Almond Water Production Function

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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 (all sites).
- Quantify the interaction of hull-split Regulated Deficit Irrigation (RDI) on the yield function. Use precision/variable rate irrigation scheduling to maintain uniform RDI plant stress across Hull Split RDI treatment replications (Kern only).
- Using NO_3 and Cl^- movement in the rootzone to determine nitrogen and water use efficiency as a function of applied water (all sites).
- Assess long-term tree health and orchard profitability given differing amounts of applied water and scheduling methods (all sites).
- 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. ABC funded research has shown that these high productivity levels require a high level of canopy cover (80-90% light interception), and it is clear that for young trees a high water availability is key to early canopy establishment. However, for a mature canopy it is not yet clear whether a high water availability and maximum water use are necessary for high yields, or desirable for sustainable orchard management. For instance, many high production orchards also see increased disease problems (e.g., hull rot and loss of lower canopy spurs and limbs), as well as an increased risk of Salmonella.

We have established orchard sites in Kern, Merced, and Tehama Counties, representing a range of environments and soil conditions, and have been imposing irrigation regimes over the range of 70 -110% ET (about 27" – 56" seasonal applied water) for two seasons (2013 and 2014). These treatments are causing clear differences in tree stress (SWP) and in 2013 the maximum stress was associated with a 20% reduction in kernel size, but based on the final yields in 2013 and preliminary yield estimates for 2014, we are not yet seeing a clear trend for reduced yields due to reductions in applied water or associated with reductions in SWP at any site. In 2013, yields were mainly determined by nut load, so it may take a series of deficit irrigation years in order to see a substantial and sustained reduction in yield. The 2014 yield/water relation may also be more apparent once canopy light interception data is available. 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.

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

For More Details, Visit

- Poster location 67, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2015) at Almonds.com/ResearchDatabase
- 2013-2014 Annual Reports CD (13-HORT17-Sanden/Shackel); or on the web (after January 2015) at Almonds.com/ResearchDatabase
- Related projects: 14-HORT13-Lampinen; 14-PREC4-Hopmans; 14-AIR2-Smart; 13-HORT11A-Sanden/Shackel; 13-PREC2-Brown