

EVALUATION OF WEST INDIAN AVOCADO SEEDLINGS'S TOLERANCE - RESISTANCE TO *PHYTOPHTHORA CINNAMOMI* RANDS COMPARED WITH CLONAL RESISTANT ROOTSTOCKS DUKE 7, THOMAS, AND TORO CANYON, UNDER FIELD CONDITIONS.

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Abstract

The aim of this research was to find West Indian avocado (*Persea americana* Mill.) germplasm resistant to *Phytophthora cinnamomi* Rands, as the West Indian race (WI) is well adapted to the Canary Islands conditions. The trial field selected was an old-established avocado plantation with a high degree of *P. cinnamomi* infection. After planting, symptom expressions of the clonal resistant rootstocks Thomas (TH), Duke 7 (D7), and Toro Canyon (TCY) were compared with those of WI seedlings and seedlings of *Persea indica* (L.) K. Spreng wild material (PI), the latter generally used as a susceptible tester for *P. cinnamomi*. A randomized block design was used for all plantings and the trial was carried out during three years. The recorded data include: height, trunk diameter, disease severity, and surviving plants. The results indicate that D7 and TH are, in our conditions, quite resistant to *P. cinnamomi* but TCY is not. Most of the PI seedlings died, but the surviving plants presented a high degree of resistance. Unselected WI seedlings seem to have a considerable natural resistance to *P. cinnamomi* when compared with the clonal rootstocks. This could be of great interest for commercial avocado plantations in countries where the WI race is the preferred rootstock.

1. Introduction

Spain currently produces around 52,000 t/yr of avocados (*Persea americana* Mill.) (FAO, 1995) on 10, 100 ha, 9, 000 ha on its southern Mediterranean coast and 1, 100 ha distributed throughout the Canary Islands. Root rot, caused by *Phytophthora cinnamomi* Rands, is the crop's most serious problem. As the best long-term control solution is the use of *Phytophthora*- tolerant rootstocks (Zentmyer, 1980), our aim was to screen for new germplasm with potential resistance among the West Indian race avocado, which has proved itself to be well-adapted to the subtropical conditions of the Canary Islands (Alvarez de la Pefia, 1979). In the present study the performance of unselected West Indian seedlings is evaluated and compared with several clonal rootstocks which have proved resistant in California over the last 20-30 years.

2. Materials and Methods

The trial was begun in August 1992 in established avocado groves with a clay-loam soil infected with *P. cinnamomi* for more than twenty years (the isolate of *P. cinnamomi* from these

groves was typified as A₂ mating type and incorporated into the University of California (Riverside) Collection as culture Pc296 in 1975). One-hundred-and-seventy-eight ungrafted clonal rootstocks of Thomas, Duke 7, and Toro Canyon, 216 unselected West Indian seedlings, and 86 viñátigo (*Persea indica* (L.) K. Spreng) seedlings were planted (Table 1). Viñátigo was included as a *Phytophthora-susceptible* control. A randomized block design was used with a 1 x 1 m planting distance to uniformly distribute the trees in the plot. The trial was conducted during three years, with a yearly global evaluation of the percentage of surviving plants; plant height, trunk diameter at 10 cm height and Disease Severity Index (DSI), using a visual scale of 0 to 5 (where 0 = healthy and 5 = dead) (Gabor *et al.*, 1990), were recorded.

3. Results

The DSI totals after three years are shown in Figure 1. Forty-one percent of the West Indian seedlings survived, although most showed some degree of disease incidence. The seedlings viñátigo were severely affected, but it is remarkable that the few surviving viñátigos were very healthy plants. Of the clonal rootstocks, Duke 7 had the highest survival rate but Thomas had a higher percentage of symptomless plants; Toro Canyon plants had the lowest survival percentage and surviving plants were severely affected.

Height and trunk diameter means, grouped according to DSI ratings, are given in Figures 2a and 2b. Toro Canyon development was clearly inferior compared with the other rootstocks. At disease rates of DSI 2, 3, and 4, few differences were appreciated between West Indian and the clonal rootstocks Duke 7 and Thomas, in trunk diameter and plant height means. In healthy and slightly affected plants (DSI = 0 and 1) differences were larger, in favour of the West Indian rootstock.

Maximum and minimum monthly average temperatures ranging between 16.6-24.3°C and 14.4-19.4°C, respectively, were registered throughout the trial.

4. Discussion

Based on a visual scale, Gabor *et al.* (1990) found that clonal rootstocks of Thomas, Duke 7 and Toro Canyon (among others) were generally healthier than the other rootstocks tested by them, with Thomas being the most resistant to *P. cinnamomi* and Duke 7 and Toro Canyon having an intermediate degree of resistance. Menge *et al.* (1992) also found Thomas to be the best under field trial conditions, while Duke 7 displayed a moderate tolerance to *P. cinnamomi*. Menge *et al.* (1992) conclude that Duke 7 could be considered as a standard reference for comparing tolerance-resistance with other rootstocks.

In the edaphic and climatic conditions of the present study, with a high degree of infection in the trial plots, Thomas and Duke 7 seem to be quite resistant to *P. cinnamomi*. Nevertheless, rootstocks have developed poorly during their 3 years of growth. Toro Canyon did not show an acceptable degree of resistance, given the low percentages of surviving plants and the advanced disease states these presented, despite the fact that fewer plants were evaluated.

The differences observed in plant development between the West Indian seedlings and the Mexican rootstocks Duke 7 and Thomas were particularly patent for symptomless and slightly-affected plants. In these stages, West Indian seedlings had a clearly better adaptation to our environmental conditions. The survival percentages of West Indian seedlings are higher in the present study than in previous trials (Gallo-Llobet, 1992; 1993).

The viñátigo seedlings were in their majority very susceptible to *P. cinnamomi* although there were a few individuals which showed a high degree of resistance. This is consistent with the results of previous trials (Gallo-Llobet, 1990; 1993).

The West Indian seedlings which gave the best results in this study are currently being propagated to further evaluate their behaviour once grafted with commercial avocado cultivars.

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Table 1. Plant material analysed for resistance to *Phytophthora cinnamomi*

Avocado rootstock or species	Type of material	Geographic origin	Total plants
West Indian	Seedling	Canary Islands	216
<i>Persea indica</i> , viñátigo	Seedling	Canary Islands	86
Duke 7 (Mexican)	Clonal	Riverside, California	96
Thomas (Mexican)	Clonal	Escondido, California	68
Toro Canyon (Mexican)	Clonal	Toro Canyon, California	14

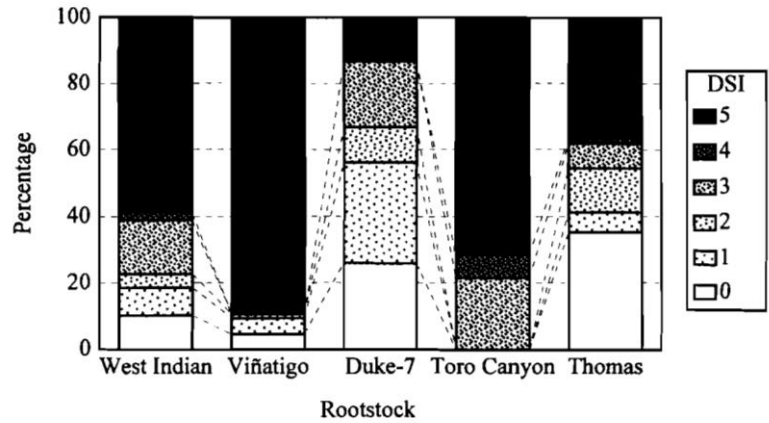


Figure 1. Percentages of surviving plants distributed according to DSI ratings.

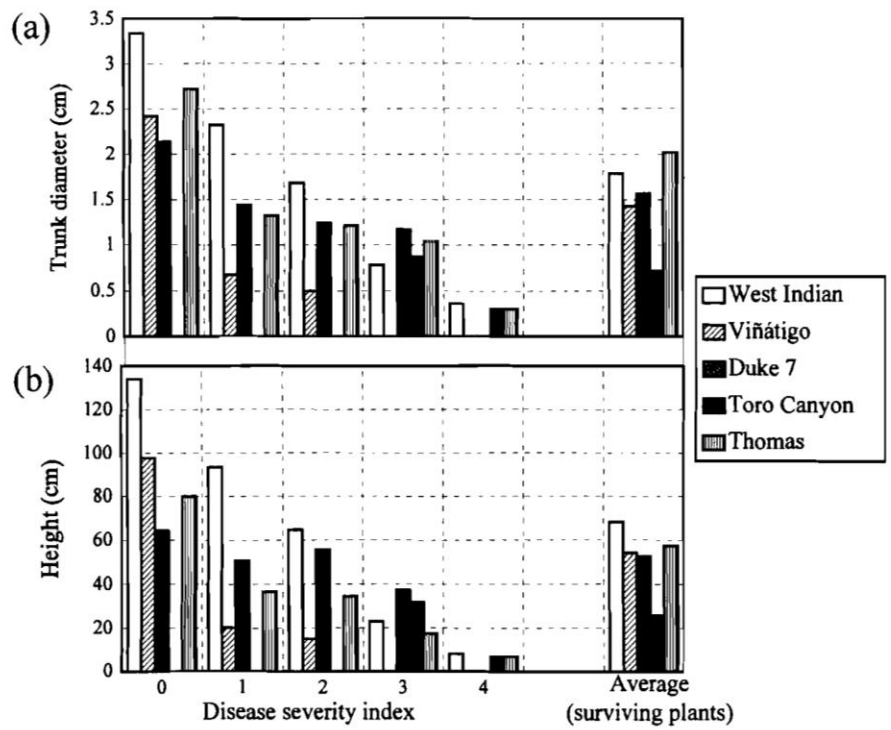


Figure 2. Mean trunk diameters (a) and mean plant height (b) of surviving plants, distributed according to DSI ratings.