

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

Project Leader: Ken Shackel

Department of Plant Sciences, University of California, Davis, One Shields Ave., Davis, CA 95616-8683
(530) 752-0928 kashackel@ucdavis.edu

PROJECT SUMMARY

Objectives:

- Continue orchard establishment (year 3), and maintain uniformity between the lysimeter tree and the rest of the orchard.
- Monitor ET_c of the lysimeter tree and SWP in the lysimeter and orchard trees.
- Test the current young tree K_c model using the 2015/16 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 (K_c) 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 K_c has raised the question of the importance of crop physiological status on K_c. In particular, whether and to what extent K_c decreases when almond trees experience water stress. A reduction in ET_c with stress has been described using the “stress coefficient” (K_s) 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 K_c should decrease substantially when almond trees experience mild to moderate levels of stress, but there is yet no direct data quantifying the relation of K_c 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 K_c and SWP in almond would allow more accurate estimates of the water savings associated with this practice.

Tree growth was good in 2017, with good uniformity between the lysimeter tree and the rest of the orchard as well as a harvestable crop. Preliminary yield estimates are 750 kernel pounds per acre for this 3rd leaf orchard. As in previous years, K_c gradually increased over the season due to tree growth. Peak K_c values were about 0.3, 0.7, and 1.2, and midsummer canopy shaded areas were about 5%, 20%, and 35% in 2015, 2016, and 2017, respectively. These observed K_c values have been 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 K_c 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; Mae Culumber, UCCE - Fresno and Madera Counties; Jim Ayars, USDA/ARS Parlier

For More Details, Visit

- Poster location 32, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2018) at Almonds.com/ResearchDatabase
- 2016 - 2017 Annual Reports (16-HORT22-Shackel) on the web at Almonds.com/ResearchDatabase
- Related Projects: 17-HORT17-Shackel; 17-HORT28-McElrone