Using SWP to Delay the Start of Irrigation in the Spring

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Problem and its Significance:

Recent results in walnut (highly sensitive to water stress) have demonstrated that delaying the start of irrigation in the spring, based on SWP, can substantially reduce overall seasonal water application (10 – 20 inches, depending on the year), with no long term effect on crop yield, and a general improvement in tree appearance. These delays, which varied from 1 to 2 months after the grower's normal start of irrigation, were also associated with small but measurable (5-10%) increases in crop load and nut quality (edible yield). Soil measurements indicated that these trees used stored soil moisture to compensate for the irrigation deficit. However, counter to expectations, this use of this soil moisture did not result in water stress at harvest, in fact, trees in the delayed treatments were less stressed at harvest compared to control trees. In almond, Prichard reported that a plant-based deficit irrigation regime gave higher yields than an ET-based deficit irrigation applying the same water, and it has become widely recognized that SWP is valuable for deficit irrigation approaches. However, this recent data in walnut may also be the first example of standard ET-based irrigation scheduling resulting in over-irrigation..

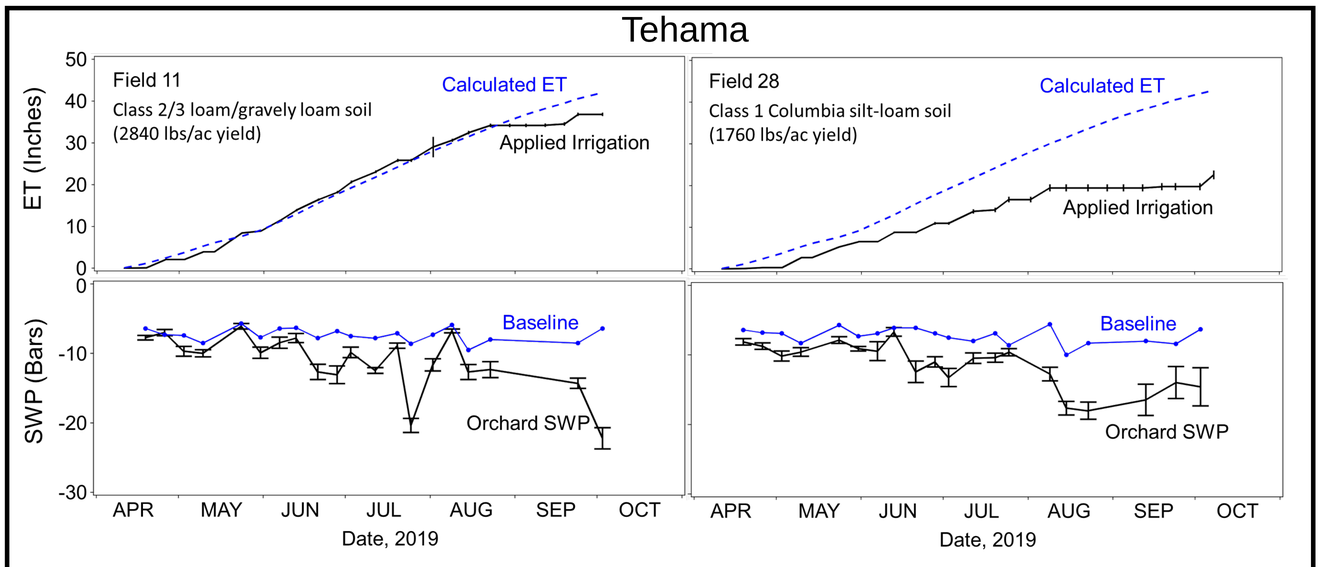
Objective:

- (2019) collect pre-treatment data on grower irrigation management, SWP, PAR, and yield at north (Tehama) and mid-south (Modesto) commercial almond sites.
- (2020) Establish and instrument plots at each site to compare grower control irrigation to between 1 and 4 levels of delay, determined by different threshold levels of (SWP-Baseline SWP).
- (2020/21) Monitor SWP, manage irrigation to achieve each threshold, measure yield and kernel size/quality.

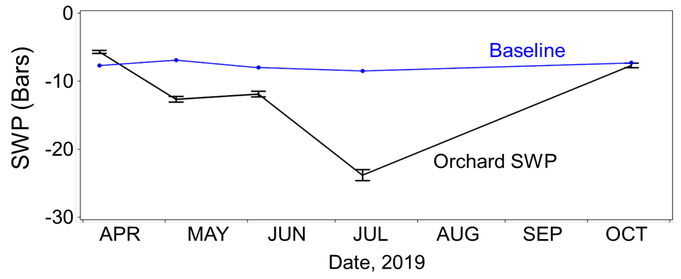
Materials and Methods:

Applied water, SWP, and yield data were collected to serve as a baseline condition for evaluating field uniformity and designing treatments for 2020.

Results and Discussion:



The 2 sites in Tehama Co. are on contrasting soils: the grower closely matched ET with irrigation over the season in the shallow soil (field 11), whereas ET was not matched in the deep soil at any time (Field 28). Field 11 trees experienced substantial stress (-20 bars) when applied irrigation did not match the calculated ET, but Field 28 trees were able to tolerate a substantial period of no irrigation without reaching this level. Interestingly, crop yield was substantially higher in field 11.



Yield (kernel lbs/ac)		SWP (bar)	
Rep	Mean	Rep	Mean
1	2950	3	-11.7
4	2450	4	-12.2
3	1820	2	-12.5
2	1800	1	-13.1

Trees at the Modesto Co. site were substantially above baseline SWP in April, but fell to relatively severe levels by mid-July (left hand graph, irrigation data not yet available). At this site we did find significant within-orchard (i.e., rep-to-rep) differences in yield due to field position, with rep 1 having the highest and rep 2 the lowest yields (right hand table, lines indicate statistically significant differences). Interestingly, we also found significant within-orchard SWP differences, but in this case the largest difference were between reps 1 and 3. Interestingly, rep 1 had the highest yield and the lowest SWP, which is the same as the trend we saw in Tehama.

Conclusions:

Since irrigation delay treatments have not yet been imposed, no conclusions can be reached, but it should be possible to delay the start of irrigation at all sites, since all sites show close to baseline SWP values early in the season.