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Effect of moisture and dry matter content of three banana varieties during storage condition

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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 moisture and dry matter content of banana varieties (Sabri, Champa and Mehersagar) during storage. Postharvest 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 reaveled that significant variations were observed in relation to moisture (%) and dry matter contents among the three varieties during storage. Moisture content (%) was higher in Mehersagar (64.76%) than Sabri (57.24%) and Champa (59.09%). Various postharvest treatments also showed significant influence in moisture content during storage. At the 8th day of storage the maximum moisture content (64.93%) was obtained in the unperforated polythene bag without $KMnO_4$ and the minimum (54.51%) in low temperature treated fruits. Maximum and minimum dry matter contents were found to be 44.16% and 29.32% in low temperature and unperforated polythene bag without $KMnO_4$, respectively. The combined effect between varieties and different postharvest treatments were significant at all days of storage.

Key words: Storage condition, Moisture content, Dry matter, Banana varieties.

Introduction

In Bangladesh, rice dominates over all other crops and Banana constituted the fourth most important global food commodity after rice, wheat and maize in terms of gross value of production (FAO, 2002). Postharvest loss of fresh fruits is one of the major problems in the tropics. The quality of banana fruits is largely dependent on the varieties, and various postharvest treatments which are principally applied to increase the storability of fruits. Application of smoke is commonly employed to hasten degreening and ripening of banana in Bangladesh. There is no known technology to the growers/traders in the country to extend the shelf life of banana. As a result, considerable quantity of banana is spoiled due to its perishable nature. The magnitude of postharvest losses in fresh fruits including banana in Bangladesh is 25-50% (Amiruzzaman, 1990), and it is only 5-25% in developed countries (Khader, 1992). Therefore, there is general support among the people that high profit to the banana growers might come from conservation after harvest rather than a further boost to its production (Hassan, 2000). 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. Percent moisture content of pulp of unripe banana has been listed an overall rise in ripening condition (Elmahmoudi and Eisawi, 1968). Acceptable moisture content in the banana pulp after one month of storage under ambient conditions while the fruits were wrapped in polythene before packing in cartons Elzayat (1996). Therefore, it is necessary to study and understand the postharvest behavior of banana espicially moisture and dry matter content attempting improved shelf life and quality of fruits using different treatments. The foregoing discussion, the present study was undertaken to evaluate the effect of post harvest treatments on moisture and dry matter content 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 moisture (%) and dry matter content of banana varieties (Sabri, Champa and Mehersagar) during storage condotion. 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 imposind the treatments. Certain days after, five gram of the pulp was taken in porcelain crucibles in triplicate and oven-dried at 72±2°C until constant weight attained. Per cent moisture content was calculated by % Moisture = (I–F) / I ×100, Where, I = initial weight of pulp (gm), and F = final weight of pulp (gm). Percent dry matter content of the pulp was calculated (% dry matter = 100 – % moisture content) from the data obtained during estimation of the moisture content. Changes in expected parameters were investigated. 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

Moisture content: Moisture content in the pulp of banana increased during the whole storage period but variation was observed between the varieties during successive days

of storage. Varieties caused significant effect on the levels of moisture content during storage and ripening (Table 3). Slightly higher moisture content was found in Mehersagar (69.86%) than Champa (64.46%) and Sabri (61.91%) at the 16th day of storage (Table 1). The unperforated polythene bag without $KMnO_4$ resulted in the highest moisture content (70.56%) followed by fruit treated with unperforated transparent polythene bag with $KMnO_4$ (69.00%), control (67.16%), perforated polythene bag without $KMnO_4$ (65.83%), hot water treatment (65.68%), perforated polythene bag with $KMnO_4$ (64.46%), tilt (64.41%), and low temperature (56.16%) The combined effects of varieties and postharvest treatments on moisture content were found to be statistically significant for all the days during storage (Table 1). It was found to be the highest (73.80%) in Mehersagar × unperforated polythene bag without $KMnO_4$ combination. Sabri × low temperature combination showed the lowest (52.10%) moisture content (Table 1). Moisture content increased during storage is supported by El-Mahmoudi and Eisawi (1968). The increase of water percent in the pulp during ripening might be due to respiratory breakdown of starch to water and $C0_2$ and osmotic movement of water from peel to pulp.

Table 1. Main effect of varieties, postharvest treatments and their combined effect on moisture content (%) of banana during storage (means across all varieties and all postharvest treatments)

Variety, postharvest treatments, Variety × treatment	Moisture content (%) at different day after storage	
	8	16
Sabri	57.24 (49.16)	61.91 (51.91)
Champa	59.09 (50.24)	64.46 (53.41)
Mehersagar	64.76 (53.59)	69.86 (56.73)
Level of significance	**	**
$LSD_{(0.01)}$	4.15	2.02
T_1	62.23 (52.09)	67.16 (55.06)
T_2	60.73 (51.22)	65.68 (54.19)
T_3	59.20 (50.31)	64.41 (53.41)
T_4	64.93 (53.70)	70.56 (57.15)
T_5	62.11 (52.01)	69.00 (56.13)
T_6	60.15 (50.86)	65.83 (54.24)
T_7	59.05 (50.22)	64.46 (53.42)
T_8	54.51 (47.59)	56.16 (48.55)
Level of significance	*	NS
$LSD_{(0.05)}$	5.08	2.47
V_1 T_1	58.39 (49.82)	63.50 (52.83)
V_1 T_2	57.20 (49.13)	60.35 (50.97)
V_1 T_3	55.80 (48.33)	59.95 (50.73)
V_1 T_4	62.25 (52.09)	68.40 (55.79)
V_1 T_5	59.80 (50.65)	66.80 (54.81)
V_1 T_6	57.50 (49.31)	64.39 (53.36)
V_1 T_7	55.80 (48.33)	59.79 (50.64)
V_1 T_8	51.20 (45.68)	52.10 (46.20)
V_2 T_1	61.60 (51.70)	66.50 (54.63)
V_2 T_2	57.50 (49.31)	64.30 (53.30)
V_2 T_3	57.00 (49.02)	62.40 (52.17)
V_2 T_4	63.75 (52.98)	69.50 (56.47)
V_2 T_5	61.80 (51.82)	68.40 (55.68)
V_2 T_6	59.20 (50.30)	63.60 (52.89)
V_2 T_7	58.50 (49.89)	66.10 (54.39)
V_2 T_8	53.40 (46.94)	54.90 (47.81)
V_3 T_1	66.70 (54.75)	71.50 (57.73)
V_3 T_2	67.50 (55.24)	72.40 (58.30)
V_3 T_3	64.80 (53.60)	70.90 (57.35)
V_3 T_4	68.80 (56.04)	73.80 (59.21)
V_3 T_5	64.75 (53.57)	71.80 (57.92)
V_3 T_6	63.75 (52.98)	69.50 (56.47)
V_3 T_7	62.85 (52.44)	67.50 (55.24)
V_3 T_8	58.95 (50.15)	61.50 (51.64)
Level of significance	**	**
$LSD_{(0.01)}$	11.75	5.73

V_1 = Sabri, V_2= Champa, V_3= Mehersagar, * = Significant at 5% level, **= significant at 1% level, NS = not significant, [a] = Colour score (1= green, 2 = breaker, 3 = one quarter skin yellow, 4 = two quarter skin yellow, 5= three quarter skin yellow, 6= fully yellow, 7= blackened/rotten), T_1 = Control, T_2 = hot water (52±2°C), T_3 = tilt, T_4 = un perforated polythene bag without $KMnO_4$, T_5 = un perforated polythene bag with $KMnO_4$, T_6 = perforated polythene bag without $KMnO_4$, T_7 = perforated polythene bag with $KMnO_4$, and T_8 = low temperature (12±2°C)

Table 2. Main effect of varieties, postharvest treatments and their combined effect on dry matter (%) of banana during storage (means across all varieties and all postharvest treatments)

Variety, postharvest treatments, Variety × treatment	Dry matter (%) at different day after storage	
	8	16
Sabri	43.17 (41.08)	38.05 (38.07)
Champa	41.03 (39.82)	35.29 (36.41)
Mehersagar	34.99 (36.24)	30.26 (33.33)
Level of significance	**	**
$LSD_{(0.01)}$	0.81	0.90
T_1	38.04 (38.06)	32.83 (34.93)
T_2	39.60 (38.95)	34.31 (35.80)
T_3	41.13 (39.87)	35.58 (36.57)
T_4	35.23 (36.43)	29.32 (32.83)
T_5	37.21 (37.57)	31.00 (33.82)
T_6	39.85 (39.13)	33.50 (35.35)
T_7	40.95 (39.77)	35.53 (36.57)
T_8	45.81 (42.59)	44.16 (41.63)
Level of significance	**	**
$LSD_{(0.01)}$	1.33	1.46
V_1 T_1	41.41 (40.05)	36.50 (37.16)
V_1 T_2	43.80 (41.43)	39.65 (39.02)
V_1 T_3	45.20 (42.24)	40.05 (39.26)
V_1 T_4	38.25 (38.32)	31.60 (34.20)
V_1 T_5	40.20(39.34)	33.20 (35.18)
V_1 T_6	42.50 (40.68)	35.61 (36.63)
V_1 T_7	44.20 (41.66)	40.21 (39.35)
V_1 T_8	49.80 (44.88)	47.90 (43.79)
V_2 T_1	39.40 (38.88)	33.50 (35.36)
V_2 T_2	42.50 (40.68)	35.70 (36.69)
V_2 T_3	43.00 (40.97)	37.60 (37.82)
V_2 T_4	36.25 (37.01)	30.50 (33.52)
V_2 T_5	38.20 (38.17)	31.60 (34.20)
V_2 T_6	40.80 (39.69)	34.40 (35.91)
V_2 T_7	41.50 (40.10)	33.90 (35.60)
V_2 T_8	46.60 (43.05)	45.10 (42.18)
V_3 T_1	33.30 (35.24)	28.50 (32.26)
V_3 T_2	32.50 (34.75)	27.60 (31.69)
V_3 T_3	35.20 (36.39)	29.10 (32.64)
V_3 T_4	31.20 (33.95)	26.20 (30.78)
V_3 T_5	33.25 (35.21)	28.20 (32.07)
V_3 T_6	36.25 (37.01)	30.50 (33.52)
V_3 T_7	37.15 (37.55)	32.50 (34.75)
V_3 T_8	41.05 (39.84)	39.50 (38.93)
Level of significance	**	**
$LSD_{(0.05)}$	1.72	1.89

V_1 = Sabri, V_2= Champa, V_3= Mehersagar, * = Significant at 5% level, **= significant at 1% level, NS = not significant, [a] = Colour score (1= green, 2 = breaker, 3 = one quarter skin yellow, 4 = two quarter skin yellow, 5= three quarter skin yellow, 6= fully yellow, 7= blackened/rotten), T_1 = Control, T_2 = hot water (52±2°C), T_3 = tilt, T_4= un perforated polythene bag without $KMnO_4$, T_5 = un perforated polythene bag with $KMnO_4$, T_6 = perforated polythene bag without $KMnO_4$, T_7 = perforated polythene bag with $KMnO_4$, and T_8 = low temperature (12±2°C)

Table 3. Analysis of variance of the data on % moisture content and % dry matter

Source of variance	Degree of freedom	Mean sum square			
		% moisture content		% Dry matter	
		8^{th} day	16^{th} day	8^{th} day	16^{th} day
Replication	2	0.81 NS	0.81 NS	3.26 NS	3.26 NS
Variety	2	128.02**	128.02**	4 32.21**	432.21**
Treatment	7	28.66*	28.66*	89.92**	89.92**
Variety x treatment	14	1.49 NS	1.49 NS	3.55 NS	3.55 NS
Error	46	10.03	10.03	2.99	2.99

* = significant at 5 % level, ** = significant at 1 % level, NS = Not significant.

Dry matter content: Data on changes in dry matter content of banana pulp were derived from percentage moisture content. Dry matter content in the pulp of banana decreased during the entire storage period, but variation was observed between the varieties during successive days of storage. Slightly higher dry matter content was found in Sabri (43.17-38.04%), than those of Champa (41.03-35.28%) and Mehersagar (34.98-30.26%). Dry matter content in pulp was found to gradually decreased during storage (Table 2).

Dry matter content in banana pulp varied significantly due to different postharvest treatments. The dry matter contents of pulp were in the following order: low temperature (44.16%)> tilt(35.58%)> perforated polythene bag with $KMnO_4$ (35.53%)> hot water (34.31%)> perforated polythene bag without $KMnO_4$ (33.50%)> control (32.83%)> un perforated polythene bag with $KMnO_4$ (31.00%)> and perforated polythene bag without $KMnO_4$ (29.33%) (Table 2)

Combined effects of varieties and postharvest treatments in respect to dry matter content was found significant, and it was highest in Sabri × low temperature combination (47.9%) and the lowest in Mehersagar × unperforated polythene bag without $KMnO_4$ (26.20%, Table 2).

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