



Irrigating to Produce Consistent, Competitive Yields and High Quality French Prunes

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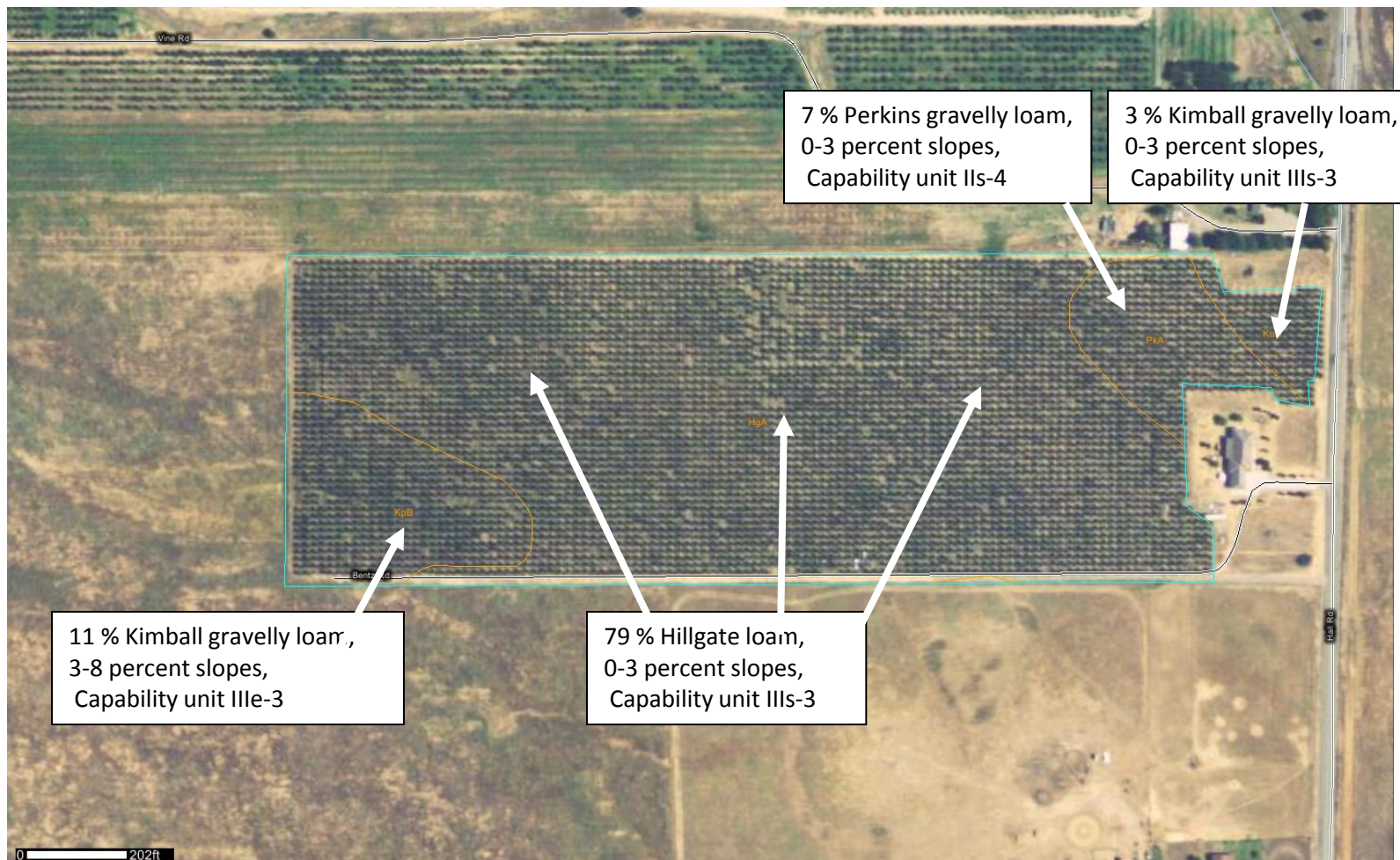
Stephen Ferguson, UC Field Research Assistant



Commercial scale case study -

- Originated from a farm call in 2007
- Demonstrated outcomes from adoption of improved irrigation scheduling techniques in French prune
- Preceded fruit thinning and sizing study
- Left with some questions

The orchard site – 28.5 acres managed by first generation grower



Other orchard features -

- Located west of Sacramento River and northeast of Corning
- 1/2 planted in 1996, other 1/2 in 1997
- Myrobalan seedling rootstock
- 183 trees per acre (17 ft between rows, 14 ft in row)
- Single line drip irrigation
 - Reliant on groundwater
 - 30 inch in-line PC emitter spacing, 5.6 emitters per tree at 0.6 gph
 - Average hourly water application rate 0.023 in/hr, 90 % DU
- Fertilizer practices
 - 500 lbs potassium sulfate banded per acre annually
 - 200 lbs N/ac annually as UAN-32 through drip system
 - Use mid summer tissue testing to adjust

Key orchard concerns -

- Small trees, too little orchard vigor
- Higher, more consistent yields
- Areas of standing water and slow water penetration
- Tree loss, long term orchard health
- “Seat of the pants” irrigation scheduling



Changes in irrigation management from 2008 through 2011

- Introduced grower to mobile irrigation lab to evaluate and understand irrigation system performance
 - Hourly water application rate
 - Irrigation distribution uniformity
- Initiate water budget using real-time ETC data
 - Basic rationale for when to irrigate and how much water to apply
- Field validate and adjust irrigation schedule
 - Monitor site specific orchard conditions and adjust for them



First approximation of weekly irrigation needs

Saturday, July 30, 2011 - Daily News 5A

Agriculture farm & ranch

WEEKLY SOIL MOISTURE LOSS IN INCHES

(Estimated Evapotranspiration)

07/22/11 through 07/28/11

West of Sacramento River			East of Sacramento River		
Weekly Water Use	Accum'd Seasonal Use	Crop (Leafout Date)	Weekly Water Use	Accum'd Seasonal Use	
1.84	26.60	Pasture	1.61	23.93	
1.77	25.71	Alfalfa	1.54	23.05	
1.38	20.10	Olives	1.20	18.08	
1.21	17.33	Citrus	1.05	15.54	
1.77	24.86	Almonds (3/1) *	1.54	22.26	
1.77	24.83	Prunes (3/15) *	1.54	22.24	
2.12	21.76	Walnuts (4/1) *	1.82	19.24	
1.72	25.06	Urban Turf Grass	1.54	22.68	

Accumulations started on March 27, 2011. Criteria for beginning this report are based on the season's last significant rainfall event where the soil moisture profile is at full capacity.

* Estimates are for orchard floor conditions where vegetation is managed by some combination of strip applications of herbicides, frequent mowing or tillage, and by mid and late season water stress. Weekly estimates of soil moisture loss can be as much as 25 percent higher in orchards where cover crops are planted and managed for maximum growth.*

0.00

Precipitation (Inches)

0.00

4.77

Accum'd Precip (Inches)

5.40

WEEKLY APPLIED WATER IN INCHES¹

50%	60%	70%	80%	90%	← Efficiency →	50%	60%	70%	80%	90%
2.8	2.3	2.0	1.7	1.5	Olives	2.4	2.0	1.7	1.5	1.3
2.4	2.0	1.7	1.5	1.3	Citrus	2.1	1.8	1.5	1.3	1.2
3.5	3.0	2.5	2.2	2.0	Almonds (3/1)	3.1	2.6	2.2	1.9	1.7
3.5	3.0	2.5	2.2	2.0	Prunes (3/15)	3.1	2.6	2.2	1.9	1.7
4.2	3.5	3.0	2.7	2.4	Walnuts (4/1)	3.6	3.0	2.6	2.3	2.0

¹ The amount of water required by a specific irrigation system to satisfy evapotranspiration. Typical ranges in irrigation system efficiency are: Drip Irrigation, 80%-95%; Micro-sprinkler, 80%-90%; Sprinkler, 70%-85%; and Border-furrow, 50%-75%.

For further information concerning all counties receiving this report, contact the Tehama Co. Farm Advisor's office at (530) 527-3101.

QUICK, WEEKLY CALCULATION OF IRRIGATION HOURS FOR WEEK OF JULY 22-28, 2011:

1.77 in. ETc – 0.0 in. rain = 1.77 irrigation needed

1.77 in. ÷ 0.023 inch/hour = 78 hours per week

78 hours x 0.85 = 66 hours per week

Consideration:

- Purposely applied less than 100 percent ETc
 - Concerned about areas of standing water
 - Allowed for stored soil moisture contribution
 - Accounted for in-season rainfall
 - Timely and moderate crop stress beneficial

QUICK, WEEKLY CALCULATION OF IRRIGATION HOURS FOR WEEK OF JUNE 24-30, 2011 WITH DIFFERENT WEATHER CONDITIONS:

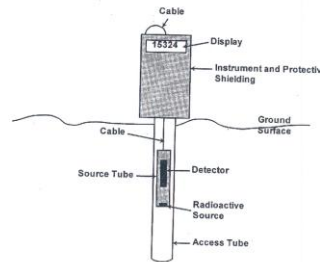
1.59 in. ETc – 0.56 in. rain = 1.03 irrigation needed

1.03 in. 0.023 inch/hour = 46 hours per week

46 hours x 0.85 = 39 hours per week

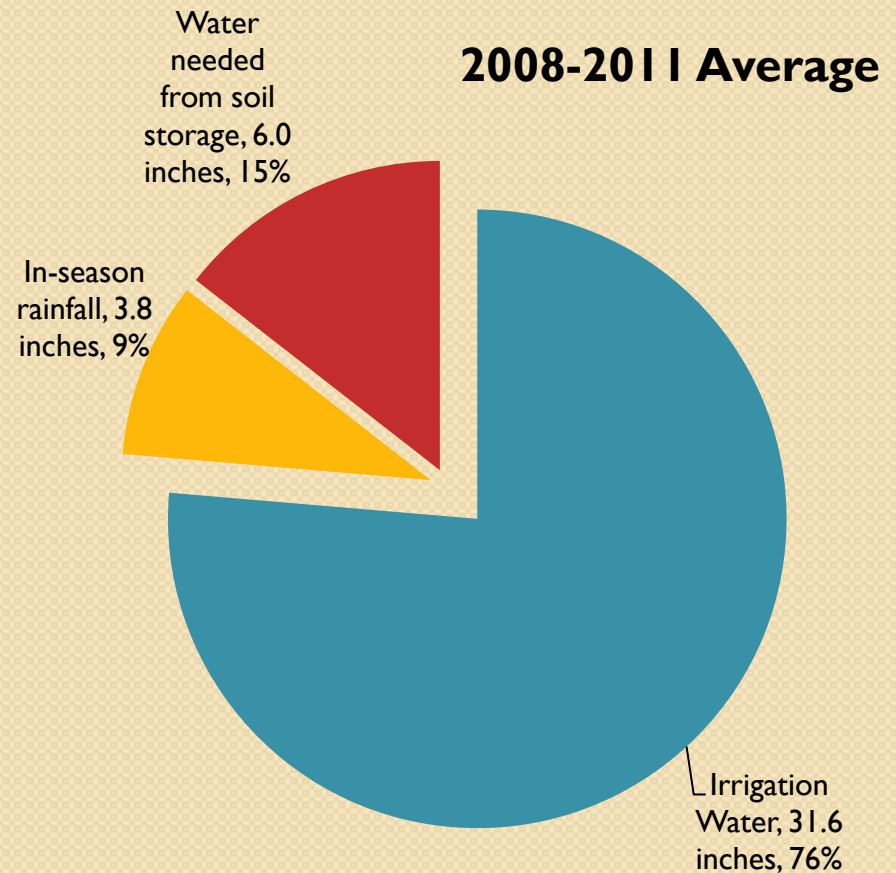
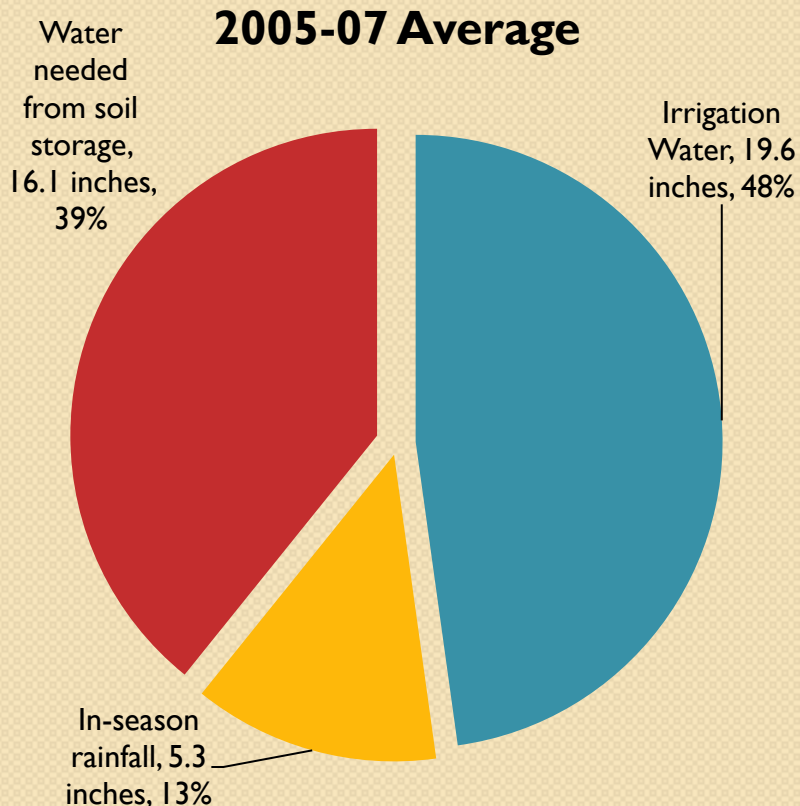
Field validate and adjust irrigation schedule

- Weekly measurement of midday stem water potential (SWP) with pressure chamber
- Weekly measurement of volumetric soil moisture content six feet deep

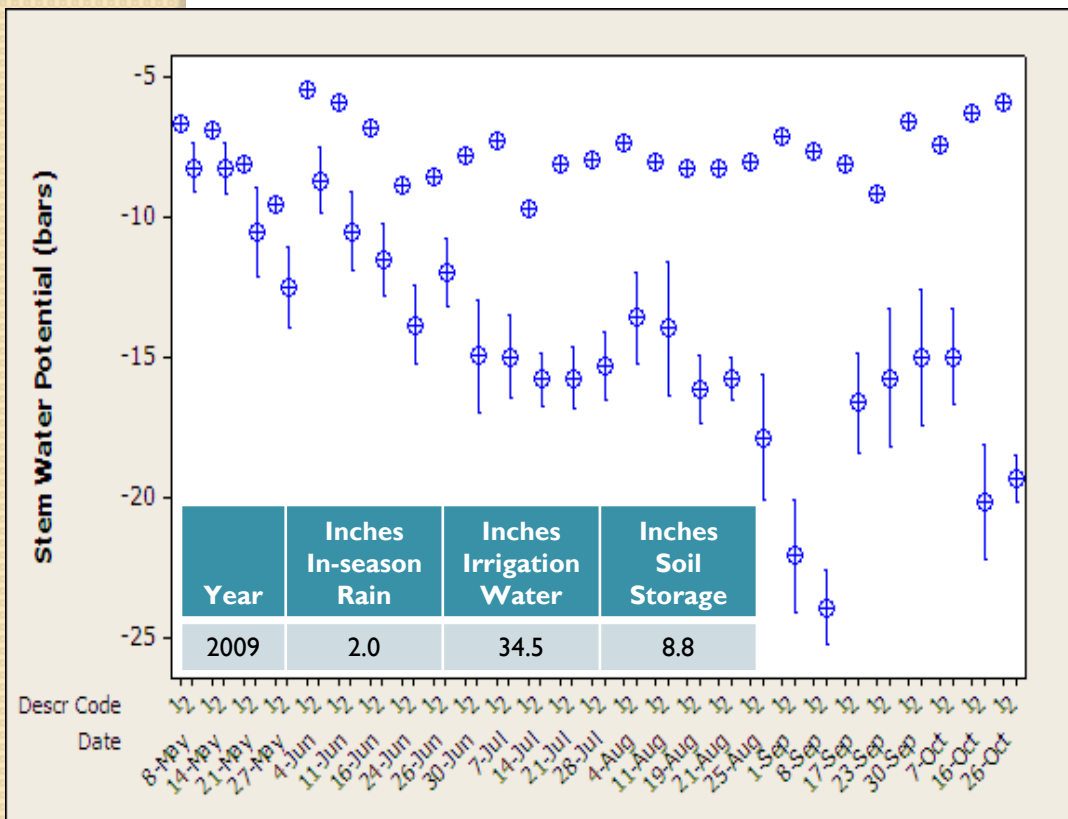


Comparison of Irrigation Management in 2005-07 versus 2008-11

Assumption: Seasonal ETc average 41.0 inches



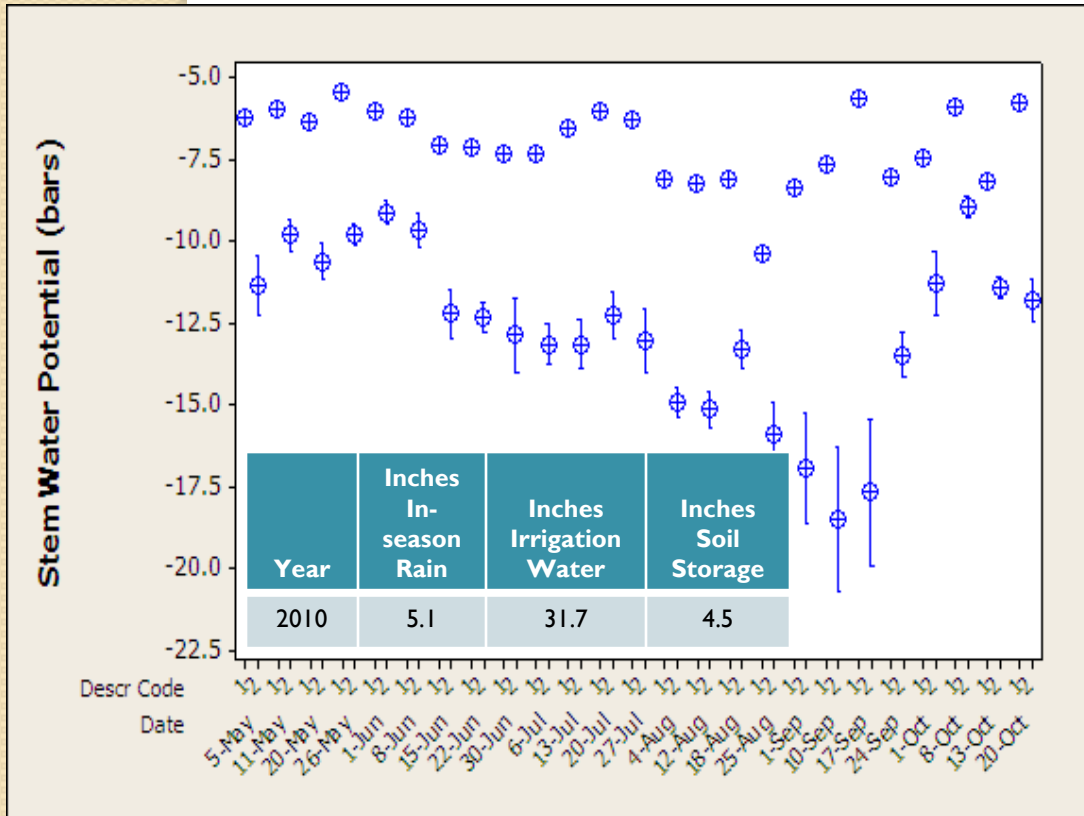
2009 Baseline and Orchard Stem Water Potential (SWP) with 95 % Confidence Interval for the Orchard SWP Mean



Pressure Chamber Reading (- bars)	PRUNES
0 to -6.0	Not commonly observed
-6.0 to -8.0	Low stress, common from March to mid April under fully irrigated conditions. Ideal for maximum shoot growth.
-8.0 to -10.0	Suggested levels in late April through mid June. Low stress levels enabling shoot growth and fruit sizing.
-10.0 to -12.0	Suggested mild levels of stress during late June and July. Shoot growth slowed but fruit sizing unaffected.
-12.0 to -16.0	Mild to moderate stress suggested for August to achieve desirable sugar content in fruit and to reduce "dry-away" (drying costs).
-16.0 to -20.0	Moderate stress acceptable in September.
-20 to -30	Moderate to high stress levels. Most commonly observed after harvest. Generally undesirable during any stage of tree or fruit growth. Most appropriately managed with post-harvest irrigation
Less than -30	High stress, extensive defoliation

* These guidelines are tentative and subject to change as research and development with the pressure chamber and midday stem water potential progress. This table should not be duplicated without prior consent by the authors.

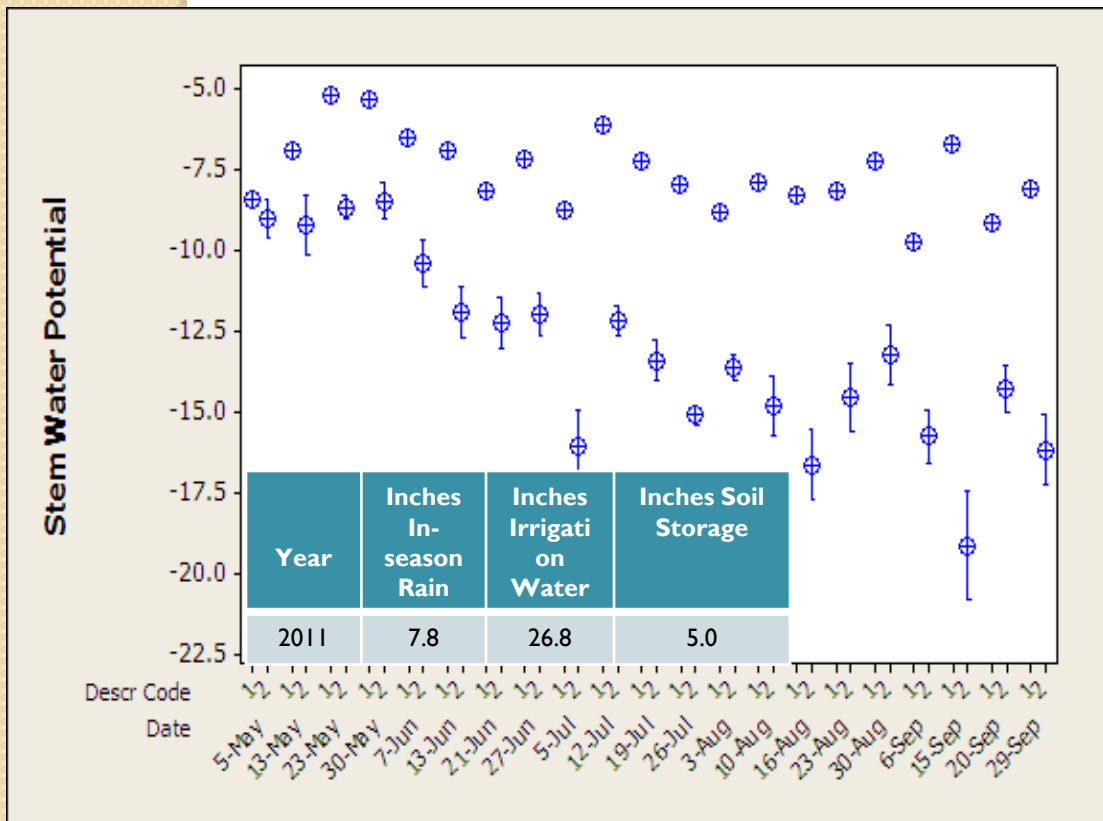
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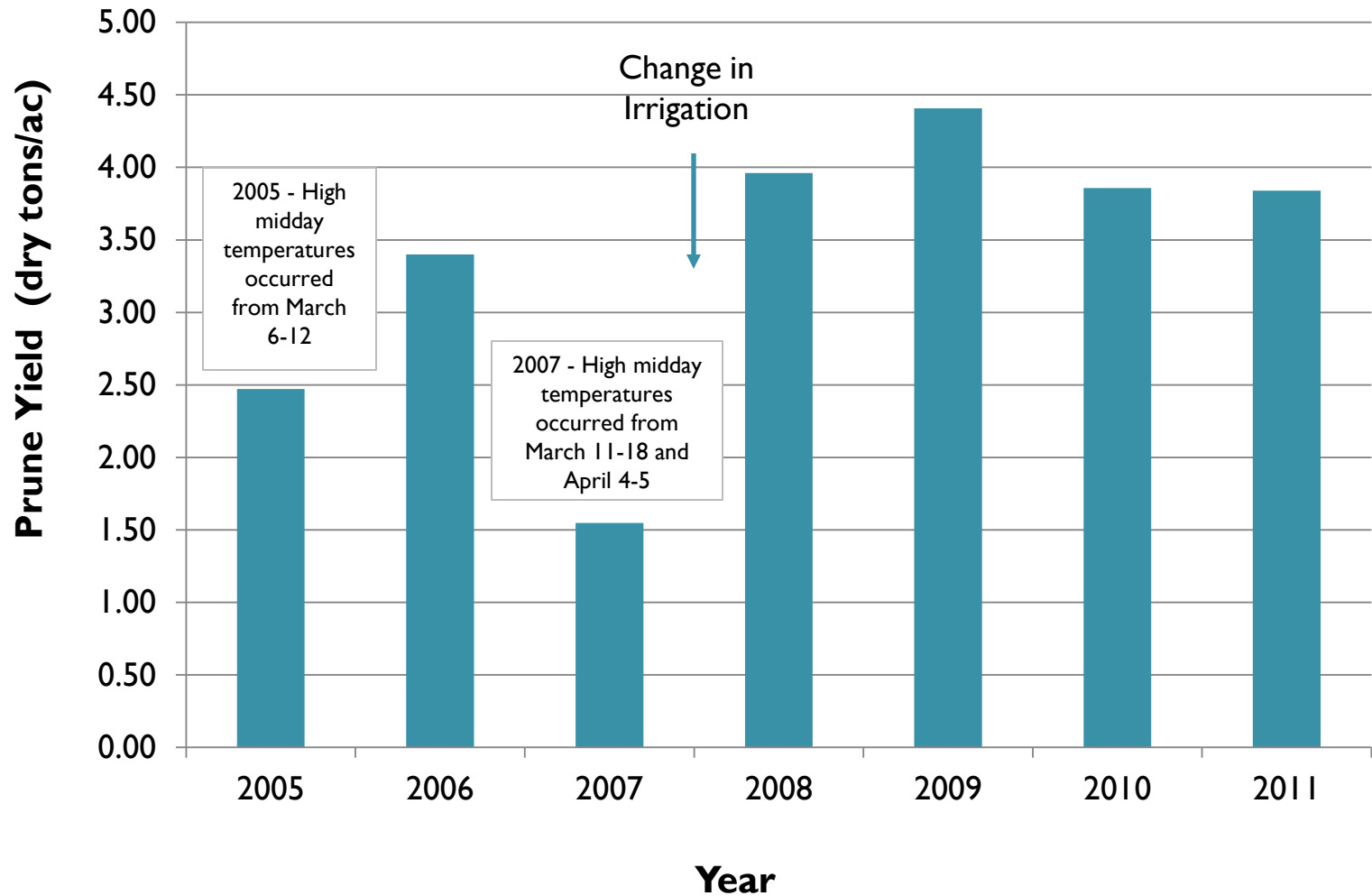
2011 Baseline and Orchard Stem Water Potential (SWP) with 95 % Confidence Interval for the Orchard SWP Mean



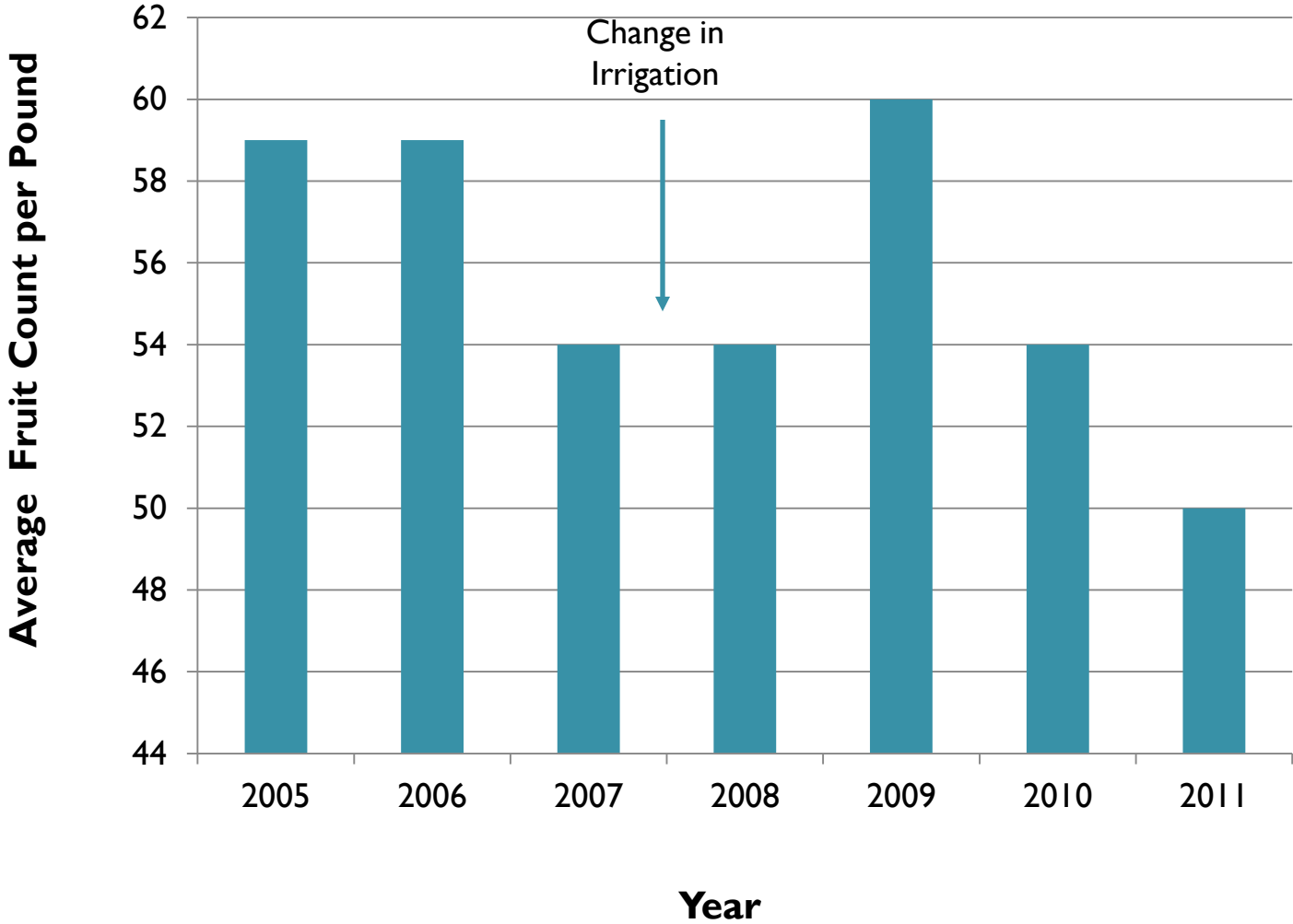
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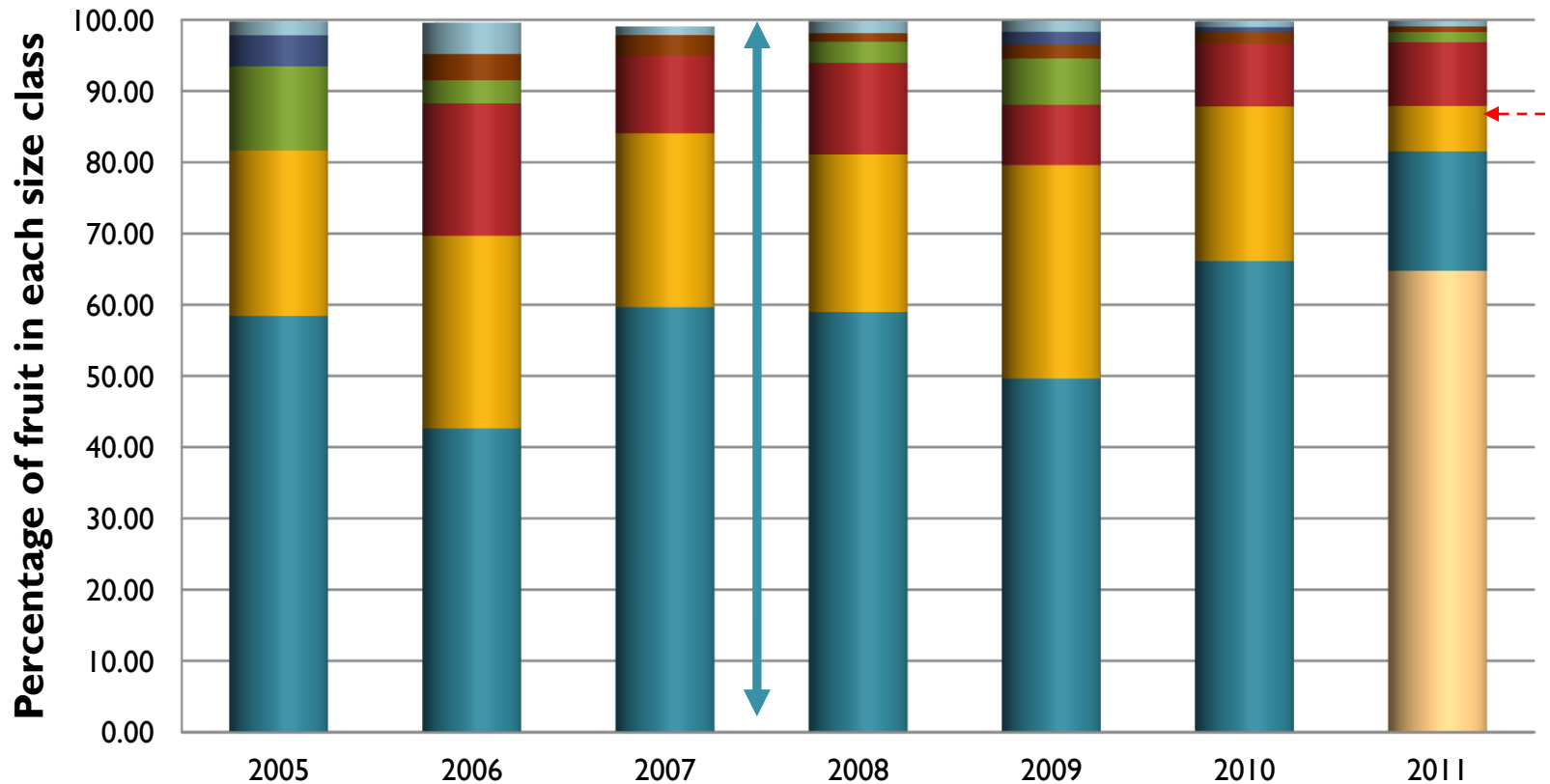
Yield trend after four years of modified irrigation management.



Trend in average fruit count after four years of modified irrigation management.

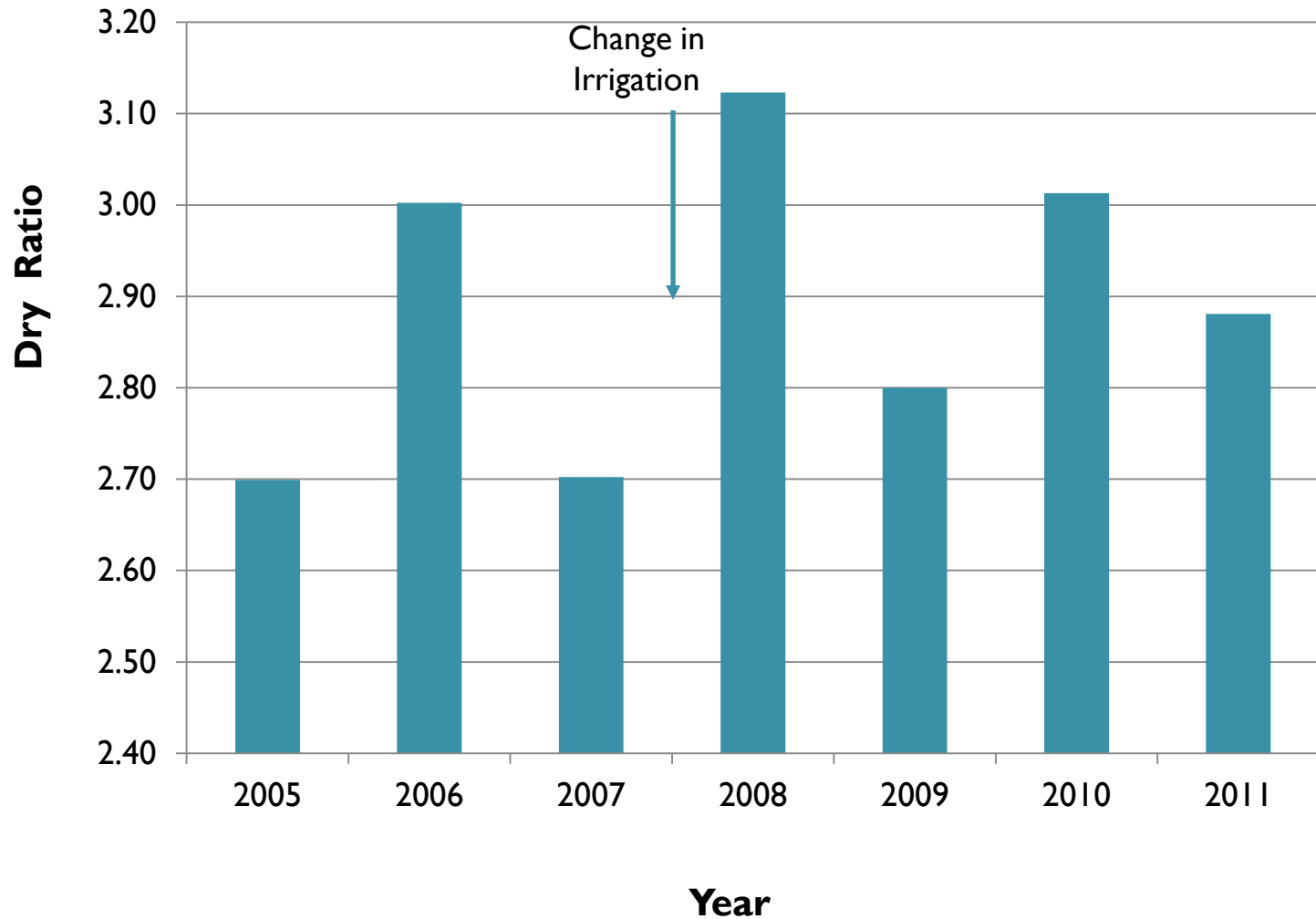


Trend in fruit size distribution after four years of modified irrigation management.

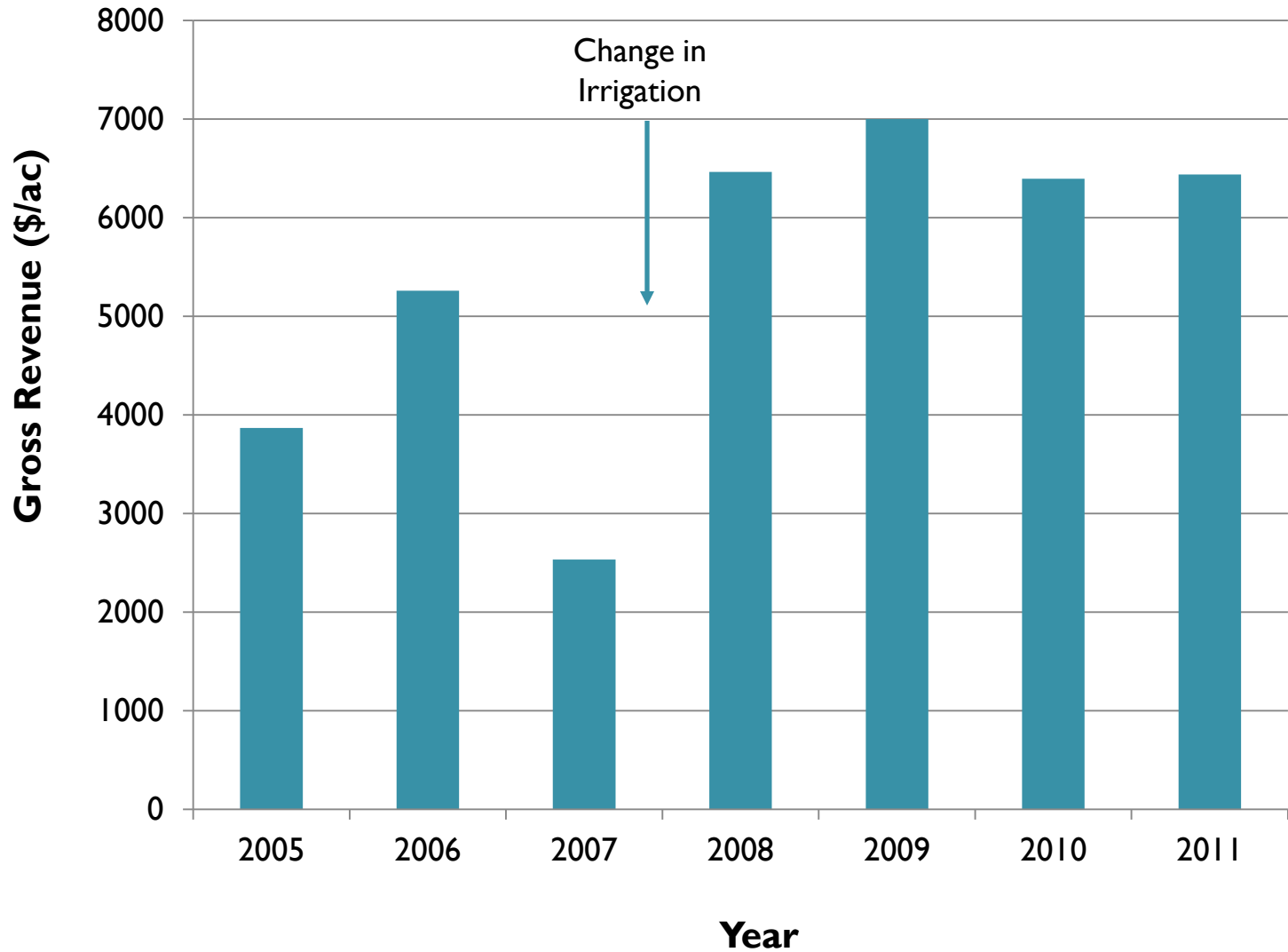


	2005	2006	2007	2008	2009	2010	2011
Under Size	1.97	4.40	1.21	1.67	1.53	0.80	0.77
097/111	4.36	0.00	0.00	0.00	1.81	0.65	0.00
087/096	0.00	3.69	2.95	1.20	1.94	1.64	0.76
077/086	11.81	3.25	0.00	2.94	6.49	0.00	1.44
067/076	0.00	18.57	10.83	12.86	8.46	8.85	8.95
057/066	23.24	27.07	24.42	22.12	29.98	21.69	6.38
046/056	58.40	42.62	59.64	58.98	49.62	66.13	16.77
034/045	0.00	0.00	0.00	0.00	0.00	0.00	64.75

Trend in dry ratio of prunes after four years of modified irrigation management.



Trend in gross revenue after four years of modified irrigation management.



Effect of Change in Irrigation Management on Tree Loss and Long Term Orchard Health

July 2005



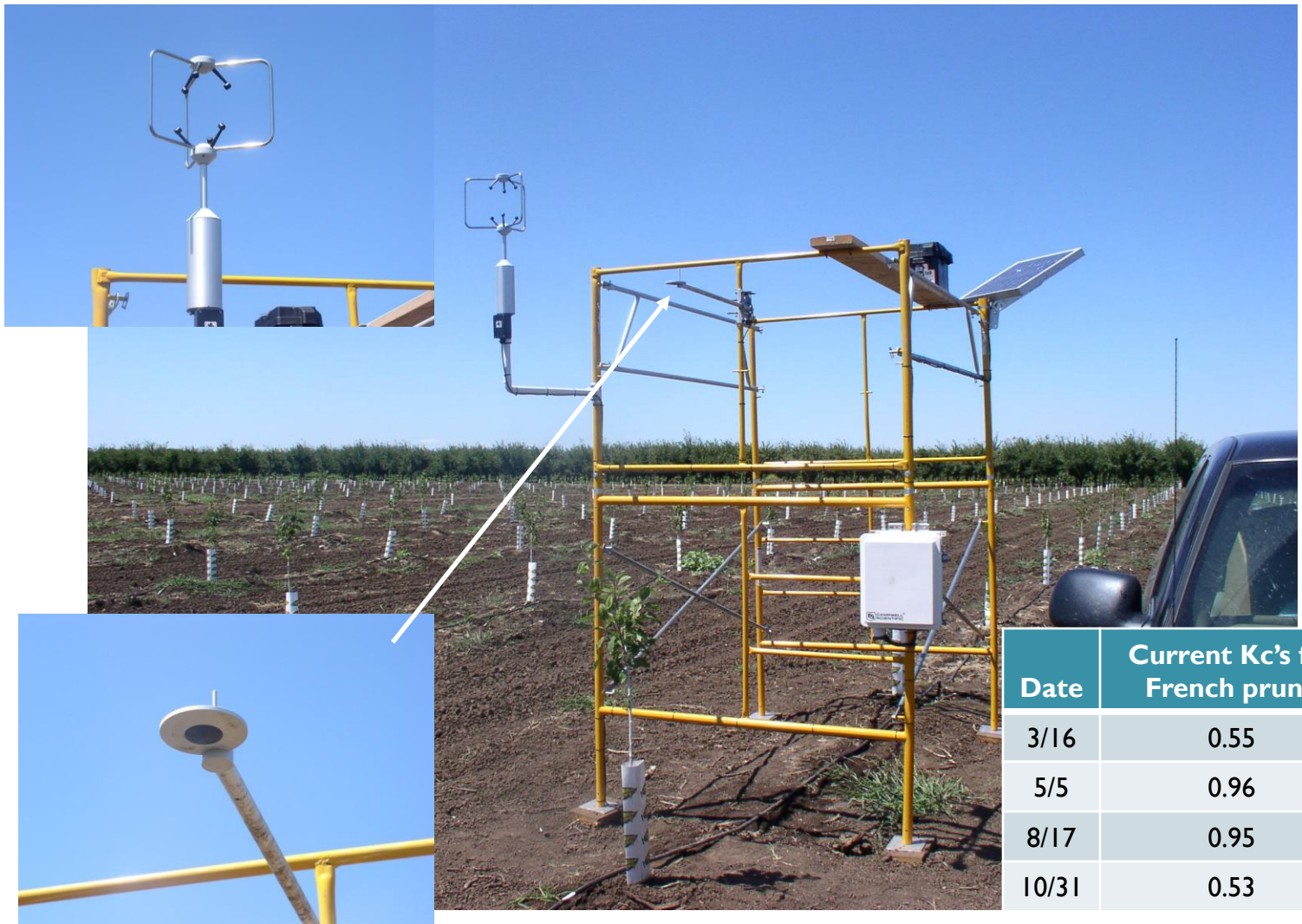
July 2011





Some Questions

Are the Crop Coefficients (Kc's) for French prune current?

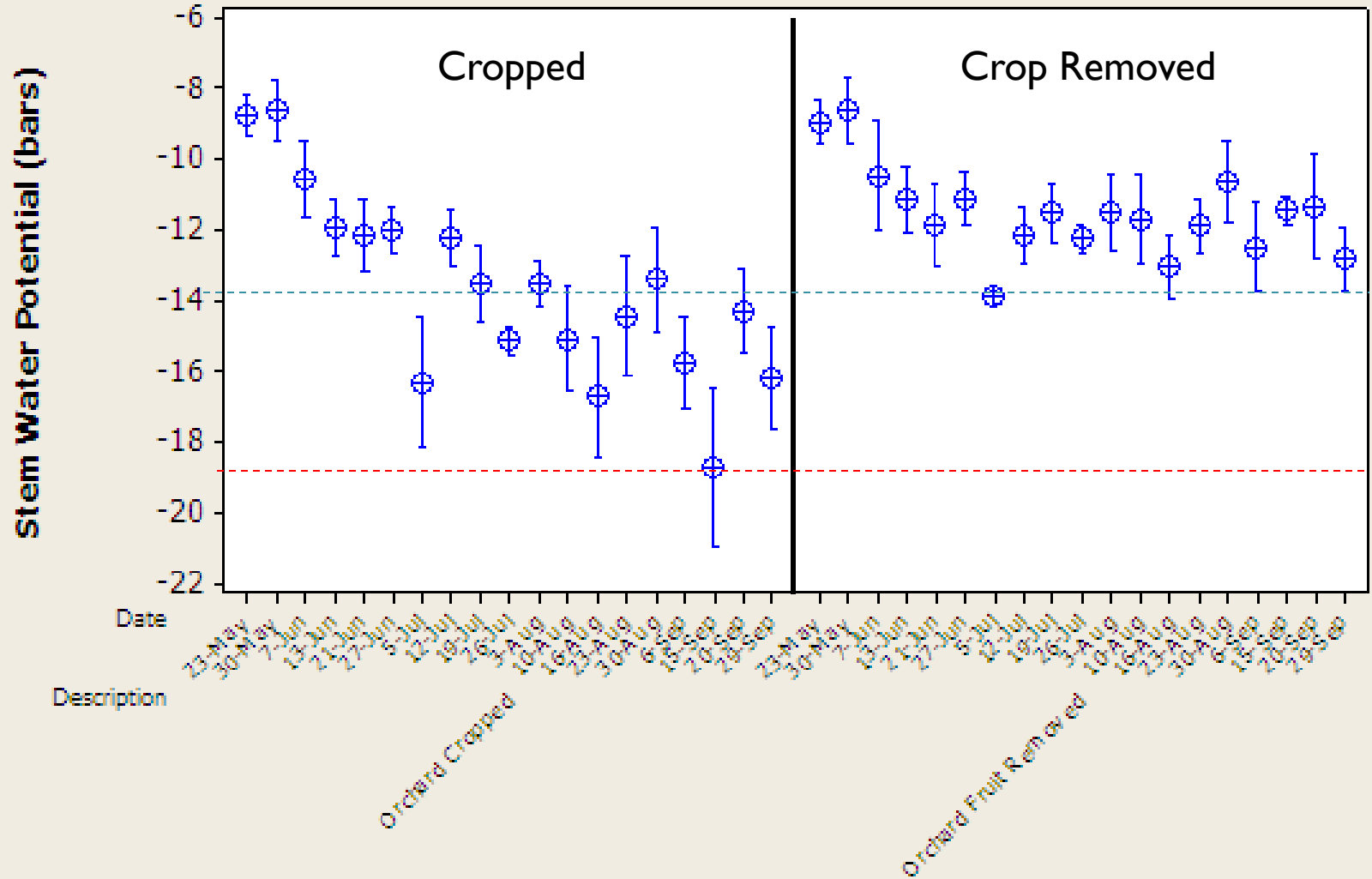


Date	Current Kc's for French prune
3/16	0.55
5/5	0.96
8/17	0.95
10/31	0.53

Does Crop Load Affect Orchard Water Stress (Midday SWP) in French Prune?



Effect of 2011 Crop Load on Midday SWP



Can irrigation management overcome too much crop load?

Time to pass the baton to Rick



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Thank you!

Buchner Effect of Fruit Thinning on
Fruit Size and.ppt