

Breeding and field testing of new avocado rootstocks for increased Hass yields and resistance to root rot

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ABSTRACT

The avocado rootstock breeding program at Merensky Technological Services (MIS) has delivered several promising selections since the start of the program in 1993. Two of these selections were grafted with Hass and included in a field test in 2000.

Vegetatively propagated rootstock selections grafted with Hass are evaluated for their root rot tolerance and yield potential in an orchard heavily infested with *Phytophthora cinnamomi*. The rootstock selections are compared to the commercial standard (Duke 7). The annual tree health rating (July 2000) showed that the tree condition generally declined severely during the extremely wet summer. However, the ranking order of the rootstocks was very similar to that in 1999. In the first orchard (planted in 1996), trees were rated from the healthiest to the poorest: VC 805, VC 256, VC 801, VC 218, VC 207, VC 241, Duke 7, Edranol seedlings and VC 225. In the second orchard (planted in 1998) trees were rated from the healthiest to the poorest: Merensky III, Merensky II, Velvick, Duke 7, Merensky IV, Edranol seedlings, Gordon and Jovo. In both orchards, a first small crop was picked in 2000.

INTRODUCTION

Root rot of avocado, caused by *Phytophthora cinnamomi*, is the most important avocado disease in South Africa. Currently, the South African avocado industry relies on chemical control of root rot with phosphite compounds, and the use of the Duke 7 rootstock which is moderately tolerant to root rot. The long term solution would be a high yielding avocado rootstock with resistance to root rot. To achieve this aim, this project includes a rootstock breeding program, and a field test in which various vegetatively propagated rootstock selections are evaluated for yield and root rot tolerance in comparison with the Duke 7 rootstock.

MATERIALS AND METHODS

Breeding program

The avocado rootstock breeding block currently contains 20 different rootstocks which have shown superior performance under *Phytophthora cinnamomi* pressure (e.g. Duke 7, Merensky I, II and III, G755A). These trees are used as parent trees for breeding, and undergo open pollination. Pollen from commercial avocado cultivars is excluded from the breeding block by the remoteness of the breeding block from commercial orchards.

Seedlings from this block (between 1500 to 3500 per annum, depending on the yields) are screened for resistance to root rot by exposure to a virulent strain of *Phytophthora cinnamomi* in a mistbed. The seedlings are planted in *Phytophthora* infested vermiculite and evaluated for root health in comparison to Duke 7 clonal rootstocks (commercial standard rootstock). Selected seedlings are then cloned and re-tested (10 of each) in the mistbed as described above (Duvenhage & Kremer-Köhne, 1998). Only the best rootstocks selected in the second mistbed screening are propagated and grafted with Hass for field tests in which they will be evaluated for yield and resistance to root rot over a period of 6 years.

Field testing

Details of the avocado field testing were reported previously (Kremer-Köhne & Duvenhage, 2000). In April 2000, a third block was planted according to the layout described for Blocks 1 and 2 (Kremer-Köhne & Duvenhage, 2000). Block 3 contains the following rootstocks Toro Canyon, Thomas, Hass (on own root), 4603, Merensky I, the South African selection PvT (Bijzet, 1999), V1 and V3 (rootstock selections from the MIS breeding program).

In Blocks 1 and 2, a first small crop was picked in May 2000. Tree condition was rated in July 2000, according to a disease index of zero (healthy) to 10 (dead) as described by Darvas *et al.* (1984). For tree size determination, trunk circumference was measured 20 cm above the ground level in June 2000. Data on yield, tree condition and tree size were analysed by ANOVA.

RESULTS

Breeding program

Since the start of the MIS breeding program in 1993, about 50 seedlings have been selected of which fifteen have been re-tested in the mistbed. So far, two selections, V1 and V3, have been planted in the field.

Field testing

The annual tree condition rating showed that the tree condition generally declined severely in Blocks 1 and 2 during the extremely wet summer with 2500 mm of rain. However, the ranking order of the rootstocks (from the healthiest to the poorest) was very similar to that in 1999. Tree condition ratings of Hass trees on rootstocks originating from Israel are presented in Table 1. In 2000, trees were rated from the healthiest to the poorest: VC 805, VC 256, VC 801, VC 218, VC 207, VC 241, Duke 7, Edranol seedlings and VC 225. Although trees on rootstock VC 801 were relatively healthy, crown rot was observed on 10% of the VC 801 trees. No other

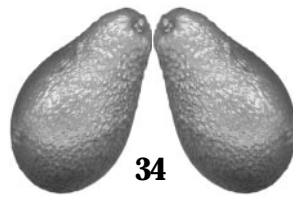


Table 1 Condition and yields of Hass trees on various vegetatively propagated rootstocks as determined in 2000 (Block 1, planted 10/1996). Tree condition was rated on a scale of 0 (healthy) to 10 (dead).

Rootstock	Tree condition	Yield (kg)	Trunk circumference (cm)
VC 805	3.4 d ¹	0.13	20.8 abc
VC 256	3.5 d	0.43	20.2 abcd
VC 801	3.6 d	1.77	23.3 a
VC 218	4.0 d	2.68	21.9 ab
VC 207	4.2 cd	0	16.9 cdef
VC 241	5.5 bc	1.80	18.0 bcdef
Duke 7	5.7 ab	0	15.1 ef
Edranol seedling	5.7 ab	0.73	19.1 abcde
VC 225	7.0 a	0.14	14.5 f
Level of significance	<0.001	NS ²	0.002

¹ Mean separation in columns by LSD, 5% level. Means followed by the same letter are not significantly different.

² NS=non-significant

rootstock was affected by crown rot. There were no significant differences between the yields of the Israeli rootstock selections (Table 1). Tree condition ratings and yields of the trees on Merensky rootstocks and Velvick are shown in Table 2. In 2000, trees were rated from the healthiest to the poorest: Merensky III, Merensky II, Velvick, Duke 7, Merensky IV, Edranol seedlings, Gordon and Jovo. The rootstocks Merensky II and III as well as Velvick were significantly healthier than the other rootstocks (except that Velvick did not differ from Duke 7). Merensky IV, Merensky III, Merensky II and Velvick yielded better than Duke 7, and good yields have been estimated for Merensky III and Velvick for the year 2001 (crop not harvested yet). In both orchards, the vigour of Hass trees as determined by trunk circumference measurements was higher in trees with good condition (Tables 1 and 2).

CONCLUSIONS

Differences in the health condition of Hass trees on various vegetatively propagated rootstock selections observed in 1999 were confirmed in 2000. A first small crop was produced in the year 2000. Preliminary results indicate that there is hope for a rootstock better than Duke 7, both with regard to root rot resistance and yield.

Table 2 Condition and yields of Hass trees on various vegetatively propagated rootstocks as determined in 2000 (Block 2, planted 02/1998). Tree condition was rated on a scale of 0 (healthy) to 10 (dead).

Rootstock	Tree condition	Yield (kg)	Trunk circumference (cm)
Merensky III	1.8 e ¹	2.23 ab	20.5 ab
Merensky II	2.0 e	2.01 abc	18.1 bc
Velvick	2.4 de	1.97 abcd	21.7 a
Duke 7	3.3 cd	0.51 e	16.2 cdef
Merensky IV	3.4 c	2.36 a	17.0 cde
Edranol seedling	3.4 c	1.25 abcde	17.5 cd
Gordon	4.5 b	1.05 bcde	15.1 defg
Jovo	7.1 a	0.53 e	13.6 g
Level of significance	<0.001	0.014	<0.001

¹ Mean separation in columns by LSD, 5% level. Means followed by the same letter are not significantly different.

ACKNOWLEDGEMENT

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