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POSTHARVEST LOSS ASSESSMENT OF TOMATO IN SELECTED LOCATIONS OF BANGLADESH

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Abstract

Tomato is a very well-known horticultural crop in Bangladesh. In order to make tomato production profitable postharvest management is very important. The present study assessed tomato postharvest losses in four intensive growing sites of Jamalpur and Rangpur districts of Bangladesh. Farm level postharvest losses were measured through using descriptive and inferential statistics. Cobb-Douglas type multiple linear regression model was used to identify the factors affecting farm level tomato postharvest loss in the survey areas. Farm level postharvest loss of tomato was 12.45% per farm in the survey area. From this3.59% was due to partial damages and the rest 8.86% was for full damages of tomato. The major causes for postharvest loss of tomato were rotten, disease and insect infestation. This loss incurs financial loss at farm level by BDT 152.45 per decimal of tomato cultivation. Total harvested amount, family member and selling price were some of the important factors for tomato postharvest loss in the survey area. Wide practices of improved postharvest management practices are essential to reduce tomato postharvest loss in the survey area.

Keywords: Farmer, Tomato**,** Postharvest loss, Farm level, Bangladesh.

Introduction

Tomato (*Solanum lycopersium)* is a very popular vegetable in Bangladesh. It is now growing all over the country due to its adaptability to wide range of soil and climate (Ahmed, 1976). In 2016-17, the area under tomato production was 68366 acres and total production was 388725 metric ton (BBS, 2017). It is popularly grown in mid-August to mid-November. December to mid-January is the appropriate time for tomato harvesting. Demand for tomato exists throughout the year, so it also has great potentiality to grow in summer season.Tomato is highly perishable crop and 50% of tomato productions in tropical areas are lost between rural production and town consumption (Oyeniran, 1988). Decay, external damages and harvesting at improper maturity stage are the principle causes for postharvest losses of tomato (Thorne and Alvarez, 1982).

The safety and quality of horticultural crops depends on postharvest management (Khatun and Rahman, 2019). Likelihood of postharvest losses depends on the level of openness of a product to the pathogens as they attack through wounds

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(Muhammad *et. al.,* 2012). So, reducing mechanical damage during postharvest practices greatly decreases the level of postharvest losses due to pathogens. This simple step can improve the safety and quality of the vegetables which ensures better access to different stakeholders. However, the country like Bangladesh suffers much of the postharvest losses due to a number of factors such as lack of adequate knowledge and information, the unavailability of appropriate practices under funded research and development (Hasan *et al.* 2010 and Azad *et al.,* 2013). The quality and nutritional value of fresh vegetables are also affected by postharvest handling and storage condition (Sablani *et al.,* 2006).

Postharvest operations like sorting, grading, packaging, cooling, storage, proper loading and unloading are very important loss reducing activities in vegetable supply chains. But these are not very common at farm level in Bangladesh which results 23.6% to 43.5% fruits and vegetable postharvest loss (Hasan *et al.,* 2010). Seasonal oversupply and absence of proper marketing system causes huge wastage of harvested vegetables. Insect infestation and rotten were the primary causes of full damages of brinjal in some areas of Bangladesh (Khatun & Rahman, 2019). Beside this conventional method of packaging also causes higher postharvest loss compared to improved cool chain method. Matin *et al.* (2016) showed that tomato postharvest loss in conventional method is 22% compared to 17.7% in improved method. A number of studies were conducted in Bangladesh on tomato postharvest loss. Khatun *et al.* (2014) found 15.37% and 10% postharvest loss of tomato at farmers and intermediaries level in some tomato growing areas of Bangladesh. Beside this Hossain *et al.* (1999) found 8% to 15% farm level postharvest loss of tomato. But still precise estimation of tomato postharvest loss is necessary. In line with this fact the present study was conducted to fulfill the following objectives:

1. To quantify farm level postharvest loss of tomato;
2. To assess the factors affecting tomato postharvest loss and
3. To identify the problems of tomato cultivation at farm level;

Methodology

Jamalpur and Rangpur districts of Bangladesh were the survey area for the present study. Four intensive growing villages were selected for the survey from the selected districts. Purposive random sampling was used for farmer selection. Total respondents were 144 of each 36 were chosen from each of the villages. Survey was conducted during January to March 2018. A pretested structured schedule was used for data collection. Besides primary data collection, BBS, published articles in referred journal and newspaper, reports and unpublished thesis were also used to gather relevant information for the study.

Analytical techniques

Postharvest losses Assessment

Studies like Amiruzzaman (1990), Kader (1992), Hasan *et al.* (2010), Khatun *et al.* (2014), Kaysar *et al*. (2016) measured loss of different vegetables which were mostly based on field survey. Matin *et al.* (2016) estimated both the quantitative and qualitative loss of vegetables through physical monitoring of vegetable lots. Khatun and Rahman (2019) quantified postharvest loss of brinjal by using both quantitative and qualitative losses. The present study quantified both quantitative and qualitative losses of tomato. The losses were also distributed to their causes as done by Khatun and Rahman (2019). Two types of physical damages *viz*., full and partial were found for tomato of which they were considered as quantitative and qualitative losses respectively. The total loss was quantified by adding both the quantitative and qualitative loss (Khatun and Rahman, 2019).

Financial loss assessment

Farmers have to incur significant financial loss due to postharvest losses of tomato. The present study measured financial loss by using the following formula as done by Khatun and Rahman (2019):

$$F_1 = Q_{fd} \times P_{fx} + Q_{pd} (P_{fd} - P_{pd})$$

Where,

F_l = Financial loss (Tk/decimal)

Q_{fd} = Amount of full damaged tomato (kg/decimal)

P_{fd} = Price of full damaged tomato (Tk/kg)

Q_{pd} = Amount of partial damaged tomato (kg/decimal)

P_{pd}= Price of partial damaged tomato (Tk/kg)

Factors affecting farm level postharvest losses of tomato

A functional analysis was applied to identify the factors affecting farm level post harvest loss of tomato as done by Nag *et al.* (2000), Khatun *et al.* (2014), Kaysar *et al.* (2016) and Khatun & Rahman (2019). The following multiple linear regression model was used to analyze the factors:

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

Where,

Y = Loss of tomato (kg/farm)

α = Constant term

$\beta_1, \beta_2 \ldots\ldots \beta_9$ = coefficients of the explanatory variables

X_1 = Total harvested amount (kg/farm)

X_2 = Education (year of scholing)

X_3 = Total family member (no.)

X_4= Farming experience (year)

X_5= Selling price (Tk/kg)

X_6= Vehicle type dummy (pulled van=0, others = 1)

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

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

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

μ_i= Error term

Problem face index (PFI) of farmers

Farmers have to face various problems during tomato cultivation. Tomato farmer responded to the problems they faced by no problem (score-0), little problem (score-1), moderate problem (score-2) and severe problem (score-3). In order to know the weight of these problems PFI was constructed by using the following formula as done by (Khatun & Rahman, 2019).

$$PFI = (P_s \times 3) + (P_m \times 2) + (P_1 \times 1) + (P_n \times 0)$$

Where,

PFI = Problem Faced Index

Ps = Respondents numberfacing severe problems

Pm = Respondents numberfacingmoderate problems

P_l = Respondents numberfacinglittle problems

P_n = Respondents numberfacingno problems

Results and discussion

Postharvestloss of tomato

The Table 1 shows postharvest loss of tomato in the survey area. It is evident that 12.45% of harvested tomato was fallen under postharvest loss. This loss was due to partial damages (3.59%) and full damages (8.86%) of tomato. Storing stage accounted to be the highest percentages of losses in case of partial damages while sorting and grading stages were the main stages for postharvest loss due to full damages of tomato.

Table 1. Postharvestloss of tomato on different postharvest activities

Items	Tomato	
	Quantity (kg)	%
Total harvested amount (kg)	38990	100
A. Partial damage (kg)		
Damage during tomato collection	123	0.32
Damage during tomato sorting & grading	381	0.98
Damage during tomato storing	710.5	1.82
Damage during tomato transportation	185	0.47
Total	1399.5	3.59
B. Full damage (kg)		
Damage during tomato collection	110	0.28
Damage during tomato sorting & grading	1849	4.74
Damage during tomato storing	1141	2.93
Damage during tomato transportation	356	0.91
Total	3456	8.86
C. Total damage (kg)		
Damage during tomato collection	233	0.60
Damage during tomato sorting & grading	2230	5.72
Damage during tomato storing	1851.5	4.75
Damage during tomato transportation	541	1.39
Total postharvest loss	4855.50	12.45

Source: Field survey, 2018

Full and partial damages occurred due to several causes which is outline by the Table 2. Partial damages occurred due to over mature and bruising while rotten, infested by insect and bird attack were responsible for full damages of tomato at farm level in the survey area.

Table2. Postharvestloss of Tomato based on causes of damages

Items	Tomato	
	Quantity (kg)	%
Total harvested amount (kg)	38990	100
A. Partial damage (kg)		
Infested by insect	0	0.00
Infested by diseases	0	0.00
Rotten	0	0.00
Over mature or ripen	472	1.21
Skinning	313.5	0.80
Bruising	414	1.06
Shrinking	55	0.14
Bird	145	0.37
Total	1399.5	3.59
B. Full damage (kg)		
Infested by insect	580.1	1.49
Infested by diseases	418	1.07
Rotten	1023.2	2.62
Over mature or ripen	348.05	0.89
Skinning	9	0.02
Bruising	63.5	0.16
Shrinking	484	1.24
Bird	530.15	1.36
Total	3456	8.86
C. Total wastage (kg)		
Infested by insect	580.1	1.49
Infested by diseases	418	1.07
Rotten	1023.2	2.62
Over mature or rippen	820.05	2.10
Skinning	322.5	0.83
Bruising	477.5	1.22
Shrinking	539	1.38
Bird	675.15	1.73
Total postharvest loss	4855.50	12.45

Source: Field survey, 2018

Financial loss of tomato farmers due to postharvest losses

The Table 3 represents financial losses of tomato. Farmer had to incur loss BDT 152.45 per decimal of tomato production due to postharvest loss of tomato.

Table 3: financial loss of tomato

Sources of Financial loss	Quantity (Tk/decimal)	Percentages
Loss due to partial damage	20.78	13.6
Loss due to full damage	131.67	86.4
Total loss	152.45	100.0

Source: Authors estimation

Factors affecting farm levelpostharvest loss of tomato

Factors responsible for farm level postharvest loss of tomato is shown by the following Table 4.Total harvested amount, selling price and selling place were found significant factors that elevate postharvest loss of tomato. Coefficients of multiple determination (R^2) was 0.73 meaning that 73% of the variation in postharvest loss was explained by the variables included in the model.

Table 4: Values of coefficients and related statistics of multiple linear regression model for factors affecting postharvest loss of tomato

Regression variables	Regression coefficient	t-statistic	p-value	Standard error
Intercept (α)	10.661	-.486	.329	20.212
Total harvested amount (X_1)	1.40***	12.220	.000	.011
Education X_2)	0.831	.455	.651	17.876
Total family member (X_3)	-3.466*	-.130	.097	2.764
Farming experience (X_4)	9.078	.915	.364	9.922
Selling price (X_5)	0.986*	.156	.076	6.302
Vehicle type dummy (X_6)	2.879	.499	.619	5.666
Packaging dummy (X_7)	-0.305	-.512	.610	5.736
Training dummy (X_8)	-0.415***	-.733	.016	5.654
Selling place dummy (X_9)	6.295*	.747	.098	8.255
Number of observations	144			
R^2	0.73			
F (144, 9)	18.324***			

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

Problems of tomato cultivation

The Table 5 enumerates various problems faced by tomato farmer. The PFI indicates the ranking of problems based on their severity. It is evident that lower price, lack of tomato storage, infested by white fly and viral infection were the top most problems faced by tomato farmers in the survey area.

Table 5. Rank of problems faced by tomato farmers

Problems	Extent of problem faced				PFI	Rank
	No problem (0)	Little problem (1)	Medium problem (2)	High problem (3)		
Lower price	0	4	21	49	193	1
Lack of tomato storage	0	14	14	44	174	2
Infested by white fly	4	12	24	32	156	3
Viral infection	8	12	15	36	150	4
Lack of labour during harvesting	10	20	10	32	136	5
Infected by diseases	15	6	18	35	147	6
Over production and supply in the peak season	12	12	23	25	133	7
Higher input price	6	28	14	24	128	8
Adulterated inputs	6	18	36	12	126	9
Higher cold and fog in winter	18	27	18	9	90	10
Adulterated seed	21	30	14	7	79	11
Unavailability of technical support for tomato storage	36	27	0	9	54	12

Source: Field survey, 2018

Conclusion and Recommendation

Tomato farmers have to bear a significant financial loss due to its postharvest losses. One of the main causes is over production. As much as tomato produces, it increases the tomato damages. To reduce the postharvest loss farmer are practicing postharvest technologies and improved management which includes mode of transportation, packaging, grading, sorting etc. But farmers have to

struggle a lot in the peak season to get a better margin as price is far lower than the profitable margin. Besides, lack of storage, white fly infestation and viral diseases incurred a significant financial loss in tomato production each year. Total harvested amount, family member and selling price at retail level were logically important for tomato postharvest loss in the study area. Therefore, wide demonstration of improved postharvest management and technologies is prerequisite for tomato postharvest loss reduction in the survey area.

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