CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
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Project Number
J1518

Project Title
Avocado "Root Rot": A Novel Approach to Combatting Phytophthora cinnamomi

Abstract

Objectives/Goals
In 2014, California avocado farmers lost over 40 million dollars in crop damage due to root rot caused by Phytophthora cinnamomi. This pathogen infects the roots of avocado plants, resulting in an eventual death. I became aware of P. cinnamomi when my family purchased a neglected avocado grove. The trees were infected with some disease. I took soil samples and sent them to a local agriculture lab, which confirmed that it was P. cinnamomi. Consequently, I began to search for a safe, practical, and eco-friendly solution to counter root rot. After conducting research, I hypothesized that employing a functionally defined soil amendment in conjunction with a solarization bed might be more effective than the currently popular phosphorus acid treatments used in combatting Phytophthora cinnamomi.
I had three goals in mind: First, to disrupt the pathogen's life cycle by forcing it into dormancy prematurely due to the soil amendment. Second, to thermally inactivate the spores by elevating soil temperature using the solarization bed. Lastly, to promote new root growth using a plant hormone.

Methods/Materials
My soil amendment was composed of gypsum, eggshells, coffee grounds, poultry manure, and a root-stimulating hormone. Gypsum and eggshells provide calcium, improve soil porosity and cause spores to encyst prematurely. Coffee grounds maintain a favorable pH, and poultry manure releases nitrogen. Indole Butyric Acid, a plant hormone, helps promote new root growth. I installed plastic tarps over the soil amendment to create my solarization beds. This created a greenhouse effect to increase soil temperature, which would thermally inactivate the P. cinnamomi spores.

Results
My experimental group consisted of 48 avocado trees. 12 infected, mature trees and 12 infected yearlings were treated with soil amendment and the solarization beds were created around them. My control plants (12 infected mature trees and 12 infected yearlings) were not treated. Avocado feeder roots are shallow and are known to remain within 25 centimeters beneath the tree. Using a surface and a probe thermometer, I measured the temperature variation of the soil at the surface and at 25 cm below, over the course of 8 weeks. I also monitored visible changes to the plants.

Conclusions/Discussion
At the conclusion of my experiment, the soil samples were retested, and were confirmed to be devoid of P. cinnamomi. My hypothesis was supported.

Summary Statement
The goal of my project was to develop an economical, comprehensive, commercially viable, and environmentally friendly method to control the spread of avocado root rot, which is caused by Phytophthora cinnamomi.

Help Received
My science teacher, Mrs. Hunker, helped guide me in this project. I purchased most of my materials from various gardening stores. My father supervised me for safety whenever necessary.