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STUDIES ON SHELF LIFE OF BRINJAL (*SOLANUM MELONGENA* L.) UNDER DIFFERENT ORGANIC PACKAGING MATERIALS

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ABSTRACT

The present investigation entitled "Studies on shelf life of brinjal (*Solanum melongena* L.) under different organic packaging materials" was conducted at the Research lab, ITM University, Gwalior (M.P.). Brinjal (*Solanum melongena L.*) is an important and indigenous vegetable crop of India. Brinjal or eggplant belongs to the family of *Solanaceae* is one of the most common popular and principle vegetable crops grown in India and other parts of the world. Brinjals or eggplants are rich sources of vitamins, minerals and antioxidant capacity. Eggplant is also a natural source of vitamin A; thus, it plays an important role for vision and eye health. Lack of appropriate postharvest storage management practices are reported to cause up to 50 % of yield losses of vegetable crops between harvesting and consumption. Packaging is a co-ordinated system of preparing goods for transport, and good for shelf life, distribution, storage, retailing and end use. The experiment was laid out in the Completely Randomized Design with four replications. Each replication was comprised of ten treatment consisting of different packing material *viz.*, news paper, tissue paper, paddy straw, gunny bag, butter paper, banana leaf, CFB, craft paper and caster leaf were used for induced the shelf life of brinjal. Result concluded that the different packing materials viz., newspaper, tissue paper, paddy straw, gunny bag, butter paper, banana leaf, CFB (10 x 10 cm^2), craft paper and caster leaf were significantly influenced the shelf life of brinjal. The treatment T_3 (Paddy straw) was found the best packing material treatment among all packing material treatments for enhancing shelf life of brinjal and it gave the maximum physical parameters. However, the minimum physical parameters were recorded in treatment T_0 (Control).

Keywords **:** Shelf life, Brinjal, newspaper, tissue paper, paddy straw, gunny bag, butter paper, banana leaf, craft paper, caster leaf.

Introduction

Brinjal (*Solanum melongena L.*) is an important and indigenous vegetable crop of India. Brinjal or eggplant belongs to the family of *Solanaceae* is one of the most common popular and principle vegetable crops grown in India and other parts of the world. It contributes 9% of the total vegetable production of the country. It is due to improvement in production technology, protection measures and the genetic improvement which has shown significant advancement in yield, quality, diseases and insect-pest resistance. The cultivars of low glycoalkaloids content with different sizes, shapes and colour increased the market acceptability of the fruits. The brinjal is of most importance in the warm areas of Far-East, being grown extensively in India and other Asian countries like Bangladesh and Pakistan. In India, the area and production of onion are 749 thousand hectare and 12874 thousand MT (Anonymous, 2020-21). Brinjal occupies third position among vegetable crops in India and covers 9 per cent of total vegetable production in India. In Madhya Pradesh, The area and production of onion are 61.32 thousand hectare and 1296.08 thousand MT (Anonymous, 2020-21).

Brinjals or eggplants are rich sources of vitamins, minerals and antioxidant capacity. Eggplant is also a natural source of vitamin A; thus, it plays an important role for vision and eye health (Igwe *et al.* 2003). Furthermore, eggplants are also known to have hepato protective properties which have shown to inhibit protein activated receptor 2 inflammation associated with atherosclerosis (Akanitapichat *et al*. 2010 and Tan *et al* 2010).

Brinjal has been a staple vegetable in many tropical countries from ancient times and is called as the vegetable of masses. Contrary to the common belief, it is quite high in nutritive value and can be well compared with tomato (Jois *et al.,* 2019). It can be grown in wide range of agro-climatic zones and provides a tremendous scope and potential for cultivation of this crop.

Lack of appropriate postharvest storage management practices are reported to cause up to 50% of yield losses of vegetable crops between harvesting and consumption (Lumpkin *et al.* 2009). Poor harvest and storage practices are the most critical problem affecting the quantity, quality and hence the market value of fruits (Bachmann and Earles, 2000). Postharvest losses of most horticultural produces are stated to be 20-50 % in developing countries and 5-25 % in developed countries (Abbas *et al.,* 2011). About 40–50% of total world fresh horticultural produce is lost before being consumed due to high rates of bruising, water loss, decays and decreased nutritional quality during postharvest handling (Kader, 2005).

Specialised postharvest handling practices and treatment methods are needed in order to extend the shelf life of the crop after harvest. Failure to adhere to these specialised handling practices and treatment methods will result in high amount of loss. Losses of up to high can be recorded in brinjals between the harvesting and consumption stages of the distribution chain in tropical countries It is therefore important to know the appropriate handling practices and treatment methods needed for harvested brinjals in order to reduce postharvest losses thereby increasing profitability for handlers in developing countries (Nasrin *et al*., 2008). Fruits and vegetables are extremely perishable products that require to be dealt with much care to reduce losses and enhance the shelf life (Nandhini, 2017).

Packaging is a co-ordinated system of preparing goods for transport, and good for shelf life, distribution, storage, retailing and end use. The need for quality packaging for distribution and marketing of food products can hardly be over emphasised. With the thrust on promotion of exports, it is imperative that adequate attention be paid to packaging and logistics. A comprehensive set of specifications for packaging of fresh fruits and vegetables is essential to help farm producers to effectively market their produce in a safe and cost effective manner-in the domestic as well as export markets.

Brinjal have limited shelf life of 3 days during ambient storage temperature (Singh *et al*., 2019). The increase in water loss and rapid shrinkage of peel due to physiological disorders during storage are most common adverse effects during storage of eggplants (Jha *et al*., 2002). A number of methods such as low temperature storage modified atmospheric storage and gamma irradiation are practiced for increasing the shelf life in eggplant. However, the wholesalers, retailers or producers are seldom to afford the above-mentioned practices for increasing the shelf life of eggplants after harvest. Traders many times use fraudulent unhygienic practices such as application of petroleum based oil to make eggplants surface shiny and attractive. Such malpractices are harmful to human health (Singh *et al*., 2019). There is an urgent need for safer technology to reduce the transpiration and physiological loss in water during storage.

Materials and Methods

Experimental details

The experiment was laid out in the Completely Randomized Design with four replications. Each replication was comprised of ten treatment consisting of different packing material *viz*., news paper, tissue paper, paddy straw, gunny bag, butter paper, banana leaf, CFB, craft paper and caster leaf were used for induced the shelf life of brinjal. The details are given below:

Crop : Brinjal (*Solanum melongena* L.)
Design : CRD
Replications : 04
Treatments : 10
Total number of treatments : 40

Treatment details

T_0 : Control
T_1 : News paper
T_2 : Tissue paper
T_3 : Paddy straw
T_4 : Gunny bag
T_5 : Butter paper
T_6 : Banana leaf
T_7 : CFB (10 x 10 cm^2)
T_8 : Craft paper
T_9 : Caster leaf

Observation recorded

The data recorded on various parameters were subdivided into different categories during the period of experimentation. The data were recorded as per standard procedure.

Physical parameters (at 0, 3, 6, 9 and 12 days after storage)

Fruit weight (g)

The average weight of fruit was calculated after the final picking as per the formula:

Average fruit weight = Total weight of fruits (g)/ Number of fruits

Fruit length (cm)

The length of fruits was recorded with the help of centimetre scale and was expressed in m centimetres.

Fruit volume (ml)

The volume of fruit was recorded by water displacement method with the help of measuring cylinder and was expressed in millilitres.

Fruit specific gravity

The specific gravity was obtained by dividing the weight of the fruit by the volume of the fruit.

Physiological loss in weight (PLW %)

The physiological loss in weight of the fruits was recorded at 0, 3, 6, 9 and 12 days after storage. The observations were taken from all the three replications and the average values were statistically analyzed.

At the beginning of storage period, initial fruit weight was recorded. On each date of observation, the fruits were weighed and this weight was termed as final weight on the particular date of observation. The percent loss in weight for each observation by using the formula suggested by Srivastava and Tandon (1968).

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

Decay or spoilage (%)

The data pertaining to decay or spoilage of the fruits was also recorded at 0, 3, 6, 9 and 12 days after storage from the three replications. It was then averaged statistically and analyzed.

Decay loss was calculated on weight basis. Fruits showing rotting due to over ripening and pathogenic infection were considered decayed and weighed on the day of each observation. Weight of decayed fruits included the total weight of fruits decayed up to that date of observation. The per cent decay loss was calculated by using the formula suggested by Srivastava and Tandon (1968).

$$\text{Decay loss (\%)} = \frac{\text{Weight of decayed fruit}}{\text{Initial weight of fruits at the time of packaging}} \times 100$$

Result and Discussion

Result reported that the different packing materials were significantly influenced physical parameters at different days after storage and the treatment T_3 (Paddy straw) was found the best packing material treatment for enhancing shelf life of brinjal and it gave the maximum physical parameters (viz., fruit weight, fruit volume and specific gravity) at 0, 3, 6, 9 and 12 days after storage except physiological loss in weight and decay or spoilage, whereas the minimum physical parameters at 0, 3, 6, 9 and 12 days after storage were recorded in treatment T_0 (Control) except physiological loss in weight and decay or spoilage. This may be due to the use of different packaging materials provide optimal environment to the fruit because of soft cushion and temperature/ transportation vibration resistant material showed highest shelf life without mechanical injury to fruit. Climatic interaction of transport vehicle and type of packing plays a major role in determining post harvest losses till it reaches to final destination. The physiological loss in weight might be due to the water loss, respiration and transpiration of eggplant even after the harvest. Fresh produce continues to lose water even after harvest due to transpiration resulting in wilting or shrivelling of the produce. Relative humidity and temperature are the important factors that influence the loss of moisture from fresh produce Water loss will also be high with increase in storage temperature. Fresh produce transpire more at high temperatures and low humidity. Packing material and cushion ma terial are also responsible for fruit decay. The results are in confirmation with the results achieved by Saeed *et al.* (2010), Asem *et al.* (2016), Sualeh *et al.* (2016), Ashenafi (2018), Barragan *et al.* (2019), Prashant *et al.* (2020), Thole *et al.* (2021) and Paneru (2022).

Table 1: Effect of different organic packaging materials on physical parameters at 0, 3, 6, 9 and 12 days after storage of brinjal.

Treatment symbols	Treatment details	Fruit weight (g)					Fruit length (cm)					Fruit volume (ml)				
		0 DAS	3 DAS	6 DAS	9 DAS	12 DAS	0 DAS	3 DAS	6 DAS	9 DAS	12 DAS	0 DAS	3 DAS	6 DAS	9 DAS	12 DAS
T_0	Control	70.20	65.01	58.01	49.03	38.13	6.10	6.00	5.90	5.83	5.68	65.01	58.07	50.07	43.00	31.07
T_1	Newspaper	86.45	79.96	70.14	57.51	45.39	6.90	6.95	6.85	6.68	6.63	79.60	70.11	60.11	51.76	36.96
T_2	Tissue paper	85.40	77.34	68.28	56.45	44.74	6.71	6.85	6.64	6.53	6.59	77.58	69.00	59.00	50.07	36.20
T_3	Paddy straw	89.16	82.11	73.09	59.03	47.06	7.30	7.10	6.95	6.81	6.80	82.04	75.01	65.04	53.06	38.00
T_4	Gunny bag	87.70	80.53	71.29	57.91	46.21	7.11	7.05	6.90	6.76	6.75	80.59	73.89	63.86	52.02	37.56
T_5	Butter paper	82.03	74.82	66.57	55.86	43.68	6.63	6.78	6.53	6.44	6.42	76.37	67.42	57.53	49.42	35.47
T_6	Banana leaf	72.41	66.52	59.20	50.38	39.60	6.25	6.24	6.01	5.93	5.78	67.21	60.53	51.89	44.39	32.64
T_7	CFB (10 x 10 cm^2)	80.41	73.72	65.89	53.88	42.45	6.56	6.73	6.40	6.38	6.27	73.98	65.65	55.71	48.09	35.12
T_8	Craft paper	77.55	70.92	62.92	52.73	41.49	6.48	6.54	6.38	6.20	6.06	70.00	63.78	53.78	47.67	34.55
T_9	Caster leaf	75.94	68.84	61.92	51.96	40.92	6.37	6.34	6.23	6.06	5.94	69.86	61.87	52.81	47.09	33.84
	SEm ±	**0.733**	**0.925**	**0.871**	**0.640**	**0.518**	**0.026**	**0.033**	**0.035**	**0.028**	**0.025**	**0.637**	**0.675**	**0.675**	**0.556**	**0.469**
	CD 5%	**2.086**	**2.632**	**2.479**	**1.820**	**1.475**	**0.074**	**0.095**	**0.099**	**0.078**	**0.070**	**1.812**	**1.921**	**1.919**	**1.582**	**1.334**

Table 2: Effect of different organic packaging materials on physical parameters at 0, 3, 6, 9 and 12 days after storage of brinjal.

Treatment symbols	Treatment details	Fruit specific gravity					Physiological loss in weight (PLW %)					Decay or spoilage (%)				
		0 DAS	3 DAS	6 DAS	9 DAS	12 DAS	0 DAS	3 DAS	6 DAS	9 DAS	12 DAS	0 DAS	3 DAS	6 DAS	9 DAS	12 DAS
T_0	Control	0.60	0.58	0.55	0.52	0.48	0.00	2.95	7.60	13.40	22.40	0.00	1.30	3.10	5.70	16.40
T_1	Newspaper	0.70	0.67	0.62	0.58	0.53	0.00	2.53	6.13	10.49	17.47	0.00	0.99	2.56	5.21	10.70
T_2	Tissue paper	0.69	0.66	0.61	0.57	0.52	0.00	2.55	6.58	11.00	18.10	0.00	1.05	2.60	5.25	11.09
T_3	Paddy straw	0.73	0.70	0.65	0.60	0.55	0.00	2.40	5.40	9.17	16.20	0.00	0.90	2.40	4.90	10.14
T_4	Gunny bag	0.71	0.68	0.64	0.59	0.54	0.00	2.48	5.78	10.12	16.80	0.00	0.96	2.48	5.05	10.33
T_5	Butter paper	0.68	0.65	0.60	0.56	0.52	0.00	2.59	6.87	12.20	18.92	0.00	1.09	2.69	5.30	11.79
T_6	Banana leaf	0.63	0.60	0.56	0.53	0.49	0.00	2.86	7.53	13.32	21.50	0.00	1.28	3.03	5.64	15.48
T_7	CFB (10 x 10 cm^2)	0.67	0.64	0.59	0.56	0.51	0.00	2.64	7.02	12.68	19.82	0.00	1.17	2.76	5.39	12.51
T_8	Craft paper	0.65	0.63	0.58	0.55	0.50	0.00	2.69	7.24	12.98	20.04	0.00	1.20	2.87	5.44	13.13
T_9	Caster leaf	0.64	0.62	0.57	0.54	0.50	0.00	2.78	7.37	13.12	20.71	0.00	1.25	2.98	5.56	14.69
	SEm ±	**0.015**	**0.015**	**0.016**	**0.012**	**0.012**	**-**	**0.024**	**0.044**	**0.774**	**0.089**	**-**	**0.018**	**0.024**	**0.034**	**0.082**
	CD 5%	**0.042**	**0.042**	**0.044**	**0.033**	**0.034**	**-**	**0.069**	**0.126**	**2.203**	**0.252**	**-**	**0.051**	**0.068**	**0.096**	**0.232**

Conclusion

Result concluded that the different packing materials viz., newspaper, tissue paper, paddy straw, gunny bag, butter paper, banana leaf, CFB (10 x 10 cm^2), craft paper and caster leaf were significantly influenced the shelf life of brinjal. The treatment T_3 (Paddy straw) was found the best packaging material treatment among all packing material treatments for enhancing shelf life of brinjal and it gave the maximum physical and biochemical parameters. However, the minimum physical and biochemical parameters were recorded in treatment T_0 (Control).

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