

## ASSESSMENT OF SHELF LIFE AND ORGANOLEPTIC VALUES OF SOME VEGETABLES BY ECO-FRIENDLY METHODS TO ENHANCE THE LIVELIHOOD OF MARGINAL FARMER OF GORAKHPUR REGION (U.P.)

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**Abstract:** In India quality deterioration of vegetables produced takes place immediately after harvest due to lack of on-farm storage. Refrigeration is energy intensive, expensive, not so easy to install and run in remote areas. Due to lack of cold/ cool storage space a substantial amount of fruit and vegetables are lost after production. The efficiency of cool chamber on shelf life and organoleptic properties of fresh cut products were studied for leaf and fruit, vegetables. An experiment was conducted to assess the effect of cold water and salt water treatment on fresh cut products in increasing the shelf life and maintaining the organoleptic properties in two different storage systems and the result were compared with normal/room temperature. During storage, physiological loss of weight and organoleptic values were evaluated. It was observed that the cold water treatment on vegetables shows increased shelf life and maintains its organoleptic properties as compared to other treatment given under cool chamber. It is an eco-friendly energy saving and cost effective alternative method to substitute refrigeration and useful for small farmers. In vegetables like Radish, (*Raphanus sativus*) Brinjal (*Solanum melongena*), Pea (*Pisum sativum*) Lauki (*Lagenaria siceraria*) Chilli (*Capsicum annum*) Tomato (*Lycopersicon esculentum*) Cauliflower (*Brassica oleracea*) during storage for treatment normal, with normal salt water treatment, normal cold water treatment, cool chamber with cold water treatment were given at 1,3,5,7,9,11 and 21<sup>th</sup> day. The cold water treatment with cool chamber is more beneficial in vegetables to the marginal farmers.

**Key words:** Shelf life, Organoleptic value, Marginal farmer, Zero energy cool chamber.

### INTRODUCTION

Postharvest strategies are generally aimed at reducing metabolic activity and maintaining the physico-chemical properties of agriculture crop. This will not only help in reducing the post production losses, generating employment opportunities in rural sector and higher income to farmers but also provides better quality products to the consumers at reduced rates. Horticulture, which includes the production of fruits, vegetables, flowers, spices, medicinal and aromatic plants and plantation crops has emerged as a major economic activity in India. There are no reliable methods for evaluating post-harvest losses of fresh produce. Some estimates suggest that about 30–40% of fruit and vegetables are lost after leaving the farm gate.

The fruit and vegetable sector has a vital role in farm income enhancement, poverty alleviation, food security, and sustainable agriculture in Asia, especially in developing countries. This sector, however, suffers greatly from postharvest losses. Some estimates suggest that about 30–40% of fruit and vegetables are lost or abandoned after leaving the farm gate. Huge postharvest losses result in diminished returns for producers. Post-harvest losses for horticultural produce are, however, difficult to measure but proper handling and storage can surely minimize this problem and enhance the livelihood of the farmers living in peri urban areas of Gorakhpur city.

The present district of Gorakhpur, 265 Kms east of Lucknow, on National Highway No. 28. It covers the area of around 3,321 Sq. Km. It is bounded by districts, Maharajganj in the north, Ambedkarnagar, Azamgarh and Mau in the south, Kushinagar and Deoria in the east and

Santkabirnagar in the west. Gorakhpur is the main terminus for Kushinagar, Kapilvastu and Nepal. Gorakhpur is Located the Terai belt of Eastern Uttar Pradesh in India. It lies between Lat. 26°13'N and 27°29'N and Long. 83°05'E and 83°56'E. Gorakhpur has the most rain during June to September.

### MATERIAL AND METHODS

To evaluate the shelf life and organoleptic properties, the vegetables were collected directly from farmer's field. All vegetables after through sorting were washed in running tap water. The samples were dipped in with normal, cold (15 to 20°C) and salt water for 30 minutes and rapped in wet jute bags before storage. The initial weights of the sample were noted and stored in two different types of storage system, viz. cool chamber and wooden box with proper ventilation. In duration of every 48 hrs, the physiological loss in weight, change in organoleptic properties of the stored product were monitored and recorded. Physiological loss of weight (PLW) is calculated using the following formula:

$$PLW = \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \times 100$$

Organoleptic properties i.e. appearance, texture, taste, flavor and odour, were measures on point scale i.e. point 4, indicates the vegetable was fresh in good quality, without any biological infection. As the product quality decreases, the point was given in decreasing order as mention in table 1. The vegetable which were rotten and shows biological infection were given point 1.

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For experiment, total 7 seasonal vegetables were selected six fruit vegetables i.e. brinjal, bottle gourd, pea, chili, tomato and cauliflower; one earth vegetables i.e. radish. The experiment was performed between 16/03/2013 to 05/04/2013 and during 1/4/2013 to 21/4/2013. At that time the normal temperature ranges between 30 to 38°C and 25.5 to 22.4°C and humidity ranges between 42-48% while in cool chamber, the temperature was between 25.5 to 22.4°C and humidity was maintained between 95 to 99%.

**Table 1:** Evaluation point for organoleptic properties of vegetables

Appearance	Taste, Flavour & Odour	Texture	P.L.W.	Organoleptic Point (O.P.)
Excellent	Excellent	Hard	0-15	4
Good	Good	Soft	16-30	3
Fair	Fair	Very soft	31-40	2
Poor	Poor	Rotten	41-100	1

**Zero energy cool chamber (ZECC)**

It is a double brick wall structure, the cavity is filled with sand and wall of the chamber are soaked in water, cool chamber can reduce temperature by 10-15 C and maintain high humidity of about 95% to 99% that can increase shelf life and retain quality of vegetable produce.

**RESULT AND DISCUSSION**

In the study, the efficiency of cold water (15 -18°C) treatment before keeping the herbage vegetables in cool chamber was found good. All leafy vegetables are filled with water and lose water quickly because they have a thin skin with many pores. As soon as they are picked, they begin losing water and may become shriveled or dry without proper storage. These vegetables need cold, humid

conditions. The cold water treatment decreases the temperature and slow the metabolic activity of fresh cut leafy vegetables and when these pre cooled vegetables were kept in cool chamber, increase the shelf life and maintain the organoleptic properties.



**Figure 1:** Normal and zero cool chamber

Radish (*Raphanus sativus*) belong to family Brassicaceae and favors in peri-urban soil but their shelf life is maximum seven days under normal storage. When stored in cool chamber with cold water treatment, their shelf life increase for nine days. After nine days the PLW was 11.82 and OP was 4 indicate their quality better than normal storage.

**Table 2:** Physiological loss of weight and organoleptic point of *Raphanus sativus* during storage

Vegetables	Treatment	1 day	3 day	5 day	7 day	9 day	
Radish	Normal	Weight(gm)	400	350	280	180	
		PLW	0	12.5	30	55	
		O.P.	4	4	3	1	
Raphanus sativus	Salt water	Weight(gm)	500	500	480	280	
		PLW	0	0	12.72	44	
		O.P.	4	4	4	1	
Raphanus sativus	Cold water	Weight(gm)	500	500	500	340	220
		PLW	0	0	0	32	56
		O.P.	4	4	4	2	1
Raphanus sativus	Cool Chamber	Weight (gm)	930	930	890	860	820
		PLW	0	0	4.3	7.5	11.82
		O.P.	4	4	4	4	4

**Brinjal** (*Solanum melongena*) belongs to family Solanaceae used as fruit vegetables in peri-urban region. At normal storage condition they were fresh for seven days (PLW was 2.00 and OP was 4) but during cool chamber storage their shelf life increases tremendously for 15 days. On fifteenth day the PLW was 14 and OP was 4 which indicate the quality of the product. (Table 3)

**Pea** (*Pisum sativum*) belongs to family papilionaceae used as fruit vegetables in peri-urban region. At normal storage condition they were fresh for five days (PLW was 12 and OP was 2) but during cool chamber storage their shelf life increases tremendously for 11 days. On eleven day the PLW was 12.4 and OP was 4 which indicate the quality of the product. (Table 4)

**Table 3:** Physiological loss of weight and organoleptic point of *Solanum melongena* during storage

S. No	Vegetables	Treatment		1 day	3 day	5 day	7 day	9 day	11 day	13 day	15 day	17 day	19 day	21 day		
2	<i>Solanum melongena</i>	Normal	Weight(gm)	500	500	500	490	430								
			PLW	0	0	0	2	14								
			O.P.	4	4	4	4	3								
		Brinjal	Salt water	Weight(gm)	500	500	500	410								
				PLW	0	0	0	18								
				O.P.	4	4	4	4								
		Cold water		Weight(gm)	500	500	480	460	420							
				PLW	0	0	4	8	16							
				O.P.	4	4	4	4	3							
		Cool Chamber		Weight(gm)	500	500	500	490	475	465	450	430	400	380	370	
				PLW	0	0	0	2	5	7	10	14	20	24	26	
				O.P.	4	4	4	4	4	4	4	4	3	3	3	

**Table 4:** Physiological loss of weight and organoleptic point of *Pisum sativum* during storage

S. No	Vegetables	Treatment		1 day	3 day	5 day	7 day	9 day	11 day	13 day	15 day			
3	<i>Pisum sativum</i> (Pea)	Normal	Weight(gm)	500	450	440	345							
			PLW	0	10	12	31							
			O.P.	4	4	4	2							
		Salt water		Weight(gm)	500	440	380	300						
				PLW	0	12	24	40						
				O.P.	4	4	3	2						
		Cold water		Weight(gm)	500	500	470	450	422					
				PLW	0	0	6	10	15.6					
				O.P.	4	4	4	4	2					
		Cool Chamber		Weight(gm)	500	500	500	480	460	438	415	380		
				PLW	0	0	0	4	8	12.4	17	24		
				O.P.	4	4	4	4	4	4	3	3		

**Bottle gourd** (*Lagenaria siceraria*) belongs to family cucurbitaceae used as fruit vegetables in peri-urban region. At normal storage condition they were fresh for eleven days (PLW was 15.5 and OP was 4) but during cool chamber storage their shelf life increases tremendously for 21 days. On twenty one day the PLW was 9.6 and OP was 4 which indicate the quality of the product. (Table 5)

**Chilli** (*Capsicum annuum*) belongs to family solanaceae used as fruit vegetables in peri-urban region. At normal storage condition they were fresh for seven days (PLW was 14 and OP was 4) but during cool chamber storage their shelf life increases tremendously for 17 days. On seventeen day the PLW was 30 and OP was 3 which indicate the quality of the product. (Table 6)

**Table 7.9:** Physiological loss of weight and organoleptic point of *Lagenaria siceraria* during storage

S. No	Vegetables	Treatment		1 day	3 day	5 day	7 day	9 day	11 day	13 day	15 day	17 day	19 day	21 day	
4	Lauki (Bottle Gourd) <i>Lagenaria siceraria</i>	Normal	Weight(gm)	900	900	880	850	800	760	730	700	650	628		
			PLW	0	0	2.2	5.5	11.1	15.5	18.8	22.2	27.7	30.2		
			O.P.	4	4	4	4	4	4	3	3	3	3		
		Salt water		Weight(gm)	880	860	850	810	780	740	680				
				PLW	0	2.2	7.9	11.3	15.9	22.7	30.1				
				O.P.	4	4	4	4	3	3	2				
		Cold water		Weight(gm)	950	950	930	920	900	845	825	800	780	755	730
				PLW	0	0	2.1	3.1	5.2	11.0	13.1	15.7	17.8	20.5	23.1
				O.P.	4	4	4	4	4	4	4	4	3	3	3
		Cool Chamber		Weight(gm)	930	930	920	910	900	880	885	870	865	860	840
				PLW	0	0	1.07	2.15	3.22	4.8	5.37	6.45	6.98	7.52	9.67
				O.P.	4	4	4	4	4	4	4	4	4	4	4

**Table 6:** Physiological loss of weight and organoleptic point of *Capsicum annuum* during storage

S. No	Vegetables	Treatment		1 day	3 day	5 day	7 day	9 day	11 day	13 day	15 day	17 day	19 day	21 day	
5	Chilli ( <i>Capsicum annuum</i> )	Normal	Weight(gm)	500	500	470	430	400	340	300	270				
			PLW	0	0	6	14	20	32	40	46				
			O.P.	4	4	4	4	3	2	2	1				
		Salt water		Weight(gm)	500	500	460	420	400	370	320				
				PLW	0	0	8	16	20	26	36				
				O.P.	4	4	4	3	3	3	2				
		Cold water		Weight(gm)	500	500	500	480	440	410	340	300	280		
				PLW	0	0	0	4	12	18	32	40	44		
				O.P.	4	4	4	3	2	2	1	1	1		
		Cool Chamber		Weight(gm)	500	500	460	460	440	420	400	380	350	330	290
				PLW	0	0	8	8	12	16	20	24	30	34	42
				O.P.	4	4	4	4	4	3	3	3	3	2	1

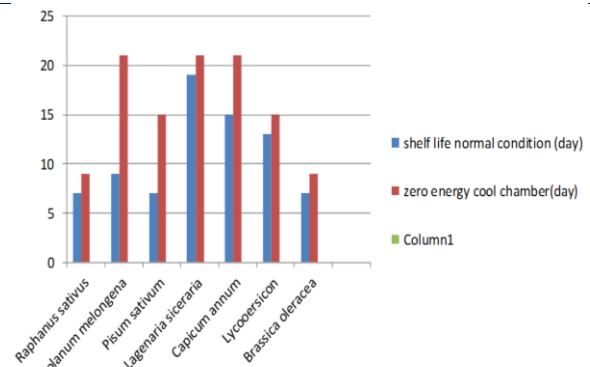
**Tomato** (*Lycopersicon esculentum* Mil) belongs to family solanaceae used as fruit vegetables in peri-urban region. At normal storage condition they were fresh for five days (PLW was 12 and OP was 2) but during cool chamber

storage their shelf life increases tremendously for 11 days. On eleven day the PLW was 12.4 and OP was 4 which indicate the quality of the product. (Table 7)

**Table 7:** Physiological loss of weight and organoleptic point of *Lycopersicon esculentum* Mil during storage

S. No	Vegetables	Treatment	1 day	3 day	5 day	7 day	9 day	11 day	13 day	15 day		
6	Tomato ( <i>Lycopersicon esculentum</i> Mil)	Normal	Weight(gm)	1000	1000	980	960	920	790	695		
			PLW	0	0	2	4	8	21	30.5		
			O.P.	4	4	4	4	4	3	2		
		Salt water	Weight(gm)	1000	960	935	900	860	820			
			PLW	0	4	6.5	10	14	18			
			O.P.	4	4	4	4	4	3			
		Cold water	Weight(gm)	1000	1000	980	940	900	860	800		
			PLW	0	0	2	6	10	11	20		
			O.P.	4	4	4	4	4	4	3		
		Cool Chamber	Weight (gm)	1000	1000	980	930	910	860	800	800	740
			PLW	0	0	2	7	9	14	20	26	
			O.P.	4	4	4	4	4	4	3	3	

**Cauliflower** (*Brassica oleracea* var. *botrytis*) belongs to family brassicaceae used as herbage vegetables in peri-urban region. At normal storage condition they were fresh for five days (PLW was 9.4 and OP was 4) but during cool chamber storage their shelf life increases tremendously for 09 days. On nine day the PLW was 23 and OP was 3 which indicate the quality of the product. (Table 8)



**Figure 2:** Vegetables and their shelf life under normal and ZECC

**Table 8:** Physiological loss of weight and organoleptic point of *Brassica oleracea* var. *Botrytis* during storage.

S.No	Vegetables	Treatment	1 day	3 day	5 day	7 day	9 day	
7	Cauliflower <i>Brassica oleracea</i> var. <i>Botrytis</i>	Normal	Weight(gm)	530	500	480	435	
			PLW	0	5.66	9.43	17.9	
			O.P.	4	4	4	3	
		Salt water	Weight(gm)	650	630	580	530	
			PLW	0	3.07	10.76	18.46	
			O.P.	4	4	4	3	
		Cold water	Weight(gm)	650	640	590	540	
			PLW	0	10.53	9.23	16.92	
			O.P.	4	4	4	3	
		Cool Chamber	Weight(gm)	560	560	520	480	430
			PLW	0	0	7	14	23
			O.P.	4	4	4	4	3

**Table 9:** Vegetables and their shelf life under normal and ZECC

S.No.	Vegetables	Shelf life in normal condition in (Days)	Zero Energy Cool Chamber in (Days)
1	<i>Raphanus sativus</i>	7	9
2	<i>Solanum melongena</i>	7	15
3	<i>Pisum sativum</i>	5	11
4	<i>Lagenaria siceraria</i>	11	21
5	<i>Capsicum annum</i>	7	17
6	<i>Lycopersicon esculentum</i>	5	11
7	<i>Brassica oleracea</i> var. <i>botrytis</i>	5	9

During storage, the salt water treatment was not beneficial for any herbage vegetables. Salt water treatment was selected to save from fungal/ microbial infection but due to hypertonic solution they decrease the shelf life of vegetables. In comparison to normal storage the cold water treatment with cool chamber is found beneficial for all vegetables. It increases the shelf life and organoleptic properties of the vegetables.

**CONCLUSION**

Cold water treatment with cool chamber storage is effective in small marginal farmers due to low cost and zero energy requirements. The facility of cold storage is beyond the reach of marginal farmers; therefore, the use of cool chamber may prove beneficial for the farmers. National Horticulture Board is given 100% grant in aid for the benefit of the farmers. Even unskilled labour can build the

chamber, as it does not require any specialized skill. Small and marginal farmers can store vegetable for a few days to avoid middleman. Therefore on farm storage technology can save energy and raise farm income of the farmers in peri-urban region.

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