Applying an Improved Heat Ratio Method Sap Flow Sensor to Almonds to Test for In-Field Variation in Water Use

Project Leader: Matthew E. Gilbert
Department of Plant Sciences, University of California, Davis, One Shields Ave. Mail Stop 1, Davis, CA 95616
530) 572-7846 megilbert@ucdavis.edu

PROJECT SUMMARY

Objectives:

Almond water use is difficult to measure, and thus key questions remain unanswered. Do Nonpareil and pollinizers use similar amounts of water? How does irrigation distribution uniformity affect water use? What is the timing of almond water use after irrigation? What are the long term effects of salinity on almond water use? Our objectives are to:

- Develop a new sap flow probe sensor that can be used to measure water use of many trees in experimental orchards,
- Validate that the sensor works well for almonds,
- Apply the sensor in an orchard to assess water use in response to varying irrigation, and
- The long term goal is to develop the sensor as a tool that extension and other researchers can use to evaluate for entire orchards how water use is affected by production issues.

Background and Discussion:

A range of technologies is available to measure the water use of almonds. These range from lysimeters (a few trees) to surface renewal (whole orchards). Water use technologies can be distinct from technologies employed to schedule irrigation, for example stem diameter, leaf temperature, soil moisture sensors, pressure chamber measurements are proxies of water use, but not actual quantitative measures of water use. Thus sap flow sensors offer an intermediate option, capable of quantitatively measuring water use and a technology that can be applied to many trees in an orchard.

However, sap flow technology is difficult to apply to almonds as they have very high water flow rates (20 inches of upward movement per hour), which are difficult to measure with conventional sap flow sensor systems. A collaborator (Tom Buckley; U. Sydney, Australia) has developed an improved heat ratio sap flow sensor that is capable of measuring high sap flow rates, and thus can be used in almonds. Almonds will be the first crop to which this sensor is applied.

The goal of this project is to further develop and adapt these sensors for almonds (August to December 2015). Validate their use on almonds in small weighing lysimeters at UC Davis (October 2015, and March to June 2016). Upon further improvement, apply the sap flow probes to the established almond lysimeter at Kearney (2016 growing season; in collaboration with K. Shackel). Simultaneously, sensors will be installed in an experimental orchard to evaluate their long term performance over the 2016 growing season. During that time drought experiments will be applied to evaluate almond drought responses and response to irrigation timing.

The sensors developed by this project are likely to be robust and do not cost a lot of money (~$50 per tree). However, the data and technology is complex to work with and thus we anticipate, in the medium term, that the sap flow sensors will be a research tool for answering applied questions, rather than a technology employed routinely by growers.

Past work by the PI on this continuing project has found:

- There is variation in the photosynthetic heat tolerance of available almond varieties, but that this variation is small and thus the available almond germplasm is generally well adapted to high temperatures,
- The use of other *Prunus* species in almond breeding programs has not led to decreasing heat tolerance, and may indeed have slightly improved heat tolerance.

Project Cooperators and Personnel: Tom Gradziel, Nicolas Bambach, Heather Vice, Ken Shackel, UC Davis; John Preece, USDA; Tom Buckley, University of Sydney

For More Details, Visit

- Poster location 65, 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-HORT21-Gilbert); or on the web (after January 2016) at Almonds.com/ResearchDatabase
- Related projects: 15-HORT1-Gradziel; 15-HORT22-Shackel