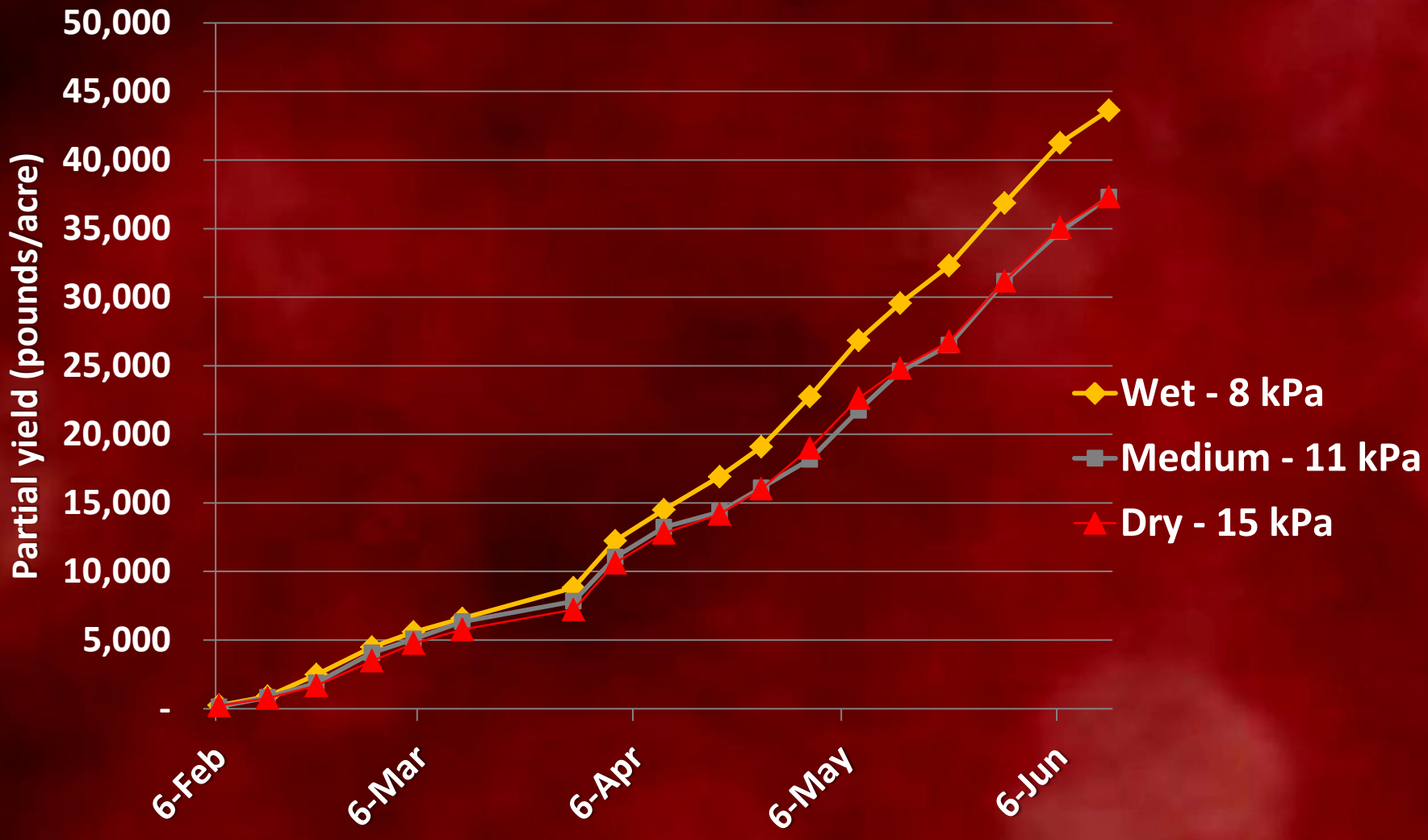
Partial Cumulative Yield (Watsonville)



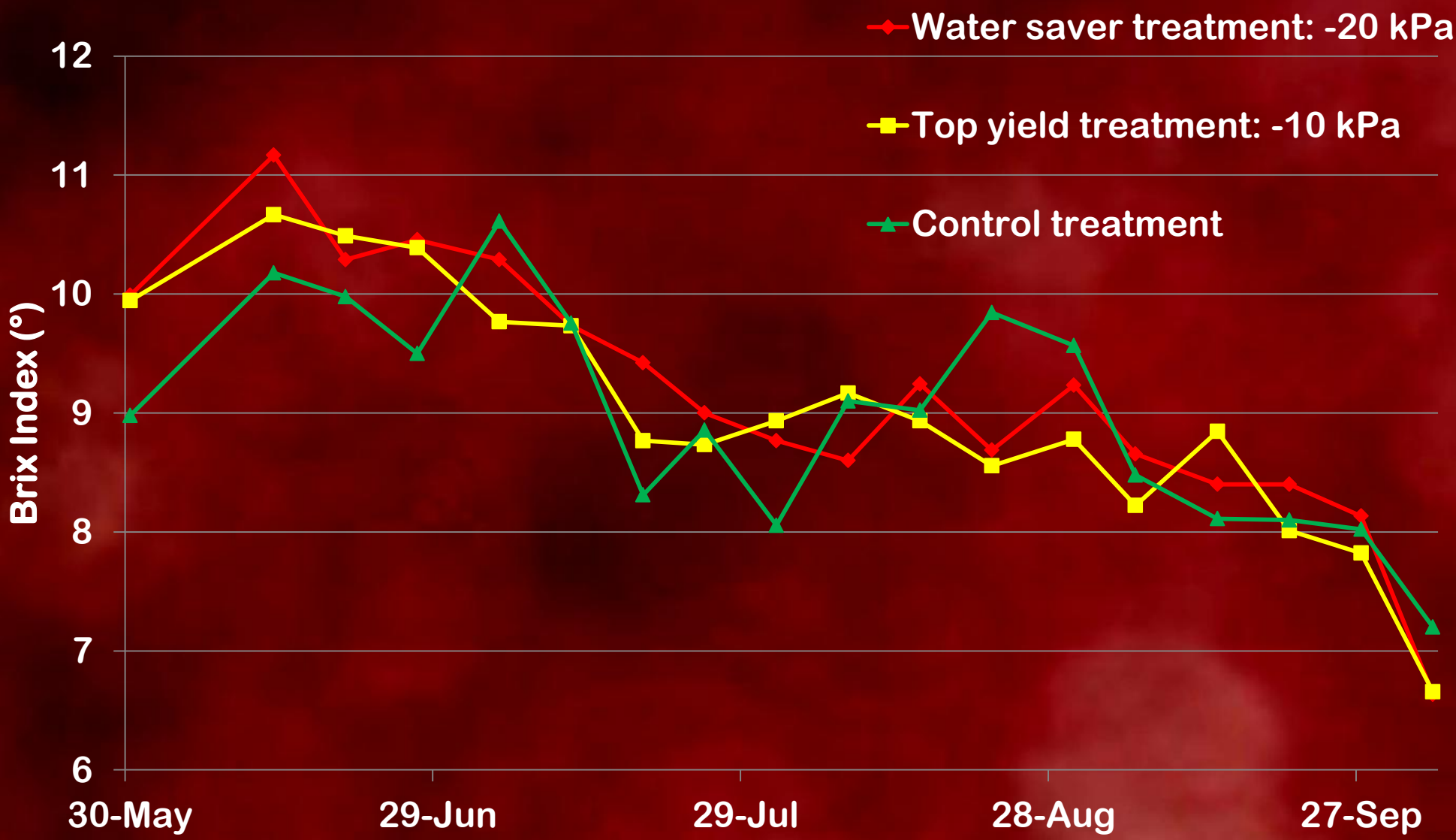
Partial cumulative yields (Salinas 2012)



Partial cumulative yields (Oxnard 2012)



Fruit Quality - Brix Index



2011-2012 Strawberry irrigation trials

yields, water use and leaching

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- Leaching control and salt buildup
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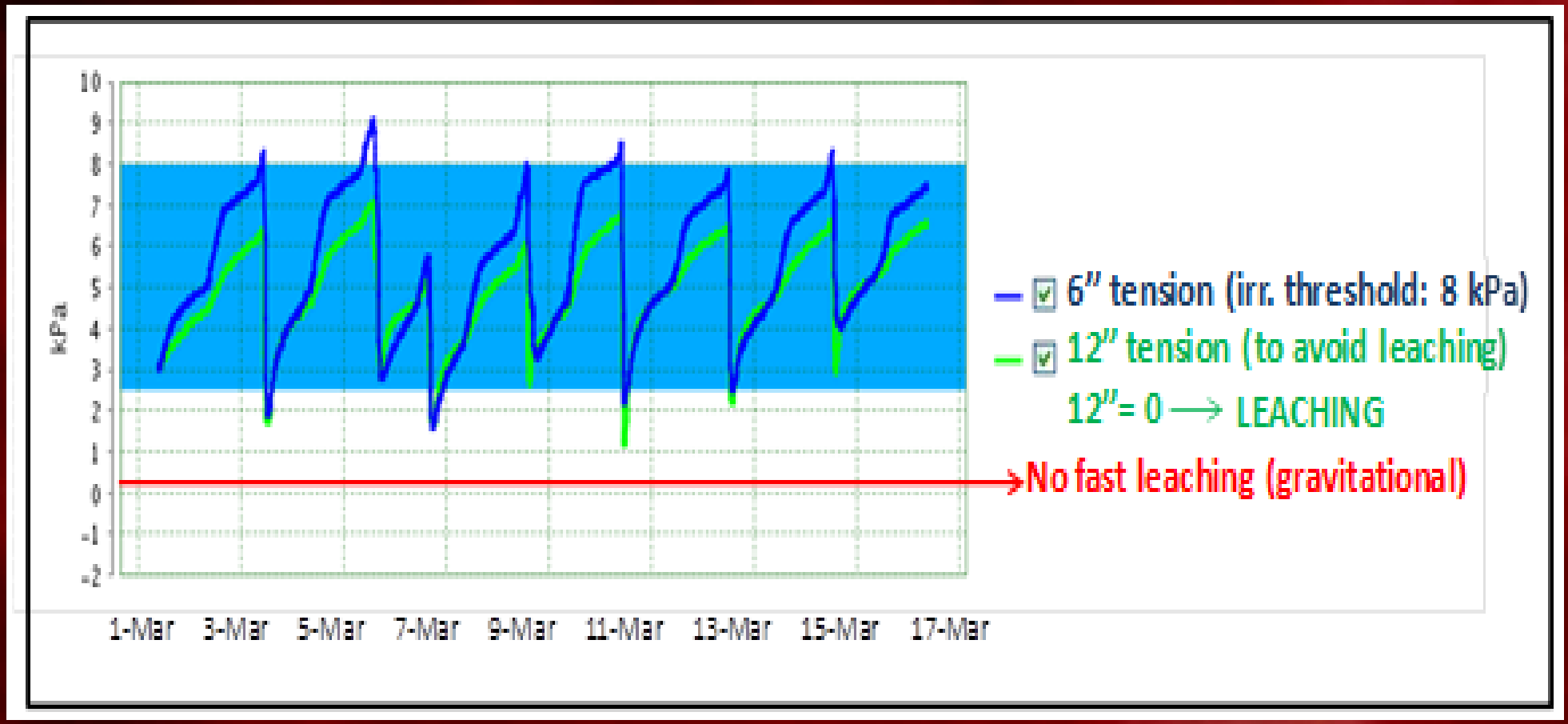
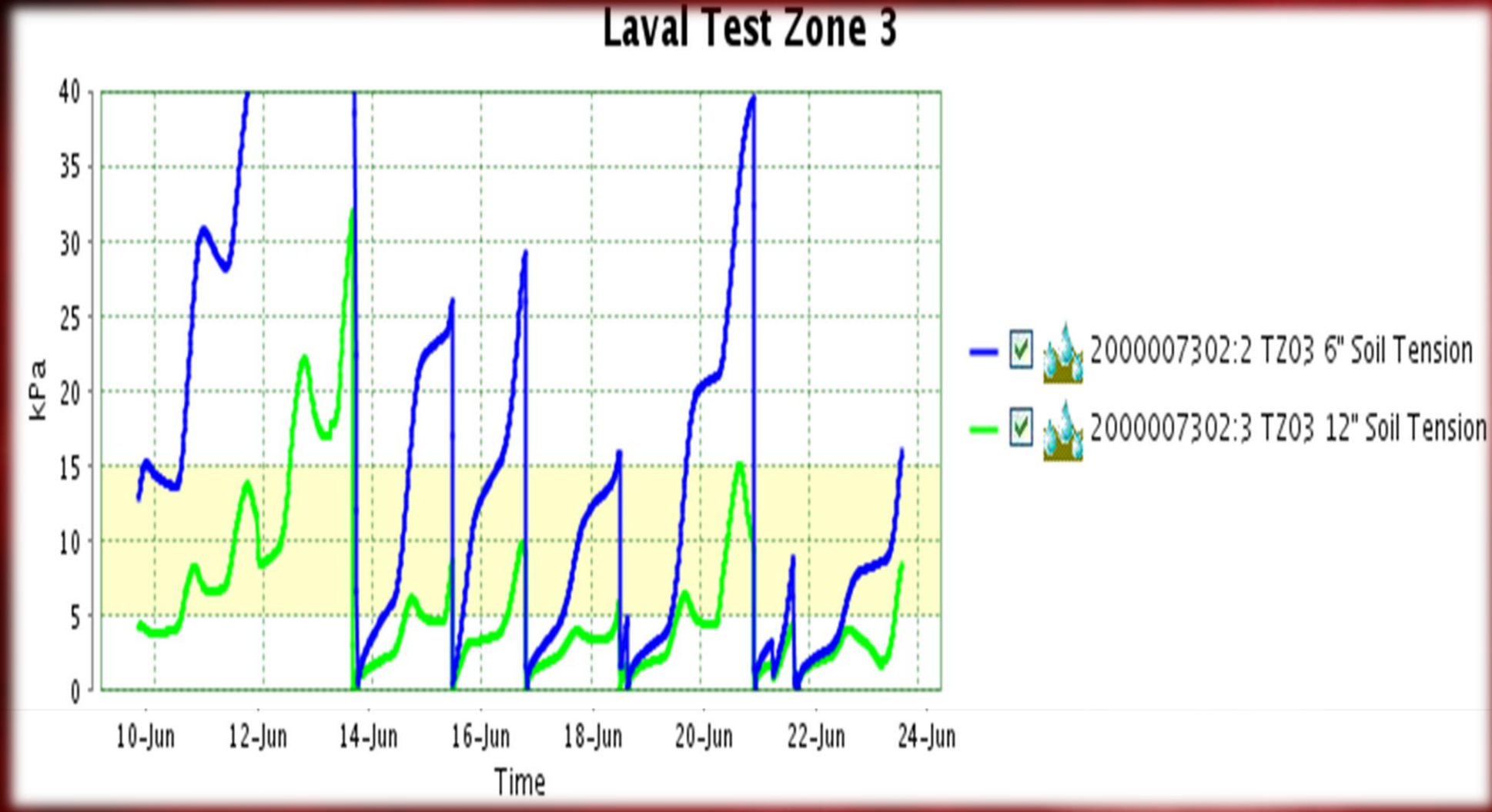
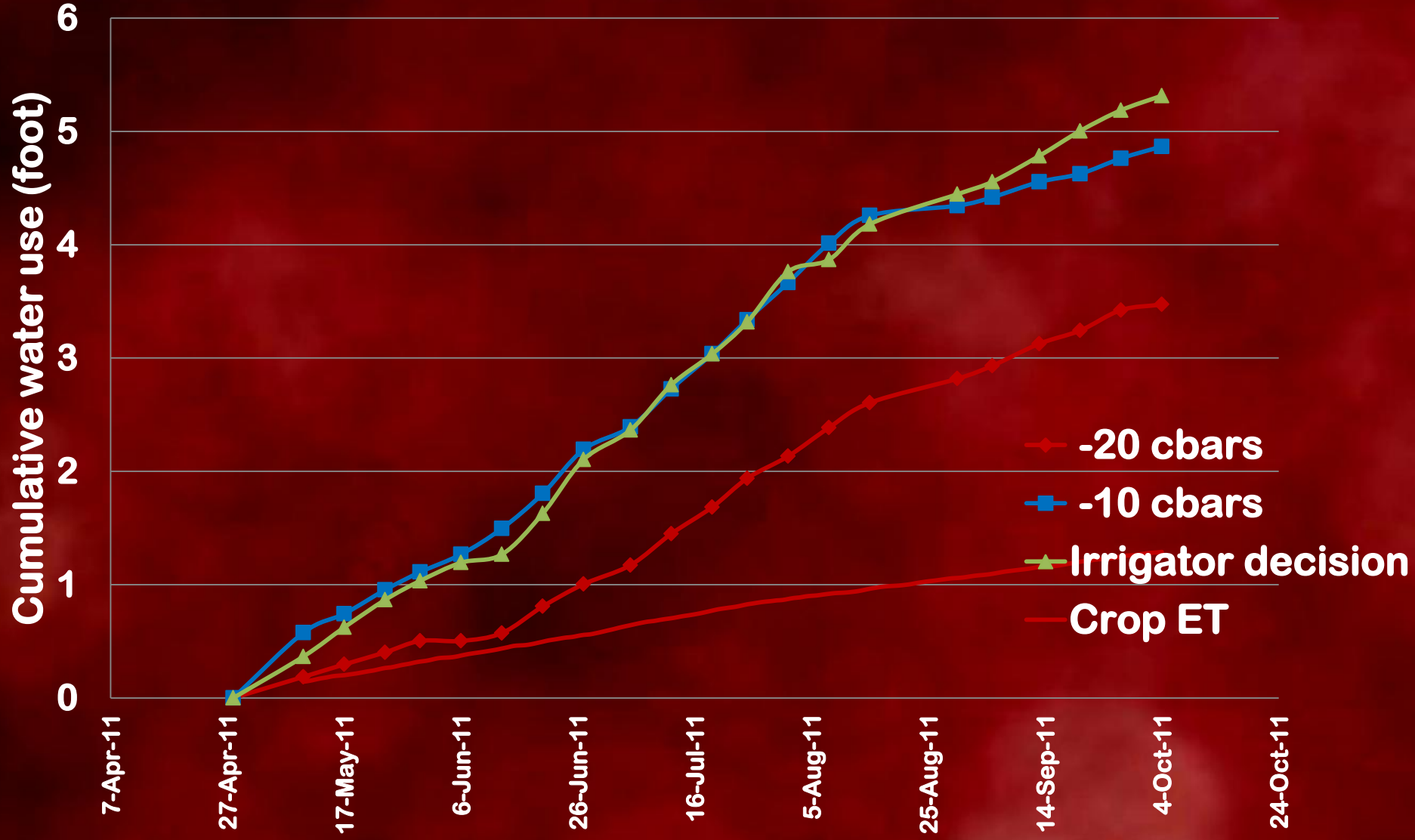
Tension fluctuations wet treatment (8 cbars, Oxnard)



Tension fluctuations Irrigator treatment (Watsonville)

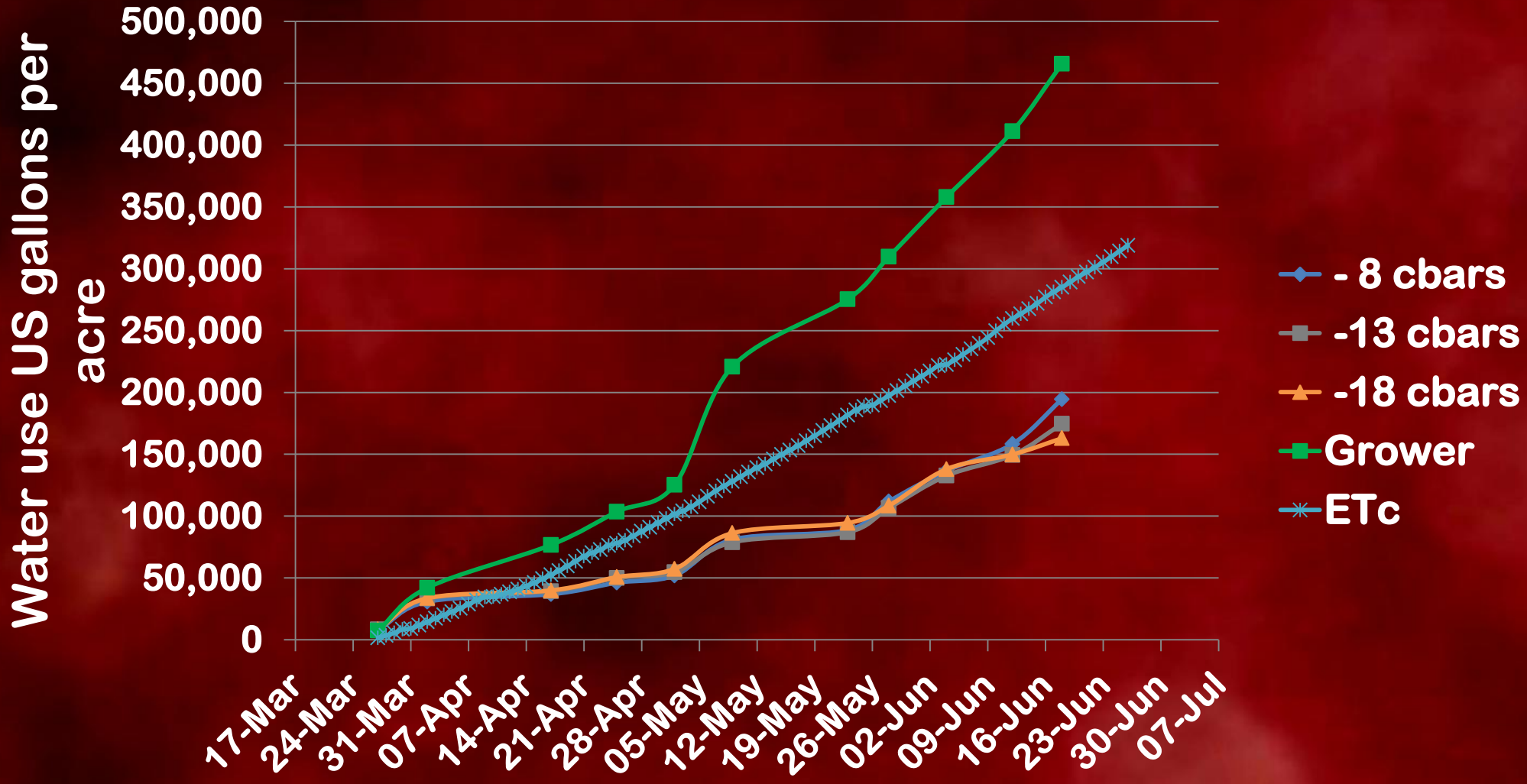


Water applied in 2011 (Watsonville)- prewetting



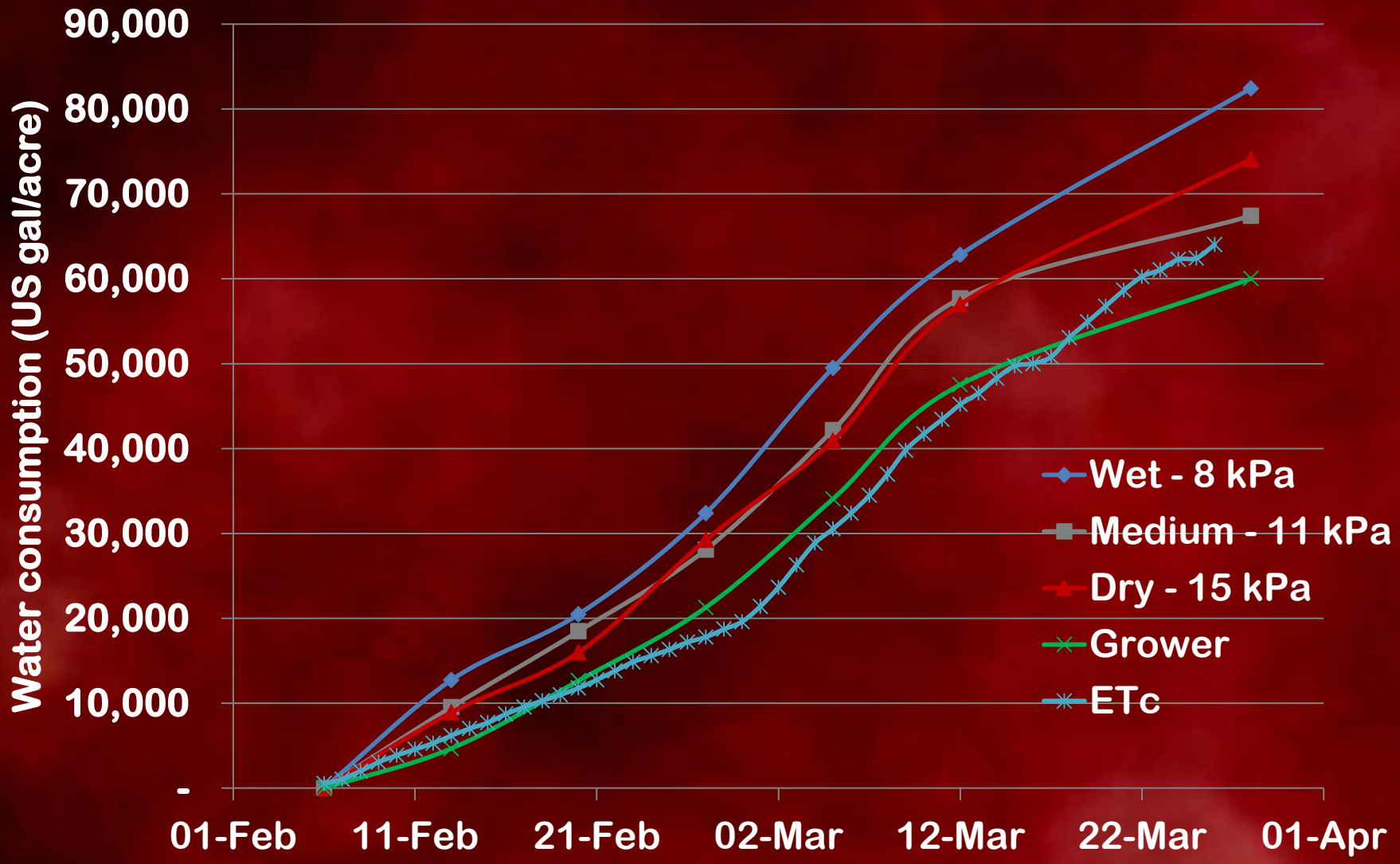
Height of water (foot of water) applied during the 2011 growing season (from April 27th to October 24th)

Water applied in 2012 (Salinas) no prewetting in tension treatments



Amount of water (US gallons per acre) applied during the 2012 in the Salinas study

Water applied in 2012 (Oxnard) yield increase with extra water

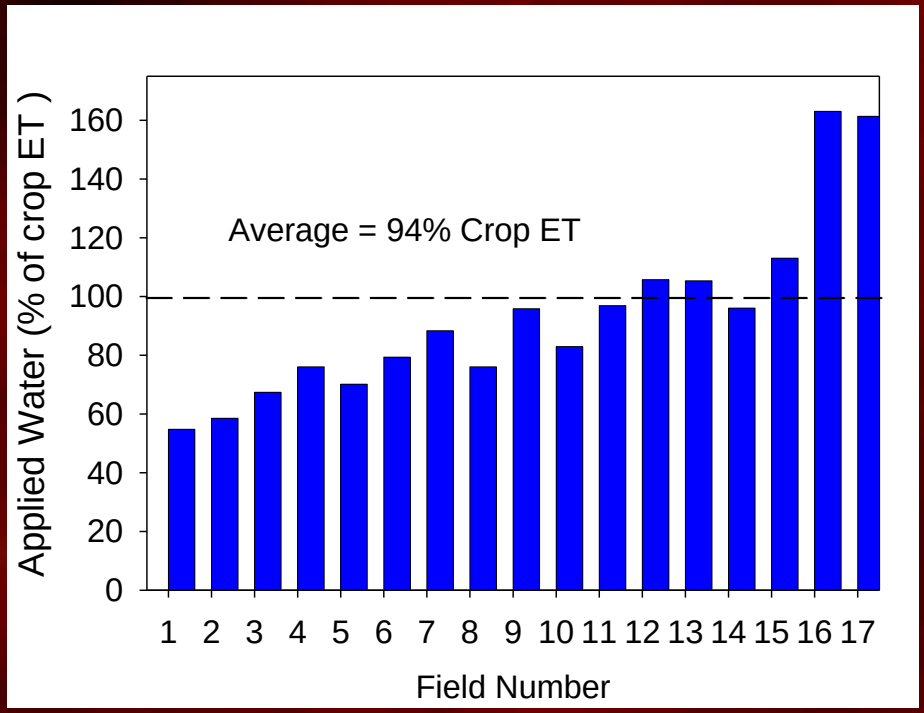


Amount of water (US gallons per acre) applied in the Oxnard Study from Feb to April 1

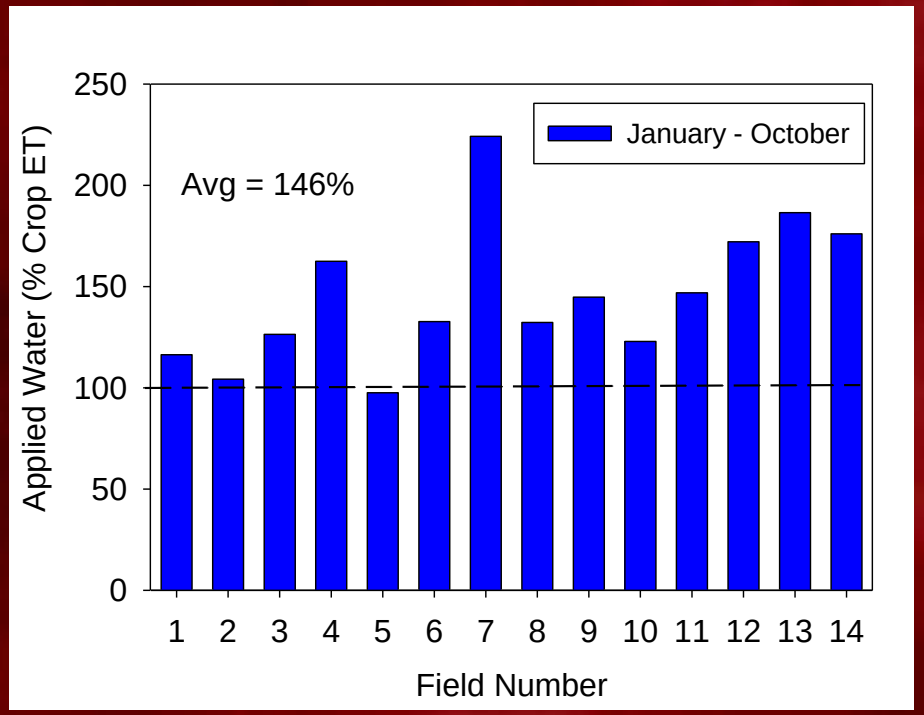
Effects of real time irrigation management on strawberry production:

	Watsonville	Salinas	Oxnard
Soil series	Clear Lake clay	Salinas Clay and Mocho silty loam	Hueneme sandy loam
Yield difference between tension treatments	20% (8-10,000 pounds per acre)	17%	17%
Optimum tension cbars	10	13	8
Acre foot/Acre difference between treatments	1.4	0.15	0.15
Percentage of crop ET from top yield	380	70	126

2010



2011



Percentage of crop ET applied by growers in 2010 and 2011 in the Watsonville area (drawn from Cahn, 2012)

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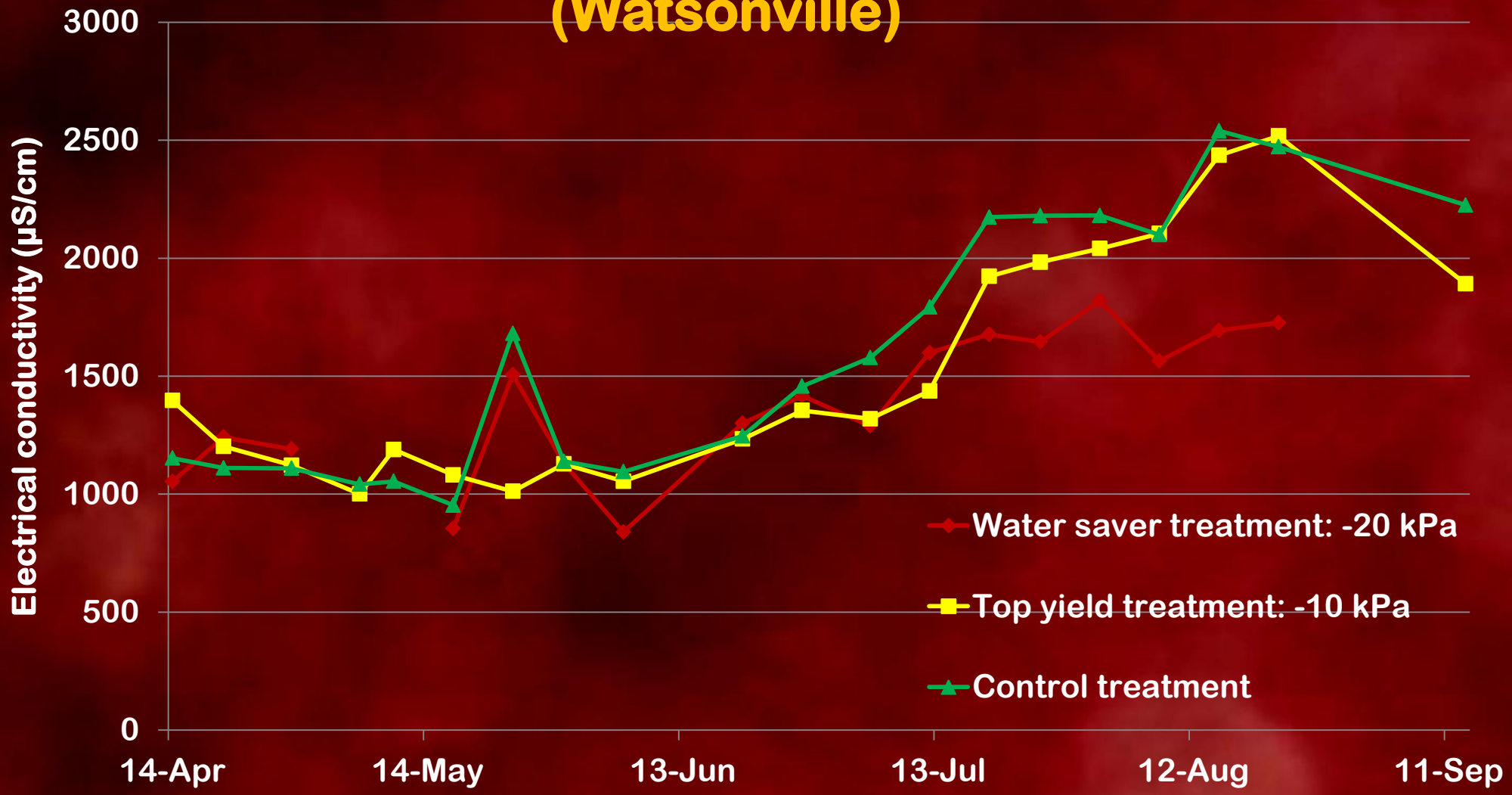
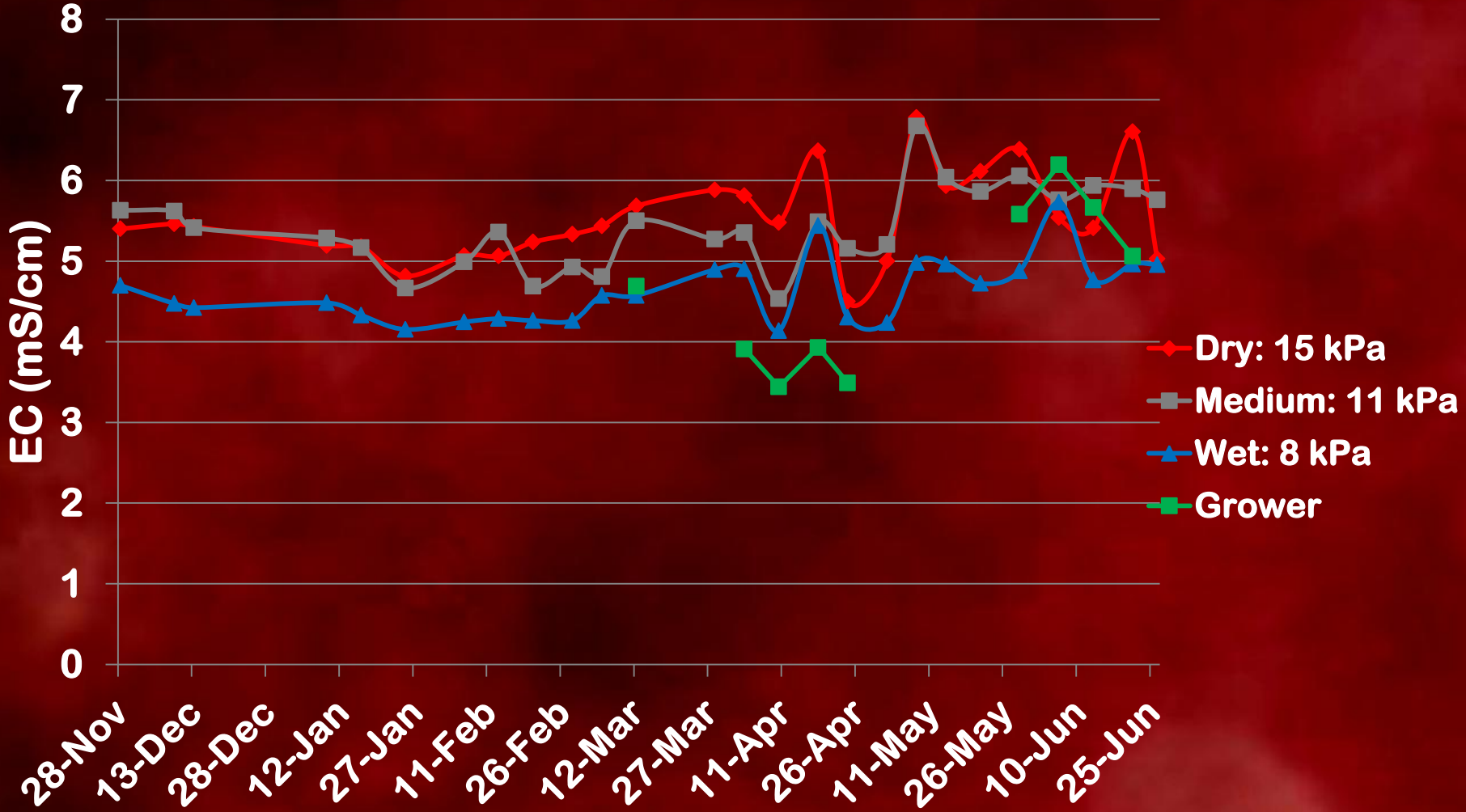
Pore water EC follow-up with lysimeter (Watsonville)

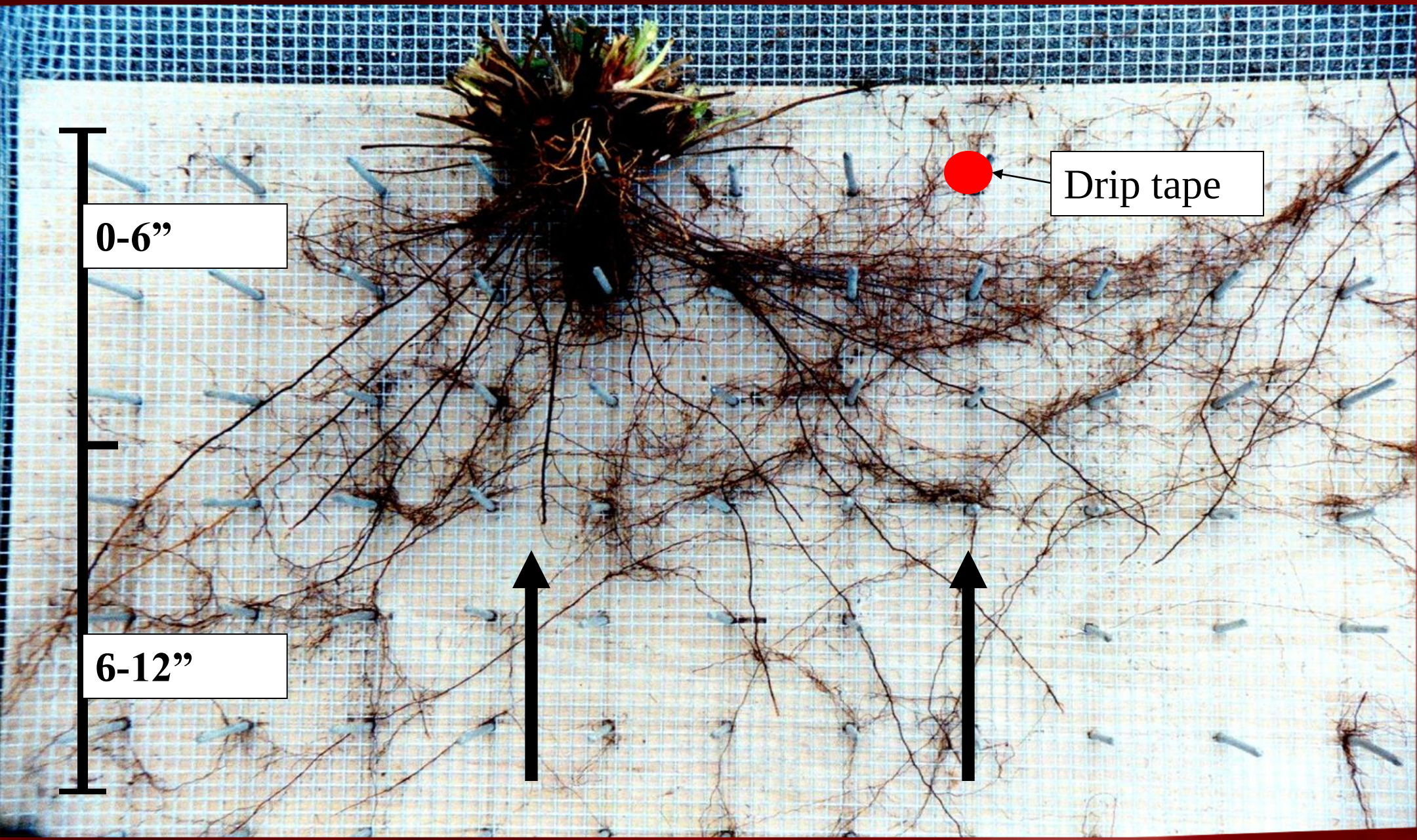


EC follow-up during the 2011 growing season
(from April 14th to September 13th) using the suction lysimeters

Pore water EC follow-up with lysimeter (Salinas)

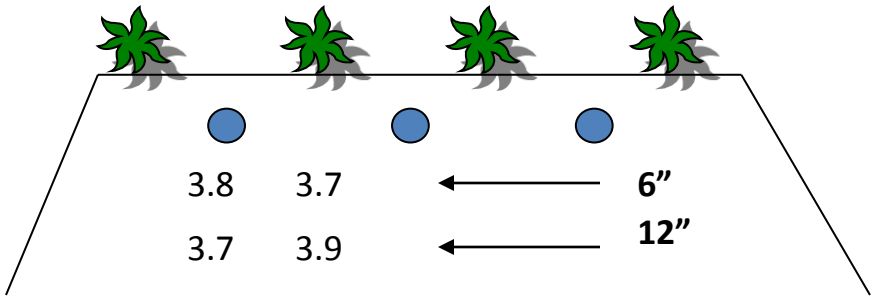


EC follow-up during the 2012 growing season
(from Nov 28th to June 13th) using the suction lysimeters


Drip tape
0-6”
6-12”

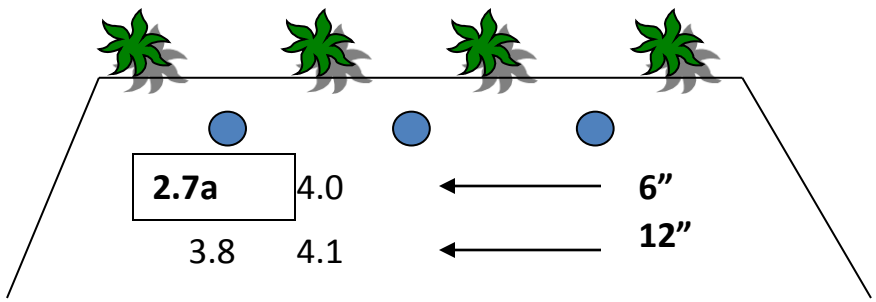
EC = electrical conductivity, ds/m

Irrigator

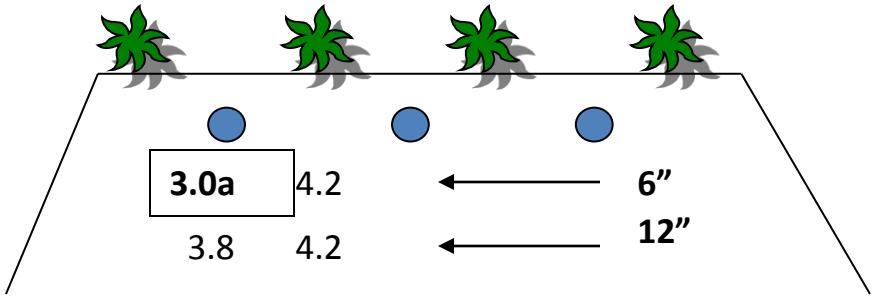


No significant differences

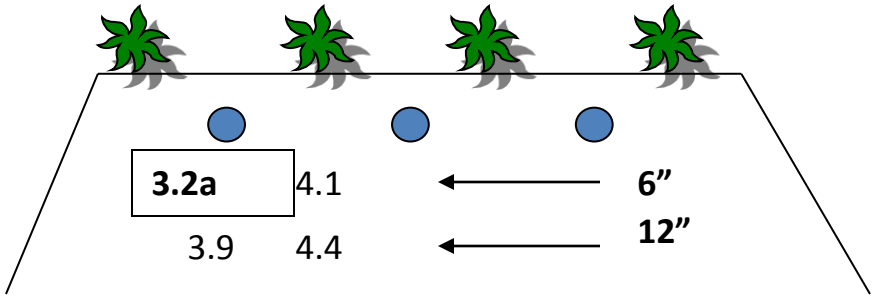
Wet



Medium



Dry

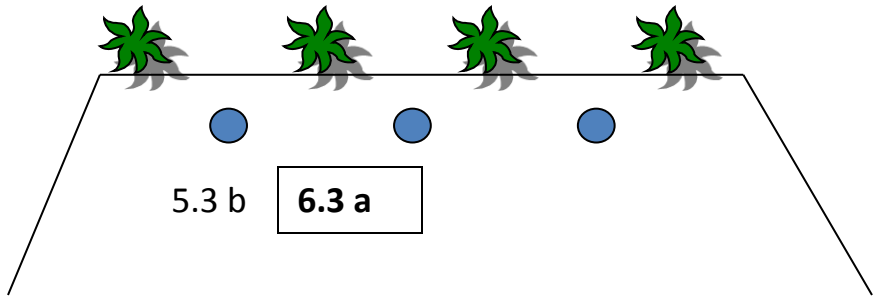


Sodium (Na), meq/l

IRRIGATION TREATMENT

Irrigator 4.8 b
Wet 5.9 ab
Medium 6.2 a
Dry 6.2 a

LOCATION WAS IMPORTANT FOR ALL TREATMENTS



DEPTH: 6-12" = 0- 6"

Sodium Absorption Ratio below 3 though, with EC dominated by $CaSO_4$

$$SAR = \frac{Na}{\sqrt{(Ca+Mg)/2}}$$

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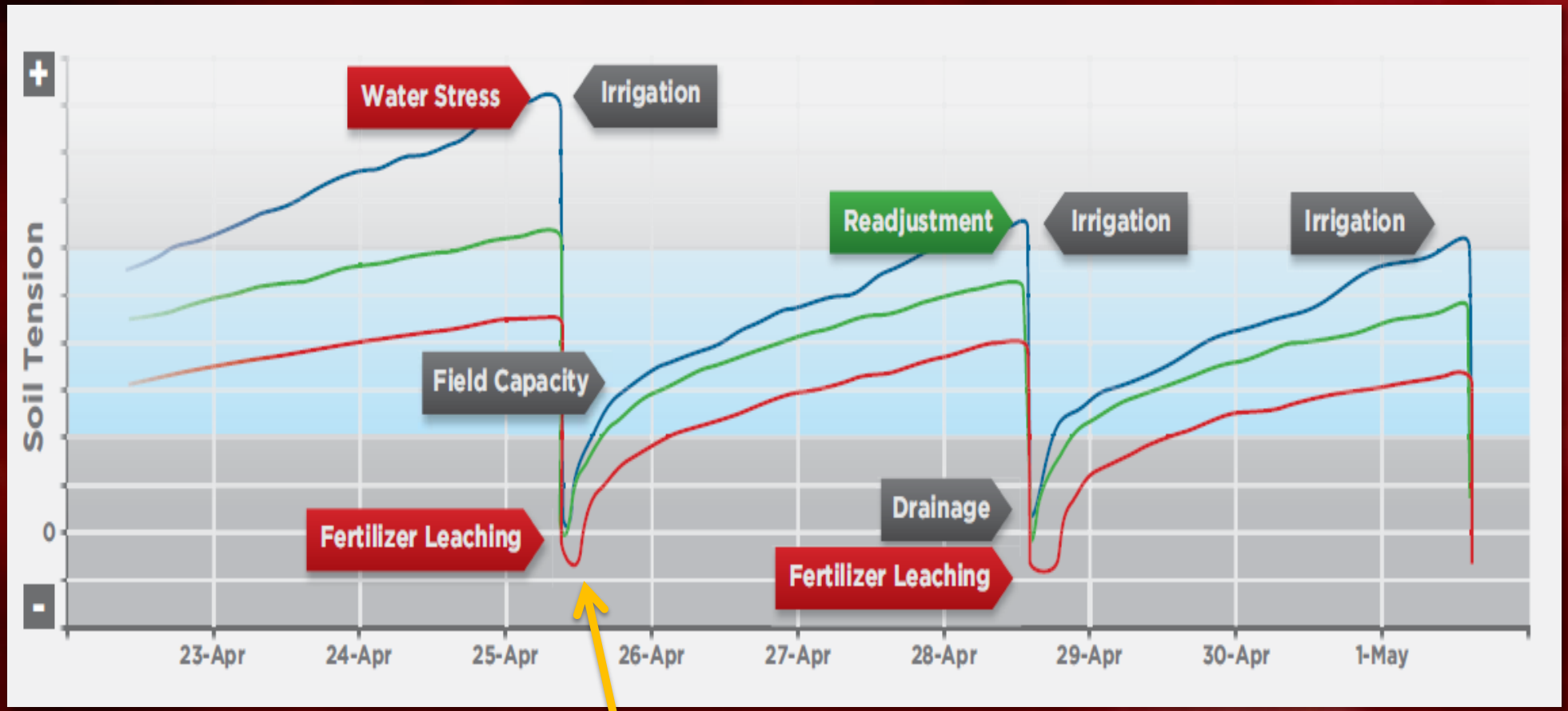
- Next steps (shelf life study, fertilizer use and leaching)

Leaching

- New sites in Ventura and Watsonville established in the fall 2012
- Different tension treatments
- Real time Salinity and leaching follow-up
- Strawberry irrigation trials also ongoing in parallel at other locations on soilless strawberry production for critical threshold determination

Leaching



Tension hits zero

2011-2012 Strawberry irrigation trials

Conclusions

Small differences in tension can result in significant yield differences (17 to 20%-8,000 to 10,000 pounds/acre)

Small difference in applied water relative to Crop ET models can results in important yield gains (17 to 20%)

Optimum tension threshold for maximum yield in Clay soils was 10-13 cbars (Watsonville-Salinas) and 8 cbars in a sandy loam (Oxnard)

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Thank you for attending

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Technical support from Hortau and three anonymous growers