

THE PRINCIPLES OF TEMPERATURE MANAGEMENT — COMMERCIAL RESULTS

L L Vorster, J J Bezuidenhout and J C Toerien

Westfalia Estate, P O Box 14, Duivelskloof 0835, South Africa

INTRODUCTION

The biggest challenge for the South African avocado industry is still to put quality fruit on the overseas markets. The avocado industries are largely dependent on the European markets and rely on sea export for a large part of its sales. Long distances must be covered during this process.

An avocado is a fruit with a limited shelf life. Low temperatures are the major commercial method used to prolong the shelf life of South African export avocados.

Soft and/or cold damaged fruit were some of the most important problems experienced in the past by the South African avocado industry on the overseas markets.

A lot of work has been done over the past number of years to find a solution for the problem.

In contrast with previous seasons, the application of a temperature management system during 1989 and 1990 picking seasons resulted in improved quality in fruit firmness and reduction of external cold damage.

COMMERCIAL ACCEPTABLE NORMS FOR FIRMNESS AND COLD DAMAGE

Fruit arriving on the European markets with a firmness of lower than 35 units measured with a firmometer (Swarts, 1981), and cold damage of less than 1%, is commercially acceptable.

By complying with the recommended temperature regimes, fruit arriving in Europe can have a firmness of lower than 35 units and cold damage of less than 1% if the storage period does not exceed 28 days.

COMMERCIAL RESULTS

Temperature regimes were applied during the 1989 and 1990 seasons. Figure 1 shows the extent of cold damage on Westfalia fruit during the 1988, '89 and '90 seasons. During 1988 two boats carrying Fuerte exceeded 2,5% (vessels 8 and 12); a further three boats 2,0% (vessels 9, 11 and 15) and yet another 1,5% (vessels 5) — a total of six-boats where Fuerte exceeded the commercially accepted standards.

During 1989 external cold damage was not a commercial factor. During 1990 only vessel 7 (0,34%) and vessel 15 (0,4%) showed signs of cold damage.

Figure 2 shows the firmness of Westfalia fruit during the 1988, '89 and '90 seasons.

During 1988 fruit on boats 5, 8 and 9 exceeded the commercial standards of 35 on the firmometer, whereas the firmness of fruit monitored during the 1989 season were all below the accepted standards.

During the 1990 season Westfalia only once exceeded the standards — on the first vessel (vessel 3).

This information was obtained from the representative of the South African Avocado Growers' Association in France.

DISCUSSION

From the results it is clear that the principle of temperature management is to the advantage of the South African avocado industry. Temperature management is the integration of various principles which include the following:

A specific temperature regime dependent on the maturity and sensitivity of the fruit at a specific stage.

- * Technical feedback from the overseas markets.
- * Time/temperature interaction.

The physical principles and mechanism of cooling and cold storage (Vorster, Toerien and Bezuidenhout, 1990).

- * Moisture loss (Vorster, *et al.*, 1990).
- * Selective picking (Vorster, Toerien & Bezuidenhout, 1989).

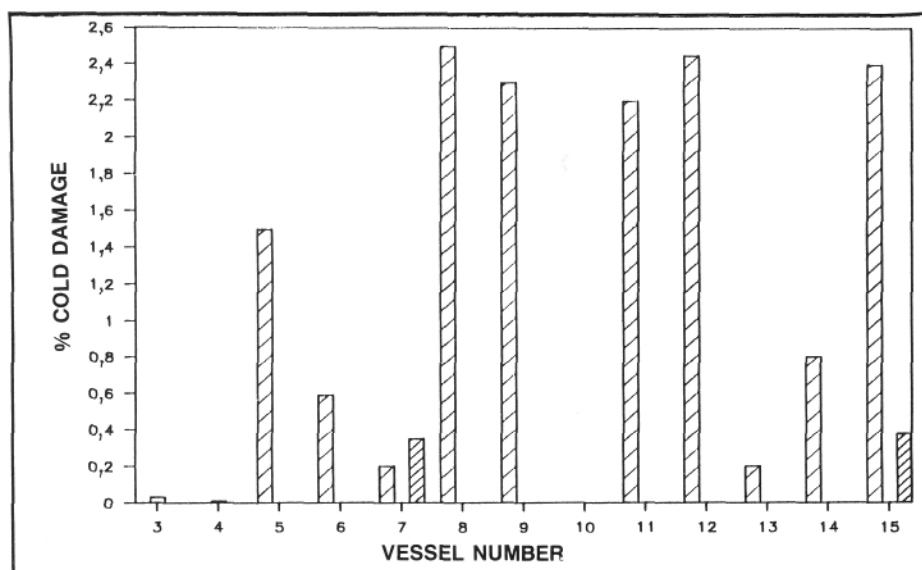


Fig 1 The incidence of cold damage in Westfalia fruit for the different vessels in 1988 (diagonal lines), 1989 (white), 1990 (cross-hatch).

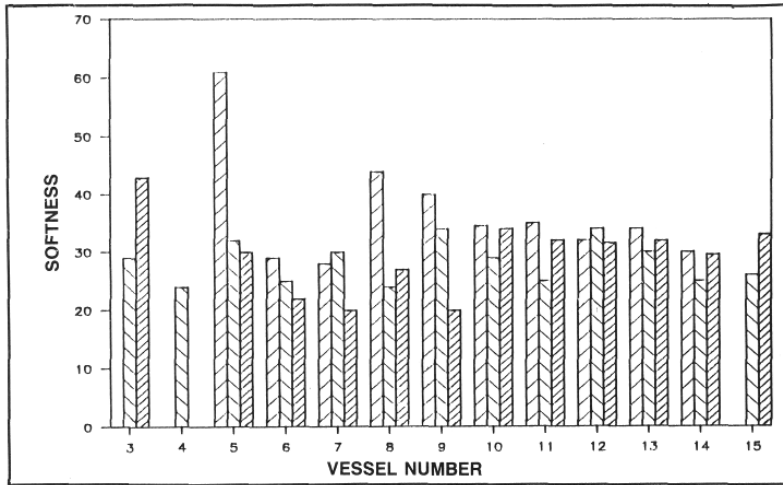





Fig 2 The softness of Westfalia fruit on arrival at Rungis for the different vessels in 1988 , 1989 , and 1990 .

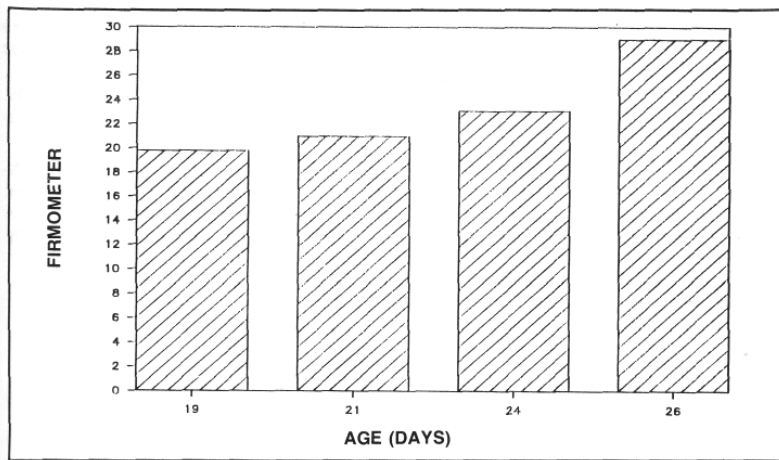


Fig 3 The influence of fruit age on the degree of softness on arrival at Rungis.

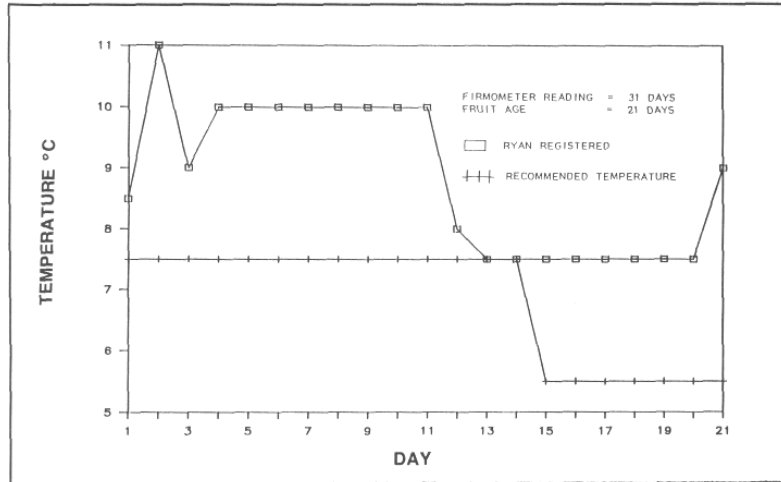


Fig 4 Effects of temperature deviation with regard to fruit firmness on young fruit at Westfalia for 1990.

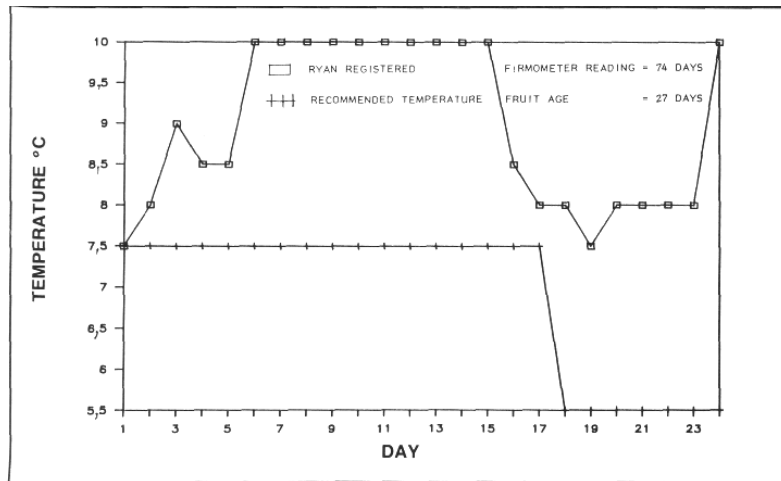


Fig 5 Effects of temperature deviation with regard to fruit firmness on old fruit at Westfalia for 1990.

Storage temperatures

Storage temperatures which are too high will result in soft fruit on arrival overseas, while temperatures which are too low will result in fruit with external cold damage. A fine balance between firm fruit and external cold damage exists.

Considerable differences in sensitivity to low temperatures have been observed during different stages throughout the avocado season (Vorster, Toerien & Bezuidenhout, 1987).

Fuerte avocados show a definite decrease in external cold damage towards the end of the picking season when stored at 5,5°C for 28 days. Due to this, adaptation of the temperatures throughout the season is necessary. A climacteric formula, formulated by Bezuidenhout (1983), forms the basis for decision making on temperatures for a

particular stage throughout the season. The time to the climacteric is a function of temperature and fruit maturity. Oil content was used as an index of fruit maturity. A moderate temperature during the early stages of storage and a lower temperature during the early stages of storage ensures that the climacteric can be reached after approximately 24 days (average time taken for Westfalia Estate avocados to arrive overseas). This was found to result in a firm fruit with no or little cold damage.

Feedback from overseas markets

Temperature management involves the implementation of a flexible system. Fruit can change from season to season. Adaptations should therefore be made whenever necessary. Well-defined and detailed feedback of firmness and cold damage is essential. Although information obtained from Ryan recorders may occasionally be defective, this information is still of vital importance.

Should fruit arrive overseas soft or with cold damage, a record of the time/temperature regime is essential in order to reach a sensible conclusion.

Time/temperature interaction

The time/temperature relationship cannot be over-emphasised in the effort to improve fruit quality on overseas markets. When packing and transport procedures are reduced so that the total export period is limited from 26 to 19 days, fewer temperature related quality problems were experienced. This also resulted in firmer fruit (Figure 3). When deviations from the recommended temperature occur young fruit are less prone to softness than older fruit (Figures 4 and 5).

The avocado industry must accept that there is a time constraint and should therefore minimise the period of post-harvest handling.

SUMMARY

Better quality has been achieved through the implementation of temperature management by the South African avocado industry. The temperature regime is but one of the important factors contributing towards temperature management. Discipline in every instance concerning the handling of fruit as well as maintenance of the cold chain, determines to a large extent the quality of fruit on the European market.

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