Proceedings of The World Avocado Congress III, 1995 pp. 344 – 347

PRESTORAGE HEAT TREATMENTS OF AVOCADOS

S. Lurie[1], A. Handros[1], G. Zauberman[1], M. Ackerman[1], R. Shapira[2]

[1] Department of Postharvest Science, ARO, The Volcani Center, Bet Dagan 50250, Israel
[2]Department of Biochemistry, Food Science and Nutrition, The Hebrew University, Faculty of Agriculture, Rehovot 76100, Israel

Abstract

Holding avocado fruits for various periods of time at temperatures between 37 to 46ºC, slowed the rate of fruit softening, decreased the climacteric respiratory peak and delayed the ethylene peak. Some of the time-temperature combinations decreased the severity of chilling injury after storage at 2ºC for 6 weeks. Activity of cellulase was lower in heat treated fruit in correlation with their slower rate of softening. In addition, when heated avocados were inocultaed with *Colletotrichum gloeosporioides* the infection developed more slowly than on unheated fruit. The treatments led in some cases to heat injury, and additional work is needed to be sure of achieving the benefit of the treatment without injury.

1. Introduction

Avocado production areas are often remote from their overseas markets, necessitating a delay between harvesting and marketing. Although storage time and shelf life of avocados can be increased by lowering their temperature, conditions below 7ºC induce chilling injury, and this is a major factor limiting the storage of avocados (Eaks, 1976; Zauberman et al., 1977). The symptoms include peel and pulp discoloration which develop after removal from storage.

We have found that a prestorage heat treatment of preclimacteric tomatoes, another fruit sensitive to low temperature, allowed storage at 2ºC without chilling injury (Lurie and Klein, 1991). In the present study we investigated whether a similar heat treatment could benefit avocados.

2. Materials and Methods

Experiments were conducted on commercially harvested avocado fruits *(Persea americana* Mill.) of both Fuerte and Hass varieties, acquired from the packinghouse on the day of harvest. The fruits were placed in heating chambers at 37, 42 and 46°C for 12 to 48 h and then transferred to 2°C. Control fruit were placed immediately in 2°C storage. After 6 weeks storage fruit were removed to 20°C for ripening and their firmness, respiration, ethylene production and cellulase activity followed during a week.

Firmness was measured on 2 sides of 5 fruits from each treatment using a motor driven penetrometer. These fruit were then taken for cellulose activity measurement according to Zauberman and Jobin-Décor (1994). Five fruits from each treatment were enclosed individually in 2 L jars and closed for 1 h each day for determination of ethylene and CO_2 production. Head space gas was withdrawn through a septum with a syringe and injected in a GC-FID with an

alumina column for ethylene and a GC-TCD with a poropak column for CO_2. At the end of 7 days of shelf life 20 fruits from each treatment were cut open for visual determination of flesh damage.

To determine the effect of heat treatment on *Colletotrichum gloeosporioides* Fuerte avocado fruits were heated and then inoculated into a puncture wound with 40µl of 10^6 spores/ml on two sides and the fruits held at 20°C for fungal development.

3. Results

After 6 weeks of 2°C storage unheated fruits developed 70% flesh damage (Table 1). All the heating regimes except 12 h at 46°C decreased the amount of internal damage considerably. The two best treatments which showed only light damage were 24 h at 37°C and 12 h at 42°C. These two treatments also slowed the rate of fruit softening during the first 4 days at 20°C (Fig. 1a). Cellulase activity in the heated fruit also appeared later in the heated fruits, but showed the same steep rise in activity between the third and fourth day of shelf life as the control fruit (Fig. 1b).

Respiration was lower in heated fruits than in control fruits, but the climacteric occurred in all fruit after 4 days at 20°C (Fig. 2a). In contrast, the peak of ethylene production in the heated fruit was shifted to longer times (Fig. 2b). Peak ethylene production occurred in control fruit on day 3, in 24 h 37°C fruit after 4 days and in 12 h 42°C fruit on day five.

The effect of a heat treatment on *Colletotrichum gloeosporioides* development was studied on unstored fruit (Table 2). When the fruits were inoculated following the heat treatment the rate of fungal growth was reduced 75% compared to growth on control fruits.

4. Conclusions

A prestorage heat treatment of avocados can decrease chilling injury in fruit stored at 2°C, slow the rate of fruit softening and inhibit the development of fungal rots. However, fine tuning of the treatment is necessary to prevent heat damage.

References

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ble 1 - Flesh injury in Hass avocados stored for 6 weeks at 2°C and then ripened at 20°C.

eatment	% Healthy	% Damaged Fruits		
		Light	Medium	Severe
ntrol	30	15	35	20
h 37°C	70	30	0	0
h 37°C	60	10	15	15
h 42°C	85	15	0	0
h 46°C	20	10	0	70

able 2 - Development of *Colletotricum gloeosporioides* lesions in inoculated Fuete avocado fruits.

eatment	Lesion Diameter (mm) Days at 20°C			
	1	3	5	7
ntrol	0	4	8	15
n 37°C	0	0.5	2.5	5
n 37°C	0	0.5	2	5
n 42°C	0	1	3	6

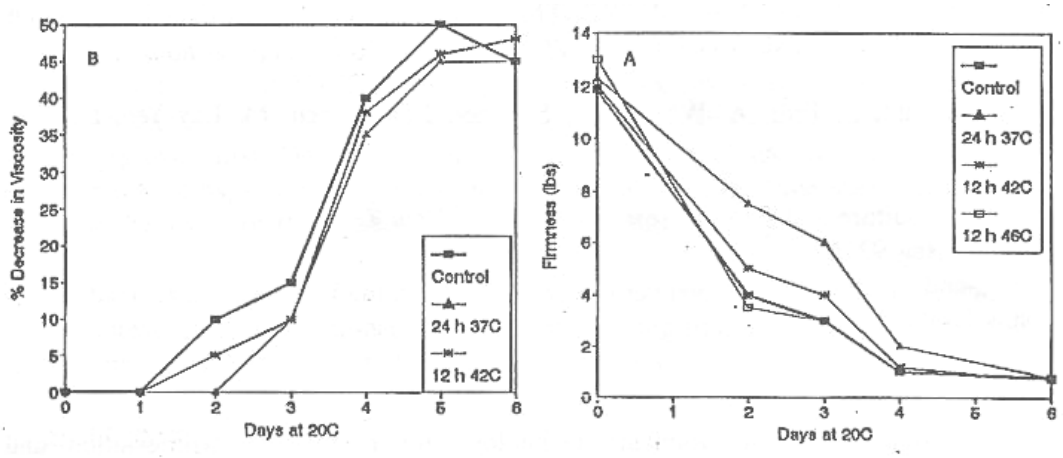

Figure 1. Firmness (a) and cellulase activity (b) of Hass avocados allowed to ripen at 20°C following 6 weeks storage at 2°C.

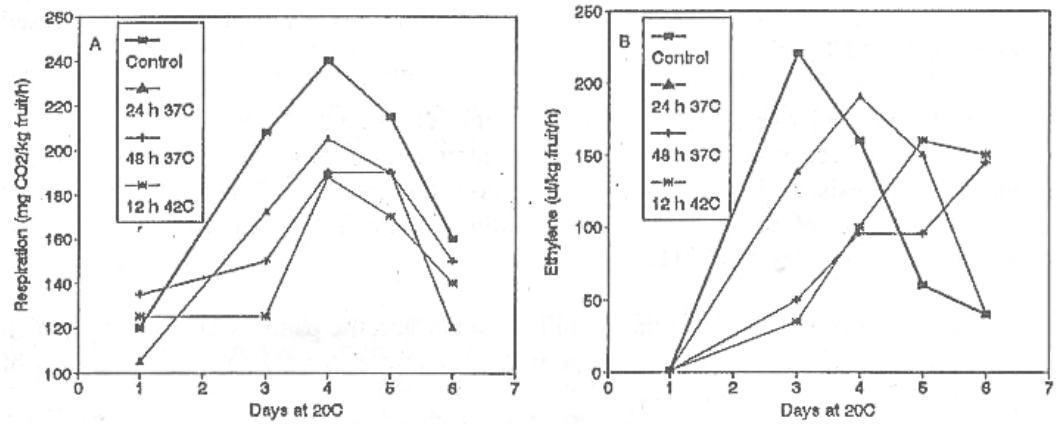

Figure 2. Respiration (a) and ethylene production (b) of Hass avocados allowed to ripen at 20°C following 6 weeks storage at 2°C.