J. Agrofor. Environ. 5 (2): 39-44, 2011 ISSN 1995-6983

Effect of postharvest treatments on physical changes and shelf life of mango

R. Roy, M.A. Rahim and M.S. Alam
Department of Horticulture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Abstract: Effect of different postharvest treatments viz. T_1 (Perforated white polythene), T_2 (Non-perforated white polythene), T_3 (Perforated black polythene), T_4 (Non-perforated black polythene), T_5 (White paper), T_6 (Brown paper), T_7 (Tissue paper) and T_8 (News paper) on physical changes of two varieties of mango were studied. Among, the treatments, the maximum (8.067 days) were required for ripening in Amrapali which were kept in non-perforated white polythene and minimum (3.447 days) for ripening was recorded in Gopalbhog with control fruits of mango. The highest total soluble solid (19.07%) and weight loss (16.14%) was occurred in controlled fruits of Amrapali and Gopalbhog, respectively and the lowest (6.723 and 2.237%, respectively) was in perforated black polythene treated fruit of Gopalbhog and Amrapali, respectively. The maximum shelf life (14.33 days) was observed from the Amrapali fruit which was treated in perforated white polythene and minimum (7.667 days) was found in controlled fruits of Gopalbhog.
Key words: Mango, shelf life, postharvest treatments.

Introduction

Mango is recognized as one of the choicest and well accepted fruit all over the world and also acknowledged as the king of fruit (Shahjahan *et al*., 1994). In Bangladesh mango is considered to be the best of all indigenous fruits because of its excellent flavour, attractive fragrance, beautiful shades of colour, delicious taste and nutritional value. Like many other fruits, mango is highly perishable in nature. The fruits undergo many physiological and biochemical changes that lead to ripening and senescence. Shelf life of mango might be extended by stopping or slowing down these physicochemical changes. Due to lack of proper preservation technology, the post harvest loss of mango due to decay is considerable. To reduce this loss and to increase the shelf life, efforts are need to develop post harvest technologies which are not health hazardous and would suit climatic and socio-economic conditions of Bangladesh. Recently, Hassan (2010) reported that due to mishandling, inadequate storage or lack of postharvest technical knowledge, producers and traders have to face about 27% losses (Hassan, 2010), and loss of this perishable commodity is estimated up to 320.7 thousand tons annually with a value of Tk 3,000 lakh in the country (Haq, 2002). Although there are abundant literature dealing with the physico-chemical changes during ripening of mango, but limited information is available on effect of wrapping materials in Amrapali and Gopalbhog. In the circumstances, the present study has been designed to obtain information on some physical changes and shelf life during ripening.

Materials and Methods

An experiment was conducted at the laboratory of BAU germplasm centre, Dept. of Horticulture, Bangladesh Agricultural University, Mymensingh during May to August 2010. The experimental materials were two mango varieties, namely Amrapali and Gopalbhog which were collected from BAU Germplasm Center, Mymensingh. Maturity of mango was identified when the shoulders were in line with the stem end and the colour was green. The experiment was laid out in Completely Randomized Design (CRD) with 3 replications. Each replication was consisting of 5 fruits. The harvested fruits were wrapped with perforated and non perforated white polythene, perforated and non perforated black polythene, white paper, brown paper, newspaper and tissue paper separately. Fruits after wrapping were stored at room temperature for observation and data collection following the procedure explained by Koolpluksee *et al*. (1993). Data on the following parameters were recorded.

Colour of peel: Each fruit was observed at 2 days interval to record the colour of the peel by estimation.

Ripening time (days) and shelf life: Days required from harvesting to softening fruits and shelf life of mango fruits as influenced by different postharvest treatments was calculated by counting the days required to ripen fully as to retaining optimum marketing and eating qualities.

General appearance and eating quality: When the fruits were reached at pre-ripe, ripe and over ripe stage, general appearance and eating quality (taste and flavour) was assessed for organoleptic evaluation.

Weight loss and TSS (%): Fruit weight was taken before and after hot water treatment. After treatment, fruits weight was recorded at 2 days interval and then weight loss was calculated and expressed as percentage. Total soluble solids (TSS) content of mango pulp was estimated using Abbe's Refractmeter. A drop of mango juice squeezed from the fruit pulp was placed on the prism of the refractometer, and TSS was recorded as %Brix from direct reading of the instrument. Temperature corrections were made using the temperature correction chart.

Results and Discussion

Changes in peel colour: Among all treatments, the result exhibited that newspaper improved peel colour of mango. After 12^{th} days of storage news paper was developed full yellow colour in Amrapali and greenish yellow in Gopalbhog. On the other hand, non-perforated and perforated white polythene retained green colour much longer than other treatments (Table 1). The increase in color development was probably due to its effects on stimulating the activity of some enzymes that are responsible for ripening of mango. On the other hand, colour development of fruits was reduced in the treatment of polythene wrapping fruits. The findings have support of Alves *et al*. (1998) in respect of polythene wrapping who reported low density polyethylene individual bag were more effective in reducing fruit colour development. The results of the present investigation also supports seal packaging retarded the development of peel colour (Straten and Oosthuyse, 1994).

Ripening time: Variation between the varieties in relation to ripening time was not significant. The maximum ripening time in this regard with found in Amrapali whereas the minimum was recorded in Gopalbhog but they are

statistically similar (Table 2). The postharvest treatment of wrapping materials manifested highly significantly variance in respect of time required for ripening. Among the treatments, non-perforated white polythene treated fruits required maximum time (7.922 days) for ripening flowed by perforated white polythene (7.307 days). On the other hand, the minimum ripening time (3.742 days) was need in control treatment (Table 3). Interaction effects between varieties and post harvest treatments exhibited non significant effect on repining time. The maximum time (8.067 days) for ripening was required in Amrapali with non perforated white polythene and the closest of it was found with same treated fruits of Gopalbhog. The minimum (3.447 days) for ripening was recorded in control treated fruits of Gopalbhog and preceded by news paper (3.540 days) (Table 4). In regard of polythene treatment mangoes tool longer ripening time is supported by Koolpluksee *et al*. (1993) who found mangoes kept in polythene or polypropylene bags perforated or not perforated and with or without ethylene absorbent delayed ripening. Polythene provides a protective covering which slowed down the rate of respiration and delayed ripening (Khumlert, 1992).

Table 1. Changes in peel colour of mango fruits as influenced by different wrapping materials

Variety	Treatments	Days after storage				
		0	3	6	9	12
Amrapali	T_0 (control)	Green	Green	Trace of yellow	Yellowish Green	-
	T_1 (Perforated white polythene)	Green	Green	Green	Trace of yellow	Trace of yellow
	T_2 (Non-perforated white polythene)	Green	Green	Green	Green	Trace of yellow
	T_3 (Perforated black polythene)	Green	Green	Trace of yellow	Greenish yellow	Greenish yellow
	T_4 (Non-perforated black polythene)	Green	Green	Trace of yellow	Greenish yellow	Greenish yellow
	T_5 (White paper)	Green	Green	Trace of yellow	Trace of yellow	Yellowish green
	T_6 (Brown paper)	Green	Green	Trace of yellow	Yellowish green	Greenish yellow
	T_7 (Tissue paper)	Green	Green	Green	Trace of yellow	Trace of yellow
	T_8 (News paper)	Green	Green	Trace of yellow	Greenish yellow	Full yellow
Gopalbhog	T_0 (control)	Green	Green	Greenish yellow	Greenish yellow	-
	T_1 (Perforated white polythene)	Green	Green	Green	Trace of yellow	Greenish yellow
	T_2 (Non-perforated white polythene)	Green	Green	Green	Trace of yellow	Greenish yellow
	T_3 (Perforated black polythene)	Green	Green	Trace of yellow	Greenish yellow	Greenish yellow
	T_4 (Non-perforated black polythene)	Green	Green	Trace of yellow	Greenish yellow	Greenish yellow
	T_5 (White paper)	Green	Green	Trace of yellow	Greenish yellow	-
	T_6 (Brown paper)	Green	Green	Trace of yellow	Greenish yellow	-
	T_7 (Tissue paper)	Green	Green	Trace of yellow	Greenish yellow	Greenish yellow
	T_8 (News paper)	Green	Green	Trace of yellow	Greenish yellow	Greenish yellow

Table 2. Main effect of varieties on ripening time, general appearance and eating quality of mango

Mango varieties	Ripening time (days)	General appearance (1-9) at the stage of			Eating quality (1-9) at the stage of		
		Pre-ripe	Ripe	Over-ripe	Pre-ripe	Ripe	Over-ripe
Amrapali	5.372	3.055 a	5.159 a	4.430 a	2.918 a	5.486 a	4.406 a
Gopalbhog	5.150	2.957 b	4.947 b	4.131 b	2.811 b	5.315 b	4.272 b
	ns	**	**	**	**	**	**
$LSD_{(0.05)}$	0.2289	0.01746	0.03023	0.3023	0.02469	0.01746	0.1062
CV (%)	7.89	1.21	1.01	1.23	1.46	0.52	4.46

Figures are given by the same letter(s) or statistically similar as per DMRT

Table 3. Main effect of postharvest treatments on ripening time, general appearance and eating quality of mango

Postharvest treatments	Ripening time (days)	General appearance (1-9) at the stage of			Eating quality (1-9) at the stage of		
		Pre-ripe	Ripe	Over-ripe	Pre-ripe	Ripe	Over-ripe
T_0 (control)	3.573 g	2.668 g	4.677 e	3.242 g	2.450 e	6.337 a	4.083 e
T_1 (Perforated white polythene)	7.307 b	3.102 b	5.053 bc	4.622 b	2.865 c	5.123 e	4.343 cd
T_2 (Non-perforated white polythene)	7.922 a	3.177 a	5.642 a	5.208 a	2.962 b	5.018 g	4.187 de
T_3 (Perforated black polythene)	5.978 c	3.013 de	5.065 b	4.630 b	2.858 c	5.080 f	3.618 f
T_4 (Non-perforated black polythene)	5.163 d	2.890 f	4.870 d	4.443 c	2.750 d	4.957 h	4.190 de
T_5 (White paper)	5.253 d	2.997 e	4.990 c	4.563 b	2.858 c	5.438 d	4.508 c
T_6 (Brown paper)	4.290 e	3.050 cd	5.043 bc	4.337 d	2.920 b	5.472 cd	4.558 bc
T_7 (Tissue paper)	4.118 ef	3.063 bc	5.045 bc	3.965 e	2.973 b	5.497 c	4.765 ab
T_8 (News paper)	3.742 fg	3.093 b	5.090 b	3.512 f	3.142 a	5.683 b	4.798 a
	**	**	**	**	**	**	**
$LSD_{(0.05)}$	0.4856	0.03703	0.06413	0.06413	0.07406	0.03703	0.2252
CV (%)	7.89	1.21	1.01	1.23	1.46	0.52	4.46

Figures are given by the same letter(s) or statistically similar as per DMRT

General appearance: The varietals effect showed significant variation in terms of general appearance at pre-ripe, ripe and over-ripe stage of ripening. Variety Amrapali manifested the higher score for general appearance whereas the lower score was found in Gopalbhog at pre-ripe, ripe and over-ripe stage, respectively. From the result it was noted that ratings on general appearance increased from pre-ripe to ripe stage after that it decreased at over-ripe stage (Table 2). The change in general appearance influenced high significantly by their post harvest treatments. At pre-ripe stage, the highest (3.177) rating for this parameter was demonstrated in non-perforated white polythene and the closest (3.102) of it was found in perforated white polythene which was statistically identical. At this stage, the lowest score (2.668) was recorded in control. At ripe and over-ripe stage, the scoring of general appearance showed the maximum (5.642 and 5.208, respectively) both in non-perforated white polythene and the minimum (4.67 and 3.242, respectively) both were found in control (Table 3). The results also revealed that the scoring gradually increased up to ripening after that it showed decline trend. The interaction effect in this regard was not significant at pre-ripe stage and significant variation was at ripe and over-ripe stage (Table 4).

Table 4. Combined effect of varieties and postharvest treatments on ripening time, general appearance and eating quality of mango

Varieties	Postharvest treatments	Ripening time (days)	General appearance (1-9) at the stage of			Eating quality (1-9) at the stage of		
			Pre-ripe	Ripe	Over-ripe	Pre-ripe	Ripe	Over-ripe
Amrapali	T_0 (control)	3.700	2.703	4.717 h	3.283 hi	2.483	6.447 a	4.150
	T_1 (Perforated white polythene)	7.633	3.153	5.097 bcd	4.677 b	2.900	5.250 g	4.417
	T_2 (Non-perforated white polythene)	8.067	3.227	6.203 a	5.767 a	3.050	5.107 h	4.253
	T_3 (Perforated black polythene)	6.067	3.050	5.150 b	4.703 b	2.917	5.147 h	3.683
	T_4 (Non-perforated black polythene)	5.233	2.947	4.870 g	4.450 d	2.800	5.030 i	4.260
	T_5 (White paper)	4.833	3.053	5.097 bcd	4.677 b	2.923	5.503 e	4.573
	T_6 (Brown paper)	4.557	3.100	5.043 cdef	4.603 bc	2.970	5.530 e	4.617
	T_7 (Tissue paper)	4.313	3.113	5.143 bc	4.023 e	3.050	5.583 d	4.833
	T_8 (News paper)	3.943	3.147	5.110 bcd	3.683 g	3.167	5.780 c	4.867
Gopalbhog	T_0 (control)	3.447	2.633	4.637 h	3.200 i	2.417	6.227 b	4.017
	T_1 (Perforated white polythene)	6.980	3.050	5.010 def	4.567 c	2.830	4.997 i	4.270
	T_2 (Non-perforated white polythene)	7.777	3.127	5.080 bcde	4.650 bc	2.873	4.930 j	4.120
	T_3 (Perforated black polythene)	5.890	2.977	4.980 ef	4.557 c	2.800	5.013 i	3.553
	T_4 (Non-perforated black polythene)	5.093	2.833	4.870 g	4.437 d	2.700	4.883 j	4.120
	T_5 (White paper)	5.673	2.940	4.883 g	4.450 d	2.793	5.373 f	4.443
	T_6 (Brown paper)	4.023	3.000	5.043 cdef	4.070 e	2.870	5.413 f	4.500
	T_7 (Tissue paper)	3.923	3.013	4.947 fg	3.907 f	2.897	5.410 f	4.697
	T_8 (News paper)	3.540	3.040	5.070bcde	3.340 h	3.117	5.587 d	4.730
		ns	ns	**	**	ns	**	ns
$LSD_{(0.05)}$		0.6868	0.05237	0.09070	0.09070	0.07406	0.05237	0.3185
CV (%)		7.89	1.21	1.01	1.23	1.46	0.52	4.46

Figures are given by the same letter(s) or statistically similar as per DMRT

Eating quality: Genotypic effect of mango was highly significant in relation to eating quality at pre-ripe, ripe and over-ripe stage. The highest grade observed in Amrapali whereas the lowest was noted in Gopalbhog at pre-ripe, ripe and over-ripe stage, respectively. It was noticed that considering eating quality variety Amrapali was always superior over Gopalbhog. The result revealed that the rank of eating quality was increasing until ripening after that it was decreasing in both varieties (Table 2). Statistically highly significant variation was exerted among the wrapping materials in respect of eating quality at all the stage of storage. At rep-ripe stage, newspaper showed the highest (3.142) rating value followed by (2.973) tissue paper treatment. On the contrary, control treated fruit of mango had the least score of this parameter (Table 3). At the ripe and over-ripe stage, eating quality also showed highly significant variations whereas the maximum eating quality (6.337 and 4.798, respectively) rating value was noted in control and news paper treated fruit, respectively. Those stages, the lowest rating value for eating quality (4.957 and 3.618) was taken from the both condition of black polythene, respectively. Eating quality was highly significant influenced by the interaction effect between varieties and postharvest treatment during storage at ripe stage whereas another two stages showed non significant variation. At pre-ripe stage, the higher rating (3.167) for eating quality was in Amrapali with news paper treated fruit. The second highest (3.117) was found in the same treated fruit of Gopalbhog. On the other hand, the lowest (2.417) value was obtained in with control treated fruit of Gopalbhog. At ripe stage, the maximum rating value (6.447) was noted in Amrapali with control and the minimum (4.883) was observed in non-perforated black polythene treated fruits of Gopalbhog preceded by non perforated white polythene in Gopalbhog. The highest (4.867) score for eating quality was obtained at newspaper wrapped fruit in Amrapali at over-ripe stage whereas the lowest (3.553) value was noted at perforated black polythene treated fruits in Gopalbhog which was also preceded by non-perforated white polythene in Amrapali at the same stage (Table 4). The results was similar to Srinivasa *et al*. (2002) who observed when fruits were kept in low density polythene bag showed off-flavour due to fermentation and fungal growth which has conformity with the present findings.

Weight loss: The variation in percentage of weight loss was highly significant due to the effect of genotypic differences during the study at all the storage period. Gopalbhog lost more weight than Amrapali after 3, 6, 9 and 12 days (Table 5). The findings indicated that Amrapali was superior in

respect of minimum weight loss than Gopalbhog. Wrapping materials demonstrated highly significant differences regarding weight loss at all days of storage. After 3 days of storage control treatment showed maximum weight loss and minimum weight losses were recorded in news paper treated fruits. At 3, 6, 9 and 12th days of storage, control treatment exhibited the highest weight loss (5.603, 6.648, 9.860 and 16.07%, respectively) and the lowest weight losses (2.395, 3.433, 6.652 and 12.870%, respectively) were noted in news paper (Fig. 1). Interaction effects between varieties and post harvest treatments exhibited non significantly effect at 3, 6, 9 and 12th days of storage. The maximum (55.670, 6.710, 9.927 and 16.14%) weight loss was found in control treated fruits of Gopalbhog. The minimum (2.327, 3.367, 6.587 and 12.810%) weight loss was recorded in news paper treated fruits of Amrapali (Table 6). The weight loss gradually increased in mango with the advancement of storage period whereas the weight loss was higher in Gopalbhog and lower in Amrapali. These characteristics of Gopalbhog might be due to its genetical make-up. The reduction of weight loss could be due to the presence of physical barrier in gas diffusion through fruit stomata by which gas exchange takes place between internal tissues and external atmospheres.

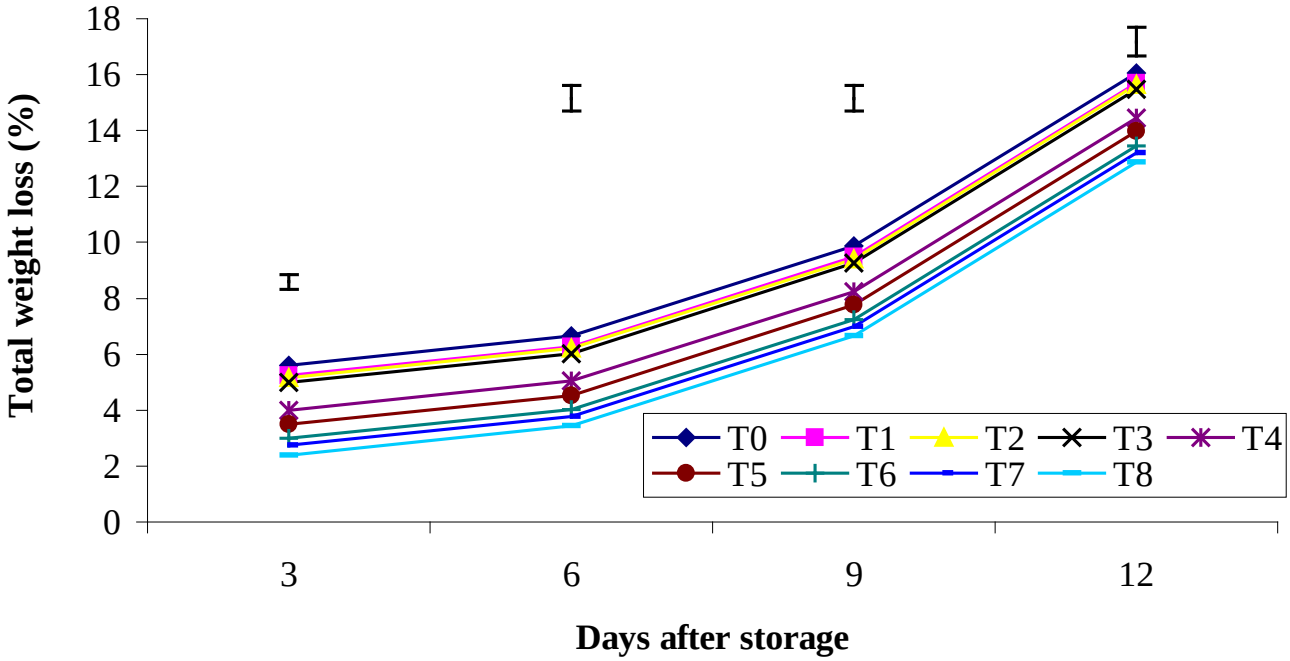

Fig. 1. Main effect of postharvest treatments on weight loss of mango. Vertical bars represent LSD at 5% level of probability

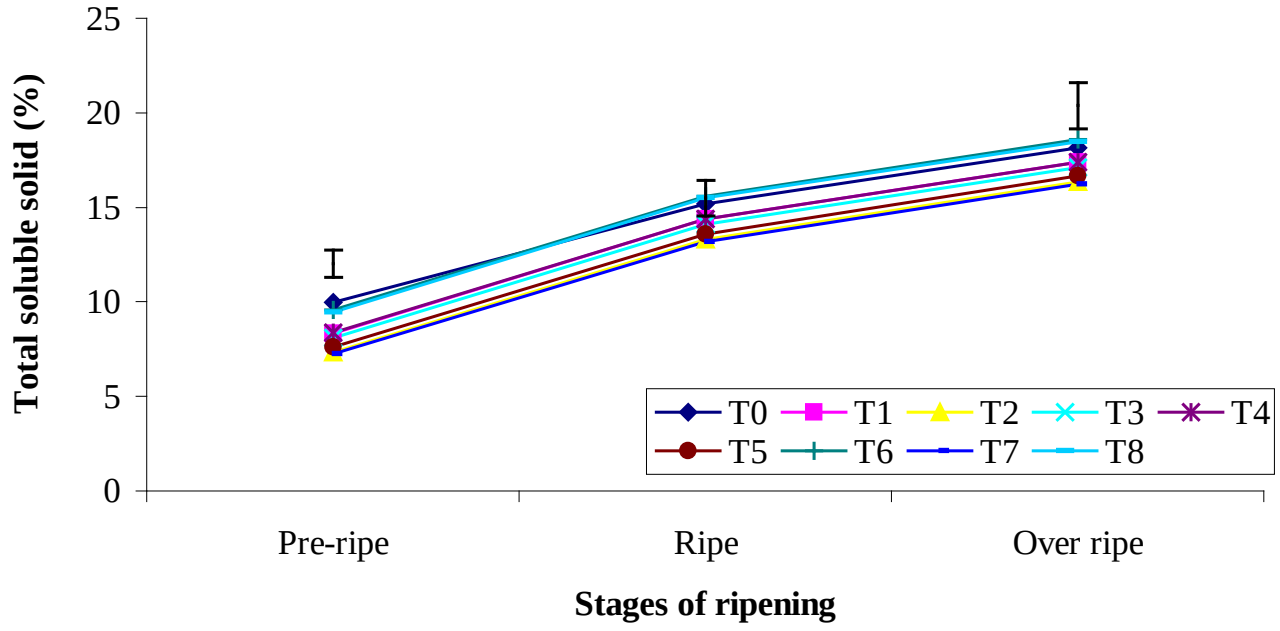

Fig. 2. Main effect of postharvest treatments on total soluble solid of mango. Vertical bars represent LSD at 5% level of probability

Total soluble solid (TSS): Varietals differences in terms of total soluble solid content were found to be highly significant at per-ripe stage whereas non significant variation was affected at the storage period. Percent total soluble solid contents increased with storage duration from pre-ripe to over-ripe stage of storage and then decreased gradually because of rotting become started. The variety Amrapaly had higher TSS content at pre-ripe, ripe and over-ripe (8.513, 14.526 and 1.526% Brix) stages of storage (Table 5). The different storage treatments used in the present investigation showed statistically highly significantly variations in relation to percent TSS at pre-ripe, ripe, and over-ripe stage. During pre-ripe stage, the untreated fruits had the highest TSS (9.993% Brix) value followed by (9.588% Brix) brown paper treated fruits. At ripe and over-ripe stage, brown paper treated fruits showed the highest TSS (15.60 and 18.60% Brix) value whereas the lowest (7.235, 13.20 and 16.24% Brix) TSS value was recorded in tissue paper treated fruits. A significant variation was found due to the interaction effect between variety and postharvest treatments, whereas the highest TSS content was found in control treated fruits of Amrapali followed by Gopalbhog at the same wrapping materials. The lowest TSS content was recorded in perforated black polythene with Gopalbhog (Table 6).

Table 5. Main effect of varieties on weight loss, total soluble solid and shelf life of mango

Varieties	Weight loss (%)				Total soluble solid (% Brix)			Shelf life
	3 days	6 days	9 days	12 days	Pre-ripe	Ripe	Over-ripe	
Amrapali	4.000 b	5.042 b	8.259 b	14.475 b	8.513 a	14.526 a	17.526 a	11.259 a
Gopalbhog	4.132 a	5.172 a	8.389 a	14.606 a	8.390 b	14.214 b	17.214 b	10.926 b
	**	**	**	**	**	ns	ns	ns
$LSD_{(0.05)}$	0.05520	0.05520	0.01746	0.1746	0.01746	0.3816	0.3816	0.5467
CV (%)	0.45	0.40	0.29	0.20	0.30	4.81	3.98	8.93

Figures are given by the same letter(s) or statistically similar as per DMRT

Table 6. Combined effect of varieties and postharvest treatments on weight loss, total soluble solid and shelf life of mango

Varieties	Postharvest treatments	Total weight loss (%)				Total soluble solid (% Brix)			Shelf life
		3 days	6 days	9 days	12 days	Pre-ripe	Ripe	Over-ripe	
Amrapali	T_0 (control)	5.537	6.587	9.793	16.00	10.06a	16.07a	19.07a	8.000
	T_1 (Perforated white polythene)	5.170	6.210	9.430	15.65	7.137m	13.15efg	16.15efg	14.33
	T_2 (Non-perforated white polythene)	5.093	6.133	9.350	15.57	6.853o	12.87g	15.87g	13.33
	T_3 (Perforated black polythene)	4.927	5.967	9.183	15.40	9.447e	15.46abcd	18.46abcd	12.00
	T_4 (Non-perforated black polythene)	3.930	4.970	8.183	14.40	8.443g	14.46bcde	17.46bcde	10.67
	T_5 (White paper)	3.427	4.463	7.687	13.91	7.957i	13.97efg	16.97efg	9.000
	T_6 (Brown paper)	2.927	3.967	7.190	13.41	9.693c	15.70ab	18.70ab	11.67
	T_7 (Tissue paper)	2.667	3.717	6.923	13.13	7.410k	13.42efg	16.42efg	11.00
	T_8 (News paper)	2.327	3.367	6.587	12.81	9.613d	15.63abc	18.63abc	11.33
Gopalbhog	T_0 (control)	5.670	6.710	9.927	16.14	9.927b	14.23def	17.23def	7.667
	T_1 (Perforated white polythene)	5.303	6.343	9.560	15.78	9.563d	15.58abc	18.58abc	14.00
	T_2 (Non-perforated white polythene)	5.227	6.267	9.480	15.69	7.817j	13.83efg	16.83efg	13.00
	T_3 (Perforated black polythene)	5.057	6.093	9.317	15.54	6.723p	12.74g	15.74g	11.67
	T_4 (Non-perforated black polythene)	4.063	5.103	8.310	14.52	8.317h	14.33cdef	17.33cdef	10.67
	T_5 (White paper)	3.557	4.600	7.827	14.05	7.307l	13.32efg	16.32efg	8.667
	T_6 (Brown paper)	3.043	4.083	7.293	13.50	9.483e	15.50abcd	18.50abcd	11.33
	T_7 (Tissue paper)	2.803i	3.850	7.070	13.29	7.060n	13.06fg	16.06fg	10.33
	T_8 (News paper)	2.463	3.500	6.717	12.93	9.313f	15.33abcd	18.33abcd	11.00
		ns	ns	ns	ns	**	**	**	ns
$LSD_{(0.05)}$		0.1656	0.05237	0.05237	0.05237	0.05237	1.145	1.145	1.640
CV (%)		0.45	0.40	0.29	0.20	0.30	4.81	3.98	8.93

Figures are given by the same letter(s) or statistically similar as per DMRT

The findings revealed that percent total soluble solids increased sharply form pre-ripe to ripe fruits thereafter it decreased or slightly increased up to over-ripe fruits have got support of Joshi and Roy (1988) who mentioned that TSS increase initially and declined later on. Variety Amrapali was superior regarding TSS content than Gopalbhog. Similar result was observed by Barua (2003). This variation in TSS might be due to inherent general character.

Shelf life: Non significant variation was obtained on shelf life in two varieties of mango. The maximum shelf life was recorded for Amrapali and the minimum was for Gopalbhog (Table 5). Different postharvest treatments used in the present study showed highly significant variation in storage ability of mango. The maximum shelf life (14.17 days) was observed in perforated white polythene bagged fruits and the closest (13.17 days) of it was obtain in non-perforated white polythene bagged fruits whereas minimum shelf life was found in control treatment (7.83 days) (Fig. 3). Interaction effect between variety and postharvest treatment also showed non significantly variation on shelf life whereas perforated white polythene treated fruits of

Amrapali showed the highest shelf life (14.33 days) and the lowest (7.667 days) shelf life was recorded from untreated fruits of Gopalbhog (Table 6). Shelf life gradually decreased with advancement of ripening. The results of the present study have got support by Shahjahan *et al*. (1994) and Hasan *et al*. (1998).

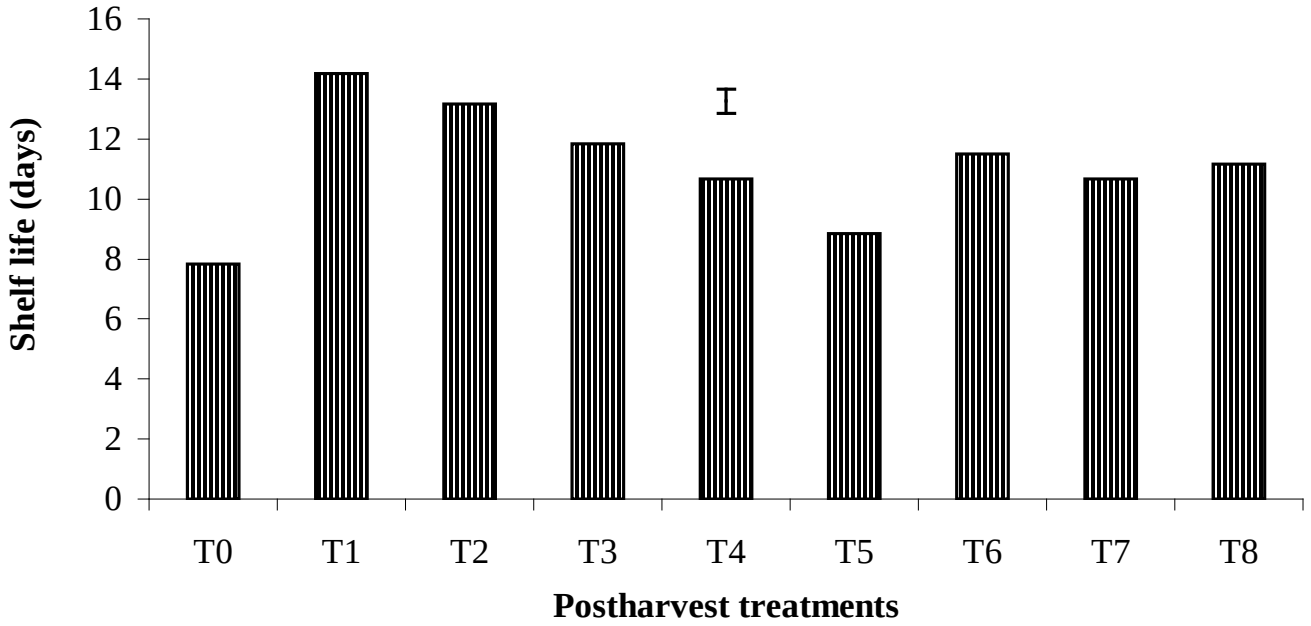

Fig. 3. Main effect of postharvest treatments on shelf life of mango. Vertical bars represent LSD at 5% level of probability

Acknowledgement: The authors thankfully acknowledge the financial assistance of BAU GPC of the Dept of Horticulture, Bangladesh Agril. Univ., Mymensingh for their guidance at the research period.

References

Alves, R.M.V., Sigrist, J.M.M. and Padula, M. 1998. Tommy Atkins mangoes under modified atmosphere. RevistaBrasileira de Fruticultura, 20(2): 220-228.

Barua, G. 2003. Shelf life and quality of mango as influenced by different post harvest treatments. MS thesis, Dept. of Horticulture, Bangladesh Agricultural University, Mymensingh. p. 105.

Haq, A. 2002. Pasckage for mango production, postharvest techniques and its export prospects, Mango Res. Inst. Shajabad, pp: 1-15.

Hasan, M.K., Mondal, M.F. and Haque, M.S. 1998. Studies on the storage behaviour of mango. Bangladesh J. Agril. Sci., 25(2): 311-318.

Hassan, M. K. 2010. Final Report: Postharvest loss Assessment: A Study to Formulate Policy for Postharvest Loss Reduction of fruits and Vegetables and Socio-Economic Uplift of the Stakeholders.P.188 (A Research Project Funded by USAID and EC, and Jointly implemented by FAO and FPM of the Ministry of Food and Disaster Management (MoFDM) under the National Food Programme Capacity Strengthening Programme NFPCSP).

Joshi, G.D. and Roy, S.K. 1988. Influence of maturity, transport and cold storage on biochemical composition of Alphonso mango fruit. J. Moharashtra. Agril. Univ., 13(1): 12-15.

Khumlert, R, 1992. Effect of gibberellic acid (GA_3) on some physico-chemical characteristics of Kheaw and Sawoey mango fruit. College Laguna (The Phillipines). p. 95.

Koolpluksee, M.S. Mesta and Subhadrabandhu, S. 1993. Effect of modified atmospheres on quality and chilling injury of Nam Dok Mai mango fruits. Kaset. J. Nat. Sci., 27(2): 115-124.

Shahjahan, M., Shell, S., Zaman, M.A. and Sakur, M.A. 1994. Optimization of harvesting maturities for major mango cultivars in Bangladesh. Bangladesh J. Sci. Res., 12(2): 209-215.

Srinivasa, P.C., Baskaran, R.M., Ramesh, N.K., Prashanth, V.H. and Tharanathan, R.N. 2002. Storage studies of mango packed using biodegradable chitosan film. European Food Res. Tech., 215(6): 504-508.

Straten, B.N. and Oosthuyse, S.A. 1994. The effect of sealing mature green sensation mangoes in semi-permeable polythene bags on fruit quality after ripening. Yearbook-South African Mango Growers Assoc., 14: 29-33.