POSTHARVEST LOSSES OF CUCUMBER PRODUCTION AT FARM LEVEL IN SELECTED AREAS OF BANGLADESH

M. S. Rahman[1] and M. Khatun[2]

Abstract

The study assessed the volume and value of postharvest losses of cucumber in Rajshahi, Rangpur and Bandarban districts of Bangladesh. The survey covered 180 cucumber farmers. Multistage stratified random sampling technique was used to select the respondents. Postharvest loss was calculated by evaluating the quantitative and qualitative losses of cucumber. Among the respondents 71% were belonged to small farm size category followed by medium (21%) and marginal farm size category (6%). Average per hectare postharvest loss was 3929 kg in the survey areas. Postharvest loss was found highest in Rangpur (5781kg) followed by Rajshahi (4075kg) and Bandarban (1931kg). Total postharvest loss was 51.79% due to complete physical damage and the rest (48.21%) was due to partial physical damage. Sorting and grading stages accounted to 27.52% and 24.98% respectively were responsible for complete physical damage and partial physical damage. The least postharvest loss (3.61%) was due to storing of cucumber, whereas the highest loss (24.03%) was due to insect infestation. Besides, rotten and skinning causes for complete and partial physical damages of cucumber in Rajshahi district, where it was due to insect infestation in Bandarban and Rangpur district. The farmer of Rangpur district spent 81720 per hectare of cucumber cultivation, whereas it was Tk. 62354 and Tk. 34826 Rajshahi and Bandarban district respectively.

Keyword: Postharvest loss, cucumber, factors of postharvest loss, Bangladesh.

Introduction

The agro-climatic conditions of Bangladesh are very much congenial for growing different vegetables. Although the share of land devoted for vegetable production is very small, but production has seen a significant rise in the last couple of years. Around 26.7 million tons of vegetables were produced across Bangladesh in 2018-19 from 1.25 million hectares which was 37.63% higher than the production in 2013-14 (DhakaTribune, 2020). Per capita vegetable production in Bangladesh was 70g in 2017 except for potatoes (BBS, 2017). So, a consumer could avail some 55g as some portion of vegetables was damaged for several reasons. This indicates that people in Bangladesh could consume one-fourth of the required vegetables daily compared to the recommended intake of 220g per capita per day by Food and Agricultural Organization (FAO).

[1]Scientific Officer, Agricultural Economics Division, Bangladesh Agricultural Research Institute (BARI), Gazipur-1701, [2]Assistant Professor, Dept. of Agricultural Finance and Banking, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh.

Among different vegetables cucurbitaceous have an important position in the vegetable kingdom. Within this group cucumber (*Cucumis sativus*) is considered a very popular vegetable crop available across seasons and space. It is a typical subtropical creeping vine. This vine bears cucumiform fruits which are used as vegetables. The climatic condition of Bangladesh is suitable for cucumber cultivation. The farmers of Bandarban, Chattogram, Tangail, Jashore, Bagherhat, Meherpur, Mymensingh, Sherpur, Bogura, Rajshahi and Rangpur districts of Bangladesh cultivate cucumber commercially. It is recommended that reduction of mechanical damage during postharvest practices will greatly decreases the magnitude of losses due to pathogenic issues (Khatun and Rahman, 2020). However, lack of adequate knowledge and unavailability of appropriate handling practices were found responsible for postharvest loss in the country like Bangladesh (Hasan *et al.*, 2010; Azad *et al.,* 2013). This loss emerges in both quantitative and qualitative in nature which affects producers, traders and consumers (Khatun and Rahman, 2019).

Cucumber production is profitable and net return is higher than any competing crops (Siful, 2008; Lutfa *et al.,* 2019; Maurya *et al.,* 2015). Though cucumber is very susceptible to postharvest losses but most of these studies covered only the farm level production avoiding detailed study on postharvest losses of cucumber. As such, it was imperative to conduct a detailed study on postharvest losses of cucumber in Bangladesh. The present study has been conducted with the following specific objectives-

  i.   To estimate farm level postharvest losses of cucumber, and

  ii.   To explore factors responsible for farm level postharvest losses.

Materials and Methods

Study area and sample size

Multistage stratified random sampling technique was followed to select the survey respondents. Considering the intensity of cucumber cultivation and different agro ecological zones, the study was conducted in three districts namely Bandarban, Rangpur and Rajshahi. Two major growing Upazilas were selected from each of the survey districts. The data were collected from one village of each selected Upazila.The number of respondent farmers was 30 for each village. Thus a total of 180 cucumber farmers were selected randomly for the study.

Data collection

A pre-tested structured interview schedule was used to collect primary data. Data were collected from March to May in 2019. Farmer selection was based on the two bases: (i) at least 3 years of cucumber cultivation experience and (ii) willing to act as respondent voluntarily.

Analytical Techniques

Assessment of farm level postharvest loss of cucumber

Postharvest loss of cucumber was quantified by adding both quantitative and qualitative losses as done by Khatun and Rahman (2019 & 2020). This quantification was separated into different stages of postharvest operations and resulting causes. Damages of cucumber are of two types- (i) partial physical damage known as qualitative losses and (ii) complete physical damage known as quantitative losses. The stages of postharvest operations include harvesting, cleaning, sorting, grading, packaging, preserving and transporting from farm yard to market level. On the other hand, insect infestation, disease infection, rotten, over mature skinning, bruising and shrinking are identified as the principle causes responsible for postharvest losses.

Assessment of financial loss of farmer due to postharvest loss

Financial loss was measured by using the following equation (Khatun and Rahman, 2018):

$$F_l = Q_{fd} \times P_{fd} + (Q_{pd}(P_{fd} - P_{pd}))$$

Where,

F_l = Financial loss (Tk)

Q_{fd} = Amount of quantitative damage (kg)

P_{fd} = Purchase price of cucumber (Tk/kg)

Q_{pd} = Amount of qualitative damage (kg)

P_{pd} = Selling price of qualitative damaged cucumber (Tk/kg)

Factors responsible for farm level postharvest losses of cucumber

Following multiple linear regression model was used to estimate the factors responsible for farm level damage.

$$Y + \alpha + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \mu_i$$

Where,

Y = Postharvest loss (kg/ha)

X_1 = Total harvested amount (kg/ha)

X_2 = Education (year of schooling)

X_3 = Family member (no.)

X_4 = Farming experience (year)

X_5 = Selling price (Tk/kg)

X_6 = Vehicle type dummy (head load=0, others=1)

X_7 = Packaging dummy (traditional packaging=0, improved packaging = 1)

X_8= Training dummy (get training = 0, no training = 1)

X_9= Selling place dummy (farm level = 0, market level = 1)

α = Constant term and $\beta_1, \beta_2 \ldots \beta_9$ = coefficients of the explanatory variables

μ_i= Error term

Results and Discussion

Socio economic profile of cucumber farmers

The highest representation of age distribution of cucumber farmers found in 30-40 years (45%) and the lowest (10%) was in above 50 years (Table 1). The survey data of each district reflect more or less same picture. The data reveal that most of the selected cucumber farmers belonged to active age group (Table 1). Four categories were used to identify the literacy level of the farmers as stated by Rahman et al. (2014). About 34% of the respondent farmers completed primary level of education. A significant number of farmers had no primary level of education and they cannot read and write but can sign (26%), while 15% farmers received above secondary level of education. Farmer's education found maximum illiterate in Bandarban (37%) and Rangpur (31%) respectively. Crop production was the main occupation of 91% of the respondents which implied that they were completely dependent on farming for their livelihood. This case was same in each of the selected areas. Farm holdings were divided into four categories based on BBS (2016). About 71% respondents belonged to smallholder category, 21% in medium and only 6% in marginal farm category. The highest 5% of large farmers were found in Bandarban district, whereas no large farmer was found in Rangpur district (Table 1).

Farm Level Postharvest Loss of Cucumber

Postharvest loss based on postharvest operations

A number of postharvest operations such as collection, cleaning, sorting, grading, transportation and storing were found in the survey areas. Postharvest loss is occurred due to physical damages at farm level. The highest percentages of both complete physical and partial damages occurred at sorting and grading stages where least share of damage occurred in storing stage. The lion share of complete physical damages occurred in sorting and grading stages which was accounted to 27.52% of the total postharvest losses. While the least share of complete physical damages 2.92% occurred in transportation. Besides, 24.98% of the total losses occurred in sorting and grading stages, 14.30% in collection stage, and 7.26% in cleaning stage. The least partial damage occurred in transportation stage which was 1.67% of the total partial damages. Overall 51.79% of the total losses were due to complete physical damages and the rest 48.21% was due to partial

physical damages. Per hectare loss (5781kg) was highest in Rangpur district which were 475kg and 1931kg in Rajshahi and Bandarban district respectively (Table 3).

Table1. Socioeconomic profile of the respondent farmers

Particulars	% of respondents			
	Rajshahi	Bandarban	Rangpur	Average
1. Age (year)				
Below 30	15	36	19	23
30-40	56	38	41	45
41-50	15	18	31	21
Above 50	14	8	9	10
2. Literacy status				
Cannot read but can sign	9	37	31	26
Primary level (Class I-V)	36	36	30	34
Secondary level (Class VI-X)	24	22	29	25
Above secondary level	31	5	10	15
3. Occupation				
a. Main occupation				
Crop production	79	94	100	91
Service	21	6	0	9
b. Subsidiary occupation				
No profession	37	75	69	60
Crop production	24	5	31	20
Business	39	10	0	16
Service	0	10	0	3
4. Farm size (ha)				
Marginal (below 0.19)	8	5	2	6
Small (0.19-0.99)	78	67	69	71
Medium (1.00-3.03)	12	23	29	21
Large (above 3.03)	2	5	0	2

Source: Field survey, 2019

Table 3. Loss of cucumber due to postharvest operations

Items of operations	Quantity (kg/ha)				% of losses
	Rajshahi	Bandarban	Rangpur	Average	
A. Quantitative damage					
Collection	414.83	304.21	503.71	407.58	20.0
Cleaning	220.93	194.29	453.40	289.54	14.2
Sorting & grading	475.03	580.42	2187.92	1081.12	53.1
Transportation	48.54	--	295.68	114.74	5.6
Storing	--	--	425.97	141.99	7.0
Total	1159.33	1078.93	3866.67	2034.97	100
B. Qualitative damage					
Collection	1094.02	201.92	389.85	561.93	29.7
Cleaning	350.19	111.80	393.24	285.08	15.1
Sorting & grading	1431.49	538.42	974.13	981.35	51.8
Transportation	40.09	--	156.72	65.60	3.5
Total	2915.79	852.14	1913.95	1893.96	100

Source: Author's calculation, 2019

Causes of postharvest losses

The study found a number of causes viz. insect, disease, rotten, over mature, skinning, bruising, bending, late sell, weather responsible for full and partial physical damages of cucumber in the survey area (Table 4). Insect was the main causes of full and partial damages of cucumber in Bandarban and Rangpur districts whereas rotten and skinning were the main causes of full and partial damages of cucumber in Rajshahi. The highest percentages of full and partial damages caused by insect infestation were 12.47% and 11.55% of the total losses respectively. Besides, diseases and rotten caused full and partial damages by 7.36%, 8.61% and 7.44%, 4.82% respectively. Bending was also an important cause of cucumber damages in both full and partial damages which accounted for 5.70% and 6.84% respectively. It was also found that a portion of full and partial damages occurred due to late selling of cucumber. Weather like rain and hail storm also found to damage significantly by 3.98% and 2.80% of the total damages respectively (Table 4).

Table 4. Amount of postharvest losses due to different causes

Particulars	Quantity (kg/ha)				% of loss
	Rajshahi	Bandarban	Rangpur	Average	
A. Quantitative damage					
Insect infestation	271.58	467.70	731.02	490.10	24.08
Disease infection	186.05	219.71	461.28	289.01	14.20
Rotten	427.83	239.07	210.13	292.34	14.37
Over mature	64.28	24.61	759.30	282.73	13.89
Skinning	48.59	10.87	557.45	205.64	10.11
Bruising	3.11	11.07	58.76	24.31	1.19
Bending	48.59	62.44	560.24	223.76	11.00
Late sell	14.08	2.21	195.72	70.67	3.47
Bad weather	95.22	41.24	332.77	156.41	7.69
Total	1159.33	1078.93	3866.67	2034.97	100.00
B. Qualitative damage					
Insect infestation	596.58	237.41	527.92	453.97	23.97
Disease infection	371.29	158.04	485.32	338.22	17.86
Rotten	68.87	57.96	147.00	91.28	4.82
Over mature	356.60	27.84	124.00	169.48	8.95
Skinning	683.99	51.48	123.50	286.32	15.12
Bruising	126.24	23.83	67.64	72.57	3.83
Bending	463.64	212.00	130.48	268.71	14.19
Late sell	149.42	28.26	132.68	103.45	5.46
Bad weather	99.16	55.33	175.41	109.97	5.81
Total	2915.79	852.14	1913.95	1893.96	100.00

Source: Author's calculation, 2019

Financial loss of farmers due to postharvest losses

The average financial loss of farmers due to different postharvest practices was Tk. 53013 per hectare in the study areas. The highest loss was reported in Rangpur district which was Tk.64442 per hectare, while the lowest loss was estimated at Tk. 28384/ha for the farmer of Bandarban district (Table 5).

Table 5. Amount of financial loss of cucumber due to different postharvest losses

Particulars	Rajshahi	Bandarban	Rangpur	All areas
Amount of quantitative damage (kg/ha)	1159	1079	3867	2035
Amount of qualitative damage (kg/ha)	2916	852	1914	1894
Purchase price of cucumber (Tk/kg)	22.95	21.00	15.15	19.70
Selling price of qualitative damaged cucumber (Tk/kg)	10.69	6.72	3.06	6.82
Total financial loss (Tk/ha)	57771	28384	64442	53013

Source: Author's calculation, 2019

Factors responsible for farm level postharvest losses

It is evident from the data that the coefficients of total harvested amount was positive and significant at 1% level, indicating 1% increase in total harvest of cucumber, keeping other factors constant, would result in an increase of postharvest loss by 0.11%. The coefficient of vehicle type was positive and significant at 1% level. It means that vehicle is important to reduce postharvest loss of cucumber. Selling place was also found positive and significant at 5% level. This implies that selling place is also important to reduce postharvest loss. As far as the selling place from the farm level postharvest loss will be higher simultaneously (Table 6).

Table 6. Estimated values of coefficients and related statistics of multiple linear regression model for postharvest loss of cucumber at farm level

Regression variables		Regression coefficient	t-statistic	p-value	Standard error
Intercept	α	-29.051	-2.512	0.013	250.447
Total harvested amount	X_1	0.113***	12.157	0.000	0.009
Education	X_2	-3.981	-0.564	0.574	7.064
Total family member	X_3	-2.011	-0.116	0.908	17.282
Farming experience	X_4	2.369	0.744	0.458	3.183
Selling price	X_5	5.490	0.947	0.345	5.796
Vehicle type dummy	X_6	27.357***	3.311	0.001	62.622
Packaging dummy	X_7	-12.216	-1.077	0.283	132.016
Training dummy	X_8	22.665	1.455	0.148	139.253
Selling place dummy	X_9	18.600**	2.105	0.037	65.844
n		180			
R^2		0.57			
$F_{(180, 9)}$		18.324***			

Note: '***','**', and'*' denote 1%, 5%and 10% level of significance

Conclusions and Recommendations

Most of the cucumber farmers in the survey areas were small category farmers and their main occupation was crop farming. Postharvest losses occurred due to

various postharvest operations like collection, cleaning, sorting, grading, transportation and storing. The highest postharvest losses occurred at sorting & grading stage followed by collection of cucumber from the field. Besides, the main causes of postharvest losses were insect & disease infestation, over mature, and skinning for both quantitative and qualitative losses. Total harvested amount, vehicle for transport and selling place were the responsible factors for postharvest loss of cucumber. Good communication at local level might reduce postharvest losses of cucumber. Proper application of pesticides can also promote postharvest loss reduction at farm level.

Acknowledgement

References

Azad, M. J. 2013. Farmers' knowledge on postharvest practices of vegetables. Master of Science Thesis, Department of Agricultural Extension & Information System, Sher-E-Bangla Agricultural University, Dhaka-1207, pp. 1-110.

BBS. 2016. Bangladesh Bureau of Statistics, *Statistical Yearbook of Bangladesh*, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka.

DhakaTribune, 2020. Vegetable production rises by one-third in 5 years. Available at: https://www.dhakatribune.com/bangladesh/2020/01/03/vegetable-production-rises-by-one-third-in-5-years [Accessed: 03/06/2020].

Hassan, M. K., B. L. Chowdhury and N. Akhter. 2010. Postharvest loss assessment: a study to formulate policy for loss reduction of fruits and vegetables and socioeconomic uplift of the stakeholders. National Food Policy Capacity Strengthening Programme, Final Report PR#8/08, pp. 1-88.

Khatun, M. and M. S. Rahman. 2018. Quantifying postharvest losses of tomato: a farm level study in selected areas of Bangladesh, *Bangladesh Development Studies,* **41(4):** 141-155.

Khatun, M. and M. S. Rahman. 2020. Postharvest loss assessment of tomato in selected locations of Bangladesh, *Bangladesh Journal of Agricultural Research*, **45(1):**43-52.

Khatun, M. and M. S. Rahman. 2019. Quantifying postharvest loss of brinjal: A farm level study in Bangladesh. *Journal of Bangladesh Agricultural University*, *17(4): 454–460*. https://doi.org/10.3329/jbau.v17i4.44605

Rahman, M. S., M. Khatun, M. A. Rahman, M. G. Azam, S. Sultana. 2014. Assessing the impact of credit on rice production and food security on farm households in Bangladesh. *International Journal of Innovative Research & Developement,* **3(6):** 300-308. http://internationaljournalcorner.com/index.php/ijird_ojs/article/view/ 134890.