Understanding Genetic and Physiological Bases of Salt Tolerance in Almond Rootstocks

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PROJECT SUMMARY

Objectives for current year:

- Evaluate diverse rootstocks for tolerance to salinity of solutions of mixed salt composition.
- Characterize physiological and biochemical markers associated with salt tolerance and salt composition of irrigation water in almond rootstocks.
- Identify and characterize the genes involved in salinity tolerance in almond rootstocks.

Background and Discussion

One of the biggest challenges California almond growers are facing is the irrigation water quality. Due to the reduced availability of good quality water, the use of alternative degraded waters is inevitable. The most important consideration for the use of degraded waters is the water salt concentration. The use of poor quality water for irrigation intensifies the salinity problem. Almonds are considered sensitive or moderately sensitive to salt and improving salt tolerance in almonds will improve yield.

To cope with salinity stress, plants develop physiological and biochemical responses for either avoiding or tolerating the stress. In order to tackle this complex problem of salinity, it is important to link the biochemical and physiological responses with the underlying genetic mechanisms, which are the key in developing genetic material tolerant to salt.

In almond, rootstock plays a major role in the success of a particular variety. There is limited research conducted to evaluate a large number of rootstocks under variable salt concentrations. The link between variation for salt tolerance and the genetic mechanisms leading to that variation is essentially missing. Some genes have been predicted to play a role in salt, based on the DNA sequence and annotated for possible function based on protein homology. However, the functional characterization of genes involved in salt tolerance in almond is still lacking.

We will evaluate 15 rootstocks under five different treatments of waters of mixed ion compositions. We will focus on screening genotypes at relatively low salinity levels (EC =4 dS/m) to avoid changes in gene expression due to osmotic shock. Tissue samples will be analyzed for major and minor elements. In addition, we will determine the levels of total phenolics, total antioxidant capacity, proline, photosynthetic activity, stomatal conductance, and use these physiological indicators to characterize almond rootstocks that are tolerant to high salt concentrations. For screening genes that play role in salt stress in almond rootstocks, we have already selected 10 genes known to be important for salinity tolerance in model plants and designed primers for those. We will study expression of these genes in roots and leaves under different irrigation water salt compositions.

Almond growers will benefit from identification and development of salt-tolerant rootstocks as these rootstocks could sustain crop yield when irrigated with waters of higher salinity.

Project Cooperators and Personnel:
Donald Suarez, USDA-ARS US Salinity Lab, Riverside; Jorge Ferreira, USDA-ARS US Salinity Lab, Riverside

For More Details, Visit

- Poster location 35, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2017) at Almonds.com/ResearchDatabase
- Related Projects: 16-HORT16-Aradhya/Ledbetter/Kluepfel (COC); 16-HORT20-Brown/Grattan; 16-HORT23-Drakakaki