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Prepackaging, Storage Losses and Physiological Changes of Fresh Tomato 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 tomato. The physical appearance and consumer's acceptability score for tomatoes at 6 days after storage revealed that, perforated polythene and wet gunny bag treatments showed better physical appearance than all other treatments. The score was the highest (10) at 0 days of storage and also the highest score 7 at 8 DAS in perforated polythene bag. The gross economic returns, considering weight loss, physical appearance and consumer's acceptability at 6 days after storage, tomatoes kept in perforated polythene bag was found to be the highest. The lowest return was observed in the polyester bag on the vegetable during storage.

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

Introduction

Farmers produce 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 systems cause 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%.

Tomato *(Lycopersicon esculentum mill)* is most widely grown vegetables in Bangladesh and is cultivated in 12587 ha of land with a total production of 93.94 thousand metric tonnes (BBS, 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; 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 tomato because of their perishability. Prolonging the shelf life of different vegetables is very important under Bangladesh condition. So, the present study was undertaken I) to identify the suitable prepackaging methods in extending the shelf life of tomato, ii) to determine the post-harvest losses of tomato 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 tomato seeds were collected from a farmer's field of Trishal, Mymensingh, Bangladesh. Tomatoes were collected immediately after harvest in the morning hours. Then tomato 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 polyethylene bag (T_3), wet gunny bag (T_5), polyester bag (T_5) and splashing of water directly on tomato (T_6). The experiments were carried out in Randomized Complete Block Design (RCBD) with three replications. For each replication of a treatment, 3 kg of freshly harvested tomato were used and the bamboo baskets containing the vegetables were kept in the floor of a laboratory room. 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 that stage. The estimated value of 3 kg freshly harvested tomato and the value of the tomato, 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 tomatoes: Tomatoes kept in perforated polythene bag and with control treatment remained edible and marketable condition up to 8 DAS (Table 1). Six days after storage, all tomatoes in perforated polythene bag ripened uniformly and developed deep red colour. Uniform red colour was also observed in wet gunny bag treatment at 6 DAS. The development of uniform deep red colour in the perforated polythene bag was probably due to higher concentration of ethylene (Pantastico *et al.*, 1975). Tomatoes stored in wet gunny bag, polyester bag, unperforated polythene bag and with splashing of water were not in edible condition at 8 DAS (Table 1). Tomatoes were in edible condition in all treatments at 6 DAS. The pattern of colour development was different in different treatments.

The tomatoes were graded for appearance and acceptability by a panel of judges during storage. The results are presented in Table 2. At the harvesting stage (0 day of storage) the score was the highest 10 and at 8 DAS the highest score 7 was recorded for the tomatoes kept in perforated polythene bag.

Effect of post-harvest treatments on economic aspect of tomatoes: Good market price of tomatoes depends upon the quality of the tomatoes. The quality comprises firmness, freshness, colour, flavour and taste (Singh *et al.*, 1979). At 6 DAS the tomatoes under all treatments were edible, but varied in physical appearance (Table 1). At that stage, the tomatoes stored in perforated polythene bags and wet gunny bags were of uniformly deep red in colour (Table 1). The weight loss was less when tomatoes were kept in unperforated polythene bag at 6 DAS. The shrinkage of tomatoes (Table 1) was observed at 6 DAS when kept in polyester bags and as well as for control sample.

The market prices of tomatoes stored in polyester bag and control treatment as indicated by the local retailers were Tk. 5 kg^{-1} and Tk. 3 kg^{-1}, respectively (Table 3). At 6 DAS, the market price of the tomatoes stored in perforated polythene bag was the highest (Tk. 8 kg^{-1}). Thus the total value of tomatoes stored in perforated polythene bag was the highest (Tk. 22.56 3 kg^{-1}). The total value of the

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

	Days after storage					
Post-harvest treatments	0[a]	2	4	6	8	10
Control	Greenish yellow	Light greenish yellow	Light yellowish few scattered spots	Pale-red black, scattered spots skin shrinkage	Red skin shrinkage edible	Mushy, not edible
Perforated polythene bag	Greenish yellow	Light red, yellowish	Uniform red colour	Uniform deep-red and fresh	Red mushy and edible	Mushy, not edible
Unperforated polythene bag	Greenish yellow	Light red, yellowish	Light red colour, brownish spot	Red spotted and skin shrinkage	Deep red, rotten not edible	Rotten not edible
Wet gunny bagGre	enish yellow	Yellowish	Yellowish green few spots and rotten	Deep red few brownish scattered spots	Red watery lesson not edible	Rotten not edible
Polyester bag	Greenish yellow	Yellowish	Light red colour and few brownish spots	Pale-red spotted and skin shrinkage	Deep-red, rotten not edible	Mushy, not edible
Splashing of water	Greenish yellow	Light greenish, yellowish	Light yellowish brownish and few scattered spots	Yellowish red large brownish spots	Red shrinkage near to stalk mushy	Mushy, not edible

a[0]days of storage is the day of harvest.

Table 2: Scores on general appearance and consumer's acceptance of tomato as influenced by different post-harvest treatments

	Scores on general appearance of tomato					
	Days after storage (DAS)					
Treatments	0	2	4	6	8	10
Control	10[a]	9	7	6	5	3
Perforated polythene bag	10	9	9	8	7	6
Unperforated polythene bag	10	9	8	4	3	3
Wet gunny bag	10	9	7	6	4	4
Polyester bag	10	9	5	4	3	3
Splashing of water	10	9	6	5	6	4

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

Table 3: Economic return from tomato stored for 6 days under different post-harvest treatments

	Initial			6 days after storage			
Post-harvest treatments	Weight (kg)	Local market price (Tk kg^{-1})[a]	Total amount (Tk)	Weight loss (kg)	Weight retained (kg)	Local market price (Tk kg^{-1})[a]	Total amount(Tk)
Control	3	10	30	0.17	2.83	5	14.15
Perforated polythene bag	3	10	30	0.18	2.82	8	22.56
Unperforated polythene bag	3	10	30	0.07	2.93	3	8.79
Wet gunny bag	3	10	30	0.07	2.93	6	17.58
Polyester bag	3	10	30	0.11	2.89	3	8.67
Splashing of water	3	10	30	0.10	2.90	5	14.50

[a]As indicated by a panel of retailers

tomatoes in the unperforated polythene bag treatment was the lowest (Tk. 8.79 3 kg^{-1}) (Table 3).

It was observed from the present study, perforated polythene and wet gunny bag showed better physical appearance than all other treatments. The gross economic returns of perforated polythene bag was found to be the highest. The lowest return was observed in the polyester bag on the vegetable during storage. So, the perforated polythene and/or wet gunny bag may be used for tomato storage.

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