*Indian J. Hort. 69(2), June 2012: 284-287*

***Short communication***

# Shelf-life evaluation of *ber* (*Ziziphus mauritiana* Lamk.) cultivars

**Pranava Pandey* and J.N. Singh**

Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi 221 005

## ABSTRACT

**An experiment was conducted to study the effect of post-harvest treatments on shelf-life of *ber* fruits. Uniform, healthy, fully mature and ripe fruits of cultivars, namely, Gola, Banarasi Kadaka, Umran, Ponda and Seb were selected for the study. The collected fruits of different cultivars were divided in two parts for treatment and packed in micro-perforated polythene bags (100 gauge) and sealed. One part of the fruits was stored at a room temperature (20 ± 5°C) and second part of the fruits was stored in home refrigerator (4.4 - 7.2°C). The observations were recorded at four days interval up to 12th day of storage. Remarkable changes were noted on physiological weight loss, spoilage, organoleptic rating, total soluble solids, acidity and ascorbic acid. Fruit weight decreased continuously during storage in all treatments and minimum recorded in cv. Ponda in both conditions. Percentage spoilage increased continuously with duration of storage in all treatments. The least incidence (2.55%) was recorded in 'Ponda'. The TSS in fruits increased with duration in all the treatments. Refrigerated temperature decreased acidity as compared to room temperature. However, the cv. Ponda exhibited least changes in TSS and acidity. Conclusively, cv. Ponda has longer shelf-life under both storage conditions.**

**Key words:** Packaging material, storage conditions, shelf-life, quality, *Ziziphus mauritiana*.

*Be*r (*Ziziphus mauritiana* Lamk.) is one of the commercial fruit crops grown in the tropical and sub-tropical regions of the country. Among the fruit trees, *ber* cultivation requires the least inputs and care. *Ber* fruits are highly nutritive, which is untapped source of cheap nutrition. The shelf-life of *ber* is extremely short, hardly 2 to 4 days at ambient temperature conditions, thus early perishability of the fruit possesses a problem. Out of different *ber* cultivars, Umran is the late ripening, *i.e.* by middle of April. If fruit of this cultivar could be stored for 4 to 6 weeks, *i.e.* upto end of May, when peach, plum, grapes and mango start arriving then it could help regulate and extended supply of *ber* during lean period and also ensure remunerative prices to the growers. Several treatments like waxing, storage in perforated polythene bags, CFB boxes and storage in zero energy cool chamber, cold store etc., are known to extend the storage life of citrus, pear and peach fruit (Pod *et al*., 9). By protecting against moisture loss, bruising, mould growth and contamination, wax coating help in longer freshness of fruits (Sindhu *et al*., 13; Meena *et al.*, 5). Proper post-harvest treatment and packaging of fruits can, therefore, help to make available fruits during off season. Hence, this study was undertaken to evaluate the effect of low temperature and packaging material on storage behaviour of *ber* fruits.

Uniform and healthy fruits of five *ber* cultivars at colour turning stage (golden colour stage) of maturity were procured for the research work. Damaged and other undesirable fruits were sorted out and healthy fruits were selected for the experiment. One kg fruits of each cultivar namely Gola, Banarsi Kadaka, Umran, Ponda and Seb were taken from two trees and divided in two parts. Fresh fruits were washed and dried in shade. Thereafter, fruits were packed in micro-perforated polythene bags (100 gauge) with 2.5% perforation created by uniform punching. The temperature and relative humidity in the room conditions was measured using a digital thermo-hygrometer. One part of the fruits was stored at a room temperature (20 ± 5°C) and the second parts was stored in refrigerator (4.4 - 7.2°C). The fruits were stored at room temperature worked as control. All the treatments were replicated three times for recording the weight loss, decay loss and for sampling during experiment for chemical analysis. Observations were recorded at four day intervals, *i.e.* 4th day, 8th day and 12th day during storage period from the day of starting research work. The total soluble solid (TSS) was determined by using an Abbe's hand held refractometer. Ascorbic acid and acidity was determined by the method suggested by AOAC (1). The data was statistically analyzed by factorial completely randomized design (Gomez and Gomez, 3).

Fruit weight decreased continuously with the duration of storage in all treatments. The minimum physiological loss in weight (PLW) was recorded in cv. Ponda followed by Seb in both conditions, *i.e.* refrigerated and room temperature conditions. Irrespective of various treatments, the physiological

*Corresponding author's E-mail: pranava.iari@gmail.com

loss in weight increased gradually and progressively with prolonged storage. But this effect was more pronounced with control where loss in weight was much higher from 8 to 12 days. However, the rate of loss in weight was significantly higher in the fruits between 8 and 12 days of storage. The loss in weight of fruits decreased due to storage under refrigeration. The fruits of cv. Ponda showed the minimum PLW, whereas it was maximum in Gola, under both conditions. The reduction in weight loss may be due to the retardation of the process of evapo-transpiration and respiration. Reduction in losses of fruit weight and decay by wax coating and packaging has already been reported in different fruit crops (Sharma and Singh, 11; Sharma *et al*., 12). Pandey *et al*. (8) have also reported increase in PLW in apple following storage either at room temperature or at cold storage. Roy (10) has suggested that modification of atmosphere during fruit storage involves reduction in oxygenase and/or elevation of carbon dioxide concentration, which might have sustained the fruit weight and freshness *via* retardation of enzymatic activities, respiration and ethylene production. Irrespective of various treatments, the physiological loss in weight increased gradually and progressively with prolonged storage. However, this effect was more pronounced between 8 to 12 days of storage.

The overall organoleptic rating of the fruits was done by a panel of five judges on the basis of external appearance of fruits, texture, taste, and flavour, making use of a 9-point Hedonic scale (Amerine *et al*., 2). The organoleptic rating of the varieties (Naik and Rokhade, 7) revealed that varieties having medium to high vitamin C content, TSS and total sugars scored higher while lower values for any of these character resulted in lower score. The eating quality of refrigerated fruits was better than untreated fruits throughout the storage period.

The total soluble solids are important factor affecting quality of fruits. In our investigation, the TSS in *ber* fruits increased with the duration of storage in all the treatments. The maximum TSS was noted in 'Gola' (15.54%) followed by 'Banarasi Kadaka', 'Umaran', 'Ponda' and 'Seb'. Temperature also affects significantly. Total soluble solids are important factor affecting quality of fruits and in every cultivar it was different before and during storage. Total soluble solids increased in all varieties and it might be due to conversion of reserved starch and polysaccharides to soluble form of sugar as *ber* is a climacteric fruits. Similar results were also reported by Singh *et al*. (14).

The perusal of data presented in Tables 1-3, indicates that the maximum acidity was noted in cv. Umran, followed by Banarsi Kadaka, Seb, Gola, and Ponda fruits. In case of storage treatments, highest acidity was found at 12$^{th}$ day of storage and minimum was found at 8$^{th}$ day. Refrigerated temperature decreased the acidity as compared to room temperature. In general, the acidity of fruits decreased with duration of storage. The decrease in acidity could be accounted for that the organic acid might be utilized rapidly in respiration from pre-

**Table 1.** Effect of cold temperature on PLW and organoleptic rating of *ber* fruits during storage.

| Cultivar | Storage periods (days) 4 | 8 | 12 | Mean |
|---|---|---|---|---|
| | | PLW (%) | | |
| Gola | 61.22 | 56.57 | 53.04 | 56.94 |
| Banarsi Kadaka | 91.09 | 86.61 | 82.63 | 86.78 |
| Umran | 82.70 | 78.28 | 75.04 | 78.67 |
| Ponda | 53.43 | 49.39 | 45.88 | 49.56 |
| Seb | 48.65 | 45.52 | 41.30 | 45.15 |
| Mean | 67.42 | 63.27 | 59.58 | |
| $CD_{0.05}$ cultivar = 0.23 storage condition = 0.18 cultivar × storage condition = 0.41 | | | | |
| | | Organoleptic rating (1-100) | | |
| Gola | 78.00 | 69.50 | 56.50 | 68.00 |
| Banarsi Kadaka | 79.83 | 70.50 | 59.50 | 69.94 |
| Umran | 76.00 | 67.00 | 56.00 | 66.33 |
| Ponda | 84.00 | 77.00 | 68.00 | 76.33 |
| Seb | 73.00 | 66.00 | 49.00 | 62.66 |
| Mean | 78.16 | 70.00 | 57.80 | |
| $CD_{0.05}$ cultivar = 0.67 storage conditions = 0.52 cultivar × storage condition = 1.17 | | | | |

**Table 2.** Effect of cold temperature on TSS, acidity and ascorbic acid contents of *ber* fruits during storage.

| Cultivar | Storage periods (days) | 8 | 12 | Mean |
|---|---|---|---|---|
| | 4 | | | |
| | | TSS (%) | | |
| Gola | 15.12 | 15.41 | 16.11 | 15.54 |
| Banarsi Kadaka | 13.97 | 14.30 | 15.12 | 14.46 |
| Umran | 12.96 | 13.62 | 14.76 | 13.78 |
| Ponda | 6.06 | 6.96 | 7.94 | 6.96 |
| Seb | 5.47 | 5.80 | 6.78 | 6.01 |
| Mean | 10.72 | 11.20 | 12.14 | |
| $CD_{0.05}$ cultivar = 0.16 storage condition = 0.12 cultivar × storage condition = 0.28 | | | | |
| | | Acidity (%) | | |
| Gola | 0.19 | 0.18 | 0.18 | 0.18 |
| Banarsi Kadaka | 0.20 | 0.21 | 0.21 | 0.21 |
| Umran | 0.33 | 0.31 | 0.33 | 0.32 |
| Ponda | 0.16 | 0.12 | 0.16 | 0.15 |
| Seb | 0.19 | 0.16 | 0.19 | 0.18 |
| Mean | 0.22 | 0.20 | 0.22 | |
| $CD_{0.05}$ cultivar = 0.006 storage condition = 0.005 cultivar × storage condition = 0.011 | | | | |
| | | Ascorbic acid (mg/100 g of pulp) | | |
| Gola | 61.22 | 56.57 | 53.04 | 56.97 |
| Banarsi Kadaka | 91.09 | 86.61 | 82.63 | 86.78 |
| Umran | 82.70 | 78.28 | 75.04 | 78.67 |
| Ponda | 53.43 | 49.39 | 45.88 | 49.56 |
| Seb | 8.65 | 45.52 | 41.30 | 45.15 |
| Mean | 67.42 | 63.27 | 59.58 | |
| $CD_{0.05}$ cultivar = 0.23 storage condition = 0.18 cultivar × storage condition = 0.41 | | | | |

climacteric to post-climacteric stage. Similar pattern in change of acidity level was reported by Singh *et al*. (14) in peach. The higher retention of acidity in fruits packed in sealed polythene bags, reducing respiration, delayed senescence and slower ripening as found several other fruits (Nain *et al*., 6). In case of storage treatments, highest acidity was found at 12$^{th}$ day of storage, while minimum was estimated at 8th day of storage.

Data pertaining to vitamin ‘C’ content of *ber* fruits presented in Table 2 showed that the highest content was observed in ‘Banarsi Kadaka’ (86.781 mg/100 g). Irrespective of cultivars prolonged storage showed decreasing trend in ascorbic acid content in fruits. During storage at room temperature, vitamin ‘C’ content decreased significantly than refrigerated conditions. In freshly harvested fruits, the highest vitamin 'C' (ascorbic acid) content was observed in all cultivars. The vitamin 'C' content of *ber* fruits gradually decreased during storage period and lowest level recorded in ‘Seb’. The decrease in vitamin 'C' content upon prolonged storage might be due to oxidation phenomenon (Mapson, 4). Similar results were also reported by Singh *et al.* (14) in case of guava fruits.

Hence, on the basis of investigation, it was concluded that cultivar Ponda had longer shelf-life followed by Seb, Umran, Gola and Banarasi Kadaka under refrigerated condition. While, based on quality aspects in terms of total soluble solids, acidity and ascorbic acid content, Banarsi Kadaka was best followed by Gola, Umran, Ponda and Seb. Hence, it can be suggested to *ber* growers so as to provide better opportunity to sell the produce in distant markets and thereby fetching good price.

## REFERENCES

1. A.O.A.C. 1990. *Official Methods of Analysis of Association of Analytical Chemists* (13$^{th}$ Edn.), Washington, D.C. USA.

2. Amerine, M.A., Pangborn, R.M. and Roessler,E.B. 1965. *Principles of Sensory Evaluation of Food.* Academic Press, London, pp. 5.

3. Gomez, K.A. and Gomez, A.A. 1984. *Statistical Procedures for Agricultural Research.* John Wiley and Sons Inc., New York.

4. Mapson, L.W. 1970. Vitamins in fruit, stability of L-ascorbic acid. **In**: *Biochemistry of Fruits and their Products*, Vol. I, Hulme, A.C. (Ed), Academic Press, London, pp. 376-77.

5. Meena, H.R., Kingsly, A.R.P. and Jain, R.K. 2009. Effect of post harvest treatments on shelf-life of *ber* fruits. *Indian J. Hort.* **66**: 58-61.

6. Nain, A.S., Sindhu, S.S. and Kumar, J. 1999. Increased shelf-life of grapes (*Vitis vinifera* L.) by different storage conditions and anti-fungal fumigant. *Haryana J. Hort. Sci.* **28**: 45-48.

7. Naik, K.R. and Rokhade, A.K. 1997. Organoleptic evaluation of *ber* cultivars under different storage conditions. *Karnataka J. Agril. Sci.* **10**: 378-82.

8. Pandey, G., Verma, M.K. and Tripathi, A.N. 2006. Studies on storage behaviour of apple cultivars. *Indian J. Hort*. **63**: 368-71.

9. Pod, K.M., Weaver, R.J. and Kleiwer, K.M. 1972. The effect of growth regulators on changes in fruits of Thompson Seedless during storage. *J. American Soc. Hort. Sci.* **97**: 67-70.

10. Roy, S.K. 2001. Storage of tropical and subtropical fruits. *Indian J. Hort*. **58**: 164-69.

11. Sharma, R.R. and Singh, Dinesh 2010. Effect of different packaging materials on shelf-life and quality of apple during storage. *Indian J. Hort.* **67**: 94-101.

12. Sharma, R.K., Kumar, Jitender and Pal, Vijai 2007. Effect of polythene and natural plant extracts on shelf-life of Kinnow. *Indian J. Hort.* **64**: 87-89.

13. Sindhu, G.S., Dhillon, W.S. and Mahajan, B.V.C. 2009. Effect of waxing and packaging on storage of pear cv. Punjab Beauty. *Indian J. Hort*. **66**: 239-44.

14. Singh, Akath, Yadav, D.S., Patel, R.K. and Bhuyan, Mousumi. 2007. Effect on shelf-life and quality of passion fruit with polythene packaging under specific temperature*. J. Fd. Sci. Tech*. **44**: 201-4.

Received: August, 2011; Revised: February, 2012; Accepted: May, 2012