2011-2013 Strawberry irrigation trials

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2011-2013 Strawberry irrigation trials

yields, water use and leaching

Conducted by

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Three growers from Watsonville, Salinas and Oxnard

Driscoll's staff in Watsonville (N. Nardeel and E. Paddock)

2011-2013 Strawberry irrigation trials

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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

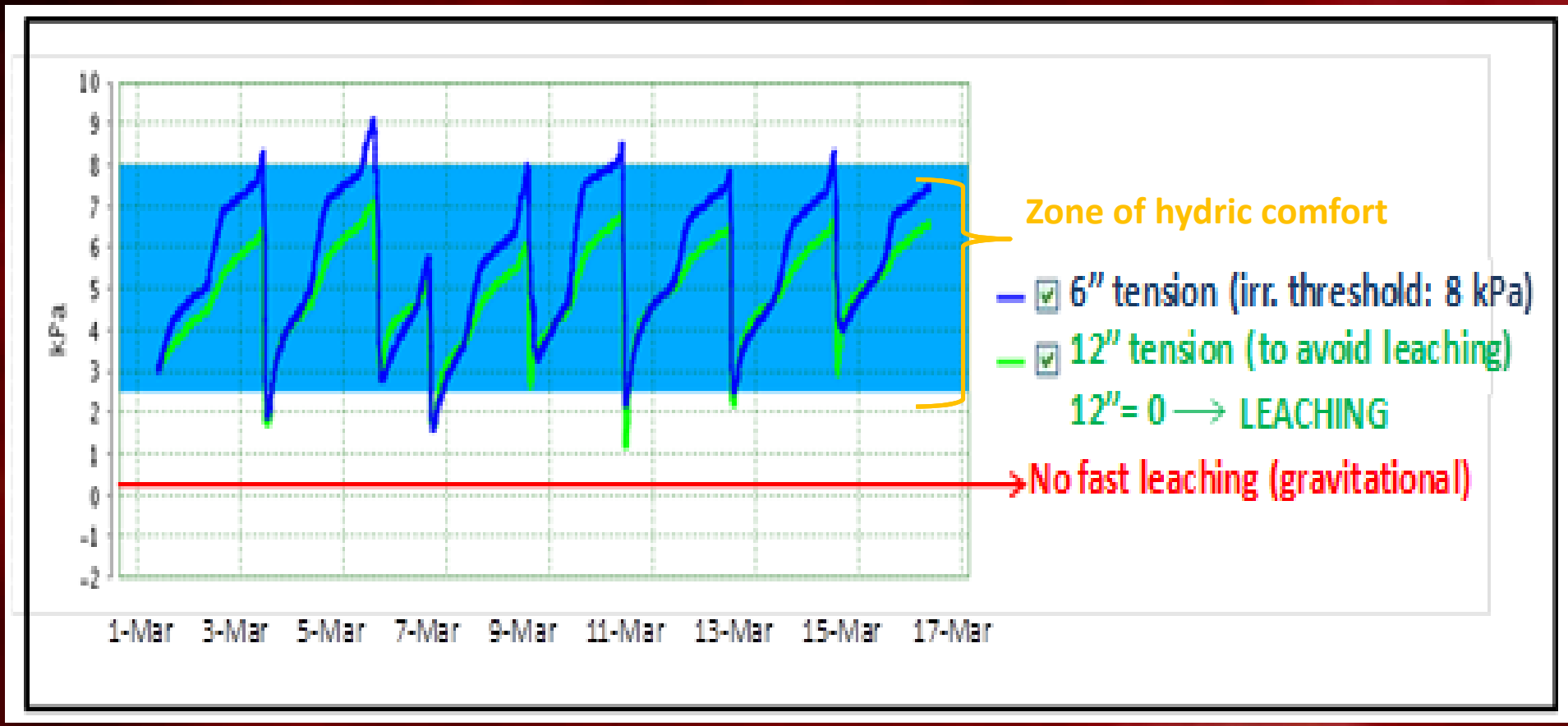
- Water moves according to laws of physics from low tension (wet spot) to high tension (dry spot)
- Tension measures the amount of energy that a plant has to exert to pull the water from the soil
  - Initiate irrigation based on plant needs
  - Tool to detect leaching (tension reaches 0 at lower depths)

Using tension or suction forces to drive irrigation decisions

Stopping irrigation: tension drops

Initiating irrigation: threshold reached

Tension fluctuations wet treatment (8 cbars, Oxnard)



Effects of real time irrigation management on strawberry production (2011-2012)

	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 (2013)

	Watsonville	Oxnard
Soil series	Clear Lake clay	Hueneme silty loam?
Tension setpoints (cbars) Based on texture	25, 17, 10, 7	30, 18, 13, 13 (short pulse)
Harvest period	April-October 2013	January 18-June 4 2013

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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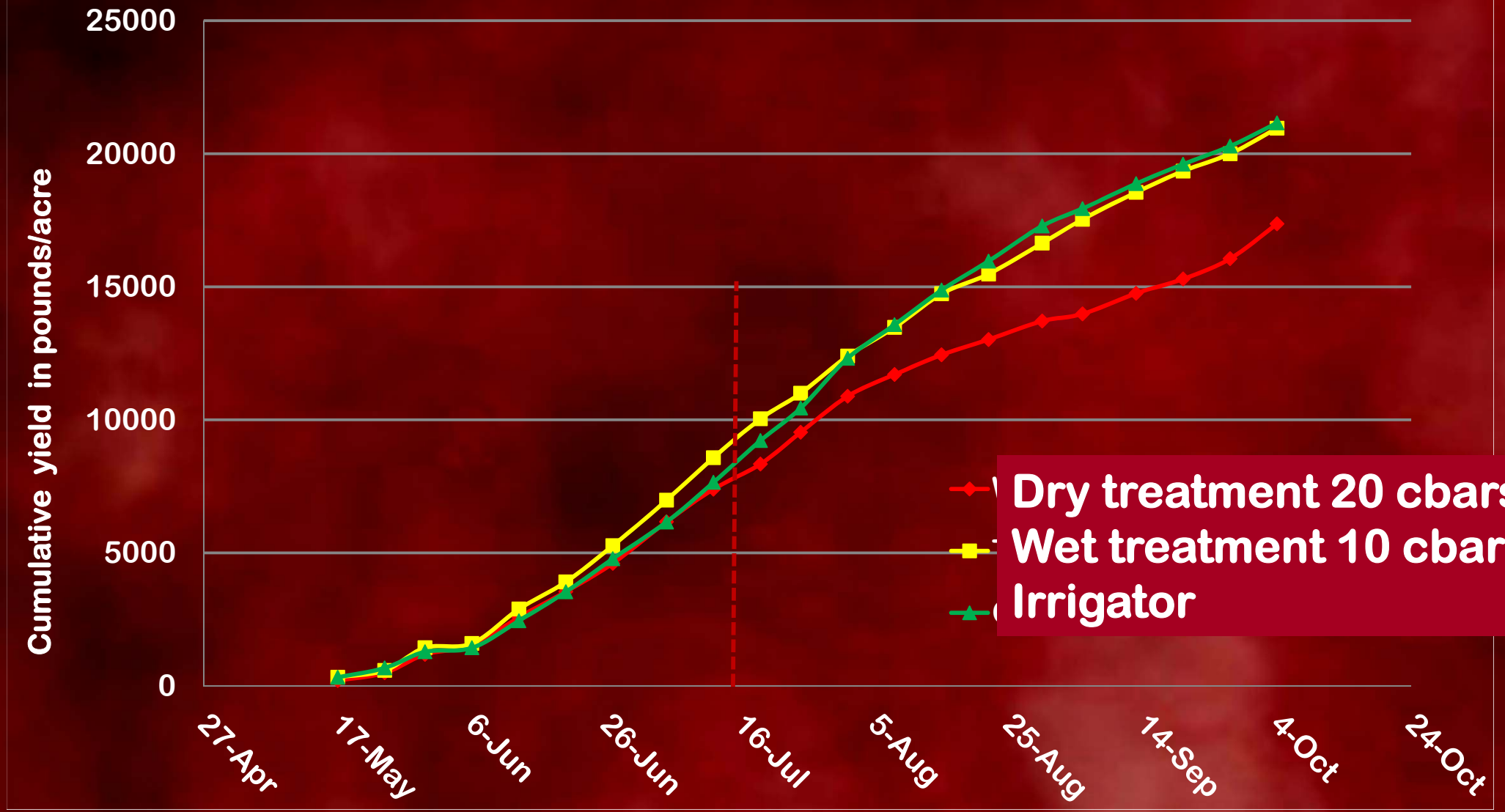
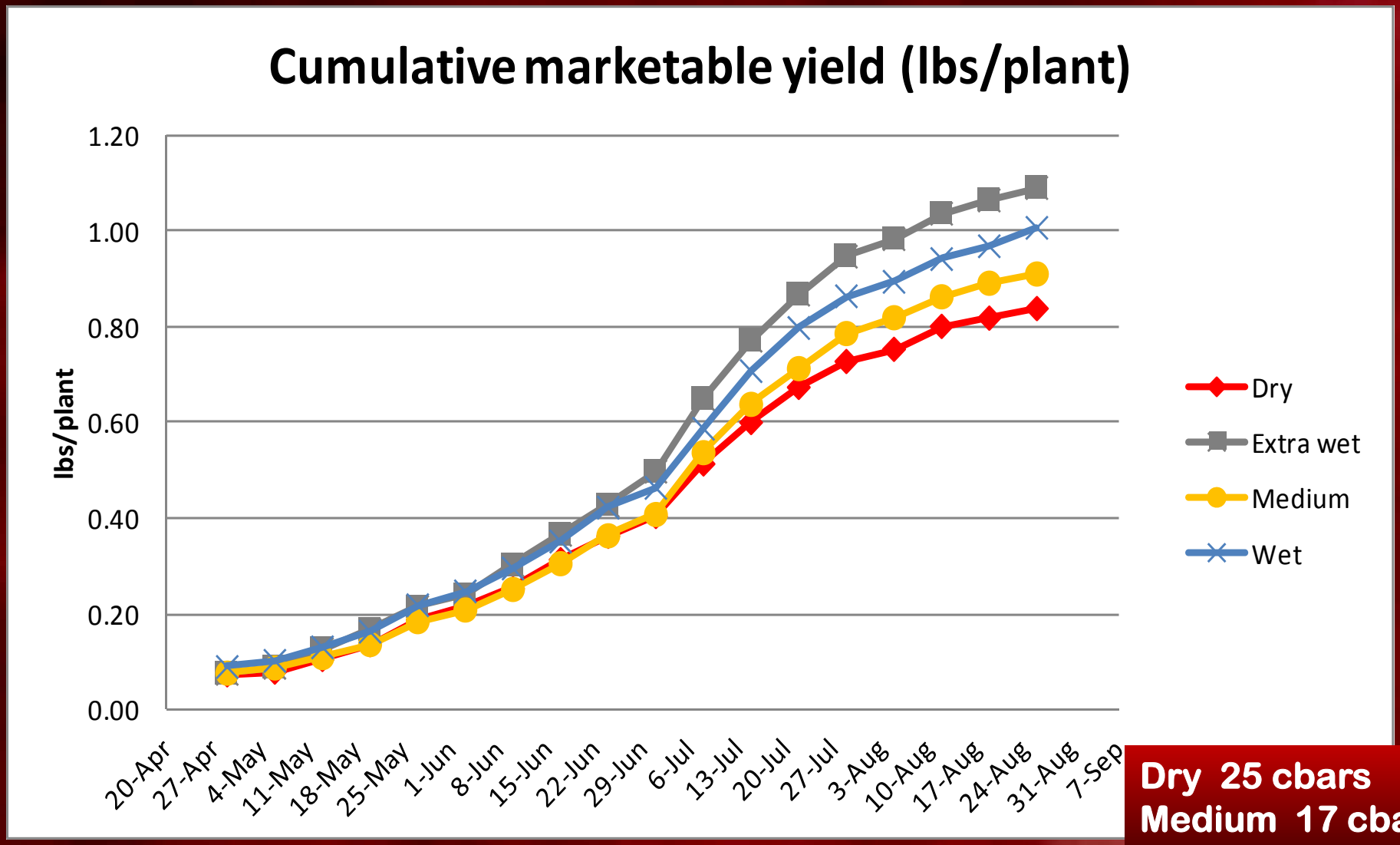
Partial Cumulative Yield (Watsonville-2012)

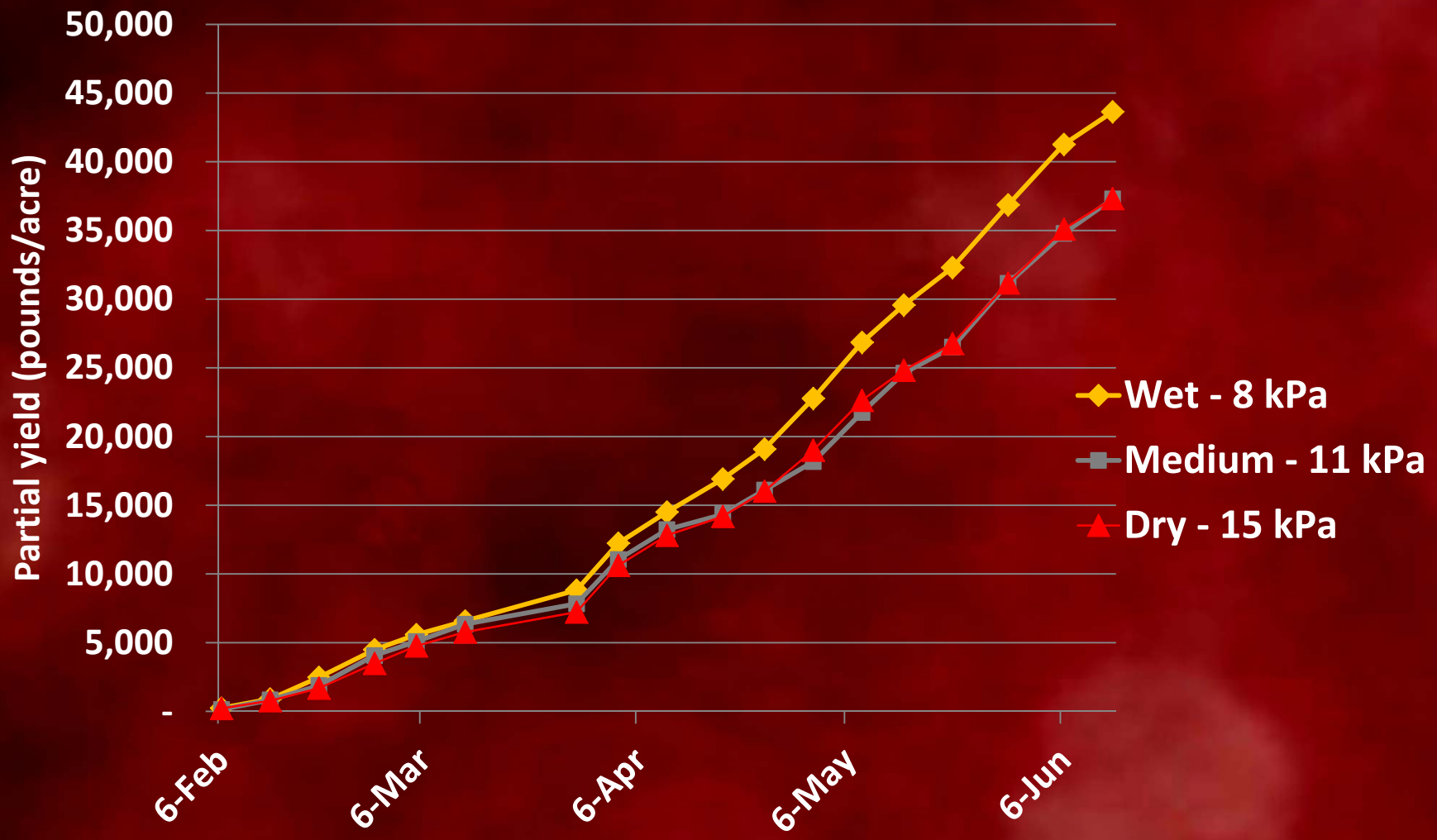


Partial cumulative yields (Watsonville 2013)

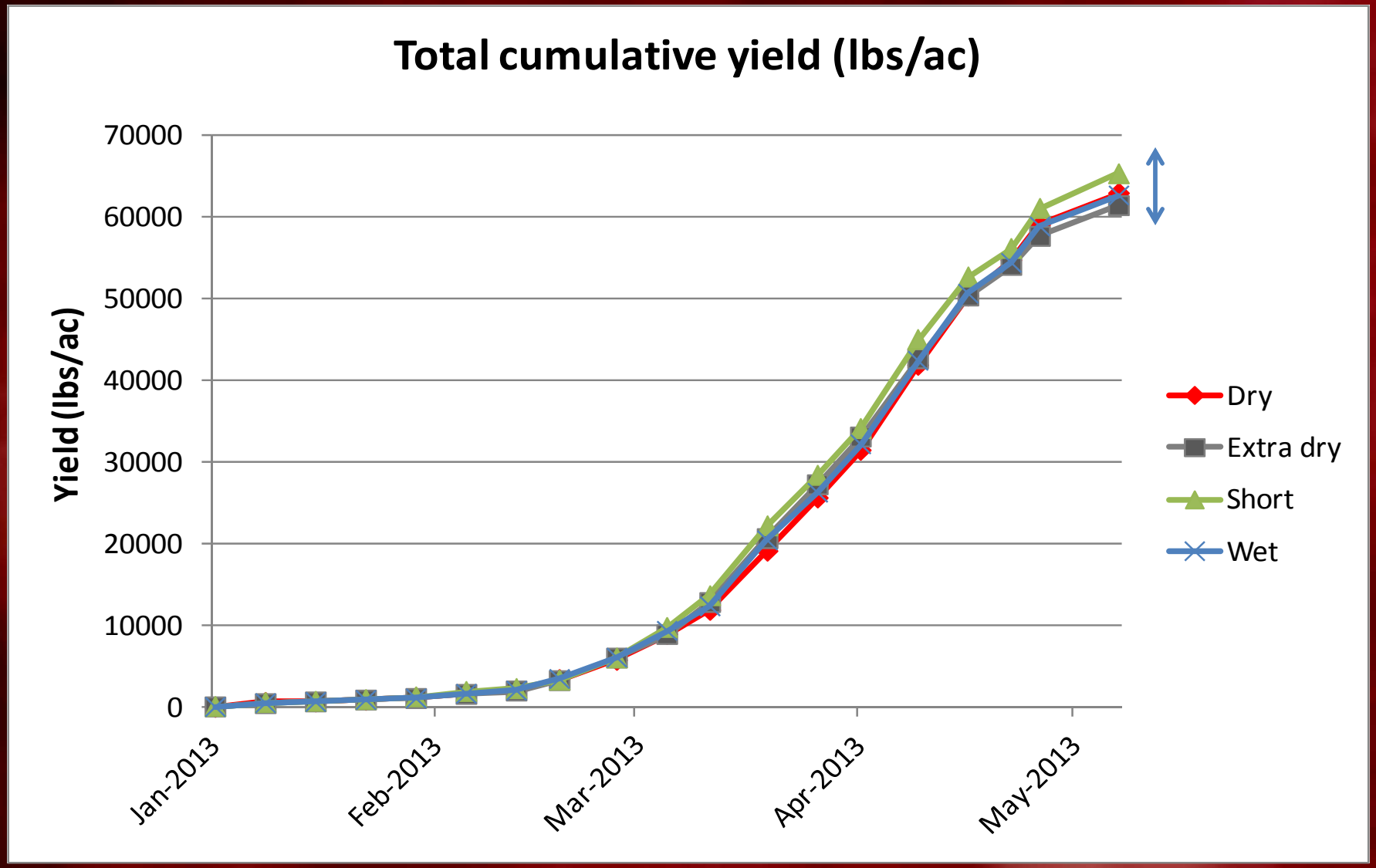


Dry 25 cbars
Medium 17 cbars
Wet treatment 10 cbars
Extrawet 7 cbars

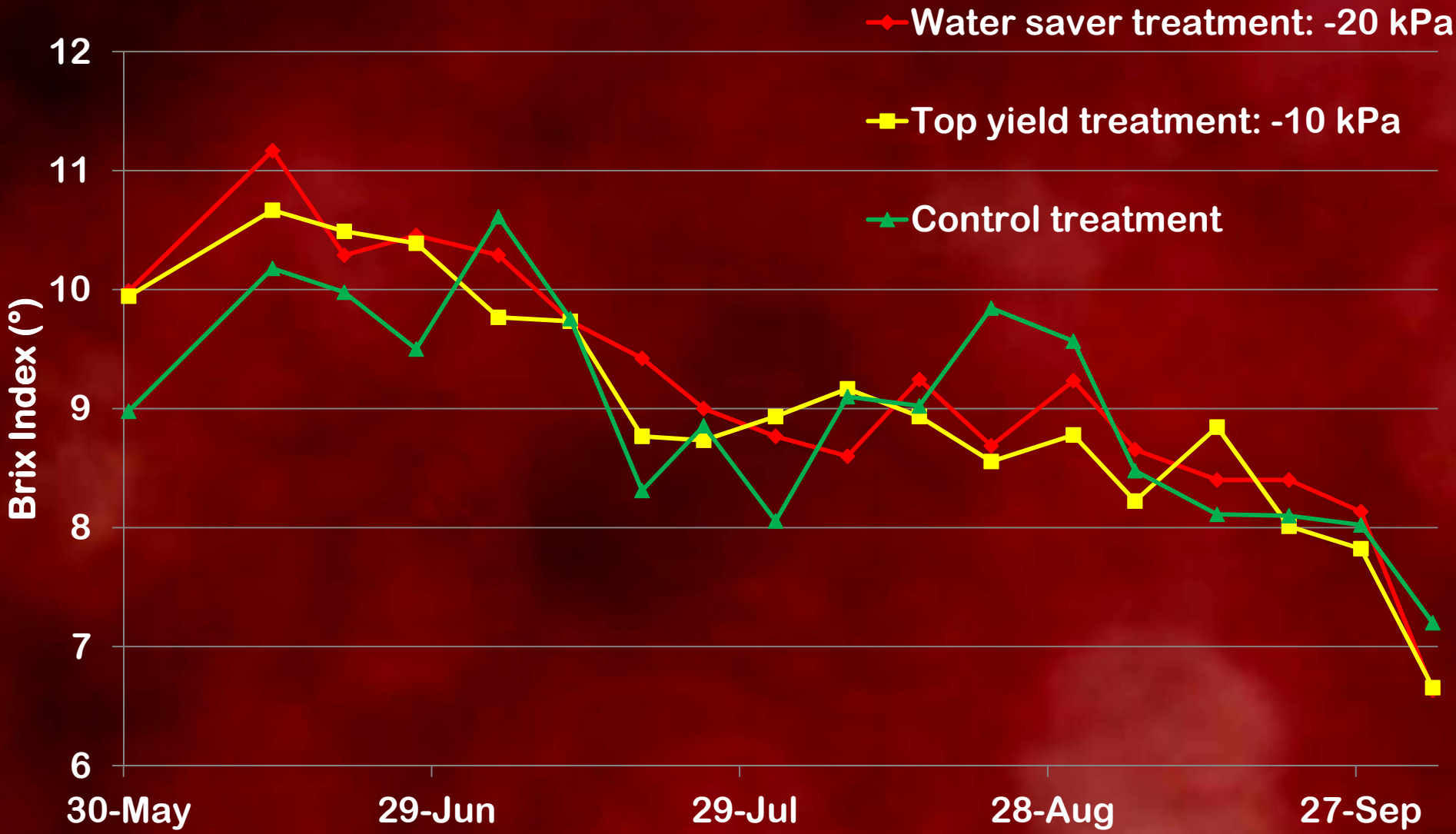
Partial cumulative yields (Oxnard 2012)



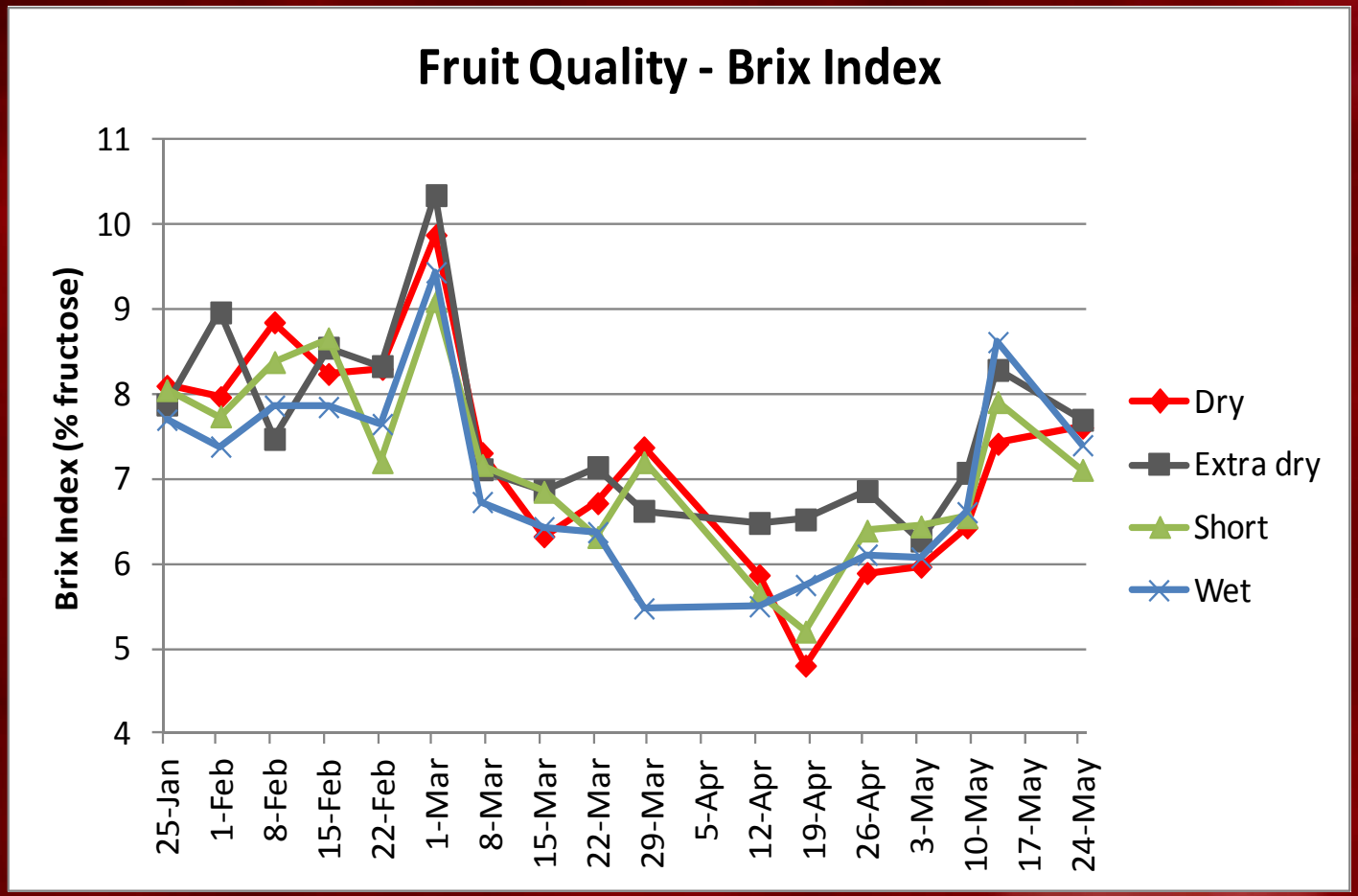
Cumulative yields (Oxnard 2013)-no differences



Fruit Quality - Brix Index



Fruit quality (Brix index) at the Oxnard site (2013)



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Evaluation of irrigation regimes in Oxnard and Watsonville strawberry fields

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- Effect on yields
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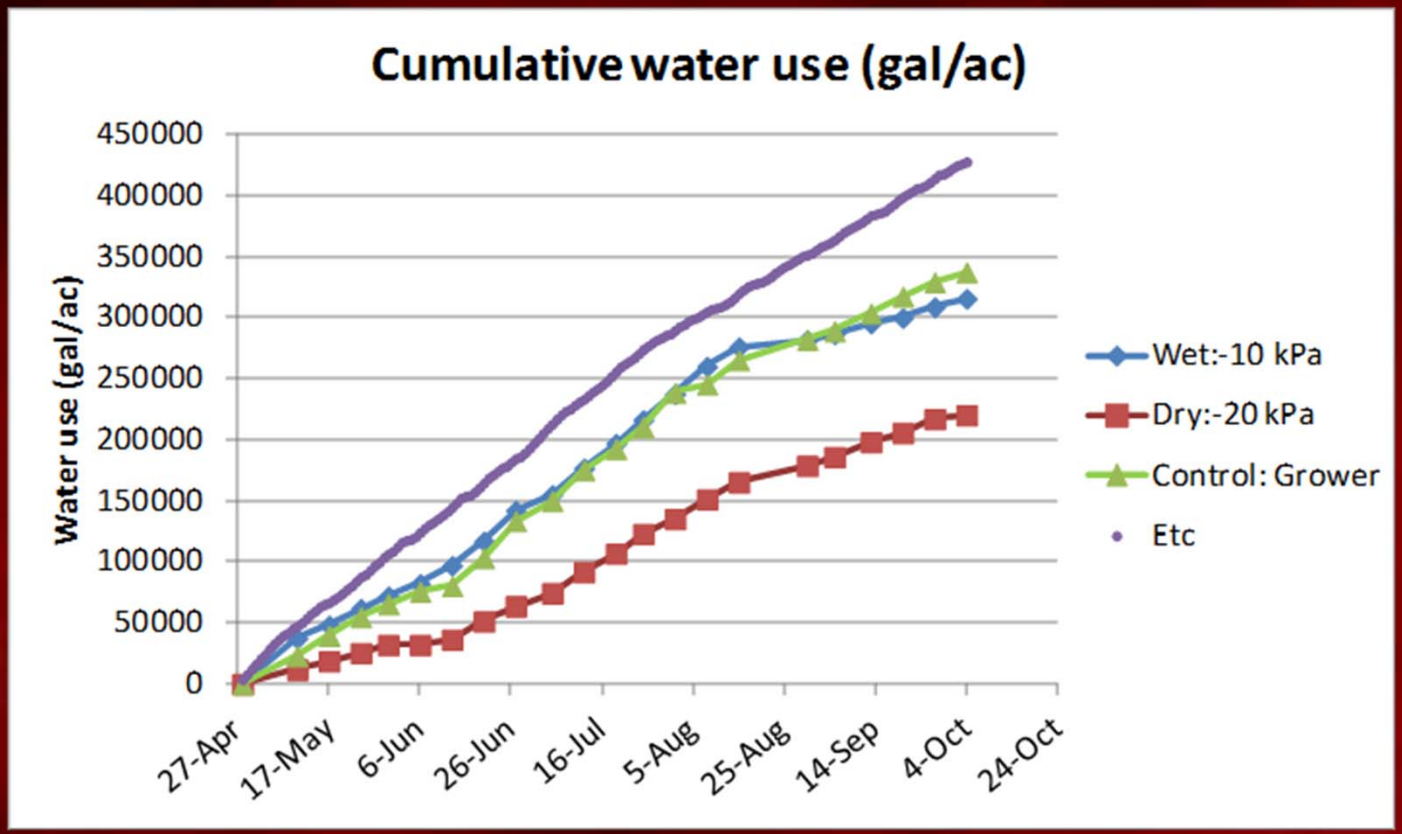
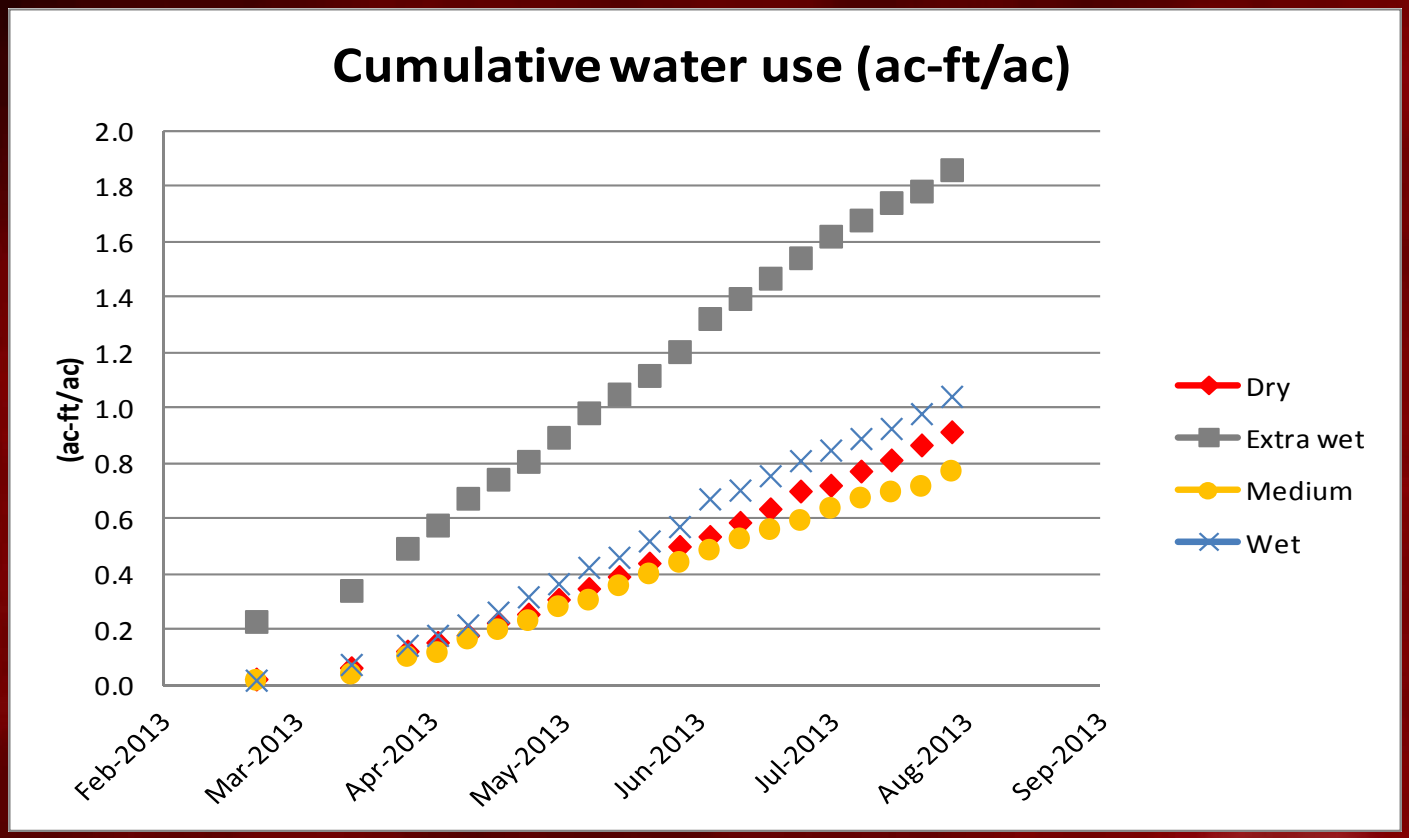
- Leaching control and salt buildup
- Next steps

Water applied in 2012 in Watsonville



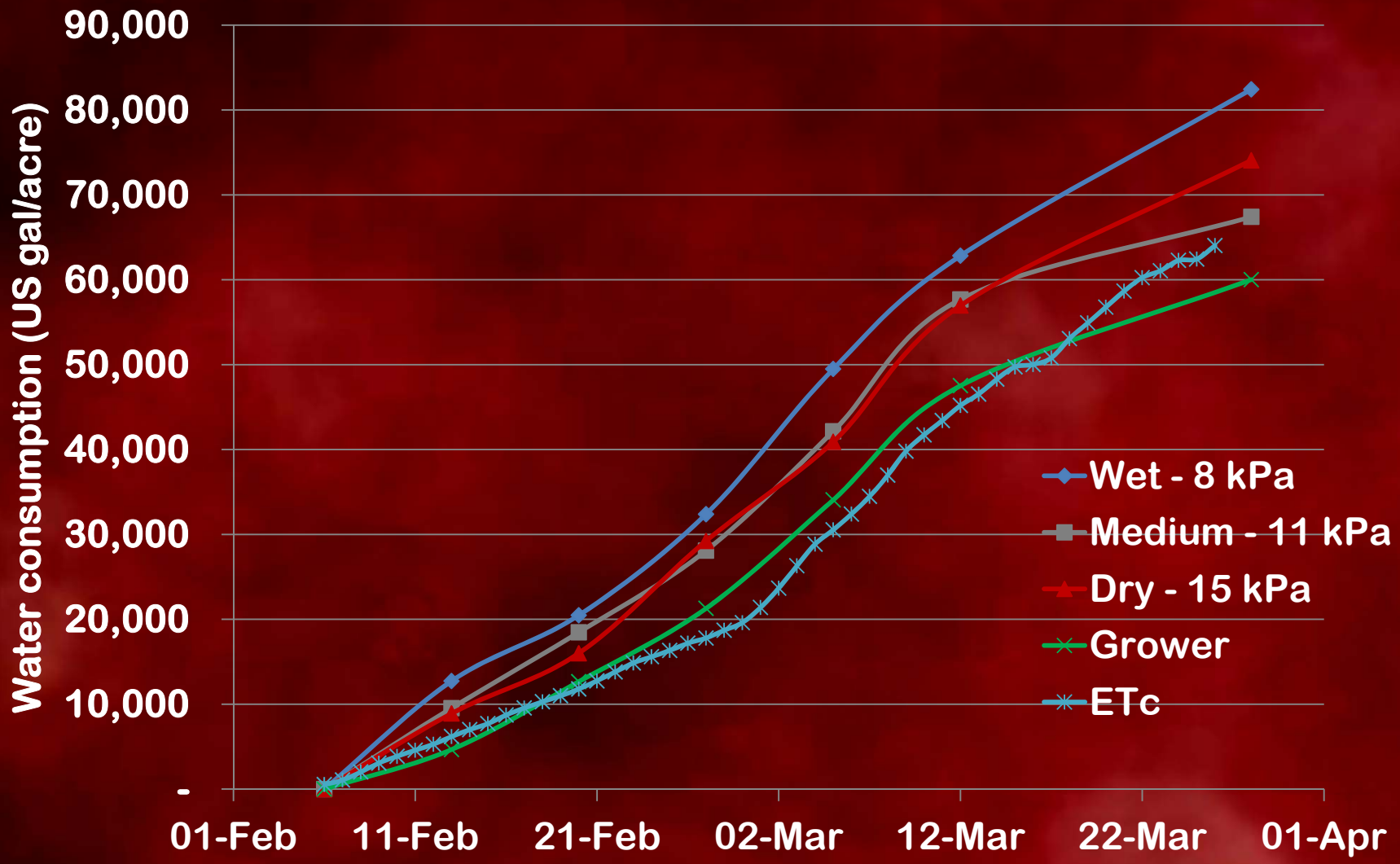
Amount of water (US gallons per acre) applied in the Watsonville Study from April to October

Water applied in 2013 in Watsonville



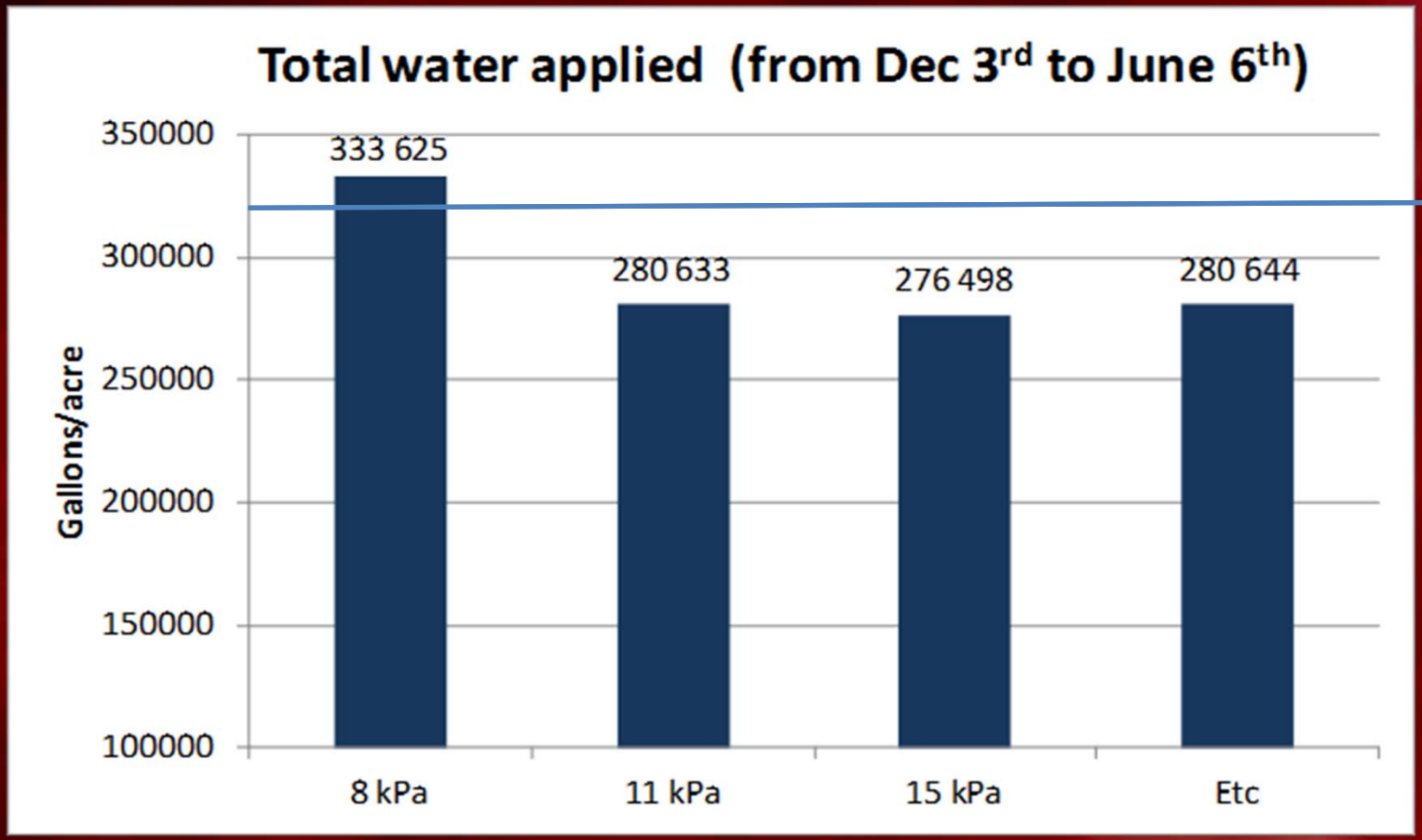
Amount of water (US gallons per acre) applied in the Watsonville study from Feb to August 2013

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



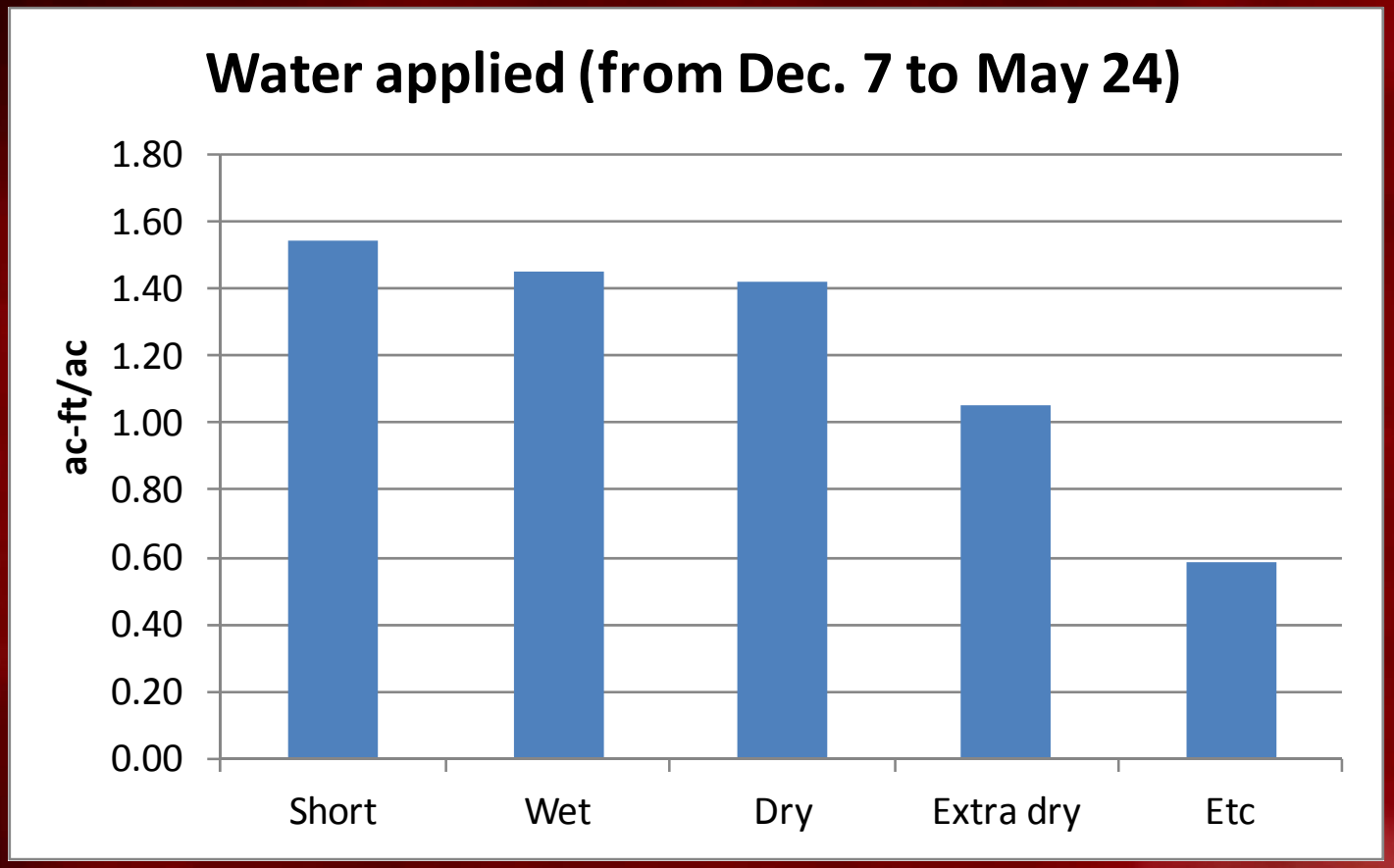
Amount of water (US gallons per acre) applied in the Oxnard Study from Feb to April 1

Water applied in 2012 (Oxnard)



Amount of water (US gallons per acre) applied in the Oxnard Study from Dec. to June 4, 2012

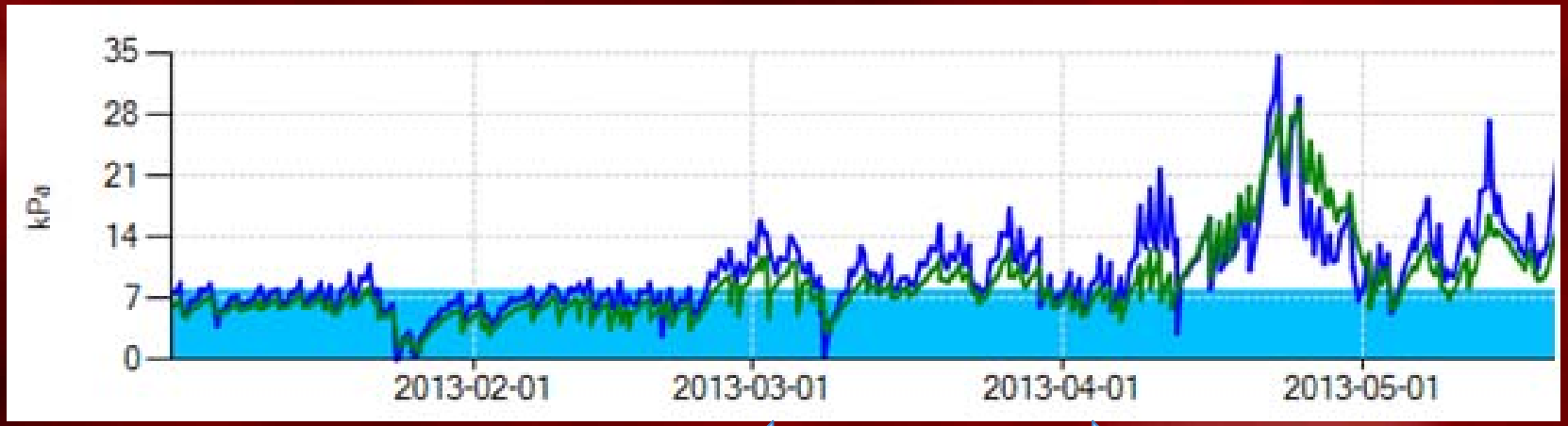
Water applied in 2013 (Oxnard) poorly efficient



Amount of water (US gallons per acre) applied in the Oxnard Study from Dec. to May 24, 2013

Evolution of tension in the dry and the wet-short treatment in Oxnard (2013) at 6’’(blue) and 12’’ (green line)

Dry



Wet-Short

City water cuts

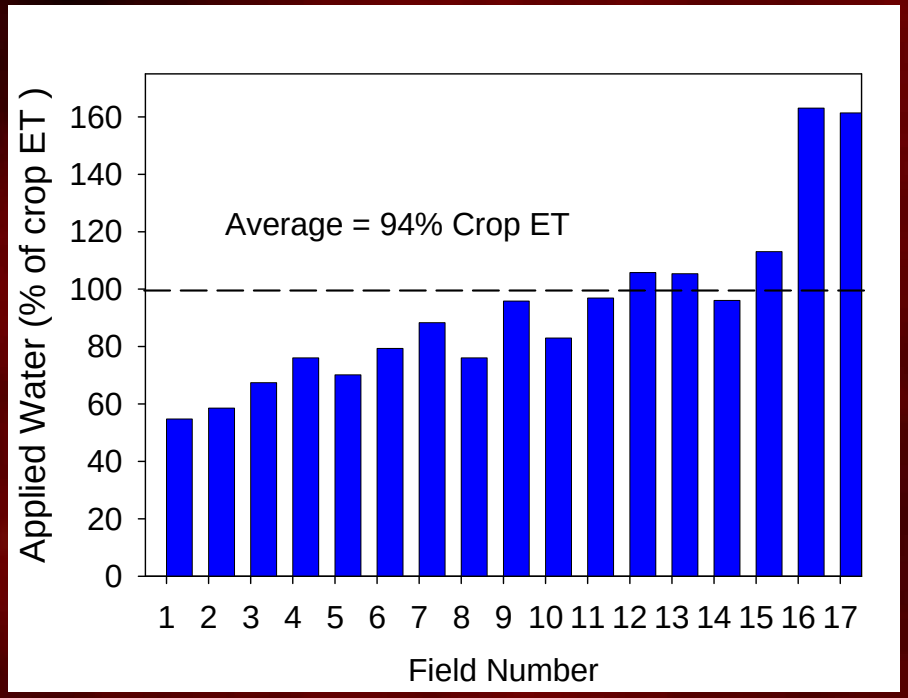
Effects of real time irrigation management on strawberry production (2011-2012):

	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	0.30	0.15	0.15
Percentage of crop ET from top yield	70	70	126

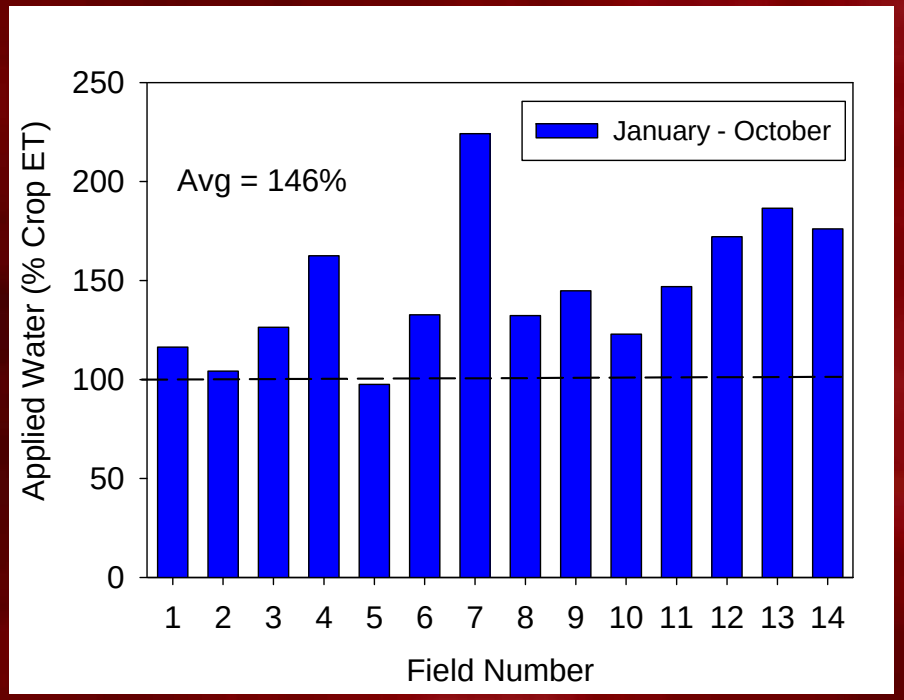
Effects of real time irrigation management on strawberry production (2013)

	Watsonville	Oxnard
Soil series	Clear Lake clay	Hueneme silty loam
Yield difference between tension treatments	(20%) 24%	6%
Optimum tension cbars	(10) 7-10	(8)13?
Acre foot/Acre difference between treatments	na	0.50
Percentage of crop ET from top yield	na	200?

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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Evaluation of irrigation regimes in Oxnard and Watsonville strawberry fields

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- Effect on yields
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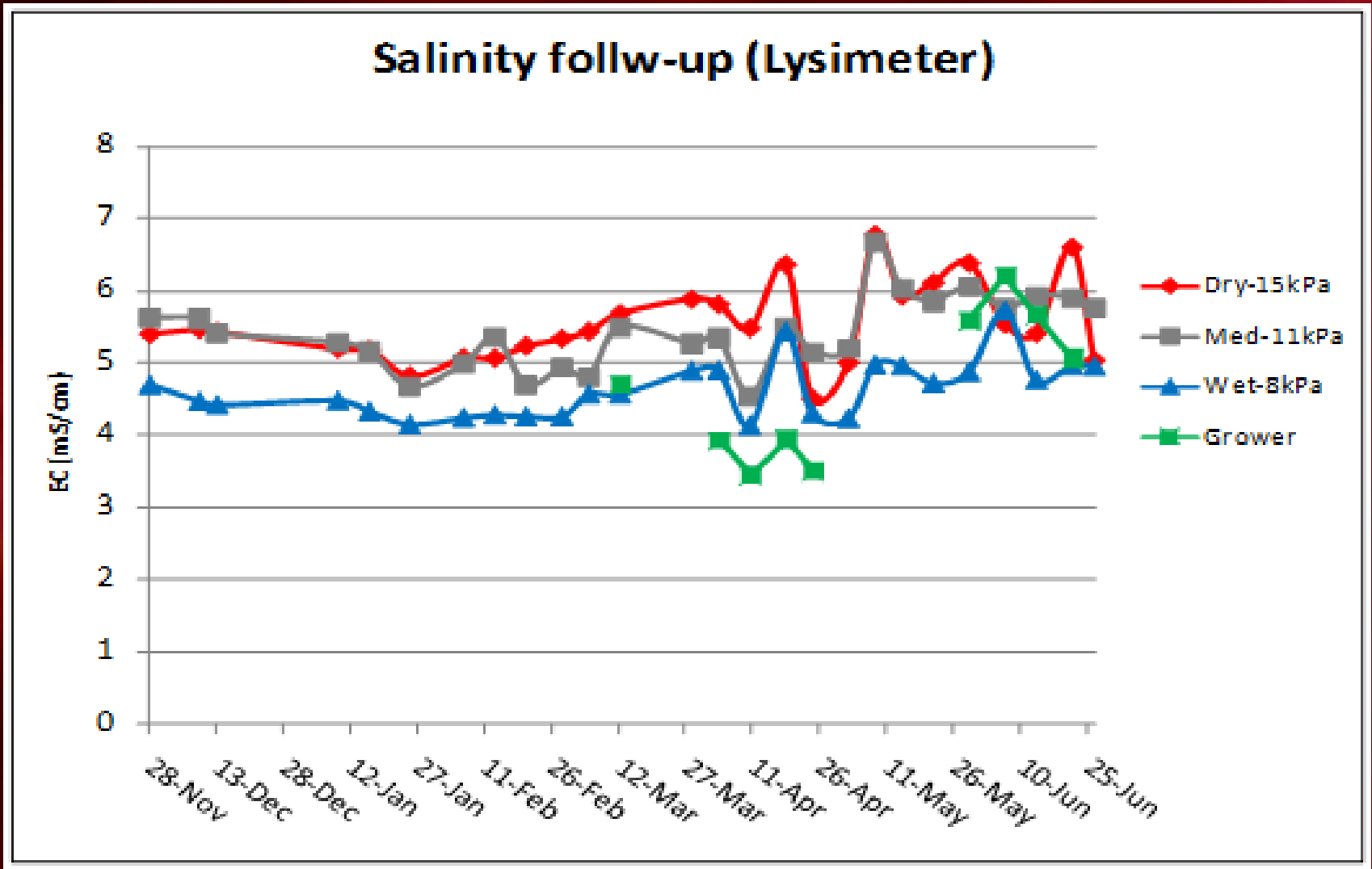
- Leaching control and reduction
- Next steps

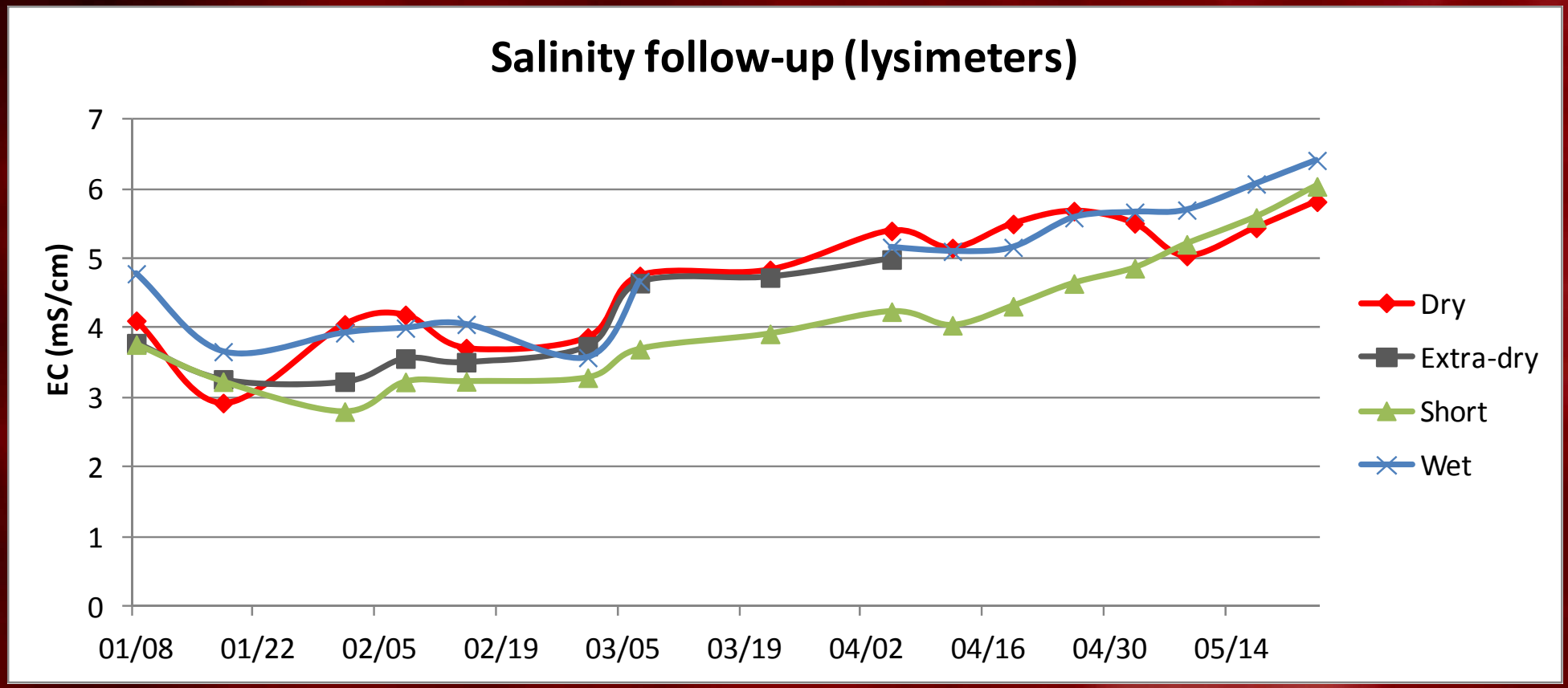
Leaching

- Ongoing in Watsonville
- Very little observed in 2013
- Runoff observed because of compaction
- Salinity increasing in all treatments (not enough leaching)

Evolution of electrical conductivity in Oxnard in 2012



Evolution of electrical conductivity in Oxnard in 2013



Evolution of tension in the dry and the wet-short treatment in Oxnard (2013) at 6’’(blue) and 12’’ (green line)

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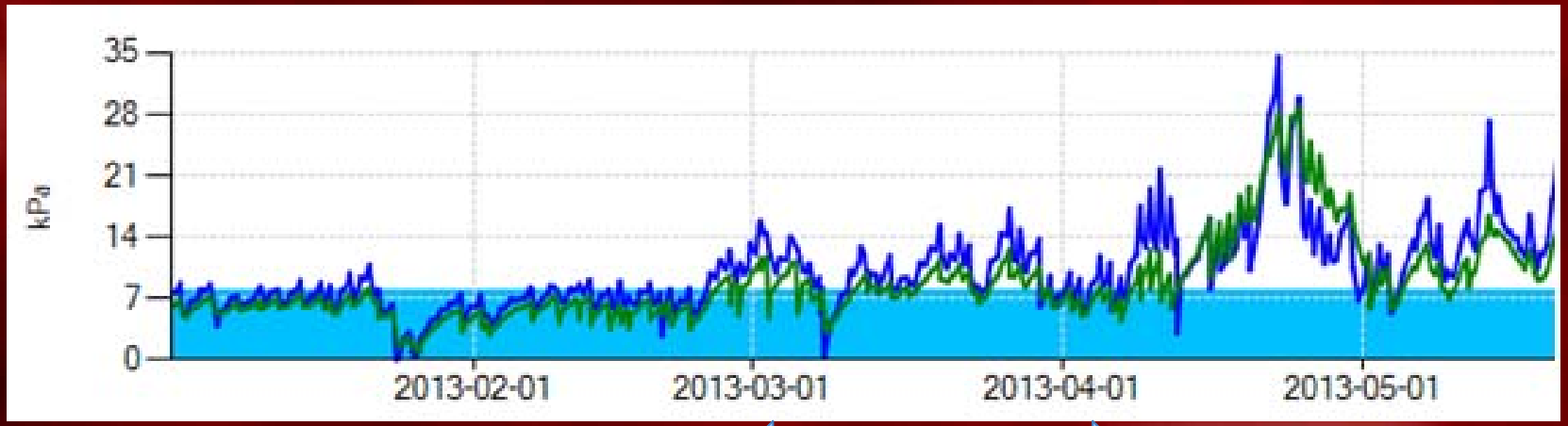

Wet-Short

City water cuts

Further work (2013-2014)

- Ongoing in Watsonville
- Enough evidence for relevance of wet threshold in peak season
- Repeat the experiment of a dry and a wet treatment for Oxnard
- Add a gradual extradry (-25 kPa) treatment early in the season to provoke deep rooting and save water, under low Crop ET, with a return to a wet threshold later
- Calculation of economical return

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Conclusions (2012-13)

Differences in tension can result in significant yield differences (17 to 24%-8,000 to 10,000 pounds/acre) in most sites, but Oxnard in 2013

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

Could possibly be run drier (30 cbars) in non-optimal conditions (compacted bed, early season with low crop ET (still to be confirmed))

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Thank you for attending

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