Almond Water Production Function

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PROJECT SUMMARY

Objectives:

- Develop a water production function (WPF) for almonds grown in California that will relate potential yield to water applied, accounting for the site-specific effects of orchard cover, soils, varieties, and physiological level of stress experienced by the tree

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 were 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 high7necessary 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 a fairly wide range of 70 -110% ET (about 27" – 56" seasonal applied water) for four seasons (2013-2017). At all sites, reduced irrigation is always associated with more stress (lower Stem Water Potential, SWP), although SWP at the lowest irrigation level was not severe, typically remaining above about -20 bars for most of the season. Nonpareil yields in the 100% ET treatment have varied between about 1,700 and 3,500 kernel pounds per acre, depending on the year and site. For the first two years of the experiment (2013-14), there was only a statistically weak trend of decreased yield with decreasing applied water at the Kern site, although kernel size (weight) was typically reduced. Based on Nonpareil yields for 2015-17 at the Kern and Merced sites, we are now seeing a clear trend of decreasing yield with decreasing water. On average, a 30% irrigation deficit has produced about a 15% reduction in kernel yield in these San Joaquin Valley orchards. At the northern California Tehama site, there has been no yield reduction with reduced irrigation in any year for Nonpareil (on Mariana 26-24 rootstock with a Padre interstem), but the Monterey pollinizer (on Lovell peach) has shown a similar yield reduction to Nonpareil at the other sites. Hence, when almond yield is limited by horticultural practices, it may not respond to increased water application. These results indicate that sustained levels on the order of a 30% deficit in irrigation, will increase tree stress in the first and subsequent years, but may require multiple years to result in a consistent yield reduction of about 15%.

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

For More Details, Visit

- Poster location 31, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2018) at Almonds.com/ResearchDatabase
- 2016 - 2017 Annual Reports (16-HORT17-Shackel) on the web at Almonds.com/ResearchDatabase
- Related Projects: 17-HORT22-Shackel, 17-HORT13-Lampinen