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

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PROJECT SUMMARY

Objectives for current year:

- Continue orchard establishment (year 2), and maintain uniformity between the lysimeter tree and the rest of the orchard.
- Monitor ETc of the lysimeter tree and SWP in the lysimeter and orchard trees.
- Test the current young tree Kc model using the 2015 lysimeter data.

Background and Discussion:

Almond growers have steadily increased per-acre yields by changes in 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 managed (regulated) deficit irrigation 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 this practice.

Tree growth was good in 2016, with good uniformity between the lysimeter tree and the rest of the orchard. As in 2015, Kc gradually increased over the season due to tree growth. In 2015, Kc reached values of about 0.3, whereas in 2016 Kc reached values of about 0.7. Measured midsummer canopy shaded area was about 5% in 2015 and 20% in 2016, so the observed Kc values were much higher (about double) than those expected based on the current generalized models of young tree water use. This may indicate that our current estimates of mature almond Kc are low, but a direct test of this will require a full canopy condition in the lysimeter.

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 76, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2017) at Almonds.com/ResearchDatabase
- 2015 - 2016 Annual Reports CD (15-HORT22-Shackel); or on the web (after January 2017) at Almonds.com/ResearchDatabase
- Related projects: 16-HORT17-Shackel (COC); 16-HORT21-Gilbert (COC); 16-PREC5-Volder; 16-STEWCROP5-Gaudin; 13-HORT11A-Sanden (online)