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Effect of calcium chloride and packaging containers on quality of cold stored peach fruits

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ABSTRACT

Investigations were conducted to study the effect of post harvest calcium chloride treatments and packaging containers on storage life of Earli Grande peach. Fruits were treated with $CaCl_2$ (4 and 6%) followed by packing in CFB (2 and 4 kg) and wooden boxes (4 and 8 kg) and stored at 0-2°C with 85-90% relative humidity for 21 days. $CaCl_2$ (6%) was proved very effective in reducing loss in weight and registered high firmness, total phenols and vitamin A content. There was a significant increase in PLW, TSS: acid ratio and reducing sugars with enhanced storage period irrespective of calcium chloride treatments and packaging containers. On the other hand firmness, total phenols and vitamin A content decreased throughout the storage. Mean maximum TSS: acid ratio and reducing sugars were observed under 8 kg wooden boxes. However, minimum PLW and maximum firmness, total phenols and vitamin A were noticed under 2 kg CFB boxes. The study suggests that calcium chloride (6%) as post harvest dip and 2 kg CFB boxes could improve the quality of the peach upto 21 days of storage.

Key words: Peach, post-harvest, calcium chloride, packaging, storage.

INTRODUCTION

Many low chilling and early ripening peach cutilvars grow well under North-Western Indian plains. Earli Grande peach ripens in last week of April when there is much scarcity of fresh fruits in Punjab. Inspite of scarcity of other fruits the farmers get low returns due to fast decaying and moisture loss during marketing. The high temperature accompanied by a low relative humidity during harvesting and marketing period are the major factors which reduce the post harvest life of peach in the state. Calcium's physiological activity as a second messenger in cellular biochemistry and its requirement in cell wall structure make it important to fruit growth and development, as well as general fruit quality (Kadir, 5). Use of appropriate packaging material can help to a great extent to reduce various losses and enhance shelf-life of the fruit. Sharma and Singh (14) reported that the apple fruits in CFB or wooden boxes had better quality attributes than those in other containers or control. The present studies were therefore, undertaken to assess the post harvest behaviour of peach cv. Earli Grande as affected by the post harvest treatment of calcium chloride and various packaging containers.

MATERIALS AND METHODS

Present investigations were carried out at Punjab Agricultural University, Ludhiana. The fruit of peach cv. Earli Grande were harvested from 6-year-old trees at optimum stage of maturity. The fruits were dipped for 10 min. in solution of calcium chloride (4 and 6%) and the fruits kept under control were dipped in distilled water for same period. Packed fruits were than air-dried and packed in corrugated fibre board (CFB) boxes of 2 and 4 kg and wooden boxes of 4 and 8 kg with paper cuttings as cushioning material and were kept in commercial cold store at 0-2°C with 85-90 per cent relative humidity. The fruits were assessed weekly for 3 weeks of storage for physiological loss in weight, firmness, TSS: acid ratio, reducing sugars, total phenols and vitamin A content. The fruit firmness was measured with the help of 'fruit pressure tester' (FT-444, Italy in kg/cm^2). TSS were recorded with the help of a hand refractometer. The acidity, reducing sugars, total phenols and vitamin A were determined according to the methods outlined in AOAC (1). The experimental data was analyzed in randomized block design with factorial arrangement.

RESULTS AND DISCUSSION

The physiological loss in weight was significantly diminished by post harvest $CaCl_2$ treatments (Fig. 1A). The fruits treated with $CaCl_2$ (6%) recorded the lowest loss in weight. The reduction in weight loss might be due to the maintenance of firmness of fruits by calcium as it decreased the enzyme activity responsible for disintegration of cellular structure, which decrease the gaseous exchange (Levy and Poovaiah, 7). The loss in weight during the storage was significant regardless of $CaCl_2$ treatment and packaging. An increase in PLW

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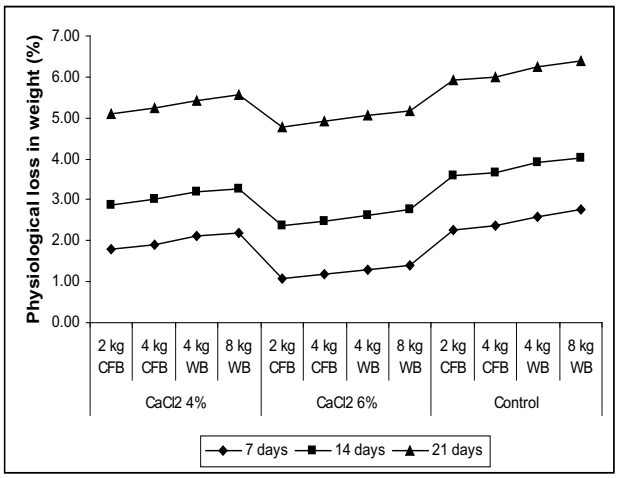
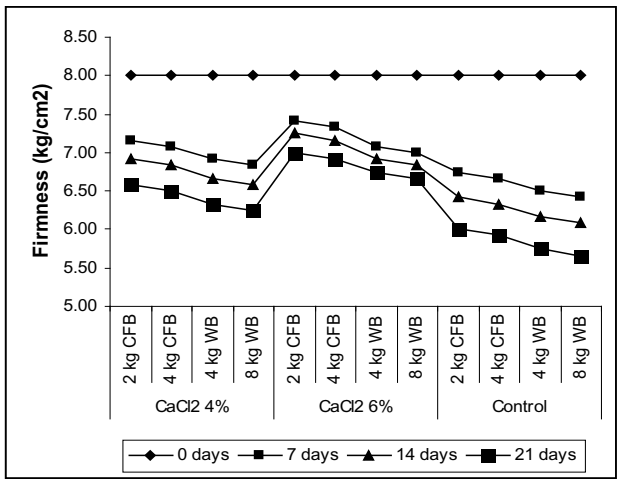
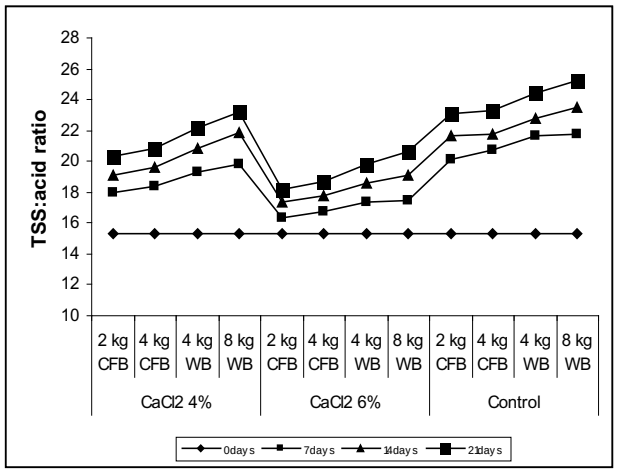


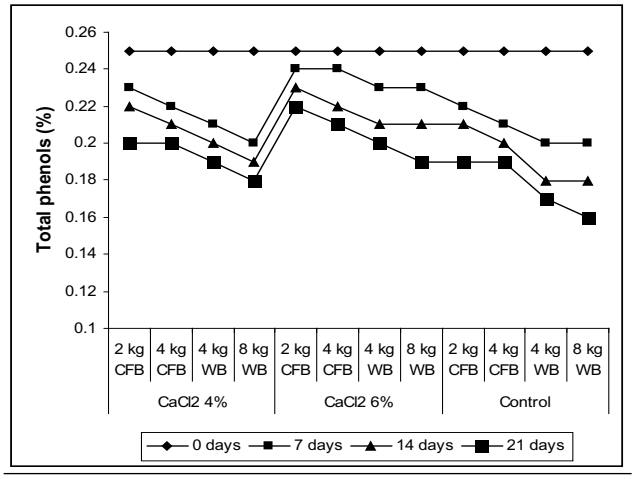
A. CD: T=0.120, S=0.150, P=0.150



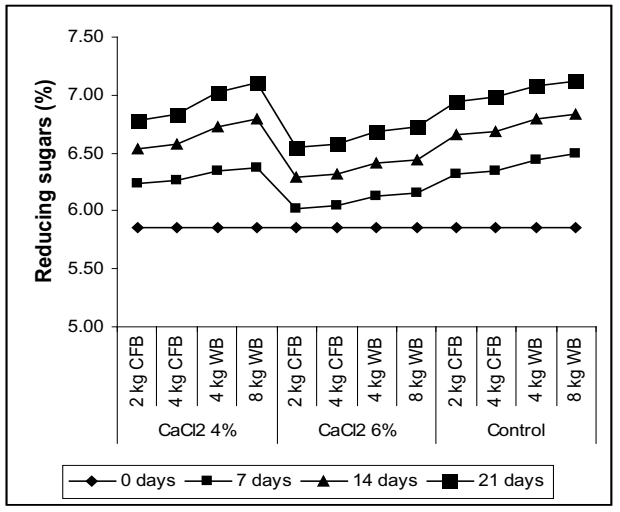
B. CD: T=0.100, S=0.116, P=0.116



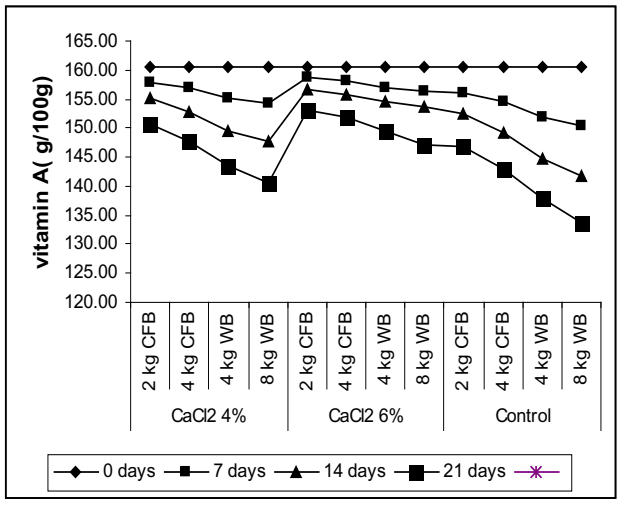
C. CD: T = 0.874, S = 0.630, P = 0.630



D. CD: T = 0.010, S = 0.0115, P = 0.011



E. CD: T = 0.045, S = 0.035, P = 0.035



F. CD: T = 1.040, S = 1.120, P = 1.120

Fig. 1. Changes in quality parameters of peach fruits treated with 0,4 and 6% $CaCl_2$ solution followed by packaging in corrugated fibre board boxes (CFB) and wooden boxes (WB) during storate at 0-2°C, 85-91% RH for 21 days: A Physiological loss in weight; B) Fruit firmness; C) TSS: acid ratio; D) Total phenols; E) Reducing sugars; F) vitamin A content. T = Treatment, S = storage, P = Packages, CD = Significant at $p \leq 0.05$.

in all treatments with period of storage was obvious as the different physiological process, like transpiration and respiration, continued in fruits even after harvest. The percentage loss in weight of fruits packed in CFB boxes was less which may be due to the build up of higher humidity conditions inside the boxes resulting in lesser loss of net weight of fruits. Wooden boxes showed maximum loss due to moisture absorption by the timber from the fruits and subsequent loss of this moisture to the atmosphere. However, CFB boxes provided a better barrier to water absorption and its subsequent loss to atmosphere. Similar findings were reported for apple by Kaushal *et al*. (6).

The fruits treated with $CaCl_2$ retained more firmness in comparison to control (Fig. 1B). Increased firmness of the fruits was due to thickening of middle lamella of fruit cell wall owing to increased formation and deposition of calcium pectate as the firmness compound has direct relationship with pectin concentration which was primarily due to higher calcium content in the treated fruits (Dey and Brinson, 2). The progressive decrease in fruit firmness with the advancement of storage may be due to hydrolysis of metabolites (Rombaldi *et al*., 13) in peaches. The rapid losses of firmness in fruits packed in wooden boxes in comparison to CFB boxes may be ascribed to the increased metabolic activities of the fruits in wooden containers resulting in breakdown of insoluble protopectin to soluble pectin and pectic acid. Meena *et al*. (9) have also reported that the *ber* fruits packed in CFB boxes were more firm than the other packaging material.

The TSS:acid ratio was progressively reduced by $CaCl_2$ treatments (Fig. 1C). It may be attributed to the reason that higher Ca has retarded the ripening and senescence processes and simultaneously reduced the conversion of starch into sugars. The increase in TSS with the advancement in storage period may probably be due to starch gets hydrolysed into mono- and disaccharides which in turn may lead to an increase in total soluble solids (Wills *et al.,*15). Reduction in acidity during storage might be due to the increased catabolism of organic acids present in fruit through the process of respiration. The results of the present study were in accordance with the earlier findings of Dris and Blanke (3). The TSS: acid ratio was significantly higher in fruits packed in wooden boxes than CFB boxes which might be due to more moisture loss from the fruits in wooden boxes leading to more concentration of juice resulting in higher sugar content whereas maximum decrease in acidity of fruits packed in wooden boxes may be ascribed to increased respiration rate and more utilization of acids in bio-chemical activities leading to depletion of organic acids.

Peach fruits treated with calcium compounds contained higher total phenols (Fig. 1D). The possible reason could be that calcium forms chelates with phenolic compounds and phenolic compounds of higher molecular weight are effective inhibitors of pectic enzymes. Similar observations had been reported by Rensburg and Engelbrecht (12) in avocados. The total phenols content decline with advancement of storage and this loss of astringency is probably connected with increased polymerization of tannins. The results are in agreement with the findings of Mahajan (8) in apples. Total phenols were significantly lower in 8 kg wooden boxes which might be a result of increased polyphenol oxidase activity in wooden boxes as compared to CFB boxes.

Calcium treatments decreased the reducing sugars significantly in comparison to control (Fig. 1E). This might be due to retarded rate of ripening and senescence processes and simultaneously reduced conversion of starch into sugars by calcium chloride treatments. Similar results were obtained by Nickhah *et al*. (10) in pear. The constant increase in the reducing sugar with storage is suggestive of the conversion of starch and possibly of other organic acids and amino acids into reducing sugars. Similar changes in reducing sugar content were also reported by Prasant and Masoodi (11). Higher level of reducing sugars in fruits packed in wooden boxes in comparison to CFB boxes might be due to the more moisture loss and faster rate of metabolic activities in wooden boxes resulting in breakdown of starch into sugars.

The $CaCl_2$ was effective in retaining the Vitamin A content of fruits during cold storage as compared to control (Fig. 1F). It might be due to the delay in senescence and minimum enzyme activity in calcium treated fruits. These results are in agreement with those of Drake and Spayd (4) in Golden Delicious apples. With the advancement of storage period, the retention of Vitamin A content decreased. This might be due to the increase in activity of certain enzymes like polyglacturonase and polyphenol oxidase with enhanced storage time that might be responsible for the break down of carotenoids during storage. Fruits packed in CFB boxes retained significantly higher vitamin A content than wooden boxes packed fruits. This may be ascribed to decrease in enzymatic activity in CFB boxes resulting in least breakdown of carotenoids.

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