Potential of Mycorrhizal Inoculation to Mitigate Water Stress in Almond

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PROJECT SUMMARY

Objectives for current year:

- Survey the extent of almond tree symbiotic relationship with mycorrhizal fungi in conventional and organically managed orchards.
- Evaluate the impact of irrigation regime and fumigation on the formation and composition of mycorrhizal fungi communities.
- Determine the aptitude for mycorrhizal root colonization of different common rootstocks
- Assess the potential of commercial inoculants to improve tree water status and alleviate water stress during early plant establishment.

Background and Discussion:

This project seeks to better understand and promote interactions between almond trees and the soil microbial community to enhance water use efficiency and orchards productivity. Intermingling webs of mycorrhizal hyphae inhabit both plant roots and surrounding soils, and play a crucial role in enhancing uptake of water and soil nutrients. Improved water relations under deficit irrigation as a result of mycorrhizal symbiosis have been reported in various tree species. However, little is known about mycorrhizal relationships in Almond, how rootstocks and management practices affect colonization in commercial orchards, and the functional significance to improve tree water status when irrigation water is limited.

In 2015, we initiated the first detailed assessment of endogenous arbuscular mycorrhizal symbiosis in almond orchards of California. We are currently using molecular approaches (RT-qPCR) to measure the impact of rootstock, orchard management (organic vs conventional), and fumigation on the extent of almond tree symbiotic relationship with mycorrhizal fungi. Surveys will be extended next season to assess how irrigation management and organic matter inputs impact mycorrhizal associations, and elucidate the orchards management practices and soil properties instrumental to enhance symbiotic relationship in commercial orchards.

We also assessed the potential of commercial inoculants to improve tree seedling water status under deficit irrigation in a pot experiment. Young trees (Nonpareil on Harding 536 rootstock) were transplanted into forty -6 gal pots in June. Half the pots were inoculated at transplant (MycoApply Ultrafine Endo® inoculant) and trees remained well watered until the first week of August, when water was withheld from half of the trees (n= 10 for each mycorrhizal by water treatment combination). Leaf gas exchange, stomatal conductance and stem water potential were measured periodically during the dry-down period. Trees were harvested on Sep15th, and separated into roots and shoots. Leaf, stem and root biomass were measured, as well as total leaf area. Root characteristics including mycorrhizal infection rate are currently being determined. Our hypothesis is that the presence of mycorrhizae will enhance leaf gas exchange and stomatal conductance rates, particularly under drought conditions.

The experiment will be repeated and, if preliminary results are encouraging, we will quantify the contribution of external hyphae to water transports in large almond trees in the field and clarify the role of mycorrhizea during long-term and repeated droughts.

Project Cooperators and Personnel: Astrid Volder and Bruce Lampinen, UC Davis, David Doll, UCCE - Merced, Franz Niederholzer – UCCE Colusa/Sutter/Yuba, Mike Amaranthus - Mycorrhizal Applications Inc, Students: Tamara McClung – MsC, Joshua Garcia – Student assistant.

For More Details, Visit

- Poster location 69, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2016) at Almonds.com/ResearchDatabase
- Related projects: 15-HORT22-Shackel; 15-PREC5-Volder