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# Effect of storage and packing materials on shelf life of bottle gourd (*Lagenaria siceraria* L.) cv. PUSA NAVEEN

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## ABSTRACT

An experiment was conducted on "Effect of storage and packaging materials on shelf life of bottle gourd (*Lagenaria siceraria* L.) cv. PUSA NAVEEN" during May 2007 and found that there was an increase followed by subsequent decrease in TSS content with corresponding decrease in acidity upon prolonged storage of bottle gourd fruits under all the storage conditions irrespective of packaging material treatments. Physiological loss in weight was increased with the subsequent increase in storage in all packaging material treatments and storage conditions. The per cent of physiological loss in weight, TSS and acidity was increased at slower rate and shelf life was recorded maximum in ZECC storage condition and also in polyethylene bag (100 gauge and 2% vent) + CFB box packing.

**Key words :** Bottle gourd, Packaging materials, Shelf life, Storage, ZECC

Cucurbitaceous family is a large group of vegetable crops, cultivated extensively in tropical and subtropical parts of the world. This group consists of wide range of the vegetables *viz*., cucumbers, melons, pumpkin, squashes and gourds. Among gourds, bottle gourd (*Lageneria siceraria* L.) commonly known as *lauki, kaddu, ghiya* or *doodhi* is grown extensively in India. Bottle gourd is cultivated as a field crop in *Kharif* and summer seasons throughout the country. However, it is grown throughout the year particularly in areas where winters are mild as in different regions of Gujarat. The post-harvest losses in bottle gourd occur due to lack of proper packaging materials, improper handling during long distance transport and microbial spoilage. Extension of shelf life can be possible by checking the rate of respiration, transpiration and microbial infection. Though packaging forms the last link in the chain of production, storage, marketing and distribution, it still plays an important role in delivering the contents safe for the "farm gate to the consumer plate." However, no systematic studies have so far been reported on the existing shelf life of bottle gourd. There is paucity of information on storage structure for storage of bottle gourd to maintain quality during storage.

## MATERIALS AND METHODS

An experiment was conducted at the Department of Horticulture, N.M. College of Agriculture, Navsari Agricultural University, Navsari (Gujarat) during the month of May 2007. The treatments comprised of three different storage conditions *viz.*, Zero energy cool chamber (ZECC) at 22.36-24.73$^0$C and 92.66-97.36% RH, room temperature (26.83-34.03$^0$C and 50.33-73.66% RH) and basement storage (24.62-32.17$^0$C and 52.11-75.33% RH) with packaging materials *viz.*, Polyethylene bag (100 gauge and 2% vent), CFB box, News paper, Polyethylene (100 gauge and 2% vent) + CFB box, News paper + CFB box and Control (without packaging). The experiment was laid out in a Completely Randomized Design with Factorial concept (FCRD) along with three repitation. The physico-chemical observations are recorded at an every two days intervals upto 14$^{th}$ day.

## RESULTS AND DISCUSSION

The results obtained from the present investigation are presented below :

### Effect of storage conditions :

In the present investigation, bottle guards were stored at three different storage conditions *viz.*, at RT (26.83-34.03$^0$C and 50.33-73.66%RH), BS (24.62-32.17$^0$C and 52.11-75.33% RH) and ZECC (22.36-24.73$^0$C and 92.66-97.36%RH). The loss in quality of bottle gourd fruit increased with the advancement of storage period under all the storage conditions. The physiological loss in weight of bottle gourd fruits was constantly less in ZECC storage condition as against constantly high at room temperature and basement storage (Table 1). It was noted that the physiological weight loss of bottle gourd fruits during initial storage period was constantly low in ZECC storage as against constantly high at RT storage condition. It was interesting to note that by the end of 14th day, there was 9.50 per cent physiological weight loss recorded in fruits stored at RT as against only 5.73 per cent in fruits stored in ZECC. From this, it could be inferred that higher humidities and low temperatures in ZECC were significantly effective in keeping down the physiological weight loss due to which it slowed down the metabolic activities like respiration and transpiration. Whereas at RT and basement storage has higher temperatures and low relative humidity resulted in rapid transpiration and respiration. Reduced weight loss in ZECC storage has been reported by Waskar *et al*. (1999) for bottle gourd fruits.

The initial rise of TSS fall afterwards was observed under all the storage conditions. But the increased rate of TSS was found to be faster at RT and BS (Table 1). Higher temperature and low humidity resulted in faster utilization of soluble solids at RT resulted in shorter shelf life of bottle gourd fruit. These changes were found to be at slower rate when fruits were stored in ZECC. Initial rise in TSS (%) might be due to conversion of starch into sugars while the later decrease was due to consumption of sugar for respiration during storage. Similar results have also been reported by Waskar *et al*. (1999) in bottle gourd and Pal and Roy (1988) in carrot, while at RT storage condition similar report was given by Gaur and Bajpai (1982) in tomato.

The acidity content declined with increase in storage period under all the storage conditions (Table 1). But this decline was at a faster rate at RT and basement storage. Decline in acidity at faster rate could be because of higher rate of respiration at RT and basement storage. During respiration, the fruit cells use organic acid as respiratory substrate (Wenjer, 1967). The decline in acidity may be attributed to utilization of acids in the process of respiration during ripening in the presence of reduced supply of sugars as a substrate of respiration due to lowest rate of starch degradation during ripening.

It could be inferred (Table 2) that ZECC was more effective in extending the storage life of bottle gourd fruit as compared to RT storage and basement storage due to low temperature coupled with high humidity prevailing in cool chamber.

### Effect of various packaging materials:

The physiological loss in weight of bottle gourd fruits was found to be the highest in control fruit and lowest in fruits packed in ventilated polyethylene bag+CFB box among all the packaging treatments (Table 1). The physiological loss in weight in ascending order was observed in treatments like polyethylene+CFB box polyethylene, news paper+CFB box, news paper, CFB box and control under all storage environments. It could be inferred that reduced physiological loss in weight was due to use of polythene packaging in combination with CFB box as it increases the $CO_2$ level in fruit environment and controls the transpiration and respiration of bottle gourd fruit during storage. On the contrary, the physiological weight loss was found to be the highest in control fruit. Similar results have also been reported by Waskar *et al*. (1999) in bottle gourd and Waskar and Nikam (1998) in sapota.

As the storage period extended, the total soluble solids increased continuously till they reached the peak (Table 1). The increase in TSS of bottle gourd fruit could be attributed to the conversion of starch and other insoluble carbohydrates into soluble sugars. TSS content of fruits and vegetables increased markedly during storage and then decreased (Pal and Roy, 1988) in carrot. The total soluble solid was further utilized for respiration thus showing the lower content of these in fruit tissue.

The rise and fall in TSS was found to be delayed in polyethylene + CFB box, but rapid in control fruit among all the packaging treatments. The rate of rise and fall in TSS in increasing order in different packaging treatments such as polyethylene + CFB box, polyethylene, news paper + CFB box, news paper, CFB box and control was observed throughout the storage period. The values of TSS indicated that polyethylene + CFB box packed fruits retained more TSS. Similar results have also been reported by Waskar *et al*. (1999) in bottle gourd and Waskar and Nikam (1998) in sapota.

The acidity of fruits generally decreases with the advancement of storage period (Table 1). The same was confirmed in the present investigation. Decrease in acidity may be due to utilization of acids during respiration (Salunkhe and Desai, 1984).

Higher level of acidity may be due to lower rate of respiration as noticed in polyethylene + CFB box packed fruits. In addition, polyethylene + CFB box packed fruits were better in quality even with extended storage life. However the ascending order for the rate of decrease in acidity of bottle gourd fruit in different packaging treatments such as polyethylene + CFB box polyethylene, news paper + CFB box, news paper, CFB box and control was observed during the present investigation. Similar findings were also reported by Waskar *et al*. (1999) in bottle gourd and Waskar and Nikam (1998) in sapota.

The shelf life (Table 2) extended when fruits of bottle guard were stored in ZECC (20.14 days) and packed with packaging material *i.e.* polythelene+CFB box (18.03

**Table 1 : Effect of storage and packaging materials on physiological loss in weight (%), total soluble solids (%) and acidity (%) of bottle gourd cv. Pusa Naveen**

| Treatments | Physiological loss in weight (%) | | | | | | | Total soluble solids (%) | | | | | | | Acidity (%) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Storage period (No. of days) | | | | | | | | | | | | | | | | | | | | |
| | 2nd | 4th | 6th | 8th | 10th | 12th | 14th | 2nd | 4th | 6th | 8th | 10th | 12th | 14th | 2nd | 4th | 6th | 8th | 10th | 12th | 14th |
| Storage treatment (C) | | | | | | | | | | | | | | | | | | | | | |
| $C_1$ | 0.899 | 1.670 | 2.393 | 3.838 | 4.522 | 5.160 | 5.728 | 3.611 | 3.745 | 3.865 | 4.004 | 4.096 | 4.215 | 4.317 | 0.113 | 0.108 | 0.104 | 0.100 | 0.097 | 0.093 | 0.091 |
| $C_2$ | 1.975 | 3.183 | 4.520 | 5.761 | 7.192 | 8.388 | 9.505 | 3.758 | 3.878 | 4.013 | 4.186 | 4.283 | 4.197 | 3.966 | 0.099 | 0.095 | 0.092 | 0.086 | 0.081 | 0.077 | 0.070 |
| $C_3$ | 1.872 | 3.082 | 4.448 | 5.621 | 7.076 | 8.238 | 9.351 | 3.704 | 3.836 | 3.960 | 4.151 | 4.85 | 4.267 | 4.016 | 0.101 | 0.097 | 0.093 | 0.087 | 0.083 | 0.079 | 0.071 |
| S.E. ± | 0.062 | 0.087 | 0.056 | 0.075 | 0.096 | 0.104 | 0.132 | 0.034 | 0.036 | 0.025 | 0.024 | 0.023 | 0.029 | 0.027 | 0.0012 | 0.0010 | 0.0010 | 0.0011 | 0.0011 | 0.0011 | 0.0009 |
| C. D. (P=0.05) | 0.179 | 0.248 | 0.159 | 0.215 | 0.275 | 0.298 | 0.381 | 0.097 | 0.104 | 0.071 | 0.070 | 0.067 | 0.056 | 0.079 | 0.0035 | 0.0030 | 0.0029 | 0.0034 | 0.0031 | 0.0032 | 0.0027 |
| Packaging material treatments (P) | | | | | | | | | | | | | | | | | | | | | |
| $P_1$ | 1.126 | 1.933 | 3.272 | 4.46 | 5.581 | 6.226 | 6.746 | 3.643 | 3.733 | 3.836 | 4.013 | 4.180 | 4.213 | 4.173 | 0.113 | 0.108 | 0.103 | 0.097 | 0.092 | 0.090 | 0.084 |
| $P_2$ | 1.823 | 3.102 | 4.153 | 5.532 | 6.833 | 7.842 | 9.201 | 3.760 | 3.884 | 4.060 | 4.220 | 4.321 | 4.215 | 4.076 | 0.095 | 0.091 | 0.088 | 0.083 | 0.084 | 0.075 | 0.068 |
| $P_3$ | 1.846 | 2.947 | 3.885 | 5.368 | 6.564 | 7.942 | 8.970 | 3.716 | 3.813 | 3.933 | 4.152 | 4.290 | 4.206 | 4.091 | 0.101 | 0.097 | 0.094 | 0.091 | 0.083 | 0.081 | 0.076 |
| $P_4$ | 0.878 | 1.823 | 3.066 | 4.306 | 5.220 | 5.862 | 6.420 | 3.576 | 3.683 | 3.763 | 3.923 | 4.080 | 4.253 | 4.175 | 0.118 | 0.114 | 0.111 | 0.106 | 0.102 | 0.098 | 0.093 |
| $P_5$ | 1.623 | 2.600 | 3.676 | 4.628 | 5.740 | 6.790 | 7.764 | 3.666 | 3.786 | 3.873 | 4.006 | 4.226 | 4.231 | 4.087 | 0.108 | 0.104 | 0.101 | 0.095 | 0.091 | 0.087 | 0.080 |
| $P_6$ | 2.195 | 3.464 | 4.750 | 6.143 | 7.641 | 8.913 | 10.06 | 3.782 | 4.020 | 4.210 | 4.368 | 4.233 | 4.141 | 3.995 | 0.090 | 0.086 | 0.083 | 0.077 | 0.073 | 0.068 | 0.063 |
| S.E. ± | 0.088 | 0.122 | 0.079 | 0.106 | 0.135 | 0.147 | 0.187 | 0.048 | 0.051 | 0.035 | 0.034 | 0.033 | 0.027 | 0.039 | 0.0017 | 0.0015 | 0.0014 | 0.0017 | 0.0010 | 0.0016 | 0.0013 |
| C. D. (P=0.05) | 0.252 | 0.351 | 0.226 | 0.304 | 0.389 | 0.422 | 0.539 | 0.137 | 0.148 | 0.101 | 0.099 | 0.095 | 0.079 | 0.112 | 0.0049 | 0.0043 | 0.0041 | 0.0048 | 0.0044 | 0.0046 | 0.0039 |
| Interaction effect (C x P) | | | | | | | | | | | | | | | | | | | | | |
| S.E. ± | 0.152 | 0.212 | 0.136 | 0.183 | 0.235 | 0.254 | 0.325 | 0.083 | 0.089 | 0.061 | 0.060 | 0.057 | 0.048 | 0.067 | 0.0030 | 0.0026 | 0.0025 | 0.0029 | 0.0026 | 0.0028 | 0.0023 |
| C. D. (P=0.05) | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |

Treatment details: $C_1$- Zero energy cool chamber, $C_2$- Room temperature and $C_3$- Basement storage
$P_1$- Polyethylene, $P_2$- CFB box, $P_3$- News paper, $P_4$- Polyethylene + CFB box, $P_5$- News paper + CFB box, $P_6$- Control
NS = Non significant

**Table 2: Effect of storage and packaging materials on shelf life (days) of bottle gourd cv. PUSA NAVEEN**

| Treatments | Shelf-life (days) |
|---|---|
| Storage treatments (C) | |
| $C_1$ | 20.14 |
| $C_2$ | 11.37 |
| $C_3$ | 12.40 |
| S.E. ± | 0.234 |
| C.D. (P=0.05) | 0.672 |
| Packaging material treatments (P) | |
| $P_1$ | 16.56 |
| $P_2$ | 12.30 |
| $P_3$ | 14.53 |
| $P_4$ | 18.03 |
| $P_5$ | 15.41 |
| $P_6$ | 11.00 |
| S.E. ± | 0.331 |
| C. D. (P=0.05) | 0.950 |
| Interaction effect (C x P) | |
| S.E. ± | 0.573 |
| C.D. (P=0.05) | NS |

NS= Non significant

days), it might be due to delayed ripening by effect of reduced ethylene concentration and modified atmospheric conditions of low $O_2$ and enhanced $CO_2$ in packaging. Similar findings were also reported by Waskar *et al*. (1999) in bottle gourd and Elangovan *et al*. (2006) in tomato.

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## REFERENCES

**Elangovan, R.**, Batra, V. K., Arora, S. K., Kumar, J. and Singh, V. P. (2006). Studies on the effect of storage conditions on the shelf life of tomato (*Lycopersicon esculentum* Mill.). *Haryana J. Hort. Sci.,* **35** (1-2): 130-134.

**Gaur, G.S.** and Bajpai, P.N. (1982). Effect of storage on tomato harvested at different stages of maturity. *Prog. Hort.,* **14** (1): 47-49.

**Pal, R.K.** and Roy, S.K. (1988). Zero energy cool chamber for maintaining postharvest quality of carrots (*Daucus carrota* var. Sativa). *Indian J. agric. Sci*., 58 (9): 665-667.

**Salunkhe, D.K.** and Desai, B.B. (1984). *Post Harvest Biotechnology Of Fruits*. Vol. **1** & **2**. Boca Raton.

**Waskar, D.P.** and Nikam, S.K. (1998). Evaluation of packaging materials for shelf life and quality of sapota fruits. *South Indian J. Hort.,* **46** (5-6): 287- 290.

**Waskar, D.P.**, Yadav, B.B. and Garande, V.K. (1999). Influence of various packaging materials on storage behaviour of bottle gourd under different storage conditions. *Indian J. agric. Res.,* **33** (2) 287-292.

**Wenjer, R.** (1967). *Ber. d. dentsch. bot. ges*., **80**: 447-450.

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