

Developing Improved Strategies for Management of Replant Problems

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PROJECT SUMMARY

Objectives:

- Determine causes of replant disease (RD).
- Develop improved approaches to manage RD and other replant and soilborne disease problems.

Background and Discussion:

This project focuses on biology and management of replant problems, especially almond replant disease (RD). RD suppresses root development, slowing canopy development and reducing yield. The disease is caused by a complex of soilborne microorganisms in almond orchards replanted after almonds or other stone fruits. RD is a separate problem from nematode-inflicted root disease. Although RD can be prevented by soil fumigation, there are economic and strategic reasons for the California Almond industry to determine the following: specific regional causes of RD, whether RD severity can reliably be predicted at any given orchard site, and how to manage RD with less reliance on soil fumigation. Developing this knowledge is the overriding goal of this project. Increments of our progress in 2013-14 are highlighted below.

In trials on RD causes and biology, we studied direct and interactive impacts of *Pythium ultimum*, *Cylindrocarpon macrodidymum*, and *Trichoderma* species on growth of Nemaguard rootstock. We previously found the first two species more abundantly in roots of RD-affected almond trees than in roots of healthy almond trees, while the opposite was found for *Trichoderma* spp. In a 2014 trial, *P. ultimum* strongly suppressed Nemaguard growth whether or not it was inoculated with the other species, whereas neither *C. macrodidymum* nor *Trichoderma* sp. significantly affected growth, with or without the other inoculants. In additional trials, we determined that *Pythium helicoides* contributes to RD and that soil water saturation favors, but is

not required for, disease caused by the pathogen. Collectively, these results emphasize the importance of *Pythium* species as RD contributors and targets for control measures.

With help from the California Department of Pesticide Regulation, we tested a greenhouse bioassay for its potential to predict RD and examine its causes regionally. We tested 20 orchard replant soils from throughout the Central Valley in greenhouse bioassay trials with Nemaguard peach. The impact of RD on seedling growth varied significantly according to: soil source, incidence of *Pythium* and *Cylindrocarpon* species on roots, soil pH, and preplant soil treatment (i.e., fumigation, pasteurization, or control), suggesting promise for RD prediction.

At the Kearney Agricultural Center, we are testing fumigant vs. non-fumigant RD control measures (i.e., shank fumigation with Telone C35 vs. deep soil ripping, sudan grass rotation, and anaerobic soil disinfestation [ASD]). ASD reduces pathogen populations and suppresses disease by generating anaerobic conditions, organic acids, microbial community shifts, etc. ASD is generated for several weeks by incorporating a readily available carbon substrate into soil, maintaining high soil moisture content, and using an impermeable tarp to elevate soil temperature and reduce gas exchange between the soil and aboveground air. Both soil fumigation and ASD strongly stimulated replanted almond orchard growth in the first growing season, whereas the other treatments had small or negligible impacts. Accordingly, this fall we are beginning efforts to optimize ASD efficacy and practicality. Further research is needed to examine ASD for control of parasitic nematodes.

Please share your RD experiences and concerns with us; we like to hear them!!

Project Cooperators and Personnel: Leigh Schmidt, USDA-ARS, Davis; Natalia Blackburn and Mike Devengenzo, UC Davis; Gurreet Brar, UCCE – Fresno/Madera Counties; David Doll, UCCE – Merced County

For More Details, Visit

- Poster location 54, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2015) at Almonds.com/ResearchDatabase
- 2013-2014 Annual Reports CD (13-PATH1-Browne); or on the web (after January 2015) at Almonds.com/ResearchDatabase
- Related projects: 14-AIR9-Doll; 13-PATH7-Baumgartner; 12-HORT16-Aradhya/Ledbetter