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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±2°C), tilt (0.2%), unperforated polythene bag with or without $KMnO_4$, perforated polythene bag with or without $KMnO_4$, low temperature(12±2°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 12thday of storage, low temperature (12±2°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 KMnO4, 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 arrest 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 bio-chemical 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 etylene 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±2°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±2°C)(T_8). The temperature and relative humidity of the storage room ranged from 19-27°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 dirts 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 analyseswere 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 $KMnO_4$ (10.82%), perforated polythene bag without $KMnO_4$ (9.70%), perforated polythene bag with $KMnO_4$ (7.52%), un perforated polythene bag with $KMnO_4$ (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 $KMn0_4$ 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 parenthesizes are arcsine-transformed data. Statistical analyses have been performed on the transform data, T_1 = Control, T_2 = hot water (52±2°C), T_3 = tilt, T_4 = un perforated polythene bag without out $KMnO_4$, T_5 = un perforated polythene bag with $KMnO_4$, T_6 = perforated polythene bag without out $KMnO_4$, T_7 = perforated polythene bag with $KMnO_4$, and T_8 = 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)

Variety, post harvest treatments, Variety × treatment	Shelf life at DAS/Days
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., T_1 = Control, T_2 = hot water (52±2°C), T_3 = tilt, T_4 = un perforated polythene bag without out $KMnO_4$, T_5 = un perforated polythene bag with $KMnO_4$, T_6 = perforated polythene bag without out $KMnO_4$, T_7 = perforated polythene bag with $KMnO_4$, and T_8 = 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, fo11wed 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 $KMnO_4$, tilt, un perforated polythene bag without $KMnO_4$ 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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