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:

The objective of this project was to implement plant water stress based site-specific irrigation management scheme in almond orchards.

Background and Discussion:

Over the last few years, we had setup a wireless mesh network consisting of sensors capable of monitoring soil and plant water status, and actuate lathing solenoid valves to implement precision irrigation in two selected almonds rows at Nickels Soil Laboratory, Arbuckle, CA. During 2015 growing season 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 measured leaf and air temperatures, ambient relative humidity, wind speed and incident light on the leaf to estimate plant water status were deployed in each management zones to implement site-specific irrigation management.

In this study an unsupervised fuzzy classification technique was used to create management zones. The soil characteristics considered were soil texture, digital elevation and surface (shallow depth) and subsurface (deep layer) electrical conductivities. Plant characteristics considered were canopy light interception and canopy temperature obtained using a handheld sensor suite. Within each management zone conventional grower treatment and plant water status based precision irrigation management were implemented. Additional drip lines were installed in the plant water status based treatment to irrigate each management zone independently. Plant water status was monitored by comparing the performance of selected trees with respect to a well-watered tree and a simulated dry tree. The position of each leaf monitor was chosen by carefully analyzing stem water potential maps created on three different occasions. Plant water status was monitored by comparing the performance of selected trees (in terms of temperature difference between the ambient and the leaf) with respect to a well-watered tree and a simulated dry tree. Attempts were made to manage irrigation in such a way that the level of plant water stress represented as daily crop water stress index values remained within a reasonable range (0 to 0.3). Preliminary results indicate that while management zone #1 required approximately 70% water compared to grower based irrigation, management zone #2 required about 90% of the water in late July and early August.

Project Cooperators and Personnel: Dr. Bruce Lampinen, UCCE, Dr. Michael Delwiche, Emeritus Prof., Dr. Francisco Rojo, Post Doc., Erin Kizer, Graduate Student Researcher, Channing Ko-Madden, Undergraduate Student Researcher, Selçuk Ozmen, Visiting Scholar, Qingsong Zhang, Visiting Graduate Student, UC Davis

For More Details, Visit

- Poster location 72, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2016) at Almonds.com/Research Database
- Related projects: 15-HORT21-Gilbert; 15-HORT22-Shackel; 15-HORT13-Lampinen;;