Impact of Drought Stress on Roots

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PROJECT SUMMARY

Objectives:

For the current year and ongoing:

- Determination of the impact of ongoing drought experiments on seasonal standing root length density and root traits (e.g., tissue density)

Next year:

- Installation of a dedicated field trial at UC Davis to measure impact of irrigation strategies on root production, root traits & physiology

Background and Discussion:

Root, shoot and vascular traits are tightly linked to expected survival and growth rate under drought conditions. The supply of water to and within plants is determined by soil water availability (water content and soil type), plant architectural traits (e.g., root:shoot ratio, root depth, root surface area, leaf area, tissue density), as well as axial and radial hydraulic conductance of the root system. In general, there exists a tradeoff between the characteristics that confer stress resistance and those that allow a high physiological activity. We aim to study variation in root morphological, anatomical and physiological traits in response to short term extreme drought (no irrigation) versus long term chronic drought (deficit irrigation). The overall goal is to combine information derived from this project (root phenology, root morphology and root uptake), with information from associated projects (N uptake rates and N movement in soils) to improve the design of irrigation and fertigation systems as well as recommend optimal irrigation strategies.

Preliminary results from samples collected in July show that standing root length density in a field trial with 5 levels of irrigation (70, 80, 90, 100, 110 % ETc) led to decreased standing root length in the lowest and two highest irrigation treatments.

In addition, root length density decreased strongly with sampling depth to 60 cm (~2 feet). There were no differences in root length per unit root mass. The next sampling will take place in November. These data suggest that both under- and over-application of water can cause reductions in standing root length density in almonds, although it is unknown whether this is due to decreased production rates, increased root mortality, or a combination of both.

A dedicated field trial to be installed at UC Davis will allow for a detailed study where both temporal and spatial patterns of root production, morphology and physiology in response to short- and long term drought conditions can be studied. Data will be used to mechanistically project root responses of perennial crops to different drought scenarios.

Project Cooperators and Personnel: Bruce Lampinen, Ken Shackel, Patrick Brown, UC Davis; David Doll, UCCE - Merced County

For More Details, Visit

- Poster location 59, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2015) at Almonds.com/ResearchDatabase
- 2013-2014 Annual Reports CD (13-PREC5-Brown); or on the web (after January 2015) at Almonds.com/ResearchDatabase
- Related projects: 14-HORT13-Lampinen; 14-AIR2-Smart; 13-PREC2-Brown; 13-HORT11A-Sanden/Shackel; 14-PREC4-Hopmans; 14-PREC6-Smart