DOI : 10.5958/0974-0112.2017.00093.7

Indian J. Hort. 74(3), September 2017: 475-477

Short communication

Enhancement of shelf-life of coriander leaves through storage in a novel high humidity storage box

S. Bhuvaneswari*, G. Senthil Kumaran, H.B. Raghupathi and H.S. Oberoi
ICAR-Indian Institute of Horticultural Research, Hessaraghatta Lake (PO), Bengaluru 560 089, Karnataka

ABSTRACT

A high humidity storage box was designed, fabricated and evaluated for freshness retention of coriander leaves. Coriander leaves in bunches were stored in storage box as well as in non-ventilated plastic crates covered with wet gunny cloth (control). Periodical observations on shelf-life, freshness and moisture loss were recorded. At the end of the storage period, the samples were analysed for quality. Coriander leaves stored in novel high humidity storage box had a shelf-life of 72 h under ambient conditions (Temp: 26-28°C, RH: 58%) as compared to 48 h in control. Samples stored in the acrylic boxes showed higher freshness retention compared to those stored in commercial practice. Moreover, coriander leaves stored in high humidity storage box had higher freshness, lesser physiological loss in weight (PLW%) (12%) and better retention of ascorbic acid (58.4%), iron (99%) and calcium (64%) compared to control. Therefore, this study showed that novel, custom designed high humidity storage box hold potential for storage and shelf-life extension of coriander leaves.

Key words: Coriander leaves, high humidity storage box, plastic crate, shelf-life.

Coriander leaves are highly perishable and their shelf-life in terms of loss in freshness, turgidity, weight loss *etc*. is only 24h with a possibility of reaching 48 h depending on the storage conditions. However, in most of the developing tropical countries like India, coriander is supplied by the push cart vendors or by vegetable vendors in retail vegetable markets and only a small part is sent to stores having refrigeration facility. In order to retain freshness and maintain a good visual perception of coriander, the common practice is to cover the leafy vegetables with wet gunny cloth and sprinkle water to maintain high relative humidity (RH%). This process causes spoilage of the produce due to condensation of water on the produce, increase in microbial proliferation with chances of presence of coli form bacteria on account of poor quality. Keeping this in view, to retain freshness with minimal spoilage of the produce, a high humidity vegetable storage box was specially designed, fabricated and tested with coriander leaves.

A high humidity storage box of size 900 mm × 600 mm × 150 mm (L×B×H), made of transparent acrylic sheet of 6 mm thickness with ability to maintain RH of more than 90% was fabricated. The box was divided into three equal chambers using acrylic sheet of 5 mm thickness with partition having perforation of 3 mm diameter for the cross ventilation. In each chamber, coriander leaves (cv. Hessaraghatta Local) in bunches (4 bunches weighing 0.5 kg each) were placed. The coriander leaves in bunches (4 bunches weighing 0.5 kg each) was placed in plastic crates measuring 400 × 300 × 150 mm covered with wet gunny bag was taken as control. Experiments were conducted at ambient temperature (Av. temp: 26-28°C, RH 58%). Samples were analysed for physiological loss in weight (PLW%), ascorbic acid content (Ranganna, 5), mineral content (Ca, Mg, Fe, Mn and Zn) (Bhargava and Raghupathi 1). Sensory analysis was done to assess the quality of fresh coriander leaves at the end of the storage period for colour, freshness, flavour/ aroma and overall acceptability of the samples with a panel of 15 untrained judges in 5-point hedonic scale (Harry and Hildegarde, 4). Microbial analysis of the coriander leaves at end of the storage period was determined by pour plate technique (Downes and Lto, 3). All experiments were statistically analyzed using completely randomised design using WASP 2.0 software (Bhuvaneswari *et al*., 2).

As evident, there was gradual increase in PLW (%) of coriander leaves during storage in both the storage systems (Fig. 1a). However, the weight loss was higher in plastic crate at the end of 48 h (15.13%) compared with those kept in storage box, which had lower weight loss (12.87%) at 72 h of storage. The coriander leaves stored in plastic crate withered and lost its acceptability in 48 h; whereas the samples in storage box were fresh and acceptable upto 72 h.

A drastic reduction in the moisture content of coriander leaves during storage in storage box as compared to control during storage was observed. In the storage box the moisture reduction was 0.07, 1.16 and 1.32% after 24, 48 and 72 h of storage,

*Corresponding author's E-mail: bhuvana@iihr.res.in

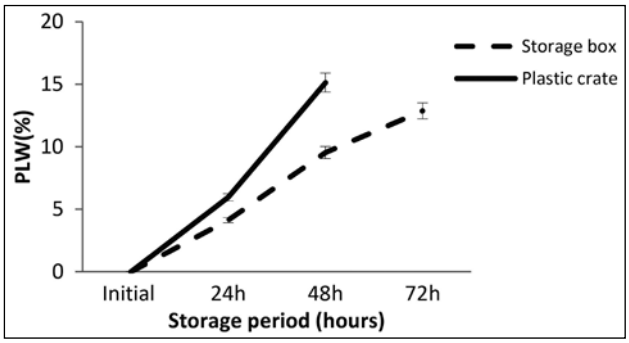

Fig. 1a. Physiological loss in weight (%) of coriander leaves during storage

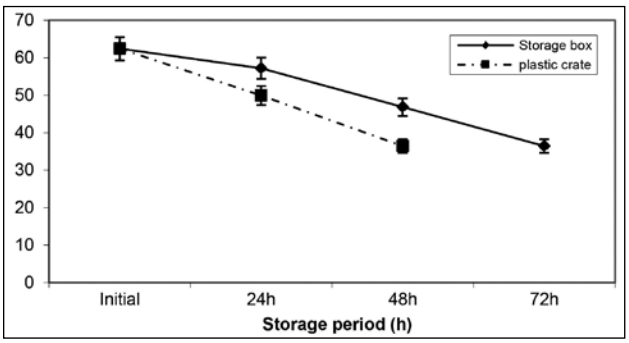

Fig. 1c. Change in ascorbic acid content of coriander leaves during storage.

respectively, where the moisture reduction of the samples placed in plastic crate was 2.11 and 3.2% after 24 and 48 h of storage respectively (Fig. 1b). The samples in the plastic crate lost freshness rapidly as compared to those stored in storage box after 48 h of storage. It was found that moisture retention was higher in samples stored in storage box than in plastic crate. In order to maintain the sensory qualities such as texture and appearance during storage period it is important for fresh green leafy vegetables to remain well hydrated. Latif and EL-Aal (6) noticed the significant reduction in moisture content of fresh coriander leaves in polythene pack after 8 days of storage at 5°C.

Change in ascorbic acid content of the samples kept in storage box as well as control during storage is presented in Fig. 1c. A reduction in ascorbic acid content in both the cases was observed. However, higher reduction was noted in plastic crate covered with moist gunny cloth in 48 h (36.4%) as compared to those kept in storage box which had lower reduction in ascorbic acid content (46.8%) in 48 h of storage. The retention of ascorbic acid content in storage box was 58.4% even after 72 h of storage. It was found from the study that samples kept in storage box retained more ascorbic acid content compared to those in plastic crate. At the end of storage, coriander leaves retained 58.4% of the initial ascorbic acid content in storage box samples. Samples placed in storage box did not have much ascorbic acid degradation during storage. Earlier, Zepplin and Elvehjein (8) found that leafy vegetables held at 6°C lost 10% of their AA content in 6 days; while those held at room temperature lost 20% in only 2 days.

From the Fig. 1d, it was observed that chlorophyll content of stored in both storage box and plastic crate continuously decline during storage. The loss was at lower level (1.3%) for the samples stored in storage box after 72 h as compared to those stored in plastic crates (1.67%) after 48 h. Chlorophyll degradation is accompanied by the loss of colour during storage. This loss of chlorophyll is responsible for the yellowing of leaves. Since the chlorophyll degradation is less in sample stored in storage box, yellowing of leaves was less even after 72 h of storage. Similar findings were noted by Latif and EL-Aal (6) where there was slight decrease in chlorophyll content in fresh coriander leaves after 5-8 days.

Coriander leaves are a rich source of minerals such as, iron, potassium and calcium. At the end of storage period of 72 h, coriander leaves in storage box had calcium 0.785 g/100 g, magnesium 0.403 mg/100 g and iron 6.81 mg/100 g (Table 1).

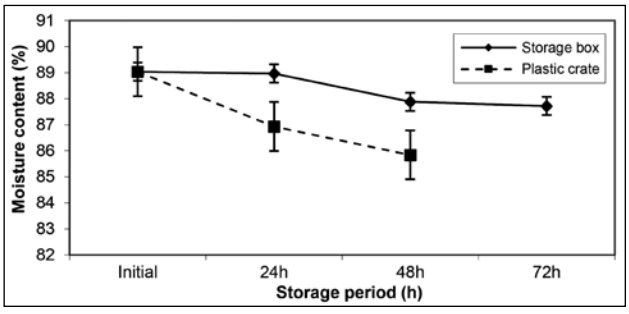

Fig. 1b. Change in moisture content of coriander leaf during storage.

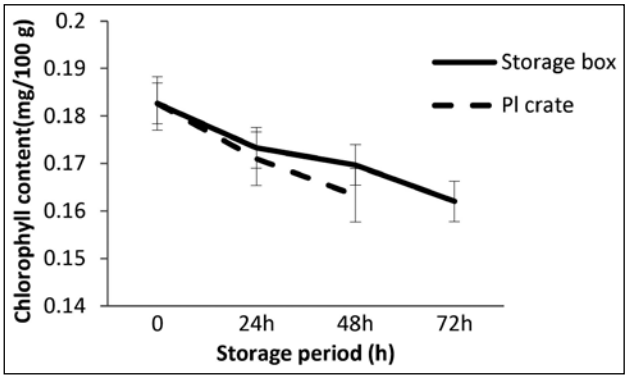

Fig. 1d. Change in chlorophyll content of coriander leaves during storage.

Table 1. Mineral composition of coriander leaves during storage.

Mineral nutrient	Quantity (mg/100 g)
Phosphorous	56
Potassium	22
Calcium	785
Magnesium	403
Iron	6.81
Zinc	3.96
Copper	1.33

The coriander leaves kept in the plastic crate withered and became unmarketable after 48 h of storage at ambient conditions. Sensory evaluation of the samples which had a storage life of 72 h in storage box under ambient conditions was done to determine the freshness and marketability of the coriander leaves. The coriander leaves had its characteristic light green colour with no yellowing of leaves. The average sensory score for colour from a panel of 15 semi trained judges was 4.5/5 (Fig. 1e). which corresponds to the very good rating. Flavour retention in storage box was 4.14 (between good and very good) in 5-point hedonic scale. Overall acceptability is the important factor which determines whether the samples after storage have consumer acceptability. The overall acceptability of the sample had a sensory score of 4.32 out of 5. Similar findings on retention of colour and freshness of coriander leaves upto 72 h in film package in low temperature storage was reported by Luo *et al.* (7). Microbial analysis of the coriander leaves showed that the total plate count is 2×10^4 units and the leaves are microbially safe at the end of the storage period of 3 days. Yeast and molds were in very low numbers in coriander leaves kept in storage box (data not shown). Similar findings were reported for fresh cut coriander leaves where leaves after sequential wash, packaged in polythene bags had reduced microbial count during storage (Luo *et al.*, 7).

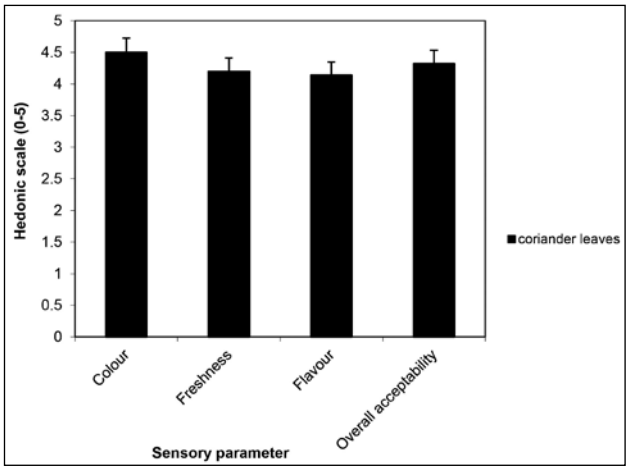

Fig. 1e. Sensory score of coriander leaves during storage.

The coriander leaves placed in high humidity storage box had a shelf-life of 72 h, whereas those placed in plastic crate covered with wet gunny cloth had a shelf-life of 48 h only under similar conditions. It was observed that the storage box retained high humidity more than 90% RH inside the box; which is very much essential for shelf-life extension at under ambient conditions with prevailing temperature 25-28°C and RH 55-62%. for leafy vegetables.

REFERENCES

1. Bhargava, B.S. and Raghupathi, H.B. 2005. Analysis of plant material for macro and micronutrients. **In**: *Methods of Analysis of Soils, Plants, Waters and Fertilizers*, H.L.S. Tandon (Ed), FDCO, New Delhi, pp. 49-82.

2. Bhuvaneswari, S., Narayana C.K., Udhayakumar, R. and Veeregowda, R. 2015. Effect of packaging and storage temperature on shelf life of minimally processed onion (*Allium cepa* L.). *J. Hort. Sci*. **10**: 216-19.

3. Downes, F.P. and Ito, K. 2001. Pour plate technique. **In**: *Compendium of Methods for the Microbiological Examination,* American Public Health Association, pp. 7-62.

4. Harry, L. and Hildegarde, H. 2010. *Sensory Evaluation of Food Principles and Practices*, Springer-Verlag, New York, pp. 19-57.

5. Ranganna, S. 2000. *Manual of Analysis of Fruit and Vegetable Products,* Tata McGraw-Hill Pub. Co. Ltd., New Delhi, pp. 10-105.

6. Latif, S.S. and Abdel-Aal, H.A. 2007. Mineral profile-shelf life extension and nutritive value of fresh green leafy vegetables consumed in Egypt. *African Crop Sci. Conf. Proc.* **8**: 1817-26.

7. Luo, Y., James, L., McEvoy, Wachtel, M.R., Kim, J.G. and Huang, Y. 2004. Package atmosphere affects post-harvest biology and quality of fresh-cut cilantro leaves. *HortSci.* **39**: 567-70.

8. Zepplin, M. and Elvehjein, C.A. 1944. Effect of refrigeration on retention of ascorbic acid in vegetables. *Food Res*. **9**: 100-11.

Received : January, 2017; Revised : July, 2017;
Accepted : August, 2017