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# Growth rates of Pinkerton avocado fruit

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## *ABSTRACT*

*The Pinkerton originated in 1961 and soon became known for its consistent, heavy yields. However, in South Africa the main drawback is that it flowers over a very long period (June to December). This results in differences in fruit maturity during picking time, ultimately causing postharvest quality problems. A trial was laid out in three different climatic areas to investigate the problem of variable fruit-set on fruit drop, growth rate and fruit quality.*

*Initial results indicate that the main fruit-set period occurred over at least a three month period, i.e. August, September and October. Data showed that a higher fruit drop can be expected from the sets that occur during the second half of the flowering season. Even though the first and last sets at two sites differed by more than 40 days, the fruit attained nearly the same size in early February. Growth rates of fruit that set later were markedly faster than those of the first set. The effect of fruit-set date on fruit quality will be reported on later.*

## INTRODUCTION

The Pinkerton originated around 1961 as a seedling amongst Hass, Rincon, Edranol and Corona trees, on the property of Mr John Pinkerton, Ventura County, California. The tree has a moderately spreading habit with a cold hardiness, presumed similar to Hass. It has an A type flower and it is known for its consistent, heavy yields. The fruit size is medium to large and pear shaped with an excellent appearance. The seed is small (8 to 9%; Anon, 1981) and sits tight in the cavity (Platt, 1975/6).

The importance of Pinkerton was highlighted in the SAAGA Avocado Census of 1987. Although it is a relatively young cultivar, it represented fifth place at 2,56% of the total number of trees planted. The order of the other cultivars was as follows: Fuerte (53,2%), Hass (29,57%), Edranol (7,0%) and Ryan (6,58%). However, nursery sales indicate that during 1985, Pinkerton sales were more than double those of Ryan and Edranol, respectively. The previous year sales of Pinkerton was equivalent to that of Ryan (Tuffin, 1987), indicating a preference towards Pinkerton. One of the reasons for this trend is its above average yields.

The environment in which a tree grows exerts the most powerful effect on tree performance and yield. Under South African climatic conditions the Pinkerton flowers over a very long period, up to five months. Fruit-set over this long period leads to

problems in mature fruit selection during harvesting (Hough, 1990), which later leads to fruit quality problems.

This investigation aims at gathering phenological growth data on the Pinkerton avocado fruit, especially the effect that different fruit-set dates have on fruit drop, growth rate, maturity, harvesting times and fruit quality. Although the investigation has only begun and still has to be carried out for another three to four years to obtain reliable data, it was deemed necessary to relate initial findings to the producers

## MATERIALS AND METHODS Plant material

Three different climatic sites were selected for the purpose of this trial:

a) Schagen
b) Kiepersol
c) Brondal

Bearing trees of uniform size and about four years old were studied. Different trial layout systems were followed at the various sites, depending on the availability of trees and the availability of fruit on the trees.

Different fruit-set periods were identified. This involved selecting and tagging the fruit of each particular fruit-set on the trees with different coloured wool strips. Tagging dates can be seen in Table 1. At each fruitset tagging date, 100 fruits of between 20 and 30 mm in length were selected. In order to minimize mistakes and also competition between fruit, all other fruit developing on the tagged inflorescence were removed. Growths in length and fruit drop of tagged fruit were monitored.

**TABLE 1** *Percentage fruit drop from different sets at three production sites for two seasons as recorded in early February*

| Site | 1990/91 | | 1991/92 | |
|---|---|---|---|---|
| | Tagging Dates | % Fruit Drop | Tagging Dates | % Fruit Drop |
| Schagen | 21/08/90 | 66 | | |
| | 05/09/90 | 84 | | |
| | 18/09/90 | 69 | | |
| | 02/10/90 | 76 | | |
| Heidelberg | *No fruit | | | |
| | *No fruit | | 05/09/91 | 44,8 |
| | *No fruit | | 20/09/91 | 58,0 |
| | 02/10/90 | 55 | | |
| | 16/10/90 | 49 | 25/10/91 | 63,2 |
| Kiepersol | 21/08/90 | 73 | | |
| | 05/09/90 | 79 | 05/09/91 | 63 |
| | 18/09/90 | 90 | 20/09/91 | 72 |
| | 02/10/90 | 93 | | |
| | | | 25/10/91 | 83 |

## RESULTS

From the tagging dates (Table 1) it is evident that there are differences between the three sites. At both Schagen and Kiepersol it was possible to commence tagging during August, and continue until October in the 1990/91 season. At the Brondal site, no fruit of required size and distribution on the trees could be found to be tagged until the first week in October during this season. During the 1991/92 season insufficient fruit were found to be tagged at Schagen. At both Heidelberg and Kiepersol it was possible to tag fruit from early September to late October.

Although fruit of between 20 and 30 mm were tagged, a large fruit drop (Table 1) was still encountered. The figures presented are for two seasons at the various sites for early February. The fruit drop at Schagen presented a trend of low figures for the first set and higher figures for the last set, except for the second set, which also had a very high fruit drop. Fruit drop at the Kiepersol site reached a high of 93% with the last fruit-set, and a low of 73% with the first fruit-set. At Heidelberg the first set (which occurred late in the season) gave 55% and the second set 49%. This is relatively low compared to the same set-period (October) at the other two sites during the 1990/91 season.

Comparing fruit drop at Heidelberg during the second season (1991/92) to that of Kiepersol for the same season, lower fruit drop figures were again obtained at the first site. At both these orchards the trend of low figures for the first sets and high figures for

the later sets were observed during the second season.

Fruit sizes for the different set-periods at the various sites for the two seasons during early February, are presented in Table 2. From this Table the fruit sizes can be compared for the different sets and between the various sites and seasons.

Although there was a 42-day difference between the first and the last tagging dates for the 1990/91 season at Schagen (Figure 1), fruit size from the last set actually surpassed that of the first set from December onwards. This difference was due to the difference in cumulative growth rate of the different sets (the cumulative growth rate comprises growth per day measured in millimeters from the first day of measuring).

Figure 2 shows that the same trend was observed at Kiepersol during the 1990/91 season. The difference here between the first and last set was 43 days. Figures for the latest season (1991/92) for Kiepersol are presented in Figure 3. In early February fruit from the last set were already the same size as that of the first set. These sets represent a 50-day difference in fruit age. The growth rate curve indicates that this last set will eventually be bigger than that of the first set.

At Heidelberg, the second set surpassed the first set in size for the latest season (Figure 4), whilst the last sets were nearly the same size. Thus the faster growth rate of fruit from the later sets resulted in these fruit being about the same size early February. Data of final fruit sizes for the Schagen orchard (not presented here), indicated that the fruit only increased about 10 mm from March until harvesting time (June).

**TABLE 2 Pinkerton fruit size from different sets at three production sites for two seasons as recorded in early February**

| Site | 1990/91 | | 1991/92 | |
|---|---|---|---|---|
| | Tagging Dates | Fruit Size (mm) | Tagging Dates | Fruit Size (mm) |
| Schagen | 21/08/90 | 105,1 | | |
| | 05/09/90 | 105,7 | | |
| | 18/09/90 | 121,6 | | |
| | 02/10/90 | 131,1 | | |
| Heidelberg | *No fruit | | | |
| | *No fruit | | 05/09/91 | 111,4 |
| | *No fruit | | 20/09/91 | 117,1 |
| | 02/10/90 | 118,0 | | |
| | 16/10/90 | 99,4 | 25/10/91 | 104,6 |
| Kiepersol | 21/08/90 | 97,3 | | |
| | 05/09/90 | 107,3 | 05/09/91 | 115,2 |
| | 18/09/90 | 113,9 | 20/09/91 | 112,3 |
| | 02/10/90 | 118,4 | | |
| | | | 25/10/91 | 115,1 |

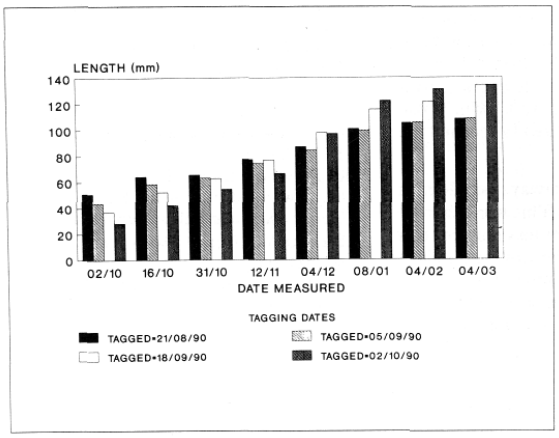


**Fig 1** Fruit growth of Pinkerton avocado at Schagen, according to date of fruit-set (1990/91 season).

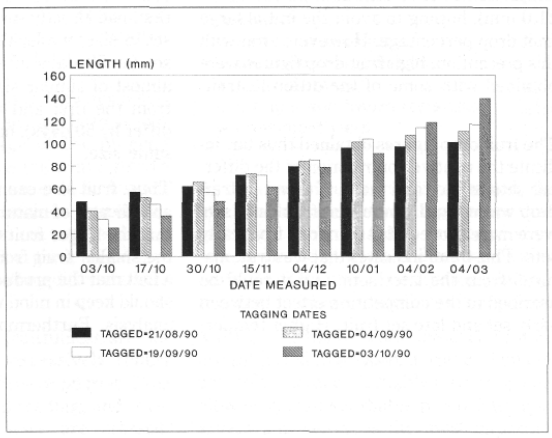


**Fig 2** Fruit growth of Pinkerton avocado at Kiepersol, according to date of fruit-set (1990/91 season).

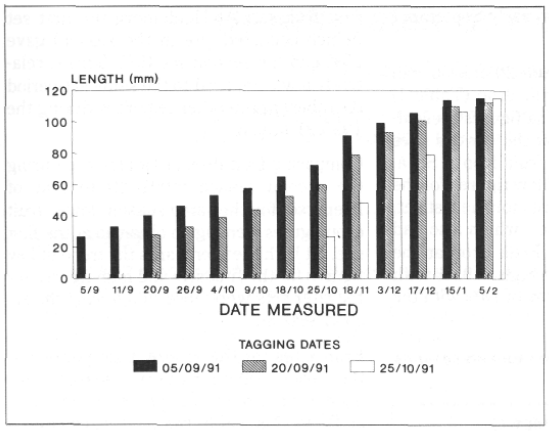


**Fig 3** Fruit growth of Pinkerton avocado at Kiepersol, according to date of fruit-set (1991/92 season).

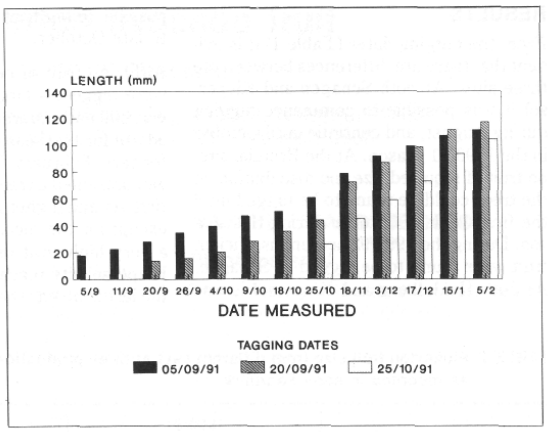


**Fig 4** Fruit growth of Pinkerton avocado at Heidelberg, according to date of fruit-set (1991/92 season).

## DISCUSSION

The difficulty of monitoring avocado fruit growth was highlighted in this trial. It is known that only a small percentage of the initial fruit-set has the ability to mature. Robertson (1969) has determined that only 6% of the initial Fuerte fruit-set reached maturity. He determined that 94% of the fruit drop occurred before Stage II in the growth of the fruit was reached. For the purpose of this trial, fruit was tagged at a length of 20 to 30 mm (average width = 21,0 mm), hoping to avoid the initial large fruit drop percentage. However, even with this precaution, high fruit drop figures were obtained with some of the different fruit-sets.

The fruit drop figures obtained thus far, indicate the relative contribution of the different sets to the final yield. A trend in fruit drop was noticed where fruit from later sets were more prone to fall than fruit from early sets. This trend indicates that less fruit matured from the later sets, and it could be ascribed to the competition effect between early set

and late set fruit. Higher temperatures during the latter part of the season could also have had a greater effect on the small fruit on the tree at that stage.

Fruit growth during the 1990/91 season at Schagen and Kiepersol showed a definite correlation with temperature. Fruit that had set early (middle August), were surpassed in size by fruit that had set later, during warmer weather (early October). At these two sites, where there was a difference of about 40 days between the first and last sets during the season, the growth rates of the last sets were between 25 and 50% more than that of the earliest set. It is postulated that the cell division stage of the later set fruit occurred during more favourable conditions, resulting in more cells that could contribute to final fruit size.

Results of the second season's (1991/92) fruit growth during early February indicate that the same trend will be observed again. At Heidelberg, fruit from the second fruitset, which occurred 15 days later than the first, had already surpassed fruit of the first set in size, whilst the fruit from the third set (at 50 days after the first set), were almost of similar size. At Kiepersol, fruit from the first and third sets (which also differ by 50 days), had already reached the same size.

Thus, fruit size cannot always be taken as an indicator of maturity. This work showed that the larger fruit were less mature than the smaller fruit from the first set. This is a fact that the producer and the researcher should keep in mind when selecting fruit for analysis. Furthermore, leaving the small (more mature) fruit on the tree during early harvesting periods to still increase in size, could only result in these fruit becoming overmature, which could lead to postharvest quality problems. Picking the large (less mature) fruit first, could also result in quality problems later.

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