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The occurrence of soils suppressive to *Phytophthora cinnamomi*

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A PRELIMINARY REPORT

ABSTRACT

Soils in which avocado trees showed exceptional vigour, even in the presence of Phytophthora cinnamomi were collected in the Tzaneen area and assayed for suppression of P cinnamomi. Blue lupins (Lupinus angustifolius) were planted in a vermiculite : soil mixture which was artificially infected with a mycelial homogenate of P cinnamomi. Fresh mass determinations of lupin plants after seven days indicated that six of the 15 soils tested significantly suppressed disease.

INTRODUCTION

The value of identifying soils suppressive to *Phytophthora cinnamomi* Rands *(P.c.),* the causal organism of root rot of avocado *(Persea Americana* Mill) (Tucker, 1929), was first reported by Broadbent & Baker (1974). In their study they showed that soils suppressive to *P.c.* supported significantly greater numbers of micro-organisms antagonistic to *P.c.* and that the soils had a higher content of exchangeable Ca, Mg and N.

Due to the success of root rot control by suppressive soils, the problems posed by resistance of *P.c.* to chemical control and public resistance to use of chemicals (Baker & Cook, 1974), this study was initiated. Finding suppressive soils in South Africa that can be used to find out how to bring about suppressiveness in soils is the primary aim of the study.

MATERIALS AND METHODS

Soil samples were taken from 12 trees on three farms in the vicinity of Tzaneen. These trees showed no visible symptoms of root rot although completely untreated and are referred to as "escape trees". Three trees that showed mild root rot symptoms were also sampled. From each tree, three soil samples were pooled and tested for suppressiveness according to a modified method described by Malajczuk, McComb & Parker (1977).

Each soil sample was air dried for 24 h, ground with a mortar and pestle and mixed with vermiculite to obtain a 5% (w/v) concentration of soil. Controls consisted of a pooled sample of each farm which was Gamma-irradiated prior to mixing with vermiculite, one which consisted only of vermiculite and one consisting only of vermiculite but not

inoculated with *P.c.*

In addition each soil was sampled and tested for the presence of *P.c.* by a modified method described by Pegg (1977).

Inoculum was grown in broth containing 1% glucose and 0,1% yeast extract for seven days at 25°C in a shaker. After harvesting the fungal mass by filtration through Whatman No 1 filter paper and washing twice with sterile distilled water, it was blotted dry with paper cloth. Mycelium was added to a 0,1% agar solution at a concentration of 0,5% (w/v) and mascerated for 15 s with an Ultra Turrax.

TABLE 1 Effect of soil amendments on rootrot severity of lupin seedlings

Soil code or treatment	Mean fresh mass *of five replicates (g)
Uninoculated control	5,296 a
Z 1	5,248 a
A 2	3,282 b
B 13	3,206 b
Z 3	3,156 b c
B 14	3,106 b c
A 7	3,024 b c
B 14	2,898 b c d
A 3	2,874 b c d
Z 2	2,834 b c d
C 19	2,548 b c d
A 5	2,376 b c d
B 4	2,334 b c d
A 6	2,260 b c d
B 1	1,708 b c d e
Z 4	1,366 c d e
Gamma irradiated control 1	1,202 d e
Gamma irradiated control 2	1,202 d e
No-soil containing control	1,202 d e
Gamma irradiated control 3	0,552 e
Gamma irradiated control 4	0,552 e

*Values followed by the same letter do not differ significantly according to Duncan's analysis of variance (P = 0,01).

This inoculum suspension was added to the soil: vermiculite mixture at a ratio of 100 mℓ to 1ℓ mixture. After mixing by shaking in a plastic bag, the mixture was divided into five plastic cups and each planted with five surface sterilised pregerminated lupin seedlings (Darvas, 1979).

Plants were grown under constant fluorescent lighting at 25°C for seven days and watered every second day with 40 mℓ distilled water per cup. After removal of whole plants from cups, roots were rinsed and blotted dry, and the whole plants from each cup weighed together to determine fresh weight.

RESULTS AND DISCUSSION

Only six "escape tree" soils (two from each farm) significantly reduced disease in

comparison with the gamma irradiated controls (Table 1) even though *P.c.* populations in all "escape tree" soils were significantly lower than in two of the soils in which diseased trees occurred (Table 2).

TABLE 2 Semi-quantitative analysis of soils for presence of *P.c.*

Soil code or treatment	Mean number of leaf* discs infected by *P.c.* from 15 sub-soil samples
A 6	4,9 a
A 5	4,3 a
B 12	1,2 b
A 7	1,2 b
Z 2	1,2 b
A 3	0,8 b
Z 4	0,8 b
B 13	0,8 b
A 2	0,7 b
B 4	0,6 b
B 14	0,5 b
C 19	0,5 b
Z 1	0,5 b
Z 3	0,4 b
B 1	0,2 b

*Values followed by the same letter do not differ significantly according to Duncan's analysis of variance (P = 0,01).

The inclusion of gamma irradiated soil as control indicates that microbes in the "escape tree" soils were responsible for the disease reduction, as the same soils were ineffective after gamma irradiation.

Furthermore, lupin seedlings, highly susceptible to infection by *P.c.* were successfully used to differentiate between the suppressive potential of the soils tested.

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