International Journal of Agriculture, Environment & Biotechnology
Citation: IJAEB: 7(3): 635-638 September 2014
DOI Number: 10.5958/2230-732X.2014.01369.2

Agricultural Engineering

Effect of Modified Atmosphere Packaging on Storage of Baramasi lemon (*Citrus limon* (L.) Burm)

S.K. Jawandha*, Harminder Singh, Anita Arora and Jagjit Singh

Department of Fruit Science, Punjab Agricultural University, Ludhiana - 14004, Punjab, INDIA.

*Corresponding author : skjawandha@pau.edu

Paper No. 250 Received: June 18, 2014 Accepted: August 17, 2014 Published: September 18, 2014

Abstract

The harvesting period of winter crop of Baramasi lemon coincides with the cooler part of the year and there is often a glut like situation in the market at its peak harvest time. This results in low returns to the growers. A study was planned to enhance the storage life of baramasi lemon fruits and fruits were harvested at green mature stage along with small pedicel in the month of January. Only healthy fruits were dipped in 0.1% bavistin solution for 2 minutes and after shade drying fruits were packed (four fruits in each pack) in high density polyethylene (HDPE) and low density polyethylene (LDPE) bags. Fruits were also waxed with Citrashine wax in one treatment. Packed/treated fruits were packed in corrugated fibre board (CFB) boxes and kept at ambient conditions. Fruit samples were analysed after 20, 35 and 50 days of storage for various physico-chemical characteristics. Results revealed that fruits treated with bavistin @ 0.1% and packed in LDPE bags maintained the best fruit quality in terms of high sensory quality, juice content, acidity and low spoilage and physiological loss in weight during 50 days of ambient storage.

Highlights

Lemon fruits treated with bavistin @ 0.1% and packed in LDPE bags maintained the best fruit quality during storage.

Keywords: Baramasi lemon, storage, LDPE, HDPE and packaging**.**

Citrus fruits occupy an important position among the tropical and sub-tropical fruits of the world. In India mandarins, sweet oranges, lime and lemons grown commercially. In Asia India is also the largest producer of limes and lemons and it is considered to be probable place of origin of lemons (Bhattacharya and Dutta, 1956, Hayes, 1957 and Hodgson, 1961). Lemon cultivation is becoming more popular because of its utilization in more different ways than any other citrus fruits. Lime and lemon have high medicinal values, as these are source of antiscorbutic vitamin C. Lime and lemons are much more sensitive than other citrus fruits to extreme cold and heat. Baramasi lemon (*Citrus limon* (L.) Burm) is well adapted to agro-climatic conditions of Punjab and it bears twice a year, i.e. July-August and January-February with a sparse flowering and fruiting throughout the year. The harvesting period of winter crop coincides with the cooler part of the year and there is often a glut like situation in the market at its peak harvest time, due to the low fresh fruit consumption during winter. This results in low returns to the growers. Baramasi lemon are sensitive to low temperature, so it is difficult to store in the commercial cold stores which are generally operated at low temperature. There is a need to enhance the shelf-

life of baramasi lemon fruit at ambient conditions for its availability during the summer months. During the storage, the main factors governing storage life of fruits are weight loss and decay. Kawda and Kitagame (1988) reported that plastic film is one of the most powerful economic tool to minimize the weight loss. Polethylene seal packaging could significantly reduce weight loss and shrivelling, but the potential decay problem of sealed fruits need to be solved through chemicals. Keeping it in view the present study was planned to enhance the storage life of baramasi lemon fruits by the use of chemical and polyethylene packaging at ambient storage.

Materials and Methods

The fruits of Baramasi lemon were harvested at green mature stage along with small pedicel in the month of January. The bruised and diseased fruits were sorted out and healthy fruits were dipped in 0.1% bavistin solution for 2 minutes and after shade drying fruits were packed (four fruits in each pack) in high density polyethylene (HDPE) and low density polyethylene (LDPE) bags. Fruits were also waxed with Citra shine wax in one treatment (T_3). Experiment comprised five treatments viz; T_1- HDPE seal packaging, T_2-LDPE seal packaging, T_3-Wax coating, T_4-Control (Bavistin treated) and T_5 -Control (untreated) with three replications in each treatment. Packed/treated fruits were packed in corrugated fibre board (CFB) boxes and kept at ambient conditions. Fruit samples were analysed after 20, 35 and 50 days of storage for various physico-chemical characteristics. The physiological loss in weight of fruits was calculated on initial weight basis. The per cent loss in weight after each storage interval was calculated by subtracting final weight from the initial weight of the fruits and then converted into percentage value. The fruits were rated for sensory quality by a panel of five judges on the basis of external appearance of fruits, texture and flavour. A nine point 'Hedonic Scale' described by Amerine *et al.*, (1965) was used for its inference, as: 9 (extremely desirable), 8 (very much desirable), 7 (moderately desirable), 6 (slightly desirable), 5 (neither desirable nor undesirable), 4 (slightly undesirable), 3(moderately undesirable), 2 (very much undesirable), 1 (extremely undesirable). The spoilage percentage of fruits was calculated on number basis by counting the spoiled fruits in each replication and total number of fruits per replication. Whereas, acidity was determined by titrating 2 ml of juice against 0.1 N NaOH using phenolphthalein as the indicator (AOAC, 1990). The data obtained were subjected to statistical analysis by following method Factorial Completely Randomized Block Design as described by Singh *et al.*, (1998).

Results and Discussion

Physiological loss in weight (PLW) increased significantly with the advancement of storage period in all the treatments. During the entire storage period minimum PLW was recorded in HDPE packaging (fig.1). Ben-Yeshoshua (1985) explained that the reduction of physiological loss in weight in HDPE film sealed fruits was due to retardation in transpiration and respiration rate. The chemical coupled application coupled with HDPE sealing was effective in reducing weight loss. It might be due to blocking of lenticels, thereby reducing the rate of transpiration and respiration. Similar results were also observed by Jawandha *et al.,*(2012) in Kinnow mandarin when fruits were treated with sodium carbonate and packed in LDPE film before ambient storage.(Cohen *et al.,* 1990) also reported a significant reduction in weight loss with HDPE packaging in cold stored lemon fruits.

Sensory quality of fruits increased in all the treatments after 20 days of storage except control with Bavistin (@ 0.1%) and control fruits (fig. 2). After 50 days of storage significantly high sensory quality rating was recorded in LDPE seal packaging. Mean maximum sensory quality rating was also recorded in this treatment. The observed maximum sensory quality in LDPE sealed fruits may be due to better retention of quality parameters and high permeability of polyethylene to CO_2 than to O_2 diffusion. At the end of storage fruit kept unsealed showed unacceptable appearance and developed off- flavour. Uni-packaging with polyethylene in citrus fruits significantly prolongs the shelf life and maintains the storage quality Hussain *et al.*, (2004). Smilarly Kumar *et al.,* (2008) also found that kinnow fruits packed in bio-fresh films maintained better fruit quality and also enhanced the storage life under ambient conditions.

Juice percentage increased upto 35 days of storage in all the treatments, after that it decreased in waxed, control (bavistin @ 0.1%) and control (untreated) fruits. At the end of storage, significantly high juice percentage was

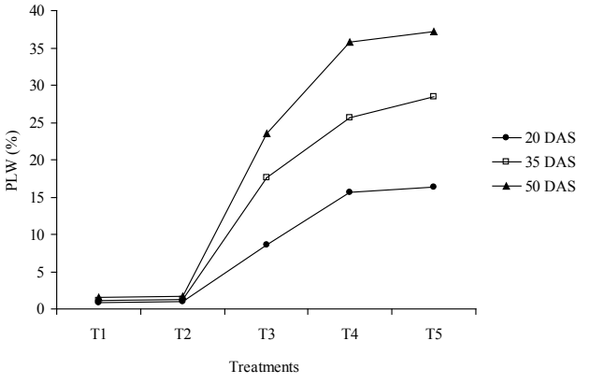

Fig. 1. Effect of packaging and wax coating on physiological loss in weight of Baramasi lemon fruits.

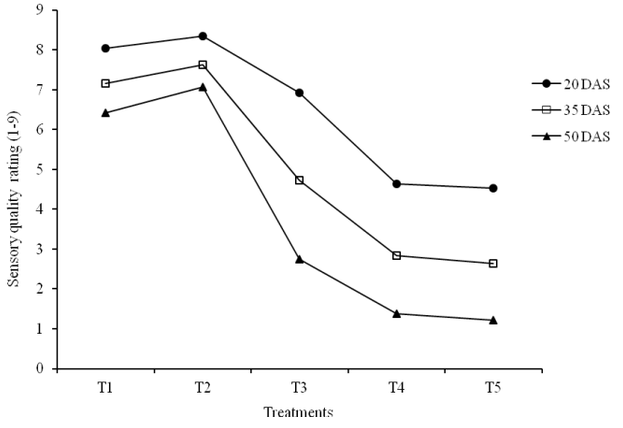

Fig. 2. Effect of packaging and wax coating on sensory quality rating of Baramasi lemon fruits .

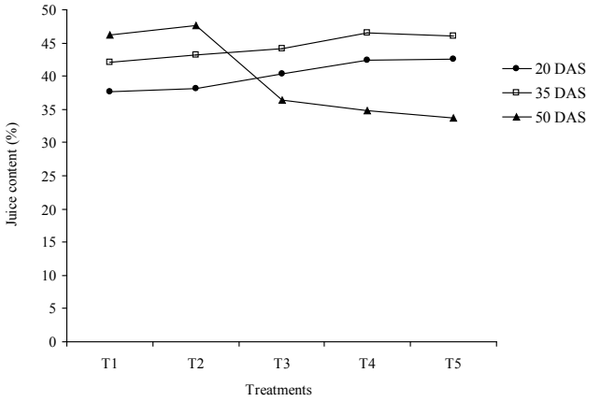

Fig. 3. Effect of packaging and wax coating on juice content of Baramasi lemon fruits

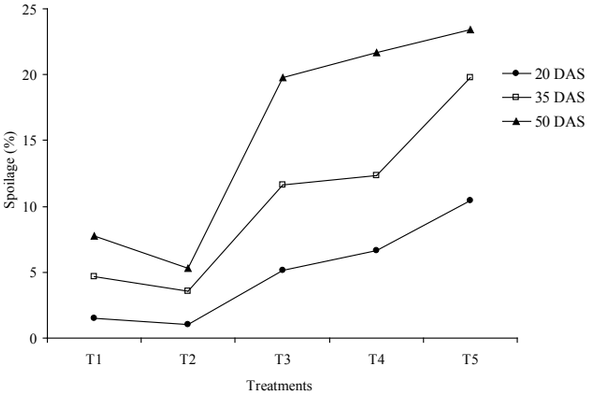

Fig. 4. Effect of packaging and wax coating on spoilage of Baramasi lemon fruits

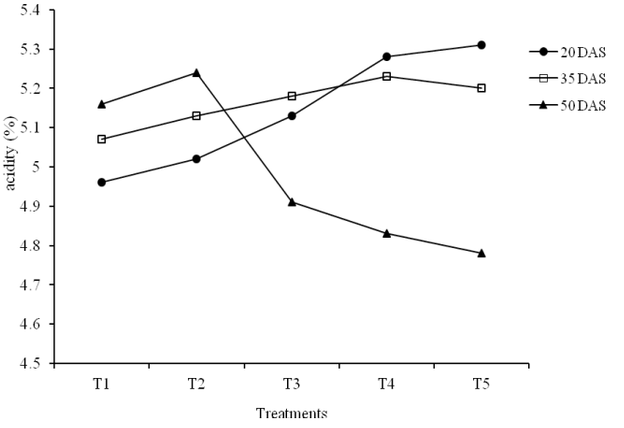

Fig. 5. Effect of packaging and wax coating on acidity of Baramasi lemon fruits.

recorded in LDPE packaging (fig. 3). Cohen *et al.*, (1990) reported that an increase in juice content occurs in lime and lemon during storage at ambient storage but not in other citrus fruits. The initial increase may be due to the fact that initial loss of moisture takes place from the peel only. The significant reduction in juice percentage with prolongation of storage was probably due to continuous dehydration of peel and juice (Kaur, 2000). Singh (2011) also found that film wrapping is effective over control treatment in lowering decrease in juice content during post harvest life of Kinnow mandarin.

Percent spoilage of fruits in all the treatments increased with the extension in storage period. It might be due to the weakening of the defence system against fungal attack.

At the end of storage minimum spoilage was recorded in LDPE packaging, followed by HDPE packaging (fig. 4). The maximum spoilage percentage was recorded in control fruits during the entire storage period. Mahajan *et al.*, (2006) found that Kinnow mandarin washed in chlorine solution followed by individually seal packaged in HDPE bags showed minimum spoilage after 60 days of storage. Ramin and Khoshbakhat (2008) observed that packaging of 'Key' acid lime fruits in High density polyethylene (HDPE) bags with micro perforations reduced decay when stored at room temperature .

Titratable acidity of fruits increased in all the treatments after 35 days of storage except T_4 and T_5 , where it showed a decline (fig. 5). At the end of storage an increase in acidity was recorded only in T_1 and T_2 and the maximum acid content was found in LDPE packaged fruits (T_2). Miller and Schomer (1939) reported that peel analysis of lemon after 11 and 13 weeks of storage showed increase in acidity and glucosides. Miller (1946) reported that when mature lemons still green in colour were held at 50°F developed more acid content. Similar results were also found by Borthakur and Kumar (2004) in Baramasi lemon during storage.

Conclusion

It can be summarized from the results that fruits treated with bavistin @ 0.1% and packed in LDPE bags maintained the best fruit quality in terms of high sensory quality, juice content, acidity and low spoilage and physiological loss in weight during 50 days of ambient storage.

References

Amerine, M.A., R.M. Pangborn, and E.B. Roessler. 1965. Principles of Sensory Evaluation of Food. Pp 5. Academic press, London.

AOAC.1990. Official and Tentative Mehods of Analysis, 15th Ed. Association of Official Agric Chemists, Washington, DC, USA.

Ben-Yehoshua, S.1985. Individual seal-packaging of fruits and vegetables in plastic film- A new post harvest technique. *Horticulture Science* **20**: 32-37.

Bhattacharya, S.C., and S. Dutta.1956. Classification of citrus fruits of Assam. Scientific monograph No. 20. ICAR, New Delhi.

Borthakur, P.K. and R. Kumar. 2004. Effect of plant extracts on biochemical constituents of Baramasi lemon fruits during storage. *Haryana Journal of horticultural Sciences* **33**: 58-61.

Cohen, E., S. Lurie, B.Shapiro, S. Ben Yehoshua, Y. Shslom and I. Rosenberger. 1990. Prolonged storage of lemons using individual seal packaging. *Journal of Horticultural Sciences* **58**: 593-598.

Hayes, W.B. 1957. Fruit Growing in India. 3rd ed. Kitabistan, Allahabad, India.

Hodgson, R.W. 1961 Classification and nomenclature of citrus fruits. *California Citrograph* **46**: 246-256.

Hussain, I., M. Asif, M. Ahmed, M. Khan and I. Shakir. 2004. effect of Uni-Packaging on the post harvest behavior of citrus fruits in N.W.F.P. *Pakistan Journal of Nutrition* **3**: 336-339.

Jawandha, S.K., P.S. Tiwana, and J.S. Randhawa. 2012 Effect of low density polythene (LDPE) packaging and chemicals on ambient storage of Kinnow. *Asian Journal of Food and Agro-Industry* **5**: 112-118

Kaur,S. 2000. Effect of high density polyethylene, chemicals and curing on quality and storage of Kinnow. Thesis M Sc (Pomology). Punjab Agricultural University, Ludhiana, Punjab, India.

Kawda, K. and H. Kitagame. 1988. Plastic-film packaged storage of citrus and some other fruits in Japan. *Proc 6th International Citrus Congress* **3**: 1555-1565, TelAviv, Israel.

Kumar, S., B.V.C. Mahajan, A.S. Dhatt and R. Kaur. 2008. Effect of polymeric films on the quality and storage behavior of Kinnow mandarin. *Indian Journal of Citiculture* **3**: 77-82.

Mahajan, B.V.C., A.S. Dhatt, and S. Kumar and L. Manohar. 2006. Effect of pre-storage treatments and packaging on the storage behavior and quality of Kinnow mandarin. *Journal of Food Science and Technology* **43**: 589-593.

Miller, E.V. 1946. Physiology of citrus fruits in storage. *The Botanical Review* **12**(7): 393-423.

Miller, E.V. and H.A. Schomer. 1939. Physiological studies of lemons in storage. *Journal of Agricultural Research* **59**: 601-608.

Ramin, A.A. and D. Khoshbakhat 2008. Effects of micro-perforated polyethylene bags and temperature on the storage quality of acid lime fruits. *American Eurasian Journal of Agricultural and Environmental Science* **3** : 590-594.

Singh, R. 2011. Effect of different packaging films and coatings on the shelf life and quality of Kinnow fruit. Thesis MSc (Pomology). Punjab Agricultural University, Ludhiana, Punjab, India.

Singh, S., M.L. Bansal, T.P. Singh and R. Kumar. 1998. Statistical Methods for Research Workers. Kalyani Publishers, New Delhi, India.