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University of California
Agriculture and Natural Resources
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UCCE

Kern Soil & Water

June 2014

KERN UCCE ALMOND IRRIGATION FIELD MEETING

Lerdo Hwy and I-99 NE (map pg.7) 9am-12pm June 20, 2014

Think of all the pie-in-the-sky "advanced" irrigation techniques you've heard people talk about over the years – fully automated on/off timing, differential application rates for different production potentials across the orchard (precision irrigation), "pulsed" vs continuous irrigation (ie. 3 hours on Set1 then 3 hours off while Set2 goes on for 3 hours, then back to Set1, etc. so that you get 24 hours on each set over 48 hours instead of a straight 24 hours Set1 then 24 hours Set2.), automatic on-demand irrigation triggered by soil moisture depletion/tension or triggered by plant stress (infrared canopy temperature in this case). Well, we finally have a trial where we are attempting to put all these things to the real test. This field meeting is your chance to see this trial, see some new technology and discuss system management alternatives for optimal irrigation.

TOPICS

1. **Kern Almond ET Production Function (ETPF) Trial (eastside, Almond Board funded)**
   - Yield/stress impacts of variable irrigation rates of 70, 80, 90, 100 and 110% ET, pulsed vs. continuous irrigation, automated irrigation, soil moisture monitoring (neutron probe, tensiometers, web-based continuous monitoring)
   - Plant-based stress monitoring and irrigation scheduling
     - Pressure chamber – stem water potential (SWP)
     - Tree dendrometry (measuring trunk shrink/swell) – Phytech continuous web-based
     - Canopy temperature – In-situ tree infrared Smartfield continuous web-based reporting
     - Aerial survey of canopy IR temp and NDVI – CERES

2. **Kern Almond "Longevity" Trial under different N and irrigation rates (westside)**
   - Yield/stress/disease impacts of variable irrigation rates of 48 vs 56 inches and applied N of 125, 200 and 275 lb/ac

3. **Kern Almond High-Frequency-Low-Concentration "Spoon-feed" fertilizer trial (westside)**
   - Comparison of a variety of K fertilizers applied in every irrigation (spoon-feed) vs. 4 times/year episodic fertigation more typical of SJV almonds. UN32 is uniformly applied at 300 lb/ac N for the season. This trial is generously funded by the Potassium Nitrate Association through special support from Haifa Chemical and SQM Fertilizers.
   - Statistical comparison of double-line drip to static spray Fanjets

4. **Distribution uniformity evaluation and field system management**
   - What does DISTRIBUTION UNIFORMITY (DU) mean?
   - Realistic DU's for Kern Micro-irrigation systems
   - How to manage in-field pressure regulation: automatic or manual valves?
   - Field evaluation of DU: **Kern County Mobile Irrigation Lab – Brian Hockett** of the NW Kern Resource Conservation District can evaluate the uniformity of your system and identify problems and possible corrections. **661-336-0967 ext 138 or email: brian.hockett@CA.nacdnet.net**
   - For some tips on Micro Irrigation Systems Tune-up the link is: http://cekern.ucdavis.edu/files/98690.doc

Defining a Central Valley ET/Yield Production Function for Almonds

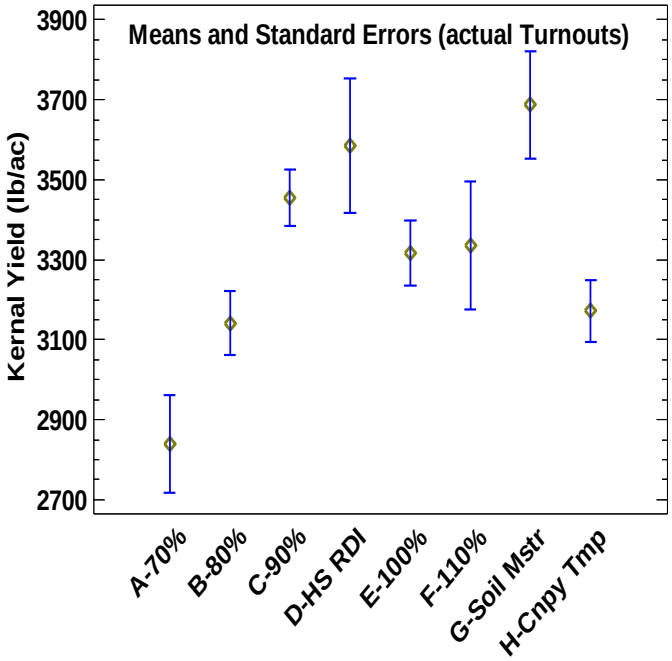
Kern - Blake Sanden, Merced – Dave Doll, Tehama –Allan Fulton, Ken Shackel – UC Davis

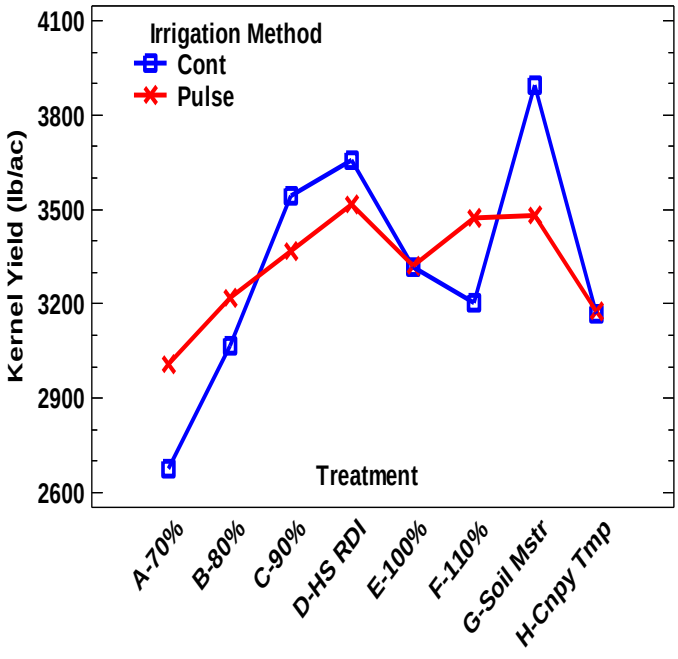
Kern County Site Trial (largest effort of all 3 counties)

a. **Objectives**

1) Quantify **kernel yield in lbs/inch actual ET** (applied water + soil moisture depletion – leaching) under non-limiting fertility levels by varying depths of applied irrigation and using various continuously monitoring plant and soil sensor technologies to provide irrigation scheduling "triggers" for precision irrigation.
2) Quantify the interaction of hull-split Regulated Deficit Irrigation on the yield function. Use precision irrigation scheduling to maintain uniform RDI plant stress across varying soil types.
3) Assess long-term tree health given differing amounts of applied water and scheduling methods.
4) Assess the yield benefit of "pulsed" vs. continuous irrigation and automated, high frequency irrigation driven by plant-based measurements.
5) Assess the feasibility, final water use and yield of high frequency "on-demand" plant stress and soil moisture triggers for irrigation scheduling

Eastside ET Yield Trial (8th leaf) 2013 YIELDS (1ST year of treatments)





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Almond Orchard Profitability & Longevity Under Differential N Fertility & Irrigation

(Follow-up to Brown fertility trial Westside) Blake Sanden, Patrick Brown, Ken Shackel, Bruce Lampenin

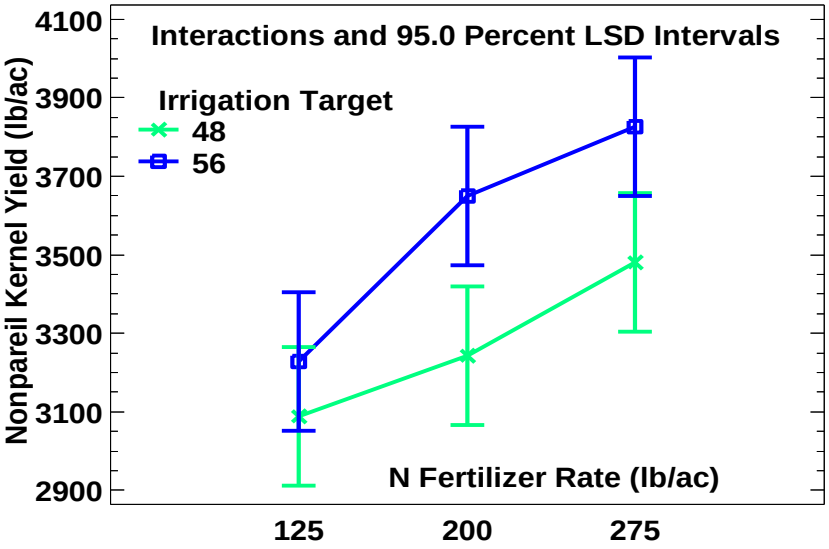
Objectives: Using the existing Belridge fertility trial site (Ranch 336 Block 12-2) document:

1. The degree of long-term alternate bearing, which may develop after several years of high yields followed by a very low yield. Is this a one year carbohydrate recovery or the start of a regular "on-year /off-year cycle"?
2. Determine the impact of differential N fertilizer rates and two rates of conservative to full irrigation on long-term yield, tree health/decline and orchard longevity.

3. Track nitrogen and water use efficiency (NUE and WUE) of respective treatments.
4. Estimate overall profitability and final efficiency of each treatment for the life of this orchard (18-24 years?) given cumulative yields and tree decline.

Treatments: **3 N rates:** 125, 200 and 275 lb/ac (continued on same rate plots from last 5 years)
2 irrigation rates: 48 inch (PFC standard), 56 inch (Sanden ET)

2013 YIELDS
Westside Longevity Trial (15th leaf)



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Suitability of potassium nitrate and continuous fertigation under drip and microsprinkler irrigation to optimize California almond productivity

Blake Sanden, Andres Olivos, Patrick Brown, Ken Shackel, Bruce Lampinen

Collaborators: Haifa Chemical, SQM, Potassium Nitrate Association (providing funding), Paramount Farming Company, Grundfos Pumps Bowsmith Irrigation, Toro Irrigation

Why this trial

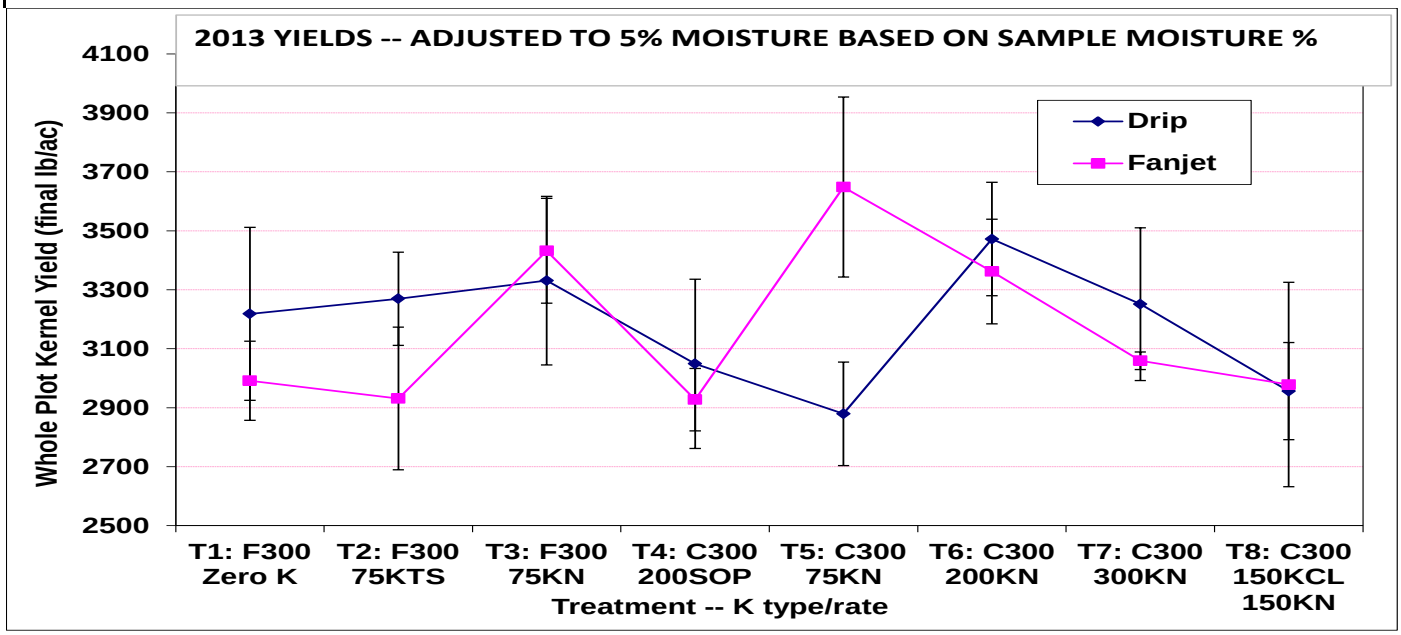
- Nutrients should be provided in a continuous supply more coincident with tree/nut accumulation.
- In the late maturity fruit stage there is a relatively greater demand for K than for N.
- Potassium applications in Almond are generally too low to replace total K removal.
- SOP remains the predominant K source and is generally applied as a banded winter or spring application.
- Continuous fertigation (every irrigation) is uncommon but could provide additional benefit
- K Nitrate is not widely used in CA

Objectives:

1) Determine the benefit of K fertilizer to both Nonpareil and Monterey varieties
2) Determine the impact of episodic (4 times/season) versus continuous fertigation under microsprinkler and double-line drip irrigation
3) Determine the effect of fertigation regime on K reaction in soils.
4) Determine the effect of fertigation regime and variety on crop ET and stress
5) Introduce and validate the concept of continuous nutrient feeding in Californian almond production

FERTILIZER TREATMENTS

F300-0	1: No K, 300 lbs N as UAN in 4 in-season fertigations 20% Feb, 30% April, 30% June, 20% post harvest.
F300-75KTS 125 SOP	2: 200 lb K. 125 lb K as SOP band February, 75 lb as KTS and 300 lb N as UAN in 4 fertigations 20% Feb, 30% April, 30% June, 20% post harvest (Grower Standard).
F300-75KN 125 SOP	3: 200 lb K. 125 lb K as SOP band February, 75 lb as KNO3 and 273 lb N as UAN in 4 in season fertigations 20% Feb, 30% April, 30% June, 20% post harvest.
C300-200SOP	4: 200 lb K as SOP dissolved in gypsum mixer and 300 lbs N as UAN (total N 300), continuous application.
C300-75KN	5: 200 lb K. 125 lb K as SOP in band February, plus 75 lb K as KNO3 and 273 lb UAN continuous.
C300-200KN	6: 200 lb K as KNO3 and 193 lbs N as UAN (total N 300) as continuous application.
C300-300KN	7: 300 lb K as KNO3 and 128 lbs N as UAN (total N 300) continuous.
C300-150 KCl 150 KNO3	8: 150 lb K as KCL, 150 lb K as KNO3, 248 lbs N as UAN continuous fertigation.



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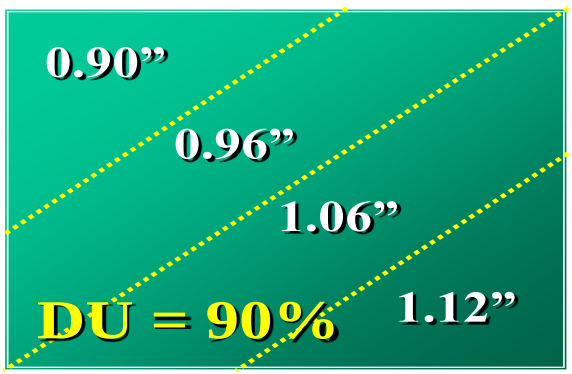
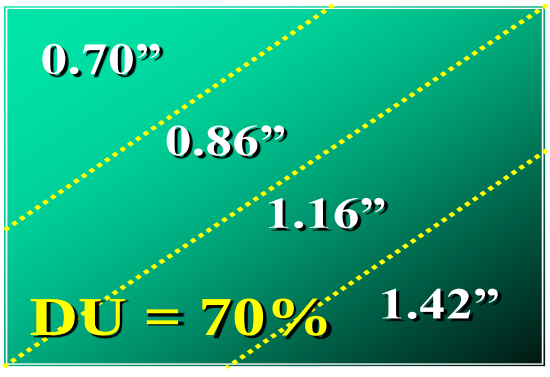
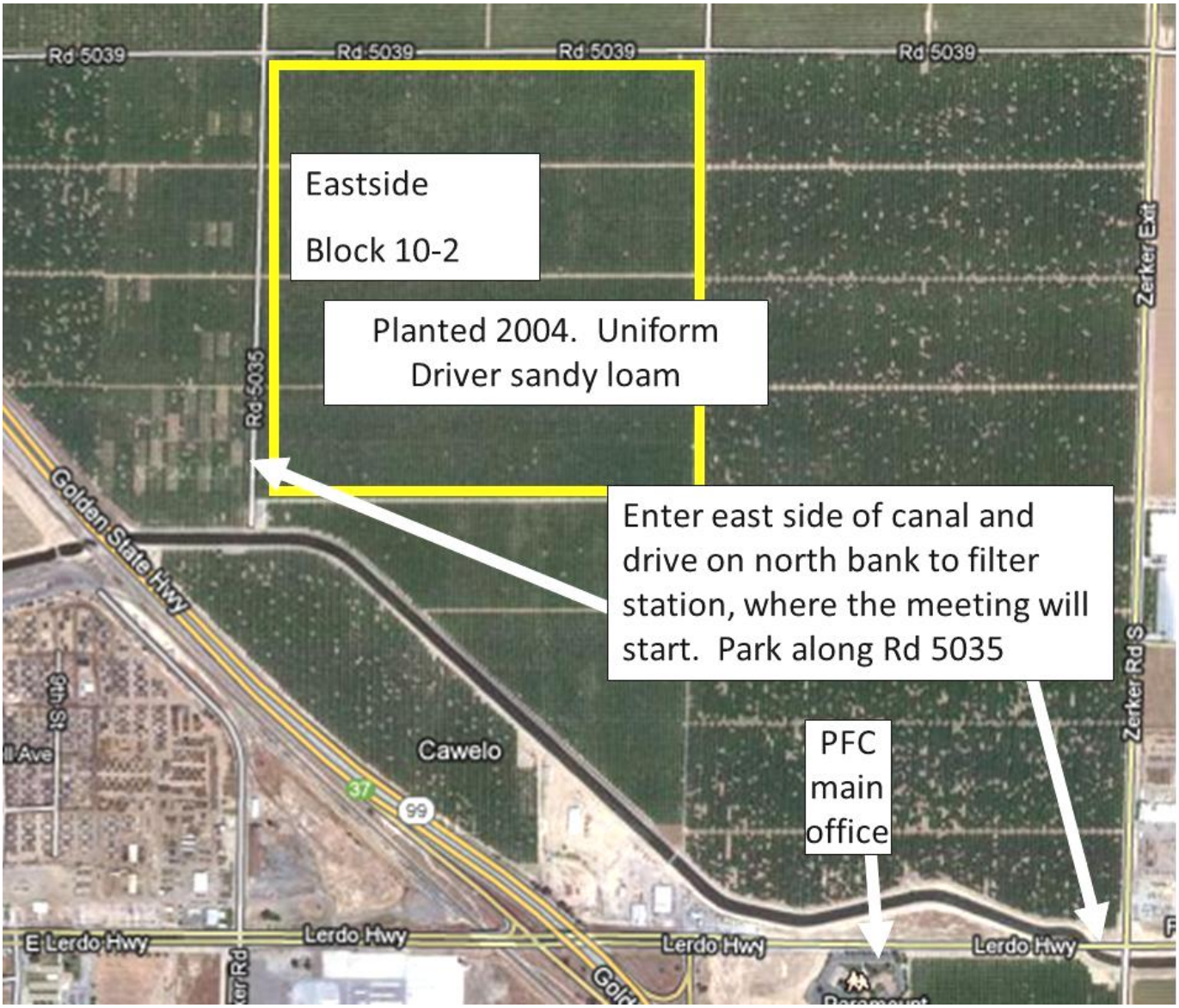
- **Distribution Uniformity = Average of low 1/4 / All Field Average**

Target Application = 1.0 inch





MAP TO ALMOND IRRIGATION FIELD MEETING JUNE 20, 2014 9am-12pm



DROUGHT RESOURCES

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REGULATED DEFICIT IRRIGATION (RDI)

The concept here is to find physiologic periods of crop development where water stress won't hurt the crop and can even benefit the development of certain characteristics. Wine grapes are the most famous for this as color and flavor of the grapes can be improved for most varieties by mild to severe stress in some cases. Of course, the more the stress the less the tonnage. Reduced ET means reduced CO2 assimilation and reduced carbohydrate production. This is why deficit irrigation for annual forage crops is not even an option since you get paid on the vegetative tonnage you produce.

RDI pros: Water stress through RDI has been shown to be helpful on increasing fruit set in canning tomatoes , decreasing "puff and crease" in late navels, reducing hull rot and advancing hull split in almonds and possibly weakening shell seal in pistachio to increase split percentage.

RDI cons: Deficit irrigation has also been shown to decrease second year yields of Early Beck navel oranges in Kern County (Craig Kallsen and I achieved this dubious result in Wheeler Ridge.), decrease nut size in the current year almond crop and decrease nut load the following year. It has also been shown to decrease split % and nut size/yield in pistachios.

Bottom line: RDI in almonds for decreasing hull rot is tricky. You have to put the trees into moderate stress (-14 to -16 bars) from the end of June to Nonpareil harvest, but it's easy to go too far and have the stress continue when you're trying to set next year's crop. Pistachios have the best window (right now, actually) to cutback on ET before nut-fill in August. You can save as much as 12" of water by using only a couple inches post harvest as well. Citrus growers usually manage their trees to get around 36 to 39" of water in a normal year. So you're not going to save much here. For a full discussion and additional links download:

- Almond-Pistachio-Citrus Regulated Deficit Irrigation http://cekern.ucdavis.edu/files/98694.doc

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