

Developing Improved Strategies for Management of Replant Problems

Project Leader: Greg Browne

USDA/ARS, Department of Plant Pathology, University of California, Davis, One Shields Ave, Davis, CA 95616,
(530) 204-7281 gtbrowne@ucdavis.edu

PROJECT SUMMARY

Objectives:

- Determine the causes of almond replant disease (RD)
- Develop improved management approaches for RD and other soilborne diseases

Background and Discussion:

This project focuses on the biology and management of almond replant disease (RD), which is caused by a complex of soilborne microbes in successive plantings of *Prunus* species and can occur in the absence of plant pathogenic nematodes. RD suppresses root development, slowing tree growth and reducing lifetime yield.

This year we began a metagenomic approach to objective 1, taking advantage of new DNA sequencing technologies that facilitate relatively unbiased views of microbial soil communities. We used root and soil samples from our various replant trials to construct "DNA libraries" for high-throughput sequencing. Our previous work has implicated several species of *Pythium*, *Phytophthium*, and *Cylindrocarpon* as contributors to RD, we hypothesize that metagenomic sequencing will: i) lead to stronger conclusions on the roles of the implicated organisms, ii) provide new insights on roles of other soilborne microorganisms in RD, and iii) support development of RD diagnostics that can predict the need for preplant fumigation or non-fumigant soil remediation. To complement our metagenomic examinations, we will use amplicon-based DNA sequencing and qPCR which, respectively, determine the presence and quantity of specific organisms or gene regions. Under objective 2, with help from both the CDPR and ABC, we continued a soil survey designed to discriminate between soils at risk and not at risk for RD. Soils were collected from 26 locations throughout the Central Valley with various

biological, chemical, and physical soil properties, and various *Prunus* cropping histories. Each soil was subdivided into 3 portions that received either i) no treatment, ii) fumigation, or iii) steam pasteurization treatment, and the treatment-soil combinations were planted with Nemaguard peach seedlings in a greenhouse bioassay. We found that positive Nemaguard growth responses to fumigation and pasteurization in the bioassay were reasonable predictors for the need to manage for RD in an orchard. In addition, we continued learning about the degree to which certain soils and soil chemical and physical properties contribute to the development of RD. Because the bioassay is cumbersome and slow, our ultimate goal is to find molecular markers in soil and roots that correlate with RD risk. In 2015 we preserved soil and root samples from our bioassay trials for metagenomic sequencing in order to identify such RD markers.

Also under objective 2, we established two new trials of anaerobic soil disinfestation (ASD) in 2014-15 and continued two ASD trials started in 2013-14. All 4 ASD trials are located in Parlier at the KAC on Hanford sandy loam soil that is impacted by RD but not plant pathogenic nematodes. Efficacy of the preplant treatments was assessed by effects on: i) survival of bioassay inoculum of *Pythium ultimum* buried in nylon bags at 15 and 46 cm soil depths, ii) growth in stem circumference of the replanted almond trees, and iii) the percentage of photosynthetically active radiation intercepted by the almond canopies in their second growing season. Both ASD and soil fumigation with Telone C35 have shown equally strong and persistent control of RD, as indicated by tree growth. Our future ASD research will focus on reducing ASD costs, as well as determining if ASD provides effective management of plant pathogenic nematodes.

Project Cooperators and Personnel: Natalia Blackburn and Hossein Gouran, USDA-ARS, Davis, CA; Gurreet Brar, David Doll, and Brent Holtz, UCCE; and Andreas Westphal, UC Riverside, Kearney Agricultural Center

For More Details, Visit

- Poster location 53, Exhibit Hall A and B during conference; or on the web (after January 2016) at <http://www.almonds.com/growers/resources/research-database>
- 2014 - 2015 Annual Report CD (14-PATH1-Browne); or on the web (after January 2016) at <http://www.almonds.com/growers/resources/research-database>
- Related Projects: 15-AIR9-Doll; 15-AIR5-Gao/Doll; 15-HORT16-Aradhya/Ledbetter; 15-PATH7-Duncan/Baumgartner