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Comparative study on weight loss and volume loss of tomato under Janta cool chamber and ambient condition

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Abstract
An evaporative cool chamber was designed and constructed by using soil & river bed sand and named Janta Cool Chamber. The maximum and minimum temperature of inside and outside of the chamber was recorded for 76 days. It was observed that the inside temperature was 3-4°C lower than outside temperature. A comparative study was made to determine weight loss and volume loss of tomato inside the Cool Chamber and in the ambient condition. The Janta Cool Chamber does not require any mechanical or electrical energy input and can be constructed with locally available materials and build by unskilled labours. It proven economical as it can store the tomato for longer period with no significant loss in quality to tomato stored.

Keywords: Janta cool chamber, storage structures, weight loss, volume loss, tomato

Introduction
Tomato is one of the most important vegetables grown in India. Post-harvest storage of tomato is the major cause of seasonal fluctuation in availability, deterioration in quality and other socio-economic inadequacies. Deterioration of fresh tomato can result from physiological breakdown due to natural ripening processes, water loss, temperature injury, physical damage, or invasion by micro-organisms. All of these factors can interact and all are influenced by temperature. Fresh fruits, vegetables and flowers are highly perishable because they are alive. They breathe (just like humans) release heat from respiration and consequently, loose moisture, which may cause weight loss, volume loss and also nutritional quality.
Maintenance of air-conditioned structures /appliances in villages is not possible for farmers due to high energy consumption and erratic supply of electricity. The cold storage facilities, confined to rural areas only are not so popular among the farmers. Evaporative cooling method of storage has been found to be an efficient technique to increase the shelf life of stored foods by reducing weight loss and volume loss. Vakis (1981) [7] also developed a cheap cool store in Kenya, with the help of local grass for the storage of vegetables. He kept the roof and walls wet by dripping water from the top of the roof. Roy and Khurdia (1986) [5] constructed an evaporative cooled structure for the storage of the fruits and vegetables with a double wall made of baked bricks chamber fulfils and all these requirements and in helpful to small and people at household level in rural areas.
Mukharjee *et.al* (2008) [6] studied on comparative study of fruits and vegetables in cool chamber and in ambient. In the study an evaporative cool chamber was constructed with the help of baked bricks and river bed sand, maximum and relative humidity were recorded inside and outside the chamber for one month. Weight loss and freshness were observed every day. It has been recorded that weight loss of fruits and vegetables kept inside the chamber was lower than those stored outside the chamber.
In the present study of Janta Cool Chamber was made to store the horticultural produce for a short period of time. The principle of working of this cool chamber is based on technique of evaporative cooling. This maintains low temperature and relative humidity in low temperature and relative humidity in the inner space compared to the ambient condition. This Janta Cool Chamber fulfils all these requirements and is helpful to small farmers and people at household level in rural areas.

Methods and Materials
The present study was conducted at Helina School of Home Science, Sam Higginbottom

University of Agriculture, Technology and Sciences, Allahabad, U.P, India, during April to September month. Tomato, variety - Pusa Ruby, produced from I.V.R.I, Varanasi stored under the supervision of Horticultural specialist.

Selection of Storage Methods

1. Janta cool chamber (JCC): It was made of entirely from the sand, red and black soil in 3:2:1 and the designed model named as Janta Cool Chamber. The size of Janta Cool Chamber is 94.5cm x63 cm, height is 26 cm and capacity to store 12 kg of fruit. It is an earthen structure in a shape of a box which has been divided into three parts:

(i) One outer box
(ii) Trays three in no
(iii) Three lids for each tray

2. Open basket: The size of Open Basket was 13cm Diameter.

For each experiment 500 gm of fresh tomato was stored both evaporative cool chamber and in open basket (ambient condition).

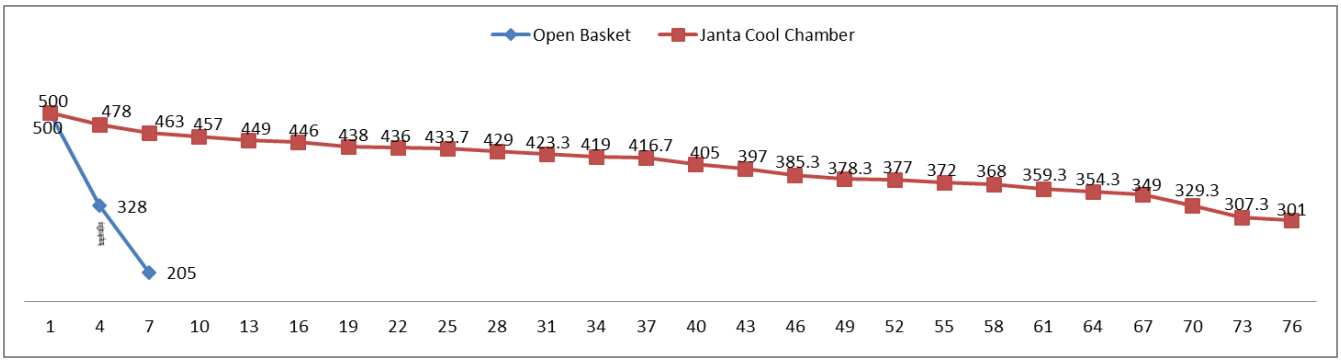
Steps followed for the storage of tomato during experiment

- The trays were placed in JCC keeping 6 cm gap between the trays. The gap was filled with coarse sand followed by moistening it. Tomatoes were kept in trays for storage study.
- After keeping the tomatoes, the chamber was covered by lid, in the lid seven holes were maintained for exchange of gases.
- The JCC was placed on a steel frame which in term supported by flat rod placed 20cms apart.
- Daily watering was done in the sand to maintain the humidity under the chambers.
- A set of 500g of tomatoes kept in open basket in veranda to study the weight loss and volume loss.
- Observations were recorded on every third day (1st day-3rd day-5th day). The study was continued up to 76 days (Two months, 16days).
- Turning of fruits was under taken at every alternate day.

Results and discussion

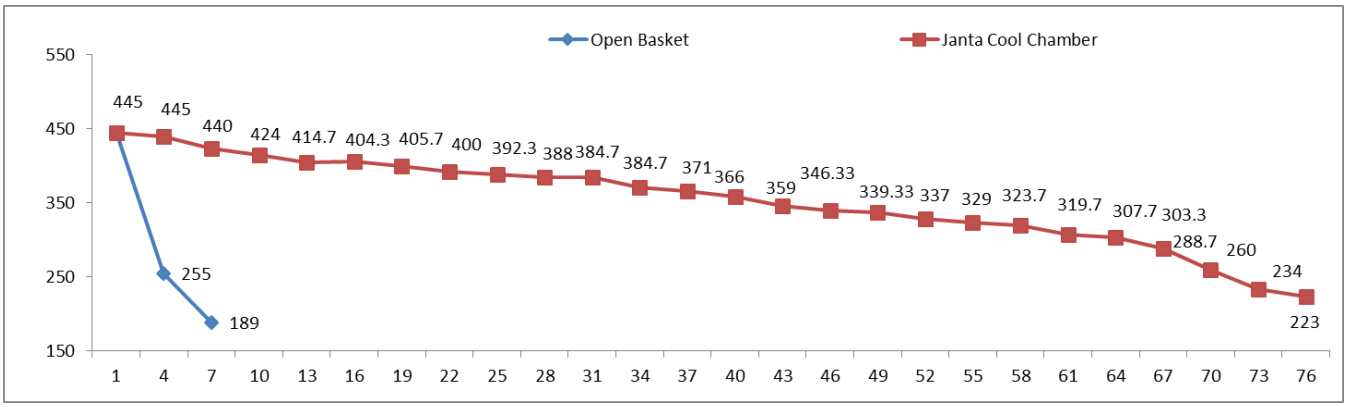
A comparative study was made on the weight and volume loss of the tomato. Remarkable retention of weight and volume of the tomato kept in Janta Cool Chamber as compared to ambient condition (open basket). This change is due to lower temperature inside the chamber.

Data regarding weight loss of tomato is presented in Table 1 and illustrated with Fig 1. The weight loss of tomato was influenced by open basket whereas Janta Cool Chamber recorded significantly superior over open basket (ambient condition) Table1 and illustrated in Fig.1.



Storage Period (Days)

Fig 1: Average weight loss (g) of tomato during storage period



Storage Period (Days)

Fig 2: Average volume loss (ml) of tomato during storage period

Data regarding volume loss of tomato is illustrated in Fig 2. The result indicated that volume loss of tomatoes was influenced by Janta Cool Chamber and open basket used in the study.

Weight loss of tomato during storage period

A significant difference was observed between open basket and JCC (Janta Cool Chamber). The average weight of tomatoes was recorded 500g for each treatment on the day of

storage.

Figure 1 clearly indicates that the maximum significant loss of weight was recorded in open basket stored tomato i.e. 205g on the seventh day of experimentation. Open basket stored tomatoes were rotted after seven days. The findings are in conformity as the study was made by Murugan *et al*. (2011) [4] that the weight loss of tomatoes and carrots were minimum when these were stored in evaporative cooling system chamber while it was maximum in ambient storage. Weight loss of fresh tomato is primarily due to transpiration and respiration. Transpiration is a mechanism in which water loss due to differences in vapour pressure of water in the atmosphere and the transpiring surface.

Respiration causes a weight reduction because a carbon atom is lost from the fruit each time a carbon dioxide molecule is produced from an absorbed oxygen molecule and evolved into atmosphere (Bhowmik and Pan, 1992) [1].

Volume loss (ml) of tomato during storage period

Data pertaining to the average volume loss (ml) of tomato stored under open basket and Janta Cool Chamber is exhibited in Fig 2. It clearly observed that significant difference between both treatments in which JCC recorded minimum loss as compared to open basket stored tomatoes.

Figure 2 clearly indicates the average volume of tomatoes was recorded 445 ml for both on the day of storage. Open basket tomatoes volume loss recorded significantly high i.e. 189 ml on the seventh day of experimentation whereas JCC stored tomatoes volume loss was minimum i.e. 424 ml. It was observed that 100 percent shrinkage for tomatoes, chillies and potatoes preserved in the cool chamber as compared to 30 percent, 50 percent and 15 percent respectively in the room. In case of lady finger and brinjal 20 percent shrinkage was found as against 50 percent and 75 percent shrinkage respectively in the room.

Conclusion

The recorded data related to weight loss of tomato during storage period, significant loss of weight was recorded in open basket stored tomato i.e. 205g on the seventh day of experimentation, whereas minimum loss was recorded in JCC (463g) stored tomatoes. Tomatoes stored in JCC remained in their prime condition till 76th day of experimentation and the recorded weight was 301g. Observations regarding volume loss of tomato recorded during storage period that the significant loss of volume was recorded in open basket stored tomato i.e. 189ml on seventh day of experimentation, whereas minimum loss was recorded in JCC (424ml) stored tomatoes. Tomatos stored in ambient temperature were rotten after seven days. Tomatoes stored in Janta Cool Chamber remained in their prime condition till 76 days of experimentation and the recorded volume was 223 ml.

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