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

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PROJECT SUMMARY

Objectives for current year:

- The long term objective of this research is to quantify the effect of water stress on almond physiology and ET, and to develop a physiologically-based model of this relation that can be used to predict the water savings associated with practices such as regulated deficit irrigation (RDI). The goal for 2014 is to prepare the existing lysimeter and land at UC Kearney Agricultural Research and Extension center (KARE) for an almond planting over the winter/spring of 2014/15.

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 also 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 practice 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. Scott Johnson reported that the Kc of lysimeter grown peach trees decreased strongly and linearly with stress, as measured by midday stem water potential (SWP), with about a 50% reduction in Kc associated with a 10 bar reduction in SWP. This is strong evidence of a link between SWP and Kc in peach, but it was only obtained with two drying cycles in one year, and the canopy structure and leaf display in peach is very different from that in almond. A 50% reduction in Kc, determined from soil moisture monitoring, as well as a 50% reduction in leaf-level stomatal conductance was also found for a 5-6 bar reduction in SWP in prune. 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 2014, the 3.5 acre lysimeter site at the UC Kearney Agricultural Research and Extension center (KARE) was prepared for winter 2014/15 planting, and a cell phone modem was installed on the lysimeter data logger/controller.

Project Cooperators and Personnel: Bruce Lampinen, UC Davis; Gurreet Brar, UCCE - Fresno & 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 2015) at Almonds.com/ResearchDatabase
- Related project: 14-HORT17-Shackel/Sanden/Fulton/Doll