



Research Article

EVALUATION OF PERFORMANCE OF MODIFIED EARTHEN POT COOL CHAMBER (MEPCC) IN SHELF LIFE OF VEGETABLES IN LATERITIC BELT OF WEST BENGAL

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Abstract: An On Farm Trial (OFT) was conducted by the Rathindra Krishi Vigyan Kendra (Rathindra KVK) adopted tribal villages of Birbhum District, West Bengal to evaluate the performance of Modified Earthen Pot Cool Chamber (MEPCC) on shelf-life of vegetables in the year 2016-17. In semi-arid red lateritic zone of Birbhum district, extreme hot climate conditions prevail over most of the time of every year and the vegetables get spoiled very quickly especially in the absence of proper storing system. The farm women face the problem of storing them with proper keeping quality. Three treatments were under taken for this trial i.e., Farmers' Practice = Vegetables stored in room temperature; T₁ = Technology Option - I: Vegetables stored in bamboo baskets covered with wet gunny bags; T₂ = Technology Option- II: Vegetables stored in modified earthen pot cool chambers. Total no. of replication for this trail was 10. Three perishable vegetables i.e., Tomato, Brinjal and Spinach were taken for the trial. 500 gms of each vegetable were taken for the trial. Observations were taken in 3rd, 5th and 7th day of keeping the vegetables. From the result, it was found that the Technology Option-II, i.e., vegetables stored in MEPCCs performed significantly better with respect to minimum loss of weight (Tomato - 6.6- 31.1%, Brinjal - 7.6 - 27.2%, Spinach-27.2 - 81%) during all the dates of observation for all the vegetables. It was also observed that the MEPCCs performed significantly better in case of Tomato and Brinjal than the leafy vegetables Spinach.

Keywords: Shelf life, Vegetables, Modified Earthen Pot Cool Chamber (MEPCC), Loss of weight

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Introduction

In India, about 16 percent of produced fruits and vegetables, valued at Rs. 40,811 crores (\$6 billion), were lost, according to an analysis of production data of 2012-13, at the 2014 Wholesale Price, by the Central Institute of Post-Harvest Engineering and Technology (CIPHET), Ludhiana, Punjab. In India, the fruits and vegetables get wasted due to gaps in the cold chain such as poor infrastructure, insufficient cold storage capacity, unavailability of cold storages in close proximity to farms, poor transportation infrastructure, etc. This result in instability in prices and farmers cannot get remunerative prices beside rural impoverishment and farmers' frustrations [1-4]. Among the states, post-harvest losses of Vegetables are highest in West Bengal (over 136.6 billion INR), followed by Gujarat (114 billion INR), Bihar (107 billion INR) and Uttar Pradesh (103 billion INR) [5]. In the semi-arid red lateritic zone of Birbhum District, extreme hot climatic conditions prevail over most of the time in almost each and every year and the vegetables get spoiled very quickly especially in the absence of proper storing system especially in the moist, humid and hot days of Rainy Seasons. They face the problem of storing the vegetables in absence of proper keeping equipment's and practices. Keeping this problem and felt needs of the Clientele of the Rathindra KVK, Birbhum in mind, this KVK has conducted an On Farm Trial (OFT) at its Tribal farming community dominated adopted villages of the District to evaluate the performance of Modified Earthen Pot Cool Chamber (MEPCC) on shelf-life of vegetables in the year 2016-17.

These MEPCCs are earthen wares which act as Cool Chambers and these wares are eco-friendly, non-toxic, less expensive, made of local lowcost materials and bio-degradable and these cool chambers are zero energy users thus helping in reducing the load of Green House Gases like Chloro Fluro Carbon (CFC) coming out from Refrigerators using electricity.

These cool chambers can be easily used in the rural areas where still continuous electricity supply is a problematic one. The scientists of the Rathindra Krishi Vigyan Kendra have designed the MEPCC on the principle of Double Vessel i.e., one larger and one smaller with lids on them, taking a technological cue from the design offered by the researchers [6] to increase the shelf life capacity as well as organo-leptic values of the stored vegetables.

Materials and Methods

The objective of the present study is to assess the physiological weight loss in stored vegetables at the specified time intervals using various methods of storing. The hypothesis of the present study is that among the various methods of storing harvested or procured vegetables, the Modified Earthen Pot Cool Chamber (MEPCC) may be a good storage system to keep the vegetables comparatively in fresh condition than storage in room temperature or storage in bamboo baskets covered with wet gunny bags. The MEPCC may be an eco-friendly, energy saving and cost effective alternative method of storage of vegetables.

To test this Hypothesis, an On Farm Trial (OFT), titled, "Evaluation of Shelf-Life of Vegetables stored in a Modified Earthen Pot Cool Chamber" comprising of three Technology Options or Treatments viz. (a) Farmers' Practice-Vegetables Stored in room temperature; (b) Technology Option-I: Vegetables Stored in Bamboo Baskets with Wet Gunny Bags and (c) Technology Option-II: Vegetables Stored in Modified Earthen Pot Cool Chambers was organized by the Rathindra KVK in the year of 2016-17 and 2017-18.

The numbers of replications for each Technology Option or Treatment were 10 (Ten) and number of MEPCC per replication is 01 (One) summing up a total of 10 (Ten) numbers of MEPCCs for this OFT and the source of technology of the above mentioned OFT was Council of Scientific and Industrial Research (CSIR).

Table-1 Performance of Modified Earthen Pot Cool Chamber regarding loss of weight (gm) of the Vegetables in Storage

Technology Options	No. of trials	Tomato			Brinjal			Spinach		
		Date 1	Date 2	Date 3	Date 1	Date 2	Date 3	Date 1	Date 2	Date 3
		i.e. 3 rd day of storage	i.e. 5 th day of storage	i.e. 7 th day of storage	i.e. 3 rd day of storage	i.e. 5 th day of storage	i.e. 7 th day of storage	i.e. 3 rd day of storage	i.e. 5 th day of storage	i.e. 7 th day of storage
Farmers' Practice – Vegetables Stored in room temperature	10	168.5	277.5	409	64.9	137.5	126.5	249	462.5	500
Technology Option – I: Vegetables Stored in Bamboo Baskets with Wet Gunny Bags		52.4	118.5	272	79.4	95.8	93	20	402	468
Technology Option – II: Vegetables Stored in Modified Earthen Pot Cool Chambers (MEPCC)		32.8	90.5	155.5	43	38	59	136	315	405
Sem ±		6.06	8.94	17.2	5.09	16.43	8.85	18.81	13.04	9.52
CD (P=0.05)		17.88	26.37	51.11	15.11	48.83	26.28	55.88	38.76	28.3

Table-2 Organoleptic Test of Fruits and Vegetables in Farmer's Practice, Vegetables Stored in Bamboo Baskets with Wet Gunny Bags and MEPCC

Technology Options	Parameters	Organoleptic Test of Fruits and Vegetables			
		3 rd day	5 th day	7 th day	9 th day
Farmers' Practice-Vegetables Stored in room temperature	Colour	4	3	-	-
	Smell	4	3	1	-
	Appearance	4	2	1	-
	Taste	4	2	1	-
Technology Option-I: Vegetables Stored in Bamboo Baskets with Wet Gunny Bags	Colour	5	4	4	3
	Smell	5	4	3	3
	Appearance	5	4	3	3
	Taste	5	4	4	3
Technology Option-II: Vegetables Stored in Modified Earthen Pot Cool Chambers (MEPCC)	Colour	5	4	4	3
	Smell	5	5	4	4
	Appearance	5	5	4	4
	Taste	5	5	4	3

The Critical Inputs needed for conducting this OFT were arranged on the sharing basis between the Kendra and the OFT Partner Farmer in the following formula:- (a) KVK Share: - Earthen Pot Cool Chamber and (b) OFT Partner Farmers' Share: - Manual Labour, Vegetables, Bamboo Baskets and Gunny Bags. The Performance / Monitoring Indicators for the evaluation of the Technology Options or Treatments were the average weights of the Stored Vegetables in Grams (before-after).

Three different vegetables viz. Tomato, Brinjal and Spinach (among whom Spinach was leafy while other two were of fruity types of vegetables) were chosen for the Trial. The weights of three types of Vegetables viz. Tomato, Brinjal and Spinach were recorded before storing them and during storage the weight changes during the storage were noted on the 3rd, 5th and 7th days of storage of the vegetables. To evaluate the organoleptic characteristics, viz. taste, texture, appearance, flavour, the following scale was used. 5 stood for Excellent, 4 stood for Very Good, 3 stood for Good, 2 stood for Fair and 1 stood for Poor.

Results and Discussion

In the present study the efficacy of three systems of storing Vegetables viz. (a) Vegetables Stored in room temperature; (b) Vegetables Stored in Bamboo Baskets with Wet Gunny Bags and (c) Vegetables Stored in Modified Earthen Pot Cool Chambers were evaluated and compared amongst themselves. During the course of storage, the changes of physiological weights of the vegetables were analyzed.

From the above [Table-1], it is to be noted that the total Weights of the stored Tomato, Brinjal and Spinach decreased due to physiological stress when stored for a longer period of time. The perusal of the data [Table-1] also revealed that the Technology Option-II i.e. Vegetables Stored in Modified Earthen Pot Cool Chambers (MEPCC) performed in significantly better way through allowing minimum loss of weight during all the dates of observation for all the vegetables. The results corroborate with the findings of other researchers in this field [7].

It was also observed the Modified Earthen Pot Cool Chambers performed significantly better in case of Tomato and Brinjal than Leafy Vegetables (here, Spinach). Among the vegetables Brinjal was stored significantly in a better way through utilizing the Technology Option-II i.e. MEPCC followed by Technology Option-I i.e. in Bamboo Baskets with Wet Gunny Bags.

Stress leads to loss of membrane integrity, leakage, loss of permeation in enzyme activity [8]. The mechanical stress leads to loss of quality during post-harvest period. The Ethylene stress widely initiates ripening in storage [9]. In MEPCC

there is less pathological stress and evaporation process is minimum, helping it to reduce the rate of weight loss of the stored vegetables.

The factors that may have accounted for the results obtained could be due to pre-harvest treatments, temperature, and relative humidity during storage. Past researchers [10] also reported that due to high rates of bruising, there is water loss and subsequent decay during postharvest handling that enhances weight loss.

The data from [Table-2] indicates the organoleptic standards of the sample vegetables in different Technological Options. It was shown that colour, smell, appearance and taste have a very high rate of depreciation in the first option i.e. regular Farmers' practice where they turn bad just after 5 days. In the second option, though the samples did not turn bad as quickly as in Technology Option - I, but had a faster decline rate than Technology Option - III. In the third option, MEPCC, the stored fruits and vegetables were seen as fresh as recently cultivated products even after 9 days with slight depreciation in colour and taste. The result is at par with the observation of other researchers [11, 12].



Fig-1 On Farm Trial on Storages of Vegetables using the Modified Earthen Pot Cool Chamber (MEPCC)

Conclusion

Thus, from the On Farm Trial (OFT) conducted by the Rathindra KVK, Birbhum, West Bengal mentioned above, it may be noted that through the utilization of the low-cost, zero energy based Modified Earthen Pot Cool Chamber, vegetables especially the non-leafy vegetables like Brinjal, Tomatoes etc., can be stored for a longer period by reducing the rate of weight loss of the stored vegetables.

Application of research: As this On Farm Trial is an Action Research with emphasis on participatory learning mode with active participation of the stakeholders, the finding will help in propagating low cost methods of storing perishable agricultural commodities like vegetables, fruits etc. If properly popularized, this low cost locally produced storing bins operating without any electricity will provide alternative green mechanism to reduce avoidable wastages aka post-harvest losses of agricultural commodities and this will be in line with "Vocal for local" mantra.

Research Category: Action Research

Abbreviations: OFT- On Farm Trial, TO-Technology Option
MEPCC-Modified Earthen Pot Cool Chamber

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Study area / Sample Collection: All the Community Development (CD) Blocks viz. Rajnagar, Dubrajpur, Khyrasole, parts of Nalhati-I, Rampurhat-I, Murarai-I, Mayureswar-I, Illambazar, Labhpur, Suri-I and Md. Bazar of the Agro Ecological Situation (AES)-II of Birbhum District which are in the Red Lateritic Zone.

Cultivar / Variety / Breed name: Tomato (Local improved variety), Brinjal (Local improved variety) and Spinach (Local improved variety).

Conflict of Interest: None

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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