



Environmentally Friendly and
Safe Technologies for Quality
of Fruits and Vegetables

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The papers contained in this book report some of the peer reviewed Proceedings of the International Conference “Environmentally friendly and safe technologies for quality of fruit and vegetables”, but also other papers related with the subject were included. The manuscripts were reviewed by the Editor and Editorial Board, and only those papers judged suitable for publication were accepted. The Editor wish to thank to all the reviewers and authors for their contribution.

Authors are responsible for content and accuracy of their papers.

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SECTION 3. QUALITY MANAGEMENT
OF FRUIT AND VEGETABLES

19. QUALITY CHANGES DURING STORAGE OF APRICOT (*PRUNUS ARMENIACA* L.) CV. 'BELIANA' AND 'LINDO' TREATED WITH CALCIUM

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Abstract

Calcium salts have been successfully used to maintain firmness and to slow down ripening processes in some fruit. This work studies the effect of postharvest calcium chloride applications on the quality preservation of apricot (*Prunus armeniaca* L.) cv. 'Beliana' and cv. 'Lindo' during storage. Harvested apricots were dipped in 0, 1, 3 or 5% CaCl₂ solutions for 2 min. Fruit were left to dry for 1 h at ambient temperatures and then stored at 3 °C. Fruit were analysed after 0, 6, 14, 21 and 28 d storage for weight loss, firmness and soluble solids content (SSC). A taste panel was performed at the beginning and at the end of the experiment. Weight loss increased through storage in both cultivars. 'Lindo' did not show differences among treatments in weight loss, but 'Beliana' had higher weight loss in fruit treated with 3% CaCl₂ followed by 5%. Firmness decreased through storage without differences among treatments in 'Beliana', except after 5 d where all treatments were firmer than control. The 'Lindo' apricots treated with 3 and 5% CaCl₂ showed higher firmness values than the other treatments through storage, except at 28 d where only the 5% CaCl₂ had significantly higher firmness. 'Beliana' did not show differences in SSC among treatments. However, 'Lindo' had lower SSC when treated with 1% CaCl₂. When tested after 27 d storage, panellists preferred fruit from the 1% CaCl₂ treatment followed by the control for both cultivars. It seems that CaCl₂ treatments with concentrations over 3% are prejudicial for apricots. Concentrations between 1 and 3% should be assayed, since 1 and 3% look to be beneficial for the different quality parameters.

Keywords: *Prunus armeniaca*, quality, storage

Introduction

Apricot fruit are highly perishable. Their quality is linked to some attributes like appearance, texture, flavour and nutritional value, which are all determined by the ripening stage at harvest and storage conditions. The most important chemical changes during apricot ripening are in the sugars, acids and pigments levels, since these properties contribute to the organoleptic characteristics for optimal consumption (Amoros *et al.* 1990). Firmness is also an important attribute to indicate the ripening stage of fruit (Souty *et al.* 1990,1995).

One of the major problems of apricots is rapid postharvest softening. It is well known that calcium plays a significant role in maintaining quality in a number of different fruit (Hopkirk *et al.* 1990). The pre and postharvest application of calcium salts has been used successfully in many fresh fruit to maintain firmness and to slow down ripening processes (Souty *et al.* 1995; Antunes *et al.* 2003).

This research studies the effects on 'Beliana' and 'Lindo' apricot fruit (*Prunus armeniaca* L.) quality during storage after postharvest application of CaCl₂ at concentrations up to 5%.

Material & Methods

Apricot fruit (*Prunus armeniaca* L. cv. 'Beliana' and cv. 'Lindo') were harvested with firmness 20 N and SSC 12% for 'Beliana' and firmness 12 N and SSC 14% for 'Lindo' cultivars. Fruit were dipped in 0, 1, 3 or 5% CaCl₂ solutions for 2 min and were left to dry for 1 h at room temperature, and then placed in trays and stored at 3 °C. After 0, 6, 14, 21 and 28 d, 10 fruit per replication were removed from storage and used for analyses.

Soluble solids content (SSC) was measured with a digital Atago refractometer (Model PAL-1, Atago Co. LTD, Japan). Firmness was recorded with a Chatillon Force TCD 200 and Digital Force Gauge DFIS 50 penetrometer fitted with a conical plunger of 6.5 mm diameter and 2.4 mm height. Maximum penetration depth was 12.6 mm. Weight loss was expressed as a percentage of the initial fruit weight. The taste panel consisted of 25 panellists.

Statistical analysis were carried out with the SPSS 16.0 software (SPSS Inc.). Two-way analyses of variance (ANOVA) and Duncan's Multiple-Range Test ($P < 0.05$) for comparisons among treatments over time were conducted.

Results & Discussion

Firmness was higher in 'Beliana' than in 'Lindo' apricot fruit, and it slightly decreased during storage for 'Beliana' and remained almost constant for 'Lindo' (Fig 1). Increased concentrations of calcium chloride were efficient in maintaining fruit firmness, this effect was more pronounced in 'Beliana' than 'Lindo'. The effect of calcium on firmness decreased after 21 d storage.

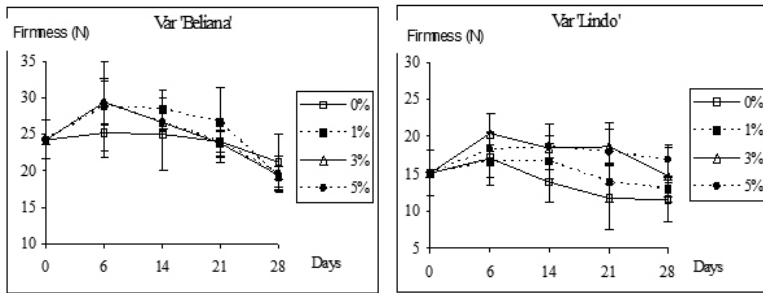


Fig 1. Firmness of apricot fruits during storage at 3 °C, after postharvest dip in water with 0, 1, 3 or 5% CaCl_2 for 2 min.

Calcium applications made both pre and postharvest to fruit tissues, can delay softening rates and ripening, by maintaining cell wall integrity and importantly cell cohesion (Knee & Bartley 1981; Roy *et al.* 1994).

Souty *et al.* (1995), Tzoutzoukou & Bourakis (1997) and Antunes *et al.* (2003) also found beneficial effects of calcium application to apricot fruit of some cultivars on their storage life capacity.

The soluble solids content were lower in 'Beliana' apricots after harvest than in 'Lindo', but at the end of the storage period they reached similar values (Fig 2).

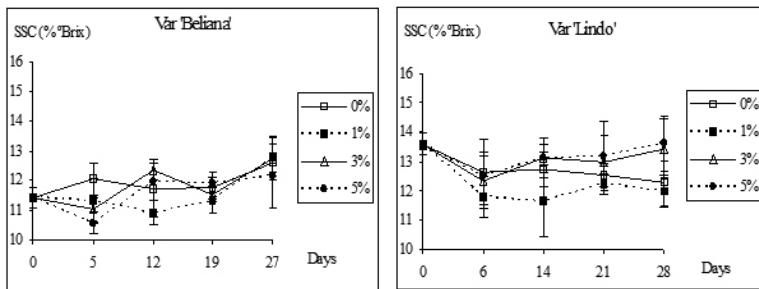


Fig 2. Soluble solids content of apricot fruits during storage at 3 °C, after postharvest dip in water with 0, 1, 3 or 5% CaCl_2 for 2 min.

It seems that 'Lindo' apricots were already eating-ripe at harvest but 'Beliana' were not. 'Beliana' did not show differences in SSC among treatments, but 'Lindo' had a lower SSC when treated with 1% CaCl_2 .

Weight loss increased with storage time in both cultivars (Fig 3). Weight loss was higher in 'Lindo' than

in 'Beliana' throughout storage. In both cultivars fruit treated with 3 or 5% CaCl₂ lost more weight than the control or 1% CaCl₂ treatments, although the differences were smaller in 'Beliana'.

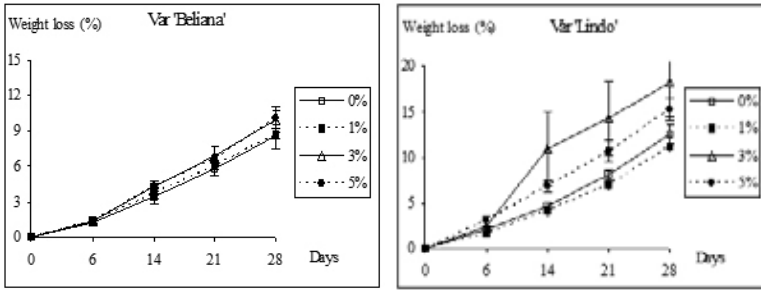


Fig 3. Weight loss of apricot fruits during storage at 3 °C, after postharvest dip in water with 0, 1, 3 or 5% CaCl₂ for 2 min.

When tested after 27 d storage, panellists preferred the 1% CaCl₂ treatments followed by the control in both cultivars (Fig 4). Panellists preferred the 1% treatment followed by control in both cultivars in terms of appearance, while for flavour the preference values were still acceptable for the 3% CaCl₂ treatment until the end of storage. Generally, fruit from the 3 and 5% treatments were rejected. Apricots of both cultivars treated with 3 or 5% CaCl₂ showed, at the end of the experiment, brown spots on the skin (data not shown).

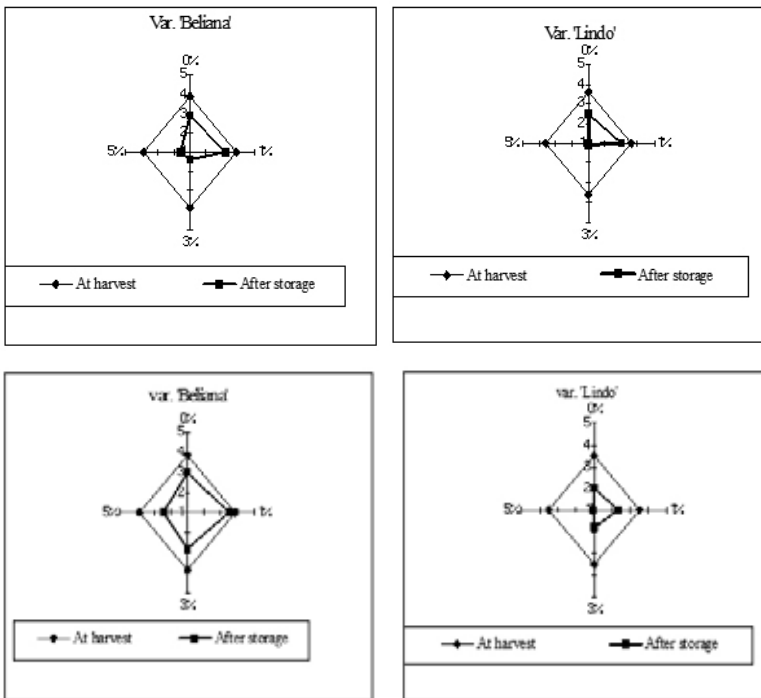


Fig 4. Appearance (A) and flavour (B) of apricot fruits stored at 3 °C, after postharvest dip in water with 0, 1, 3 or 5% CaCl₂ for 2 min, as evaluated by panellists at harvest and after 27 d storage.

Souty *et al.* (1995) and Antunes *et al.* (2003) already reported a detrimental effect from high CaCl₂ concentration postharvest dips on apricot fruit (4% and 3-5%, respectively).

This current work suggests that postharvest dipping of apricot fruit in 1% CaCl₂ increases potential storage life, but levels over 3% are prejudicial. Concentrations between 1 and 3% should be assayed.

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