Identification of almond rootstocks with resistance to Armillaria root disease

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What is Armillaria root disease?

Armillaria root disease is a localized soil-borne disease caused by the fungus *Armillaria mellea*.

The underground mycelium colonizes woody roots and decomposes them. Such destruction inhibits water and nutrient uptake from the soil, significantly reduces crop growth and yield, and eventually kills infected trees. *Prunus* species are among the most susceptible tree crops in the US.

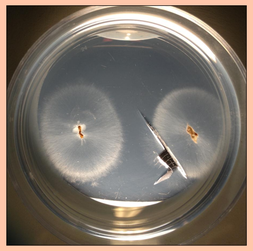
How do I know I have it?

- disease centers

- stunted shoots
- wilting
- dwarfed foliage
- premature defoliation
- dwarfed fruit
- the presence of dead plants

- gradual, multi-year symptom development
- thick, white mats of fungal tissue beneath the bark of infected roots

- confirmation by lab culture on selective media



A. mellea on minimal medium with antibiotics

A. mellea on rich medium

What can be done?

Infected root removal After deep tilling brings residual roots to the surface, manual removal may reduce inoculum levels.

Root collar excavation Permanent removal of soil from the base of the trunk causes mycelium to recede from grapevines and peach trees, increasing their yield.

Resistant rootstocks Rootstocks with plum backgrounds (Marianna, *P. domestica*, Myrobalan) have shown high resistance.

Other measures have been tried:

Systemic fungicides Decomposition of the root crown disrupts movement of fungicides through the vascular tissue.

Soil fumigation The pathogen escapes fumigation in deep soil.

Fallow The pathogen persists 10+ years in residual roots.

Biological control Tested agents have not been effective in field situations.

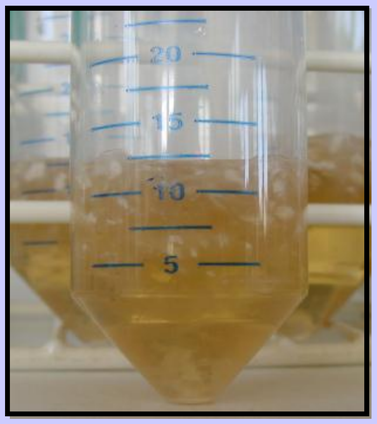
What are USDA Armillaria researchers working on?

We are testing a rapid screening procedure for Armillaria resistance in new rootstocks. Armillaria screening is notoriously difficult –

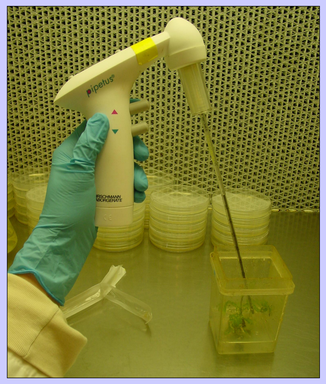
- There has only been one properly designed field test of *Prunus* rootstocks, which required 10 years to complete.
- Greenhouse trials require 2-3 years, infection is hit-and-miss, and infected plants rarely develop symptoms.

Our procedure relies on rooted cuttings in tissue culture.

We grow the pathogen in liquid culture,

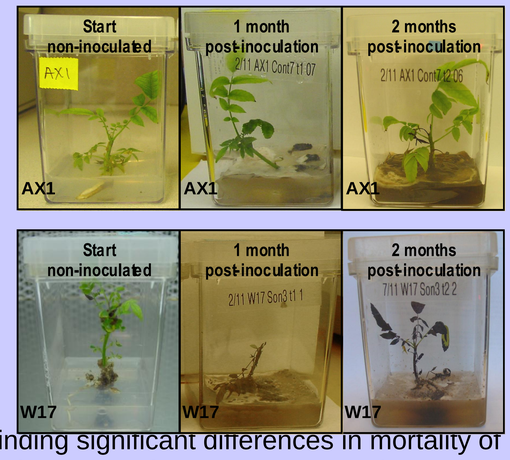


homogenize it, and inoculate it onto the medium,



and we record mortality or calculate root colonization based on qPCR.

In 2011 we adapted our technique to walnut,



finding significant differences in mortality of the rootstock crosses we tested.

Our upcoming screen will test Armillaria resistance of these almond rootstocks:

- Empyrean 1
- Lovell
- Bright 5
- Hansen 536
- Krymsk 1
- Krymsk 86 (Kuban 86)

against known susceptible and resistant rootstocks:

- Nemaguard
- Marianna 2624

Acknowledgements

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