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PROGRESS REPORT ON AVOCADO TREE SIZE CONTROL BY MEANS OF BARK MANIPULATION, DWARFING INTERSTOCKS AND ROOTSTOCKS

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ABSTRACT

To reduce the growth rate of young Hass avocado trees, bark manipulation treatments were tested. While tree size was controlled by these treatments the condition of treated trees deteriorated, as the ring of bark manipulated in this study was too wide.

Dwarf avocado selections are being tested as interstocks and rootstocks for the commercial cultivar Hass, in an attempt to reduce tree vigour. Colin V-33 and Hansie were used as interstocks and Colin V-33, Hansie, Ryan and Wilg as rootstocks. Information on the clonal propagation of these potentially dwarfing rootstocks has been gained.

INTRODUCTION

Avocado orchard productivity can be increased by increasing tree planting density while controlling vegetative growth. Good tree size control in young avocado trees has been achieved by using the growth retardant paclobutrazol (Köhne & Kremer-Köhne, 1990; 1991).

Other possibilities for controlling tree size are bark manipulations and the use of dwarfing interstocks or rootstocks. With apple trees, bark-grafting experiments presented strong evidence that the bark is the key to the dwarfing mechanism in fruit trees (Lockard & Schneider, 1981). Barrientes *et ai,* (1987) reported the dwarfing of Fuerte avocado trees on Colin V-33 interstocks in Mexico.

The purpose of this paper is to report on an experiment in which avocado bark was manipulated in various ways. Furthermore, observations made during the early developmental stages of avocado trees, grown on potentially dwarfing interstocks and rootstocks, are described.

MATERIALS AND METHODS

Bark manipulation

Three-year-old Hass avocado trees on Duke 7 rootstock grown on Westfalia Estate were used in this study. There were seven trees per treatment. The control trees were left untreated. In January 1992, two horizontal ring-cuts (20mm apart) were performed

on the rootstock just below the graft union on all treated trees. Subsequently, the following manipulation treatments were applied:

1) Untreated control;

2) Ring of Duke 7 bark removed;

3) Ring of Duke 7 bark loosened and rotated 180°;

4) Ring of Duke 7 bark removed and placed back in inverted position;

5) Ring of Duke 7 bark removed and replaced with Ryan bark of same width;

6) Same as 5), but Ryan bark inserted in an inverted position.

In treatments 3-6, wounds were wrapped with grafting tape for the first two months after treatment. In all treatments, trunk circumference was measured above and below the ring-cut immediately after treatment and five months later at the termination of the experiment.

Canopy silhouette area was measured as an indication of tree size (Winter, 1977). Tree condition was rated in January and June 1992, according to an index of 0 (healthy) to 10 (dead) as described by Darvas *et al.,* (1984).

Dwarfing interstocks and rootstocks

Interstocks: In 1992, the production of 30 trees each of different rootstock interstock-scion combinations started in the nursery (Table 1).

Rootstocks: In 1992, clonal propagation of rootstocks was initiated to produce 60 trees each of the plant material listed in Table 2. To facilitate rooting, the etiolation process as described by Frolich & Platt (1972) was used in combination with an application of IBA (Ernst, 1981). The percentage of rooted trees suitable for grafting with the cultivar (Hass) was recorded.

In 1992, leaf samples of all mother trees involved in this trial were analysed twice for avocado sunblotch viroid (ASBV) by the plant pathology department of the ITSC in Nelspruit. All plant material used, tested free of ASBV.

TABLE 1 Production of rootstock-interstock-scion combinations in the nursery.

Rootstock	Interstock	Scion
Duke 7	-	Hass
Duke 7	Hass	Hass*
Duke 7	Hansie	Hass
Duke 7	Colin V-33	Hass*

* Scion not yet grafted.

TABLE 2 Vegetative propagation of avocado material to be tested as dwarfing rootstocks.

Rootstock	Description	Rooting success (%)
Duke 7	Most commonly used clonal rootstock	98
Hass	Scion cultivar	28
Fuerte	Scion cultivar	89
Ryan	Scion cultivar with dwarfing characteristics	44
Colin V-33	Mexican selection controlling tree size when used as interstock	18
Wilg	Local selection with drooping branches	18
Hansie	Local dwarfing selection	82

RESULTS AND DISCUSSION

Bark manipulation

Wounds healed quickly in treatments 3-6. The ring of bark was firmly attached in all trees two months after the treatment, when the grafting tape was removed.

The increase in tree size was considerably reduced by all treatments when compared with the untreated control (Table 3). Treatment 3, the loosening and rotating of a narrow ring of bark, was easy to apply and seems to be a promising treatment. Transplanting Ryan bark into Duke 7 bark requires considerable skill and did not give better results.

Swelling of the trunk above the ring-cut occurred in all treatments. The thickening of the bark was first noticed one month after cutting the ring. Treatment 5 (Ryan bark inserted) showed the most pronounced swelling at the termination of the experiment. Similar observations were made on apple trees grafted with bark of a different cultivar (Lockard & Schneider, 1981).

With the exception of the control, tree condition declined in all treatments (Table 3). Five months after treatment, all trees in treatment 2 had died, while trees in treatments 3-6 were in a poor condition, having lost most of their leaves. Leaf drop in avocado after girdling was also reported from Israel (Lahav *et al.,* 1972).

Judging from the fruit skin colour, fruit maturity was about one month more advanced in treatments 3 6 as compared with the control.

Dwarfing interstocks and rootstocks

Interstocks: Graft take of the interstocks was generally satisfactory. The growth rate of the interstocks differed, with Hansie being further developed than Colin V-33 and Hass (Table 1).

Rootstocks: The rooting success rate is presented in Table 2. Best results were achieved with Duke 7. Fuerte and Hansie rooted fairly easily, while Hass and Ryan only gave limited rooting success. Wilg and Colin V-33 were difficult to root. Wilg was difficult to graft after etiolation, as this selection developed very thin, long shoots in the absence of light.

In conclusion, this study showed that bark manipulation controlled the size of avocado trees. The 20 mm ring of bark removed and/or manipulated in this study was evidently too wide, judging from the considerable decline in tree condition. Further experiments using narrower rings of bark are warranted and the experiments should be performed for a longer period.

Dwarfing interstocks and rootstocks have been produced in the nursery, and useful information on the clonal propagation of possible dwarfing avocado rootstocks has been gained. The rootstock-interstock-scion combinations mentioned in this study will be planted in the field in October 1993. These trees will be monitored closely and more data will be recorded once fruiting commences.

TABLE 3 The influence of rootstock bark manipulations on size and condition of young Hass avocado trees.

TREATMENT	CANOPY AREA (m^2)			TREE CONDITION	
	JAN	JUN	INCREASE(%)	JAN	JUN
1) Untreated control	3.58	6.75	88	1	1
2) Bark removed	3.68	4.50	22	1	10
3) Bark rotated 180°	3.43	4.57	33	1	5
4) Bark inverted	3.85	4.99	29	1	5
5) Bark transplanted with Ryan	3.42	4.36	27	1	5
6) Bark transplanted with Ryan and inverted	3.80	5.19	36	1	5

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