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BUNCH BAGGING EFFECT ON FRUIT SETTING AND QUALITY OF FRUIT IN DIFFERENT LITCHI GERMPLASM

M.A. Hossen[1*], M. Ahmad[2], M.A. Islam[3] and M. Rokonuzzaman[3]

Abstract

An experiment was carried out at the BAU Germplasm Centre (GPC), Bangladesh Agricultural University, Mymensingh during February to May, 2021 to study the effect of bagging on fruit setting and fruit quality of different litchi germplasm. The experiment was laid out in a Randomized Complete Block Design with three replications of four litchi germplasms viz. Mongolbari, China-3, Bombai, Mozzafforpuri. Here replication number is represented by number of plants observed per variety. The data were recorded on number of fruit set per inflorescence, fruit dropping, fruit color, weight per fruit, TSS (% brix). At marble stage, bunch bagging was done with brown and white polypropylene bag and bunches were without bagging in control plants. Bunch bagging has significantly influenced on yield and yield attributes of litchi germplasms. The highest fruit setting was obtaining from Bombai litchi with brown polyethylene bag followed by Mongolbari with white polyethylene bag, while non-bagged China-3 obtained the lowest fruit setting. Mongolbari had highest TSS (18.65% Brix) in brown polypropylene bag treatments. Bolder fruit (21.15g) was found in Bombai on brown polypropylene bag treatment and small fruit (12.83g) from China-3 in control. Attractive fruit color, no/less fruit cracking, no bird damage was found on bunch bagging treatment at ripening which may add more consumer value of litchi. Based on the study it can be concluded that as a good agricultural practices (GAP) timely establishment of brown polypropylene bunch bagging was the best to reduced fruit dropping as well as increased the average fruit weight, fruit color and %TSS value of litchi fruit.

Key Words: Bunch Bagging, Litchi Fruit Setting, Fruit Dropping, Average Fruit weight, Fruit Color, TSS Value.

Introduction

Litchi (*Litchi chinensis* Sonn.) is an important subtropical evergreen fruit crop belongs to family Sapindaceae. It is known as queen of the fruit due to its attractive deep pink/red color and flavored juicy aril (Singh *et al.*, 2012). Fruit set in litchi is climate dependent and profoundly affected by temperature and humidity. To prevent the losses caused by biotic and abiotic factors several good agricultural practices (GAP) are becoming popular throughout the World (Sharma, 2009). Pre-harvest fruit bagging has emerged as an effective approach in which individual fruit or fruit bunches are bagged on the tree for a specific period. Bagging is a physical protection technique which not only improves their visual

[1]Department of Entomology, Bangladesh Agricultural University, Mymensingh-2202;
[2]Professor, Department of Entomology, Bangladesh Agricultural University, Mymensingh-2202,
[3]Bangladesh Agricultural University, Mymensingh-2202;
***Corresponding author:** akramhossen114@gmail.com

quality by promoting peel coloration and reducing the incidence of fruit cracking and resetting but can also change the microenvironment for fruit development (Fan and Mattheis, 1998). Bagging has been used extensively in several fruit crops to improve skin colour and to reduce the incidence of disease, insect pests, mechanical damage, sunburn of the skin, agrochemical residues on the fruit, and bird damage (Bentley and Viveros, 1992; Kitagawa *et al.,* 1992). Preharvest fruit bagging effects on postharvest quality and shelf life of mango cv. Amrapali (Jobayer *et al.,* 2020). Fruit bagging has helped to reduce bird damage in various fruit (Kitagawa *et al.,*1992; Hofman *et al.,* 1997). Bagging with plastic bags increased average fruit weight, and it was the highest when bagging was carried out 10 days after full bloom (Xu *et al.,* 2008). Bagging during fruit development increased superficial scald and eliminated stain during cold storage (Fan and Mattheis, 1998). Preharvest fruit bagging time regulates postharvest quality and shelf life of dragon fruit (Mokter *et al.,* 2021). Bagging is commonly applied to many fruits and for improving fruit size, skin color, taste, decreases cracking, protecting from pests, extreme environmental conditions, and pesticide residues, thus increasing commercial value (Sharma *et al.,* 2014). Thus, fruit bagging can be a beneficial practice for producing higher quality fruit without or less use of chemicals to control pest and diseases. Owing to the increasing population, it is very essential to protect the litchi fruits from the heavy losses by insect, pests under field condition as well as increasing the yield and quality by maximum fruit setting. The research work related to the reduction of fruit setting problem and maintain quality of fruit of available litchi varieties of Bangladesh are unnoticeable despite its great importance. So, the present study was conducted to know the varietal response on fruit setting and dropping of litchi due to the bunch covering with presence and absence of polypropylene bag. Further, the effect of bunch covering with polypropylene bag on quality of litchi fruit was determined.

Materials and Methods

The experiment was conducted at the BAU Germplasm Centre (GPC) of Bangladesh Agricultural University (BAU), Mymensingh during the period from February to May 2021. About ten to twelve years old Mongolbari, China-3, Bombai, and Mozzafforpuri were selected for the study and the experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Here replication number is represented by number of plants observed per variety. Insecticides were not applied during the study period. In each tree about twenty days of fruit set, bunch of clove size five fruits were selected randomly per plant and were bagged with brown (T_1) and white (T_2) coloured polypropylene bags. Three bunches per plant were kept (control) without polybag (T_3) treatment. The bagging materials were collected from Chapai Agro Limited, chapainawabgonj and were wrapped tightly at the upper end to prevent the entry of water and insects. The following parameters were studied:

Fruit setting: Number of fruit settings per inflorescence were counted. Bagging: Three of each brown, white and without polybag covered per litchi germplasm with five undamaged fruits were maintained (Photo-1). Fruit dropping: Number of fruit dropping due to bird damage, harmful insects, unfavourable climatic condition per inflorescence of treated varieties were calculated. Fruit number: Number of undamaged fruit per inflorescence were counted. Fruit colour, weight per fruit, TSS value (%brix) were analysed and recorded under Horticultural Laboratory at BAU.

The data obtained during experiments were statistically analysed by using MSTAT software in a computer. The means of different parameters were separated by Duncan's Multiple Range Test (DMRT).

(a) (b) (c)

Photo 1. Showing covering of litchi fruit with **(a)** white polypropylene bag, **(b)** brown polypropylene bag and **(c)** control without polybag at BAU Germplasm centre.

Results and Discussion

Table 1. Mongolbari variety showing significant difference on fruit setting and dropping under polybag covered and uncovered at marble stage

Treatment	Fruit set No.	Fruit dropping
White Polybag	8.00ab	7.00ab
Brown Polybag	9.66a	5.33b
Without Polybag	6.66b	8.33a
$LSD_{(0.05)}$	2.21	2.21
SE(±)	0.90	0.90
Level of significance	**	**
CV(%)	13.63	6.05

In a column, means of similar letter (s) do not differ significantly,
** = Significant at 1% level, CV = Co-efficient of Variation.

In Mongolbari variety, number of fruit set per inflorescence was higher in brown polybag (9.66) and white polybag (8.00) compared to the uncovered bunch (6.66). This may be due to polybag protected inflorescence from insect infestation, natural hazards, all other environmental factors and the microclimate growing inside the polybag. In Mongolbari variety, fruit dropping per inflorescence was highest (8.33) in case of without polybag covering, whereas fruit dropping in white and brown polybag covered plant was 7.00 and 5.33 per inflorescence, respectively.

Table 2. China-3 variety showing significant difference on fruit setting and dropping under polybag covered and uncovered at marble stage

Treatment	Fruit set No.	Fruit dropping
White Polybag	4.66b	10.33a
Brown Polybag	6.33a	8.666b
Without Polybag	4.00b	11.00a
$LSD_{(0.05)}$	1.48	1.48
SE(±)	0.61	0.61
Level of significance	**	**
CV(%)	14.91	7.45

In a column, means of similar letter (s) do not differ significantly,
** = Significant at 1% level, CV = Co-efficient of Variation.

In China-3 variety, number of fruit set per inflorescence was higher in brown polybag (6.33) and white polybag (4.66) compared to the uncovered bunch (4.00). This may be due to polybag protected inflorescence from insect infestation, natural hazards, all other environmental factors and the microclimate growing inside the polybag. In China-3 variety, fruit dropping per inflorescence was highest (11.00) in case of without polybag covering, whereas fruit dropping in white and brown polybag covered plant was 10.33 and 8.66 per inflorescence, respectively.

Table 3. Bombai variety showing significant difference on fruit setting and dropping under polybag covered and uncovered at marble stage

Treatment	Fruit set No.	Fruit dropping
White Polybag	10.00a	5.00b
Brown Polybag	12.33a	2.66b
Without Polybag	6.000b	9.00a
$LSD_{(0.05)}$	3.12	3.12
SE(±)	1.27	1.27
Level of significance	**	**
CV(%)	6.55	8.14

In a column, means of similar letter (s) do not differ significantly,
** = Significant at 1% level, CV = Co-efficient of Variation.

In Bombai variety, number of fruit set per inflorescence was higher in brown polybag (12.33) and white polybag (10.00) compared to the uncovered bunch (6.00). This may be due to polybag protected inflorescence from insect infestation, natural hazards, all other environmental factors and the microclimate growing inside the polybag. In Bombai variety, fruit dropping per inflorescence was highest (9.00) in case of without polybag covering, whereas fruit dropping in white and brown polybag covered plant was 5.00 and 2.66 per inflorescence, respectively.

Table 4. Mozzaforpuri variety showing significant difference on fruit setting and dropping under polybag covered and uncovered at marble stage

Treatment	Fruit set No.	Fruit dropping
White Polybag	7.33a	7.66ab
Brown Polybag	6.00ab	9.00b
Without Polybag	5.00b	10.00a
$LSD_{(0.05)}$	1.76	1.76
SE(±)	0.72	0.72
Level of significance	**	**
CV(%)	14.43	9.92

In a column, means of similar letter (s) do not differ significantly,
** = Significant at 1% level, CV = Co-efficient of Variation.

In Mozaffarpuri variety, fruit set per inflorescence was higher in white polybag (7.33) and brown polybag (6.00) compared to the uncovered bunch (5.00). This may be due to polybag protected inflorescence from insect infestation, natural hazards, all other environmental factors and the microclimate growing inside the polybag. In Mozaffarpuri variety, fruit dropping per inflorescence was highest (10.00) in case of without polybag covering, whereas fruit dropping in white and brown polybag covered plant was 7.66 and 9.00 per inflorescence, respectively.

Increase undamaged fruit retention under polybag covering over control:

In the study both white and brown polybag increased fruit retention in the four litchi varieties. In case of Bombai variety brown polybag bunch covering increased highest fruit retention (12.33 fruits) followed by white polybag covering (10.00) then without polybag covering (6.00). In Mozaffarpuri and Mongolbari variety, white and brown polybag increased fruit retention 7.33, and 6.0, 9.66 and 8.0, respectively but uncovered polybag had lower fruit retention. In China-3 variety white polybag increased fruit retention 4.66 and brown polybag 6.33 but uncovered polybag had the lowest (4.00) among the litchi varieties studied (Fig. 1).

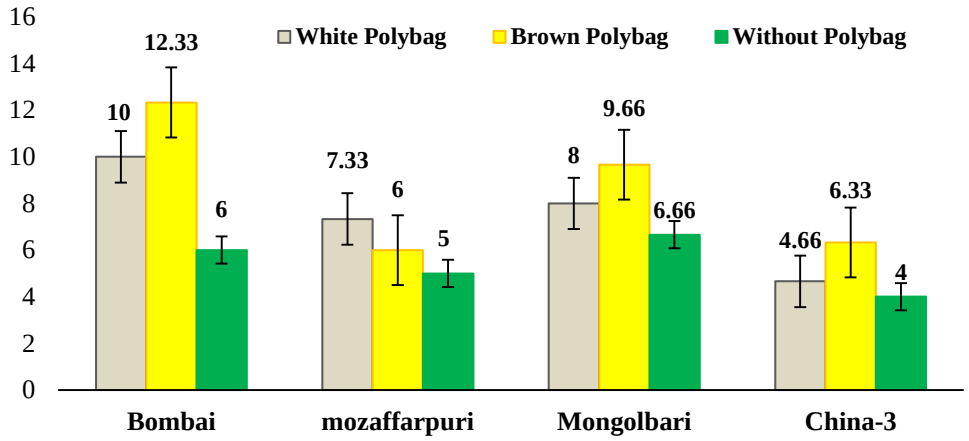

Fig. 1. Showing the increased undamaged fruit retention in different litchi varieties under white and brown polybag covering over control.

Table 5. Effect of bagging on quality attributes of fruit on different litchi varieties

Variety / Treatment	Average fruit weight (g)			Fruit color			% TSS value		
	Brown	white	Control	Brown	white	Control	Brown	white	Control
Bombai	21.15a	20.06a	16.00a	Moderate purple	Deep purple	Natural color	17.18b	16.80a	15.33a
Mongolbari	17.75c	18.30b	15.63ab	Deep purple red	Purple red	Reddish natural	18.65a	15.96ab	14.00b
Muzafforpuri	19.30b	17.13b	14.13b	Pale brown	Whitish yellow	Greenish color	18.02ab	15.07b	14.57ab
China-3	16.05c	14.40c	12.83c	Moderate red	Deep red	Natural color	15.07c	14.60c	12.86d
LSD $_{(0.05)}$	1.50	1.50	1.50	-	-	-	0.90	0.90	0.90
Level of significance	**	**	**	**	**	**	**	**	**

In a column, means of similar letter (s) do not differ significantly,
** = Significant at 1% level, CV = Co-efficient of Variation.

The highest average fruit weight (21.15 g) was recorded from Bombai variety in brown polypropylene bagging treatment and lowest average fruit weight (12.83 g) from China-3 variety in control treatment. The table shows that different bagging materials has a significant effect on total sugars (%TSS) of litchi. The highest percentage of TSS value (18.65) was found at Mongolbari variety with brown polybag treatment and the lowest TSS value (12.86) was found with control treatment at China-3 variety. The photos (2&3) are showed that Fruit color of litchi in different treatments were deep purple, moderate purple, natural color, fruit dropping (photo-2) and pale yellow, natural greenish to deep red color compare to control treatment in fruit ripening which may add more consumer value with no/less fruit cracking, bird damage of litchi fruit (photo-3).

(a) deep purple (b) moderate purple (c) natural color (d) dropping fruit

Photo 2. Showing fruit color and size of litchi at (a) white polybag, (b) brown polybag (c) without polybag(control) & (d) fruit dropping in Bombai.

(a) Pale yellow (b) Pale brown (c) Greenish red (d) Deep red

Photo 3. Showing different fruit color at ripening stage with white (a), brown (b), control (c) bagging at Mujafforpuri variety & (d) white polybag covered at Chins-3 litchi fruits.

Conclusion

This study with litchi four litchi germplasms viz. Mongolbari, China-3, Bombai and Mozzafforpuri was conducted in the Germplasm Centre, BAU. At marble stage, bunch bagging was done with brown and white polypropylene bag and while the bunches were without bagging in control germplasm. Both white and brown polypropylene bunch bagging has significantly influnced on yield and yield contributing traits of litchi germplasms. The highest fruit setting was obtaining from the combination of Bombai litchi with brown polyethylene bag followed by Mongolbari with white polyethylene bag, while non-bagged China-3 obtained the lowest fruit setting. Highest average fruit weight was found at Bombai variety on brown polypropylene bag treatment and lowest average fruit weight from China-3 variety on control treatment. The highest percentage of TSS (Total Soluble Solids) value (18.65) was found at Mongolbari variety with brown polybag treatment and the lowest TSS value (12.86) was found with control treatment at China-3 variety. Fruit color as, moderate purple, pale yellow, brown, reddish green to deep red color was found on different bagging treatment in fruit ripening which may add the consumer value of litchi fruit. From the study, it was revealed that bunch bagging treatment of litchi fruit as good agricultural practices (GAP) has performed better to the control treatment (without polybag) on fruit setting and quality attributes viz. fruit weight, fruit color and percent TSS value.

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