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Madhav Parajuli

Tennessee State University

Fulya Baysal-Gurel

Tennessee State University

Milan Panth

Clemson University

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Effect of Solitary and Combined Use of Cover Crops on Soilborne Disease Suppressiveness in Woody Ornamental Nursery Production Systems

Madhav Parajuli¹, Fulya Baysal-Gurel¹ and Milan Panth²

¹Tennessee State University, McMinnville, TN and ²Clemson University, Blackville, SC

Abstract

Cover crops are known to be effective in reducing soilborne diseases in woody ornamentals. However, it remains unknown how solitary and combined uses of cover crops influence soilborne disease, and whether these effects differ with seed rate. The objective of this study was to explore the impacts of cover crops, in solitary and combined use, on soilborne disease suppressiveness in woody ornamental nursery production systems. Soils were sampled from the established red maple (*Acer rubrum* L.) plantation grown with and without cover crops [crimson clover (*Trifolium incarnatum* L.)] or triticale (*x* Triticosecale W.) or (their mixture)] following the cover crop senescence. Greenhouse bioassays were carried out using red maple cuttings on inoculated (with *Rhizoctonia solani*, *Phytophthora vexans*, or *Phytophthora nicotianae*) and non-inoculated field soils. Plant height, total plant weight, and fresh root weight were measured, and plant roots were assessed for root rot disease severity using a scale of 0 to 100% roots affected. Population of beneficial *Pseudomonas* in soil was counted. Results showed that there were no significant differences in plant height among the treatments. Total plant and root fresh weights were significantly or numerically greater for red maple plants grown in soil collected from cover cropped than non-cover cropped field. Although all the cover crop treatments demonstrated effective control of root rot diseases, a high rate of crimson clover and a high rate of the mixture were the most effective. Cover crops also improved fluorescent *Pseudomonas* activities in the soil. These findings may be helpful to nursery growers in making soilborne disease management decisions.

Introduction

- Root and crown rot disease is one of the major problems often faced by the woody ornamental nursery growers that aid a huge economic burden to nursery growers every year.
- Rhizoctonia solani*, *Phytophthora vexans*, and *Phytophthora nicotianae* are very common soilborne pathogens causing root and crown rot in nursery production.
- Cover crops are known to be effective in reducing soilborne diseases in woody ornamental field production
- However, it remains unknown how solitary and combined uses of cover crops influence soilborne diseases, and whether these effects differ with seed rate.



Figure 1 . (a) Triticale usage between nursery plants; (b) crimson clover; (c) root rot disease.

Objective

To determine the impacts of cover crops, in solitary and combined use, on soilborne disease suppressiveness in woody ornamental nursery production systems.

Acknowledgment

We thank NIFA, USDA Evans-Allen grant for the financial support to conduct this experiment.

Materials and Methods

- A field trial with and without cover crops were arranged in a completely randomized design with four replications in a nursery in McMinnville, TN.

Soil collected from cover cropped and non-cover cropped field

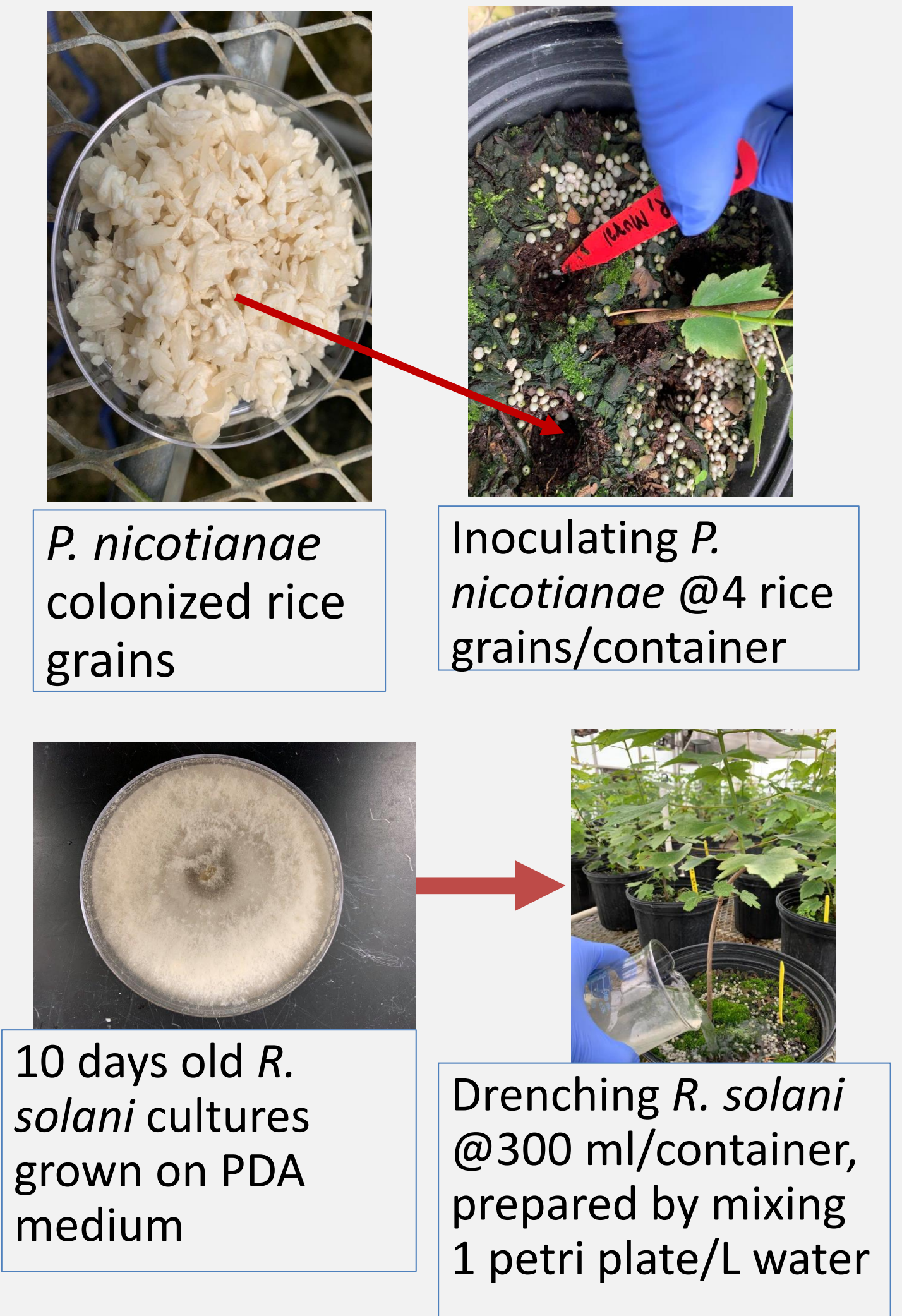
Greenhouse bioassay carried out using red maple cuttings (completely randomized design-ten single plant replications)

Inoculated with pathogens (*P. vexans* or *P. nicotianae* or *R. solani*)

Experiment was terminated

Plant vigor and root rot diseases were evaluated

Data were analyzed (SAS, Tukey, at $P < 0.05$)



Results

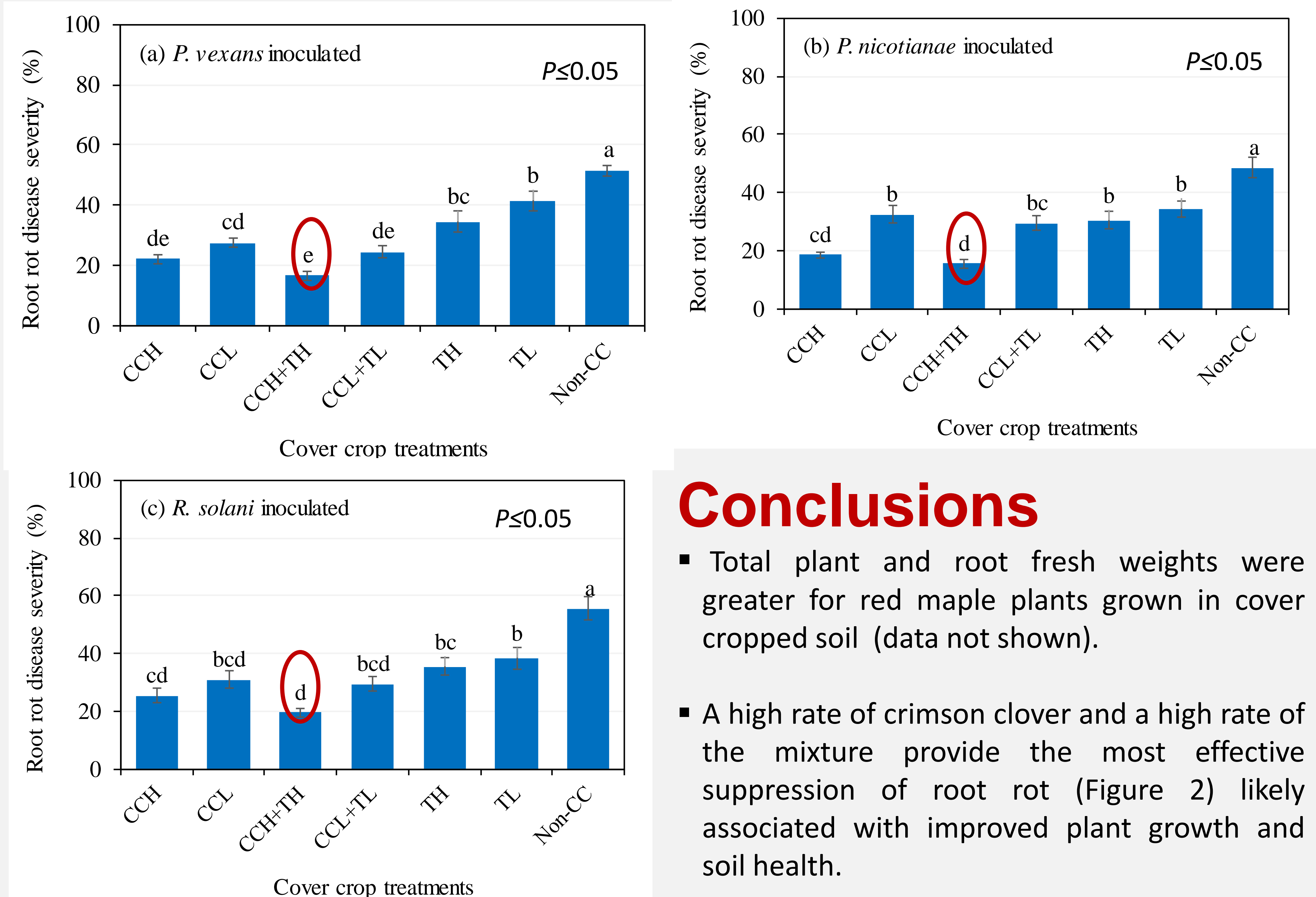


Figure 2. Root rot disease severity caused by (a) *P. vexans*, (b) *P. nicotianae* and (c) *R. solani*. CCH: crimson clover high; CCL: crimson clover low; TH: triticale high; TL: triticale low. Treatments followed by the same letter within a column are not significantly different. Error bar represents standard error.

Conclusions

- Total plant and root fresh weights were greater for red maple plants grown in cover cropped soil (data not shown).
- A high rate of crimson clover and a high rate of the mixture provide the most effective suppression of root rot (Figure 2) likely associated with improved plant growth and soil health.
- These findings may be helpful to nursery growers in making soilborne disease management decisions.