Proceedings of The World Avocado Congress III, 1995 289 - 293

FRUIT MATURITY OF THE 'PINKERTON' AVOCADO AS AFFECTED BY FRUIT SET PERIOD

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Additional index words: *Persea americana*, growth, flowering.

Abstract

In South Africa the 'Pinkerton' avocado tree tends to flower over a long period, giving rise to fruit of differing maturities at harvesting stage. This study was aimed at investigating the effect of different fruit set periods on fruit maturity by limiting fruit set to a specific period. Flowers and fruitlets were removed during 1992 in two 'Pinkerton' orchards, one at Kiepersol and another at Heidelberg (White River). During the first season the treatments consisted of an August set, September set, October set and a control (no manipulations). The second season included a pre-August set and the set period at Kiepersol was reduced to 15 days instead of 30 days.

At Kiepersol the September set had the effect of increasing fruit size whilst at Heidelberg both September and October set showed increased fruit size with the control fruit set showing smaller fruit sizes than the other sets. These size differences were also reflected by the spatial shape of the fruit.

Moisture percentages of the different treatments indicated that at Kiepersol, the early fruit set was ready for marketing a month before the control fruit. Under the cooler climatic conditions at Heidelberg the fruit from all the different manipulations took at least a month longer than those at Kiepersol to reach the same maturity stage. Data on post-harvest cold storage are also presented.

1. Introduction

In South Africa, flowering of avocado trees normally starts around June/July with fruitset occurring during September (Robertson, 1969). Local 'Pinkerton' trees flower profusely over a very long period, ie. from June through to December. This long flowering time causes fruit to be developed over a long period, resulting in fruit of different maturities at harvest time. It was also shown (Sippel, et al., 1992) that fruit setting late had a much faster growth rate and the potential to become larger than early set fruit. These large late-set fruit, which at harvesting time (May) can still be immature, can be wrongly picked if fruit size is taken as a maturity index.

Fruit and flower manipulation was investigated as a possible means to produce uniform-mature fruit. This trial concentrated on limiting the fruitset period by physical removal of unwanted fruit and flower panicles. The effect of these manipulations on fruit size, yield, fruit maturity and fruit quality was studied, coupled to two different climatic areas.

2. Materials and methods

The trial was conducted in two different climatic areas namely Kiepersol and Heidelberg (Nelspruit/White River). Uniform-sized trees were selected for manipulation purposes. Both orchards received standard horticultural practices.

During the first season (1992/93) four different treatments were laid out randomly in the orchards. Single whole tree treatments were applied, replicated three times. The treatments consisted of an August set, September set, October set and a control (not manipulated). All unwanted flowers and fruit were physically removed to allow set periods of about 30 days for each treatment. A fixed starting and end date for each treatment was chosen beforehand, and these determined the fruit set periods. Data collected at harvest consisted of moisture analysis as well as quality assessments on fruit that were export simulated. These fruit were subjected to four different cold storage regimes as well as a control at 18ºC.

During the second season (1993/94) flower and fruit removal was done on 10 trees per treatment. A pre-August manipulation was included together with the August, September, October and control treatments. At Kiepersol the fruit set period was limited to 15 days whilst it was limited to 30 days at Heidelberg. All fruit that set before the required periods was removed and all flowers produced after the fruit set period were also removed. Data were accumulated on yield, fruit growth, moisture and oil analysis and fruit quality. Fruit were both exported and export simulated and quality was analyzed.

3. Results

3.1 1992/93 season

3.1.1 Fruit maturity

August set fruit from the Kiepersol site were ready for harvesting during mid-April whilst the other sets and the control were still outside the picking norm of 75% moisture (Table 1). One month later all the sets were at harvestable stage with the control fruit and the October set fruit showing the highest decrease in percentage moisture, and the August set fruit the lowest. At the Heidelberg site none of the sets were ready to be harvested during mid-April (Table 1). One month later the manipulated sets were ready for harvesting whilst the control fruit were still outside the picking norm at 78,3%.

3.1.2 Cold storage

At the control temperature (18ºC) early set fruit from both sites performed similar being of better quality than fruit from the other sets. At Kiepersol, the warmer production area, the August and September set fruit performed better at the higher storage temperatures (7.5 and 6.5ºC) whilst the October and control sets performed better at 5.5ºC. These last two were also

judged to be the best overall. Flowering at this site tended to be earlier than flowering at Heidelberg.

At Heidelberg the August set again performed better, together with the control set, at the higher storage temperatures. The September and October sets performed better when subjected to colder storage temperatures. Overall the early set fruit had the better quality. Good quality were obtained with fruit between 75 and 76% moisture content. At lower and higher figures fruit quality tend to be poor, regardless of storage temperature.

3.2 1993/94 season

3.2.1. Moisture determinations

Table 2 compares freeze drying of moisture samples with conventional oven drying. A very good correlation was found between the two methods. The table also shows differences in moisture content between the two sites. Even with a ten day later sampling date, maturity of the Heidelberg control fruit was retarded compared with that of the Kiepersol control. In contrast, fruit maturity of all the manipulated treatments at Heidelberg was more advanced than those at Kiepersol.

3.2.2. Yield & fruit size

Fruit size was affected by fruit count per tree as well as the fruit set period. The best treatment at Heidelberg was the mid-August set with an average of 244 fruit per tree and a 20% higher yield per tree than the control. At the Kiepersol site the control treatment had about 10% fewer fruit than the best treatment (mid-August), but a 38% lower yield per tree due to smaller fruit.

Figure 1 shows yield per hectare differences between set periods and sites. Note that the mid-August set treatment was superior to the control treatment at both sites. Heidelberg shows a poor fruit set at the beginning of the season while Kiepersol shows a rapid decline from mid-September.

3.2.3. Fruit quality

Table 3 presents quality data from Heidelberg fruit that were exported to the UK. No clear treatment differences were shown in fruit firmness. However, trends were observed with black cold, lenticel damage and greypulp during both pre- and post ripening of the fruit samples. Older fruit (early sets) had more problems than fruit from later sets. Control fruit gave variable results. With dusky cold only the post-ripening analysis showed a definite trend of older fruit being more susceptible to damage.

4. Discussion

4.1 Moisture determinations

Differences in fruit set period resulted in definite differences in moisture content. If manipulated into different sets, fruit from the early sets could be ready for harvesting up to one month before that of later sets, which could also mean better prices due to market demand for early fruit. Freeze drying and conventional oven drying gave a very good correlation enabling the former to be reliably used for future analysis. Freeze drying is a much easier method and a larger number of samples can be dried more rapidly.

4.2 Yield & fruit size

Low average fruit counts from the pre-August treatment at Heidelberg can be ascribed to unfavourable climatic conditions during the early part of the flowering season. Kiepersol, on the other hand, had good flowering from early in the season with a rapid decline after mid-September. This phenomenon explains the low fruit count during the October set in this orchard. At both sites optimum fruit set was obtained during the mid-August period.

Yield was influenced by fruit set period. If a producer is prepared to manipulate this, his production could be 38% higher. An increase in fruit size is an added benefit, which could possibly result in better market prices. This benefit should be weighed against labour costs to manipulate the trees.

4.3 Fruit quality

Results obtained from the export fruit quality analysis indicate the importance of fruit age and optimum fruit maturity towards improved fruit quality. This highlights the disadvantage of a single harvest, when old and young fruit of different sets are picked at the same time, a process followed by many producers. Post-harvest problems can be avoided if the producer is prepared to manipulate his trees. However, he should also be prepared to harvest the manipulated trees separately to ensure optimum post-harvest quality.

Acknowledgements

The producers, namely Messrs Vos & Son (Kiepersol) and Pienaar Packers (Heidelberg), willingness to donate their orchards for the purpose of this study is greatly appreciated. Thanks are also due to Mr & Mrs Hearne for accumulating climatic data at Kiepersol and to Mrs Marie Hattingh for computerizing it. Also many thanks to Miss Mariet Christie for constant field work and computerizing all the data and Mrs Valerie Claassens and Mr Coenie Pretorius for valuable technical assistance with the field work, as well as SAAGA and Jerome Hardy for assistance with the analysis of exported fruit.

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Table 1. The effect of fruitset period on moisture percentage of the 'Pinkerton' avocado fruit harvested at two sites during two pre-harvest periods (1993).

Treatment	Kiepersol		Heidelberg	
	15 Apr	17 May	15 Apr	17 May
Aug set	75.3	73.3	76.3	75.0
Sep set	78.5	74.8	77.5	74.0
Oct set	79.8	75.2	77.8	75.8
Control	80.0	75.3	79.8	78.3

Table 2. Comparison between oven and freeze drying of 'Pinkerton' avocado pulp for moisture percentage determinations (1994).

Treatment	Kiepersol		Heidelberg	
	Oven 27 May	Freeze 27 May	Oven 7 Jun	Freeze 7 Jun
Pre-Aug	72.5	72.0	71.5	71.8
Mid-Aug	75.9	75.2	73.9	73.4
Mid-Sept	77.7	77.5	75.0	74.8
Mid-Oct	77.1	77.6	75.3	74.8
Control	72.3	71.2	75.6	75.5

Table 3. Quality analysis before and after ripening of 'Pinkerton' avocado fruit exported to the UK from Heidelberg (1994).

Treatment	Firmmometer reading	Rating	Black cold %	Dusky cold %	Lenti damage %	Greypulp %	Days to ripen
Pre-Aug	49.1	Soft	6.06	2.54	2.82	-	-
Mid-Aug	39.4	Break	2.88	0.00	3.03	-	-
Mid-Sep	45.1	Break	1.06	2.42	2.27	-	-
Mid-Oct	50.4	Soft	0.32	3.87	1.29	-	-
Control	47.9	Soft	0.00	4.66	0.00	-	-
Pre-Aug	-	Ripe	3.43	33.71	17.71	18.29	4.11
Mid-Aug	-	Ripe	2.35	10.00	6.86	13.24	4.41
Mid-Sep	-	Ripe	1.39	1.39	7.50	0.00	4.83
Mid-Oct	-	Ripe	0.00	1.94	3.06	5.28	4.58
Control	-	Ripe	0.00	3.00	6.33	4.00	4.50

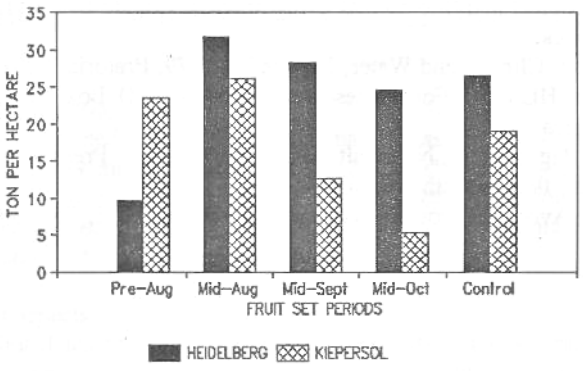

Figure 1. Effect of different fruit set periods on 'Pinkerton' avocado yield.