

A Leaf Monitoring System for Continuous Measurement of Plant Water Status to Assist with Irrigation Management of Specialty Crops

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PROJECT SUMMARY

Objectives for current year:

Our goal for the 2016 growing season was to implement precision irrigation from the beginning of the season. The specific objectives were:

- Quantify the benefits of a plant water stress based site-specific irrigation management scheme that employs a wireless mesh network for almond crop in comparison to ET based irrigation management schemes
- Demonstrate the technology to growers

Background and Discussion:

Over the last five years, we have setup a wireless mesh network consisting of sensors capable of monitoring soil and plant water status, and controllers capable of actuating latching solenoid valves to implement precision irrigation in an almond orchard in Nickels Soil Laboratory, Arbuckle, CA. During the 2015 and 2016 growing seasons we expanded the scope of this project to a 5 acre plot. This plot was divided into two management zones based on soil and plant characteristics. Specially developed continuous leaf monitors that estimate plant water status by measuring leaf and air temperatures, ambient relative humidity, wind speed and incident light on the leaf were deployed in each management zone to implement site-specific irrigation management.

During the 2015 growing season, preliminary tests were conducted based on management zone based precision irrigation technique. The results indicated that while management zone #1 required approximately 70% of the grower based irrigation, management zone #2 required about 90% in late July and early August.

During the 2016 growing season, we installed additional sensors and implemented this site-specific irrigation throughout the growing season. Tensiometers were added to complement previously installed soil moisture sensors and flow meters were used to measure the exact amount of water applied to each zone in both the plant water stress based and the grower treatments. While plant water stress was monitored using leaf monitor data, midday stem water potential was also obtained using a pressure chamber to verify the methodology. Attempts were made to maintain plant water stress (SWP) between -12 to -14 bars prior to and post hull split periods. During hull split, attempts were made to maintain plant water stress around -16 bar. The data related to plant water stress variability and amount of water applied to each zone, yield and quality of yield in each zone and treatment were obtained. We are currently analyzing these data and expect to have the results available by the 2016 Almond Conference in Sacramento. This management zone based precision irrigation system that uses a wireless network and leaf monitors was demonstrated to growers, farm advisors, extension specialists, and others during the 2016 Nickels Field day on May 19, 2016. This field demonstration resulted in an article in the Pacific Nut Producer, Volume 22 (6), June 2016.

Project Cooperators and Personnel: Dr. Bruce Lampinen – Plant Science Dept, Dr. Michael Delwiche, Emeritus Prof., Dr. Francisco Rojo, Post Doc., Erin Kizer, and Channing Ko-Madden, Graduate Student Researchers, Alex Schramm and Kelley Drechsler, Junior Specialists, Julie Meyers, Undergraduate Student and Qingsong Zhang, Visiting Graduate Student, Biological and Agricultural Engineering Department, UC Davis.

For More Details, Visit

- Poster location 70 Exhibit Hall A + B during the Almond Conference; or on the web (after January 2017) at Almonds.com/Research Database
- 2015 - 2016 Annual Reports CD (15-HORT24-Upadhyaya); or on the web (after January 2017) at Almonds.com/ResearchDatabase
- Related projects: 16-HORT21-Gilbert (COC); 16-HORT22-Shackel(COC); 16-HORT13-Lampinen