FLESH FIRMNESS UTILISING A PENETROMETER WITH A 6-MM PLUNGER AS A HARVEST MATURITY PARAMETER FOR APRICOTS

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Introduction

Skin colour and the percentage wring are currently used as parameters for determining optimum harvest maturity of apricots in South Africa. Skin colour is determined using an industry colour chart, and the wring test is performed by cutting the fruit along the suture and twisting the halves in opposite directions to enable visual inspection of the stone. The fruit is regarded as wrung if no flesh adheres to the visible part of the stone. Despite use of these maturity indices, large variations in harvest maturity occur across years, farms and orchards, often resulting in inconsistent apricot quality in the market place.

Flesh firmness is generally a good indicator of physiological maturity of stone fruit and is one of the parameters used for plums, nectarines and peaches. With these fruit kinds, a penetrometer fitted with an 11-mm plunger is used. Visagie (1985) found that flesh firmness is also a good indicator of harvest maturity of apricots, but that it must be used in combination with skin colour and the wring test to reduce the possibility of harvesting immature fruit. The value of flesh firmness as a maturity parameter for apricots was confirmed by Brown and Walker (1990), who reported that skin colour was a good indicator of physiological maturity at any one site, but that it was a poor indicator between sites.

Despite the value of flesh firmness as a harvest maturity indicator for apricots, this parameter is not used as a maturity parameter for apricots in South Africa. Khumalo (2004) found that standard 11-mm plungers could not be used on apricots, because the reading would either be out of the penetrometer range, or that the fruit would crack and split and hence no reading could be obtained. By contrast, he found that flesh firmness could be determined using plungers of 2- and

6-mm diameter without the problems associated with plungers of 11-mm. While promising results were obtained with both the 2- and 6-mm plungers in initial testing, it was decided to continue evaluation of only the 6-mm plunger, since this would enable use of the standard penetrometer typically used for plums, nectarines and peaches.

This communication reports on the final testing of penetrometers fitted with 6-mm plungers to accurately determine the harvest maturity of apricots. The flesh firmness of commercially harvested Supergold, Charisma and Imperial apricots was measured at intake and the results were correlated with fruit quality after storage.

Materials and methods

Supergold, Charisma and Imperial apricots were sourced from early to late in the commercial export harvest window for each cultivar. Fruit was sourced from various producers in Ladismith and Roberson. The research was conducted over 3 seasons for Supergold and 2 seasons for both Charisma and Imperial. For each single sample carton of fruit, the harvest maturity was determined using flesh firmness (6-mm plunger), skin colour, total soluble solids (TSS) and titratable malic acid equivalents. The samples were then cooled passively to -0.5°C. Supergold and Charisma were cold stored for 32 days and Imperial for 38 days before examination. A second examination was conducted after a subsequent simulated shelf life of 5 days at 10°C. Fruit were examined for decay and shrivel, and the internal quality disorders comprising overripeness and gel breakdown.

Results

Supergold

The preliminary trials for Supergold apricots indicated that fruit with a flesh firmness softer than 1.8 kg at harvest were more prone to develop internal disorders after cold storage than firmer fruit. In subsequent research, a total sample volume of 76 commercial samples, each comprising a single carton of fruit were tested. It was found that the percentage of samples with apricots softer than 1.8 kg, over the three years of study, was 12.5%, with the remainder firmer at between 1.8 and 3.0 kg (Fig.1). This indicated that of the samples drawn from the commercial environment, most complied with the flesh firmness window of between 1.8 to 3 kg, which the preliminary research suggested as being the likely optimum range.

After subsequent cold storage and shelf life, on average 11 % of the samples in the softer flesh firmness classification (< 1.8 kg) developed internal disorders, compared to only 1% in the firmer fruit (Fig. 2). This indicated beyond doubt, that flesh firmness measured with a penetrometer fitted

with a 6-mm plunger at harvest, could be used to establish the risk of Supergold apricots developing internal disorders during cold storage.

In the case of skin colour, 40% of the samples exhibited advanced skin colour (9 or higher on colour plate AP. 01), while 60% fell within the less advanced colour range of 7 to 8 (Fig. 1). Although there was a trend for higher levels of internal disorders in the advanced coloured fruit (Fig. 2), the difference in the levels of disorders between the two skin colour categories was less than between the flesh firmness categories. This implied that skin colour at harvest is a less accurate indicator of storage potential than flesh firmness at harvest.

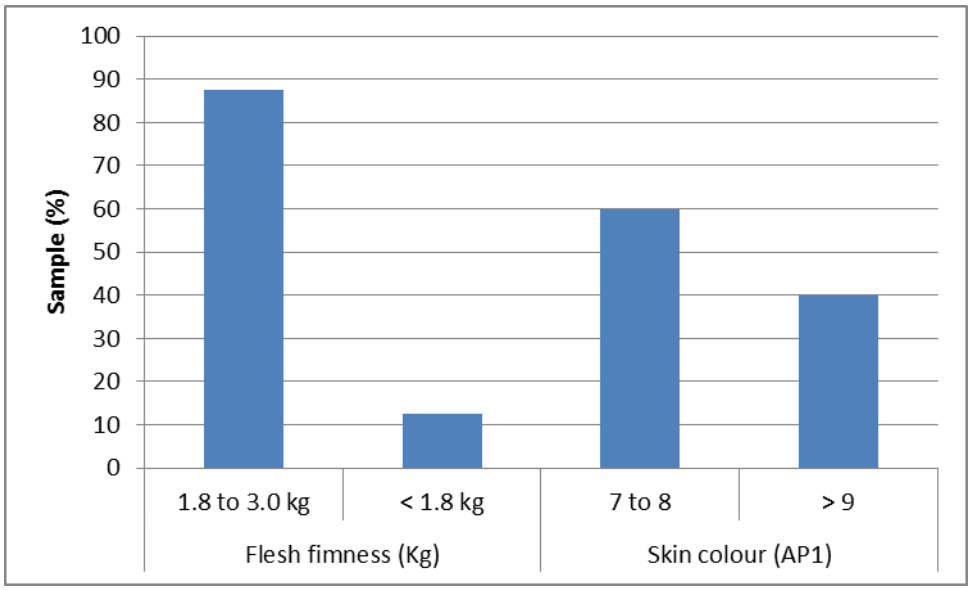

Figure 1 : Percentage samples of Supergold apricots in different flesh firmness and skin colour categories at harvest.

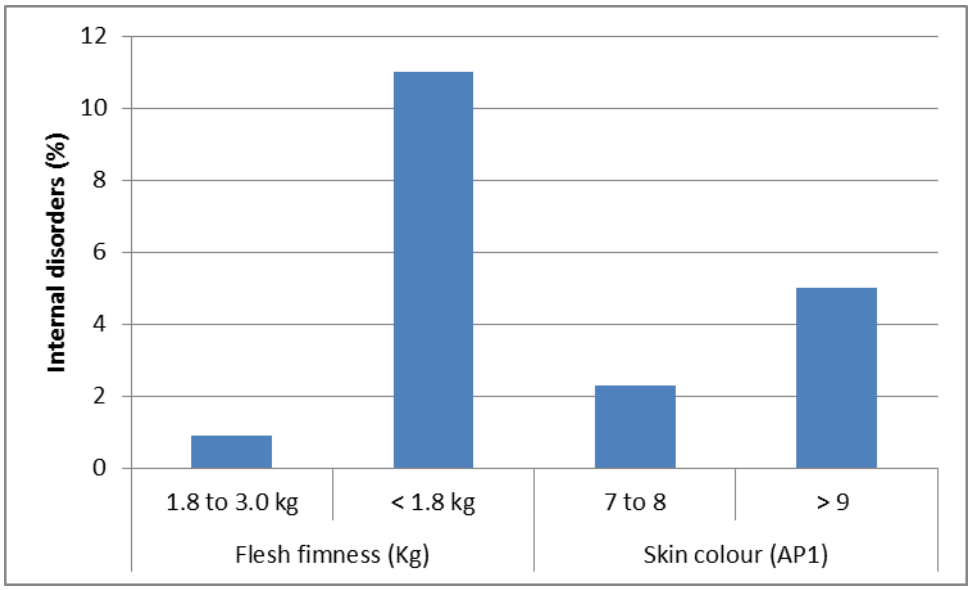

Figure 2 : Internal disorders in Supergold apricots in different flesh firmness and skin colour categories after 32 days in cold storage followed by a simulated shelf life of 5 days at 10°C

Charisma

The first trials with Charisma apricots suggested that apricots with a flesh firmness lower than 2.0 kg were more prone to develop internal disorders after cold storage than firmer fruit.

The percentage of samples softer than 2.0 kg during the two years of the study was 83%, with the balance firmer than 2.0 kg (Fig. 3). Most of the samples therefore contained fruit harvested softer than the preliminary minimum cut-off of 2.0 kg. All the fruit were harvested at a relatively advanced skin colour ranging between 9 and 11, considering that the minimum skin colour is 3 on colour plate AP. 01. In this trial, samples were classified into two colour categories, namely from 9 to 10 for less coloured and higher than 11 for more advanced colour

On average, internal disorders occurred on 12% of the softer Charisma apricots after cold storage and shelf life, compared to 4.5% on firmer fruit (Fig. 4). Similar to Supergold, this suggested that flesh firmness at harvest can be used to determine the risk of internal disorder development during cold storage.

The more advanced the skin colour at harvest (Fig. 3), the higher the levels of internal disorders after storage (Fig. 4). Within the skin colour range tested in these trials, the associated differences in internal disorder levels after storage were smaller than for flesh firmness measured at harvest. This again suggested that flesh firmness was a more accurate indicator of post storage internal quality than skin colour.

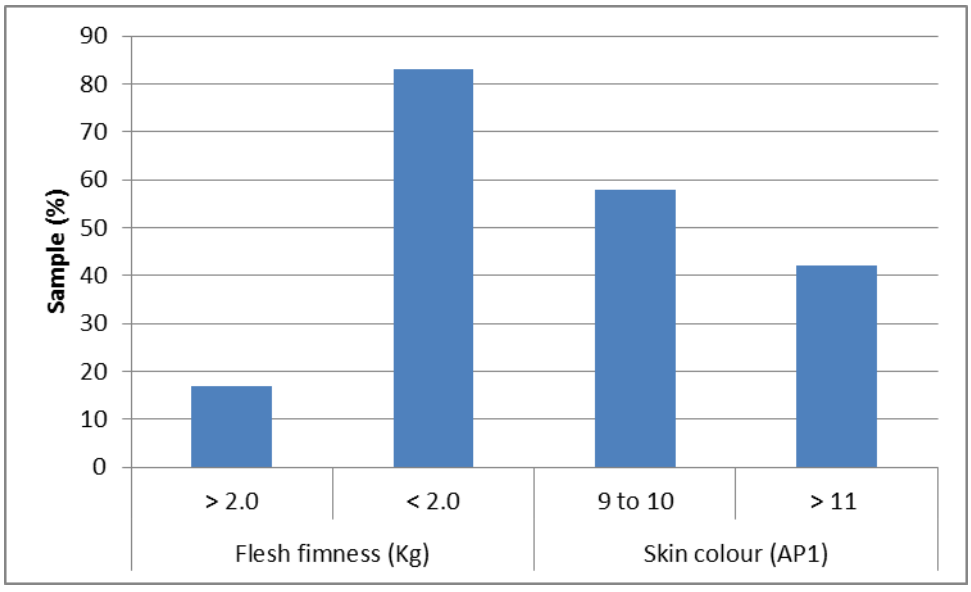

Figure 3 : Percentage samples of Charisma apricots in different flesh firmness and skin colour categories at harvest.

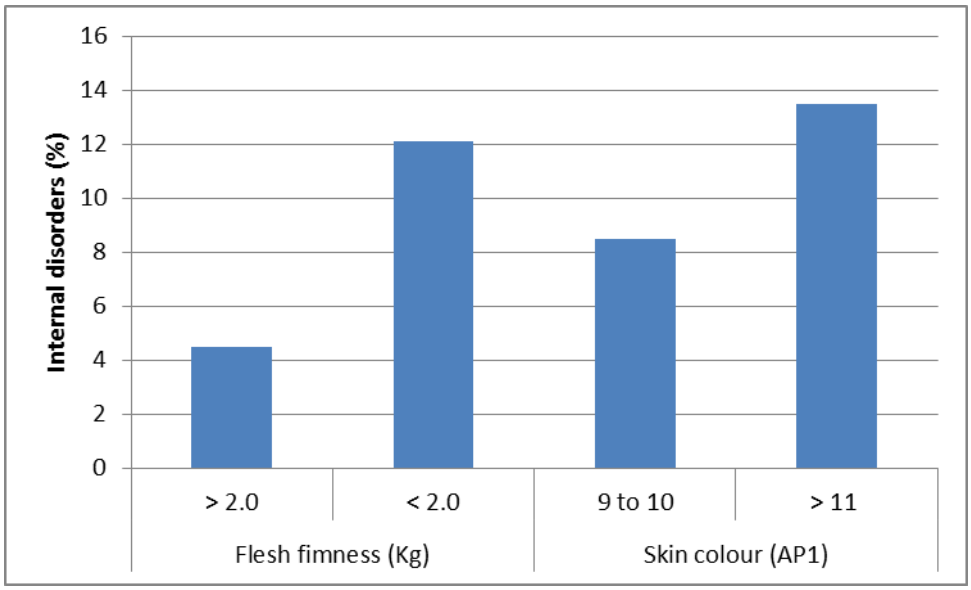

Figure 4 : Internal disorders in Charisma apricots in different flesh firmness and skin colour categories after 32 days in cold storage followed by a simulated shelf life of 5 days at 10°C

Imperial

To verify the conclusions drawn from the research on Supergold and Charisma, statistical correlations were conducted on the Imperial apricot data set. The correlation between flesh firmness at harvest and internal disorders after storage explained 35% of the variation in the data (Fig. 5), while the correlation between skin colour at harvest and internal disorders after storage only explained 13% of the variation (Fig. 6). Flesh firmness at harvest therefore gave a better indication of the potential of the fruit to develop internal disorders after cold storage and shelf life than skin colour. Internal disorders consisted of approximately 50% gel breakdown and 50% overripeness (Data not shown). Similar to Supergold and Charisma apricots, the results indicated that flesh firmness on Imperial apricots at harvest is a better indicator of potential fruit quality after cold storage than skin colour.

Based on this study, the recommended minimum flesh firmness for Imperial apricots, determined using a penetrometer fitted with an 6-mm plunger is 2.0 kg.

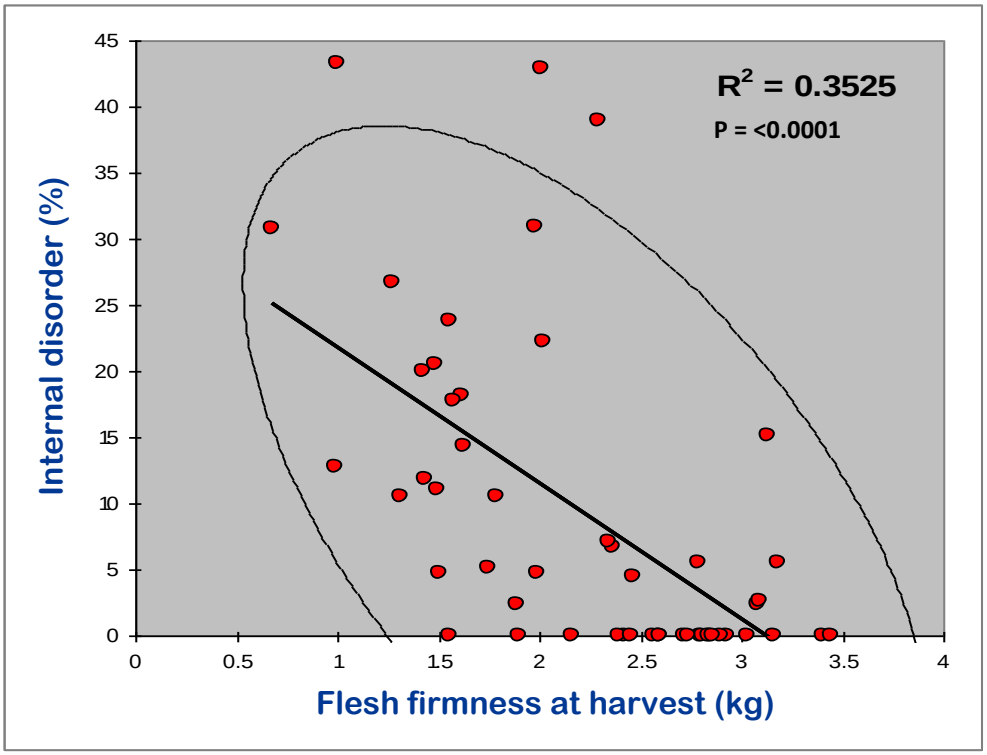

Figure 5 : The relationship between flesh firmness at harvest and the development of internal disorders in Imperial apricots after 38 days cold storage at -0.5°C followed by 5 days at 10°C

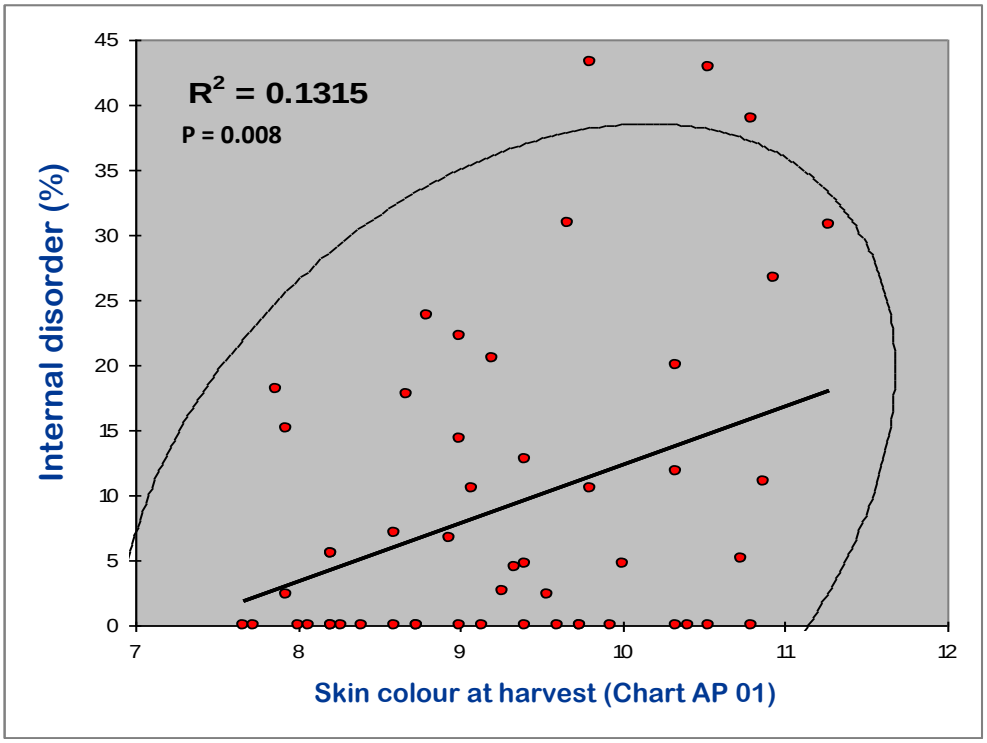

Figure 6 : The relationship between skin colour at harvest and the development of internal disorders in Imperial apricots after 38 days cold storage at -0.5°C followed by 5 days at 10°C

Conclusion

The results for the three apricot cultivars tested in this study, Supergold, Charisma and Imperial, confirm the findings of Visagie (1985) and Brown & Walker (1990), namely, that flesh firmness is a valuable parameter for determining the optimum harvest maturity of apricots. Furthermore, this research has shown that a penetrometer fitted with a 6-mm plunger can be used to accurately determine flesh firmness.

It is suggested that flesh firmness using a penetrometer with a 6-mm plunger be used as an additional parameter to compliment skin colour and the wring test for determining the optimum harvest maturity of apricots. However, confirmation of this recommendation is required through further testing on commercial consignments, prior to implementation.

References

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