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Physiological changes and shelf life of the postharvest mango (*Mangifera indica* L.) influenced by different levels of Bavistin DF

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Abstract

An investigation was carried out with the postharvest mangoes (viz., the Langra and the Khirshapat) treating with different levels of Bavistin DF solution (namely, 250, 500, and 750 PPM) for obtaining results on the reduction of postharvest losses, pattern of physical, biochemical changes as well as storability of postharvest mango. Data obtained from various biochemical analyses in terms of physicochemical properties and shelf life of postharvest mango, were recorded and statistically analyzed for comparison among the mean values using DMRT and LSD. The Khirshapat along with Bavistin DF at 750 PPM performed better in retardation of rapid augmentation of these compositions resulting in prolongation of shelf life. The Langra using 750 ppm of Bavistin DF was found to be excellent in lower diminishing tendency in terms of dry matter, ash, vitamin C followed by other treatment combination.

Introduction

Mango (*Mangifera indica* L.) is one of the most important fruit crop in tropical and subtropical regions of the world under the family of Anacardiaceae and it was originated in South Asia or Malayan archipelago (Salunkhe and Desai, 1984). It had been cultivated for more than 4000 years (Mukherjee, 1949). Mango is acknowledged as the king of fruits in Bangladesh as well as in other South-East Asian countries (Pursglove, 1972; Shahjahan *et al*., 1994). Nutritionally, it contains substantial quantity of appreciable β carotene, vitamin C, and dietary fibre (Pal, 1998) as well as soluble sugars and different minerals which are used for good sources of nutrition and readily available and easily assumable in human body (Singh, 1960) and therefore, is capable to prevent many deficiency diseases (Samad *et al*., 1975; Purohit, 1985).

Postharvest losses and deterioration of nutritional quality of fresh fruit are the most important problems in tropical and sub- tropical regions of the world. A huge quantity of nutritious fruits is being markedly deteriorated due to the lack of proper knowledge on postharvest management practices. As a result, people do not have sufficient nutrition from fruits according to their requirements. A considerable amount of fresh fruits goes waste every year through post-harvest decay. The magnitude of postharvest losses in fresh fruit is estimated to be about 5 to 25% in developed countries and 20 to 50% in developing countries (Khader, 1985). Srinivas *et al.* (1996) reported from India that the total postharvest losses of mango cv. Totapuri and Alphonso to be 17.9% (3.5% orchard/ field, 4.9% transportation, 4.10% storage and 5.4 retail level) and 14.4% (1.9% orchard /field, 3.7% transportation, 3.7% storage and 5.3% retail level) , respectively.

Lashley (1984) reported the methods of reducing post-harvest decay through genetic control of storage life, field and post-harvest treatments viz., hot water treatments, wooden crate packaging, corrugated fibre board packaging and plastic films for atmospheric medication. In addition, wax coating, application of fungicide and growth regulators, low temperature storage, oil dipping, use of different chemicals for slowing down the physical activity and ripening process of fruit during the transport and marketing are the commonly used methods to prevent postharvest wastage of mango fruits. Many workers studied the effects of many postharvest treatments with a large number of mango cultivars and observed the extended shelf life (Feng *et al*., 1991; Sankat *et al*., 1993; Baez *et al*., 1993; Inyang and Agbo, 1995).

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In this study it was aimed to observe the behavioral pattern of physicochemical properties of postharvest mango in the storage conditions. We tried to find out a desirable technology for extension of shelf life of mango and also to select the best method for reduction of losses and extension of its postharvest life. Moreover we investigated the shelf life of selected fruits as influenced by different physical, chemical and hormonal treatments under different storage conditions.

Materials and Methods

Experimental materials

Two mango varieties namely, Langra and Khirshapath were selected as experimental materials. The mango varieties that undertaken for investigation were collected from mango grower of Kansart, Shibgonj Upazila of ChapaiNowabgonj district and Chirghat upazila of Rajshahi district and others material used as postharvest treatments viz., Bavistin DF (BDF) was purchased as analytical grade. The experiment consisted of two factors and was conducted in Randomized Complete Block Design (RCBD) with three replicates. The collected data was statistically analyzed by analysis of variance method. The means of different parameters was compared using DMRT as described by Gomez and Gomez (1984).

Preparation of Bavistin DF (BDF) solution

The solution of BDF of 250, 500, and 750 ppm were prepared by dissolving 250, 500 and 750 mg of BDF in one liter of distilled water. The fruit of both the varieties were dipped into the BDF solution for a period of 5 minutes. Care was taken to ensure enough quantity of BDF being absorbed by the fruits and stored at ambient condition on brown paper.

Estimation of vitamin C content of mango pulp

Vitamin C of mango pulp was estimated by the titrimetric method as stated by Bessey and King (1933). 3% Metaphosphoric acid (HPO_3) was dissolved in 80 ml of acetic acid and made volume up to 100 ml with distilled water. Standard vitamin C solution (0.1 mg/ml) was used to make calibration.

Results and Discussion

Changes in skin color

Different doses of BDF significantly affected the skin color of both the fruits, namely Langra and Khirshapat. Both varieties demonstrated the original green color at the initial stage of harvesting. At 3rd day, Langra developed trace in yellow color at control (B0) and green color at 250 ppm (B_1), 500 ppm (B_2) and 750 ppm (B_3), and Khirshapat was perceived light green at control and retained its green color at B_1, B_2 and B_3 treatments.

At 15th day of storage, Langra was found to be decomposed at B_0 and B_1, yellow and greenish yellow at B_2 and B_3 treatments, respectively. At the same time Khirshapat was notified as completely rotten at B_0 and B_1 treatment and changed into deep yellow and greenish yellow at B_2 and B_3 treatments, respectively. The results of the present study are in partially agreement with the findings of Dhemre and Waskar (2004).

Physiological weight loss

Varieties were found to be highly significant in terms of PWL at different days after storage. At each day, Khirshapat (V_2) successively showed more PWL comparing to Langra with the rising of storage duration. Higher (10.86%) and lower (9.85%) of PWL were obtained from Khirshapat and Langra at 12th day, respectively. The results also denoted that total PWL progressively grew up with the increase of storage duration. The data also explained that Langra was better than Khirshapat owing to its lesser PWL. Water loss through lenticel seems to be the possible reason of physiological weight loss in the fruits during storage. Lower lenticel density in Langra facilitated lesser water loss leading to minimum total weight loss. Singh *et al*. (2000) also observed more or less the similar findings.

The combined effect of varieties and different doses of BDF showed significant variation in PWL at different days after storage except 12th day. At different days, the results stated that various treatments combination showed in PWL successively with the rising of storage duration. At 9th day, there found the maximum PWL (10.65%) at V_2B_0 and the minimum (7.25%) at V_1B_3. It also revealed that Khirshapat lost the highest amount of water along with B3 treatment followed by other treatment combinations.

Moisture content

The analysis of variance of imposed varieties showed highly significant variation in moisture content at different days after storage except initial day. At different days, the results interpreted that moisture content increased with the increase of storage period. The increasing trend was more or less similar from initial to 9th days and thereafter its increasing trend decreased due to starting decay. It also denoted that each day of storage, the Khirshapat

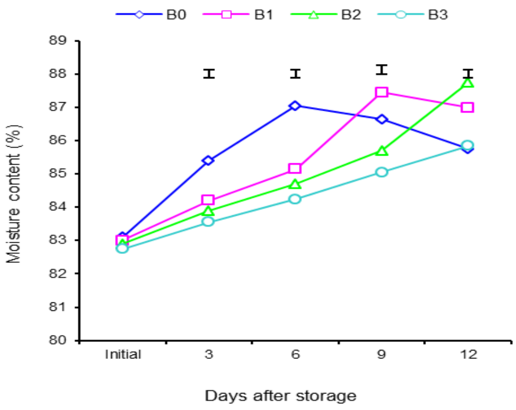

Figure 1. Effect of different doses of Bavistin DF (BDF) on moisture content of mango pulp at different days after storage. Vertical bars represent LSD at 0.05 levels

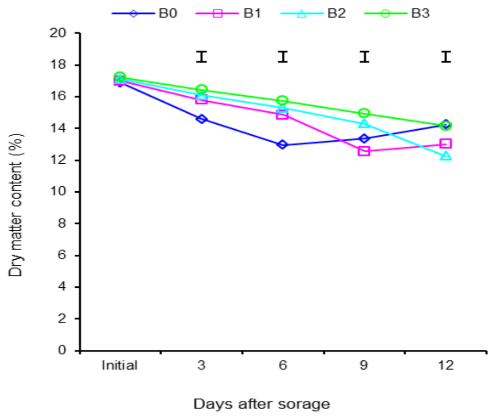

Figure 2. Dry matter content of mango pulp as influenced by different doses of Bavistin DF (BDF) at different days after storage. Vertical bars represent LSD at 0.05 levels

absorbed more moisture comparing to the Langra. Higher (88.13%) and lower (85.05%) were derived from the Khirsapat and the Langra at 12th day. The reports were quite different than the present results as stated by Shajahan *et al.* (1994) and they observed that moisture content increased in the Langra than the Khirsapat. This variation might be possible due to genetical, location, weather effect, soil quality or maturity of the fruit etc.

Variation among the means of different doses of BDF solution in connection with moisture content was perceived to be significant at different days after storage except initial day. At different days, moisture content increased continuously with the advancement of storage duration. The last growing up trend of moisture content was noticed from control and B_1 treatment at 6 and 9th days and shown in Figure 1, whereas B_2 and B_3 treatments also showed their increasing trend. Untreated fruit absorbed the highest moisture content (87.45%) at 9th day and the lowest (85.05%) was noted from B_3 treatment, respectively. The increasing trend of moisture content from initial to 6th days might be possibly due to metabolic activities and osmotic pressure inside the mango fruit as well as its decreased might be possible due to suppression of metabolic activities that resulted in decaying and drying.

Dry matter content

The variation in varieties means in connection with dry matter content exhibited highly significant variation at different days after storage. At different days of storage, dry matter content diminished successively with the rising of storage duration. It denoted that the Langra produced comparatively more dry matter comparing to the Khirshapat. At initial day,the Lngra gave higher (18.65%) dry matter while, the Khirshapat had lower (15.48%) and at 12th day,the Langra achieved higher (14.95%) while the Khirshapat achieved lower (11.88%), respectively.

Different doses of BDF solution used in this study in terms of dry matter content of mango pulp exhibited highly significant variation at different days after storage except initial day. At different days of storage, dry matter content diminished continuously with the increase of storage duration as shown in Figure 2. It also revealed that B_3 treatment gave the highest dry matter (15.75%) at 6th day while; the lowest dry matter (12.95%) was recorded from control.

Ash content

Variation in varieties means in connection with ash content of mango pulp showed significant variation at different days after storage. At different days of storage, values of ash content fell off continuously with the advancement of storage duration. It narrated that the Langra gave comparatively more ash than the Khirshapat at all days of storage. Higher (1.03%) ash content was derived from the Langra at initial day whereas; the Khirshapat produced the lowest (0.87%) and again at 12th day higher (0.83%) was recorded from Langra and lower achievement (0.67%) was recorded from Khirshapat.

Different doses of BDF solution were selected as non-significant in connection with ash content of mango pulp at different days after storage. The results indicated that ash content imposed by different doses of BDF solution diminished slightly from B_3 treatment and markedly from control represented in Figure 3. At 9th day, the highest (0.85%) was noticed from B_3 and the lowest (0.72%) was noticed from control.

The combined effect of varieties and different

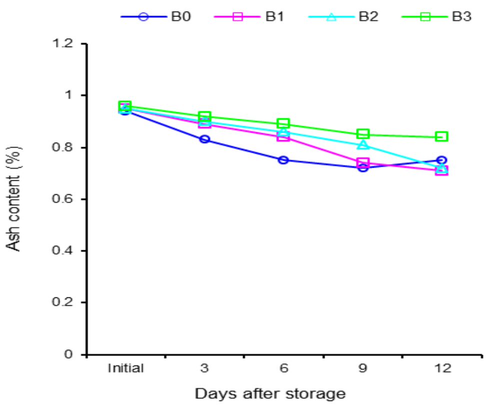

Figure 3. Ash content of mango pulp as influenced by different doses of Bavistin DF (BDF) at different days after storage. Vertical bars represent LSD at 0.05 levels

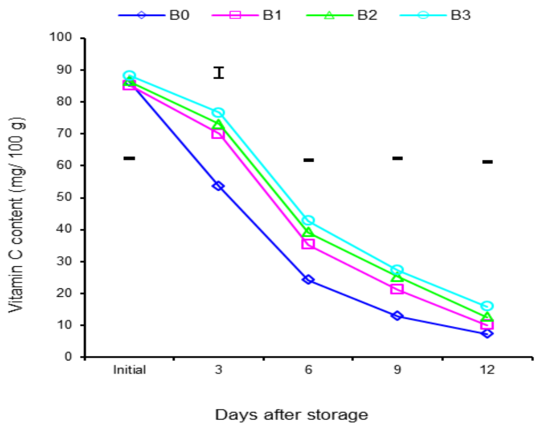

Figure 4. Effect of different doses of BDF on vitamin C content of mango pulp at different days after storage. Vertical bars represent LSD at 0.05 levels

doses of BDF solution were manifested to be non-significant in connection with ash content of mango pulp at various days after storage. At various days, the results obtained from investigation that ash content gradually decreased with the rising of storage period. It may suggest from the present data that ash content demonstrated good correlation with the dry matter content.

Vitamin C content

Variation among the means of different doses of BDF solution in connection with vitamin C content was performed highly statistical significant at different days after storage. At initial day, green mangoes treated with B_3 treatment produced the highest (88.24 mg/100 g) amount of vitamin C while; the lowest (85.25 mg/100 g) was notified from the untreated mangoes. After initial day, the results diminished successively with the advancement of storage time (Figure 4). It also denoted that the diminishing tendency was hastily in control, but it was delay in B3 treated fruit. At 12th day, the maximum (16.00 mg/100 g) was derived from B_3 treatment and the minimum (7.35 mg/100 g) was derived from control, respectively. The reduction of vitamin C content in both treated and untreated mangoes at different storage period might be possible due to oxidation of ascorbic acid and B3 treatment was possibly causing delay ripening resulting in lower oxidation in vitamin C. These results of the present investigation are in agreement with the findings of Ahmed and Singh (2000). Parmar and Chundawat (1989) also found more or less similar result.

The combined effect of varieties and different doses of BDF solution showed significant variation in respect of vitamin C content at different days after storage. At various days, the results were found that vitamin C content came down with the extending of storage period. The quantity of vitamin C ranged between 3.90 to 19.70 mg per 100 g of fresh mango pulp at 12th day. The highest (19.70 mg/100 g) was obtained from the treatment combination of V1B1 and the lowest (3.90 mg/100 g) was obtained from the treatment combination of V_2B_0.

Shelf life

There appeared to be significant variation between the varieties in terms of shelf life of mango. The longest shelf life (13.58 days) was recorded in the Khirshapat and the shortest (12.25 days) was recorded in the Langra. Variation in shelf life between varieties might be possible due to genetical. The results of the present investigation revealed that Khirshapat was much better over Langra in preservation.

Subjected to different doses of BDF solution in this investigation in connection with shelf life of mango exhibited highly significant. The shelf life of mango ranged between 7.83 to 16.67 days was recorded from different doses of BDF solution. The longest shelf life (16.67 days) was obtained from the fruit treated with B3 treatment followed by the shelf life of the fruits treated with B_2 (14.00 days), and B_1 (13.17 days) treatments while; the shortest shelf life (7.83 days) was obtained from control as shown in Figure 5. The longest shelf life obtained from the fruit treated with B_3 treatment might be probably due to suppression or depression of physiological and biochemical activities that was responsible for slower senescence of harvested fruits, and consequently led to the longest shelf life. The results of the present investigation are in conformity with the findings of Ahmed and Singh (2000) and Dhemre and Waskar (2004).

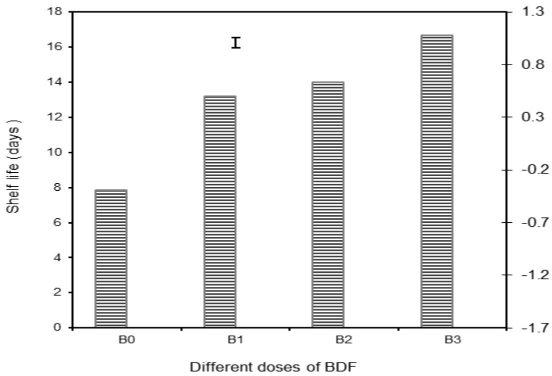

Figure 5. The effect of different doses of BDF on shelf life of mango. Vertical bars represent LSD at 0.05 levels

Conclusion

Different postharvest treatments subjected to the investigation demonstrated significant variation in most of the physicochemical properties and shelf life of mango at different days after storage. The results explored that some physicochemical properties viz., physiological weight loss, moisture content, as well as skin color, dry matter, ash, vitamin C, along with shelf life drastically decreased from untreated mangoes, but, low temperature in refrigerator caused delaying of these changes except physiological weight loss. BDF with the doses of 750 ppm showed better results in delaying the changes in physicochemical properties and extended shelf life.

The results of the interaction effect of varieties and different postharvest treatments in different experiments were found to be significant in terms of most of the physicochemical properties and shelf life. On the other hand, The Khirshapat using no treatment extensively lost physiological weight; absorbed more moisture, but using 750 ppm of BDF solution strongly interrupted these activities. The Khirshapat along with 750 ppm of BDF solution extended shelf life up to 17.33 days after storage. Therefore, 750 PPM solution of BDF found was the best method for preservation and delay ripening of postharvest mango which might be easily adopted by common people for mango preservation.

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