

## TEMPERATURE CONTROL OF AVOCADOS FOR SEA EXPORT

J C TOERIEN

WESTFALIA ESTATE, DUIVELSKLOOF

### SUMMARY

*The condition of sea freighted avocados varies considerably on arrival overseas. Fruit with cold damage as well as soft fruit can be found in the same consignment. This points to a ventilation problem and also an incorrect temperature regime. An experiment confirmed that fruit is temperature sensitive in the climacteric phase and can be stored at relatively low temperatures in the post climacteric phase. A new carton design shows promise in achieving better ventilation.*

### OPSOMMING

*Avokado's wat per see uitgevoer word, arriveer in variërende kondisie op oorsese markte. Koueskade en sagte vrugte kom dikwels in dieselfde besending voor. Dit dui op 'n ventilasieprobleem sowel as 'n verkeerde temperatuurregime. In 'n proef is bevestig dat vrugte temperatuursensitief is in die klimakteriese fase en veilig teen relatiewe lae temperature in die na-klimakteriese fase opgeberg kan word, 'n Nuwe kartonontwerp toon potensiaal vir beter ventilasie.*

### INTRODUCTION

The present avocado cooling chain from the packhouse to the market has improved considerably over the past 10 years and can be regarded as excellent. Road transport delivers fruit to Cape Town in 36 hours instead of 3 to 5 days, with excellent temperature control. Furthermore, final inspection which now takes place at the packhouse has streamlined the Cape Town containerisation process and delays are minimized. Containerisation has also speeded the loading process and the temperature control of the holding store and recession and high cost of fuel are responsible for the fact that the voyage takes 16 days instead of the designed 12 days.

Soft fruit on arrival is still a major problem, indicating too high transport temperatures. At the same time cold damage was present throughout the season including the last shipment with what could be regarded as very mature fruit.

This brings us to the question: Should the temperature be increased or decreased? Both have their advantages as well as disadvantages.

For the purpose of analysis, the following precepts were accepted:

1. Fruit reaction to cold storage is predetermined by orchard conditions.

2. Early season fruit is more sensitive to low temperatures than late season fruit (higher oil content and/or orchard temperatures).
3. Ready-to-eat avocados can be stored at 2°C.
4. With reference to an analysis by Bezuidenhout (1983) of correlations between temperature and mesocarp discolouration, the following:
  - a) The more cold damage fruits show, the more pulpspot and grey pulp can be expected.
  - b) Seafreight avocados reach the climacteric phase during the sea journey.
  - c) The correlation between pulpspot and temperature is probably contributed to low temperatures during the climacteric phase.
  - d) Grey pulp can be correlated with high temperatures in the post climacteric phase.
  - e) Internal anthracnose correlates with high temperatures in the post climacteric phase.

## TEMPERATURE TRIAL PROCEDURE

A total of 560 Fuerte avocados of count 14 were selected from homogeneous healthy trees and were selectively picked from the eastern aspect of trees. The fruits were packed and grouped into 8 randomly selected groups of 70 fruits and placed under different temperature regimes for 28 days in order to determine the correlation between temperature and the climacteric phase, which was assumed to be completed after 13 days, according to Bezuidenhout (1983).

## RESULTS AND DISCUSSION

**TABLE 1**

Treatment	Temperature (°C)			Week 4	Cold damage index scale 0-10
	Week 1	Week 2	Week 3		
1	5,5	3,5	3,5	3,5	1,0
2	5,5	5,5	5,5	3,5	0,4
3	5,5	5,5	5,5	3,5	0,2
4	5,5	5,5	5,5	5,5	0,2
5	3,5	5,5	5,5	5,5	1,1
6	3,5	3,5	5,5	5,5	1,2
7	3,5	3,5	3,5	5,5	1,2
8	3,5	3,5	3,5	3,5	1,1

Picking date 4 July 1985  
Moisture content 68,6 (21,2% oil)

### The cold damage of avocado fruit stored under various temperature regimes

The results confirm that avocados are more sensitive to low temperatures in the climacteric and preclimacteric phase.

Low temperatures in the post climacteric phase cause a minimum of cold damage.

A full season's work will be required in order to work out a detailed temperature recommendation, but the following could be considered as a guideline:

Early season fruit should be shipped at a higher temperature than the late season fruit.

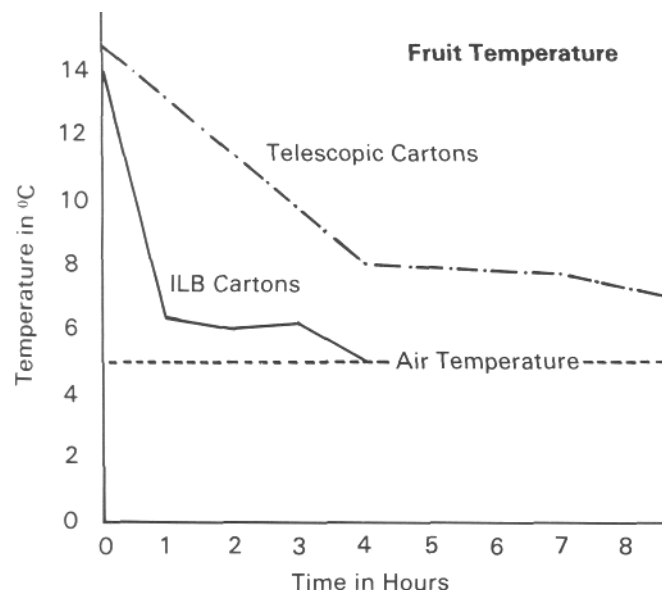
The early phase of the cold chain should be at a higher temperature and the last part at a lower temperature. As an example, the following model could be a basis for discussion:

In the table below 5,5°C is accepted as the carrying temperature (X):

Week	Air Temperature
1	$\times + 1,5 = 7^{\circ}\text{C}$
2	$\times + 0 = 5,5^{\circ}\text{C}$
3	$\times - 1,5 = 4,0^{\circ}\text{C}$
4	$\times - 2,5 = 3,0^{\circ}\text{C}$

It can be expected that fruit temperature will be 1 to 2°C higher than air temperature.

Most packhouses have an adequate cooling capacity and road transport has the capacity to lower the temperature. The holding store and container vessels have the same capacity. While it is argued by authorities that the capacity is designed for temperature-holding only, Ryan charts indicate that the systems do have the capacity to lower the temperature in transit.



**Fig. 1. A fruit temperature survey with two types of cartons.**

With a non ISO pallet it is possible to fully utilize the capacity of the container, which is therefore more economical and better for ventilation. A more homogeneous temperature regime can be expected with the new ILB box. The open sided box design of the ILB carton shows promise. Pallet stability is better than the telescopic box.

A temperature survey in the U.K. by Mr J van Wyk showed the following fruit arrival temperatures:

Telescopic boxes 6,5 to 11°C

ILB boxes 6,5°C

## **CONCLUSIONS**

The cooling experiment confirmed Bezuidenhout's (1983) findings that avocados are more sensitive to cold damage in the preclimacteric phase. The post climacteric phase is shown to be much less sensitive to low temperatures.

This finding should be kept in mind when planning the cold chain and in the drawing up of regulations.

It is proposed that avocados should be kept at a higher temperature (7 to 8°C) at the packhouse and that road transport to Table Bay could run at the same temperature. The holding store in Table Bay could be set at a slightly lower temperature (6 to 7°C). The temperature of the ships should be further decreased to 3,5°C for the last ten days of the journey. Avocados may be kept at relatively low temperatures after arrival overseas.

Fruit maturity should, however, be taken into account when absolute temperatures are determined.

## **REFERENCES**

BEZUIDENHOUT, J.J., 1983. Die voorkoms van mesokarpverkleurings by Fuerte avokado's op die Rungismark gedurende 1982. S. Afr. Avocado Grws. Assc. Yrbk. 6, 24 - 27.