

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

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ABSTRACT

In the avocado rootstock breeding program, 1970 seedlings were screened in the mistbed for root rot resistance and two seedlings with healthy roots were selected in 2001 for further evaluation. After re-testing a number of previously selected seedlings in the mistbed, one selection was identified for field evaluation.

Vegetatively propagated rootstock selections grafted with 'Hass' were evaluated for their root rot tolerance and yield potential in an orchard heavily infested with *Phytophthora cinnamomi*. These were compared to the commercial standard (Duke 7 clonal rootstock) and susceptible controls (Edranol seedling rootstocks). The first orchard (established 1996) contained root rot tolerant rootstocks from Israel, while the second orchard (established 1998) contained root rot tolerant rootstock selections from Westfalia Estate. The annual tree health rating (July 2001) showed that the tree condition in the first and the second orchards had in general declined further, but not as severely as during the extremely wet summer in 2000. In both orchards, the ranking order of the rootstocks remained consistent during the period 1999 to 2001. In the first orchard, rootstock VC 801 out-performed all the other rootstocks in terms of yield; 10% of the VC 801 trees were, however, affected by crown rot. In the second orchard, rootstocks Merensky II, Merensky III and the Velvick selection V100 out-performed the Duke 7 rootstock in terms of yield and root rot resistance.

INTRODUCTION

The long term aim of this project is to select and evaluate high yielding avocado rootstocks 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 resistance in comparison with the Duke 7 rootstock. Progress made with the evaluation of rootstocks was reported previously (Kremer-Köhne, Duvenhage & Mailula, 2001) and data are updated in this paper.

MATERIALS AND METHODS

The avocado rootstock breeding program at Merensky Technological Services continued as described by Kremer-Köhne *et al.* (2001).

Details of the avocado field testing were reported previously (Kremer-Köhne &

Duvenhage, 2000; Kremer-Köhne *et al.*, 2001). In the first two orchards (Blocks 1 and 2) a second crop was picked in May 2001. Tree condition was rated in July 2001, according to a disease index of zero (healthy) to 10 (dead) as described by Darvas, Toerien & Milne (1984). For tree size determination, trunk circumference was measured 20 cm above the ground level in June 2001. Data on yield, tree condition and tree size were analysed by ANOVA, and LSDs at the 5% significance level were used to compare rootstocks.

RESULTS

Breeding program. In 2001, 1970 seedlings were screened in the mistbed for root rot resistance and two seedlings with healthy roots were selected for further evaluation. After re-testing a number of previously selected seedlings in the mistbed, one selection (V20) was

identified for field evaluation.

Field testing. The annual tree health rating (July 2001) showed that the tree condition in the first and the second orchards (Blocks 1 and 2) had in general declined further, but not as severely as during the extremely wet summer in 2000. The ranking order of the rootstocks (from the healthiest to the poorest) remained consistent during the period 1999 to 2001. Tree condition ratings and yields of 'Hass' trees on rootstocks originating from Israel (planted in Block 1) are presented in Table 1. In 2001, trees were rated from the healthiest to the poorest: VC 805, VC 256, VC 801, VC 207, VC 218, VC 241, Edranol seedlings, Duke 7 and VC 225. Although trees

on rootstock VC 801 were relatively healthy, crown rot was observed on 10% of the trees. No other rootstock was affected by crown rot. Regarding yield, a high number of trees on various Israeli rootstock selections produced either no crop or a very small crop, while VC 801 out-produced all other rootstocks (Table 1). Tree condition ratings and yields of 'Hass' trees on rootstocks originating from South Africa (planted in Block 2) are shown in Table 2. In 2001, trees were rated from the healthiest to the poorest: Merensky II, Merensky III, V100, Duke 7, Edranol seedlings, Merensky IV, Gordon and Jovo. The rootstocks Merensky II, Merensky III and V100 were healthier than the Duke 7 rootstock, with only Merensky II being significantly healthier than Duke 7. Merensky II, Merensky III and V100 yielded significantly better than Duke 7. In Blocks 1 and 2, the vigour of 'Hass' trees as determined by trunk circumference measurements was higher in trees with good condition (Tables 1 and 2).

Table 1. Condition, yields and trunk circumference of 'Hass' trees on various vegetatively propagated rootstocks as determined in 2000 and 2001 (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)	
	2000	2001	2000	2001	2000	2001
VC 805	3.4 d ¹	3.6 d ¹	0.13	3.56 b ³	20.8 abc ¹	24.7 abc ¹
VC 256	3.5 d	3.7 d	0.43	2.34	20.2 abcd	23.3 abcd
VC 801	3.6 d	4.0 d	1.77	10.11 a	23.3 a	28.0 a
VC 207	4.2 cd	4.3 d	0	0.34	16.9 cdef	21.0 bcdef
VC 218	4.0 d	4.4 d	2.68	6.31	21.9 ab	25.0 ab
VC 241	5.5 bc	5.8 bc	1.80	3.74	18.0 bcdef	21.1 bcdef
Edranol seedlings	5.7 ab	5.8 bc	0.73	1.78	19.1 abcde	22.2 bcde
Duke 7	5.7 ab	6.0 b	0	0.22	15.1 ef	18.8 def
VC 225	7.0 a	7.3 a	0.14	0.03	14.5 f	16.4 f
Level of significance	<0.001	<0.001	NS ²	0.099	0.002	0.003

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

² NS = non-significant

³ Due to a high number of trees on various rootstocks producing either no crop or a very small crop, only rootstocks VC 805 and VC 801 could be tested at the 10% level.

Table 2. Condition, yields and trunk circumference of 'Hass' trees on various vegetatively propagated rootstocks as determined in 2000 and 2001 (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)	
	2000	2001	2000	2001	2000	2001
Merensky II	2.0 e ¹	2.2 f	2.01 abc	8.56 ab	18.1 bc	23.6 bc
Merensky III	1.8 e	2.3 ef	2.23 ab	8.56 ab	20.5 ab	25.8 ab
V100 ²	2.4 de	2.7 ef	1.97 abcd	10.72 a	21.7 a	26.9 a
Duke 7	3.3 cd	3.3 de	0.51 e	2.79 c	16.2 cdef	19.7 def
Edranol seedlings	3.4 c	4.0 cd	1.25 abcde	3.41 c	17.5 cd	22.2 cd
Merensky IV	3.4 c	4.9 bc	2.36 a	4.83 bc	17.0 cde	20.4 cde
Gordon	4.5 b	5.5 b	1.05 bcde	2.25 c	15.1 defg	17.7 efg
Jovo	7.1 a	7.6 a	0.53 e	0.45	13.6 g	15.3 g
Level of significance	<0.001	<0.001	0.014	0.009	<0.001	<0.001

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

² Velvick selection

CONCLUSIONS

In 2001, the health condition of 'Hass' trees on various vegetatively propagated rootstock selections in general declined further, but not as severely as during the extremely wet summer in 2000. The ranking order of the rootstocks remained consistent during the period 1999 to 2001. In the first orchard, rootstock VC 801 out-performed all the other rootstocks in terms of yield; 10% of the VC 801 trees were, however, affected by crown rot. In the second orchard, rootstocks Merensky II, Merensky III and the Velvick selection V100 outperformed the Duke 7 rootstock in terms of yield and root rot resistance.

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