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# Studies on storage behaviour of peach cv. EARLI GRANDE

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**ABSTRACT**
The fruits of peach cv. Earli Grande were harvested at 75 per cent colour break stage and dip treated with varying concentrations of $CaCl_2$ (4 and 6%) for 10 minutes. The fruits were air dried and packed in corrugated fibre board boxes (2 and 4 kg) and wooden boxes (4 and 8 kg) and stored in cold storage (0-2°C and 85-90% RH). The observations on physiological and biochemical parameters were recorded at weekly intervals upto 3 weeks. The data revealed that post harvest application of $CaCl_2$(6%) turned out to be the most effective treatment in improving the shelf life and quality of fruits upto three weeks against control fruits which could be stored only upto two weeks. CFB boxes (2 kg) proved useful in keeping good quality characters and extending storage life.

**Key words :** Peach, Calcium chloride, Packaging, Storage, Weight loss, Firmness, Quality.

## INTRODUCTION

The peach is the third most important fruit crop after apple and pear grown in temperate zone of world. Fruits of peach cv. Earli Grande mature during last week of April, when temperature is high and atmospheric humidity is low. Under these conditions, fruits cannot be stored for longer duration at ambient temperature. The high levels of water loss, rapid respiration and mechanical damage effect the physico-chemical quality of the fruit and its market value. Chemical modification of fruit ripening or delaying of senescence with a view to increase the shelf life of fruits have been attained by different workers (Bal *et al.,* 1990; Ochel *et al.,* 1993). Packaging of fruits in appropriate containers for storage of fruit can also help to reduce various losses and enhance shelf life of fruit. Keeping these facts in view the present investigations were conducted to find out the suitable post harvest treatment and packaging container to improve the quality of peach fruit under cold storage.

## MATERIALS AND METHODS

Six years old healthy and uniform plants of Earli Grande cultivar of peach were selected. The fruits were picked at 75 per cent colour break stage. These fruits were dipped in different concentrations of $CaCl_2$ (4%, 6%) for 10 minutes. The fruits were air dried and packed in corrugated fibre board (CFB) boxes 2 kg ($P_1$) and 4 kg ($P_2$) and wooden boxes of 4 kg ($P_3$) and 8 kg ($P_4$) and stored in cold storage maintained at 0-2°C and 85-90% RH. The fruit firmness was measured with the help of fruit tester penetrometer. TSS were recorded with the help of a hand refractometer. The acidity, total sugars and vitamin A were determined according to the methods outlined in AOAC (1990). The experimental data was analyzed in randomized block design with factorial arrangements.

## RESULTS AND DISCUSSION

Physiological loss in weight reduced significantly by $CaCl_2$ treatments as compared to control which recorded the maximum (3.81%) weight loss (Table 1). 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, 1979). The physiological loss in weight increased progressively with the increase in storage period irrespective of $CaCl_2$ treatments. Minimum weight loss (2.84%) was recorded after 7 days of cold storage whereas it was found to be maximum (6.35%) after 21 days of storage. The weight loss was significantly lower in fruits packed in CFB boxes than the wooden boxes, 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. Kaushal *et al.* (1996) have also observed minimum loss in weight of fruits in CFB boxes in apple.

$CaCl_2$ treatments retained fruits more firmer in comparison to control, where it was minimum (5.27 kg/cm$^2$). These results are in conformity with the findings of Roy *et al.* (1994) who have concluded that calcium ions reduced fruit softening by strengthening the cell walls. The fruit firmness decreased gradually with increase in storage interval. Fruits were significantly firmer (5.54 kg/cm$^2$) after 7 days of cold storage in comparison to fruits at other days of storage interval. The progressive decrease in fruit firmness with the advancement of storage may be due to hydrolysis of metabolites when the fruits were stored for a longer period (Rombaldi *et al.,* 2001) in Peaches. Fruits in CFB boxes retained significantly higher firmness than wooden boxes. The higher losses of firmness in wooden 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.

The $CaCl_2$ treatments significantly decreased the total soluble solids as compared to control (Table 1). 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. Fruits stored for 21 days exhibited the minimum TSS (12.64%) whereas the fruits after 7 days of storage recorded maximum TSS (13.02%). The increase in total soluble solids upto 7 days of storage may possibly be attributed to rapid hydrolysis of starch into sugars whereas at later stages utilization of sugars were at faster rate. Fruits in wooden boxes of 8kg and 4kg sizes had significantly higher TSS than the fruits in 2 kg and 4kg CFB boxes. The higher TSS content in wooden boxes in comparison to CFB boxes may be ascribed to the increases in PLW, increased metabolic activities and partly by hydrolysis of starch, which resulted in disappearance of starch, associated with the increase in TSS in apples (Thakur and Lal, 1989).

Significantly higher acidity (0.63%) was determined in fruits treated with $CaCl_2$ (6%) in comparison to fruits treated with 4 per cent of $CaCl_2$ (0.60%). However, minimum acidity was observed under control (Table 2). The higher acidity in fruits treated with calcium compounds might be due to decreased hydrolysis of organic acids and subsequent accumulation of organic acids which were oxidized at a slow rate because of the decreased respiration (Ochel *et al.,* 1993) in peaches. Acidity was recorded to be maximum (0.68%) before cold storage and minimum (0.54%) after 21 days of cold storage. Reduction in acidity in storage might be due to the increased catabolism of organic acids present in fruit through the process of

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Table 1 : Effect of post harvest calcium treatments, packaging and storage time on PLW, firmness and TSS of peach cv. Earli grande

| Treatments | | PLW (%) | | | | Firmness (kg/cm$^2$) | | | | TSS (%) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 14 | 21 | Mean | 7 | 14 | 21 | Mean | 7 | 14 | 21 | Mean |
| $CaCl_2$ (4 %) | P1 | 2.48 | 3.67 | 5.99 | 3.04 | 5.75 | 5.42 | 5.00 | 5.73 | 12.80 | 12.70 | 12.40 | 12.48 |
| | P2 | 2.59 | 3.83 | 6.08 | 3.13 | 5.66 | 5.33 | 4.92 | 5.67 | 12.90 | 12.80 | 12.53 | 12.56 |
| | P3 | 2.83 | 4.01 | 6.30 | 3.29 | 5.50 | 5.17 | 4.75 | 5.54 | 13.07 | 12.93 | 12.73 | 12.68 |
| | P4 | 2.97 | 4.17 | 6.39 | 3.38 | 5.33 | 5.00 | 4.58 | 5.42 | 13.20 | 13.00 | 12.80 | 12.75 |
| Mean | | 2.72 | 3.92 | 6.19 | 3.21 | 5.56 | 5.23 | 4.81 | 5.59 | 12.99 | 12.86 | 12.62 | 12.62 |
| $CaCl_2$ (6 %) | P1 | 2.00 | 3.47 | 5.57 | 2.76 | 6.00 | 5.75 | 5.42 | 5.98 | 12.20 | 12.10 | 11.90 | 12.05 |
| | P2 | 2.11 | 3.58 | 5.71 | 2.85 | 5.92 | 5.67 | 5.33 | 5.91 | 12.33 | 12.20 | 12.00 | 12.13 |
| | P3 | 2.48 | 3.83 | 6.00 | 3.08 | 5.75 | 5.50 | 5.16 | 5.79 | 12.53 | 12.33 | 12.15 | 12.25 |
| | P4 | 2.59 | 3.94 | 6.10 | 3.16 | 5.66 | 5.42 | 5.08 | 5.73 | 12.66 | 12.46 | 12.35 | 12.37 |
| Mean | | 2.30 | 3.71 | 5.85 | 2.96 | 5.83 | 5.58 | 5.25 | 5.85 | 12.43 | 12.27 | 12.10 | 12.20 |
| Control | P1 | 3.18 | 4.51 | 6.77 | 3.62 | 5.42 | 5.00 | 4.50 | 5.42 | 13.40 | 13.10 | 13.00 | 12.88 |
| | P2 | 3.41 | 4.64 | 6.84 | 3.72 | 5.33 | 4.92 | 4.41 | 5.35 | 13.53 | 13.33 | 13.10 | 12.99 |
| | P3 | 3.62 | 4.83 | 7.15 | 3.90 | 5.16 | 4.74 | 4.24 | 5.22 | 13.75 | 13.53 | 13.26 | 13.14 |
| | P4 | 3.79 | 4.94 | 7.31 | 4.01 | 5.00 | 4.58 | 4.00 | 5.08 | 13.86 | 13.60 | 13.40 | 13.22 |
| Mean | | 3.50 | 4.73 | 7.02 | 3.81 | 5.23 | 4.81 | 4.29 | 5.27 | 13.64 | 13.39 | 13.19 | 13.05 |
| Mean | | 2.84 | 4.12 | 6.35 | 3.33 | 5.54 | 5.21 | 4.78 | 5.57 | 13.02 | 12.84 | 12.64 | 12.62 |
| At Harvest = 6.75 | | | | | | | | | | | | | |
| CD at 5% | | Treat-ments 0.120 | Days 0.150 | Pack-ages 0.150 | TDX XP NS | Treatm-ents 0.100 | Days 0.116 | Packa ges 0.116 | TXD XP NS | Treat-ments 0.150 | Days 0.065 | Pack-ages 0.065 | TDX XP NS |
| Mean for Packages | | P1 | P2 | P3 | P4 | | | | | | | | |
| PLW (%) | | 3.14 | 3.23 | 3.42 | 3.52 | | | | | | | | |
| Firmness (Kg/Cm$^2$) | | 5.71 | 5.64 | 5.52 | 5.41 | | | | | | | | |
| TSS (%) | | 12.47 | 12.56 | 12.69 | 12.78 | | | | | | | | |

respiration. Dundar *et al.* (1997) in peaches have also reported reduction in acidity during storage. The fruits in 2kg and 4kg CFB boxes recorded significantly higher acidity, which were statistically at par than the fruits in 4kg (0.59%) and 8kg (0.58%) wooden boxes. Thakur and Lal (1989) in apple have reported that the fruits packed in CFB boxes maintained higher acidity.

The maximum average total sugars (8.98%) was estimated in fruits treated with $CaCl_2$ (6%) and $CaCl_2$ (4%). The total sugars decreased gradually with enhanced storage period and minimum average total sugars (8.39%) were recorded after 21 days of storage. There was a progressive increase in the total sugars during earlier days of colds storage periods but no significant increase was recorded during later period. This could probably be due to the rapid hydrolysis of starch into simple sugars and consequently the rate of conversion was higher than the utilization but during later stages, utilization of sugars in respiration was at much faster rate. Similar changes in total sugars were also reported by Robertson *et al.* (1990) in peaches. Fruits in 8 kg and 4 kg wooden boxes had higher total sugars content than the fruits in 2 kg and 4 kg CFB boxes. The packaging material exerted a significant influence on the total sugars of peach fruits during storage. The improved sugar contents of fruits in wooden boxes might be result of rapid loss of moisture and fast hydrolysis of starch and other polysaccharides to soluble form of sugars. The lower levels of total sugars in CFB boxes had also been reported earlier in ber by Radder *et al* (1998).

The fruits treated with $CaCl_2$ (6%) retained maximum vitamin A (158.82 mg/100g). However, the minimum vitamin A (153.15 mg/100g) was observed under control (Table 2). Drake and Spayd (1983) have also reported that the $CaCl_2$ was effective in retaining the vitamin A content of fruits during cold storage as compared to control. It might be due to the delay in senescence and minimum enzyme activity in calcium treated fruits. Maximum vitamin A content (158.40 ìg/100g) was recorded at the beginning of storage, whereas the minimum vitamin A content (148.79 ìg/100g) was observed after 21 days of storage. With the advancement of storage period the retention of vitamin A content decreased. This may be ascribed to the increased 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 in 2 kg and 4 kg of CFB boxes retained significantly higher (158.65 and 157.18 mg/100 g) vitamin A, than the fruits in 4 kg and 8 kg wooden boxes. This may be ascribed to decreased enzymatic activity in CFB boxes resulting in least breakdown of carotenoids.

Table 2 : Effect of post harvest calcium treatments, packaging and storage time on acidity, total sugars and vitamin A of peach cv. Earli Grande

| Treatments | | Acidity (%) | | | | Total Sugars (%) | | | | Vitamin A (μg/100g) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 14 | 21 | Mean | 7 | 14 | 21 | Mean | 7 | 14 | 21 | Mean |
| $CaCl_2$ (4 %) | P1 | 0.63 | 0.60 | 0.58 | 0.62 | 9.26 | 9.11 | 8.40 | 8.94 | 160.73 | 158.07 | 153.98 | 158.95 |
| | P2 | 0.62 | 0.59 | 0.57 | 0.62 | 9.30 | 9.14 | 8.41 | 8.96 | 159.75 | 155.74 | 150.95 | 157.36 |
| | P3 | 0.60 | 0.56 | 0.54 | 0.60 | 9.38 | 9.20 | 8.43 | 9.00 | 158.05 | 152.65 | 146.98 | 155.17 |
| | P4 | 0.59 | 0.55 | 0.52 | 0.59 | 9.41 | 9.23 | 8.44 | 9.02 | 157.06 | 150.68 | 144.05 | 153.70 |
| Mean | | 0.61 | 0.58 | 0.55 | 0.60 | 9.34 | 9.17 | 8.42 | 8.98 | 158.90 | 154.29 | 148.99 | 156.30 |
| $CaCl_2$ (6 %) | P1 | 0.66 | 0.63 | 0.61 | 0.65 | 9.17 | 9.09 | 8.49 | 8.94 | 161.52 | 159.73 | 156.42 | 160.17 |
| | P2 | 0.65 | 0.62 | 0.60 | 0.64 | 9.21 | 9.12 | 8.49 | 8.96 | 160.80 | 158.93 | 155.28 | 159.50 |
| | P3 | 0.64 | 0.60 | 0.58 | 0.63 | 9.30 | 9.20 | 8.55 | 9.01 | 159.81 | 157.50 | 152.88 | 158.30 |
| | P4 | 0.64 | 0.60 | 0.56 | 0.62 | 9.34 | 9.23 | 8.56 | 9.03 | 159.07 | 156.71 | 150.49 | 157.32 |
| Mean | | 0.65 | 0.61 | 0.59 | 0.63 | 9.26 | 9.16 | 8.52 | 8.98 | 160.30 | 158.22 | 153.77 | 158.82 |
| Control | P1 | 0.59 | 0.54 | 0.52 | 0.58 | 9.37 | 9.10 | 8.28 | 8.94 | 158.95 | 155.35 | 150.01 | 156.83 |
| | P2 | 0.59 | 0.53 | 0.51 | 0.58 | 9.41 | 9.14 | 8.23 | 8.95 | 157.30 | 152.11 | 146.29 | 154.68 |
| | P3 | 0.54 | 0.50 | 0.47 | 0.55 | 9.48 | 9.22 | 8.20 | 8.98 | 154.60 | 147.73 | 141.07 | 151.60 |
| | P4 | 0.53 | 0.49 | 0.45 | 0.54 | 9.52 | 9.27 | 8.18 | 8.99 | 153.10 | 144.81 | 137.06 | 149.49 |
| Mean | | 0.56 | 0.52 | 0.49 | 0.56 | 9.45 | 9.18 | 8.22 | 8.96 | 155.99 | 150.00 | 143.60 | 153.15 |
| Mean | | 0.61 | 0.57 | 0.54 | 0.60 | 9.35 | 9.17 | 8.39 | 8.98 | 158.40 | 154.17 | 148.79 | 156.09 |
| | | At Harvest = 0.68 | | | | At Harvest = 9.00 | | | | At Harvest = 163.00 | | | |

| | Treat-ments | Days | Pack-ages | TDX XP NS | Treatm-ents | Days | Packa ges | TXD XP NS | Treat-ments | Days | Pack-ages | TDX XP NS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CD at 5% | 0.013 | 0.015 | 0.015 | | 0.444 | 0.053 | 0.053 | | 1.04 | 1.12 | 1.12 | |

| Mean for Packages | P1 | P2 | P3 | P4 |
|---|---|---|---|---|
| PLW (%) | 0.62 | 0.61 | 0.59 | 0.58 |
| Firmness (Kg/$Cm^2$) | 8.96 | 9.00 | 8.99 | 9.01 |
| TSS (%) | 158.65 | 157.18 | 155.02 | 153.50 |

## REFERENCES


**A.O.A.C. (1990).** *Official Methods of Analysis*. 12th Edition, Washington, *DC, USA.*

**Bal, J.S., Bindra, A.S., Bajwa, G.S. and Minhas, P.P.S. (1990).** Studies on harvesting and handling of plum. *Acta Hort* **283 :** 179-88.

**Drake, S. T. and Spayd, S. E. 1983.** Influence of calcium treatment on Golden Delicious apple quality. *J. Fd. Sci.* **48 :** 403 – 05.

**Dundar, O., Kuden, A. B. and Dennis, F. G. Jr. (1997).** Investigations on cold storage and post harvest physiology of J. H. Hale peach. *Acta. Hort.* **441**: 411 – 41.

**Kaushal Lal, B. B., Thakur, K. S. and Thakur, N. S. (1996).** Preliminary studies on use of new packages for packaging and Transportation of Starking delicious apples. *Ind. Fd. packer*: 27 – 32.

**Levy, D. and Poovaiah, B. W. (1979).** Effect of calcium infiltration of senescence of apples. *HortScience* **14 :** 466.

**Ochel, C. O., Basiouny, F. M. and Woods, F. M. (1993).** Calcium mediated post – harvest changes in storage ability and fruit quality of peaches. *Proc. Fla. State Hort. Soc.* **106**: 266 – 69.

**Radder, Y. B., Patil, H. B., Patil, D. R. and Mantur, S. M. 1998.** Studies on suitable package for transportation of 'ber' CV. Umran. *Adv. Agric. Res. India* **10**: 65 – 69.

**Robertson, J. A., Meredith, F. I., Horvat, R. J. and Senter, S. D. 1990.** Effect of cold storage and maturity on the physical and chemical characteristics and volatile constituents of peaches (cv. Cresthaven). *J. Agric. Food Chem.* **38**: 620 – 24.

**Rombaldi, C. V., Silva, J. A., Machado, L. D., Parussolo, A., Kaster, L. C., Girardi, C. L. and Danieli, R. 2001.** Harvesting stage and cold storage influences on the quality of Chiripa peaches (*Prunus persica* L.). *Ciencia. Rural* **31** : 19 – 25.

**Roy, S., Conway, W. S., Watada, A. L., Sams, L. E., Pooley, C. D. and Wergin, W. P. 1994.** Distribution of anionic sites in the cell wall of apple fruit after calcium treatment quantitation and visualization by a cationic colloidal gold probe. *Protoplasma.* **178** : 156 – 67.

**Thakur, N. S. and Lal, B. B. 1989.** Evaluation of plastic carton and corrugated fibre board carton vis-à-vis conventional wooden box for packaging and transportation of apple. *J. Fd. Sci. Technol.* **26**: 239 – 41.


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