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Effect of post harvest treatments on the incidence of banana disease 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 observe the disease incidence and its severity during storage condition of banana varieties (Sabri, Champa and Mehersagar). Postharvest treatments included in this study 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 in all varieties, disease incidence progressed with duration of storage and significant variations were observed in percent disease severity level among the varieties. Disease incidence was the highest in Mehersagar (70.85%) than Sabri (67.07%) and Champa (53.78%) at the 8th day of storage. Disease severity level was the highest in Sabri (77.54%) than Mehersagar (61.88%) and Champa (64.70%) at 12th day of storage. Post harvest treatments exerted significant variation in influencing disease incidence and disease severity level during storage. The lowest incidence of disease and minimum disease severity (3.22%) was found in low temperature treated fruits as compared to those of the control (74.07%) fruits during the entire period of investigation.
Key words: Disease incidence, Disease severity, Post harvest treatments and Banana varieties.

Introduction

Banana is one of the most relished fruit crops in Bangladesh with a total production of 756 thousand metric tons in an area of 50.2 thousand hectares. In respect of total production, it ranks top position among the major fruits grown in Bangladesh (BBS, 2002). Banana constituted the fourth most important global food commodity after rice, wheat and maize in terms of gross value of production (FAO, 2006). Postharvest loss of fresh fruits is one of the major problems in the tropics. 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 every year due to its perishable nature. The perishibility of the fruit is attributed to adverse phyiological changes, namely loss of weight due to respiration and transpiration, softening of flesh and lack of resistance capacity against microbial attack. Such spoilage causes considerable economic loss to both traders and retailers. The postharvest losses of fruits per year including banana have been estimated to be 0.23 million tons, and these were valued amounting to Tk. 1356 million (Shams-ud-din, 1997). A considerable quantity of harvested banana goes waste due to its perishable nature and the enormity of postharvest losses of 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.

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 (e. g. 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 disease incidence and severity during storage condition 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 observe the disease incidence and severity during storage condition 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 darts and latex, and subsequently air-dried before imposing the treatments. Disease incidence means percentage of fruits infected with disease. This is measured by calculating the percentage of fruits infected. In the present investigation, black spots, blemishes and visible disease symptoms were considered as disease. Disease severity means percentage of fruits skin area diseased. This was subjectively assessed by naked eye. 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

Disease incidence: Disease incidence means percent fruit infected by disease. In early stage of storage period, Mehersagar showed highest disease incidence (70.85%) followed by Sabri (67.07%) and Champa (53.78%) (Table1). Disease incidence increased with the advancment of storage period in all varities. At the 16th day of storage all varieties had statistically identical disease incidence (Table1). Postharvest treatments exhibited significant differences in disease incidence (Table 1). Higher incidence of disease was observed in all the postharvest treatments except those of tilt and low temperature during storage. The polythene bags irrespective of perforations and $KMnO_4$, failed to disease incidence. The combined effect of variety and postharvest treatments were significant. The lowest level of disease was observed in the low temperature-treated fruits of champa variety (Table 1).

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

Variety, postharvest treatments, Variety × treatment	Disease incidence (%) at different day after storage			
	4	8	12	16
Sabri (V_1)	67.08 (55.43)	85.27 (69.90)	98.61 (87.56)	98.61 (87.56)
Champa (V_2)	53.79 (47.19)	90.27 (75.03)	94.44 (84.77)	95.83 (85.59)
Mehersagar (V_3)	70.85 (65.05)	83.32 (62.62)	95.83 (85.59)	97.22 (86.48)
Level of significance	**	**	**	**
$LSD_{(0.01)}$	2.32	1.97	2.33	2.99
T_1	67.77 (54.92)	88.88 (67.63)	100 (90.00)	100 (90.00)
T_2	66.66 (64.7)	77.77 (71.75)	100 (90.00)	100 (90.00)
T_3	62.96 (53.49)	86.66 (83.50)	100 (90.00)	100 (90.00)
T_4	77.77 (66.48)	96.29 (70.52)	100 (90.00)	100 (90.00)
T_5	62.96 (57.86)	96.29 (83.50)	100 (90.00)	100 (90.00)
T_6	58.25 (50.70)	88.88 (64.55)	100 (90.00)	100 (90.00)
T_7	62.95 (52.79)	92.58 (55.62)	100 (90.00)	100 (90.00)
T_8	51.92 (46.12)	62.95 (56.38)	70.36 (57.81)	77.77 (64.51)
Level of significance	**	**	**	**
$LSD_{(0.01)}$	3.79	3.23	3.81	4.89
V_1 T_1	55.56 (48.19)	88.88 (70.52)	100 (90.00)	100 (90.00)
V_1 T_2	66.66 (54.73)	66.66 (54.73)	100 (90.00)	100 (90.00)
V_1 T_3	88.89 (70.52)	88.88 (70.52)	100 (90.00)	100 (90.00)
V_1 T_4	66.66 (54.73)	88.88 (70.52)	100 (90.00)	100 (90.00)
V_1 T_5	44.44 (41.80)	100 (90.00)	100 (90.00)	100 (90.00)
V_1 T_6	55.55 (48.18)	77.77 (61.86)	100 (90.00)	100 (90.00)
V_1 T_7	66.66 (54.73)	88.88 (70.52)	100 (90.00)	100 (90.00)
V_1 T_8	88.88 (70.52)	88.88 (70.52)	88.88 (70.52)	88.88 (70.52)
V_2 T_1	66.66 (54.73)	88.88 (70.52)	100 (90.00)	100 (90.00)
V_2 T_2	66.66 (54.73)	88.88 (70.52)	100 (90.00)	100 (90.00)
V_2 T_3	55.55 (48.16)	100 (90.00)	100 (90.00)	100 (90.00)
V_2 T_4	66.66 (54.73)	100 (70.52)	100 (90.00)	100 (90.00)
V_2 T_5	44.44 (41.80)	88.88 (90.00)	100 (90.00)	100 (90.00)
V_2 T_6	30.33 (33.41)	100 (90.00)	100 (90.00)	100 (90.00)
V_2 T_7	44.44 (41.80)	100 (48.18)	100 (90.00)	100 (90.00)
V_2 T_8	55.55 (48.18)	55.55 (70.52)	55.55 (48.18)	66.66 (54.73)
V_3 T_1	77.77 (61.86)	88.88 (61.86)	100 (90.00)	100 (90.00)
V_3 T_2	66.66 (84.73)	77.77 (90.00)	100 (90.00)	100 (90.00)
V_3 T_3	44.44 (41.80)	77.77 (90.00)	100 (90.00)	100 (90.00)
V_3 T_4	100 (90.00)	100 (70.52)	100 (90.00)	100 (90.00)
V_3 T_5	100 (90.00)	100 (70.52)	100 (90.00)	100 (90.00)
V_3 T_6	88.88 (70.52)	88.88 (41.80)	100 (90.00)	100 (90.00)
V_3 T_7	77.77 (61.86)	88.88 (48.18)	100 (90.00)	100 (90.00)
V_3 T_8	11.33 (19.66)	44.44 (28.12)	66.66 (54.73)	77.77 (61.86)
Level of significance	**	**	**	**
$LSD_{(0.01)}$	6.56	5.59	6.61	8.47

* =Significant at 5% level, **= significant at 1% level, NS= Not Significant. Figures in the parenthesized 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 $KMnO_4$, 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 disease severity (%) of banana during storage (means across all postharvest treatments)

Variety, postharvest treatments, Variety × treatment	Disease severity (%) at different day after storage			
	4	8	12	16
Sabri (V_1)	2.08 (7.77)	17.57 (23.20)	77.54 (65.89)	88.62 (80.93)
Champa (V_2)	1.29 (6.30)	25.29 (28.01)	74.70 (64.74)	88.06 (80.28)
Mehersagar (V_3)	2.62 (8.52)	6.58 (14.35)	61.88 (51.12)	87.90 (72.73)
Level of significance	**	**	**	**
$LSD_{(0.01)}$	0.33	1.11	1.88	2.46
T_1	1.96 (8.03)	13.10 (21.09)	74.07 (59.89)	100 (90.00)
T_2	3.54 (10.35)	10.81 (19.03)	71.14 (57.61)	100 (90.00)
T_3	1.58 (7.22)	8.47 (16.79)	68.62 (56.02)	100 (90.00)
T_4	3.03 (9.46)	32.58 (33.48)	94.81 (82.25)	100 (90.00)
T_5	1.88 (7.12)	29.95 (31.56)	91.10 (75.72)	100 (90.00)
T_6	1.88 (7.62)	16.92 (22.36)	86.10 (73.40)	100 (90.00)
T_7	1.10 (5.80)	18.29 (23.68)	81.92 (69.95)	100 (90.00)
T_8	0.96 (4.62)	1.66 (7.04)	3.22 (9.78)	5.59 (13.36)
Level of significance	**	**	**	**
$LSD_{(0.01)}$	0.534	1.81	3.08	4.01
V_1 T_1	2.00 (8.13)	16.77 (24.17)	86.66 (68.57)	100 (90.00)
V_1 T_2	6.77 (15.08)	13.11 (21.22)	66.11 (54.39)	100 (90.00)
V_1 T_3	1.77 (7.64)	11.66 (19.96)	76.10 (60.73)	100 (90.00)
V_1 T_4	1.10 (6.02)	21.33 (27.50)	100 (90.00)	100 (90.00)
V_1 T_5	1.00 (5.73)	57.99 (49.59)	100 (90.00)	100 (90.00)
V_1 T_6	1.00 (5.73)	5.66 (13.76)	95.55 (77.82)	100 (90.00)
V_1 T_7	1.00 (5.73)	10.9 (19.27)	90 (71.56)	100 (90.00)
V_1 T_8	2.00 (8.13)	3.11 (10.15)	5.9 (14.05)	9.00 (17.45)
V_2 T_1	1.66 (7.40)	13.11 (21.22)	75.55 (60.36)	100 (90.00)
V_2 T_2	1.77 (7.64)	12.33 (20.55)	68.44 (55.82)	100 (90.00)
V_2 T_3	1.66 (7.40)	6.77 (15.08)	63.11 (52.60)	100 (90.00)
V_2 T_4	2.11 (8.35)	66.66 (54.73)	100 (90.00)	100 (90.00)
V_2 T_5	0.44 (3.80)	25.22 (30.14)	87.77 (69.53)	100 (90.00)
V_2 T_6	1.33 (6.62)	38.33 (38.25)	100 (90.00)	100 (90.00)
V_2 T_7	0.44 (3.80)	38.66 (38.44)	100 (90.00)	100 (90.00)
V_2 T_8	0.88 (5.38)	1.22 (6.34)	2.77 (9.58)	4.55 (12.31)
V_3 T_1	2.22 (8.56)	9.44 (17.89)	60.00 (50.76)	100 (90.00)
V_3 T_2	2.10 (8.33)	7.00 (15.34)	78.88 (62.62)	100 (90.00)
V_3 T_3	1.33 (6.62)	7.00 (15.34)	66.66 (54.73)	100 (90.00)
V_3 T_4	5.88 (14.03)	9.70 (18.21)	84.44 (66.76)	100 (90.00)
V_3 T_5	4.22 (11.85)	6.66 (14.95)	85.55 (67.65)	100 (90.00)
V_3 T_6	3.33 (10.51)	6.77 (15.08)	62.77 (52.39)	100 (90.00)
V_3 T_7	1.88 (7.88)	5.33 (13.34)	55.77 (48.31)	100 (90.00)
V_3 T_8	0.00 (0.37)	0.66 (4.65)	1.00 (5.73)	3.22 (10.33)
Level of significance	**	**	**	**
$LSD_{(0.01)}$	0.925	3.15	5.33	6.95

* =Significant at 5% level, **= significant at 1% level, NS= Not Significant. Figures in the parenthesized 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 $KMnO_4$, 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)

Disease severity: Varieties caused significant effect on the levels of disease severity during storage and ripening (Table 3). Mehersagar showed slightly higher disease severity (2.62%) than Sabri (2.08%) and Champa (10.28%) at the 4th day of storage. Disease severity then increased sharply with the advancement of storage duration in all the varietis. At the 16th day of storage, severity level reached very high, and varietal differences were insignificant (Table 2). Postharvest treatments exerted significant result in terms of disease severity (Table 2). Disease severity increased with the increase of storage duration (Table 2). During the earlier part of storage, tilt was found good to reduce incidence (1.59 and 8.47% at the 4th and 8th days of storage, respectively). Low temperature was found the best in reducing disease severity during the entire period of study (5.59% at the 16th day of storage). The reduced diseases due to tilt and low temperature were probable because of the supression of fungal growth. However polythene bags did not perform well in reducing disease, possibly due to increased humidity inside the bag and increased infections by anaerobic pathogens. The combined effect of variety and postharvest treatments were also found significant in influencing disease severity (Table 2).

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