

## Screening and Evaluation of New Rootstocks with Resistance to

### *Phytophthora cinnamomi*

Greg W. Douhan  
UC Riverside

Cooperators: Brandon McKee – UC SRA, Elinor Pond – UC SRA, Mary Lu Arpaia – UCCE Gary Bender – UCCE, Ben Faber – UCCE

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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 on avocado. Our ability to find such rootstocks has been enhanced as a result of our breeding blocks where we focus on crossing already resistant rootstocks. Our objectives over the life of this project have been to collect, select, breed and develop avocado germplasm that exhibits resistance to *Phytophthora* root rot of avocado. This project has already produced several new tolerant rootstocks (Zentmyer, Uzi, and Steddom), which are greatly improving the yields of avocado on land infested with *Phytophthora cinnamomi*. The Office of Research is currently processing these rootstocks for release.

#### **PROGRESS:**

This past year we have rated 18 plots and harvest data has been collected from 3 plots in 2010. We currently have three newer varieties which are showing good promise (Brandon, Eddie, and Lexa) but these varieties have not been in the field long enough to evaluate yield data. This year we are planting two plots. One plot has been planted at the Ag Ops facility on campus where we will test some of our advanced lines and 6 new lines from South Africa that have demonstrated good tolerance to PRR under South African conditions. Moreover, 3 of the new SA selections have been shown to become heavy producing trees when grafted to Hass. All trees came from Browkaw nursery. 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 will consist of three treatments; an un-inoculated control, a *P. cinnamomi* inoculated treatment, and an inoculated treatment with phos acid applied for control of PRR. The second plot has yet to be planted but will consist of 200 trees from C & M nursery.

A total of 2,031 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 were from our breeding blocks on campus. There are currently around 540 seeds still left to begin screening. No newer selections have been made but there are currently a total of 124 advanced selections since the program began (28 in the last 5 years). We have also made selections in recent years from 12 additional maternal parents compared to the 8 original maternal parents

when this project began, demonstrating that the breeding and selection process is moving forward. From the 2010 crop, 4,801 seeds were collected with 2,230 seeds from SCFS and 2,571 from our breeding blocks on campus. We are also planning on establishing new breeding blocks this 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 described below, to choose which varieties to place in these blocks in the coming years.

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. In the last progress report, we noted that the *P. cinnamomi* population is highly clonal and not genetically diverse and suggested that the initial screening in the greenhouse using a single isolate would likely not be a problem. However, we have continued this work and sampled more isolates from both the Northern (N) and Southern (S) California avocado growing regions and we have determined that there is actually significant genetic structure in the pathogen population (Fig. 1).

UPGMA

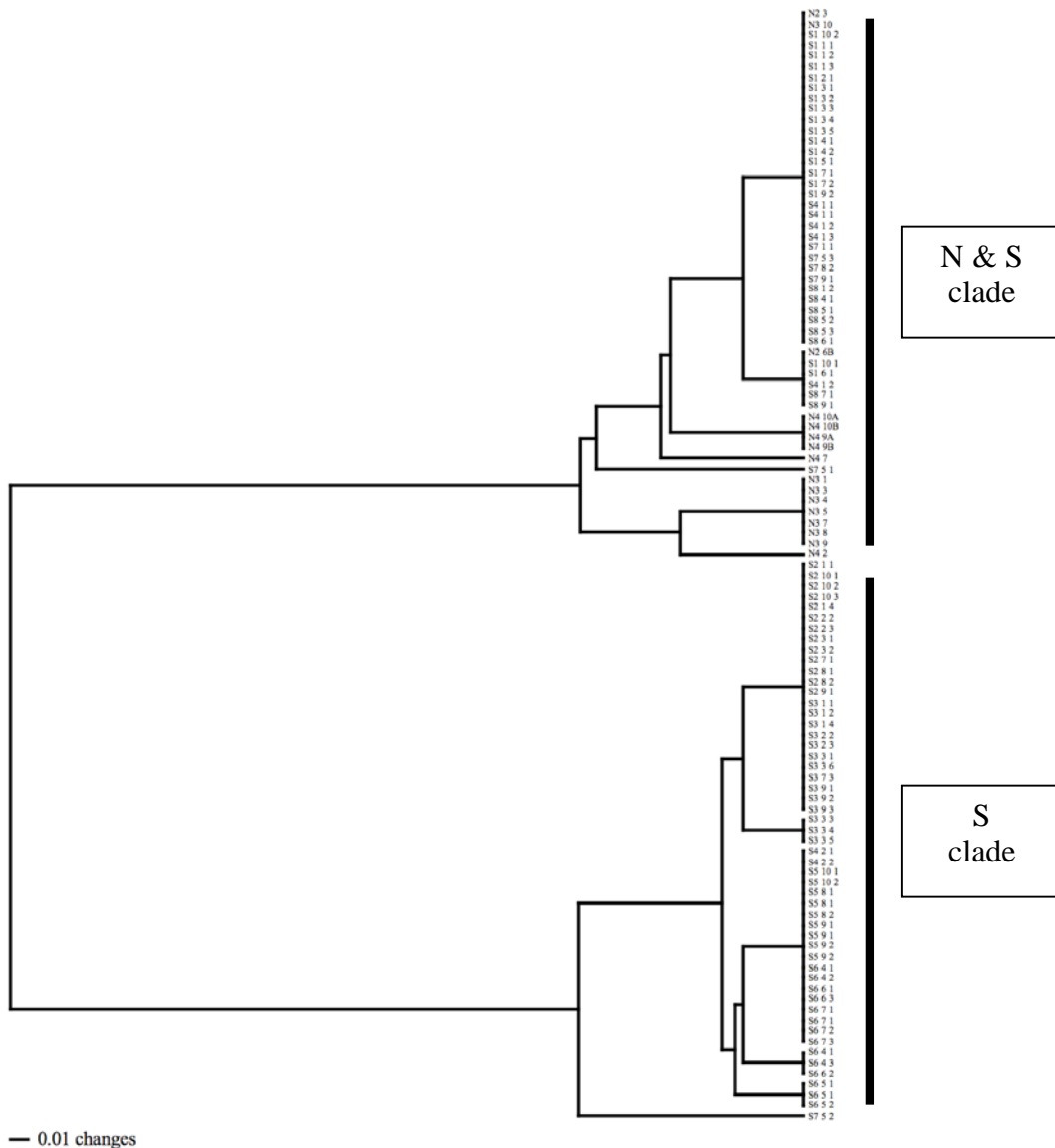


Figure 1. Cluster analysis of over 100 isolates of *P. cinnamomi* collected from 7 groves among the N & S avocado growing regions. Note the two main clades of isolates that are isolated genetically from one another (two main clusters in the genetic tree).

The interpretation of this type of data is that the pathogen population is differentiated genetically primarily among growing regions but that there is also some movement of genotypes (genetically distinct individual isolates) between the growing regions. Therefore, we may need to test these isolates for virulence among various rootstocks since there may be some genotype X rootstock interactions (or even isolate X geography interactions). This would also mean that we may need to use multiple isolates in the greenhouse screening in the future so that the various rootstocks are challenged with isolates which represent the observed diversity in the pathogen population. We are currently writing a manuscript describing the genetic diversity of *P. cinnamomi* isolates Ca from avocado groves.

Given the growing concern of salinity issues in our agricultural water, we have also conducted a preliminary greenhouse experiment recently to investigate how salinity affects pathogenicity of *P. cinnamomi* on avocado. We hypothesized that increased salinity in the soils would increase disease. However, we found no significant differences among the treatments (low to high salt conditions) but further investigations and replication of the experiment are needed to substantiate this preliminary result.

We have also completed a study on genetically characterizing many of our advanced rootstock lines using molecular techniques that we described in the last report. The manuscript for this work has recently been accepted for publication in the journal *Euphytica*. We have also published an update on the rootstock-breeding program at UCR in the latest California Avocado Society Yearbook which can be accessed at:

[http://www.avocadosource.com/CAS\\_Yearbooks/CAS\\_Yearbooks.htm](http://www.avocadosource.com/CAS_Yearbooks/CAS_Yearbooks.htm)

## **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 are committed to continuing our efforts towards developing more tolerant avocado rootstocks for California avocado growers.