Published with Open Access at Journal BiNET
Vol. 25, Issue 02: 2114-2121
Journal of Bioscience and Agriculture Research
Journal Home: www.journalbinet.com/jbar-journal.html

Effect of different time of bagging for ensuring quality mangoes Cv. Mishribhog

Md. Tariqul islam[1], Md. Shamsuz Zoha[2], Md. Sorof Uddin[3], Md. Abdul Bari[4], Md. Hassanur Rahman[1], Mst. Moli Akter[1] and Nazmin Akter[1]

[1]Dept. of Horticulture, Hajee Mohammad Danesh Science and Technology University, Dinajpur 5200
[2]Dept. of Chemistry, Hajee Mohammad Danesh Science and Technology University, Dinajpur- 5200
[3]Pomology division, Horticulture Research Centre, Bangladesh Agricultural Research Institute, Joydebpur, Gazipur-1701
[4]Insect Biotechnology Division, Institute of Food and Radiation Biology, Atomic Energy Research Establishment, Savar, Dhaka 1349, Bangladesh

✉ For any information: tariqulhstu@gmail.com (Islam, MT)
Article received: 12.08.2020; Revised: 21.09.2020; First published online: 30 September 2020.

ABSTRACT

Fruit bagging is a newly developed technology, widely used by the farmers, easy practice, and environment friendly and useful for high quality mango production in Bangladesh Four treatments were included in this experiment namely non-bag (control); white polythene bag; single layered white paper bag and double layered brown paper bag. The fruits were bag at 35, 45 and 55 days after fruit set. The experiment was carried out in the Randomized Complete Block Design with three replications. Fruit bagging has direct effect on fruit length, diameter, fresh weight and pulp weight (9.49cm, 8.31cm, 295.8g and 267.4g, respectively) while minimum was recorded in non-bagged control fruits (7.75cm, 6.91cm, 211.1g and 182.0g, respectively) at 35 and 45 days. In addition, the total sugar, reducing sugars, total soluble solid, ascorbic acid, pH and β-carotene were improved over control fruits. Brown paper bags are competent to change the fruit color. Brown paper bag extended shelf life up to 9 days with premier sensory quality as against 5 days of non-bagged control fruits. Considering the results, double layered brown and single layered white paper bagged fruits performed the best in respect of quality parameters and extending shelf life in mango cv. Mishribhog.

Key Words*: Mango, Bagging time, Sensory evaluation, Shelf life and Physico-chemical parameters*

Cite Article: Islam, M. T., Zoha, M. S., Uddin, M. S., Bari, M. A., Rahman, M. H., Akter, M. M. and Akter, N. (2020). Effect of different time of bagging for ensuring quality mangoes Cv. Mishribhog. Journal of Bioscience and Agriculture Research, 25(02), 2114-2121.
Crossref: https://doi.org/10.18801/jbar.250220.258

I. Introduction

Mango (*Mangifera indica* L.) belonging to the family Anacardiaceae, is considered significant profitable tropical fruit in Bangladesh. Most of the people like this fruit considering its taste and nutritive values.

Published with open access at journalbinet.com
EISSN: 2312-7945, © 2020 The Authors, Research paper

At present, the area under mango cultivation is 44366 hectares and production 1165800 MT (BBS, 2019). It plays an important role in balancing the human diet by providing about 64-86 calories per 100 g of ripe fruits. It is a good source of essential protective nutrients like vitamins A, B, C and also rich in minerals including calcium, potassium and iron (Amin and Hanif, 2002). The commercial use of this technology only confined in the North-West part of the country since less use in the North part of the country. Different types of mango cultivated in Bangladesh including gutti (non-grafted plant), popular commercial varieties and high yielding regular varieties. Mishribhog is the most popular and delicious variety, commonly known as Khirsapat/Himsagor at the other regions of the country. (Sharma et al., 2014) mentioned that currently, more importance is being placed on reducing the use of pesticides to make sure worker and consumer health safety, and environmental protection. Among the alternatives, pre-harvest fruit bagging has proven as effective in many mango growing countries. Bagging is a physical protection technique, not only defend pest and diseases but also affects the quality of the produce by changing microenvironment of fruit during development (Sharma et al., 2014; Zhang et al., 2015). The pre-harvest bagging of fruit can also reduce the incidence of disease, insect pest and/or mechanical injury or damage, sunburn of the skin, fruit cracking, agrochemical residues on the fruit, and bird damage (Akter et al., 2020; Islam et al., 2019; Jakhar and Pathak, 2016; Nagaharshitha et al., 2014 and Sharma et al., 2014). For rising, yield and quality mango production, pre-harvest bagging is one of the effective technologies by which individual fruits wrapping with distinctively designed paper or cloth bags (Nagaharshitha et al., 2014). Fruit bagging has a direct effect on fruit color development and brown paper bag capable to change fruit color into yellow (Uddin and Reza 2017). A glamorous, unblemished and pest free fruits are developed by using this technology. However considering the above facts this study has been under taken to find out the effects of time of bagging on quality and enhance the mango shelf life cv. Mishribhog.

II. Materials and Methods

Experimental site, design and treatments

The study was conducted at the mango orchard near Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur, during March to July, 2017. The experiment was laid out in the randomized complete block design with three replications. Four treatments were applied in this experiment namely non-bag (control); white polythene bag; single layered white paper bag and double layered brown paper bag. Selected mangoes were bagged at 35, 45 and 55 days after fruit set. The size of bag was 25 cm × 20 cm. Before bagging a small perforation (≤4 mm diameter) was made at the bottom of the polythene bags for proper ventilation. The bags were tied with peduncle by the help of attached thread. Chemical analyses were examined in the laboratory of Atomic Energy Commission, Savar, Dhaka and rest of parameters was assessed at the Department of Horticulture, HSTU, Dinajpur, Bangladesh.

The fruit length and diameter were measured by slide calipers in centimeter (cm).

Fresh weight of fruit, pulp and stone were measured using digital balance and expressed in gram (g).

Weight Loss

Fruit weight loss was evaluated using a digital balance. Weight loss was expressed as a percentage using the following formula (AOAC, 2000).

$$(\%)\ \text{weight loss} = \frac{\text{Initialweight (g)} - \text{weight at the sampling date}}{\text{Initialweight}} \times 100$$

Total Sugars

Total sugar content of mango fruit was determined by the Anthrone method (Hansen and Moller, 1975) with slide modification. Fruit pulp (0.1 ml) mixed with distilled water (1.9 ml) and kept in icebox (10 min). Then, anthrone reagent (3 ml) was added and heated in boiling water (15 min). The absorbance measured at 620 nm, after cooling room temperature.

Reducing Sugars

Reducing sugar of mango fruit was determined by DNS method (Miller, 1972).

Published with open access at journalbinet.com
EISSN: 2312-7945, ©2020 The Authors, Research paper

Ascorbic acid

The ascorbic acid content analyzed by the titration method of Rangana, 1986. 10 g of fresh pulp was taken in beaker with 50 ml 3% metaphosphoric acid and then it was transferred in blender and homogenized. After that it was filtered through Whatman filter paper. Then 5 ml filtrate was titrated using 2, 6-dichloroindophenol indophenols until a light pink end-point.

$$\text{Vitamin C (mg/100 g)} = \frac{\text{Titre} \times \text{dye factor} \times \text{volume made up(ml)}}{\text{Aliquot volume (ml)} \times \text{Sample weight(g)}} \times 100$$

Total Soluble Solids

The total soluble solids (TSS) content of the fruit juice was determined using Erma Hand Refractometer and expressed as a percentage.

pH

The pH of fruit juice was assessed by pH meter and it was calibrated with buffers at the pH values of 7.0 and 4.0.

β-Carotene

β-carotene were determined by the procedure in mango pulp was determined according to the method of Nagata and Yamashita, 1992**.** Fruit pulp was mixed with hexane and acetone mixture (6: 4) and then filtered and absorbance was measured at 663, 505 and 453 nm.

$$\beta\text{-carotene (mg /100ml)} = 0.216\ A_{663} - 0.304\ A_{505} + 0.452\ A_{453}$$

Shelf Life

The shelf life (days) was accounted from the date of harvesting. When the fruits were spoiled then shelf life was recorded.

Sensory evaluation

For assessing color, texture, appearance, sweetness, flavour and overall expression of the fruits were made by using 9 point Hedonic Scale by a panel of five judges as described by Amerine et al. (1965).

Disease incidence

Diseases incidence means percentage of fruits infected with disease. The disease incidence was calculated as follow:

$$\text{(\%) Disease incidence} = \frac{\text{Number of infected fruits in each treatment}}{\text{Total number of fruits in each treatment}} \times 100$$

Statistical analysis

The data were analyzed by using SPSS 22.0 for Windows (SPSS Inc., Chicago, IL, USA) with Duncan's Multiple Range Test (DMRT) at $P \leq 0.05$.

III. Results and Discussion

Fruit length, diameter, fresh weight and pulp weight

Pre-harvest fruit bagging had significant influence on fruit length, diameter, fresh weight and pulp weight of fruit. The maximum fruit length, diameter, fresh weight and pulp weight were found in brown paper bag (9.49 cm, 8.31 cm, 295.8 g and 267.4 g, respectively) and minimum were recorded in non-bagged control fruit (8.81cm, 7.43 cm, 211.1g and 182.8g, respectively) at 35 days of bagging (Table 01). Bagging on fruit growth, size, and weight has positive effects which have been reported by many researchers (Stover and Simmonds., 1987; Xu et al., 2008; Watanawan et al., 2008; Yang et al., 2009; Harhash and Al-Obeed., 2010; Chonhenchob et al., 2011; and Zhou et al., 2012).

Weight loss

Weight loss among all the treatments was statistically non-significant. The maximum weight loss was found in the polythene bag (18.58%) and minimum in brown paper bag (12.91%) followed by white paper bag and non-bagged, control fruits (15.35 and 15.37%, respectively) at 35 day (Table 01).

Published with open access at journalbinet.com
EISSN: 2312-7945, © 2020 The Authors, Research paper

Table 01. Effects of pre-harvest bagging on physical parameters of mango cv. Mishribhog

Treatments	Time	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	Pulp weight (g)	Weight loss (%)
Non-bagged (control)		7.75b	6.91b	211.1e	182.8e	15.37a
Polythene bag	35 days	8.81ab	7.43ab	256.7cd	226.3d	18.58a
	45 days	8.28ab	7.20ab	248.0d	235.0cd	14.74a
	55 days	8.32ab	6.95b	257.3cd	221.7d	15.21a
White paper bag	35 days	8.44ab	7.51ab	267.0bc	225.1d	15.35a
	45 days	8.49ab	7.73ab	260.8cd	246.1bc	13.00a
	55 days	8.33ab	7.13ab	259.6cd	228.4d	13.73a
Brown paper bag	35 days	9.49a	8.31a	295.8a	267.4a	12.91a
	45 days	9.27ab	7.68ab	279.7b	252.2b	13.31a
	55 days	8.92ab	7.7ab	278.0b	257.2ab	15.28a
LSD		12.46	11.49	13.55	13.88	4.885
CV%		8.68	9.18	3.16	3.64	14.42

Means followed by the same letter(s) within each column didn't significantly different (DMRT, $p < 0.05$).

Total sugar content

The pre-harvest fruit bagging showed significant variation in respect of total sugar content among all treatments (Table 02). Results showed that the maximum amount of total sugar (12.12%) was found in control fruits and minimum in polythene bagged fruits (5.52%) at 45 days. The fruits of brown paper bagged sugar content was found (10.05%) at 55 days, while lower amount of total sugar was recorded in polythene bagged fruits (5.52%) at 45 days (Table 02). Total sugar content is the combination of reducing sugar and non-reducing sugar and other molecules. During ripening process, non-reducing sugar converted to reducing sugar and sweetness increase. For bagging mango the conversion process is slow and it will take long time. For non-bagging mango internal biochemical changes is faster than bagging mango. Therefore, during biochemical analysis, reducing sugar is higher to non-reducing sugar.

Reducing sugar

The pre-harvest bagging used in this experiment showed statistically significant effect on reducing sugar of mango fruits among all treatments at different time of bagging. The maximum reducing sugar content (3.67%) was recorded in white paper bagged fruits at 55 days of bagging while the minimum was found in control fruits (1.94%) at 45 days (Table 02). The results of the present study are in support of the finds of Haldankar et al. (2015) and Islam et al. (2017). They reported that due to the pre-harvest bagging reducing sugars were increased.

Ascorbic acid

The different treatments significantly affected the content of ascorbic acid. The highest ascorbic acid content was recorded in non-bagged control fruit (2.23mg/100g) as compared to bagged fruits. The polythene bag showed lowest ascorbic acid (1.36mg/100g) (Table 02). The bagging led to lower content of chemical components such as ascorbic acid (Vitamin C), phenols and organic acids in most of peach varieties (Lima et al., 2013). The above results are very close to the findings of (Islam et al., 2017; Haldankar et al., 2015; Sharma et al., 2013) in mango.

Total soluble solid (TSS)

The TSS in the fruit juice of all bagged fruits showed lower value that non-bagged control fruits. The results is in agreement with the findings of Haldankar et al. (2015), they found lower TSS in bagged mango. In this study, it observed that higher TSS content (15.95% Brix) in un-bagged control fruits and lower (8.74% Brix) in polythene bagged fruits at 55 days of bagging (Table 02).

Pulp pH

The pulp pH was significantly affected by the pre-harvest bagging (Table 02). The highest mean value of pH (4.89) was recorded in un-bagged control fruits while the lowest in polythene bagged fruits (3.96).

Published with open access at journalbinet.com
EISSN: 2312-7945, ©2020 The Authors, Research paper

Table 02. Effects of pre-harvest bagging on chemical composition of mango cv. Mishribhog

Treatments	Time	Total sugars (%)	Reducing sugars (%)	Ascorbic acid (mg/100g)	TSS (% Brix)	Pulp pH	β-carotene (µg/100 g)
Non-bagged (control)		12.12a	1.94d	2.23a	15.95a	4.88a	649.6a
Polythene bag	35 days	10.53abc	2.77bc	1.36c	11.54bcd	4.22c	634.0a
	45 days	5.52e	1.96d	1.60bc	10.76cd	4.17c	632.0a
	55 days	6.51e	2.05d	1.68bc	8.74d	3.96c	639.0a
White paper bag	35 days	11.26abc	3.56a	1.57bc	13.87abc	4.37bc	640.6a
	45 days	10.94abc	3.24ab	1.81b	14.72abc	4.26c	644.0a
	55 days	7.95cde	3.67a	1.84b	11.58bcd	4.10c	637.3a
Brown paper bag	35 days	7.03de	2.13d	1.76bc	12.21abcd	4.42abc	641.7a
	45 days	8.78bcde	2.45cd	1.68bc	12.54abcd	4.33bc	641.3a
	55 days	10.05abcd	3.22ab	1.76bc	13.31abc	4.34bc	661.0a
LSD		2.952	0.45	0.38	3.78	0.45	37.14
CV%		18.20	10.34	13.27	17.10	6.06	3.39

Means followed by the same letter(s) within each column didn't significantly different (DMRT, p <0.05).

β-carotene

The β-carotene was statistically non-significant among in different treatments. In some previous reports that flesh lycopene and β-carotene content was increased due to pre-harvest bagging in mango (Zhao et al., 2013; Haldankar et al., 2015; Islam, 2017). The highest β-carotene content was recorded in brown paper bagged (661.0 µg/100 g) and the lowest in polythene bagged fruits (632.0 µg/100 g) (Table 02).

Shelf life and pest (disease and insect) incidence

Brown paper bag had prolonged shelf life (9.00 days) followed by white paper bag (6.00 days) and polythene bag (5.00 day) at 35 days. Minimum shelf life was observed in polythene bag (4.00 days) compared to non-bagged control fruits (Table 03). It is assumed that non-bagged fruits affected by insect and diseases earlier giving the shortest shelf life during storage. Bagging provided a physical barrier between fruit and pest which resulted prolong shelf life of mango. The bagging modified the microenvironment near fruit especially in respect to temperature and humidity (Yang et al., 2009). Singh et al. (2007) reported that pre-harvest bagging delayed ripening period resulting prolonged shelf life of grape. The brown paper and white paper bagged fruits showed free from fruit fly infestation at 35 and 45 days of bagging but at 55 days showed in less infestation. The maximum incidences of fruit fly, anthracnose and stem end rot (9.33 %, 29.37% and 38.94%, respectively) were recorded in non-bagged control fruits (Table 03). Hofman et al. (1997) reported that the infestation of anthracnose and stem end rot reduced in mango cv. Keitt with white paper bags used at approximately 100 days before harvest.

Table 03. Effect of pre-harvest bagging on shelf life and different pest incidence of mango cv. Mishribhog

Treatments	Time	Shelf life (days)	Stem end rot (%)	Anthracnose (%)	Fruit fly infestation (%)
Non-bagged (control)		5.00b	38.94a	29.37a	9.33a
Polythene bag	35 days	4.00b	22.43d	4.96c	2.46g
	45 days	5.00b	26.46c	5.43c	3.62fg
	55 days	4.67b	33.93b	5.54c	6.76cd
White paper bag	35 days	6.00b	13.94e	3.10cde	0.00h
	45 days	6.00b	11.67e	3.20cde	0.00h
	55 days	6.00b	12.10e	3.40cd	5.93de
Brown paper bag	35 days	9.00a	1.16f	0.17de	0.00h
	45 days	8.33a	1.30f	0.00e	0.00h
	55 days	8.00a	2.17f	0.77de	4.95ef
LSD		1.78	3.77	2.972	1.39
CV%		17.59	11.50	19.71	19.83

Means followed by the same letter(s) within each column didn't significantly different (DMRT, p <0.05).

Published with open access at journalbinet.com
EISSN: 2312-7945, © 2020 The Authors, Research paper

Sensory evaluation

Sensory evaluation was done on colour, texture, appearance, sweetness, flavour and overall acceptability at 35, 45 and 55 days of bagging. In case of overall acceptability, brown paper bag at 35 days was observed highest score (8.33) that was statistically similar with the score (8.67) at 45 days of bagging. It indicated that the sensory qualities of fruits were affected by pre-harvest bagging in mango (Table 04). Sharma et al. (2014) reported that pre-harvest bagging improved the visual and physical quality of fruits.

Table 04. Effect of pre-harvest fruit bagging on sensory evaluation in fruits of mango cv. Mishribhog

Treatments	Time	Color	Texture	Appearance	Sweetness	Flavour	Overall acceptability
Non-bagged (control)		6.33bc	7.00a	5.33c	7.67a	7.00abc	4.33de
Polythene bag	35 days	4.00e	7.00a	3.00d	7.33a	5.33c	3.33e
	45 days	3.00e	7.67a	3.33d	7.00a	6.33bc	5.33cd
	55 days	3.30e	7.00a	3.00d	7.33a	5.33c	5.00d
White paper bag	35 days	5.70cd	7.00a	7.00ab	7.33a	7.00abc	7.33ab
	45 days	7.33abc	7.00a	7.00ab	8.33a	7.00abc	7.67ab
	55 days	7.67ab	7.00a	7.00ab	7.67a	7.33abc	6.67bc
Brown paper bag	35 days	8.43a	7.67a	8.33a	6.67a	8.00ab	8.33a
	45 days	7.67ab	7.67a	7.67a	7.00a	8.67a	8.67a
	55 days	8.33a	7.67a	7.33a	7.00a	7.67ab	7.67ab
LSD		1.54	1.98	1.30	1.79	1.84	1.40
CV%		14.85	16.16	13.09	14.43	15.99	13.52

Means followed by the same letter(s) within each column didn't significantly different (DMRT, p <0.05).

IV. Conclusion

Considering the physical, chemical and sensory parameters it is proved that pre-harvest bagging had a significant effect to increase the shelf life maintaining quality of mango cv. Mishribhog. Brown paper bag had showed the best performance in case most of the parameters at 35 to 45 days of bagging. Therefore, the pre-harvest bagging are suggested to the mango grower of Bangladesh could be produced quality production with a prolonged shelf life to obtain a profitable price of mangoes in domestic and export markets.

Acknowledgement

This work was supported by funds (ID 444) of PIU-BARC, NATP Phase-II, Ministry of Agriculture, Government of the People's Republic of Bangladesh.

V. References

[1]. Akter, M. M., Islam, M. T., Akter, N., Amin, M. F., Bari, M. A. and Uddin, M. S. (2020). Pre-harvest Fruit Bagging Enhanced Quality and Shelf-life of Mango (*Mangifera indica* L.) cv. Amrapali. Asian Journal of Agricultural and Horticultural Research, 45-54. https://doi.org/10.9734/ajahr/2020/v5i330055

[2]. Amerine, M. A., Pangborn, R. M. and Rocssler, E. B. (1965). Principles of sensory evaluation of food. London: Academic Press. https://doi.org/10.1016/B978-1-4832-0018-7.50012-X

[3]. Amin, M. and Hanif, M. (2002). Cultivation of Mango in Dera Ismail Khan. Agri. Research Institute, Ratta, DI Khan, 1-18.

[4]. AOAC. (2000). Official Methods of Analysis. 17th Edition, Association of Official Analytical Chemists, Washington, DC, USA.

[5]. BBS. Year book of agricultural statistics-2018. (2019). Bangladesh Bureau of Statistics, Statistics and Informatics Division, Ministry of planning, Government of the People's Republic of Bangladesh. 157-158.

Published with open access at journalbinet.com
EISSN: 2312-7945, ©2020 The Authors, Research paper

[6]. Chonhenchob, V., Kamhangwong, D., Kruenate, J., Khongrat, K., Tangchantra, N., Wichai, U. and Singh, S. P. (2011). Preharvest bagging with wavelength-selective materials enhances development and quality of mango (*Mangifera indica* L.) cv. Nam Dok Mai# 4. Journal of the Science of Food and Agriculture, 91(4), 664-671. https://doi.org/10.1002/jsfa.4231

[7]. Haldankar, P. M., Parulekar, Y. R., Kireeti, A., Kad, M. S., Shinde, S. M. and Lawande, K. E. (2015). Studies on influence of bagging of fruits at marble stage on quality of mango cv. alphonso. Journal of Plant Studies, 4(2), 12-20. https://doi.org/10.5539/jps.v4n2p12

[8]. Hansen, J. and Moller, I. B. (1975). Percolation of starch and soluble carbohydrates from plant tissue for quantitative determination with anthrone. Analytical biochemistry, 68(1), 87-94. https://doi.org/10.1016/0003-2697(75)90682-X

[9]. Harshash, M. M. and Al-Obeed, R. S. (2010). Effect of bunch bagging color on yield and fruit quality of date palm. American-Eurasian Journal of Agricultural and Environmental Science, 7(3), 312-319.

[10]. Hofman, P. J., Smith, L. G., Joyce, D. C., Johnson, G. I. and Meiburg, G. F. (1997). Bagging of mango (*Mangifera indica* cv. Keitt') fruit influences fruit quality and mineral composition. Postharvest Biology and Technology, 12(1), 83-91. https://doi.org/10.1016/S0925-5214(97)00039-2

[11]. Islam, M. T., Rahman, M. S., Shamsuzzoha, M., Chowdhury, A. K. M. M. B. and Alom, R. (2017) Influence of pre-harvest bagging on fruit quality of Mango (*Mangifera indica* L.) cv. Mishribhog. International Journal of Biosciences, 11(3), 59-68. https://doi.org/10.12692/ijb/11.3.59-68

[12]. Islam, M. T., Zoha, M. S., Rahman, M. S., Bari, M. A., Akter, M. M., Khatun, A. and Uddin, M. S. (2019). Influence of bagging time on fruit quality and shelf life of mango (*Mangifera indica* L.) cv. Amrapali in Bangladesh. International Journal of Agriculture and Environmental Research, 5(4), 412-423. https://doi.org/10.35410/IJAEB.2019.4424

[13]. Jakhar, M. S. and Pathak, S. (2016). Effect of pre-harvest nutrients application and bagging on quality and shelf life of mango (*Mangifera indica* L.) fruits cv. Amrapali. Journal of Agricultural Science and Technology, 18, 717-729.

[14]. Lima, A. D., Boari, J., Angelo, A., Alvarenga, M., Ribeiro, M., Deyse, G. and Elisa, B. D. (2013). Chemical evaluation and effect of bagging new peach varieties introduced in Southern Minas Gerais-Brazil. Food Science and Technology, 33(3), 434- 440. https://doi.org/10.1590/S0101-20612013005000077

[15]. Miller, G. L. (1972). Use of dinitro salicylic acid reagent for determination of reducing sugar. Analytical Chemistry, 31, 426-428. https://doi.org/10.1021/ac60147a030

[16]. Nagaharshitha, D., Khopkar, R. R., Haldankar, P. M., Haldavanekar, P. C. and Parulekar, Y. R. (2014). Effect of bagging on chemical properties of mango (*Mangifera indica* L.) cv. alphonso. Agrotechnology, 3, 124. https://doi.org/10.4172/2168-9881.1000124

[17]. Nagata, M. and Yamashita, I. (1992). Simple method for simultaneous determination of chlorophyll and carotenoids in tomato fruit. Nippon Shokuhin Kogyo Gakkaishi, 39(10), 925-928. https://doi.org/10.3136/nskkk1962.39.925

[18]. Nelson, N. (1944). A photometric adaptation of the Somogyi method for the determination of glucose. Journal of biological Chemistry, 153(2), 375-380.

[19]. Rangana, S. (1986). Pectin analysis. *Handbook of analysis and quality control for fruit and vegetable products*, 342.

[20]. Sharma, R. R., Pal, R. K., Asrey, R., Sagar, V. R., Dhiman, M. R. and Rana, M. R. (2013). Pre-harvest fruit bagging influences fruit color and quality of apple cv. Delicious. Agricultural Sciences, 4(9), 443-448. https://doi.org/10.4236/as.2013.49059

[21]. Sharma, R. R., Reddy, S. V. R. and Jhalegar, M. J. (2014). Pre-harvest fruit bagging: a useful approach for plant protection and improved post-harvest fruit quality–a review. The Journal of Horticultural Science and Biotechnology, 89(2), 101-113. https://doi.org/10.1080/14620316.2014.11513055

[22]. Singh B. P., Singh R. A., Singh, G. and Killadi B. (2007). Response of bagging on maturity, ripening and storage behaviour of winter guava, Acta Horticulturae, 735, 597–601. https://doi.org/10.17660/ActaHortic.2007.735.77

[23]. Stover, R. H. and Simmonds, N. W. (1987). Bananas Third Edition (Tropical Agriculture Series).

[24]. Uddin, M. S. and Reza, M. H. (2017). Fruit bagging technology and exportable mango production. Regional Horticulture Research Station, Bangladesh Agricultural Research Institute, Chapainawabganj. Pp: 1-16

Published with open access at journalbinet.com
EISSN: 2312-7945, © 2020 The Authors, Research paper

[25]. Watanawan, A., Watanawan, C. and Jarunate, J. (2008). Bagging 'Nam Dok Mai' mango during development affects color and fruit quality. Acta Horticulturae, 787, 325-330. https://doi.org/10.17660/ActaHortic.2008.787.40
[26]. Xu, H. X., Chen, J. W. and Xie, M. (2010). Effect of different light transmittance paper bags on fruit quality and antioxidant capacity in loquat. Journal of the Science of Food and Agriculture, 90(11), 1783-1788. https://doi.org/10.1002/jsfa.4012
[27]. Yang, W. H., Zhu, X. C., Bu, J. H., Hu, G. B., Wang, H. C. and Huang, X. M. (2009). Effects of bagging on fruit development and quality in cross-winter off-season longan. Scientia Horticulturae, 120(2), 194-200. https://doi.org/10.1016/j.scienta.2008.10.009
[28]. Zhang, B.B., Guo, J. Y., Ma, R. J., Cai, Z. X., Yan, J. and Zhang, C.H. (2015). Relationship between the bagging microenvironemnt and fruit quality in 'Guibao' peach [*Prunus persica* (L.) Batsch]. The Journal of Horticultural Science and Biotechnology, 90(3), 303-310. https://doi.org/10.1080/14620316.2015.11513187
[29]. Zhao, J. J., Wang, J. B., Zhang, X. C., Li, H. L. and Gao, Z. Y. (2013). Effect of bagging on the composition of carbohydrate, organic acid and carotenoid contents in mango fruit. Acta Horticulturae Sinica, 992, 537-54. https://doi.org/10.17660/ActaHortic.2013.992.66
[30]. Zhou, J., Zhong, G., Lin, Z., Xu, H. L. and Mathooko, F. M. (2012). The effects of bagging on fresh fruit quality of Canarium album. Journal of Food, Agriculture & Environment, 10(1), 505-508.

HOW TO CITE THIS ARTICLE?

Crossref: https://doi.org/10.18801/jbar.250220.258

MLA
Islam, M. T. "Effect of different time of bagging for ensuring quality mangoes Cv. Mishribhog". Journal of Bioscience and Agriculture Research, 25(02), (2020): 2114-2121.

APA
Islam, M. T., Zoha, M. S., Uddin, M. S., Bari, M. A., Rahman, M. H., Akter, M. M. and Akter, N. (2020). Effect of different time of bagging for ensuring quality mangoes Cv. Mishribhog. *Journal of Bioscience and Agriculture Research*, 25(02), 2114-2121.

Chicago
Islam, M. T., Zoha, M. S., Uddin, M. S., Bari, M. A., Rahman, M. H., Akter, M. M. and Akter, N. "Effect of different time of bagging for ensuring quality mangoes Cv. Mishribhog". Journal of Bioscience and Agriculture Research, 25(02), (2020): 2114-2121.

Harvard
Islam, M. T., Zoha, M. S., Uddin, M. S., Bari, M. A., Rahman, M. H., Akter, M. M. and Akter, N. 2020. Effect of different time of bagging for ensuring quality mangoes Cv. Mishribhog. Journal of Bioscience and Agriculture Research, 25(02), pp. 2114-2121.

Vancouver
Islam, MT, Zoha, MS, Uddin, MS, Bari, MA, Rahman, MH, Akter, MM and Akter, N. Effect of different time of bagging for ensuring quality mangoes Cv. Mishribhog. Journal of Bioscience and Agriculture Research. 2020 September 25(02): 2114-2121.

Published with open access at journalbinet.com
EISSN: 2312-7945, ©2020 The Authors, Research paper