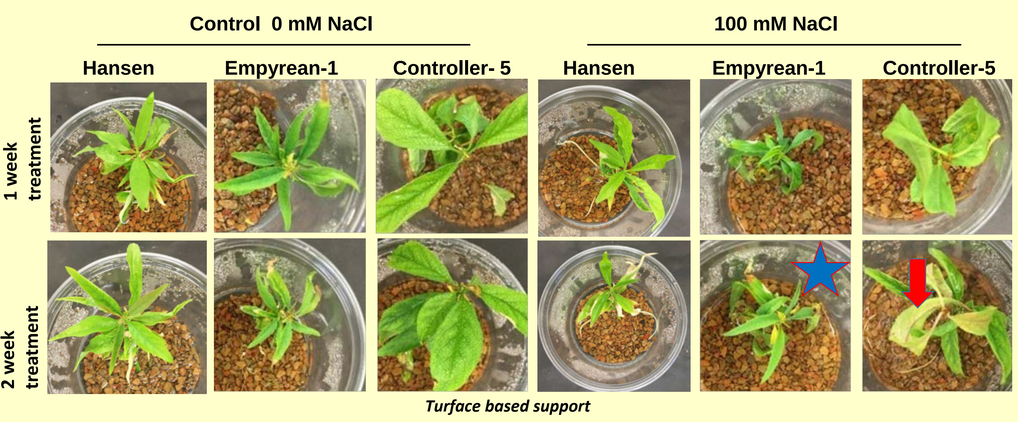
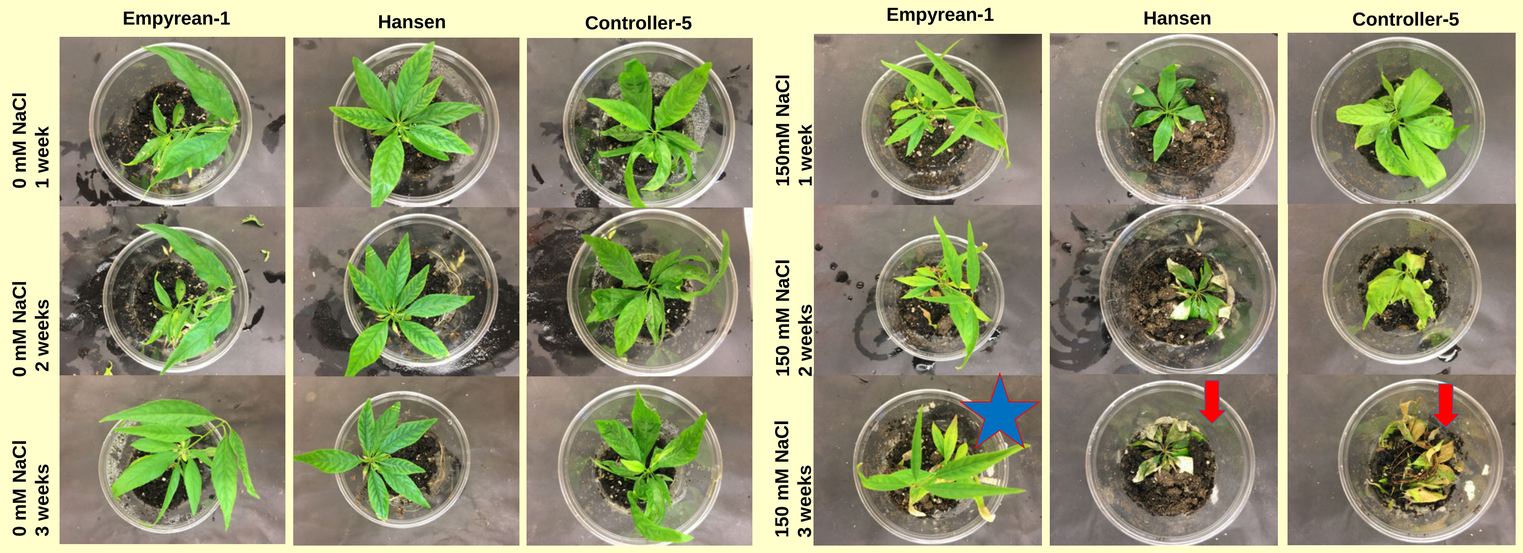
Subcellular Characterization of Salinity Tolerance in Almond Rootstocks

Yukun Cheng[1], Thomas Wilkop[1,2] , Alessandra Quartararo[1], Hank Dorsey[3], Judy Jernstedt[1], Georgia Drakakaki [1*] *[1]Department of Plant Sciences, University of California, Davis, CA 95616, USA, [2]University of Lexington Kentucky, Lexington, KY 40506, [3]Sierra Gold Nurseries, Yuba City, CA , *gdrakakaki@ucdavis.edu*

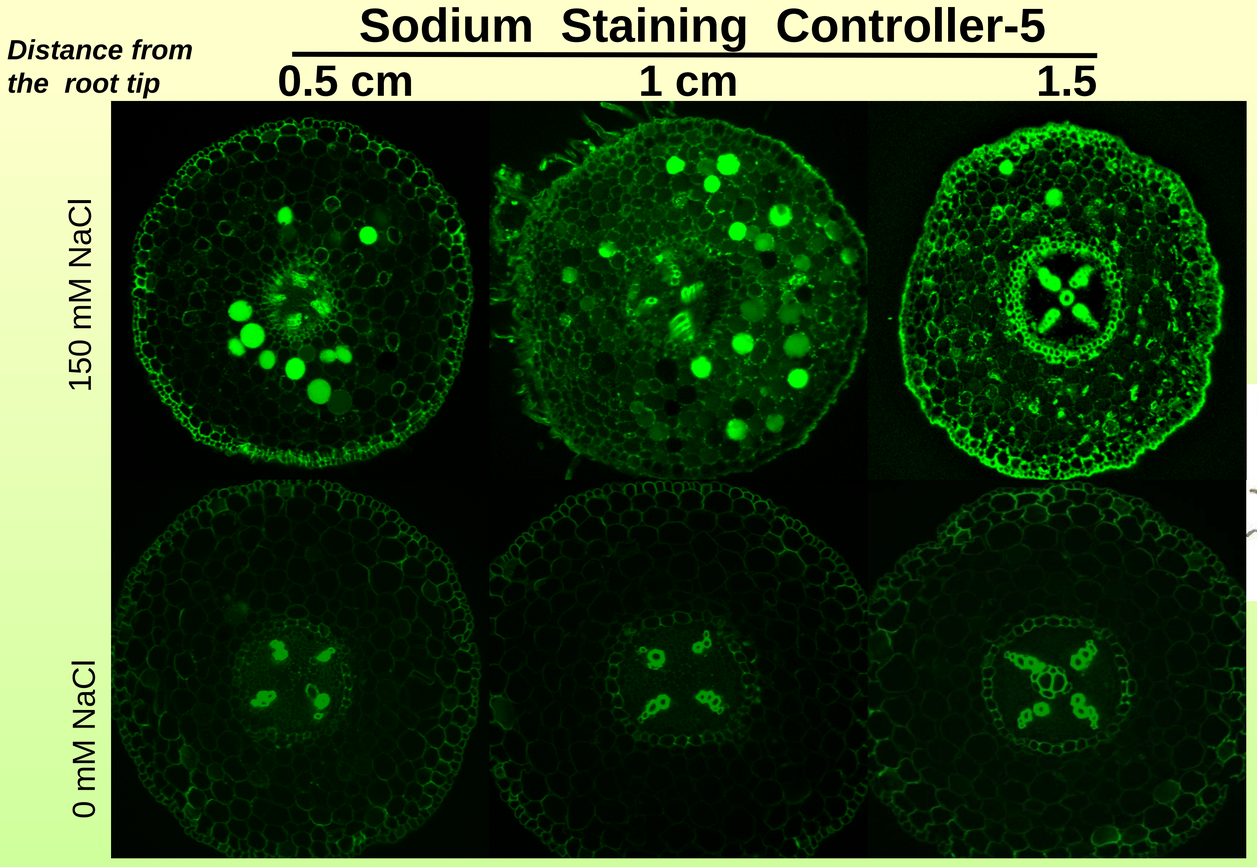
Rationale: California is experiencing increasing soil salinization, which is projected to accelerate in the current drought conditions due to the increased use of saline ground water. Almond plants, one of the most economically important crops in California and one with the highest expansion rate, are 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. However, no existing technology can settle throughput sorting for salt-resistance rootstocks during their seedling stage. In this study, we attempt to develop general cellular and molecular methodologies towards identifying sodium uptake, ion compartmentalization and its effect on cellular morphology and viability for various rootstocks and rootstock/scion combinations. Live cell fluorescent microscopy affords localizing and evaluating saline induced structural and morphological changes in the cell and cell wall as a robust criterion for halotolerance across various rootstocks.

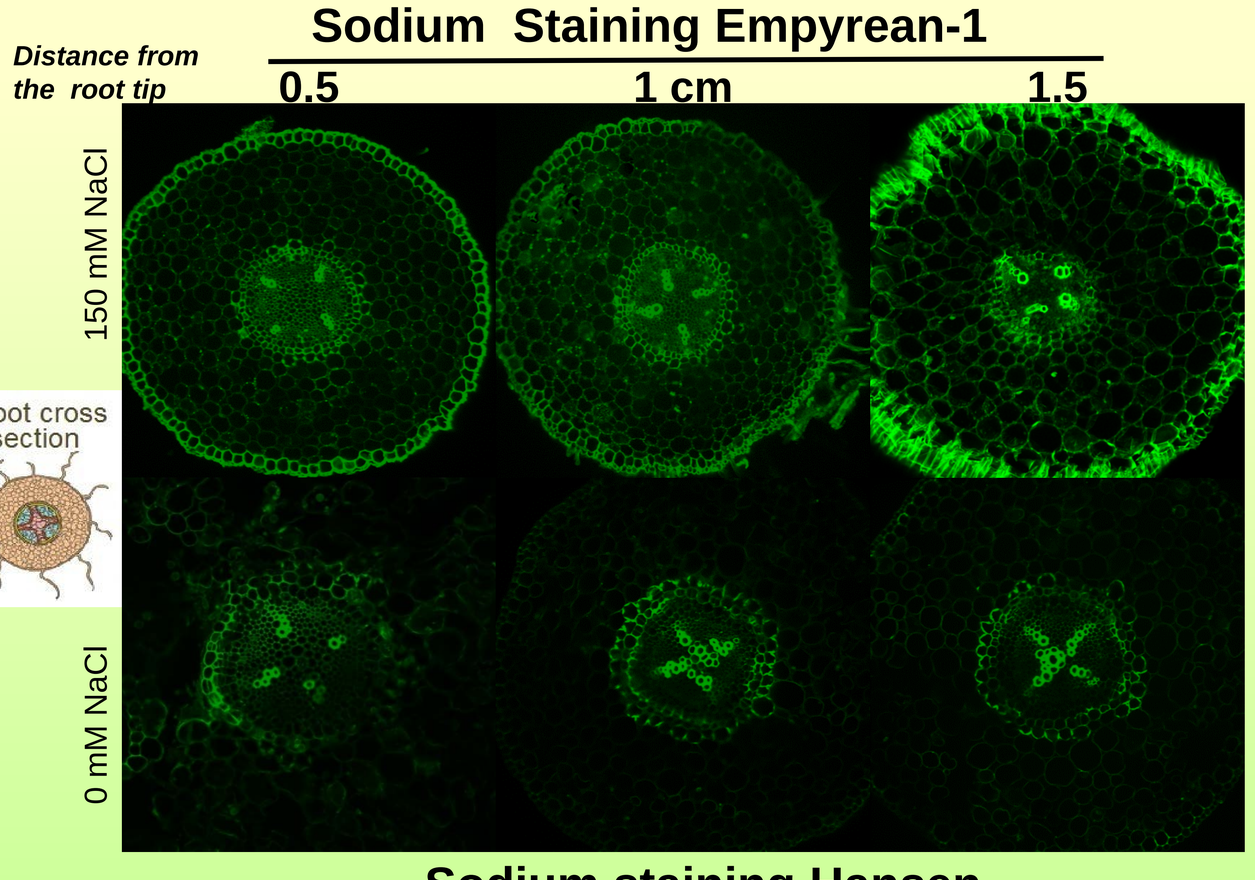
Results: Empyrean-1 shows tolerance to salinity stress compared to the Controller-5 and Hansen rootstocks





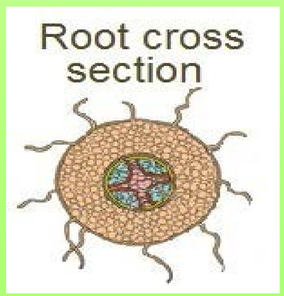
Sodium and potassium localization in root sections after NaCl treatment





Salinity treatment leads to a marked increase of the cellular localization of Na^+ with a distinct pattern in Empyrean-1 Hansen and Controller roots.

The overall staining in root parenchyma cells of Controller-5 is significantly higher compared to Empyrean-1. The subcellular staining pattern of sodium in Controller-5 compared to Empyrean-1 indicates a likely mechanism of ion exclusion as a response to salt treatment in Empyrean -1 .



ACKNOWLEDGMENTS. This work is supported by the California Almond Research Board and independent funding from other sources to G. Drakakaki.

REFERENCES: Bojórquez-Quintal E et al. (2014) Front Plant Sci.12;5:605. Gonzalez P et al., (2012) HortScience 47:1504–1511. Wilkop et al., 2016 Annual report, Almond Research Board. Drakakaki et al., 2017 Annual report , Almond Research Board