Quality challenges facing the South African avocado industry – An overview of the 2009 South African avocado season

RM Nelson

SAAGA Overseas Technical Officer
SAAGA, PO Box 866, Tzaneen 0850, South Africa
E-mail: Richard.nelson@wanadoo.fr

ABSTRACT
South Africa has a long history of supplying avocados to Europe. The industry thus has considerable experience in the long distance transport of avocados and is generally considered to be a world leader regarding avocado research and production. Despite these advantages, South Africa no longer enjoys the reputation of supplying superior quality avocados to the European market. This reputation was severely damaged during the 2009 export season, when many South African avocados were perceived as being of substandard quality. This article provides details of the various quality defects affecting South African avocados during the 2009 export season.

The European avocado market has become increasingly competitive, and other producer countries are now supplying large volumes of good quality avocados. The South African avocado industry needs to concentrate on addressing recurring (and in many cases manageable) quality defects, if it is to regain the reputation of being a preferred supplier of good quality avocados.

INTRODUCTION
The South African Avocado Growers' Association has been monitoring the quality of South African avocados delivered to Europe for more than two decades now. Since the late 1980's a technical representative (the SAAGA Overseas Technical Officer – OTO) have been based in Europe for the duration of the South African avocado export season. Over this time period, the industry has observed that some quality defects have become less common and / or less problematic. These changes have been partially due to technological advances, allowing the South African industry to deliver better quality fruit to our European clients. The downside to these advances is that the market place itself is becoming more demanding and less tolerant of "quality defects" which a few years ago would have been deemed acceptable. In contrast, certain quality defects have continued to be problematic, whilst others have gained in importance.

Up until the late 1990's, the biggest challenge for the South African avocado industry was to supply firm avocados to the European market. With the development of controlled atmosphere (CA) technology for transporting avocados long distances, and the adoption of this technology by the South African industry, soft deliveries largely became a problem of the past. In more recent years, alternatives to CA, such as 1-MCP, have been increasingly used by the industry. The net result has been that the overwhelming majority of South African avocados are delivered to Europe in a firm condition. This allowed for greater flexibility in terms of avocado storage and marketing. However, since South Africa's competitor countries are also now able to deliver firm avocados to the European market place, this is no longer a commercial advantage for the South African industry. It should also be noted that European agents are now far less willing to accept consignments of softer avocados – which are still delivered from time to time (mainly as a result of logistical difficulties resulting in older fruits being delivered to Europe, and fortunately in far lower volumes that was the case up until the late 1990's). It is thus important to ensure that fruits are properly cooled and that the cold chain is maintained in order to limit the incidence of softer avocado deliveries.

Until the advent of CA technology, the South African avocado industry had to rely exclusively on refrigeration to delay the in transit ripening of avocados. The sensitivity of avocado fruits to low temperatures is strongly correlated with the physiological maturity of the fruit at time of harvest. The impossibility of ensuring that all fruits within a consignment have been harvested at the correct physiological maturity, has meant that a significant percentage of South African avocados have been found to display various forms of external chilling injuries (black cold injury, etc.). The use of CA (or 1-MCP, etc.), as well as better management of shipping temperature regimes, has lessened the incidence of such quality defects. Regardless, external chilling injury remains one of the most problematic quality defects affecting South African avocados – especially Fuerte, Pinkerton and Edranol.

Internal greying of the fruit flesh (grey pulp) has been (and continues to be) a problem for later season green-skinned cultivars – Fuerte in particular. The close correlation between increasing incidence of grey pulp and the time of year is a strong indication that this symptom is primarily related to fruit maturity – more physiologically mature fruits being much more likely to display grey pulp. This trend has been experienced every year since SAAGA first began collecting such data.

The United Kingdom fruit trade has over the past decade developed the "pre-ripened avocado" market – a successful marketing strategy which is now starting to be developed in parts of continental Europe (e.g. France). Naturally, the development of this strategy has led to the implementation of very strict quality controls – which have included considerable sampling of ripened avocados. In consequence, the South African avocado industry has been provided with detailed feedback from the UK trade regarding the ripe quality of South African avocados and specifically feedback as to the type of "defects" which cause technical and / or marketing difficulties. In addition to the quality defects mentioned above, as well as comments related to the overall general "cosmetic" appearance of South African avocados, the UK trade has noted what it refers to as "mixed maturities", as being a problem with South African Hass (more so than is the case, for example, for Peruvian or Chilean Hass). What this term refers to, is the observation that there is considerable variation within individual South African avocado cartons as to the ripeness of fruits. Since the pre-ripening programmes aim to provide the end-customer with fruits of uniform ripeness levels, the UK pre-packers' technical staff are obliged to sort fruits manually according to firmness as part of the pre-ripening process, which is both time-consuming and costly. This is a problem which is unlikely to be fully resolved until the South African avocado industry is able to accurately sort harvested fruits according to their maturity levels. During the 2009 season in particular, the situation was exacerbated by the fact that many fruits were found to have an excessively long ripening time. For Hass it was found that many fruits ripened but that their peels did not change to the normal purple-black colour when ripe. It is probable that this phenomenon is partially interrelated with fruit maturity, also that some of the information related to ripening times obtained from the UK trade might be skewed by the fact that staff may have identified Hass fruits as being unripe whereas some of these fruits were in fact ripe but not properly coloured.

A problem which has caused, and which continues to cause difficulties in markets which sell hard (and thus green) Hass, is that of lenticel damage. To a certain extent, this problem has been overcome in the United Kingdom, where the majority of Hass avocados are sold pre-ripened (lentidamage being masked by the darkening of the Hass peel as the fruit ripens – except when Hass do not colour up properly, as was often the case during 2009). However, in much of continental Europe (e.g. France and Germany), Hass avocados are sold while still green and lenticel damage makes such fruits unsightly and unappealing to the customer. European traders claim that lentidamage is more common on South African Hass than is the case for Peruvian, Chilean, Mexican, Israeli or Spanish Hass.

In addition to the more traditional quality defects noted above, the 2009 South African avocado export season was characterised by a high incidence of what are normally less common reasons for customer complaints – namely cercospora infection, sooty mould infection and pepperspot infection (Hass) as well as a higher incidence of fruits with other cosmetic defects (e.g. wind damage, scratches). These defects are a reflection of the unfavourable growing conditions experienced in many production areas, but they contributed to the general impression that the South African avocado crop was of substandard quality during 2009.

There is clearly much work to be done if the South African avocado industry is to regain its reputation of being a reliable supplier of superior quality avocados to the European market. The market has become more competitive, and buyers have become increasingly demanding as they now have a choice of suppliers and are no longer reliant on a single source for their avocados.

This article summarises the quality of South African avocados delivered to and inspected in Europe during the 2009 export season.

OTO SAMPLING PROCEDURES

The fruit quality data on which this report is based were collected by the author between March and October 2009. Quantitative "arrival" and "ripe" quality reports were provided to the industry on a weekly basis. Arrival quality was gauged by inspections of pallets on the day of delivery to the importers' warehouses; ripe quality data were obtained from ripened fruits originating from sample cartons collected during arrival inspections. Arrival inspections were carried out at importers' warehouses in Rungis (France) and in Rotterdam (the Netherlands). The driving distances between the various UK centres receiving large volumes of South African avocados makes it impractical to inspect or sample representative volumes of avocados delivered to that country. Regardless, there were regular interactions with UK receiving agents and the author makes a point of meeting with them a couple of times a year. The nature of the avocado trade in the United Kingdom – being largely centred on the "pre-ripened" market – means that the type of customer feedback differs considerably from that received from continental European customers. Details on sampling and data collection procedures are provided in Nelson *et al.*, 2001. Only Hass and Fuerte are discussed in this report – volumes for other cultivars were too low to allow for meaningful data collection.

RESULTS AND DISCUSSION

Fuerte black cold injury

There were isolated cases of black cold injury on Fuerte during the 2009 export season (**Figure 1**), but these were largely confined to fruits originating from specific growers. As is commonly the case, larger-sized fruits (e.g. counts 10, 12) were more commonly affected by

black cold lesions than were smaller-sized fruits. Early season fruits tend to be more prone to black cold injury (because of the lower oil content) and until a few years ago it was common to note a rapid decline in the incidence of black cold injury as the season progressed (and thus as fruits became more physiologically mature). The fact that this trend has not been seen for several years now is most encouraging, and suggests that the industry is taking care not to transport early season fruit at unacceptably low temperatures, and / or that cultural practices which pre-dispose fruit to this disorder have been adjusted. The percentage incidence of black cold injury was also considerably higher (e.g. around 4% during 1999, compared with a seasonal industry average of 0.05% for 2009 - **Figure 1**).

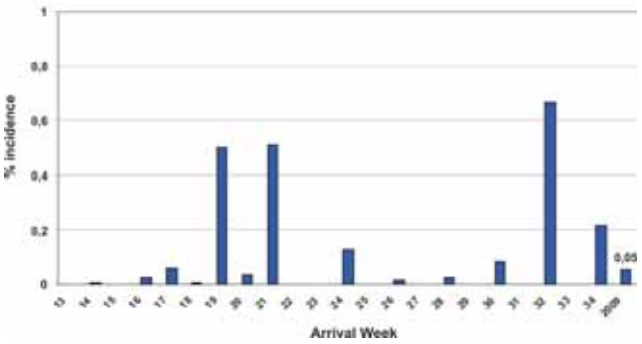

Figure 1. Fuerte – industry black cold injury 2009.

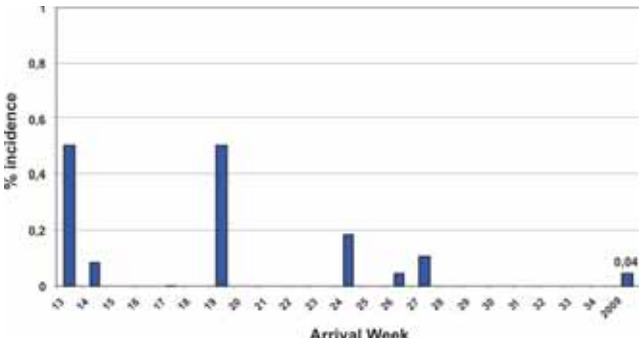

Figure 2. Fuerte – industry breaking fruits 2009.

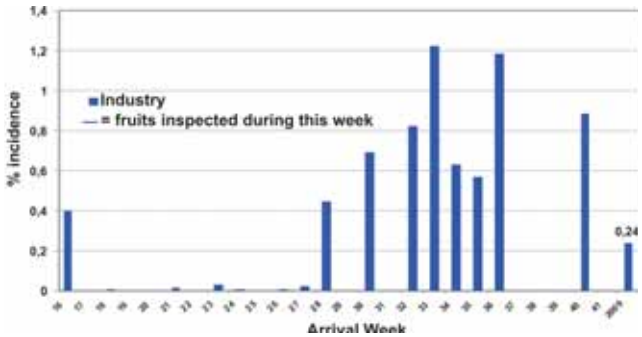

Figure 3. Hass – industry arrival % breaking fruits 2009.

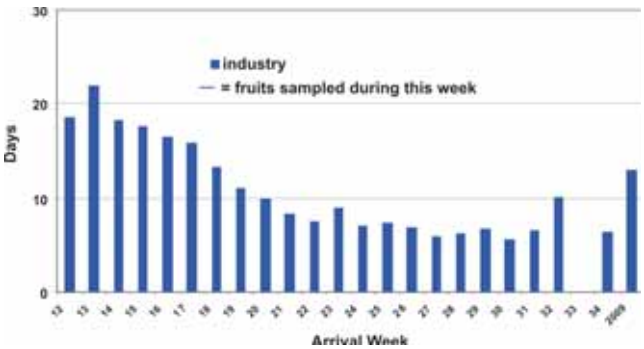

Figure 4. Fuerte – industry ripening time 2009.

Breaking fruits upon arrival

There were occasional cases of breaking fruits upon delivery during the 2009 export season, but the industry averages were very low: 0.04% for Fuerte and 0.24% for Hass (**Figure 2** and **3**). Up until the late 1990's it was not uncommon for 10% or more of the total South African export avocado crop to arrive in Europe in a ripe to over ripe condition (Eksteen *et al.*, 1998; Leclercq, 1989). Such a high percentage of soft deliveries caused severe marketing difficulties, but it must be emphasised that today even small volumes of soft fruits can negatively impact upon the market. The higher incidence of softer fruits for later season Hass during the 2009 season is probably partially related to the fact that the largest South African Hass volumes were delivered during the warmest months (July and August) of the European summer, when even a short break in the cold chain would be sufficient to trigger rapid ripening of the fruits.

Fruit ripening times

Early season Fuerte were found to take an unusually long time to ripen at room temperature – three weeks or longer. It was also observed that when such sample fruits finally did ripen, the fruit flesh was very watery and bland. Since the OTO first started sampling avocados for SAAGA in 1997, it was observed in the past that (as is to be expected as fruits become more mature) early season avocados can take two weeks or longer to ripen, whereas later season fruits often ripen very quickly (with in a day or two at room temperature). The OTO has, however, never previously seen such a high percentage of fruits which take more than three weeks to ripen. These observations would indicate that fruits had been harvested well before they ought to have been. The same trend was (to a slightly lesser extent) observed for Hass fruits during 2009. Please refer to **Figure 4** and **5** and note that the figures plotted on these graphs are averages, meaning that some fruits took four weeks or longer to ripen during the early part of the season. It must be emphasised that immature fruits damage the reputation of South African avocados on the overseas markets. The SAAGA recommendations regarding the determination of fruit maturity should be rigorously adhered to.

Hass ripe colour

It was observed that during the early part of the 2009 season there was a higher incidence of Hass fruits whose peels did not colour up properly when these fruits ripened (**Figure 6**), possibly also partially related to fruit maturity. In contrast, later season Hass generally coloured up well. It is quite likely that this phenomenon is at least in part related to orchard nutri-

tion and / or management, since specific growers' Hass fruits were found to be prone to colouring up poorly, whereas fruit originating from neighbouring farms did not display such quality defects. Such scenarios mean that one can probably rule out local climatic conditions as being the primary cause of poor fruit colouration.

At the annual SAAGA post-harvest workshop held in Nelspruit in November 2009, it was postulated that lengthy ripening times and the ripe colour of Hass could be inter-related and both be the result of unfavourable climatic conditions during the 2008/09 summer. From December 2008 through late January 2009 most production areas experienced very wet and overcast conditions. In addition to favouring the development of fungal infections (discussed in further detail hereafter), these climatic conditions might have meant that there was insufficient sunlight available to provide the energy necessary for the fruits to be able to build up the carbohydrate reserves to fuel the (energy demanding) ripening process. In consequence, the fruits took a long time to ripen, even though the microwave method of determining moisture (and hence maturity) levels might have indicated that the fruits were physiologically ready for harvest. Similarly, the lack of carbohydrate reserves could have impacted on the fruits' ability to colour up correctly. Whilst this theory certainly has merit, there must also be other factors to explain why some growers' fruits were more prone to these defects than were others.

Fuerte grey pulp

There was a marked and exponential increase in the incidence and severity of greying of the fruit pulp in Fuerte fruits received in Europe from Week 26 onwards (**Figure 7**). This trend is observed every season and is mainly related to fruits having been harvested at too high maturity levels. Fortunately, by late June the volume of South African Fuerte being received in Europe has usually decreased significantly and as a result such substandard quality fruits are usually able to be sold rapidly and for acceptable prices. In consequence, the marketing of such fruits has only a limited impact on overall sales prices. Regardless, the reputation of South African avocados is adversely affected by selling physiologically over-mature fruits susceptible to developing grey pulp. On the positive side, it should be noted that in recent seasons (e.g. 2007) more than 25% of all the Fuerte fruits ripened by myself during the export season were found to display grey pulp. In comparison, a seasonal average of 6.23% of Fuerte fruits displaying grey pulp during 2009 is an encouraging result. Until one realises that this does translate into thousands of tonnes of poor quality Fuerte over the 2009 export season!

Pathological infections

Figure 8, **9** and **10** respectively show data of incidence of stem-end rot, sooty mould and cercospora on ripened Fuerte samples during the 2009 export season. The incidence of stem-end rot was high for the early part of the season and is partially explained by the fact that these fruits mainly originated from the Levubu and Tzaneen production areas. These regions experienced inclement weather during December 2008 and January 2009 – which heightened the risk of orchard infections. This pattern is less clear for sooty mould – infection rates seemed to be higher mid-season. For cercospora, infection levels remained significant throughout the season. All three of these quality defects were important reasons for low percentage packouts in many

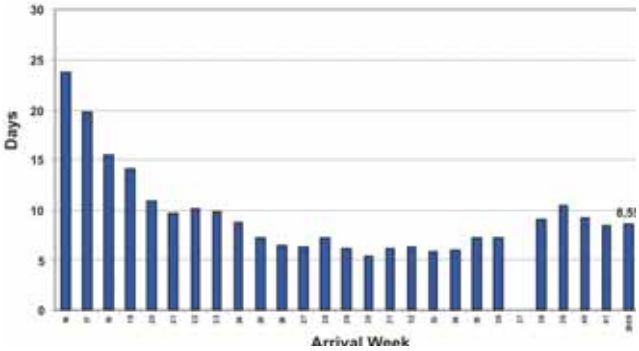

Figure 5. Hass – ripening time 2009.

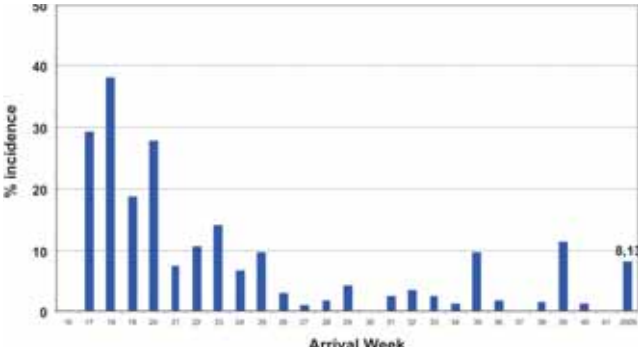

Figure 6. Hass – poor ripe colour 2009.

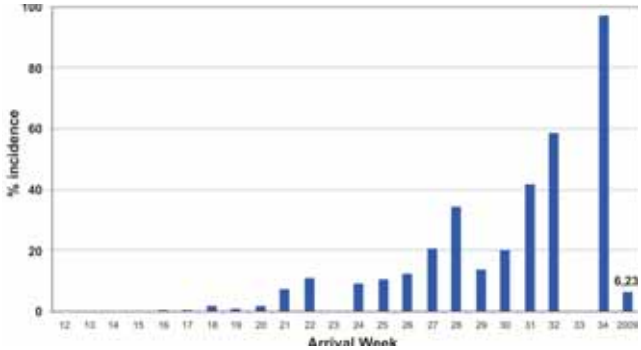

Figure 7. Fuerte ripe – industry grey pulp 2009.

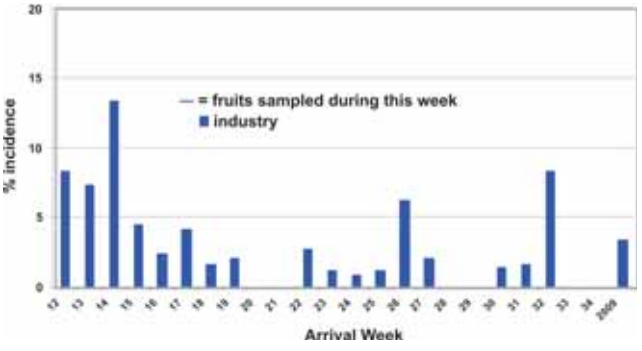

Figure 8. Fuerte ripe – industry stem-end rot 2009.

production regions, and the symptoms seen on fruit exported to Europe are a reflection of the high level of infection present in many orchards during the 2009 export season. **Figure 11** and **12** respectively indicate stem-end rot infection and pepperspot infection in Hass. Stem-end rot incidence in Hass was higher in the early (high relative humidity levels?) part of season. In contrast, pepper spot infection seemed to be confined to later season fruits from specific growers, an indication that proper orchard management is crucial to minimise infection levels (and hence the percentage of marketable fruits).

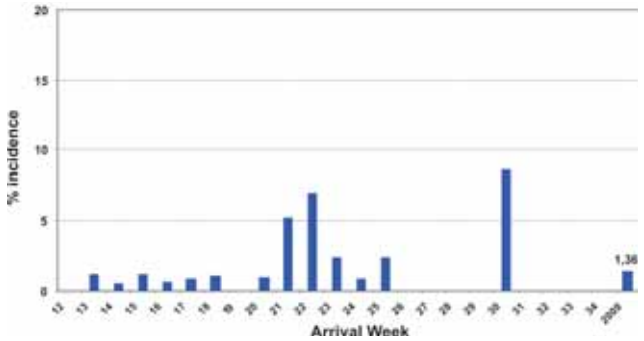

Figure 9. Fuerte ripe – industry sooty mould 2009.

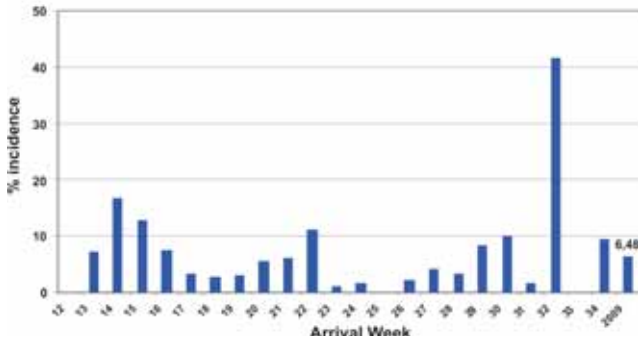

Figure 10. Fuerte ripe – industry cercospora 2009.

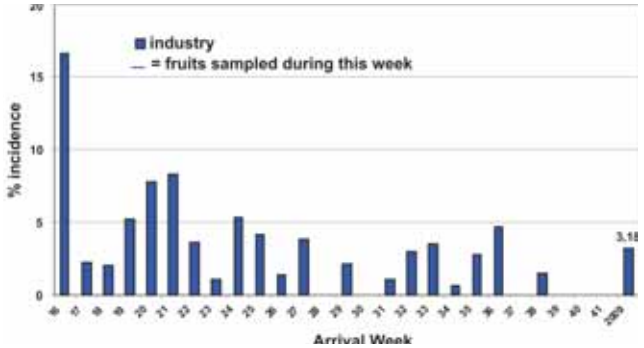

Figure 11. Hass – stem-end rot 2009.

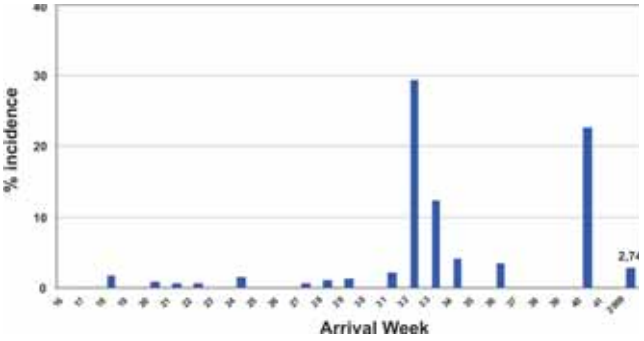

Figure 12. Hass – industry arrival pepperspot 2009.

Hass lentidamage

This quality defect remains a problem regarding South African Hass (**Figure 13**). Spanish Hass can be affected by lentidamage, but volumes are low from Spain at the time of year that the largest South African Hass volumes are available for sale in Europe. The lentidamage incidence is generally considerably lower for Hass originating from Peru and Chile – possibly a climatic effect. During 2009 the industry average for Hass lentidamage was 4.63% – which remains within acceptable levels, even if specific consignments sometimes had a much higher incidence of lentidamage. As for most quality defects, the incidence and severity of lentidamage varied depending on grower origin. Particular care should be taken when picking and packing Hass immediately after periods of inclement weather.

SUMMARY AND RECOMMENDATIONS

The South African avocado industry has, over the past couple of decades, made considerable progress in improving the quality of avocados marketed in Europe. Specifically, the most important advances have been in reducing the percentage of soft deliveries to negligible levels and limiting the percentage of fruits affected by black cold injury to isolated cases. Despite this progress, other quality defects continue to cause sales difficulties in a market which has become increasingly competitive, and which can now choose from a number of different avocado producing countries during the European summer, when the majority of South African avocados are available for sale.

Most prominent amongst these quality defects is the high incidence of grey pulp which continues to be observed in later season Fuerte. Despite the financial incentives for hanging Fuerte for the late season (September / October) European market, when green-skinned cultivars are generally in short-supply, growers should be aware that the reputation of South African avocados is being adversely affected by the continued supply of later-season, over-mature South African Fuerte to Europe.

A second quality defect which continues to cause marketing difficulties, is that of lentidamage on Hass. It is acknowledged that it is more challenging to limit the

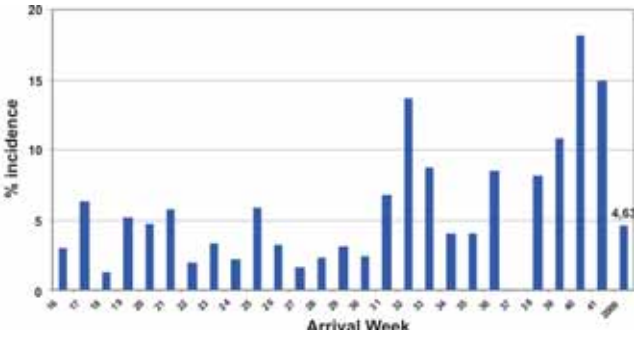

Figure 13. Hass – industry arrival lentidamage 2009.

incidence of lentidamage when climatic conditions are or have been unfavourable (inclement weather). Extra care should be taken when harvesting and packing Hass fruits under such conditions, since lentidamaged South African Hass compares unfavourably with Peruvian and Chilean Hass (generally lentidamage-free).

During 2009, a high percentage of South African avocados were noted to display packing and picking injuries, these quality defects are also most probably mainly associated with fruits having been more susceptible to such physical injuries as a result of unfavourable weather conditions. The incidence of fungal infections was also unusually high during 2009 – growers having noted that traditional methods of controlling such infections (spray-programmes) were either ineffective or difficult to apply during such conditions. It should, however, be noted that some growers were more successful at controlling orchard infections than were others, despite adverse weather conditions.

Two quality defects that acquired particular importance during the 2009 export season, were those of lengthy ripening times for both Hass and Fuerte, as well as poor ripe colour of Hass fruit peels. The issue of Hass colour is no doubt related to several factors including orchard management and orchard nutrition, since the incidence of this defect varied depending on the farm of origin. Regardless, fruit physiological maturity at time of harvest may well have contributed to this phenomenon. Fruit maturity is certainly largely responsible for the lengthy time that fruits took to ripen following delivery to Europe – the bland taste and white colour of Fuerte fruit pulp during the early part of the season confirms that such fruits were harvested too early. The SAAGA recommendations regarding testing of fruit maturities in order to determine harvest times, need to be rigorously adhered to. The South African industry cannot afford to start off the export season by supplying poor quality fruits which will ripen poorly. Greenskinned cultivars are now available from other supplier countries during April and May (e.g. Fuerte and Ettinger from Peru, Fuerte from Kenya), and European clients are thus not obliged to accept substandard South African fruits.

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