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Effect of pre-cooling of fresh vegetables in low cost zero energy cool chamber at farmers field in Janjgir-Champa District of Chhattisgarh

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Abstract

A low cost "Zero Energy Cool Chamber (ZECC)" has been developed for storing of fruits and vegetables by using passive evaporative mechanism. This paper presents the result of a survey on the farmer's opinion regarding the exploitation of zero energy cool chamber. The Front Line Demonstration was conducted at Janjgir-Champa district of Chhattisgarh from 2015-2016 and it also revealed that most of the farmers sell their produce to the middlemen just after the harvest. Lack of transportation facility, shortage of energy supply and lack of investment on storage, lower price of vegetables during the harvesting season, farmers in this areas often sell their products to the middleman or in the local market at low price. They are not even able to get the return of invested money of cultivating vegetables or fruits. As a result, higher percentage of poverty level remains in farmer's community. They demanded low cost storage system such as zero energy cool chamber also called Desi freez which doesn't require electricity for operating to store their agricultural produces. The ZECC was evaluated for shelf life of various vegetables like Tomato, Okra, onion leaf, Brinjal, chili, Amaranthes, cabbage, under Zero energy cool chamber and ordinary room condition during the month of April. It was observed that the mean maximum temperature inside the ZECC was about 7 °C to 11°C lower than the ambient Room condition during summer. However, Relative humidity (RH) inside the cool chamber was more than the ambient Room condition. It was found that the shelf life of amaranths was increased from 2 to 4 days, 4 to 8 days for chilli, 1 to 3 days for onion leaf, 3 to 7 days for Brinjal, 4 to 10 days for Tomato, and 2 to 4 days for Okra, during hot summer season when it was kept in the ZECC as compared to ordinary room condition. It was noticed that, the physiological weight loss drastically reduced with ZECC as compared to ambient condition i.e. Tomato(23.76%), Amaranths (35.86%), Okra(12.60%), Chili (7.75), Onion leaf (37.36) Cabbage (2.35) and in Brinjal (21.35%). The ZECC also found helpful in reducing rotting of vegetables from 59.1-64.0% as compared to ambient condition.

Keywords: Zero energy cool chamber, vegetable storage, physiological weight loss, relative humidity

Introduction

The zero energy cool chamber (ZECC) is an ecofriendly system with low cost of construction. It also saves energy as it does not need electricity for its operation. It is constructed with locally available materials therefore this structure can be easily constructed in rural areas (Saiyed and Joshi 2014) [5]. The Trial were conducted to work out the efficacy of the cool chamber in the field conditions as well as the efficacy of the locally grown vegetables in the nearby villages. Various vegetables like Tomato, okra, Chili, Amaranths, Onion leaf, Brinjal were studied and significant findings have been recorded. The Zero Energy Cool Chamber is one such technology which can prolong the shelf life of fresh produce through evaporation cooling without any utilization of external power. (Lata and Singh, 2013) [2] had successfully experimented zero energy cool chamber for the farmers of Gujarat. (Kumar *et al.* 2014) [1] studied utility of zero energy cool chamber successfully in Jaipur. The ZECC developed by Roy and Khurdia (1983) at IARI, Pusa, New Delhi for the storage of fruits significantly contributed towards the reduction of post-harvest losses and maintaining the quality of the produced (Singh *et al.*,2010) [4]. ZECC could lower temperature range of 10-15°C cooler than the outside temperature and maintain about 95% relative humidity.

Material and Methods

Work completed during Front Line Demonstration by krishi vigyan Kendra Janjgir-champa

Every aspect of vegetable growers attitude, awareness level and existing knowledge was taken into consideration to select the beneficiary farmers among them. Consequently area under the vegetables cultivation, pattern of farmers participation and problem pertaining to short term storage and transportation were studied closely.

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This formed on the basis for designing the appropriate training strategy and accordingly proper stress on the aspects of training methodology was given. Demonstration for group of framers were undertaken to show the methods of erection of the structure, methods of storage, type of produce to be stored and methods of operation of the zero energy cool chamber.

Construction of Zero Energy Cool Chamber at farmer's field

ZECC-The demonstration was on farm oriented low cost storage structure which operates on the principles of evaporative cooling was developed at IARI, New Delhi, using locally available raw materials such as bricks, sand bamboo, dry grass, jute cloth etc. The chamber is an above ground double walled structure made up of bricks. The cavity of the double wall is filled with river bed sand. The lid was made by using dry grass /straw on a bamboo frame. ZECC had a maximum efficiency during the summer season where in vegetables could be stored afresh for longer period than the conventional storage and handling methods that was practiced as handling in bulk, room storage and packing in the gunny sacks. The rise in relative humidity (90% or more) and fall in the temperature from the ambient condition could be achieved by watering the temperature twice a day. Performance evaluation of cool chambers at different location was found to be satisfactory for short term maintenance of vegetables.



Length-2mt, Breath-1.15mt,
Height-0.65mt, Temp diff 15-18°C,
Humidity-80-90%



Diagrammatic Sketch and photos of zero energy cool chamber: During the Trial various training aids were used and the literature prepared by the K.V.K. distributed among the farmers to depict importance of the low cost technology as per the target set out in the trial were conducted in the selected village Baheradih, Pisod, Sivni. The reaction and feedback of the beneficiaries were recorded and studied critically during the training. The regular follow-up has helped to increase the predication of the direct beneficiaries in the KVK. Programme.

Result and Discussion

The Trial was conducted in selected village Sivni, Baheradih and Pisod and studied that the Cabbage, Tomato, Brinjal, Okra and chili could be stored inside the chamber for 12,10,7,5,8 days, respectively with maximum retention of marketable quality. The shelf life of leafy vegetable like amaranths and onion which are main summer vegetable crops of poor farmers can be increased upto 3 and 4 days which otherwise at ambient room temperature only can be stored for a single day as per the observations made at the farmers field.

Table 1: Zero energy cool chamber to reduce post-harvest losses in vegetables- The Storage of fresh vegetables in ZECC and at ambient Room Condition: In case of vegetables crops (Table 1, Fig 1) maximum shelf life under ZECC were ranges from 5to 10 days whereas in room condition ranges from 1 to 12 days. Similarly PLW under ZECC ranges from 37.36 to 2.35 and under room condition ranges from 331.08 to 5.25. (Table 2, Fig-2).

Sr. No.	Vegetable	Physiological weight loss		Vegetable % Gain	Vegetables (shelf life days)		% change in Parameter
		T1 (Ambient temp)	T2 (ZECC)		T1 (Ambient temp)	T2 (ZECC)	
1	Tomato	35.86	23.76	33.74	4	10	150.0
2	Okra	145.09	12.61	91.30	2	4	100.0
3	Onion leaf	119.29	37.36	68.68	1	3	166.6
4	Brinjal	38.88	21.35	45.08	3	7	133.3
5	Chilli	228.4	7.75	96.60	4	8	100
6	Amaranths	331.08	35.86	89.16	2	4	150.0
7	Cabbage	5.25	2.35	55.23	12	5	58.33

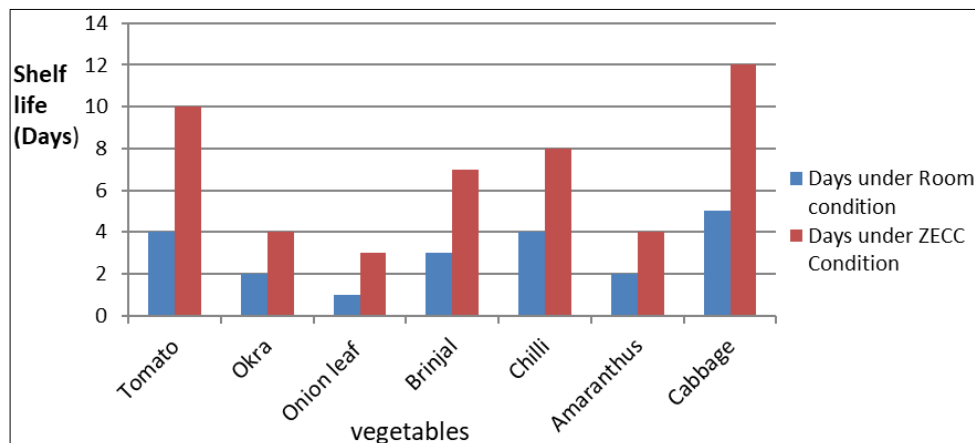


Fig 1: Comparison of shelf life of vegetables under Zecc Condition and Room Condition In Janjgir-Champa District of Chhattisgarh.

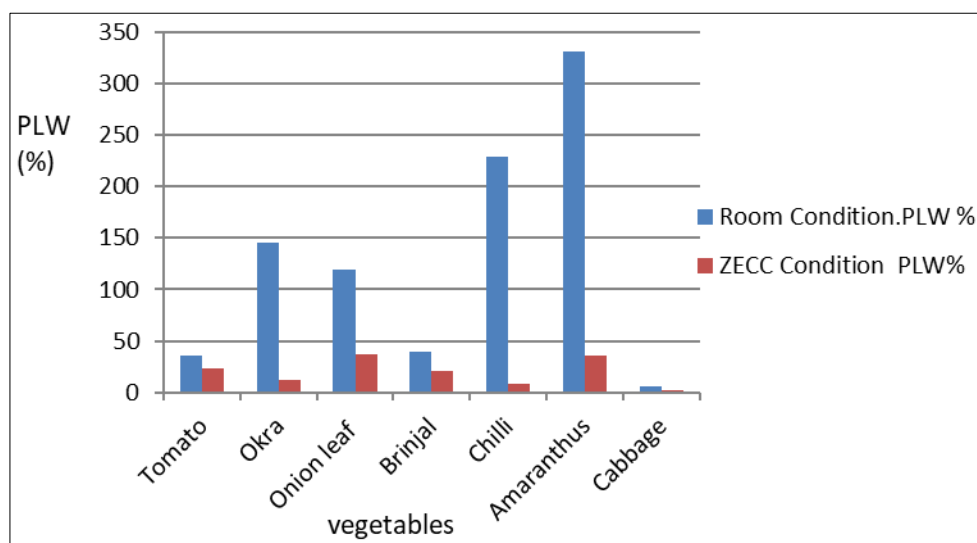


Fig 2: Comparison on percent of physiological loss in Weight (PLW) of various vegetable between room condition and ZECC condition.

Impact: The actual adoption of the technology among the farmers in the selected village among the beneficiaries is about 94%. The popularity of the cool chamber has since increased not only among the farmers but also among the extension agencies of the state as the state department of agriculture. The impact of the trial is evident from the fact that the other fruit grower, flower and milk producer have also approached the K.V.K. for use of the zero energy cool chamber for pre cooling of the fruits, cold drinks, mushroom and milk in bulk.

Salient finding /recommendations: The vegetable like cabbage, tomato, brinjal, okra chili, can well be stored inside the chamber with maximum retention of quality. Milk, curd, cooked food, flowers and mushroom that have a very short storability can well be stored inside the chamber. can also be utilized easily for mushroom cultivation. The zero nergy cool chamber can be constructed by an unskilled person and has a very limited capacity which should be strictly be recommended for the small and marginal farmers growing vegetables on small area of land in order to facilitate them to market their produce in bulk instead of intermittent harvest and marketing. Hence, not forced to sell at low prices.

Conclusion: The study was conducted to qualify the quantity and storability of vegetables like Cabbage, Tomato, Brinjal, Okra, chili, Onion leaf and Amaranths Under ZECC and room condition.

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