Assessment of Almond Water Status Using Inexpensive Thermographic Imagery

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PROJECT SUMMARY

Objectives for current year:

- Collect and evaluate initial thermographic imagery data using low-cost and high-cost infrared cameras in almonds with varying water treatments
- Use models to determine expected temperature differences due to varying transpiration rates, and explore associated sensitivities
- Explore transient cooling rates and correlations with stomatal conductance and water potential

Background and Discussion:

In order for almond growers to meet the increasing demands for reduced water consumption, the efficiency of irrigation practices must be improved to minimize waste. The traditional means for accomplishing this goal is to use some indication of tree water demand (most commonly a crop coefficient) to guide irrigation scheduling. As available resources have continually declined, growers have progressively used more sophisticated means of measuring tree water status in order to better guide irrigation decisions (e.g., soil sensors, leaf sensors, trunk sensors, micrometeorological sensors). While these various sensing techniques do indeed give improved indications of plant water demand than traditional crop coefficients, adoption of such technologies is often slow because of expense, both in terms of money and time. Aside from the initial costs of purchasing and deploying equipment, sensing networks are expensive to maintain and rapidly become dilapidated if significant maintenance resources are not allocated.

Smartphone-based sensing platforms present a feasible yet challenging means for measuring plant water status. Utilizing the computational power of smartphones can reduce the cost to purchase and maintain sensing systems, but have the drawback that they only provide measurements at a single point (or limited number of points) in time and space. Our goal is to develop a thermal sensing-based smartphone application that can effectively determine almond irrigation needs by combining leaf- and tree-level measurement approaches.

Our strategy is to use low-cost thermal cameras to estimate tree water status. The obvious drawback of using low-cost cameras is that their resolution is relatively low. We will use a combination of high-resolution cameras and three-dimensional models (see 17-PREC1-Bailey) to develop a calibration for the low-resolution cameras. We will explore a range of different measurement techniques, from tree-level to leaf-level measurement, and transient to steady-state measurement. Our deliverable will be a smartphone app and thermal sensing platform that can be used to determine tree irrigation needs at a given point in time and space. We will also work to determine appropriate irrigation thresholds based on measurements provided by the instrument.

Our primary activities for the first year will be to collect initial data, and begin developing processing methods. We are currently using an experimental orchard with varying water treatments managed by Dr. Astrid Volder to collect initial thermographic data to begin methodological exploration.

Project Cooperators and Personnel: Bruce Lampinen, UCCE; Astrid Volder, UC Davis

For More Details, Visit

- Poster location 44, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2018) at Almonds.com/ResearchDatabase
- Related Projects: 17-PREC1-Bailey; 17-PREC5-Volder; 17-HORT28-McElrone/Parry; 17-HORT21-Gilbert; 17-HORT24-Upadhyaya;