Subcellular and Molecular Characterization of Salinity Tolerance in Almonds with Novel Tools

Project Leader: Georgia Drakakaki
Department of Plant Sciences; University of California, Davis; One Shields Ave.; Davis, CA 95616
(530) 752-1664; gdrakakaki@ucdavis.edu

PROJECT SUMMARY

Objectives for Current Year:

- Development/refinement of confocal based assays for the detection of sodium, chloride and potassium in almond rootstock cells.
- Characterize commercially available rootstocks in response to salinity.
- Characterize the root structure of almond rootstocks.

Background and Discussion:

California is experiencing increasing soil salinization, which is projected to accelerate in the current drought conditions due to the increased use of saline ground water. Almond plants, one of the most economically important crops in California and one with a high expansion rate, are strongly sensitive to salt stress. Selection of elite rootstocks with improved salinity tolerance affords a way to ensure high yield production in this long-term trend. The development of universal cellular and molecular methodologies towards identifying sodium uptake, ion sequestration and its effect on cellular morphology and viability for various rootstocks and rootstock/scion combinations is a hitherto unexplored approach.

Real time *in vivo* fluorescent microscopy of plant tissues affords localizing evaluation of saline induced structural and morphological changes in the cell and cell wall and it is a robust criterion for determining halotolerance-salt tolerance across various rootstocks.

So far, we have developed the methodologies for the detection of the implicated ions in salinity stress, sodium, potassium and chloride. Our results are the first successful subcellular potassium and chloride imaging experiments in all plants.

In our pilot experiments, distinct, genotype specific, subcellular accumulation patterns of sodium were observed in rootstocks, demonstrating a likely exclusion mechanism in Empyrean-1 compared to the Controller-5 rootstock. We hypothesize that control of ion uptake and redistribution contributes to salinity tolerance; characterization of this mechanism is our current and future research focus.

Further, the data indicate an important role of the plant root structure in allowing sodium transport within root tissue. Our structural analysis of root vasculature aims to determine the role of specific root tissues in salinity tolerance.

This methodology will provide the flexibility for future extensions beyond salinity stress to assess cellular structural modifications in response to biotic and abiotic stresses, including that of various pathogens. We expect that dissemination of the developed methodology will spur rapid adaptation and follow up studies, in tandem with a proliferation of the use of advanced microscopy tools in almond research on the cellular level.

Project Cooperators and Personnel: Yukun Cheng, Malli Aradhya, John Preece, Bruce Lampinen, Patrick Brown, Tom Gradziel, Roger Duncan, Hank Dorsey, John Labavitch, Judy Jernstedt, Thomas Wilkop

For More Details, Visit

- Poster location 86, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2018) at Almonds.com/ResearchDatabase
- 2016 - 2017 Annual Reports (16-HORT23-Drakakaki) on the web at Almonds.com/ResearchDatabase
- Related projects: 17-HORT20-Brown; 17-HORT26-Sandhu