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BIOCONTROL OF *PHYTOPHTHORA CINNAMOMI* ON AVOCADO: IDENTIFICATION AND FIELD TESTING OF LOCAL NATURAL ANTAGONISTS, AND EVALUATION OF ROOTSTOCKS FOR RESISTANCE

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Abstract

Soils suppressive to root rot of avocado (caused by *Phytophthora cinnamomi),* were first identified in South Africa in 1990. Mcro-organisms from these soils were tested for *in vitro* antagonism to *Phytophthora cinnamomi* and subsequently evaluated for suppression of root rot of avocado seedling plants in a mistbed. Three fungal antagonists, *Paecilomyces filacinus, Aspergillus candidus and Trichoderma hamatum* were effective in suppressing root rot. These antagonists have been evaluated since 1992 for control of root rot in avocado trees in the field. Populations of the antagonists have been found to increase in the root zone of newly planted trees (after antagonist treatment in the nursery and in the orchard) and in the root zone of established Hass and Fuerte trees planted in 1981 and 1980 (after antagonist treatment in the orchard).

In an isolated planting site consisting of various ungrafted avocado rootstocks (eg. G1033, Dusa, Latas, D9, Duke 7, Barr Duke, Thomas, Velvic) trees undergo open pollination. Seeds from this orchard, situated at Westfalia Estate, are germinated and the seedlings evaluated for resistance to root rot in a mistbed. A number of successful selections have been made and these are being clonally propagated and grafted with Hass. These trees are to be planted in a root rot infested field site where they will be evaluated for yield and resistance to root rot.

1. Introduction

Root rot of avocado (*Persea americana* Mill.), caused by *Phytophthora cinnamomi* Rands (Pc), is the most important avocado disease in Australia (Broadbent and Baker, 1974; Pegg *et al.* 1982), California (Zentmyer 1984) and South Africa (Kotzé *et al.* 1987).

The South African avocado industry relies on chemical control of root rot with phosphite compounds and Duke 7 rootstock (tolerant to root rot), which is widely used. Thus, resistance of Pc to phosphite compounds would constitute a serious threat to the avocado industry. However, it has been reported that resistance of Pc to fosetyl-Al occurs on *Chamaecyparis lawsoniam* (*Vegh et al.* 1985), and a tendency has also been reported of Pc. from soil of avocado trees treated with phosphites over a prolonged period to be less sensitive to phosphites *in vitro* than Pc from soil of untreated trees (Duvenhage 1994). This stresses the importance of the search for biocontrol methods root rot control such as the use of antagonistic micro-organisms or another rootstock genetically different from Duke 7 with tolerance or resistance to root rot, but which is

high yielding. This would facilitate less reliance on Duke 7 as a rootstock, and possibly less reliance on chemical control of root rot.

2. Materials methods and result

2. 1. Identification and field testing of local natural antagonists

In 1990 soils suppressive to avocado root rot were identified in South Africa (Duvenhage and Maas, 1990; Duvenhage *et al.* 1991). Several antagonists from these soils were consequently found to effectively control avocado root rot under glasshouse conditions (Duvenhage and Kotzé, 1993). Field trials are currently under way to evaluate the ability of three fungal antagonists to effectively control avocado root rot in the orchard.

During November to December 1992 one trial block each of Fuerte and Hass on Duke 7 rootstocks was planted with nursery trees of which the growth medium had been amended with three fungal antagonists; *Paecilomyces filacinus, Aspergillus candidus and Trichoderma hamatum,* and also a mixture of all three (Duvenhage and Köhne, 1995). Antagonist treatments are repeated annually in the orchard (Duvenhage and Köhne, 1995), and the tree condition and yield, antagonist and *Phytophthora cinnamomi* populations, and suppressiveness of the soils are monitored annually. Also, two avocado blocks, a Hass block planted in 1981 on Duke 7 rootstocks, and a Fuerte block planted in 1980 on Guatemalan seedling rootstocks, have been treated since 1992 with antagonist spore suspensions (Duvenhage and Köhne, 1995) and evaluated on the same criteria mentioned above. Although there was a tendency for the antagonist populations to increase in soil of all antagonist treatments, over the period from 1992 (before the start of the treatments) to 1995, the increases were not always significant (data not shown). Figure 1 illustrates the increased populations for the Fuerte block treated with different antagonists, during the period of 1992 (before planting) to 1995. Antagonist populations in the untreated soil (control) did not change significantly during this period (data not shown). To date, tree condition, yield, populations of *Phytophthora cinnamomi,* and suppressiveness of soils have not been influenced by antagonist applications (data not shown).

2.2. Evaluation of rootstocks for resistance

In order to obtain rootstocks with better resistance or tolerance to root rot and better horticultural characteristics than currently used rootstocks, a breeding programme was started a number of years ago. In an isolated planting site, situated on Westfalia Estate, consisting of various ungrafted avocado rootstocks (eg. G1033, Dusa, Latas, D9, Duke 7, Barr Duke, Thomas and Velvic) trees undergo open pollination. Seeds from this orchard are germinated and the seedlings evaluated for resistance to root rot in a inistbed by planting in Pc inoculated vermiculite, and subsequent visual evaluation of the root system of each seedling for root rot symptoms. The breeding programme has produced approximately 13 00 seedlings to date, and 10 promising new rootstock selections have been made. Material of each selection is now being propagated and the first trees (36 of each rootstock selection) will be planted in a root-rot-prone field site during 1996. All rootstocks will be grafted with Hass and will be compared with Hass on Duke 7 rootstock (as the standard) for root rot symptoms and yield.

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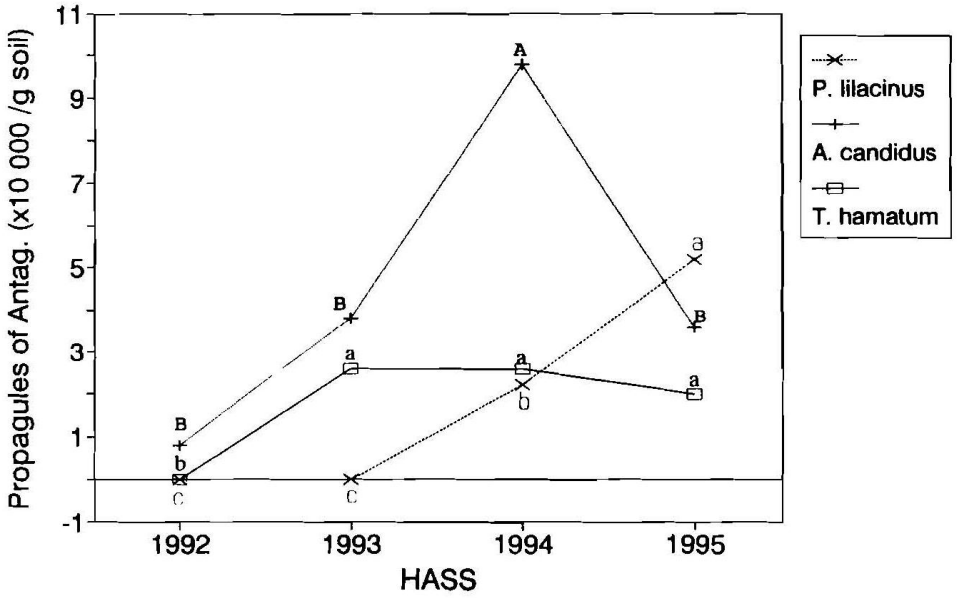

Data points on the same curve not accompanied by the same letter are significantly different according to Duncan's multiple range test (P=0,05)

Fig 1 Antagonist populations in soils treated with different antagonists (trees planted in 1992).