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RESEARCH

COMPARATIVE STUDIES ON STORAGE OF BOTTLE GOURD

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Abstract: Bottle gourd without any treatment and wrapper (1000g) were placed over perforated plastic round basket and stored under Room storage and zero energy cool chamber (ZECC) up to 8 days with thrice replication. The moisture (db, %), mass (g), physiological loss in weight (PLW, %), shrinkage (%) and volume (cc) of bottle gourd was evaluated. It is clear from that the shelf life of bottle gourd were increased by keeping them in room storage and ZECC. Low PLW and shrinkage was noticed under ZECC throughout the period of storage. As per present study, due to lowest decrement in PLW and shrinkage was observed in Zero energy cool chamber was found best suitable for bottle gourd in place of room storage. Temperature was observed viz. 23.4 to 26.9^{0}C and RH 77 to 84 % in ZECC as compared to room storage with temperature ranged 33.0 - 37.8^{0}C and RH (14 - 39 %).

Keywords: Room storage, Bottle gourd, Cool chamber, Physiological loss

INTRODUCTION

Vegetables are essential to a person's everyday diet. One of the rules of nature is, "Thy food be thy medicine." Consuming vegetables is linked to protection against a number of health risks, including cancer, heart disease, and many age-related illnesses. They serve as an essential supply of salts, vitamins, and minerals that the body needs to be nourished. India grows a wide variety of vegetables, but the bottle gourd (Langenaria siceraria) is particularly valued because it is an inexpensive and abundant source of nutrients. Although it is native to Africa, it was probably brought to Asia and America as a wild species about 9000 years ago. In India bottle gourd is popularly called as Doodhi, Ghia, Kaddu and Lauki, it is absolutely not getting all attention it deserves. Complex compound such as, cucurbitacins are found in plants belonging to Cucurbitaceae family (Gupta *et al.*, 2022).Bottle gourd is very health and easily available vegetable. It is composed of 96.1% moisture, 0.1% fat, 0.5% minerals, 0.6% fiber, 2.5% carbohydrates, 12 kcal energy, 0.7 mg/100g iron, 0.03 mg/100g thiamine, 0.2 mg/100g niacin and 0.01 mg/100g riboflavin (Srivastiva *et al.*, 2002). It is a good source of antioxidant and phenols. It also contains 10.10 mg/100g ascorbic acid, 5.80 g/100g total sugar, 5.22 g/100g reducing sugar and 1.31 g/100g starch (Milind and Satbir, 2011).

Storage of horticultural products inside the cool chamber has showed reduction in physiological loss in weight, optimum color, better firmness and extended shelf life by 1–2 weeks in other parts of the country. Cool chambers are effective in maintaining the fruit acceptability for a longer period and minimizing the weight loss during storage (Bhatnagar *et al.*, 1990). The storage life of vegetables can be extended greatly by removing the field heat and applying cooling as soon as possible after harvesting. The optimum storage temperature of most vegetables is above their freezing point. Proper storage is an important for marketing and distribution of horticultural commodities. Storage also balances the daily fluctuations of supply and demand (Chakravarty *et al.*, 2003).Relatively lower weight loss of fruits and vegetables under evaporative cooler than that of ambient has been reported by many researchers. The least deterioration in quality parameters of tomato such as TSS, acidity and ascorbic acid content when stored in zero energy cool chamber reported by (Sandooja *et al.*, 1987).Although the concept of zero energy cool chambers, which utilize evaporative cooling, was invented earlier, the push to make this low-cost storage structure widely available for the on-farm storage of perishables is just now beginning to gain traction. This would be simple to build by farmers themselves using materials that are readily available in the area, and it would aid in keeping vegetables fresh for a brief amount of time. This would allow farmers to store

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their produce for a few days and send the majority of it to the wholesale market, avoiding difficult local sales through middlemen. Fruits and vegetables are mostly stored according to temperature and humidity levels. Temperature is the single most important factor affecting the deterioration rate of freshly harvested commodities also, proper relative humidity is required to be maintained during storage (Kadar, 1992).

A significant crop farmed throughout the northeast is bottle gourd. The plant tends to trail. Vegetables include green fruit and leaves that have a stem. Hard shells are used by the indigenous people as musical instrument preparation materials and as cutlery. A useful source of fiber-free carbs is fruit pulp. In many parts of the world, bottle gourds are used to prepare a variety of recipes and as fresh vegetables. But as food technology has advanced, a wider variety of liquids and powders are now offered for purchase. The defatted seed flours had the necessary amounts of critical amino acids that both adults and children need. Based on experimental work carried out in France, oil was extracted from Lagenaria seeds and it contains high amount of linoleic acid and sterolic compounds. Seed has potential for protein supplement in cereal based complementary diets or in the replacement of animal proteins in conventional foods (Ogunbusola *et al*., 2010).Weight loss of fresh tomato has been reported to be primarily due to transportation and respiration, and limited shelf-life and losses in quality have been identified as the major problems faced in the marketing of fresh tomatoes (Bhowmic and Pan, 1992). Zero energy cool chambers along with packaging materials, ventilation and antifungal treatments can help in minimizing the losses of ascorbic acid in the stored lemon fruits to some extent compared to the storage under ambient conditions of storage (Prabha *et al*., 2006).

MATERIALS AND METHODS

Bricks, cement mortar (1:10), rivered sand, brick batts, gunny bags were used for development of zero energy cool chamber (ZECC). Digital electronic balance, thermometer, hydrometer and water supply system were used during experiments. The development of ZECC was done with some modifications of the design of ZECC.

The Zero-Energy Cool Chamber is developed under RKVY funded project entitled "Establishment of Agro Processing Centre" in 2021 at Department of Agricultural Engineering, College of Post Harvest Technology and Food Processing, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (UP), India. Zero energy cool chamber (2 nos.) having outer dimension 210×210×50cm and inner size 110×110×40 cm was constructed with double brick walls using cement mortar (1:10) leaving a 25 cm spacing them. Photographic view of ZECC is shown in Fig. 1. The cavity of between brick walls was filled with riverbed sand. Out of twostructures, the first made of without cement mortar and second with plaster inner and outer side of structure. In present study with plaster ZECC was used for experiment of bottle gourd fruit. The inner flour of structure was made with brick and plastered with cement mortar. The top of the storage space was covered with plastic sheet. All two structures were covered with tin shade. Water supply was made through 1 inch diameter plastic pipe spread all side in cavity with small holes which is connected to rooftop water tank. The sand used in cavity were completely moistened till they got saturated. It was ensured that before actual recording of temperature and relative humidity data, the cool chamber was thoroughly wet. Water was supplied carefully in order to prevent flowing out of sand from the cavity of the walls. The whole experiment was conducted during month of April. The temperature and relative humidity of the ZECC and ambient under shed were recorded one time at 1.00pm each day with the help of liquid-in-glass thermometer and hygrometer made of India with least count of 0.5^0C and ±1%, respectively.

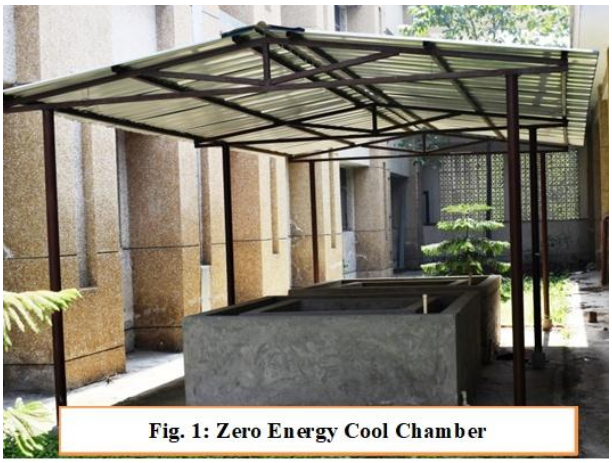

Fig. 1: Zero Energy Cool Chamber

Freshly harvested bottle gourd of irregular shape and size, firm texture and properly mature were brought from local market of Meerut and sorted out for elimination of brushed, punctured and damaged materials generally occur during transport. Soon after sorting, the bottle gourd was washed thoroughly in running water, drained and wiped out with tissue papers. Bottle gourd without any treatment and wrapper (1000g) were placed over perforated plastic round basket and stored under Room storageand zero energy cool chamber (ZECC) up to 8 days with thrice replication. The variation in mass (g), moisture (%),physiological loss in weight (PLW), shrinkage (%) and volume (cc) of bottle gourd were evaluated. Data were noted everyday at 4.00 pm in the evening and the weighing of bottle gourd was done with help of electronic balance with least count of 0.1 g. The shelf life and marketability of stored bottle gourd was evaluated on the basis of all the observation data.

RESULTS AND DISCUSSION

Bottle gourd without any treatment and wrapper (1000g) were placed over perforated plastic round basket and stored under Room storage and zero energy cool chamber (ZECC) up to 8 days with thrice replication. The variation in mass (g), moisture (%), physiological loss in weight (PLW), shrinkage (%) and volume (cc) were evaluated and presented in Table 1 & 2. Data were noted every day at 4.00 pm in the evening and the weighing of bottle gourd was done with help of electronic balance with least count of 0.1 g. The shelf life and marketability of stored bottle gourd was evaluated on the basis of all the observation data. Variation in quality parameters like mass (g), moisture (%), physiological loss in weight (PLW), shrinkage (%) and volume (cc) as affected by different storage systems are shown in Fig. 2-6.

Table 1. Effect on Quality of Bottle Guard at Room storage

Day of storage	Mass, g	Moisture, %	PLW, %	Volume, cc	Shrinkage, %
1	1000.00	1150.00	0	1029.86	0
2	961.80	1102.25	3.82	942.01	8.53
3	954.46	1093.07	4.55	867.69	15.74
4	939.77	1074.71	6.02	816.48	20.72
5	923.33	1054.16	7.66	712.44	30.82
6	914.52	1043.15	8.55	724.08	29.69
7	905.71	1032.13	9.43	698.85	32.14
8	902.64	1028.30	9.74	661.75	35.74

Table 2. Effect on Quality of Bottle Guard in Zero Energy Cool Chamber (ZECC)

Day of storage	Mass, g	Moisture, %	PLW, %	Volume, cc	Shrinkage, %
1	1000.00	1150.00	0	1076.42	0
2	993.68	1142.10	0.630	1063.89	1.16
3	988.92	1136.15	1.108	1045.36	2.88
4	984.18	1130.22	1.582	1029.47	4.36
5	982.61	1128.26	1.739	1016.14	5.60
6	981.82	1127.27	1.818	1015.32	5.67
7	981.03	1126.28	1.897	1013.46	5.85
8	969.96	1112.45	3.004	1005.14	6.62

From the Fig. 1, It reported that the mass of bottle gourd was lose higher in room storage (1000 to 902.64 g) and lowest ZECC (1000 to 969.96 g) and similarly in case of moisture (%), it was lost higher in room storage (1150.00 to 1028.30%) and lowest in ZECC (1150.00 to 1112.00%) shown in Fig. 2. Similarly, lowest moisture and mass loss was observed in ZECC and highest was at room storage due to higher temperature of ambient (33.0 to 37.8^0C). It is clear from that the shelf life of bottle gourd was increased considerable by keeping them in room storage, Refrigeration and ZECC. Low PLW and shrinkage was noticed under refrigeration and ZECC throughout the period of storage (Fig. 4 & 5). PLW was observed lower on second day of storage and there after suddenly increased continuously. It appears that high humid condition (78 to 84 %) and comparatively low temperature (23.4 to 26.9^0C) under zero energy cool chamber retarded the metabolic activities through respiration and transpiration, which resulted the longer shelf life and smaller physiological loss in weight (PLW) during storage period (Khan and Samsher, 2001).

The loss in PLW is an indication of moisture loss from the horticultural commodity which renders unmarketable as they not only lose colour, freshness and crispiness but also the palatability. Thus, the moisture loss cannot be taken as mere loss in weight of produce but also it also results in loss in appearance, taste and nutrients, leading to greater economic loss (Sundaram, 2016). The higher relative humidity retains the moisture content of post-harvest sample. Because of water is an important factor in maintaining post-harvest quality (Murugan *et al*., 2011). Shrinkage in bottle gourd is depend on geometric dimension of bottle gourd which affected by temperature, relative humidity and type of storage conditions. Lowest shrinkage (Fig. 5) was reported in ZECC (0 to 6.62%), and highest at room temperature (0 to 35.74 %). It is clear that higher temperature and low humidity affect the dimension of horticultural commodity which responsible for shrinkage of the tissue during storage. From Fig. 6, It is clear that the lowest value of coefficient of determination was found best indication of lowest Physiological loss in weight in bottle gourd during storage in ZECC.

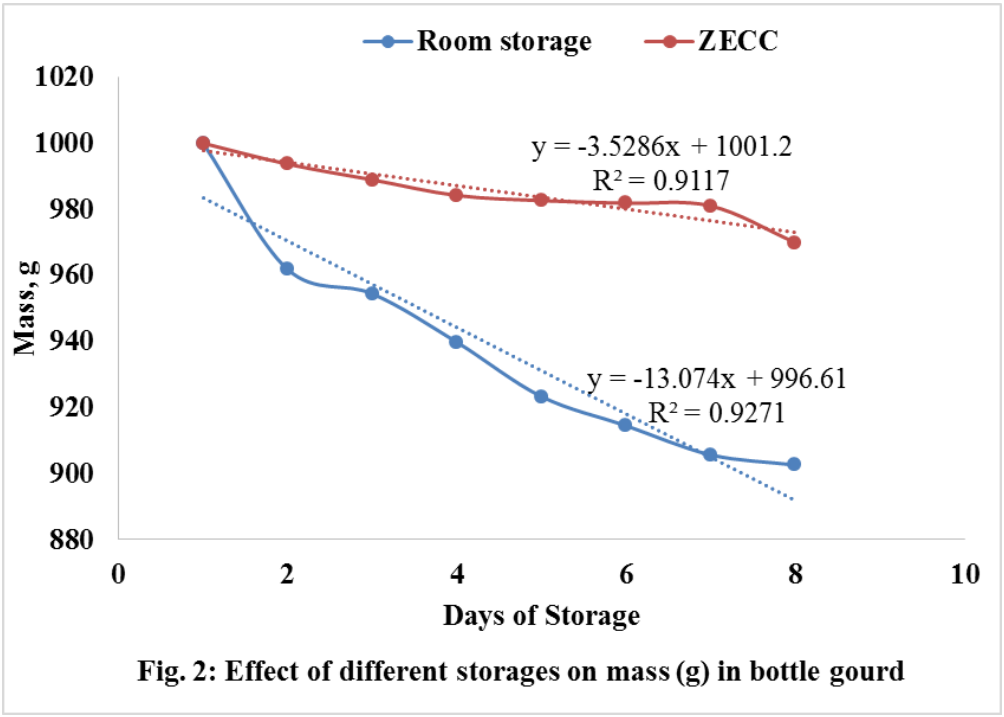

Fig. 2: Effect of different storages on mass (g) in bottle gourd

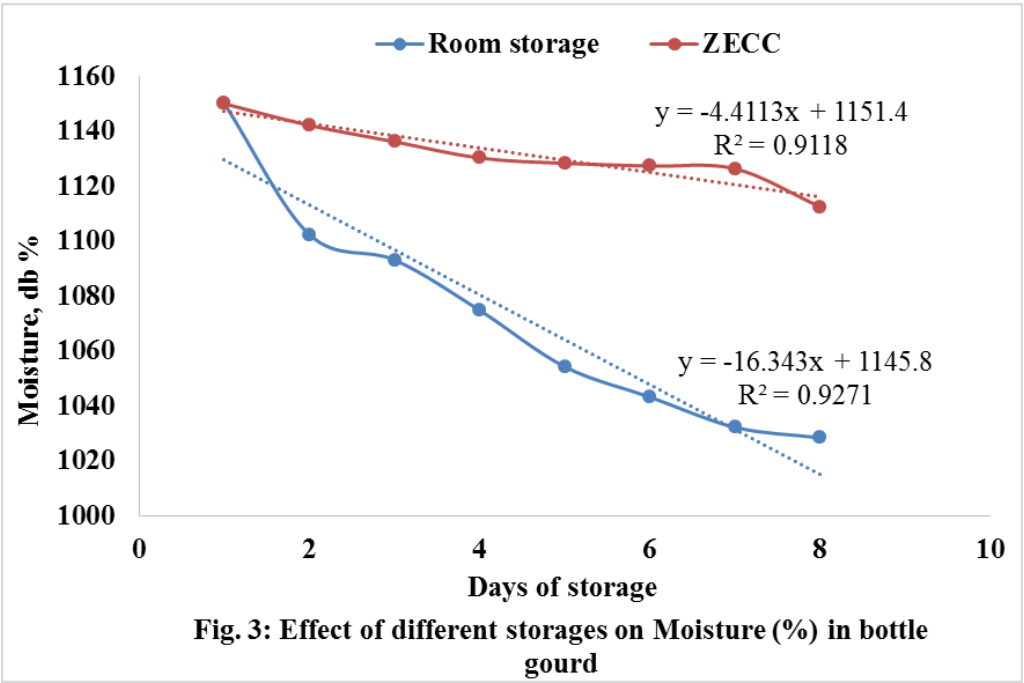

Fig. 3: Effect of different storages on Moisture (%) in bottle gourd

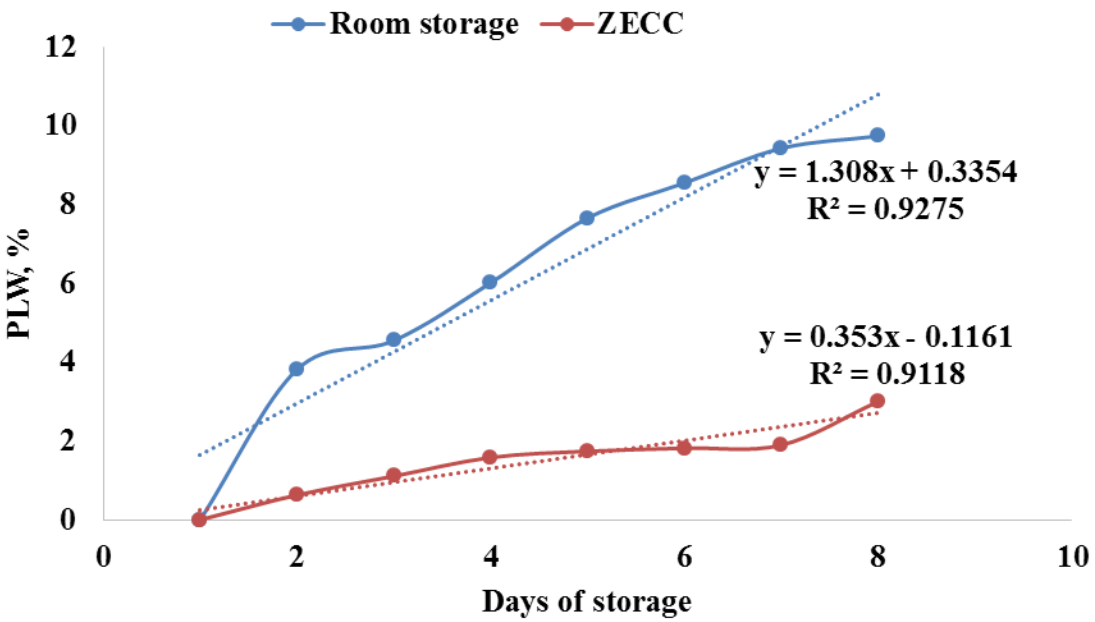

Fig. 4: Effect of different storages on Physiological loss in weight (%) in bottle gourd

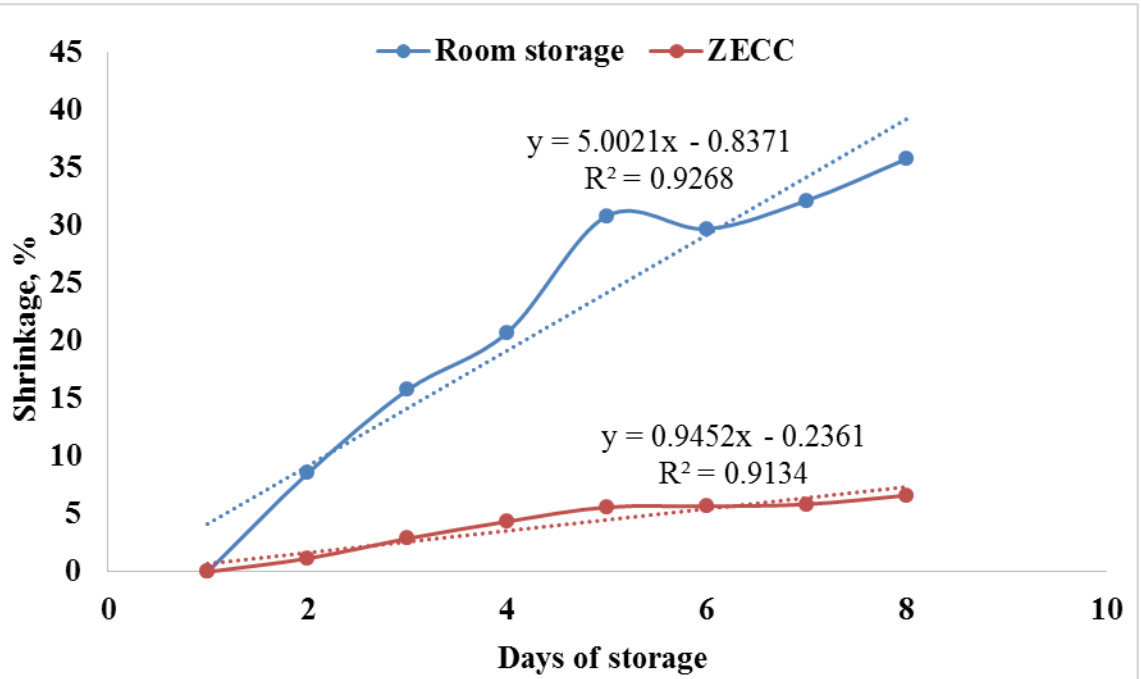

Fig. 5: Effect of different storages on shrinkage (%) in bottle gourd

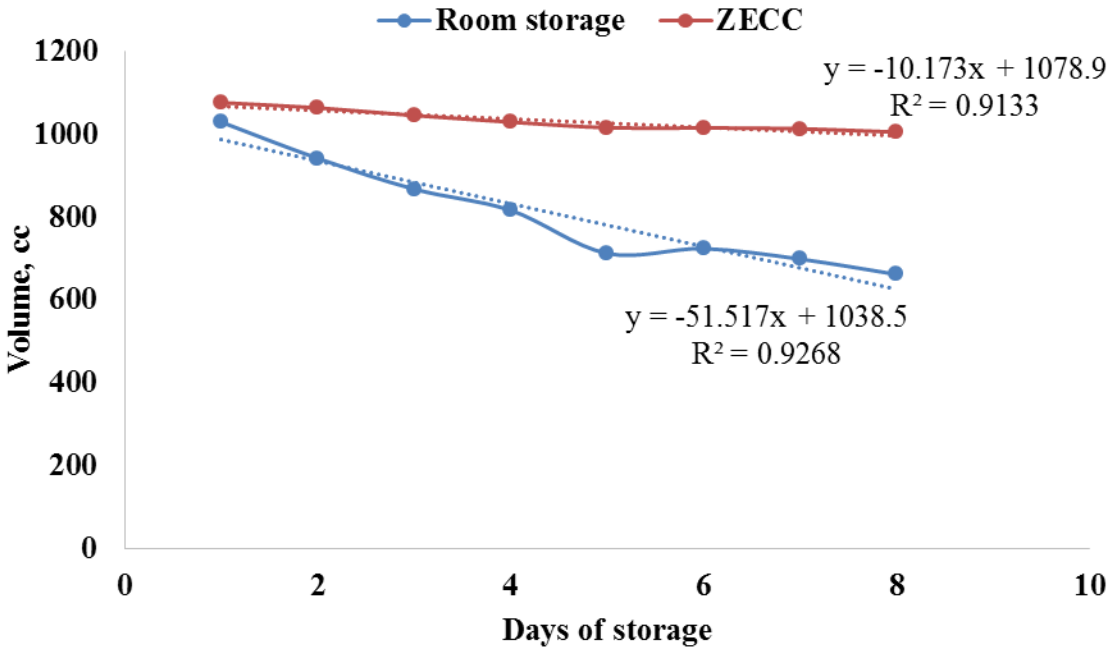

Fig. 6: Effect of different storages on volume (cc) in bottle gourd

CONCLUSIONS

The initial moisture content in bottle gourd were evaluated 92.00 % (1150.00 %, db). In case of bottle gourd, the moisture content and masswere decreased while Physiological loss in weight (%) and shrinkage (%) was increased with increasing days of storage in both types of storage. Lowest decrement in PLW and shrinkage was observed in Zero energy cool chamber as compared toroom storage condition. Zero energy cool chambers (ZECC) are also observed the lowest rate of decrement in PLW, shrinkage and volume. ZECC was found suitable for fruits of bottle gourdas per present study and some human errors also taken during experiments. Temperature was observed viz. 23.4 to 26.9^{0}C and RH 77 to 84 % in ZECC as compared to room storage i.e. Temperature ranged 33.0 - 37.8^{0}C and RH (14 - 39 %).

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