

Effect of Fruit Bagging on Eggplant Fruit and Shoot Borer for Quality Eggplant Production

AKM Quamruzzaman, Ferdouse Islam, M. Nazim Uddin, and M. Shahadath Hossain

ABSTRACT

The study was tested the technical feasibility of bagging eggplant fruits during production to protect them against Eggplant fruit and shoot borer (EFSB) following randomized complete block with 6 treatments. Highest number of marketable fruits per plant was produced by imported white bag (12.33), which was followed by butter paper bag (10.67). Maximum aborted fruit was obtained from the imported brown bag (23.33%) and HDPE bag (20.00%). The highest average fruit weight (363.33 g) was obtained from fruits bagged with Imported white, while maximum fruit length and fruit diameter was also produced from imported white bag (15.27 cm and 11.23 cm, respectively). Zero percent damage by eggplant fruit and shoot borer was produced by imported brown bag, imported white bag and butter paper bag, while higher infection was observed in open fruit (control) (17.70 %), HDPE bag (11.70 %). Bagging eggplant fruit produced 38.78 to 58.20 t/ha, while open fruit (control) produced only 35.66 t/ha. The highest calculated fruit yield 58.20 tons/ha was estimated from imported white bag and other bagging fruits were local brown bag (46.74 t/ha), HDPE bag (45.00 t/ha), butter paper bag (43.23 t/ha). The bagging of eggplant fruits with imported white bag and butter paper bag were more effective in reducing damage by eggplant fruit and shoot borer than the other bagging treatments and the control. These two treatments produced higher number of consumers preferred fruit, without negative effects on the color of the skin, fresh weight and fruit abortion, thus resulting in higher economic gains.

Keywords: Eggplant, eggplant fruit and shoot borer (EFSB), *Leucinodes orbonalis*, fruit bagging, marketable eggplant yield.

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I. INTRODUCTION

Eggplant (*Solanum melongena* L.) is one of the most important, widely and round the year cultivated popular vegetable in Bangladesh. It occupies an area of about 50,415 hectares with a total production of 5,04,817 tones. The average yield being only 10.013 tones per hectare [1], which is very low as compared to that in other eggplant growing countries. This low yield may be either due to lack of good variety or proper management. In eggplant, several biotic factors viz., pest and diseases are responsible to reduce the yield, amongst them eggplant fruit and shoot borer (EFSB), *Leucinodes orbonalis*, is the most damaging pest of eggplant in South and Southeast Asia especially in Bangladesh. Its larvae feed inside eggplant fruit, making the fruit unmarketable and unfit for human consumption. To combat this problem several attempts have been taken so far. Farmers are currently using too many toxic chemicals and applying them too frequently (up to 100 times) to control EFSB. This excessive pesticide usage threatens the health of farmers and consumers, besides making eggplant fruit more costly to consumers. In the meantime, the insect is becoming tolerant to the chemicals, making it more difficult to control. To address these chemical pesticides now a day's farmers are

using sex pheromone trap, bio pesticide, botanical pesticides, clean cultivation etc. But no one can reduce the EFSB for the farmers.

Very recently few farmers are starting fruit bagging in their eggplant in Bangladesh and getting better result in terms of quality fruits. They wrapped each eggplant with a specially-made plastic bag imported from China soon after it started growing. That way, the farmers not only managed to save additional costs on chemical pesticides to control EFSB, but also trying to offer 100 percent chemical-free eggplants to the consumers. So, it is essential to validate the imported brown bag, imported white bag along with locally available plastic and paper bags. So, there is a great scope to get safe and quality eggplant using fruit bagging. The present study was undertaken to study the imported brown bag, imported white bag along with locally available plastic and paper bags to control EFSB. So, this study has been undertaken to find out the suitable bagging material to control EFSB and also higher yield with quality fruits.

II. MATERIALS AND METHODOLOGY

A. Experimental Site

The experiment was conducted at the experimental farm of Joydebpur during the winter of 2018-19. The experimental field was at 23.9917° N Latitude and 90.4124° E Longitudes having an elevation of 8.2 m from sea level under agro-ecological zone (AEZ) 28 [2]. The experimental site is situated in the sub-tropical climatic zone and characterized by scanty rainfall during the experimental time. The average minimum and maximum temperature were 18.37 °C and 29.37 °C and the average relative humidity varied from 55.55 to 75.70 %. The soil of the experimental field was sandy clay loam in texture having a pH range around 6.0.

B. Treatments and Plant Materials

Five bagging materials were used in this study viz., i) Imported brown bag- (thick paper bag and brown colored with black colour inner side) ii) Local brown bag iii) Imported white bag iv) Butter paper bag (locally available white cellophane paper bags) v) HDPE bag (transparent plastic) vi) Open fruit (Un-bagging) (control) included in the study. The seeds were sown on the seedbed on 05 September 2018. Thirty days old seedlings were transplanted in the main field on 04 October, 2018.

C. Experimental Design and Layout

The experiment was laid out in a RCB design with three replications. The unit plot size was 7.0×0.70 m and 10 plants were accommodated in a plot with a plant spacing of 70 cm apart in single row maintaining a row-to-row distance of 1 m with 30 cm drain.

D. Land Fertilization

The land was fertilized with organic fertilizer, N, P, K, S, Zn and B @ 3,000 100, 30, 75, 13, 1.5 and 0.8 kg/ha, respectively. One third of the organic fertilizer and half of P and full of S, Zn and B were applied during final land preparation. Rest of organic fertilizer and P and 1/3 of K were applied as basal in pit. Entire amount of N and rest of K were applied in four equal installments starting from 20 days after transplanting. Rest three installments were applied at vegetative, flowering and initial fruiting stage. Irrigation, weeding, crop protection measures and other intercultural operations were done following standard practice.

E. Data Collection and Statistical Analysis

Data on days to 1st harvest, number of marketable fruit, aborted fruit (%), average fruit weight (g), fruit length (cm), Fruit diameter (cm), fruit yield per plant (kg), eggplant fruit and shoot borer (EFSB) infection (%), spotted/ scratched fruits (%), fruit skin colour and fruit yield (t/ha) were recorded from five randomly selected plants per entry per replication. The recorded data for different characters were analyzed statistically using 'MSTAT-C' program to find out the significance of variation among the treatments. The analysis of variance (ANOVA) was performed by F-test, while the significance of difference between the pairs of treatment means were evaluated by the Duncan's Multiple Range Test (DMRT) test at 5% and 1% level of probability [3].

III. DISCUSSION

Different types of fruit bagging had significant effect in brinjal fruit development. The development of fruit bagged either with imported white bag (106.00 days) or butter paper bag (107.00 days) to first harvest exhibited about a 3.67-4.67 days early compared to imported brown bag (110.67 days) (Table I). Highest number of marketable fruits per plant was produced by imported white bag (12.33), which was followed by butter paper bag (10.67), local brown bag, HDPE bag, open fruit (10.33) and lowest number was produced by imported brown bag (9.67). The low production was due to its thick paper bag and brown colored with black colour inner side. Maximum aborted fruit was obtained from the imported brown bag (23.33%), which was statistically similar with HDPE bag (20.00%). Rest all bags including open fruit (control) were not responsible for any aborted fruit, which suggest that the material of these bags affect the fruit abortion. [4] measured similar production rate of fresh mass for bagged and non-bagged tomato fruit. Average fruit weight is important for commercial production and it is an important factor in market competitiveness [5]. Fruit weight mainly differed for those with higher fruit diameter. The highest average fruit weight (363.33 g) was obtained from fruits bagged with Imported white, while statistically similar result was obtained from local brown bag (348.33 g). Lower weighed fruit was obtained from open fruit (control) (265.00 g) and imported brown bag (308.33 g). Maximum fruit length was produced from imported white bag (15.27 cm), which was statistically similar with butter paper bag (15.07 cm), HDPE bag (14.80 cm) and local brown bag (14.70 cm). The lowest lengthen fruit was from imported brown bag (14.42 cm) due to its less photosynthesis occur.

Fruit diameter is an important character which plays important role towards higher yield. Higher diameter fruit was obtained from imported white bag (11.23 cm), followed by local brown bag (10.75 cm), imported brown bag (10.67 cm), HDPE bag (10.30 cm), lowest diameter fruit was obtained by open fruit (control) (9.83 cm). The highest fruit yield per plant (4.48 kg) was obtained by imported white bag, which was calculated from number of marketable fruit and average fruit weight. In both cases the imported white bag performed far better, while other bagging fruits were 2.98 to 3.60 kg/ plant and open fruit (control) produced only 2.74 kg. Zero percent damage by eggplant fruit and shoot borer (EFSB) was produced by imported brown bag, imported white bag and butter paper bag, which ensures higher fruit production with higher quality. Because the bagging materials were different, so there was an impact in fruit colour.

Higher infection was observed in open fruit (control) (17.70 %), HDPE bag (11.70 %). Local brown produced 6.00 % infected fruits due to rupture of bag was seen at middle stage of fruit maturity. This finding agrees with the reduced damage inflicted by *N. elegantalis* on clusters of tomatoes bagged with paper glessine compared to insecticide treatment [6]. Efficient control resulted from greater protection by bags, which were sealed to prevent the penetration of this insects (i.e., oviposition on the fruits). Also, [7] observed that a protective paper cone open at the bottom reduced damage by *N. elegantalis* by 70%, and that by *H. zea* by 40%, but this type of protection was not

effective against *T. absoluta*. Similar results were observed by [8] with fruits of *A. crassiflora* bagged to protect them against fruit borers; and these authors found that paper bags were destroyed by rain thus allowing a high level of insect damage. Spotted/ scratched fruits were seen maximum in open fruit (control) (18.45 %) due to its open condition creates scratch with neighbor twigs which was followed by HDPE bag (14.65 %). Beside these, other bagged eggplants produced spotless fruits, which ensure high quality of eggplants. In case of fruit skin colour, imported brown bag produced white-colored fruits which was discolored type, which has no market value, while rest all bagging and non-bagging produced true colored "Light green" colored fruits. In our study, bagging eggplant fruit produced 38.78 to 58.20 t/ha, while open fruit (control) produced only 35.66 t/ha. The highest calculated fruit yield 58.20 tons/ha was estimated from imported white bag. Open pollinated eggplant varieties of oval shaped fruit reached an average yield of 30-45 tons/ha with an average fruit weight of 200-250 g, suitable for marketing. The national average of conventional eggplant production in the open field is 10 tons/ha [1]. So, it is quite higher than the commercially

grown any variety in open condition. Other bagging fruits viz., local brown bag (46.74 t/ha), HDPE bag (45.00 t/ha), butter paper bag (43.23 t/ha).

No infection by eggplant fruit and shoot borer (EFSB) was observed in imported brown bag, imported white bag and butter paper bag, which ensures higher fruit production with higher quality. But the bagging materials were different in nature, so there was a variation in fruit skin colour. Imported brown bagged fruit produced white skin colored fruit which was abnormal colour will not popular to the consumer. So, imported white bag and butter paper bag will be the best option to protect EFSB infection with true to colour of fruits. There were no scratched fruits observed in these two bagging types. So, by following these bagging materials, safe eggplant can be produced without spraying of toxic insecticides. This bagging system can be adopted in organic eggplant production practices. Safe brinjal bring prices 199% higher than conventionally brinjal grown, which can more than compensate for the difficulties encountered when producing organic brinjal and other organic vegetables [9].

TABLE I: EFFECT OF DIFFERENT BAGGING MATERIALS ON YIELD AND YIELD CONTRIBUTING CHARACTERS

Treatment	Days to 1st harvest	Number of marketable fruit	Aborted fruit (%)	Average fruit weight (g)	Fruit length (cm)
Imported brown bag	110.67 a	9.67 b	23.33 a	308.33 c	14.42 b
Local brown bag	108.67 a-c	10.33 b	0.00 b	348.33 ab	14.70 ab
Imported white bag	106.00 c	12.33 a	0.00 b	363.33 a	15.27 a
Butter paper bag	107.00 bc	10.67 b	0.00 b	311.67 c	15.07 ab
HDPE bag	109.67 ab	10.33 b	20.00 a	335.00 b	14.80 ab
Open fruit (control)	110.00 ab	10.33 b	0.00 b	265.00 d	14.47 b
Level of sig.	*	*	*	*	*
CV (%)	1.69	6.81	70.00	2.58	2.56

TABLE I: CONTD.

Treatment	Fruit diameter (cm)	Fruit yield per plant (kg)	Eggplant fruit and shoot borer infection (%)	Spotted/ scratched fruits (%)	Fruit skin colour	Fruit yield (t/ha)
Imported brown bag	10.67 b	2.98 cd	0.00 c	0.00 b	White	38.78 cd
Local brown bag	10.75 b	3.60 b	6.00 bc	0.00 b	Light green	46.74 b
Imported white bag	11.23 a	4.48 a	0.00 c	0.00 b	Light green	58.20 a
Butter paper bag	10.00 cd	3.33 bc	0.00 c	0.00 b	Light green	43.23 bc
HDPE bag	10.30 bc	3.46 b	11.70 ab	14.65 a	Light green	45.00 b
Open fruit (control)	9.83 d	2.74 d	17.70 a	18.45 a	Light green	35.66 d
Level of sig.	*	*	*	*	-	*
CV (%)	2.38	7.05	64.75	64.23	-	7.02

Level of sig. ** = 1%; * = 5%.



Fig. 1. Field performances with different bagging materials on fruit eggplant fruit yield.

IV. CONCLUSION AND RECOMMENDATION

The bagging of eggplant fruits with imported white bag and butter paper bag were more effective in reducing damage by eggplant fruit and shoot borer than the other bagging treatments and the control. These two treatments produced higher number of consumers preferred fruit, without negative effects on the color of the skin, fresh weight and fruit abortion, thus resulting in higher economic gains. Bagging of eggplant fruits with the imported white bag material reused for minimum 3 consecutive seasons can provide an economic gain similar to those of bagging with butter paper bag. In addition to economic profitability, bagging eggplant fruits has major environmental benefits.

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