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YIELD AND FRUIT QUALITY OF AVOCADO CV FUERTE AS INFLUENCED BY PACLOBUTRAZOL FOLIAR APPLICATIONS

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ABSTRACT

Avocado trees cv Fuerte were treated in spring 1988 with the growth retardant paclobutrazol (PBZ) at three rates (6,25; 12,5 and 25 mℓ PBZ per tree). A high volume (HV) and an ultra low volume (ULV) applicator were used. In spring 1989, only the medium dosage PBZ treatments were re-applied, in 1989, yield from the PBZ-treated trees did not differ significantly from the control and there was no clear difference in the occurrence of physiological disorders in fruit from the various treatments. In 1990, however, the medium dosage ULV application significantly increased yield and all PBZ treatments improved fruit quality when compared to the control. Over the two years, the ULV applied medium dose PBZ treatment resulted in the highest profit.

INTRODUCTION

Optimum production and quality are of utmost importance for the economic survival of the export orientated avocado industry in South Africa. Fuerte is the most important cultivar, representing 56% of the South African avocado production (Toerien *et al,* 1991). However, in the cv Fuerte, yields are low (Popenoe, 1941; Lahav *et al,* 1971; Trochoulias & O'Neill, 1976) and fruit quality is often impaired by physiological disorders (Bower, 1988). In Fuerte, the vigorously growing spring flush that occurs during and shortly after flowering competes with fruit-set (Buchholz, 1986; Zilkah *et al*,1987). This results in high fruit-drop rates and consequently low yields, as well as an imbalance in the mineral composition of the fruit, i.e. predisposing fruit to physiological disorders that occur during ripening after storage. Retarding the spring flush by spraying the growth retardant paclobutrazol has been shown to improve yield (Adato, 1990) and fruit quality (Köhne, 1989).

The purpose of this study was to evaluate the effect of a foliar application of the growth retardant paclobutrazol in spring on yield and fruit quality in avocado cv Fuerte. A high volume and an ultra low volume applicator were tested for their efficacy and economy.

MATERIALS AND METHODS

Fuerte avocado trees on Duke seedling rootstock were used in this experiment. The trees were planted in 1978 at Westfalia Estate, situated in the north-eastern Transvaal.

There were 30 single tree replicates per treatment.

The growth retardant paclobutrazol (PBZ) was applied using two types of applicators: a conventional, labour intensive, high volume applicator with hand lances (HV) widely used for disease control in the avocado industry and a new hand-held ultra low volume applicator (ULV; Pulsfog, model K-22G, 25% Pulsfog additive VK2; Cyrose, Edenvale). For each tree, PBZ was applied in 25 litres of aqueous spraying solution (HV) and in 400 mℓ of fogging solution (ULV), respectively. Three PBZ dosages were used: 6,25; 12,5 and 25 mℓ PBZ per tree. PBZ was applied in September 1988. Only the trees that received 12,5 mℓ PBZ per tree in 1988 were re-treated in September 1989, using the HV and ULV methods and the same dosage.

In 1989 and 1990, single tree yields were recorded. Fruit were harvested in two picking rounds (April and June) according to fruit size and maturity. Samples consisting of 140 fruit (mass range 266 — 305 g) per picking round and treatment were stored for four weeks at 5°C. Thereafter the temperature was increased to 18°C to induce ripening. Soft-ripe fruit were cut open and inspected for the physiological disorders cold damage, pulp spot, grey pulp and vascular browning. Results on fruit quality are presented as percentage of fruit free of the above-mentioned physiological disorders. The percentage fruit free of physiological disorders is an average for the two picking rounds per season.

RESULTS AND DISCUSSION

In 1989, yield from the PBZ treated trees did not differ significantly from the control. This is probably due to the fact that the orchard in which the experiment was conducted, had an 'on' year in 1989. In the following “off” year 1990, the medium dosage ULV application significantly increased yield when compared to the control (Table 1). This is in agreement with previous reports on PBZ-induced avocado yield increases in “off” years (Köhne, 1989; Adato 1990).

Fruit quality in the 'on' year 1989, was considerably better than in the 'off year 1990. In 1989, there was no clear difference in the occurrence of physiological disorders in fruit from the various treatments. In 1990 however, all PBZ treatments improved fruit quality when compared to the control (Table 1). This agrees with the findings of Köhne (1989) that foliar PBZ application reduces the incidence of physiological disorders in Fuerte avocados. Improved fruit quality after PBZ treatment has also been reported for apple (Greene, 1986; Elfving *et al,* 1987; Mantinger *et al*, 1988). As only the medium dosage treatments were re-applied in this experiment, the effects obtained from the low and high dosage treatments in 1990 could be due to a carry-over effect. A carry-over effect on apple fruit shape and pedicle length after discontinuing PBZ treatment has been described by Greene (1986).

TABLE 1 Effect of high volume and ultra low volume PBZ applications in 1988 on yield per tree and fruit quality in 1989 and 1990

Application	PBZ (m/tree)	Yield (kg/tree)		Fruit free of physiological disorders (%)	
		1989	1990	1989	1990
HV	6,25	264,2a	107,3cd	76	55
	12,50*	227,1ab	178,7ab	78	65
	25,00	227,0ab	87,5d	77	50
ULV	6,25	183,4b	150,0bc	78	50
	12,50*	253,9a	220,2a	73	46
	25,00	272,5a	185,5ab	72	54
Control	0	222,8ab	156,6b	76	32

Mean separation in columns by Duncan's multiple range test, 5% level.

* PBZ was re-applied in 1989.

TABLE 2 Annual income, total costs and profit as affected by high volume and ultra low volume PBZ applications in 1988

Application	PBZ (m/tree)	R/ha		
		Income†	Total Costs ‡	Profit
HV	6,25	28 500	5 750	22 750
	12,50*	30 000	6 550	23 450
	25,00	24 000	6 500	17 500
ULV	6,25	25 500	5 750	19 750
	12,50*	36 000	6 550	29 450
	25,00	34 500	6 500	28 000
Control	0	28 500	5 500	23 000

* PBZ was re-applied in 1989.

† Calculations based on average yields and prices for 1989 and 1990.

‡ Production costs at R5 500/ha.

Annual income, total costs and profit for the untreated control and the PBZ applications are listed in Table 2. It is evident that the ULV applied medium dose PBZ treatment resulted in the highest profit.

There was no difference in the total application costs between the HV and ULV method. However, there is a difference in the cost structure comparing the two application methods: tractor and labour costs are high in the case of HV application, while the fogging additive (VK2) accounts for a large portion of the ULV application costs.

In conclusion, foliar application of PBZ during the time of early spring flush growth offers a clear yield and quality advantage, particularly if used on avocado trees going into an "off" year.

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