Survey of Orchard Colonization and Potential of Mycorrhizal Inoculation to Mitigate Water Stress

Project Leaders: Amélie Gaudin[1] and Astrid Volder[2]
Department of Plant Sciences; University of California, Davis; One Shields Ave.; Davis, CA 95616
[1] (530) 752 1212, agaudin@ucdavis.edu; [2] (530) 752 8527, avolder@ucdavis.edu

PROJECT SUMMARY

Objectives:

- Survey the extent of almond tree symbiotic relationships during the growing season across soil type and management practices.
- Determine the aptitude for mycorrhizal root colonization of different common rootstocks
- Monitor root colonization rates upon inoculation of seedling and mature trees.
- Assess the potential of commercial inoculants to improve tree water status and alleviate water stress during early plant establishment.

Background and Discussion:

Mycorrhizal fungi are a key component of soil ecosystems and symbioses with tree crops can enhance acquisition and uptake of soil resources. However, very little is known about mycorrhizae associations with almond trees and the potential benefit of inoculation to growers. In fact, many California growers inoculate their trees but the extent to which Prunus rootstocks are mycorrhizal and the impact of management practices on root colonization by endogenous or applied mycorrhizae populations remains unknown. The utility of inoculation to almond water status when water is limited remains unclear. ***This project seeks to elucidate whether almond roots effectively form beneficial associations in common rootstocks, identify management practices that promote symbiosis, and characterize their potential to help mitigate water stress in young trees.*** A better understanding of interactions between almond trees and the soil microbial community could enhance water use efficiency and orchards' productivity.

We completed the first detailed assessment of arbuscular mycorrhizal symbiosis in almond orchards of California as affected by management. Mycorrhizae were ubiquitous in the 15 orchards sampled across the Central Valley. Preliminary results indicate that higher colonization rates are found in non-fumigated and organically managed orchards and lowest rates in conventional orchards. Potential differences between rootstocks in terms of colonization rate and responsiveness to symbiosis are being investigated. We are also exploring how soil health building management practices such as compost/ biochar/cover crop additions influence symbiotic relationships in commercial orchards and linkages with soil properties.

We found sharp increase in colonization rates upon inoculation of young trees in a field setting. We further assessed how inoculation with mycorrhizae may alter nonbearing almond host status under well-watered or low-watered conditions in pot experiments in 2015 and 2016. Leaf gas exchange, stomatal conductance, and stem water potential were measured periodically during the dry-down period. Preliminary results from 2015 indicate that when plants were exposed to extreme drought stress an increase in stomatal conductance occurred in inoculated trees, and analysis is under way for our 2016 experiment. If preliminary results are encouraging, we will quantify the contribution of external hyphae to water transport in large almond trees in the field and clarify the role of mycorrhizea during long-term and repeated water deficits.

Project Cooperators and Personnel: Bruce Lampinen, UC Davis; David Doll, Franz Niederholzer, Daniele Lightle, Roger Duncan – UCCE; Mike Amaranthus - Mycorrhizal Applications Inc; Greg Browne –USDA. Students: Tamara McClung – MsC, Anna Azimi – Student assistant, Christos Vasilikiotis – visiting scholar

For More Details, Visit

- Poster location 78, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2017) at Almonds.com/ResearchDatabase
- 2015 - 2016 Annual Reports CD (15-STEWCROP5-Gaudin); or on the web (after January 2017) at Almonds.com/ResearchDatabase
- Related projects: 16-PREC5-Volder,16-PREC3-Holtz, 16-PREC7-Brown/Khalsa, 16-STEWCROP7-Guadin