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Agriculture Intensive dans les Iles de la Caraibe : enjeux, contraintes et perspectives
Intensive Agriculture in the Caribbean Islands : stakes, constraints and prospects
Agricultura Intensiva en la Islas del Caribe : posturas, coacciones y perspectivas

ALTERNATIVES TO LOW TEMPERATURE AND/OR CONTROLLED ATMOSPHERE STORAGE METHODS FOR IMPROVED ABILITY OF SELECTED TROPICAL FRUITS

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ABSTRACT

The efficacy of calcium chloride dips on the storage ability of 'Julie' mangoes and of polyethylene film wrapping or the storage ability of 'Jaffa' oranges are reported.

Ripening as determined by peel colour development and textural softening was retarded in calcium treated versus untreated 'Julie' mangoes, and an organoleptic evaluation indicated an improvement in consumer satisfaction of calcium treated fruit. Calcium chloride treatment extended the shelf life of fruits to 14 days compared to a 5 day shelf life in untreated fruit.

Film wrapping retarded the commercial deterioration and fresh weight loss of 'Jaffa' oranges held at 15 °C and under ambient conditions and thus improved the storage life and marketability of fruits. Juice quality was not adversely affected by film wrapping. Despite the improvement in the commercial quality, marketability and storage life of film wrapped versus unwrapped fruits, the data indicated that storage temperature is of greater importance in the keeping quality of 'Jaffa' oranges than film wrapping in polyethylene. The longest storage life of 126 days was observed in film wrapped fruit held at 15 °C compared to a storage life of 16 days in unwrapped fruit held under ambient conditions.

INTRODUCTION

The vast majority of tropical fruits are highly perishable and subject to rapid deterioration in quality during the postharvest period. Few of them have been studied in adequate detail and their postharvest behavior still remain largely unknown. The challenge for quality retention and storage life extension of tropical fruits still eludes us and many remain underutilised and/or underexploited.

The relative susceptibility of tropical versus temperate horticultural produce to chilling injury, coupled with the large capital outlay required for low temperature and/or controlled atmosphere storage methods, limit their use as methods for storage life extension in the Third world. This paper reports on the results of laboratory studies undertaken to investigate the use of alternative postharvest techniques for quality retention and improved storage ability of 'Julie' mangoes and 'Jaffa' oranges.

CALCIUM CHLORIDE DIPS AS A POSTHARVEST TREATMENT FOR IMPROVED STORAGE ABILITY OF "JULIE" MANGOES

Calcium is known to be an essential plant nutrient involved in a number of physiological processes involving membrane structure and function and enzyme activities (JONES and LUNT, 1967), and calcium compounds have shown promise in the quality retention of fruits and vegetables (SHEAR, 1975; Huber, 1983) by maintaining firmness, reducing respiratory rates and ethylene evolution (POOVAIAH, 1986) and decreasing storage rots (CONWAY and SAMS, 1984).

Calcium Chloride dips at five concentrations (0, 2, 4, 6 and 8 percent) were applied to fruits using the temperature differential method described by ESGUERRA and BAUTISTA (1984). The calcium content of peel and pulp tissue was determined by atomic absorption spectrophotometry, and quality characteristics and shelf life of fruits were monitored.

The temperature differential method was effective in increasing the calcium concentrations of both peel and pulp tissues of 'Julie' mangoes (Table 1). Colour development (Fig 1) and textural

softening (Fig 2) were significantly retarded and the organoleptic rating was significantly higher (P 0.05) in calcium treated versus untreated fruit (Table 1). The low organoleptic rating of untreated fruit resulted from higher incidences of rotting, anthracnose infection and oversoftening (unpublished data) compared to calcium treated fruits which maintained firm texture and good external appearance. This supports the implication that calcium reduces decay in stored fruit by stabilizing cell walls (CONWAY and SAMS, 1984). Retardation of the ripening processes in calcium treated fruit, coupled with reduced incidence of disease infection, resulted in an extension of shelf life over untreated fruit (Table 1).

Despite the higher calcium concentrations of both peel and pulp tissues in 8 percent calcium chloride treated fruits compared to 6 percent calcium chloride treated fruits (Table 1), the shelf lives and organoleptic ratings of both treatments were not significantly different (P 0.05). This suggests that the optimum concentration of calcium chloride for shelf life extension of 'Julie' mangoes is 6 percent.

The retardation of ripening, the extension of shelf life and the organoleptic superiority of calcium treated versus untreated fruits indicate good promise for its use as a postharvest technique for quality retention and reduction of postharvest losses.

INDIVIDUAL FILM WRAPPING AS A POSTHARVEST TREATMENT FOR IMPROVED STORAGE ABILITY OF 'JAFFA' ORANGES

Among the various techniques developed to extend postharvest life, the use of plastic film is growing in importance as an alternative to the more conventional methods of low temperature and controlled atmosphere storage.

'Jaffa' oranges were either individually film-wrapped in polyethylene or left unwrapped, and held under two temperature regimes, viz. continuous storage under ambient conditions or continuous storage at 15 °C. Fruit salability as described by BEN-YEHOSHUA (1969), marketability and fresh weight loss were assessed at weekly intervals and the storage life of fruits of all treatments was monitored. At prescribed intervals, juice quality was assessed by determination of total soluble solids content, using a Bausch and Lomb refractometer, and total acidity by titration with 0.1N NaOH.

The salability and percent marketable fruit were significantly (P 0.05) higher in film-wrapped versus unwrapped fruit held at both temperature regimes (Fig 3,4). There was also a significant reduction in fresh weight loss in film-wrapped versus unwrapped fruits at both storage temperatures (Fig 5). The storage life of fruits were significantly (P 0.05) improved by film-wrapping, with the longest storage life (126 days) being observed in film-wrapped fruit held at 15 °C and the shortest (16 days) in unwrapped fruit held under ambient conditions (Table 2).

These results concur with the findings of BEN-YEHOSHUA *et al.* (1983), and GOLOMB *et al.* (1984); and have been explained as being due to a reduction in transpirational water loss in film-wrapped fruit, thus reducing shrinkage, softening and drying of fruit; in addition, to the maintenance of a juvenile hormonal balance (Ben Yehoshua, 1985).

There was a significant (P 0.05) decrease in the total acid content of the fruit juice from all treatments over time (Fig 6) but no significant change was observed in the total soluble solids content of the juice (Fig 7). This suggests that acids may be preferentially used over sugars during the respiratory process of 'Jaffa' oranges. The increase in the ratio between total soluble solids and total acid content observed in Figure 7 may be explained by the declining levels of total acidity, compared to the consistency of the total soluble solids content over time.

The improvement in the commercial quality, marketability and storage ability of film-wrapped versus unwrapped fruit offers an exciting opportunity in the search for possible substitutes to refrigeration given the present energy crisis and even increasing fuel costs.

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Table 1 Effect of postharvest dips of calcium chloride on shelf life, calcium content and organoleptic rating of 'Julie' mangoes.

Treatment (% Cacl)	Shelf Life (days)	Peel Calcium Content (mg/100 g dried tissue)	Pulp Calcium Content (mg/100 g dried tissue)	Organolectic Rating
0	4.5 a	188.3 a	134.2 a	2.4 a
2	8.6 b	657.2 b	329.2 b	3.1 b
4	9.4 b	696.0 b	336.7 b	3.3 b
6	14.6 c	867.5 c	550.4 c	4.6 c
8	14.8 c	1027.1 d	730.0 d	4.7 c

Mean values in the same column followed by different letters are significantly different at the 5% level by Duncan's multiple range test.

Table 2 Effect of temperature and film wrapping on the storage life of 'Jaffa' oranges.

TREATMENTS	STORAGE LIFE (DAYS)
Unwrapped (control)	16.2 a
AMBIENT	
Film wrapped	38.3 b
Unwrapped	62.73 c
15° C	
Film wrapped	126.4 d

Mean separation by Duncan's multiple range test at 5% level.