Plant Pathology Seminar Series

"Anaerobic Soil Disinfestation as a Sustainable Soil-Borne Disease Management Practice for Apple and Strawberry and Mechanisms of Disease Suppression"

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Comprehensive studies were conducted to identify functional mechanisms contributing to soil-borne disease control in response to anaerobic soil disinfestation (ASD). The interaction of ASD carbon source (orchard grass) input rate and apple rootstock genotype on control of *Rhizoctonia solani* AG-5 was assessed in greenhouse studies. A field study was conducted to confirm the results and determine overall treatment efficacy for control of apple replant disease. ASD treatment resulted in plant growth that was similar to that attained in pasteurized or fumigation soil and was superior to the no treatment control. Apple rootstock genotype significantly affected root infestation by *Pythium ultimum* and *R. solani.* Transformations in the soil microbiome induced by ASD treatment persisted for greater than 20 months in the apple nursery field trial and were associated with disease suppression.

Studies were conducted to assess the effect of environment at the time of ASD application on efficacy of this treatment for control of multiple lethal strawberry pathogens including *Fusarium oxysporum* f. sp. *fragariae*, *Verticillium dahliae*, or *Macrophomina phaseolina.* ASD incubation temperature, but not duration of the incubation period, affected control of Fusarium wilt and charcoal rot. In general, disease control was superior when ASD was conducted at higher soil temperature. When ASD carbon sources were applied at 20 t ha^{-1}, orchard grass or wheat leaf residues, but not rice bran, significantly reduced charcoal rot severity and density of *M. phaseolina* DNA in strawberry crown tissue.

Temporal changes in the soil metabolome and microbiome in response to ASD conducted with rice bran was examined in microcosms over a 15 day period. Weighted gene correlation network analysis of metabolites and microbial operational taxonomic units showed that metabolites and microorganisms act as modules. Metabolite network analysis indicated, production, consumption, and intermediate trends which were parallel to the microbial network. Nitric oxide and antimicrobial hydrocarbons can be proposed as new modes of disease control resulting through ASD. Overall, ASD implementation variables will require consideration of the host, pathogen, and environmental factors to optimize disease control efficacy and feasibility of commercial application.

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PhD Exit Seminar

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