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The Effects of Ringing, Double Incision and Applications of Paclobutrazol Cultar on the Avocado (*Persea americana* Mill) cv. Negra de La Cruz.

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Abstract

This study was carried out on two-year-old avocado plants of the local variety "Negra de La Cruz", in the Quillota area, and was directed aimed to improve precocity and productivity of this cultivar, which is heavily demanded by consumer, but very vigorous and slow to come into production. Ringing and Double Incision were performed during the first week of April, as the beginning of the autumn flush. Applications of the Paclobutrazol were carried out both in the autumn flush and in the flowering peak period in spring. A significant effect of the Ringing and Double Incision was observed on the differentiation of flower buds; however, the effect was lower with the autumn applications of Paclobutrazol. Similar results were observed with measurement of flowering on trees and intensity of flowering on panicle, evaluated in spring. Despite these observations, the highest increasing in yield were observed in the Paclobutrazol applications as well in Ringing and Double Incision plus Paclobutrazol in spring.

1.- Introduction

One of the biggest problems with avocado orchards, is their irregular and unsatisfactory production behavior, which bears no relation to the trees excellent vegetative growth (Lahav et al, 1971).

Among the different varieties of avocado, some are of big vigor and have a clear tendency towards vegetative growth, starting to produce their fruit late and with low yields. The Negra de La Cruz - which has these characteristics - is a Chilean variety, possibly being a natural hybrid between Mexican and Guatemalan races, and produces a large black-colored fruit of good flavor which ripens between the months of May and July. It is resistant to low winter temperatures, tolerating levels around -5°C , and this allows its cultivation in zones where other varieties would fail.

In order to control the trees strength and to reduce vegetation growth, and thereby favoring fruit production, different techniques have been tried such as ringing, double incision, and leaf-spraying with paclobutrazol (Razeto and Longueira, 1986; Rowlands, 1994).

The aim of this research is to study the different management techniques for this variety which allow to reduce strength, and to induce early fruit bearing and increased productivity.

2.- Material and method

The study was carried out between the months of March 1994 and August 1995, in the Boco area, Quillota, Province, Chile (32° 50' latitude south and 71° 13' longitude west).

Two-year old avocado trees of the Negra de La Cruz variety on Mexicola seedling rootstock were used, planted 6x6 in. apart, over a two-hectare area.

Seventy trees were used in the study, chosen according to strength and uniformity of size. The assignment of the treatments was made completely at random. There were 10 treatments including the control, distributed as follows:

- T0: Control. Sprayed with water.
- T1: Sprayed with paclobutrazol in March (0.3 lg.i.&/l. of water)
- T2: Sprayed with paclobutrazol in March (0.625g. i.a./l of water)
- T3: Sprayed with paclobutrazol in March (0.625) and in October (0.3 lg. i.a./l. of water)
- T4: Sprayed with paclobutrazol in March (1.25g. i.a./l. of water)
- T5: Sprayed with paclobutrazol in March (1.25) and in October (0.3 lg. i.a./l. of water)
- T6: Ringing in March
- T7: Double incision in March
- T8: Ringing in March and sprayed with paclobutrazol in October (0.3 l. i.a./l of water)
- T9: Double incision in March and sprayed with paclobutrazol in October (0.3 l g.i.a./l. water).

The doses of paclobutrazol used were obtained from the commercial product Cultar, made up of 25% active ingredient, with final doses of 1.24, 2.5 and 5g. of the commercial product per liter of water.

Ringing was carried out in March at the beginning of the flush of vegetation growth in autumn. A South African 2 mm. ringing knife was used on the tree-trunks, leaving 3 to 4 strong branches below the ring. Double incision was carried out at the same date, using two saws one centimeter apart, taking the same precautions as in ringing. Paclobutrazol spraying was done manually with a shoulder sprayer, and leaves were sprayed until they were beginning to drip.

The parameters measured were autumn and spring growth, differentiation among terminal buds, degree of differentiation, flowering (degree and intensity), total weight of yield per tree and the characteristics of the harvested fruit (weight of fruit, polar and equatorial diameter).

The experiment used a completely random design. For the qualitative variables, such as degree of flowering, the Kruskal-Wallis range test was used. For the measurement of fruit characteristics a completely random design was used with sub sampling. When there were significant differences between treatments, the Tuckey Comparison of Means test was used at a 5% significance level.

3.- Results

Autumn growth was not affected by any of the treatments. In the spring flush, the treatments: ringing, double incision, ringing plus paclobutrazol and double incision plus paclobutrazol, all display significant differences in growth compared with the other treatments, but not between each other. The significance of this growth detention, lies in the fact that competition between

reproductive and vegetative growth at this time of year is what determines fruit production and quality, especially in vigorous varieties (Wolstenholme and Whiley, 1990).

The development of early blossom is clearly brought forward by the ringing and double incision treatments compared to both the control and the applications of paclobutrazol (Table 1), and this agrees with Razeto and Longueira (1986). Ringing leads to an accumulation of fotosyntates and of growth-regulating substances (Lahav et al., 1971), both of them are very important at the time of blossom, when carbohydrate reserves are at their minimum (Scholefield et al., 1985).

Table 1 - Differentiation of buds in the last 20 cm. of branch.

Treatment	Percentage
T0	41,1 a
T2	66,5 b
T4	59,3 b
T6	79,6 c d
T7	83,7 d

Tukey 5%.

Paclobutrazol spraying causes differences with respect to the control occupying a position midway between the control and double incision, probably due to its effect on the distribution of assimilated substances, diverting them towards reproductive growth and the formation of flower buds, fruit set and fruit growth (Lever, 1986).

This effect shows itself again at the moment of flowering, where the highest degrees of flowering are obtained under double-incision and ringing, followed by paclobutrazol spraying and lastly the control (Table 2).

Table 2 - Flowering degrees

Treatments	1-20	21-40	41-60	61-80	81-100
	Percentage				
T0	80	20	0	0	0
T2	0	40	60	0	0
T4	0	20	80	0	0
T6	0	0	0	20	80
T7	0	0	0	40	60

The evaluation of the total harvest per tree shows that the best results come from trees treated with ringing plus paclobutrazol, and the application of paclobutrazol on two dates (1.25g. i.a./l. plus 0.3 l g. i.a./l.) (Figure 1).

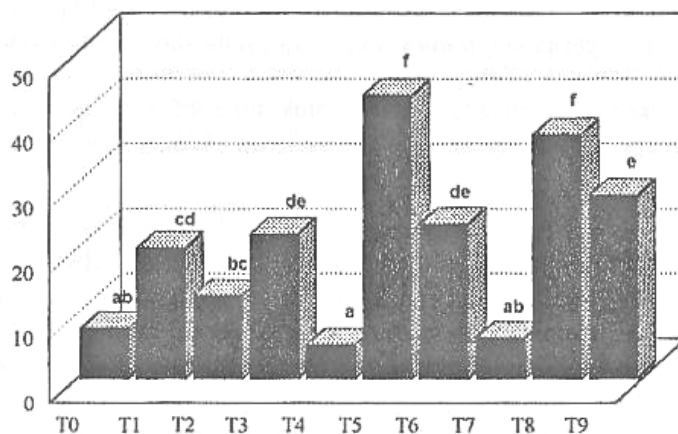


Figure 1 - Production - Kg./Tree.

Tukey 5%.

Double-incision plus paclobutrazol comes after these treatments, with results statistically similar to those of ringing, paclobutrazol spraying in March (0.625g. i.a./l.) and applications of paclobutrazol in October (0.31g. i.a./l.).

This demonstrates that the effect on production is related to the severity of the treatment on the control of vegetative growth, which in this variety, due to its excessive vigor, is the factor which mostly influences production.

The poorest production, results were obtained by the control, double incision and paclobutrazol spraying in October (1.25g. i.a./l.). Double-incision produced one of the greatest intensities of blossom, but like the control, the spring flush was extremely vigorous in each case, with low fruit retention. It is possible that the highest dose of paclobutrazol used is above optimum for this variety when applied during the flowering period.

Individual fruit weight did not show statistically significant differences for any of the treatments: despite the great differences in yields, possibly due to the age of the orchard and its great vigor, the trees were able to support the burden without being affected the weight of the fruits.

With regard to the shape of the fruit, the only alteration was in the polar diameter measurement, where paclobutrazol was applied on two occasions (1.25 plus 0.31g. i.a./l.). The diameter was smaller under this treatment, and the fruits more rounded. This is similar to the results obtained by Symon and Wolstenholme (1990).

At the moment of harvest, an evaluation was made of the presence of paclobutrazol residues in the fruit, and no residues were found in any case.

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