
Screening and Evaluation of New Rootstocks with Resistance to *Phytophthora cinnamomi*

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PROJECT OBJECTIVE

Ultimately, the control of *Phytophthora* root rot (PRR) of avocado will be accomplished with resistant rootstocks. Our goal is to find rootstocks that will eliminate *Phytophthora cinnamomi* as a serious pathogen of avocado. Our ability to find such rootstocks has been enhanced as a result of our breeding blocks where we focus on crossing previously identified tolerant selections. Our objectives over the life of this project have been to collect, select, breed and develop avocado germplasm that exhibits tolerance to *Phytophthora* root rot of avocado. This project has already produced several new tolerant rootstocks (Zentmyer, Uzi, and Steddom) and the Office of Research is currently processing these rootstocks for release (Figure 1).

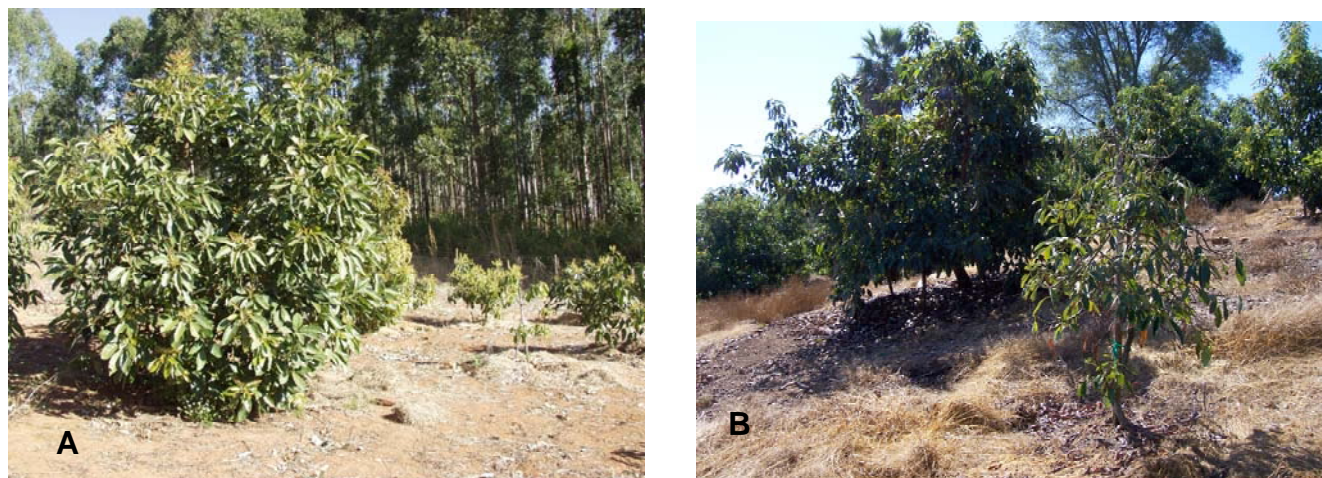


Figure 1. A) Zentmyer rootstock grafted to Hass (left) growing vigorously in root rot infested soil in South Africa next to unknown susceptible rootstocks grafted to Hass. B) Uzi rootstock grafted to Hass (left) growing vigorously in root rot infested soil in Southern California next to Spencer rootstock grafted to Hass that is showing symptoms of *Phytophthora* root rot.

PROGRESS:

This past year we have rated 20 plots and harvest data has been collected from only 1 plot since most of our newer plots are not old enough to yield yet. This year we plan on planting 3 plots consisting of 200 trees each; 400 trees from Brokaw and 200 from C & M nursery. The two best selections in recent years are Brandon and Eddie (Fig 1). We now have established plots with both of these varieties in 12 and 7 plots in the past few years, respectively, and will be watching these varieties closely to evaluate how well they yield. A total of 2,607 seeds have been screened from the 2009 crop year with about half coming from our advanced lines in our germplasm block at South Coast Field Station (SCFS) and the rest from our breeding blocks on campus. Five new GD selections have been added to the 28 prior selections, which are the advanced lines selected since I took over the program in 2005. From the 2010 crop, 4,801 seeds were collected with 2,330 seeds from SCFS and 2,471 from our breeding blocks on campus. We have also established one new breeding block this past year using advanced lines that have good tolerance and are heavy producers, because some of the advanced lines rarely produce fruit. For example, Eddie produces heavily whereas Zentmyer generally does not produce well. We will also use the genetic data we acquired, as reported in the mid-year report, to choose which rootstock varieties to place in other breeding blocks in the future.

On April 12th, 2011, we set up a large experiment at the Ag Ops facility on campus to test some of our best advanced lines and 6 new lines from South Africa (Fig. 2). The cultivars we are testing are Thomas (control), Dusa (control), Zentmyer, Uzi, stedom, Eddie, Brandon, and 6 new SA selections. Three of the SA selections have demonstrated good tolerance to PRR under South African conditions and 3 of the new SA selections have been shown to become heavy producing trees when grafted to Hass. However, we do not know how these rootstocks will perform under California conditions since our climate is much drier and we have higher alkaline soils with much more salinity problems than South Africa. The experiment originally consisted of three treatments; an uninoculated control, a *P. cinnamomi* inoculated treatment, and an inoculated treatment with phos acid applied for control of PRR. However, Ag Ops has decided recently that they do not want to risk inoculating *P. cinnammomi* on their premisses over such a large area since other susceptible hosts, including other Avocado plots, are present at this location. This decision was made after we had been approved for the project and is out of our control.

Although this is a dissapointing position that the University has put us under, we do understand the concerns they have and therefore we are determing if this large field trial can now be manipulated into a soil salinity rootstock trial. This is a discussion that I will have with CAC and I have already spoken briefly to Jonathan Dixon about this current situation. In the long run, this could turn out to be an excellent field trial and also could serve as a demonstration trial for growers.

We have also collected new isolates of *P. cinnamomi* to determine how diverse the population is so that appropriate isolates can be used in the initial screening process. Thus far, it appears that the *P. cinnamomi* population is highly clonal as suspected but is much more diverse than we expected. The most important finding to this study of 138 isolates collected from both the Northern and Southern production zones is that we found evidence of a potential new introduction of the pathogen in the Southern growing area. This was evident from the molecular marker data we collected and was also further verified independently with additional DNA sequence data provided by Dr. Frank Martin from the USDA-ARS, Salinas, CA. It will now be important to sample more Southern isolates and to study some basic biology of these isolates (growth rates, virulence, salinity tolerance, etc..) to determine how this may effect disease control or influence the breeding program. This additional project idea was submitted to CAC during the pre-proposal process for next years funding.

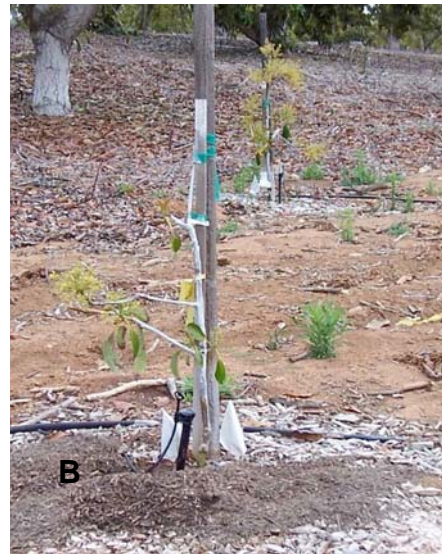


Figure 1. A) Eddie rootstock (left) grafted with Hass and Dusa rootstock (right) grafted with Hass growing under heavy root rot conditions. B) Thomas rootstock grafted with Hass showing significant symptoms of avocado root rot at the same location as A & B. C) Brandon rootstock grafted to Hass growing under heavy root rot conditions.



Figure 2. Rootstock trial at Ag Op planted April 12, 2011 consisting of Thomas, Dusa, Zentmyer, Uzi, Steddom, Eddie, Brandon, and 6 new South African selections.

Conclusions

This project continues to move forward in developing rootstocks that are tolerant to *P. cinnamomi* so that California growers have 'options' when it comes to choosing which clonal rootstock they would like to grow. For example, we consistently get feedback from our grower collaborators and many seem to have a favorite rootstock that does best under their particular growing conditions. This is not surprising given the variability of soil types, salinity problems, grove topography, as well as management practices. The program thus far has produced rootstocks that are far superior to other rootstocks that UCR has developed and we have also begun to utilize more molecular modern tools in the past few years to better understand both the genetics/diversity of the host and the pathogen in this system. These advances will ultimately lead to a better understanding of the dynamics and control of PRR. We are committed to continuing our research efforts for California avocado growers.