

Effect of post harvest treatment on weight loss and shelf life of banana during storage

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Abstract: A study was conducted at the laboratory of the Department of Horticulture, Bangladesh Agricultural University, Mymensingh during the period from August 2006 to January 2007 to evaluate the effect of post harvest treatments on weight loss and shelf life of banana varieties (Sabri, Champa and Mehersagar). Post harvest treatments included were control, hot water ($52\pm 2^\circ\text{C}$), tilt (0.2%), unperforated polythene bag with or without KMnO_4 , perforated polythene bag with or without KMnO_4 , low temperature ($12\pm 2^\circ\text{C}$). The two-factor experiment was laid out in completely randomized design with three replications. Data revealed that the difference in total weight loss among three varieties and different post harvest treatments were significant at different days of storage. Total weight loss was the highest in Champa (16.89%) than Sabri (15.67%), and Mehersagar (10.13%). At the 12th day of storage, low temperature ($12\pm 2^\circ\text{C}$) treated bananas were found to exhibit the least (4.23%) weight loss as compared to control (21.62%). Shelf life of banana was significantly affected by varieties and also by the post harvest treatments. It was the longest in Mehersagar (18.36 days) than Champa (16.46 days) and Sabri (15.26 days). The longest (36.66 days) and the shortest shelf life (11.66 days) were recorded in the low temperature-treated and controlled bananas, respectively. Combinedly, low temperature treated Mehersagar had the longest (38.00 days) and Sabri under control had the shortest (9.77 days) shelf lives. In addition the shelf lives of banana were extended by 4, 3 and 2 days in the perforated polythene bag with KMnO_4 , hot water treatment and un perforated polythene bag without KMnO_4 , respectively over control (6.29 days). Even though, plastic bags (perforated and unperforated) with or without KMnO_4 extended shelf life and reduced weight loss but failed to avert disease infections.

Key words: Post harvest treatments, Weight loss, Shelf life, Banana varieties.

Introduction

In respect of total production, banana ranks top position among the major fruits grown in Bangladesh (BBS, 2006). But postharvest loss of fresh fruits is one of the major problems in the tropics. As a result, considerable quantity of banana is spoiled due to its perishable nature. Shelf life is the most important aspect in postharvest technology of fruits and the extension of shelf life of fruits has been one of the prime concerns of mankind throughout the recorded history (Salunkhe and Desai, 1984). There is a natural tendency of fruits to degrade to the simpler inorganic compounds (CO_2 , H_2O , NH_3) from which they were synthesized in the first place through spontaneous biochemical processes and consequently reduce the shelf life as well as other qualities of fruits. Banana fruits are not generally allowed to ripen on the plant. For this, it is necessary to delay ripening for distant market and then to enhance ripening for the retail sale. Therefore, it is necessary to study and understand the postharvest behavior of banana attempting improved shelf life and quality of fruits using different treatments. The probable reasons for the postharvest losses in bananas are poor handling and storage characteristics, postharvest physiological and biochemical changes (eg. respiration and ethylene production), and high incidence of postharvest diseases. Conceptually, the storage life of banana would be significantly extended if postharvest handling practices improved, physiological processes are slowed down and microbial decay reduced. Considering the foregoing discussion, the present study was undertaken to evaluate the effect of post harvest treatments on weight losses and shelf life of banana varieties (Sabri, Champa and Mehersagar).

Materials and Methods

The study was conducted at the laboratory of the Department of Horticulture, Bangladesh Agricultural University, Mymensingh during the period from August 2006 to January 2007 to evaluate the effect of post

harvest treatments on weight loss and shelf life of banana varieties. The varieties were Sabri (V_1), Champa (V_2) and Mehersagar (V_3) and postharvest treatments included control (T_1), hot water ($52\pm 2^\circ\text{C}$) (T_2), tilt (0.2%) (T_3), unperforated polythene bag without (T_4) or with (T_5) KMnO_4 , perforated polythene bag without (T_6) or with (T_7) KMnO_4 , low temperature ($12\pm 2^\circ\text{C}$) (T_8). The temperature and relative humidity of the storage room ranged from $19-27^\circ\text{C}$ and 73-85%, respectively. The two-factor experiment was laid out in completely randomized design (CRD) with three replications of 5 fruits. The mature fruits collected from farmer's garden near Madhupur, Tangail were uniform in size, shape, and free of any visible defects, disease, and insect infestations. The experimental fruits were washed in running water to remove dirt and latex, and subsequently air-dried before imposed the treatments. Immediately after harvest three fingers from each replication of each treatment were randomly selected and weighted. Differences in weight during ripening were monitored by weighing the fingers at every 4th day interval. Shelf life was calculated by containing the number of days required to completely ripen the fruit with optimum eating qualities. The means for all the treatments were statistically calculated and analyses of variances for all the parameters were performed by F-test. The significance of difference between the pairs of means was compared by least significant difference (LSD) test at 1% and 5% level of probability (Gomez and Gomez, 1984). For the percentage data, arc-sine transformations were carried out and statistical analyses were performed on the transform data.

Results and Discussion

Weight loss of banana: Varieties and post harvest treatments used in the present investigation had caused significant effects on the levels of weight loss of banana during storage period. Total weight loss was always higher in Champa (15.67%) fruits during the entire

period of storage than Sabri (12.44%) and Mehersagar (10.13%) at the 12th day of storage. Weight losses gradually increased in all varieties were statistically significant (Table1). The highest weight loss (21.88%) was found in hot water treated fruits followed by control (21.62%), tilt (20.367%), un perforated polythene bag without KMnO₄ (10.82%), perforated polythene bag without KMnO₄ (9.70%), perforated polythene bag with KMnO₄ (7.52%), un perforated polythene bag with KMnO₄ (7.16%) and low temperature (4.23%) at the 12th day of storage (Table 1). The result of the present investigation is supported by the findings of Bhadra and Sen (1997) that polythene bagging with KMnO₄ was the best in reducing

physiological weight loss of custard apple during storage. Lower rate of weight losses in low temperature and plastic bags were probably due to the fact that plastic film acted as physical barrier to gas diffusion from fruit stomata through which the gas exchanges took place between tissue and external atmosphere. This reduced vapour pressure inside the polyethylene causes lower rate of transpiration and respiration resulting lower rate of losses in fresh weight. On the contrary, the highest percentage of total weight loss occurred in control condition, this might be resulted from higher rates of transpiration, respiration and evaporation.

Table 1. Main effect of varieties, post harvest treatments and their combined effect on weight loss of banana during storage (means across all post harvest treatments)

Variety, post harvest treatments, Variety × treatment	Weight loss (%) at different days after storage		
	4	8	12
Sabri (V ₁)	4.41 (11.735)	8.92 (16.68)	12.94 (18.43)
Champa (V ₂)	4.91 (12.36)	9.64 (17.42)	15.67 (22.58)
Mehersagar (V ₃)	3.76 (10.64)	7.10 (14.69)	10.13 (17.68)
Level of significance	**	**	**
LSD _(0.01)	1.012	1.152	1.172
T ₁	7.86 (16.25)	14.64 (22.42)	21.62 (27.65)
T ₂	6.41 (14.65)	14.11 (22.03)	21.88 (22.74)
T ₃	6.60 (14.88)	13.77 (21.75)	20.36 (26.80)
T ₄	3.66 (10.37)	7.10 (14.69)	10.82 (18.11)
T ₅	2.51 (9.10)	4.37 (12.05)	7.16 (15.43)
T ₆	3.27 (10.38)	6.13 (14.27)	9.70 (18.12)
T ₇	3.14 (10.19)	5.15 (13.11)	7.52 (15.91)
T ₈	1.43 (6.80)	2.92 (9.78)	4.23 (11.77)
Level of significance	**	**	**
LSD _(0.01)	1.653	1.881	3.316
V ₁ T ₁	8.99 (17.44)	17.64 (24.83)	23.71 (29.13)
V ₁ T ₂	6.20 (14.41)	15.47 (23.16)	21.74 (12.55)
V ₁ T ₃	6.25 (14.47)	13.17 (21.27)	20.77 (27.11)
V ₁ T ₄	2.54 (9.17)	4.89 (12.77)	7.31 (15.68)
V ₁ T ₅	2.54 (9.17)	4.52 (12.27)	7.17 (15.53)
V ₁ T ₆	3.92 (11.41)	7.51 (15.90)	10.69 (19.08)
V ₁ T ₇	2.85 (9.71)	4.83 (12.69)	7.30 (15.67)
V ₁ T ₈	1.99 (8.10)	3.39 (10.60)	4.84 (12.70)
V ₂ T ₁	7.81 (16.22)	14.86 (22.67)	23.54 (29.02)
V ₂ T ₂	6.75 (15.05)	14.78 (22.60)	26.05 (30.68)
V ₂ T ₃	7.07 (15.42)	15.65 (23.30)	22.39 (28.24)
V ₂ T ₄	7.22 (15.58)	13.59 (21.63)	21.51 (27.63)
V ₂ T ₅	2.90 (9.80)	4.72 (12.54)	9.01 (17.46)
V ₂ T ₆	2.79 (9.61)	4.75 (12.58)	9.69 (18.13)
V ₂ T ₇	3.57 (10.89)	5.52 (13.58)	8.13 (16.56)
V ₂ T ₈	1.22 (6.34)	3.30 (10.46)	5.05 (12.98)
V ₃ T ₁	6.78 (15.09)	11.44 (19.76)	17.63 (24.82)
V ₃ T ₂	6.28 (14.51)	12.08 (20.33)	17.86 (24.99)
V ₃ T ₃	6.50 (14.77)	12.50 (20.70)	17.94 (25.05)
V ₃ T ₄	1.23 (6.36)	2.83 (9.68)	3.66 (11.02)
V ₃ T ₅	2.11 (8.35)	3.88 (11.36)	5.30 (13.30)
V ₃ T ₆	3.10 (10.14)	6.15 (14.35)	8.73 (17.163)
V ₃ T ₇	3.01 (9.99)	5.12 (13.07)	7.15 (15.50)
V ₃ T ₈	1.08 (5.96)	2.08 (8.29)	2.81 (9.65)
Level of significance	**	**	**
LSD _(0.01)	2.864	1.152	3.31

**= significant at 1% level, ns= not significant. Figures in the parentheses are arcsine-transformed data. Statistical analyses have been performed on the transform data, T₁= Control, T₂ = hot water (52±2°C), T₃ = tilt, T₄= un perforated polythene bag without out KMnO₄, T₅ = un perforated polythene bag with KMnO₄, T₆ = perforated polythene bag without out KMnO₄, T₇ = perforated polythene bag with KMnO₄ and T₈= low temperature (12±2°C)

Table2. Main effect of varieties, post harvest treatments and their combined effect on shelf life of banana during storage (means across all post harvest treatments)

Sabri (V ₁)	15.264
Champa (V ₂)	16.461
Mehersagar (V ₃)	18.360
Level of significance	**
LSD _(0.01)	0.739
T ₁	11.643
T ₂	14.880
T ₃	14.093
T ₄	13.903
T ₅	14.33
T ₆	13.937
T ₇	15.132
T ₈	35.667
Level of significance	**
LSD _(0.01)	1.20
V ₁ T ₁	9.77
V ₁ T ₂	13.48
V ₁ T ₃	12.9
V ₁ T ₄	8.77
V ₁ T ₅	9.78
V ₁ T ₆	11.75
V ₁ T ₇	11.89
V ₁ T ₈	33.5
V ₂ T ₁	11.68
V ₂ T ₂	14.58
V ₂ T ₃	13.88
V ₂ T ₄	10.36
V ₂ T ₅	10.58
V ₂ T ₆	11.20
V ₂ T ₇	11.81
V ₂ T ₈	35.5
V ₃ T ₁	13.48
V ₃ T ₂	16.58
V ₃ T ₃	15.5
V ₃ T ₄	10.25
V ₃ T ₅	11.5
V ₃ T ₆	11.8
V ₃ T ₇	12.89
V ₃ T ₈	38.00
Level of significance	**
LSD _(0.01)	2.09

**= significant at 1% level, ns= not significant., T₁= Control, T₂= hot water (52±2°C), T₃= tilt, T₄= un perforated polythene bag without out KMnO₄, T₅= un perforated polythene bag with KMnO₄, T₆= perforated polythene bag without out KMnO₄, T₇= perforated polythene bag with KMnO₄, and T₈= low temperature (12±2°C)

The interaction effect of varieties and post harvest treatments on total weight loss of fruits was found significant at different days of storage. The highest weight loss (23.71%) was found in Champa fruits under hot water treatment, while it was the lowest (3.73%) in Mehersagar fruits under low temperature treatment at the 16th day of storage (Table 1).

Shelf life: Shelf life of banana fruit was significantly affected by both varieties and different post harvest treatments. The longest shelf life (18.36 days) was recorded in Mehersagar fruits, followed by the Champa (16.46 days) and Sabri (15.26 days) (Table 1). Mehersagar fruits had long shelf life due to the selection of un-uniform finger or use of immature fruit, so precaution should take for further studies. Mehersagar generally possess shorter duration. The longer shelf observed in the current study

may be due to handling error or due to different maturity. A further research with Mehersagar would be carried out the findings of the present investigation. The longest shelf life (35.66 days) was observed when fruits treated with low temperature followed by un perforated transparent polythene bag without KMnO₄ (15.00). The shortest shelf life (11.64 days) was noticed in control (Table 2). The shelf lives of banana fruits were extended by 4, 3 and 2 days in perforated polythene bag with KMnO₄, tilt, un perforated polythene bag without KMnO₄ respectively over the control (11.64 days). The result is supported by the findings of Patil and Hulamani (1998). The longer shelf life of low temperature treated fruits was probably due to the decreased respiration and ethylene production during storage. Relatively longer shelf lives in polythene

bags irrespective of perforations and KMnO₄ may be due to the elevated levels of CO₂ inside the plastic bags. The interaction effect between varieties and post harvest treatments was found significant in respect of shelf life. The longest shelf life (38.00 days) was recorded in Mehersagar under low temperature treatment, whereas the shortest shelf life (9.77 days) was observed in Sabri under control treatment (Table 2)

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