# Further observations on the development of a total soluble solids (TSS) based maturity/ ripening-efficacy measurement tool for South African avocado fruit

**FJ Kruger, GO Volschenk and L Volschenk**

Lowveld Postharvest Services,
PO Box 4001, Mbombela (Nelspruit) 1200, SOUTH AFRICA

E-mail: fjkruger58@gmail.com

**ABSTRACT**

A preliminary study indicated that the total soluble solids (TSS) content of avocado fruit may potentially serve as a maturity measurement as well as a ripening prediction tool. During 2018, three longitudinal studies were performed. The first two were with, respectively, early season 'Maluma' and early season 'Pinkerton'. The results indicated that the TSS content of the fruit decreases linearly to approximately 8°Brix whereafter it starts to increase again. The increasing leg then continues linearly to around 10.5°Brix, whereafter it starts to flatten out. Additional observations made with late season 'Lamb Hass' also indicated that the increasing leg continues to approximately 11°Brix, whereafter it flattens off and starts to decrease again. From the results it would appear that TSS measurements have potential to be used as a maturity parameter and ripening prediction tool for avocado fruit. A detailed study is planned for the 2019 season with the 'Hass' cultivar.

**INTRODUCTION**

A pilot study conducted during the 2017 season (Kruger *et al*., 2018) indicated that the total soluble solids (TSS) content of avocado fruit drifted towards 7.7°Brix during storage. The means of samples with TSS values higher than 7.7°Brix reduced during storage while samples with a lower TSS increased during the same period. In general, samples which did not contain individual fruit with a TSS content lower than 7.7°Brix had a mean TSS content higher than 8.2°Brix. When correlating the mean TSS values of SmartFresh treated samples with observed ripening variations, it was noticed that samples with a mean TSS higher than 8.2°Brix ripened more evenly (after storage at 6°C for 30 days) than those with lower readings. Most interestingly, the lowest individual TSS readings in samples with mean TSS values higher than 8.2°Brix was 7.7°Brix.

In the current study, we aimed to establish how the TSS content of the fruit varied during the month prior harvest as well as during the harvest window.

**MATERIALS AND METHODS**

Three trials were performed during the 2018 season. The first study was a longitudinal survey performed during the early season with the 'Maluma' cultivar. Ten fruit each were sampled from an orchard in the Tzaneen area on a regular basis for a two-and-a-half-month period from March to May 2018. The dry matter (DM) and TSS contents of each fruit were determined and plotted against the sampling date.

The second study was performed with "pre-season ripening" and "export holdback" 'Pinkerton' cartons. Eight fruit from each batch were used to determine the DM and TSS contents of the batch. As the fruit originated from a range of orchards with different maturity rates, the TSS readings could not be plotted against the dates and they were therefore plotted against the mean DM contents of the samples.

The third study was also a longitudinal survey. This time it was performed with late season 'Lamb Hass'. Ten fruit each were sampled from an orchard in the Tzaneen area on eight occasions over a three-month period from August to October 2018. The DM and TSS contents of each fruit were determined and plotted against the sampling date.

## RESULTS AND DISCUSSION

The DM and TSS contents of the early season 'Maluma' fruit that were plotted against the sampling date are shown in, respectively, Figure 1 and Figure 2. In Figure 3, the early- to mid-season TSS readings of the 'Pinkerton' samples are plotted against the mean DM readings. The DM and TSS readings of the late season 'Lamb Hass' fruit that were plotted against the sampling date are shown in, respectively, Figure 4 and Figure 5.

Both the longitudinal study conducted with early season 'Maluma' (Figure 2) as well as the early season survey conducted with 'Pinkerton' (Figure 3) indicated that the TSS contents of the fruit decreases linearly up to a certain point, whereafter it starts to increase again. In the case of 'Maluma' (where a single orchard was involved and the TSS was plotted against the date) the turning point was approximately 7.7°Brix, which corresponds with the cut-off level associated with smooth ripening by Kruger *et al*., (2018). With the early season 'Pinkerton' (where the holdback samples originated from many orchards and the TSS was plotted against the DM), the turning point was around 8°Brix.

In both 'Maluma' and 'Pinkerton', the TSS content of the second (increasing) leg continued linearly to around 10.5°Brix, whereafter the line started to flatten out.

With late season 'Lamb Hass' (Figure 5), the curve reached a turning point at approximately 11°Brix and then started to decrease.

The results are certainly quite interesting and it would appear that the TSS of the avocado fruit decreases on the tree until a TSS content of around 8°Brix is reached. It then increases again to about 11°Brix after which it declines again.

The next step is to determine the practical value to the industry. In both early season 'Maluma' and 'Pinkerton', the bottom turning point presaged the currently accepted DM

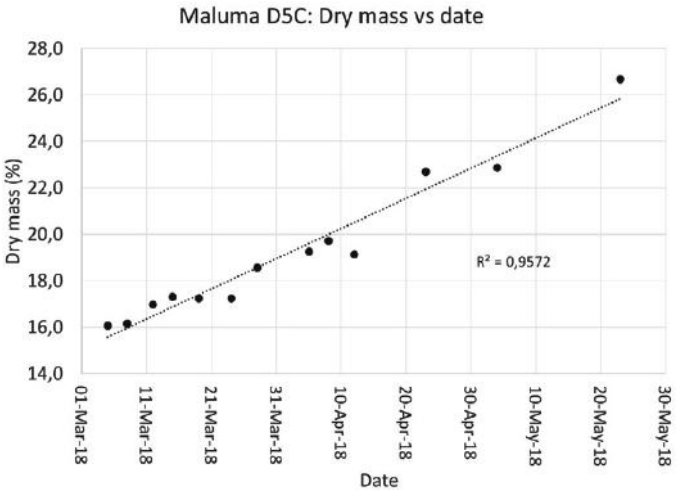


**Figure 1.** Dry matter content of 'Maluma' avocado fruit sampled on a regular basis over a three-month period from an orchard in the Tzaneen area.

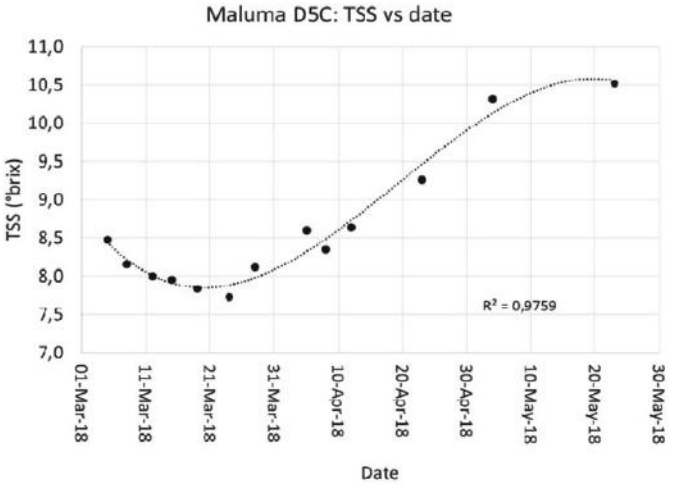


**Figure 2.** Total soluble solid contents of 'Maluma' avocado fruit sampled on a regular basis over a three-month period from an orchard in the Tzaneen area.

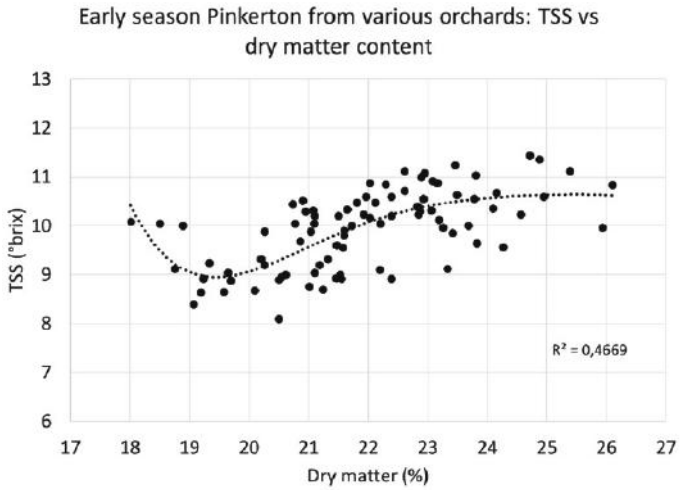


**Figure 3.** Total soluble solid content versus the dry matter content of "pre-season ripening" and "export holdback" 'Pinkerton' samples.

threshold value for satisfactory ripening and taste. Trials aimed at using TSS to replace/supplement early season ripening tests are therefore indicated.

In so far as the late season cultivars are concerned, the second (high) turning point may signal the end of the maturation phase and the start of on-tree ripening. The slowing of the ripening rate of ultra-late season cultivars may possibly be associated with declining sugar levels and a concurrent slowdown in the metabolism of the fruit. Further research on the topic is certainly warranted.

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**REFERENCE**

KRUGER, F.J., VOLSCHENK, G.O. & VOLSCHENK, L. 2018. Towards the development of a total soluble solids (refractometer) based maturity measurement and ripening prediction procedure for avocado fruit. *South African Avocado Growers' Association Yearbook* 41: 115-117.

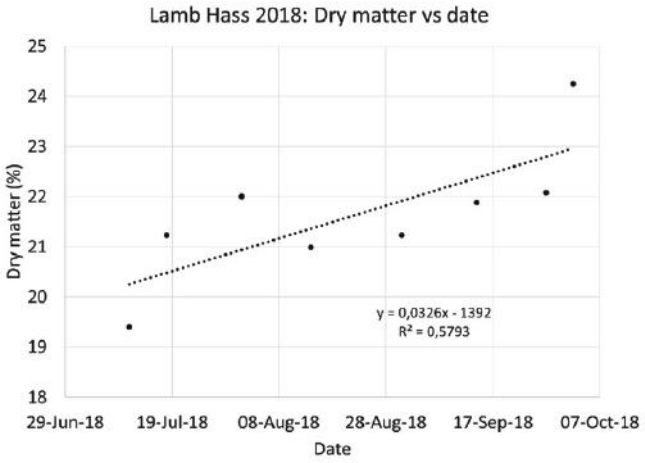


**Figure 4.** Dry matter content of late season 'Lamb Hass' avocado fruit sampled on a regular basis over a three-month period from an orchard in the Tzaneen area.

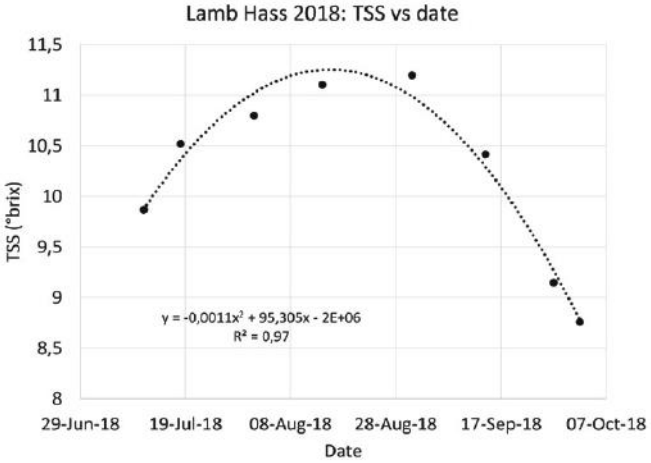


**Figure 5.** Total soluble solid content of late season 'Lamb Hass' avocado fruit sampled on a regular basis over a three-month period from an orchard in the Tzaneen area.

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