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PRE-RIPENING OF AVOCADO FRUIT BY POSTHARVEST TREATMENT WITH ETHYLENE

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OPSOMMING

Rypmaking van avokadovrugte is ondersoek na behandeling vir 48 uur in 'n rypmakingskamer. Opbergingstoestande tussen pluk en etileen behandeling blyk belangrik te wees vir suksesvolle rypmaking. Etileenbehandeling onmíddellik na oes het nie die rypmakingsproses van Hass of Fuerte vrugte verhaas nie. Vinnige en eenvormige rypmaking was bereik nadat avokados vir 4 dae voor behandeling opgeberg was.

SUMMARY

Softening of avocado fruits was studied after 48 hours treatment in a ripening chamber. Storage conditions between picking and ethylene treatment proved to be of great importance for successful pre-ripening. Ethylene treatment immediately after harvest did not speed up the ripening of Hass or Fuerte fruit. Fast and uniform softening was achieved if avocados were stored for 4 days prior to treatment.

INTRODUCTION

Ethylene is known to trigger the ripening of fruit (Abeles, 1973). Avocados do not ripen while attached to the tree (Tingwa & Young, 1975) and usually require 7 10 days at ambient temperature to soften and develop to palatable maturity. Californian studies have shown that there is a big potential for controlled ripening of avocado fruit (Eaks, 1980 and Tourney, 1982). When "ready-to-eat" Hass fruit was displayed together with hard (unripened) fruit, ripe fruit sold 25 to one over the hard fruit (Henry, 1984).

MATERIALS AND METHODS

The ripening chamber used for treating avocados with ethylene gas is commercially available in the USA and was imported by Westfalia Estates and SAAGA. This "Quick-Ripe" fruit ripened is basically a fiber glass container (vol. 0,2 m^3) mounted on a sturdy wheel-based caddy which can be moved about as needed. The electrical supply to the heater, ventilator and control panel had to be modified from 115 to 220v using a transformer. A rubber hose connects the regulator of the gas cylinder ("Gas mix 4": 95% N_2 + 5% C_2H_4) and the ripening chamber. A control panel using electronic pressure

sensors and indicator lights to show operating pressure is screwed onto the ripening containers.

In the Quick-Ripe fruit ripened, ethylene concentration and operating temperature can not be altered by the user. The ripening chamber has got simple ventilation holes and works at an ethylene concentration varying from 10 to 1000 ppm by blowing gas into the container at certain intervals (Lombard, 1984). Under operating conditions the unit can hold up to 10 standard cartons simultaneously. The temperature in the fruit ripened was controlled at 25°C ± 5°C) with a relative humidity of close on 100%.

Fuerte and Hass avocados in standard 4 kg cartons were treated in the fruit ripened for 48 hours. Fruits for treatment I and II originated from one specific orchard and picking date but were kept under different storage conditions prior to ethylene treatment:

Experiment 1

I. Fuerte (picked 1 2-7-84, packed 13-7-84, [H_2O] = 66,5%

firmometer-reading[1]): $\underline{x}$ = 21,0)

a) Immediate treatment after packing

b) 2 Days cold storage at 5,5°C before treatment

c) 4 Days cold storage at 5,5°C before treatment

d) 25 Days cold storage at 5,5°C before treatment

II. Hass (picked 5-9-84, packed 6-9-84, [H_2O] = 69,9%;

firmometer-reading[1]): $\underline{x}$ = 19,4)

a) Immediate treatment after packing

b) 2 Days cold storage at 5,5°C before treatment

c) 4 Days cold storage at 5,5°C before treatment

d) 4 Days at ambient temperature (+18^{o}C) before treatment.

The desired stage of pre-ripening was defined as the moment when 90% of the fruits in a treatment reached a firmometer-reading of 72.

Experiment 2

Fuerte fruit (picked 1 2-7-84, packed 1 3-7-84, [H_2O] = 66,5%) was cold stored at 5,5°C for two days after packing and then treated as follows:

A. 48 hours in Quick-Ripe unit (ethylene and ± 25^{o}C)

B 48 hours in modified Quick-Ripe unit (±25^{o}C only, no Ethylene)

C. Control left at ambient temperature (+18^{o}C) after Initial 2 days of cold storage

Two cartons (count 14) were used for each treatment. All fruits were measured at daily

intervals on a firmometer. After removal from the ripening units treatment A and B were held at ambient temperature also.

RESULTS

Experiment 1

Ethylene treatment immediately after picking proved to be ineffective in accelerating ripening (Fig. 1, Ia & IIa). Cold storage of packed fruit for two or four days prior to treatment gave much better results. Fastest and most uniform softening was achieved with avocados left at room temperature for 4 days before placing them into the ripening unit (Fig. 1, IId).

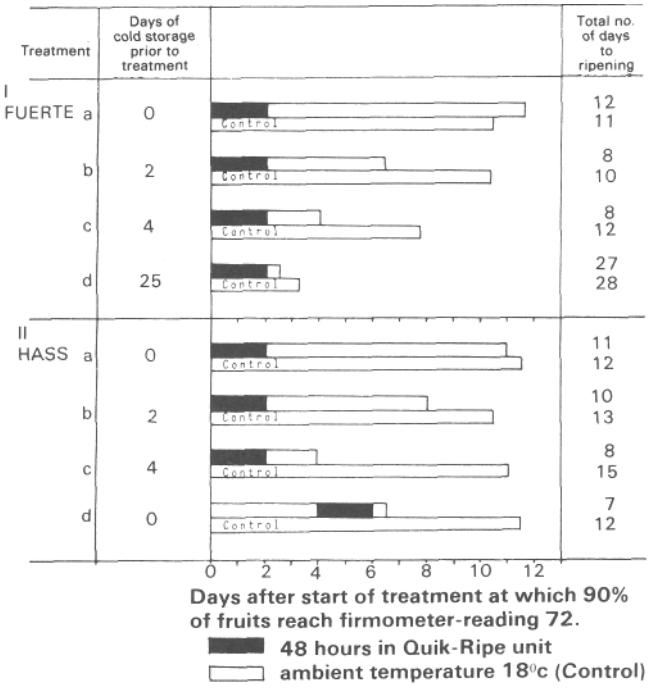

Fig. 1 Pre-ripening of avocado fruit as influenced by time and storage condition prior to ethylene treatment.

Experiment 2

The importance of temperature in ripening of avocados is shown by comparing a standard and a modified Quick-Ripe unit (Table 1). The modified ripening unit had no ethylene cylinder attached and therefore only created warm ($25^{o}C \pm 5^{o}C$) storage conditions for the fruits.

Table 1. Softening of Fuerte fruit under different ripening conditions.

TREATMENTS	A Quik-Ripe Unit ethylene and 25°C	B modified Quik-Ripe Unit 25°C only (no ethylene)	C Control left at ambient temperature (18°C)
	Average Firmometer-reading		
Before start of treatment	21,1	21,7	22,9
After 48 hours in Quik-Ripe Unit	43,4	39,6	--
2 Days after removal from Quik-Ripe Unit	64.0	46,6	25,0
3 Days after ··	68,0	50,8	26,5
4 Days after ··	69,6	54,2	28,1
5 Days after ··	72,0	68,3	33,5

DISCUSSION

In the first experiment Hass and Fuerte fruit did not respond to ethylene treatments given immediately after harvest. Gazit and Blumenfeld (1970) found the same effect and explained this by assuming the existence of an endógeno us factor inhibiting ethylene action. For pre-ripening of avocados it is, therefore, essential to wait for about 4 days after picking before successful ethylene ripening can take pi ace. During that time the ripening inhibitor disappears, or, conversely, a ripening promoter increases before autocatalytic ethylene production can start (McGlasson, Wade & Adato, 1978). Only then can additional ethylene and optimal temperatures assure quick and uniform ripening (Fig 1, Ic & Id).

In the second experiment the temperature regime played an essential role in ripening of avocados and supplemented the effect of ethylene. Table 1 (B) indicates that a simple warm room (+25"C) can also speed up ripening considerably.

CONCLUSIONS

The longer avocados have been cold stored the quicker is the ripening reaction of both, the ethylene treated and the naturally ripened fruit. Advantages in pre-ripening are therefore mainly seen for the local market while fruit for export will ripen very quickly anyway, after a shipping and handling period of 26 - 30 days.

In order to pre-ripen larger quantities of avocados, more ripening facilities are required locally. The "Quick-Ripe" unit evaluated here is unsuitable for this purpose. It is suggested that simple ripening rooms be built where avocados can be held at about 22°C for two days prior to ethylene treatment. Retailers need to receive orders for "ready-to-eat" avocados approximately one week in advance, to be able to supply the market with high quality pre-ripened fruit.

Once ripened, avocados can be kept in an excel lent condition for 2 weeks if stored at 2,0 - 5,5°C at high humidity (Young, 1979). Such avocados should be labelled ("ready-to-eat") prior to ripening and handled by the unbroken cold chain technique (Rousseau, 1981). More information is needed on how to vary the ripening technique throughout the season, with special reference to decreasing moisture content of the fruit and the effect on different cultivars.

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