Lysimeter – Whole Tree ET Response to Mild and Moderate Water Stress

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PROJECT SUMMARY

Objectives for current year:

- Prepare the lysimeter area and establish a 3.5 ac almond orchard
- Monitor lysimeter tree growth, shaded area, and ET
- Monitor the stem water potential (SWP) of the lysimeter and additional orchard trees and manage irrigation/nutrition to achieve good tree growth

Background and Discussion:

Almond growers have steadily increased per-acre yields by changes in a cultural practices (e.g., pruning, planting density, nitrogen fertilization), and by increasing irrigation to support a larger canopy and higher potential yield. In the 1980's a per acre yield of 2,000 pounds of nutmeats was considered to be a practical upper limit for yield in almonds, and now some growers can consistently achieve 3,500 – 4,000 pounds per year, with evidence that the upper limit may actually be 5,000 pounds (although for practical reasons, this may not be sustainable). Measured ET from high yielding orchards has demonstrated that almond crop coefficients (Kc) are higher than previously thought. The Almond Board is currently supporting research to determine a water production function in almonds, which will provide practical information to guide efficient and environmentally sustainable irrigation practices, as well as improve our ability to achieve "more crop per drop." The upward revision of what was thought to be a well-established almond Kc has raised the question of the importance of crop physiological status on Kc. In particular, whether and to what extent Kc decreases when almond trees experience water stress. A reduction in ETc with stress has been described using the "stress coefficient" (Ks) approach, but this approach is based on the level of soil available water, which is difficult or impossible to reliably establish for deep rooted perennials such as almond. A number of studies have shown that ET declines when plants are water stressed, and in almonds, we have consistently found a 50% reduction in stomatal conductance with a 10 bar reduction in SWP. Hence, there is good reason to expect that Kc should decrease substantially when almond trees experience mild to moderate levels of stress, but there is yet no direct data quantifying the relation of Kc to SWP in this crop. Experience has shown that many commercial almond orchards exhibit periodic (intended or unintended) moderate stress during the growing season. Also, there are documented benefits of regulated deficit irrigation (RDI) with moderate levels of water stress at hull split in almond, so a more accurate description of the relation between Kc and SWP in almond would allow more accurate estimates of the water savings associated with the practice of RDI.

In 2015, the 3.5 acre lysimeter site at the UC Kearney Agricultural Research and Extension center (KARE) was planted and the lysimeter data acquisition and irrigation control system was updated. Trees were grown on a single line drip system with one emitter per tree. Tree growth was very good, and Kc increased steadily over the season as the canopy grew. Surprisingly, for most of the season, SWP was below (more stressed than) the baseline, particularly when evaporative demand was high, however, additional irrigation did not increase SWP. This observation will be confirmed in 2016.

Project Cooperators and Personnel: Bruce Lampinen, UC Davis; Gurreet Brar, UCCE - Fresno and Madera Counties; Jim Ayars, USDA/ARS Parlier

For More Details, Visit

- Poster location 66 Exhibit Hall A + B during the Almond Conference; or on the web (after January 2016) at Almonds.com/ResearchDatabase
- 2014 - 2015 Annual Reports CD (14-HORT22-Shackel); or on the web (after January 2016) at Almonds.com/ResearchDatabase
- Related project: 15-HORT17-Shackel; 15-HORT13-Lampinen; 5-PREC5-Volder; 15.STEWCROP-Gaudin; 15-HORT21-Gilbert