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Prepackaging, Storage Losses and Physiological Changes of Fresh Cauliflower as Influenced by Post Harvest Treatments

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Abstract: Different post-harvest treatments manifested specific attribute in maintaining physical appearance, acceptability and economic return for cauliflower. It was observed that storage in perforated polythene bag prolonged the shelf life and helped maintaining highest physical appearance, acceptability and economic return of cauliflower. Considering weight loss and economic return, the wet gunny bag treatment was also found to be acceptable. Cauliflower showed the best physical appearance, acceptability, lower weight loss and thereby rendered the highest economic return with perforated polythene bag treatment at 4 days after storage (DAS). In this case wet gunny bag was also found to be acceptable considering as physical appearance, acceptability grade and net economic return.

Key words: Prepackaging storage losses, physiological changes, post harvest, days after storage (DAS), cauliflower

Introduction

When a farmer produces a vegetable crop, which is particularly perishable in nature, it should be brought to the consumer as quickly as possible in order to justify the market requirement. Unfortunately, often poor prepackaging and poor handling methods and marketing system causes a high post-harvest loss of the commodity. Its quality deteriorates gradually during temporary storage, prepackaging, transport, wholesaling and retailing, particularly when the conditions remain unfavourable, and at a stage it becomes unfit for marketing or human consumption. It is estimated that a loss of nearly 25-40% of the vegetables occurs due to rough prepackaging and improper post harvest handling, transportation and storage practices; and the variation often depends on type of vegetables (Singh and Chadha, 1990). Sharma (1987) reported that, post-harvest losses of vegetables in Bangladesh could be as high as 43%. The average post-harvest loss as estimated by Khan (1991) is 26%.

Cauliflower *(Brasica oleracea* var. *botrytis*) is cultivated in 10,142 ha in Bangladesh with a total production of 78.70 thousand metric tonnes (Anonymous, 1998). The major vegetable growing areas of Bangladesh are Jessore, Bogra, Comilla, Chittagong, Khulna, Kushtia, Dhaka, Tangail, Rangpur, Rajshahi and Dinajpur and a major part of the vegetables produced in these areas are transported to the capital or other cities as soon as possible through different marketing channels (Ahmed, 1992 and Hossain, 2000).

The present traditional methods of harvesting, post-harvest handling, prepackaging, transporting and storing of vegetables can be improved with a little additional cost or interference with the existing marketing practices. Expensive machinery is not always required; more efficient and better utilization of the existing facilities is often sufficient. The activities of pre-packaging, transportation and storage are to bridge up the gap between harvesting and consumption and post-harvest losses. Good pre-packaging transport and storage are especially important for cauliflower because of their perishability. Prolonging the shelf life of different vegetables is very important under Bangladesh condition. With these above views in consideration the present study was undertaken I) to identify the suitable prepackaging methods in extending the shelf life of cauliflower, ii) to determine the post-harvest losses of cauliflower and iii) to find out the physiological changes of the vegetables during post-harvest treatments.

Materials and Methods

The experiment was conducted in the Department of Food

Technology and Rural Industries, Bangladesh Agricultural University (BAU), Mymensingh, during 2002. The cauliflowers were collected from a farmer's field of Trishal, Mymensingh, Bangladesh. Cauliflowers were harvested on February 3, 2002 in the morning hours. Immediately after harvest, the cauliflowers were transferred to the laboratory of the Department of Food Technology and Rural Industries, BAU, Mymensingh for the different post-harvest treatments.

The prepackaging and post-harvest handling treatments were selected as control (T_1), perforated polyethylene bag (T_2), unperforated polythylene bag (T_3), wet gunny bag (T_5), polyester bag (T_5), and splashing of water directly on cauliflower (T_6). The experiments were carried out in randomized complete block design (RCBD) with three replications. For each replication of a treatment, 3kg of freshly harvested cauliflowers were used, and the bamboo baskets containing the vegetables were kept in the floor of a laboratory room. The study was conducted during the winter season from February to March, 2002. The temperature and relative humidity of the atmosphere during the study period ranged from 16.8 to 26.9°C and 79 to 87% respectively.

Data were collected mainly under laboratory conditions during the post-harvest study. Post-harvest data were collected only up to the stage of edible conditions. Visual observations on shrinkage freshness and colour changes were recorded. The price of the vegetables at the last marketable and edible stage under each treatment was recorded. A panel of local retailers (10) estimated the price of the vegetables at the stage. The estimated value of 3kg freshly harvested cauliflower and the value of the cauliflower, after loss in weight and price during storage under different treatments were determined and recorded. Recorded data were subjected to statistical analysis for mean values and test of significance. The variations among the respective data were compared following the Least Significant Difference (LSD) test (Gomez and Gomez, 1984).

Results and Discussion

Effect of post-harvest treatments on physical appearance of cauliflower: Cauliflower kept in perforated polythene bag remained adible and marketable condition up to 6 days after storage (DAS). In this treatment, the flowerest of cauliflower were firm and whitish, stalks remained green and attached to the flowerest, and the physical appearance was comparatively better (Table 1). The physical appearance of the flowerts stored in perforated polythene bag remained better probably due to less gaseous exchange. But 8 days after storage, the cauliflower flowerets and stalks started rotting due to microbial infection, and ultimately became unsuitable for consumption or marketing (Table 1). Polythene bags might have also acted as physical barrier for the extreme of the decay organism up to a certain period than in other treatments (Jang *et al.*, 1993).

In case of wet gunny bag treatment, the flowerets were not in edible condition at eight DAS. Although the flowerets were firm at six DAS in the treatment, the physical appearance of the flowerets was not good when compared with the perforated polythene bags (Table 1). The physical appearances of the control, cauliflower, in unperforated polythene bag, polyester bag or with splashing of water treatments were not similar. Though in all treatments the flowerets at four DAS were in edible condition, the flowerets became less firm and had spots both in flowerets and stalks for the control, unperforated

Table 1: Change of colour and physical appearance of cauliflower during the storage as influenced by different post-harvest treatments

Post-harvest treatments	Days after storage				
	0[a]	2	4	6	8
Control	Whitish Firm floweret floweret	Yellowish stalk, blackish spots or detached from floweret	Less firm floweret, spots on floweret,	Loose floweret, not edible	Rotten flowert, not edible
Perforated polythene bag	Whitish firm floweret	Brownish stalk, firm floweret	Firm floweret, greenish stalk, attached to the floweret	Firm floweret, whitish stalk, edible	Rotten flowert, not edible
Unperforate d polythene bag	Whitish firm floweret	Yellowish stalk	Less firm floweret, spots on floweret	Rotten flowert, not edible	Rotten flowert, not edible
Wet gunny bag	Whitish firm floweret	Yellowish stalk, firm floweret	Firm floweret, stalk detached from floweret	Firm floweret, stalk rotten, floweret edible	Rotten flowert, not edible
Polyester bag	Whitish firm floweret	Brownish stalk	Firm floweret, yellowish stalk few attached to the floweret	Rotten flowert, not edible	Rotten flowert, not edible
Splashing of water	Whitish firm floweret	Yellowish stalk, brownish spot on floweret	Firm floweret with spots, stalk detached from floweret	Rotten flowert, not edible	Rotten flowert, not edible

a° = days of storage is the day of harvest.

Table 2: Scores on general appearance and consumer's acceptability of cauliflower as influenced by different post-harvest

	Scores on general appearance of cauliflower				
	Days after storage (DAS)				
Treatments	0	2	4	6	8
Control	10[a]	7	5	4	3
Perforated polythene bag	10	8	6	5	4
Unperforated polythene bag	10	6	5	4	3
Wet gunny bag	10	6	4	4	3
Polyester bag	10	6	4	3	3
Splashing of water	10	7	6	5	4

[a]Freshly harvesteds good looking cauliflowers had the maximum score (10); cauliflowers with 5 or 4 scores were still edible, but were poor in appearance and consumer's acceptance

Table 3: Economic return from cauliflower stored for 4 days under different post-harvest treatments

	Initial			4 days after storage			
Post-harvest treatments	Weight (kg)	Local market price (Tk/kg)[a]	Total amount (Tk)	Weight loss (kg)	Weight retained (kg)	Local market price (Tk/kg)[a]	Total amount (Tk)
Control	3	15	45	0.62	2.38	6	14.28
Perforated polythene bag	3	15	45	0.14	2.86	13	37.18
Unperforated polythene bag	3	15	45	0.03	2.97	2	5.94
Wet gunny bag	3	15	45	0.05	2.95	10	29.50
Polyester bag	3	15	45	0.19	2.81	4	11.24
Splashing of water	3	15	45	0.35	2.65	8	21.20

[a]As indicated by a panel of retailers.

polythene bag and polyester bag treatments. The cauliflowers were graded for appearance and acceptability by a panel of judges during the course of storage (Table 2). At the harvesting stage (0-days of storage) the score was the highest 10, and at eight DAS the highest score 4 was for the perforated polythene bag and splashing of water treatment (Table 2).

Effect of post-harvest treatments on economic aspect of cauliflower: Market price depends upon freshness and physical appearance of any vegetables. At 4 DAS the cauliflower under all treatment were edible, but exhibited differential effects on the physical appearance (Table 1). At that stage the cauliflower stored in perforated polythene bags were more fresh. But the weight was higher when the vegetable was kept in unperforated polythene bag, and wet gunny bag (Table 2). In unperforated polythene bag, the flowerets were less firm, stalk was yellowish and was detached from the floweret. The market price of those cauliflowers, as indicated by the local retailers (Table 3) was the lowest (Tk. 2.00 kg^{-1}). After 4 days of storage the market price of the cauliflower stored in perforated polythene bag was the highest (Tk. 13.00 kg^{-1}). Though the weight of cauliflower was higher in the wet gunny bag treatment at 4 DAS, the price of the cauliflower was less than those kept in perforated polythene bags. Thus the total value of the cauliflower stored in perforated polythene bag was higher (Table 3) than that of splash in of water on the cauliflower at an interval of 2 hrs caused spots on the floweret, and hence the market price was relatively lower (Tk. 8.00 kg^{-1}). The total value of the vegetables stored in unperforated polythene bag at 4 DAS was the lowest (Tk. 5.49 per 3kg), while it was the highest (Tk. 37.18 per 3kg) when kept in perforated polythene bag (Table 3).

It is concluded that Cauliflower showed the best physical appearance, acceptability, and lower weight loss and thereby rendered the highest economic return with perforated polythene bag at four days after storage (DAS). In this case wet gunny bag was also found to be acceptable, considering as physical appearance, acceptability grade and net economic return.

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