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Manipulation of Fruit Set Period of The Pinkerton Avocado and its Effect on Fruit and Tree Characteristics

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ABSTRACT

Growth patterns of Pinkerton avocado fruit were investigated at both Kiepersol and Heidelberg in the Transvaal Lowveld. It was previously found by the authors that fruit growth rate differences exist between early set fruit and late set fruit. This phenomenon was further investigated where fruit quality of different manipulated fruit set periods was compared. Export analysis of fruit quality showed that the older fruit from the early set had more problems than fruit from the later set. This result was found with fruit that were exported to England. Fruit picked from early set periods had more dusky cold and lenticel damage as well as grey pulp problems. The control fruit gave more intermediate results.

Moisture and oil analysis of fruit from the different manipulated fruit sets was also done. Fruit from the early fruit set periods were approximately 2 to 3 percentage points lower in moisture content during mid-April sampling than fruit from later fruit set periods. The fruit from the early fruit set period were thus ready for harvesting about one month earlier than the rest of the fruit. A comparison between oven dried and freeze dried moisture analysis samples was also done. Due to the good correlation found between these two methods it was decided to follow the freeze dried method in future due to its simplicity.

The effect of fruit set manipulation on yield was such that the early set (pre-August) produced 50% less fruit than any of the other treatments, making this manipulation a non-viable option. The best yield was obtained from the August treatment followed by the September treatment. Although the control gave an average yield, fruit from this treatment was smaller than those of the other treatments.

INTRODUCTION

Despite the quest for technological precision which exists at every level of human life and has enabled man to land on the moon and come back, as well as to transfer genes in plants and alter their behaviour for instance, he has yet to produce the perfect

avocado fruit for the meticulous consumer. This is still a major goal for many researchers, producers, packhouses, distributors, wholesalers and retailers.

The quest for the perfect fruit has prompted this research project. To determine exact avocado fruit maturity is still a problem for researchers and producers alike. We would like to advise the producer on the correct procedures to follow from flower initiation to final marketing of the fruit. One of the biggest problems with the Pinkerton avocado is the extended fruit set period that influences fruit maturity at harvesting, resulting in quality problems after marketing.

The aim of this part of the project was to determine the effect of fruit set manipulation on tree performance, fruit behaviour and fruit quality.

MATERIAL & METHODS

Eight year old Pinkerton avocado trees grafted on Duke 7 rootstock that received standard horticultural management were used for the manipulations. The orchard sites were as follow:

- Kiepersol:

  25°05'S; 31°01'E; 800m; 939mm;
- Heidelberg:

  25°18'S; 30°56'E; 774m; 755mm.

Manipulations consist of flower and fruit removal based on different set periods:

- Pre-August
- Mid-August
- Mid-September
- Mid-October
- Control (no manipulations)

Ten tree replications per treatment were used. An illustration of the manipulations is given below.

- Pre-fruit set period

  -Removal of fruit already formed
- Actual fruit set period

  -Kiepersol: 15 days

  -Heidelberg: 30 days
- Post-fruit set period

  -Removal of unwanted flowers

Data accumulation consisted of determining yield per tree, fruit size, moisture analysis and quality determinations of fruit exported to the United Kingdom via sea freight.

RESULTS

Moisture determinations

Figure 1 presents the moisture percentage of Pinkerton avocado at Heidelberg from mid-April to harvest. The effect of different fruit set periods on moisture percentage in the fruit is clearly visible. The early sets were ready for harvest at least a month before the control and the late sets.

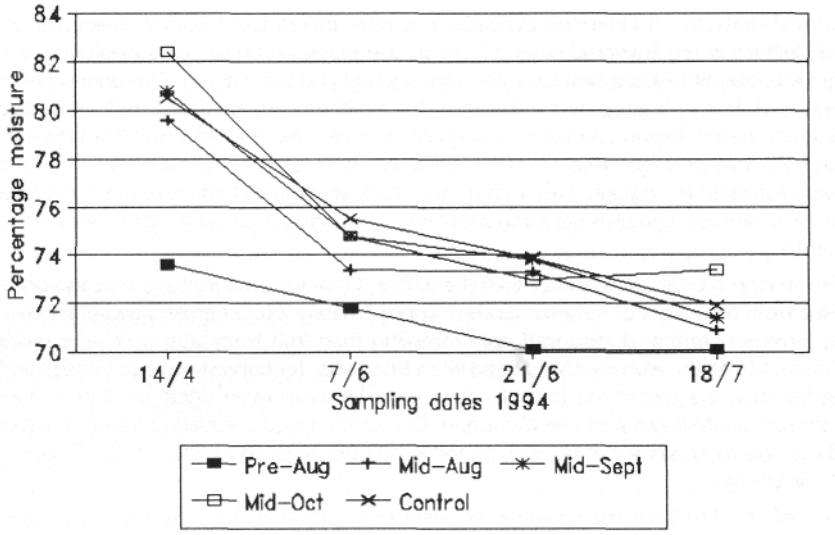

Figure 1
Moisture percentage of Pinkerton avocado pulp at different sampling dates (Heidelberg, 1994).

Table 1 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.

Table 1
Comparison of moisture percentage between oven and freeze drying methods of Pinkerton avocado pulp.

Treatment	*Kiepersol*		*Heidelberg*	
	Oven 27/5	*Freeze 27/5*	*Oven 7/6*	*Freeze 7/6*
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

Yield & fruit size

The effect of different fruit set periods on average fruit counts and size per tree at Heidelberg can be seen in Table 2. The pre-August treatment had abnormally few fruit per tree. The best treatment was the mid-August set with an average of 244 fruit per tree and a 20% higher yield per tree than the control. The latter gave a similar number of fruit as the mid September treatment.

Table 2
Average number of fruit, fruit mass, yield per tree and projected calculated yield per hectare (Heidelberg, 1994).

Treatment	*Average number of fruit*	*Average fruit mass (g)*	*Average yield/tree (kg)*	*Projected calculated yield/hectare (t/ha) (400 trees)*
Pre-Aug	75.2	320.5	24.1	9.6
Mid-Aug	243.9	326.7	79.5	31.8
Mid-Sept	217.8	324.4	70.7	28.3
Mid-Oct	187.5	328.4	61.5	24.6
Control	217.8	304.5	66.2	26.5

Fruit size was affected by fruit count per tree as well as the fruit set period. Even though the control and mid-September treatments had the same average number of fruit, the September fruit were larger, which resulted in a higher average yield per tree than the control treatment.

Data from the Kiepersol site are presented in Table 3. Fruit counts declined with later set periods. 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.

Table 3
Average number of fruit, fruit mass, yield per tree and projected yield per hectare (Kiepersol, 1994).

Treatment	*Average number of fruit*	*Average fruit mass (g)*	*Average calculated yield/tree (kg)*	*Projected yield/ha (t/ha) (400 trees)*
Pre-Aug	218.1	269.5	58.8	23.5
Mid-Aug	218.7	298.2	65.2	26.1
Mid-Sept	112.4	280.5	31.5	12.6
Mid-Oct	43.5	305.6	13.3	5.3
Control	198.8	237.3	47.2	18.9

Figure 2 shows projected yield per hectare differences (400 trees) between set periods and orchard 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.

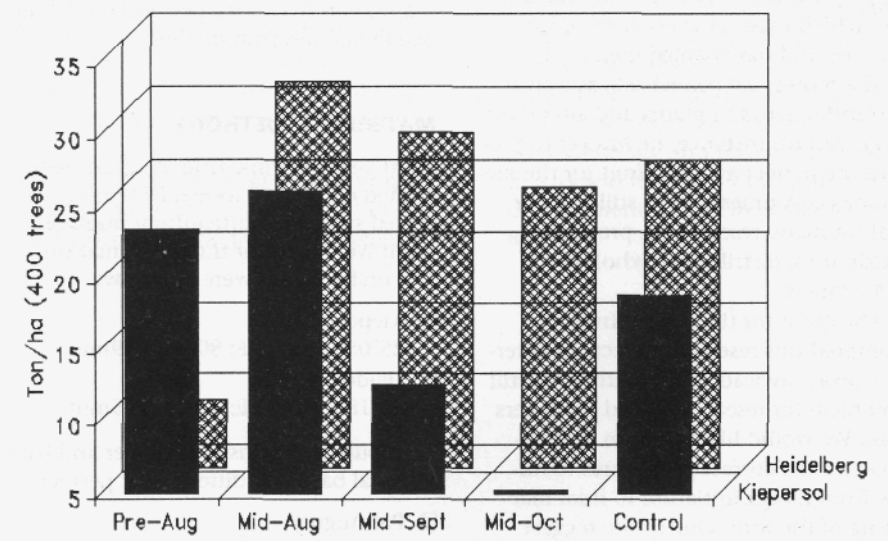

Figure 2
Comparison between projected yield per hectare for fruit set period and orchard site of Pinkerton avocado.

Fruit quality

In order to fall in with the producer's harvesting and packing procedures, all treatments were harvested at the same time. Table 4 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 grey

pulp 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.

DISCUSSION

Moisture determinations

The normal drop in moisture percentage was observed from early in the season to harvest. However, 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.

Yield & fruit size

Low average fruit counts from the pre August treatment at Heidelberg can be ascribed to unfavourable 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 very much influenced by climatic conditions during the fruit set period. If a producer is prepared to regularly inspect flowering behaviour of his trees and manipulate them into the best period, 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.

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.

Table 4
Quality analysis of Pinkerton avocado fruit exported to the UK from Heidelberg, 1994.

TRT	*Firmness*	*Rating*	*Black cold*	*Dusky cold*	*Lenticel damage*	*Greypulp*	*Days to ripen*
Pre-Aug	49,1	Soft	6,06	2,54	2,82		
Mid-Aug	39,4	Break	2,88	0	3,03		
Mid-Sept	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	4,66	0		
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-Sept		Ripe	1,39	1,39	7,50	0	4,83
Mid-Oct		Ripe	0	1,94	3,06	5,28	4,58
Control		Ripe	0	3,00	6,33	4,00	4,50

CONCLUSIONS

Manipulating fruit set period of Pinkerton avocado has definite advantages to the producer. Firstly he will know the age of fruit on the tree. Secondly the fruit will be more uniform in shape, size and maturity, making harvesting and packing easier. Thirdly, he will be able to harvest the early set fruit at least a month before the control fruit.

By inspecting the trees regularly and manipulating fruit set period, an increased yield can be expected provided the optimum period is selected. A controlled spread of harvest can also be manipulated.

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