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AVOCADOS AND TEMPERATURE CONTROL

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Temperature is the most important factor in maintaining post-harvest quality of avocados. Other treatments such as irradiation, modified atmospheres, hypobaric storage, may affect quality, but none eliminates the need for a good refrigeration practice.

However, before attempting to define where temperature should be measured in refrigerated cargoes, the true nature of the problem and what it is hoped to achieve with such measurements, should be ascertained.

The optimum carrying temperature prescribed for avocados is 5,5°C ± 0,5°C with a minimum air delivery of 4,5°C. In the temperature control system for containers, the air entering the container is the medium that is controlled. To have control on the return air would undoubtedly cause freezing damage.

It is often advocated that a continuous air delivery temperature should be maintained for chill cargoes, but it would be extremely difficult to maintain temperature at a precise level without variation on either side.

Extensive analysis of data logger recordings for avocados has shown that the air delivery for the 1981 season varied between 4,6 and 5,1°C with an average of 4,8°C. THIS IS THE ONLY CONTROL THE SHIP CAN EXERCISE. It has no control over product quality, packaging, precooling, and loading and unloading practices. Yet these factors are basic contributors to good or poor outturn.

In the area oí product quality, nothing but the finest grade of product ought to be considered for shipment. The computor slogan of 'garbage in — garbage out' applies equally to overseas shipment of highly perishable products. This point must be emphasized, for no matter how carefully the cargo is handled throughout its transit, if it is poor quality to begin with, it can only be poor quality at the end of the journey. In the area of packaging thought must be given to packages that facilitate temperature management through proper air distribution as well as protecting the product from injury by bruising or compression under severe stacking. The air distribution in a 20' container is considered good but on this very important aspect there are more theories than there are firm data. Palletized loads complicate matters further. Extensive studies done on palletized avocado loads in containers in the City of Durban showed that average fruit temperatures varied between 5,8°C at the bottom of pallets and 8,1°C at the top. The other significant factor is the very gradual temperature reduction in pulp temperature during the voyage which means a high loading temperature will not be reduced substantially during the voyage. It would appear that sufficient air does not reach into and move through the pallet stack. The tolerance gaps between the 10 pallets in a

container amounts to 9,6% of the total floor area. The avocado trays are perforated and assuming the cartons are completely register stacked on a pallet and no ventilation holes are blocked by fruit, the total free area for 10 pallets for air to move through is 6,5% of the total floor area. Air always chooses the path of least resistance and it is evident that the tolerance gaps between pallets receive the greater share of air.

If it is assumed that there is equal resistance to flow, then the air moves through the pallets in the proportion 6,5, 9,6 or 726 m^3/hr through fruit cartons and 1 074 m^3/hr past the fruit stack.

The average air return temperature in a container recorded for the 1981 avocado season is 6,2°C which means the circulating air of 1 800m_3 hr did work to the extent of 780 kCal/hr (1 800 x 1,4x 1,29x 0,24). Balance this against the heat leakage into the container = 384 kCal/hr (32 x 12°C) and one sees that 396 kCal/hr was available to cope with the respiration load of 340 kCal/hr.

Exporters must be convinced that the container is not designed as a precooling chamber but rather a travelling cold store. The avocados should therefore be cooled down to carrying temperature before they are loaded into a container. The success of the heat absorption of the circulating air depends on effective penetration of the air into the stack and any restriction will produce unpredictable temperature gradients. Problems could undoubtedly arise with avocados loaded at temperatures above the optimum storage temperature when respiratory activity is high. Warm avocados at the centre of the pallet could rise in temperature to unacceptable levels.

The problem would therefore seem to be one of acceptance temperatures. There are no mandatory temperatures laid down.

TABLE 1: Shipping temperature pattern of avocados for 1981 season

SHIP	Percentages						
	4/5 Deg C	5/6	6/7	7/8	8/9	9/10	Greater 10° C
Waterberg 25/2	—	29	57	—	14	—	—
Winterberg 3/3	—	27	54	18	—	—	—
Sederberg 10/3	—	16	63	19	3	—	—
Ortelius 16/3	26	42	18	3	11	—	—
Helderberg 23/3	8	58	15	11	4	4	—
Transvaal 31/3	10	36	42	7	5	—	—
City of Dbn 7/4	—	44	40	12	2	—	2
Waterberg 14/4	3	32	31	36	1	—	—
Winterberg 20/4	2	19	31	25	14	7	2
Sederberg 27/4	4	31	46	6	2	4	7
Ortelius 5/5	—	28	41	19	12	—	—
Helderberg 13/5	—	59	31	10	—	—	—
Transvaal 20/5	—	46	24	19	11	—	—
City of Dbn 25/5	—	67	11	11	4	7	—
Waterberg 1/6	4	—	4	34	58	—	—

This Table should be looked at in relation to arrival temperatures at point of shipment and time available for re-cooling. The influence of initial avocado temperatures on the

temperature distribution in the stack in the container is best illustrated by Table 2 compiled from temperature surveys carried out in avocado containers on the City of Durban.

TABLE 2: Temperature distribution in avocado pallets during 1981 trials on City of Durban using 100 point data logger

Average air delivery 4,8°C
Average air return 6,2°C

Stow	Temp difference between pulp and air °C								
	Top			Centre				Bottom	
	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave
Bonded Stow									
Day 1	6,5	2,6	3,8	3,8	2,0	2,5	1,7	1,0	1,3
Day 14	3,7	1,3	2,3	3,3	0,9	1,7	1,2	0,7	1,0
Registered Chimney									
Day 1	2,2	2,1	2,1	2,4	1,8	2,1	1,8	1,6	1,7
Day 14	1,6	1,4	1,5	1,7	1,2	1,4	1,0	1,2	1,1
Registeredd Vertical									
Day 1	2,8	2,1	2,4	2,6	2,6	2,6	1,1	0,8	0,9
Day 14	1,9	1,4	1,6	2,1	2,1	2,1	0,7	0,6	0,6

It is obvious that if avocados are loaded with a difference between pulp and air delivery temperature these differences tend to decrease very slightly during the voyage.

The susceptibility of avocados to chilling injury means that refrigeration cannot be used to full capacity and the fruit is held close to a temperature at which ageing, ripening and decay cause the destruction of the fruit over *a* relatively short period. The production areas of avocados are long distances from major markets and effective temperature management thus becomes specially significant.

In conclusion it is well to remember the influence of preharvest and post-harvest conditions on the quality of the avocados when considering its transportation over long distances which may involve a total transport time of up to 28 days.

The call should be for a functional approach to all activities associated with the handling, packaging, precooling, inspection and refrigerated transport of avocados in order to market the product in an acceptable condition.

REFERENCE

FANTASTICO ER. *Post Harvest Physiology Handling and Utilization of Tropical and Sub-tropical Fruits and Vegetables.* 1975. pp 560.