Development of an Operational Dynamic Crop Model for a Better Understanding of Water Management of Almond Orchards in California

Project Leader: Ted DeJong
Dept. of Plant Sciences, UC Davis, One Shields Ave., Davis, CA 95616
(530) 752-1843, tmdejong@ucdavis.edu

PROJECT SUMMARY

Objectives:

The goal of this project is to develop an operational dynamic crop model for better water management in almond orchards. Steps include:

- Develop an applied model taking into account interacting effects of weather, soil characteristics and plant functioning on almond tree growth and productivity.
- Adapt the L-Almond model in order to improve the formalisms of the applied model.
- Evaluate the operational model using historical data sets.

Background and Discussion:

Water is crucial to assure proper development and high yields of almond trees. Recent climate change and the increased drought frequency in California therefore imply a need for adopting strategies to optimize irrigation water use and maintain future almond production. The 2014 Almond sustainability report showed that 83% of growers' base irrigation scheduling on tree water needs and soil or weather conditions. Among these growers, only 20% adapt irrigation management to plant demand through plant-based methods such as measurements of stem water potential (SWP) or use of microdendrometer or sap flow sensors. The measurement of the SWP with a pressure chamber is an effective method to obtain the water stress level of a tree. However, this method is time and labor consuming and can only be used as a proxy from time to time.

This project aims at creating an applied model for defining the dynamics of the SWP through the season in order to track the water stress of an almond orchard on a daily basis. This new model will be based on the functional-structural plant model L-Almond (14-PREC1-DeJong) to take into account the development of the canopy. In L-Almond, the development of the tree results from: i) different sub-models which represent the functioning of ecophysiological processes such as carbohydrate production by photosynthesis, carbon allocation, evapotranspiration, and fate of meristem estimation; and ii) the spatial organization of organs (i.e., trunk, twigs, leaves, fruits) which results from meristem growth and position. In order to develop an applied model for a better irrigation management, L-Almond will be adapted by integrating new sub-modules (e.g., simulating plant available water through modeling of soil water balance, SWP and root growth). The resulting model will strive to reach a compromise between model complexity of L-Almond and the reliability of input parameters. This will allow limiting the number of model input parameters to those easily provided by final users in the field. Special emphasis will be given to model evaluation using existing historical data sets.

This project will be achieved in collaboration between UC Davis and iTK, which is a research and development company developing decision-support solutions for growers based on soil-plant-atmosphere modeling.

Project Cooperators and Personnel:
Damien Fumey, Ken Shackel, Bruce Lampinen, Matthew Gilbert, Blake Sanden, Allan Fulton

For More Details, Visit

- Poster location 68, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2017) at Almonds.com/ResearchDatabase
- Related projects: 16-HORT13-Lampinen; 16-HORT17-Shackel (COC); 16-HORT21-Gilbert (COC); 16-HORT22-Shackel (COC); 14-PREC1-DeJong;