Almond Water Production Function

Project Leaders: Ken Shackel[1], Blake Sanden[2], Allan Fulton[3], and David Doll[4]

[1]Dept. of Plant Sciences, UC Davis, One Shields Ave., Davis, CA 95616-8683 (530) 752-0928, kashackel@ucdavis.edu
[2]UC Coop. Ext., Kern County, 1031 S. Mt. Vernon Ave., Bakersfield, CA 93307 (661) 868-6218, blsanden@ucdavis.edu
[3]UC Coop. Ext., Tehama County, 1754 Walnut Street, Red Bluff, CA 96080 (530) 527-3101, aefulton@ucdavis.edu
[4]UC Coop. Ext., 2145 Wardrobe Avenue, Merced, CA 95341-6445 (209) 385-7403, dadoll@ucdavis.edu

PROJECT SUMMARY

Objectives:

- 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 total seasonal ET.
- Quantify the interaction of hull-split Regulated Deficit Irrigation on the yield function. Use precision/variable rate irrigation scheduling to maintain uniform RDI plant stress across Hull Split RDI treatment replications.
- Using NO_3 and Cl^- movement in the rootzone to determine nitrogen and water use efficiency as a function of applied water.
- Assess long-term tree health and orchard profitability given differing amounts of applied water and scheduling methods.
- Assess the impact on ET and yield of "pulsed" vs. continuous irrigation (Kern only).

Background and Discussion:

According to UC publications and trials in the 1980's and 1990's, almond crop water use (evapotranspiration or "ET") for micro irrigated orchards in the Central Valley was estimated to be about 42 inches. Average California yields were less than 1,500 lb/ac, with a 2,500 lb/ac kernel yield considered a rare exception.

In the 1990's, growers began adopting long pruning, closer spacing, and in some cases in Kern County, increased irrigation. Average Kern County yields surpassed 2,000 lb/ac in 2002 and have been around 2,500 lb/ac for 2010-11. A recent five year Kern County trial determined that a vigorous full canopy orchard can use as much as 56 inches of water over the season and produce over 4,800 lb/ac of kernels. This and other research has led to a substantially revised estimate for almond ET. Some growers have attained similar yields in production orchards from Modesto south, but virtually all of these high production orchards also see increased disease problems (e.g., hull rot and loss of lower canopy spurs and limbs). Previous research in almond and other tree crops has demonstrated that some of these problems can be effectively addressed by more precise plant-based water management using midday stem water potential (SWP). Recent research has also shown a close relation between maximum yield and canopy size (% shaded area) in almonds, as well as an important trade-off between increasing % shaded area and increasing the risk of Salmonella occurrence.

We have established orchard sites in Kern, Merced, and Tehama Counties, representing a range of environments and soil conditions, and imposed irrigation regimes over the range of 70 - 110% ET. In 2013, the first year of treatment application, the 70% ET treatment reduced kernel size in all locations (from 8 -13%), but only the Kern County site exhibited a clear and progressive yield reduction (10%) from the highest to the lowest ET treatment. More severe carry-over effects are expected in subsequent years. Based on the results of this study, we will be able to put a price tag on the benefits and problems associated with both over- and under-irrigation in almonds.

Project Cooperators and Personnel: Patrick Brown, Jan Hopmans, David Smart, Bruce Lampinen, Mike Whiting, University of California, Davis

For More Details, Visit

- Poster location 52, Exhibit Hall A and B during conference; or on the web (after January 2014) at www.almondboard.com/researchreports
- 2012.2013 Annual Report CD (12-HORT17-Sanden/Shackel); or on the web (after January 2014) at www.almondboard.com/researchreports
- Related Project: 13-HORT11A-Sanden; 13-HORT13-Lampinen; 13-PREC2-Brown; 13-PREC4-Hopmans; 13-AIR2-Smart