International Journal of Sustainable Agricultural Research
2019 Vol. 6, No. 4, pp. 203-212
ISSN(e): 2312-6477
ISSN(p): 2313-0393
DOI: 10.18488/journal.70.2019.64.203.212

SOCIOECONOMIC IMPACT OF BAGGING TECHNOLOGY FOR VALUE ADDITION IN MANGO IN THE CHITTAGONG HILL TRACTS OF BANGLADESH

M. Jamal Uddin[1+]
Md. Sami Ur Rashid[2]

[1]*Senior Scientific Officer, Agricultural Economics Division, Regional Agricultural Research Station, Bangladesh Agricultural Research Institute, Hathazari, Chattogram, Bangladesh.*
Email: jamaluddin1971@yahoo.com Tel: +8801815425857
[2]*Scientific Officer, Value Chain Development Project, Krishi Gobeshona Foundation (KGF), RARS, Hathazari, Chattogram, Bangladesh.*
Email: samiurrashid@gmail.com Tel: +8801912927995


(+ Corresponding author)

Article History
Received: 5 August 2019
Revised: 9 September 2019
Accepted: 7 October 2019
Published: 12 November 2019

Keywords
Socioeconomic impact
Bagging technology
Mango
Value addition
Hill tracts
Bangladesh.

ABSTRACT

The study was conducted in eight selected villages in the Chittagong Hill Tracts (CHT) of Bangladesh aiming to perceive the socio-economic impact of bagging technology on farmer's income and livelihood and to know the factors affecting adaption of pre-harvest mango bagging technology. Findings of the study revealed that a few varieties in particular BARI Mango 4, BARI Mango 8, BARI Mango 3, Mallika and Arshina were reported to be the most preferred varieties for bagging because of less pest attacks, attractive color and higher market prices. The average market price received from bagged mango was 74% higher than non-bagged mango. The difference of average gross margin of bagged and non-bagged mango was recorded Tk.22790 per ton which implies that bagged mango was more profitable than non-bagged mango. According to the survey report on an average 15.7% of the annual gross income was increased due to adoption of bagging technology whereas this technology contributed 25.13% increment in income from mango selling. About 96% of the respondents admitted that they were able to control fruit flies and 92% of them confirmed that they were able to produce safe and toxicity free fruits utilizing pre-harvest bagging technology. The price of bagged mangos, training, research contacts, extension contacts, risk taking behavior and willingness of farmers influenced the adoption process significantly. This technology should be disseminated for the welfare of the hilly areas with maintaining proper time and methods.

Contribution/Originality: This study is one of very few studies which have investigated the socioeconomic impact of pre-harvest bagging technology on livelihoods of CHT mango growers of Bangladesh through value addition and the factors influencing the rate of adoption of bagging. As a new concept in the CHT, this study is original.

1. INTRODUCTION

Fruit bagging is the practice of putting bags over fruits to protect them from pests, disease and other harmful elements. Pre-harvest fruit bagging is gaining popularity among the mango growers all over the world as an effective alternative to chemical pesticides. This eco-friendly method has been adapted by more farmers after successful use of it in different orchards last few years. Bagging prevents pests, especially fruit flies, from damaging mangoes and checks latex burns, fungal spots and mechanical damages on fruits. The bagging method came as a blessing to farmers against the canvas of widespread use of pesticides; that popped up as a potential threat to the

ecological balance and public health (Sharma *et al*., 2014). Mango growers usually spray pesticides at least 15 to 25 times in their orchards in a season (Islam *et al*., 2017). But pre-harvest bagging technology allows escaping that much use of chemicals, that has been considered as one of the greatest threats to the environment as it requires spraying pesticides for only two to three times at the early stages of fruiting.

Mango (*Mangifera indica L.*) belonging to the family *Anacardiaceous*; arguably known as the king of fruits; is one of the most popular tropical fruits especially in Asia and by large the most popular fruit in Bangladesh. Bangladesh is currently being the 8th largest mango producing country in the world (Islam *et al*., 2017) as there are about 25100 hectares of land occupied by mango orchards (Islam *et al*., 2014) and produces around 10,00,000 tons (Khrishi, 2016).

Several good agricultural practices (GAP) are becoming popular throughout the world for the production of high quality fruit with less dependence on man-made chemicals. Bagging technology has several beneficial effects on internal fruit quality reducing fruit disorders etc (Abdel *et al*., 2017). Brown paper bag improves fruit color, texture, appearance and sweetness (Islam *et al*., 2017). Rathore and Pal (2016) recommended for fruit bagging for mango in commercial use to the growers to escape attack of insect- pests and diseases, fruit cracking, and blackening. Rakesh *et al*. (2017) reported that the fruits bagged with brown paper bag gave better results in all of the parameters (colour, texture, taste, flavor, TSS and carotenoids contents). Kireeti *et al*. (2018) concluded that different types of bags influenced growth and development of mango fruit and it is one of the best alternatives to avoid adverse effect of recent changes in climate on fruit. Jakhar and Pathak (2016) reported that the pre-harvest treatment of 2% CaCl2+1% K2SO4+bagging was found superior to improve the quality of fruits in respect of highest fruits weight, firmness, TSS, ascorbic acid, total sugars with minimum black spotted fruits per cent and maintained it throughout the storage period up to 18 days over control.

The adoption of bagging technology could minimize environmental pollution and accumulation of the ill-effects of chemicals on the health of workers, household members and consumers (Maria, 2009). The chemical parameters such as moisture content, acidity, TSS, reducing, non-reducing sugars and β carotene were not significantly varied due to bagging (Nagaharshitha *et al*., 2014). Bagging technology saves fruits from pests, improves quality. Fruit bagging could reduce use of harmful chemicals, insecticides and pesticides to a great extent on the trees (The Independent, 2017). Sharma *et al*. (2014) reported that pre-harvest bagging of fruit can also reduce the incidence of disease, insect pest and/or mechanical damage, sunburn of the skin, fruit cracking, agrochemical residues on the fruit, and bird damage. The differences in taste, flavor and texture between ripe bagged and non-bagged mango were not significant. Non-bagged fruits had a higher postharvest weight loss than bagged mango (Josphat, 2009).

The Chittagong hill tract is an area with an enormous potentiality for fruit production. According to BBS (2018) about 6316 ha land is currently occupied in the Chittagong hill tracts under mango production and the recently recorded production was 14823 m.tons in the year of 2017-18. Besides quality production and better prices the bagging technology has been found to be the most effective economic and environment friendly way to solved production related problems. With this view the following objectives were set (i) to document socioeconomic profile and contextual information of the sample farmers (ii) to estimate the price increments of mango due to adaption of bagging technology as compared to non-bagging and (iii) to identify the factors effecting adaption of mango bagging technology and (iv) to know the socioeconomic benefits of bagging technology for mango.

2. METHODOLOGY

2.1. Description of the Area

A survey was conducted in 9 villages in three hill districts of Chittagong Hill Tracts aiming to perceive the socio-economic benefit of bagging technology regarding value addition of mango and to know farmers responses to the technology. Multi-stage sampling techniques were followed to select the study areas and sample farmers. The selected villages namely were: Guamahat, Madhupur, Comilla Tila, Protap para, Hafchari in Khagrcahri District;

Manikchari in Rangamati and Basantopara and Bandarban Sadar in Bandarban Hill District. The specific locations were selected based on numerical abundance of mango growers who have been adopting bagging technology.

2.2. Sampling Technique Adopted

Purposive and stratified random sampling technique was followed for selecting the samples in each area. In total, 164 mango growers (adopter-117 and non-adopter-47) were selected purposively. As the technology is quite a new one for adoption in the CHT, the sample size couldn't be extended to strategic standard, but it was enough to represent the areas considering the circumstances.

2.3. Data Collection Procedures

Both primary and secondary data were used in the study. The primary data were collected by using pre-tested semi-structured survey questionnaire. The secondary data were collected from published reports, journal, internet and BBS sources. Face to face interview with respondents were conducted by the scientific assistants, scientific officers and the researcher himself. Several case studies on the mango growers were done in the study areas to know the impact of bagging technology on farmer's livelihood and yearly household earning in terms of income generation from mango sales. The data collection period was May-August 2018.

2.4. Analytical Techniques

In tabular technique, mean, percentages and mean comparison were used in the study. In statistical technique the Probit regression analysis was done for estimating the contribution of factors responsible for adopting the technology by the farmers. In that case, the independent variables were chosen as: price of bagged mango, family size, family type, education, training, risk taking behavior, willingness, having knowledge on bagging technology and mass media exposures. Two communication variables were included in the study: research and extension contact. Suitable scales were used to measure the variables. The collected data were analyzed using appropriate statistical techniques. One-way ANOVA was used for analyzing the mean differences of the selected variables in all locations. The mathematical expression of the Probit model is given below:

2.5. Probit Model

In order to ascertain the adoption of bagging technology, the following empirical Probit model was employed. Since the dependent variables were dichotomous, Ordinary Least Square (OLS) method was not suitable. Therefore, MLE method was followed to run the Probit model using STATA software. The empirical probit model was as follows:

$$Ai = \alpha + \beta iXi + \ldots\ldots + Ui$$

Where,

Ai = Adopter of bagging technology (Adoption of the bagging technology= 1; Otherwise = 0).

α = Intercept.

Xi = Explanatory variables.

βi = Coefficients of respective variables.

Ui = Error term.

The adoption impact of bagging technology is likely to be influenced by different explanatory variables.

The variables are

X^1 = Ln price of bagged mango (tk/kg).

X^2 = Family size (no.).

X^3 = Family type (score).

X^4= Education of the respondents.

X^5 = Training (score).

X^6 = Risk taking behavior (score).

X^7 = Willingness (score).

X^8 = Having knowledge on bagging technology (score).

X^9 = Mass media exposure (score).

X^{10} = Research contact of the farmers (score).

X^{11} =Extension contact of the farmers (score).

The analytical results of the model are shown in the next section.

3. RESULTS AND DISCUSSION

3.1. Socioeconomic Profile and Contextual Information of the Respondents

Table 1 revealed that the average age of the respondents was found to be 43.8 years; implied that most of the respondents belong to the young age category. In case of education of the respondents, the average year of schooling was found to be 11.2 years in all locations; that explains the cause of willingness of the respondents to adopt new technologies. The major occupation of the respondents was agriculture (100%). The secondary occupation was reported to be business (40.0%) followed by private jobs (20.0%). The average household size was found to be 5.92; which was higher than the average household size (4.06) of Bangladesh (BBS, 2018). Most of the respondents were belonging from single family (84.0%). The average cultivable land per household was 7.88 ha and the average size of mango orchard was 5.94 ha. The mean differences of the cultivable land and average area of mango orchard was found to be significant at 5% (F=5.312) and 10% (F=2.111) level of probability, respectively.

As shown in 'Table 2" the respondents had quite a collection of BARI and local varieties of mango. The cent percent (100%) of the respondents reported to have BARI mango-3(Ammropali) in their orchards. The second highest preferred variety was BARI Mango 8 (Ranguai) followed by BARI Mango-4 (80%). Among the local varieties Mollika had the highest rating (64%). Regarding preferences for bagging, BARI Mango 4 became on top of all (96.2%); followed by Mollika (87.0%) and BARI Mango-8 (Ranguai) (82.3%).

Table-1. Socioeconomic profile of the respondents.

Sl. No.	Particulars	Statistics
1	Average age of the respondents (years)	43.8
2	Education (average years of schooling)	11.2
3	Main occupation (%):	
	- Agriculture	100.0
	- Business	40.0
	- Private job	20.0
4	Household size (No. of person per family)	5.9
	- Male	3.4
	- Female	2.4
5	Family type (%)	
	- Single	84.0
	- Join	16.0
6	Average cultivable land per household (ha)	7.8
7	Average area of mango orchard per household (ha)	5.9

Source: Field survey, 2018.

As mentioned in Table 3, for both of bagged and non bagged mangoes, BARI Mango 3 (Amropali) was the highest producing variety (0.97 and 4.33 tons for bagged and non bagged mangoes, respectively) followed by BARI Mango 8 (Ranguai) (1.16 and 3.83 tons, respectively). Among the local varieties it was Asshina to have the highest yield (1.6 and 2.7 tons, respectively). The mean differences of bagged and non-bagged mangoes were varied significantly at 5% and 1% level of probability among the sample farmers and locations.

Table-2. Preference ranking of mango varieties for bagging in the study areas.

Sl No.	Mango varieties	Varietal preferences (%)	Preferences for bagging (%)	Preference ranking for bagging
1	BARI mango 3 (Amropali)	100.0	64.2	4
2	BARI mango 8 (Ranguai)	96.0	82.3	3
3	BARI mango 4	80.0	96.2	1
4	Mollika	64.0	87.0	2
5	Asshina	32.0	51.0	5
6	Himsagor	24.0	6.0	8
7	Mohalisha	20.0	26.0	6
8	Fozli	24.0	3.2	9
9	Ratna	24.0	17.5	7

Source: Field survey, 2018.

Table-3. Per household average production of bagged and non-bagged mangoes.

Sl No.	Mango varieties	Yield (tons/household)	
		Bagged mango	Non-bagged mango
1	BARI mango 3 (Ammropali)	0.97	4.33
2	BARI mango 8 (Ranguai)	1.16	3.83
3	BARI mango 4	0.88	0.49
4	Mollika	0.52	0.55
5	Asshina	1.6	2.7
6	Mohalisha	-	0.005
7	Fozli	0.02	0.06
8	Ratna	0.01	0.09
9	Himsagor	-	0.04
	F-value	2.211^{**}	7.079^{*}

Source: Field survey, 2018.

Most of the respondents (76.0%) reported to receive training on mango production 'Table 4". Among the trained farmers 40% got training on mango bagging technology from KGF followed by DAE (36%) and companies (20%). Around 64% respondents reported to get training on mango bagging. About 44% was from KGF, 16% from DAE, 8% from the companies and 4% from research stations.

Table-4. Received training on mango production and bagging technology.

Sl. No.	Training topics	In %		Training provider (In % of respondents)			
		Yes	No	Res. inst	DAE	KGF	Companies
1	Mango production	76.0	24.0	16	36.0	40.0	20.0
2	Mango bagging technology	84.0	36.0	4.00	16.0	44.0	8.0

DAE= Department of Agriculture Extension and KGF= *Krishi Gobeshona Foundation.*
Source: Field survey, 2018.

Table-5. Differences of average selling price for bagged and non-bagged mango.

Sl. No.	Name of fruits/varieties	Average selling price (Tk./kg)		Differences of average prices (Tk/kg)	% of increased price for bagging
		Non-bagging	Bagging		
1	BARI mango 3 (Amropali)	35.4	64.3	28.9	81.6
2	BARI mango 4	58.4	110	51.6	88.4
3	BARI mango 8 (Rangui)	27.7	48.3	20.6	74.4
4	Mallika	26.3	48.0	21.7	82.5
5	Ashina	26.0	48.5	22.5	86.5
6	Fazli	35.5	55.0	19.5	54.9
7	Harivanga	34.4	50.0	15.6	45.3
8	All mango varieties (average)	34.81	60.59	25.77	74.0
	F-value	1.371^{ns}	4.232^{**}	7.112^{***}	

Source: Field survey, 2018.

Table 5 shows that the average selling price of bagged mango was found to be Tk.60.59 per kg irrespective of all varieties where Tk. 25.77 per kg was found difference with non-bagged mango. Its revealed that about 74% higher prices was received for bagged mango in the study areas. The mean differences of bagged mango prices were varied significantly at 5% level of probability among the sample farmers.

Table 5 revealed that the price of bagged mango was greater than non-bagged mango by 74%. The difference of average price per kg was recorded at Tk. 25.77 irrespective of all mango varieties. Among the mango varieties, the highest price increment by 88.4% was found for BARI mango 4 followed by BARI mango 3 and BARI mango 8.

Table 6 shows that the difference of average gross margin between bagged and non-bagged mango was recorded at Tk.22790 per ton, implies that the bagged mango was more profitable than non-bagged mango due to its higher market price. Table 7 revealed that 15.7% annual gross income increased due to adoption of bagging technology irrespective to all interviewed farmers; whereas it was 25.13% increment over income from mango selling.

Table-6. Cost and return of bagged and non-bagged mangoes per ton basis.

Sl. No.	Mango varieties	Gross return (Tk)			Bagging cost (BC) (Tk/ton)	Gross margin over BC (Tk.)		
		Bagging	Non-bagging	Differences (Tk)		Bagging	Non-bagging	Differences (Tk.)
1	BARI mango 3 (Amropali)	64300	35400	28900	6270	58030	35400	22630
2	BARI mango 4 (Hybrid)	110000	58400	51600	6270	103730	58400	45330
3	BARI mango 8 (Rangui)	48300	27700	20600	6270	42030	27700	14330
4	Mollika	48000	26300	21700	6270	41730	26300	15430
5	Asshina	48500	26000	22500	6270	42230	26000	16230
	All (average)	63820	34760	29060	6270	57550	34760	22790

Source: Field survey, 2018.
Note: The bagging cost include bag purchasing cost per piece @Tk4.00, labour cost for bagging and harvesting of bagged mangoes @Tk. 6.27 per kg. The average labour wage was at Tk. 378 per person/man-days.

Table-7. Impact of bagging technology on farmer's income (results of 9-case studies).

Sl. No.	Name of farmers	Locations	% Increased over annual gross income	% Increased over income from mango selling
Farmer 1:	Dibakar Chakma	Madupur, Khagrachari	16.3	23.7
Farmer 2:	Babu Marma	Gograchari, Khagrachari	15.0	22.0
Farmer 3:	Dipul Chakma	Guamahat, Khagrachari	14.6	23.6
Farmer 4:	Atiar Rahman	Hafchari, Khagrachari	12.7	17.8
Farmer 5:	Md. Salim Ullah	Hafchari, Khagrachari	9.0	24.0
Farmer 6:	Mongching Marma	Guamahat, Khagrachari	15.1	24.8
Farmer 7:	Samir Ahmed	Protap para, Khagrachari	18.4	27.8
Farmer 8:	Simpat Mro	Basonto Para, Bandarban	15.6	31.2
Farmer 9:	Hemo Kumar Chakma	Sukkorchari, Rangamati	25.0	31.3
	All		15.74	25.13

Source: Farmers interview, 2018.

Table 8 shows that about 96% of the respondents mentioned that they were able to control fruit fly trough bagging technique, whereas 88% of them admitted that they got attractive color and spotless skin (92%) of bagged mangoes. Around 76% of the respondents agreed upon getting higher market prices and 88% of them thought it was more profitable. Almost cent percent of the respondents were happy as their reputations (100%) were built up and had their social status uplifted (84%) with increased self satisfaction (84%) through mango bagging.

As shown in "Table 9" that some other issues had been come up as the respondents mentioned them along with the benefits as well; where 78% of the respondents claimed that harvesting time of bagged mango couldn't be exactly determined. About 64% of them claimed not to have proper knowledge of bagging. About 24% respondents

claimed the sweetness of the bagged mango to be lower and some mentioned about the unavailability of quality bag (42%).

Table-8. Socio-economic impact of mango bagging technology (benefits).

Sl. No.	Particulars	Respondents agreed Upon (%)
1	Fruit fly control	96
2	Attractive skin color of mango	88
3	Spotless skin	92
4	High market price	76
5	More profit	88
6	Toxicity free and safe	92
7	Less fruit drop	64
8	Safe from Bat and other similar fruit loving animals	57
9	Less bagging cost compare to profit	19
10	Increased self life of ripe mango	29
11	Less physical damages at harvest	14
12	Reputation increased	100
13	Social status uplifted	84
14	Good mass media exposure	80
15	Self satisfaction increased	84

Source: Field survey, 2018.

Table-9. Problems faced by the farmers for using bagging technology.

Sl. No.	Particulars	Respondents agreed Upon (%)
1	Appropriate knowledge of bagging is insufficient	64
2	Sweetness of bagged mango turns down	24
3	Bagging is difficult for tall trees	32
4	Unavailability of quality bag	42
5	Size of bag is inappropriate for large size of mango	27
6	Harvesting time of bagged mango cannot be exactly determined	78
7	Takes more time to bagging	24
8	Fruit spoils while bagging is not done in proper way	68

Sources: Field survey, 2018.

Table-10. Probit regression coefficient of extent of adoption

Independent variables	Probit coefficient	Std. err.	Z	P-value
Constant	-1.2644	1.1604	-0.99	0.303
Ln Price of bagged mango	0.2372***	0.0680	3.49	0.000
Family size	0.0246^{ns}	0.0379	0.65	0.515
Family type	0.1070^{ns}	0.3757	0.28	0.776
Education (year of schooling)	0.2011**	0.0131	4.21	0.041
Training	2.1823***	0.4184	2.83	0.005
Risk taking behavior	0.5123**	0.2625	2.33	0.020
Willingness	0.5121**	0.2236	-2.25	0.024
Having knowledge on mango bagging	-0.3319^{ns}	0.2738	-1.21	0.225
Mass media exposure	0.2158^{ns}	0.2447	0.88	0.378
Research contact	2.2294***	0.3386	4.68	0.498
Extension contact	1.1588**	0.3152	3.50	0.000
Model diagnosis:				
Log likelihood	-50.2441	-	-	-
Pseudo R^2	0.3767	-	-	-
LR chi-squared	60.73***	-	-	0.000
Accuracy of prediction (%)	79.0%			
Number of observations	164			

Note: The variable of education dropped because of multi co linearity problem.
*** Significant at 1% level (P≤ 0.01); ** Significant at 5% level ((P≤ 0.05); * Significant at 10% level (P≤ 0.10).

3.2. Factors Influencing Adoption of Bagging Technology

In order to review the contribution of various factors to the extent of adoption of bagging technology at farm level, a regression equation was applied with dependent variables (0 and 1) and 11 independent variables; mentioned in the methodology section.

The results of the analysis are presented in "Table 10" and "Table 11". The price of bagged mango is a significant determinant of decision to adopt this technology. The net margin was recorded for bagged mango and non-bagged.

Table 10 shows that the marginal effect of the relevant variables for price of bagged mango, training, research and extension contact and risk taking behavior were estimated at 0.332, 2.18, 2.22, 1.15 and 0.512 implying that a one per cent increase in price of bagged mango, the training, research, extension contact and risk taking behavior will increase the adoption of bagging technology significantly by 0.33, 2.18 and 2.22, 1.15 and 0.512% respectively. On the other hand, the marginal effect of the variable, willingness to adopt this technology is estimated at 0.34 implying that a one per cent increases in the willingness will increase the adoption of those technology by 34% "Table 11". The results of regression analysis revealed that the income from bagging mango, training, research and extension contact, risk taking behavior and willingness has indeed helped in contributing to adopt this technology at farm level. Out of these, family size, family type and mass media exposure can be seen as insignificant but positive indicator of formulation of adoption of bagging technology in the region.

Table-11. Marginal effects of probit analysis.

Independent variables	dy/dx	Std. err.	z	P-value	X
Ln Price of bagged mango	0.0682***	0.0179	3.80	0.000	2.513
Family size	0.0070	0.0108	0.65	0.513	52.786
Family type	0.0307	0.1078	0.29	0.775	1.778
Education	0.0219**	0.0180	0.66	0.031	3.269
Training	0.2960***	0.0902	3.28	0.001	0.374
Risk taking behavior	0.1761**	0.0742	2.37	0.018	1.923
Innovativeness	0.0465	0.0715	0.65	0.515	2.618
Willingness to take loan	-0.1449**	0.06431	-2.25	0.024	1.786
Having modern knowledge on mango production	-0.0954	0.0777	-1.23	0.219	1.801
Economic aspiration	-0.0502	0.0863	-0.58	0.561	2.664
Mass media exposure	0.0620	0.0699	0.89	0.375	2.564
Research contact	-0.0662	0.0986	0.67	0.502	0.473
Extension contact	0.2108***	0.1122	3.39	0.001	0.687

Marginal effect after probit **y** = 0.5909 (*) dy/dx is for discrete change of dummy variable from 0 to 1.
Note: The marginal effect is the average change probability when x increases by one unit. Since a probit is a non-linear model, that effect will differ from individual to individual.

4. CONCLUSION

Bangladesh has been an agricultural country since the very beginning of its birth. Agriculture has been always the main driving force of our economy. It is in present already acknowledged as one of the countries which have achieved self sufficiency in food. As intention to get to the next level, the government is giving emphasis of value addition and uplifting the nutritional value of the crops; altering nutritionally single value crops with multi valued crops like fruits and vegetables. To execute the process the government is willing to introduce new modern technologies to agriculture sector. Fruit bagging is one of those revolutionary technologies which brought benefit to all the people from different poles; from fruit growers to traders and consumers. Though bagging technology had been introduced in the plane land of Bangladesh much earlier, but the idea is almost new in CHT for adoption. Based on the survey results it seems like the respondents were heavily influenced with the impact of bagging technology on their socio-economic conditions and livelihoods. Though unlike the other parts of the country, mango bagging is still a new concept in this region; but the great responses and acceptance from the consumer level

and the ostensible benefits of the technology made the farmers believe in it. The income from bagged mango, training, research, extension contact, risk taking behavior and willingness of farmers influenced to adopt bagging technology significantly. Finally, considering the benefits of bagging technology, it should be disseminated throughout the CHT through the Department Agriculture Extension (DAE) and NGO's for increasing farmer's income to a greater extent.

5. RECOMMENDATIONS

To spread out the benefit of pre-harvest bagging technology a series of recommendation could be made: (i) Conducting promotional activities is the best way to get to the farmers with the technology. Proper initiatives could be taken by the Department of Agricultural Extension in collaboration with other governmental and nongovernmental sectors, different sorts of means can be used like, documentaries, radio and TV programs, visual, audio visual, posters, leaflets, articles on news papers etc. (ii) Arranging intensive campaigns and training programs.

(iii) Some initiatives to motivate the farmers should be taken, like disseminating fruit bags free of charge or provision of aids and subsidy from the government. (iv) Conduction of more research works both in technical and socioeconomic aspects; for example of technical aspects: impact of using different kinds of fruit bags, time of bagging, change of physiochemical properties of fruits due to bagging etc.

Funding: This research work was carried out with the financial support of Entrepreneurship and Value Chain Development Project for Linking Farmers with Markets, a Commissioned Research Program-1: Hill Agriculture (Component-IV), Krishi Gobeshona Foundation (KGF), Farmgate, Dhaka, Bangladesh. Gratitude and thanks to Dr. Wais Kabir, Executive Director, KGF for providing funds for the research work.
Competing Interests: The authors declare that they have no competing interests.
Acknowledgement: All authors contributed equally to the conception and design of the study.

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