

Susceptibility of avocado rootstocks to *Phytophthora cinnamomi*

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ABSTRACT

Grafted Duke 7, G6 and G755 trees showed less resistance to *P. cinnamomi* in an *in vitro* test programme, than ungrafted trees. When the Hass cultivar was grafted onto the various rootstocks, the roots of the composite plants were more susceptible to attacks by *P. cinnamomi*. The Hass/Duke 7 combination was especially susceptible to crown canker development. However, two-year-old Hass/Duke 7 trees yielded ca three times more fruit than the Hass/G6 and Hass/G755 combinations. Barr/Duke showed promise in an *in vitro* screening programme.

UITTREKSEL

In 'n *in vitro* toetsprogram het geënte Duke 7, G6 en G755 betekenisvol swakker gevaar as ongeënte borne. As die Hass-kultivar op die onderstamme geënt is, was die onderstamme meer vatbaar vir aanvalle van *P. cinnamomi*. Die Hass/Duke 7-kombinasie was veral vatbaar vir kroonkanker. Die Hass/Duke 7-kombinasie se opbrengs twee jaar na aanplanting, was ongeveer drie maal hoër as die Hass/G6-en Hass/G755-kombinasie. Van sestien onderstamme wat *in vitro* getoets is, het Barr/Duke veral beïndruk.

INTRODUCTION

Avocado root rot is currently under control due to the excellent research by Darvas, Kotzé & Toerien, 1978; Snyman & Kotzé, 1983 and Darvas, Toerien & Milne, 1983. In an attempt to obtain genetical control of the disease, root-stocks like Duke 7, G6 and G755 have been selected in Guatemala and California and are currently used extensively in South Africa. Since resistance of the pathogen to fungicides is not precluded, selection of new and better rootstocks is of great importance.

In this article rootstocks like Duke 7, G6 and G755 are compared to new rootstocks in an *in vitro* screening programme. The three rootstocks were also evaluated for yield.

MATERIALS AND METHODS

The previous article showed that the rootstock G755 was more resistant to *P. cinnamomi* than Duke 7, G6 and Edranol. These results, which were obtained with the DM and the agar plate techniques, correlated well with known resistance of the rootstocks (Coffey,

1987).

However, these results were obtained using ungrafted trees. The rootstocks (Edranol, Duke 7, G6 and G755) were grafted with Fuerte and Hass, while ungrafted trees served as controls. Ten months later the roots of each rootstock-scion combination were individually collected and tested for tolerance to *P cinnamomi* using the two techniques previously mentioned. In the same trial susceptibility to crown canker was also determined. Each plant was inoculated on the stem area with *P cinnamomi* mycelium after artificial wounding of the bark. The wounds with mycelium were sealed with grafting tape and lesion development was determined two weeks later.

Sixteen rootstocks (including Edranol, Duke 7, G6 and G755) were compared *in vitro* for tolerance to *P cinnamomi*. The rootstocks were all grafted with Hass. Lesion development on root tips (measured with the agar plate technique) was used as criteria. Duke 7, G6 and G755 were also compared in a commercial planting at Westfalia Estate. Yield and fruit diameter were used as criteria (Hass scion; planting date March 1987).

RESULTS

Grafted rootstocks (Duke 7, G6 and G755) became more susceptible to root colonisation by *P cinnamomi* than ungrafted trees. The rootstocks were generally more predisposed to infection by the Hass scion (Table 1). The same tendency was also observed in zoospore attraction (Table 2). Edranol was the only rootstock not negatively affected by grafting. The Hass/Duke 7 combination showed the highest susceptibility to crown canker, two weeks after inoculation with *P cinnamomi* (Figure 1).

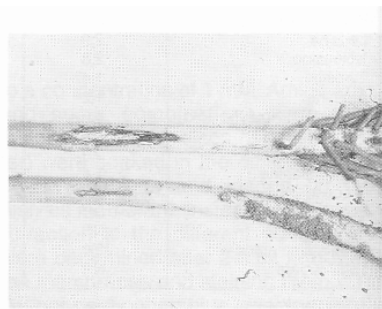


Fig 1 Crown canker lesions on stem of the Duke 7 avocado rootstock after inoculation with *P cinnamomi*.

LEFT = CONTROL
RIGHT = INOCULATED

TABLE 1 Resistance of excised roots of 12 avocado rootstocks/scion combinations to *P cinnamomi* according to lesion development

Rootstock/scion combination	Length of lesion (mm) after 48 h
Edranol (without scion)	12,5abc
Edranol/Fuerte	6,5ef
Edranol/Hass	9,5cde
Duke 7 (without scion)	8,5de
Duke 7/Fuerte	12,6abc
Duke 7/Hass	15,7a
G6 (without scion)	7,1ef
G6/Fuerte	13,7ab
G6/Hass	12,5abc
G755 (without scion)	4,1f
G755/Fuerte	8,7de
G755/Hass	11,6bcd

Each value is the mean of 15 replicates. Values not followed by the same letter differ significantly according to Duncan's multiple range test (P=0,05).

TABLE 2 Zoospore encystment of *P cinnamomi* on root tips of 12 avocado scion/rootstock combinations determined by means of the dialysis membrane technique

Rootstock/scion combination	Number of cysts produced
Edranol (without scion)	211 a
Edranol/Fuerte	29bc
Edranol/Hass	113b
Duke 7 (without scion)	26bc
Duke 7/Fuerte	18c
Duke 7/Hass	88bc
G6 (without scion)	39bc
G6/Fuerte	10c
G6/Hass	55bc
G755 (without scion)	23c
G755/Fuerte	33bc
G755/Hass	71bc

Each value is the mean of ten replicates. Values not followed by the same letter differ significantly according to Duncan's multiple range test (P=0,05).

Of the sixteen rootstocks tested, Barr/Duke was a new selection that showed promise in an *in vitro* screening programme, where root colonisation was used as a criteria (Table 3). Duke 7 showed higher yield and greater fruit diameter than G6 and G755 in a commercial planting at Westfalia (Hass scion) (Table 4).

TABLE 3 *In vitro* tolerance of new and existing avocado rootstocks to *P cinnamomi* as measured with the agar plate technique

Experiment 1		Experiment 2	
Root-stock	Lesion length (mm)	Root-stock	Lesion length (mm)
Latas	26,4	G1033	26,7
Edranol	23,1	Edranol	19,9
Gordan	20,0	G6	17,6
G6	19,8	Thomas	16,9
Duke 9	13,8	Gordan	16,7
Jovo	11,8	Duke 9	16,4
Evstro	9,5	Evstro	16,3
Duke 7	7,1	W14	14,6
Thomas	6,5	Jovo	13,1
Dusa	6,3	Dusa	12,7
G1033	4,6	Latas	12,4
W14	3,4	Duke 7	10,9
G755C	2,8	G755A	8,7
Barr Duke	2,4	G755B	6,1
G755B	0,6	Barr Duke	3,9
G755A	0,3	G755C	2,6

All the rootstocks were grafted with Hass.

TABLE 4 Yield performance of three avocado rootstocks grafted with Hass

Rootstocks*	Fruit per tree N=25	Fruit diameter (cm) N=30
Duke 7	16,3	6,30
G6	4,3	6,25
G755	5,8	6,08

*Planting date - March 1987.

DISCUSSION

Grafted Duke 7, G6 and G755 rootstocks were more susceptible to *P cinnamomi* than ungrafted trees. Rootstocks on which the Hass cultivar was grafted showed greater susceptibility than ungrafted rootstocks. These results correspond with those of Coffey (1987), who conducted his experiments under field conditions. The rootstock-scion interaction was also evident in the crown canker experiment where the Hass/Duke 7 combination proved to be very susceptible. Lesions on this combination were unusually large. Lonsdale, Botha, Wehner & Kotzé (1988) described this problem on Hass/Duke 7 in a field situation. Crown canker has also been monitored on the Ryan/Duke 7 combination (unpublished data). The occurrence of the disease is exceptionally high where Duke 7 is used in a replant situation, and extra attention should be given to trees planted in *P cinnamomi* infested soils. When comparing rootstocks in an *in vitro*

screening programme, all the trees should be grafted with the same scion to standardise results.

For this reason, all the new and existing rootstocks tested were grafted with Hass. Duke 7 and especially G755 were commercial rootstocks that showed tolerance to *P. cinnamomi*. Barr/Duke showed a similar degree of tolerance as G755 and no differences were evident between the three G755 clones.

Hass grafted on Duke 7 yielded ca three times more fruit than Hass on G6 or G755 in a two-year-old orchard at Westfalia. Similar results were obtained in California by Bekey (1989). This shows that tolerance to *P. cinnamomi* is not the only criteria to look at when selecting a rootstock. Duke 7 is susceptible to crown canker and gives disappointing result in waterlogged soils (Coffey, 1987).

The answer to the root rot problem in South Africa lies in the selection of a rootstock with high tolerance of *P. cinnamomi* over a wide range of environmental conditions and with desirable horticultural characteristics like high yield of high quality fruit.

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