PROFITABILITY OF MANGO MARKETING IN DIFFERENT SUPPLY CHAINS IN SELECTED AREAS OF CHAPAI NAWABGANJ DISTRICT

M. A. M. MIAH[1], M. S. HOQ[2] AND M. G. SAHA[3]

Abstract

A plenty of mangoes are spoiled and damaged every year due to improper postharvest handling and inefficient supply chain. Sufficient information are lacking on these issues in Bangladesh. The study *assessed the postharvest handling of key actors in mango supply chains and estimated the post-harvest losses at different stakeholder level in Chapai Nawabganj district, Bangladesh. In total 83 respondents taking 30 mango growers and 53 mango traders were interviewed from Chapai Nawabganj and Dhaka districts. The* study identified eight marketing channels for mango marketing. The prominent channel was *Grower> Bepari> Urban Arathdar> Urban retailer> urban Consumer* since 85.1% mangos moved through this channel. *Bepari* incurred the highest marketing cost (Tk.7338/ton) due to long distance coverage followed by retailer (Tk.1218/ton) and *Faria* (Tk.738/ton). *Faria* received the highest net margin (Tk.8068/ton) due to lower marketing cost and spoilage followed by retailer (Tk. 6601/ton) and *Bepari* (Tk.5394/ton).*The results revealed that the estimated average postharvest losses were 14.11% and 9.61% at farm and traders' level respectively. At farm level,* these losses occurred during harvesting, sorting & grading, and transportation. *Harvesting losses were due to cracking, bruising, compression, and disease and insect infestation. T*he highest loss was recorded at retail level (4.64%) followed by *Bepari* (3.95%). Farmers and *Farias* used different local carriers, whereas trucks and pick up van were used by *Bepari* to transport mango from assemble markets to urban wholesale markets. Major marketing problems in the supply chain were delayed sale and lack of buyers.

Keywords: Mango, supply chain, postharvest loss, postharvest handling, marketing cost, marketing margin.
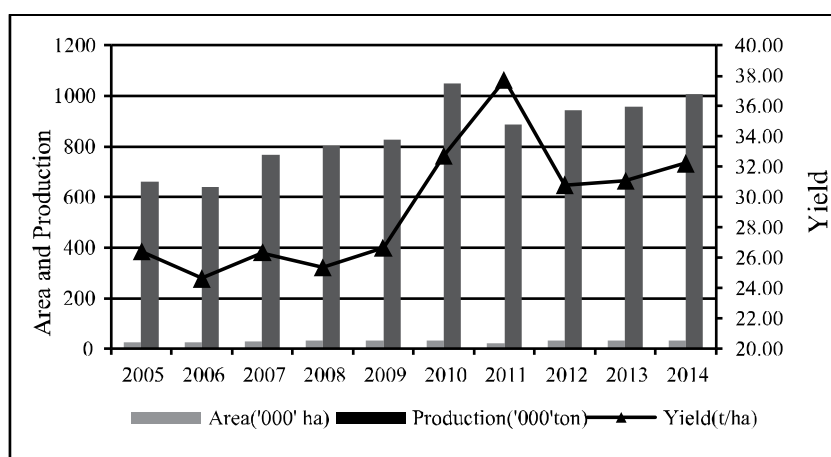
Introduction

The fruit nutrients are vital for maintaining good health. They are naturally low in calories, fat, sodium, and cholesterol. Fruits are rich in fiber, which is essential for the smooth movement of food in the body's digestive system. It can reduce the risk of many illnesses, including heart disease and stroke (www.healthyeating.org/Healthy-Eating). The per capita consumption of fruits in Bangladesh is 44.8 gm. However, sharp increase (58.02%) was taken place in the

[1&2]Respectively Principal Scientific Officer and Scientific Officer, Agricultural Economics Division, Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur-1701, [3]Chief Scientific Officer, Pomology Division, Horticulture Research Centre (HRC), BARI, Gazipur, Bangladesh.

per capita consumption of fruits in the country over the period from 2000 to 2010 (HIES, 2010).

Mango (*Mangifera indica*) is one of the important fruits of Bangladesh. It occupies a total area of land 30.80 thousand hectares with a total production of 956.87 thousand tons having an average yield of 31.07 ton/ha (BBS, 2013). In the last couple of years, mango production is increasing due to the introduction of improved varieties and production techniques as well as increased market demand (Fig 1). The area and production of mango are increasing at the rate of 1.5% and 5.3% in the last ten years, respectively.

Fig 1. Area, production and yield of mango, 2005-2014.

Source: Various issues of BBS (2005-2014).

There are some intensive mango growing districts in Bangladesh, where mangoes are produced commercially and marketed in other areas of the country. Therefore, mango needs to be transported to a long distance to reach the ultimate consumers under the prevailing marketing system. Mangoes are bulky and perishable in nature and maintaining cool chain is not always possible due to higher cost involvement. In the peak season, there is an excess supply creating a glut in the market and causing a fall in the price and affecting the incomes of the farmers. However, both pre-harvest and postharvest factors are responsible for the postharvest losses of mango. A huge amount of mangoes are damaged every year due to their perishability, seasonality, bulkiness, poor infrastructure, and poor pre- and postharvest practices in Bangladesh that need to be taken into consideration. Due to inefficient marketing system, farmers are forced to sell their mangoes at lower price.

Efficient marketing system usually ensures higher producer's share, reducing the number of middlemen in the supply chain, and restricting the marketing charges and mal-practices during marketing of farm products (Matin *et al.,* 2008). It is,

therefore, essential to study the existing supply chain of mango in order to suggest suitable channel for the producers, appropriate technology for postharvest handling, and proper safety measures for the key stakeholders of the supply chain to ensure food quality and safety for the consumers.

The study was conducted with a view to developing capacity to reduce postharvest losses in Horticultural Chains in SAARC countries to promote, support and implement good practices in order to minimize postharvest losses and improve quality and safety in horticultural supply chains. Therefore, the study was conducted with the following objectives:

   i.   To investigate the supply chain of mango marketing;

   ii.   To estimate the marketing costs and margins at different stakeholders levels in mango supply chains;

   iii.   To assess the postharvest losses of mango at producers' and traders' level; and

   iv.   To identify the problems and constraints in mango supply chain.

Methodology

Study area selection: Mango is an important fruit of Bangladesh. It grows more or less every parts of the country. However, Chapai Nawabganj, an intensive mango growing district, was purposively selected for this study. The district was selected in consultation with the personnel of Department of Agricultural Extension (DAE) and the fruits scientists of Bangladesh Agricultural Research Institute for administering field and market survey. Again, two suitable *Upazilas* Shibgonj and Bholahat were selected in terms of the availability of data, convenience of data collection, and easy accessibility.

Sampling procedure and sample size: At first, a complete list of mango farmers was prepared with the help of DAE personnel. A total of 30 mango farmers (15 from each *Upazila*) were randomly selected from the list for interview to collect primary data. It was planned that in total 75 key actors in the mango supply chain (i.e. 15 each for *Faria*, *Bepari*, retailer, *Arathdar* and consumer) will be selected and interviewed, but due to the unavailability of some key actors the actual number of sample size was 68. All the actors were randomly selected and interviewed from different assemble, wholesale, and retail markets levels (i.e. *Upazila*/district/Dhaka City).

Period of study: Primary data were collected by interviewing mango farmers and traders using two structured and pre-tested interview schedules during August-September, 2015. The researcher himself along with trained enumerators collected data and information for this study.

Analytical technique: The collected data were edited, tabulated and analyzed applying simple descriptive methods. However, marketing margins of the key actors were calculated by the following equations.

$$GM_i = PR_i - PP_i \quad \text{..} \quad (1)$$

Where,

GM$_i$= Gross margin (Tk/ton) for ith intermediary
PR$_i$ = Price received (Tk/ton) for ith intermediary
PP$_i$ = Price paid (Tk/ton) by ith intermediary

$$NM_i = GM_i - MC_i - CPL_i \quad \text{..} \quad (2)$$

Where,

NM$_i$ = Net margin (Tk/ton) for ith intermediary
MC$_i$ = Marketing cost incurred (Tk/ton) by ith intermediary
CPL$_i$ = Cost of postharvest loss incurred (Tk/ton) by ith intermediary

$$CPL = (Q_{cd} + Q_{ndu}) \times P_n - Q_{nds} \times 0.5P_s \quad \text{........................} \quad (3)$$

Where,

|		
CPL	=	Cost of postharvest loss (Tk/ton)
Q_{cd}	=	Quantity damaged completely (ton)
P_n	=	Average purchase price (Tk/ton)
Q_{ndu}	=	Quantity damaged partially that could not be sold (ton)
Q_{nds}	=	Quantity damaged partially that could be sold with less price (ton)
P_s	=	Average sell price (Tk/ton)

Results and Discussion

Mango Marketing System

The process of mango marketing started with the producers and continued through certain channels until the produce reached the final consumers. Selling mango garden in advance by its owner is a common and prominent system in the study areas. However, both direct and indirect transaction between the producers or advance buyer of mango garden and consumers were found in mango marketing system. The indirect transaction was found more prominent than the direct one. A number of intermediaries such as *Bepari, Faria*, *Arathdar*, and retailer were involved in the mango marketing channel (Fig 1). *Bepari* and *Faria* were the most important middlemen in the process of mango marketing. *Bepari* traded a large volume of mangoes in both peak and lean seasons covering a long

distance. *Farias* traded volume was much lower than *Bepari*. Usually they do not store mangoes for even one night. *Arathdar* simply plays their role as a commission agent. Retailer traded in the consuming areas and their traded quantity was small. They purchase small quantity, hold long period and sell small quantity according to the consumer demand. Some institutional buyers such as PRAN Agro, Akij group, Agro Food Industries, Agro Food & Beverage, Technoprime Inc. BD. Ltd., Seazon, etc also good buyers (through *Bepari*) of mango in the study areas.

The following channels were identified in the study areas for mango marketing:

	%
1. Farmer/advance buyer >Bepari>Urban Arathdar>Urban Retailer>Urban Consumer	85.1
2. Farmer/ advance buyer >Faria>Local Arathdar>Bepari>Urban Arathdar>Urban Retailer>Urban consumer	4.8
3. Farmer/ advance buyer >Faria>Bepari>Urban Arathdar>Urban Retailer>Urban Consumer	4.2
4. Farmer/ advance buyer >Faria>Local Arathdar>Local Retailer>Local consumer	4.0
5. Farmer/ advance buyer >Local Retailer>Local consumer	1.0
6. Farmer/ advance buyer >Faria>Local Retailer>Local consumer	0.5
7. Farmer/ advance buyer >Faria>Institutional buyer	0.2
8. Farmer/ advance buyer >Bepari >Institutional buyer	0.2
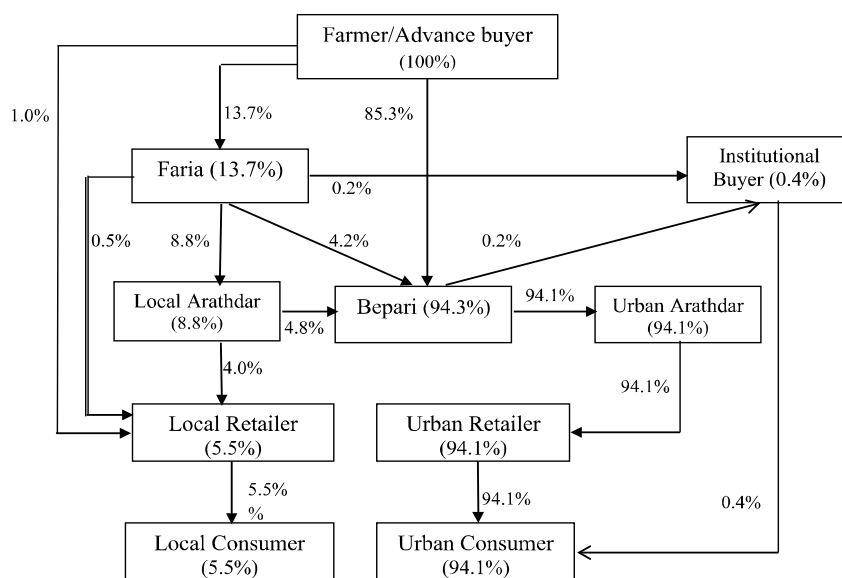
Fig 1: Flow diagram of mango supply chain.
Source: Field survey, 2015.

Volumes Traded and Seasonal Variations

The volume of mango traded by the traders varied according to seasons and due to many other factors. In the peak season[*] *Bepari, Faria* and retailers traded about four, three and five times higher quantities of mango compared to lean season respectively. On average, *Bepari* bought 62.1% mangoes from farmers and the rest from *Faria* (Table 1). On the other hand, they sold the lion share (99.8%) of mangoes to retailers through *Arathdar*. Some local *Beparis* also supplied a small percentage (0.2%) of mangoes to the local agent of the mango pulp factory situated in the study areas (Table 2). *Beparis* mainly supply low-quality sour variety of mango (*Ashina*) to the pulp factory in the lean season when the price and demand of mangoes both are low in the study areas.

Faria is an important trader in the mango supply chain. However, they purchased entire volume of mangoes from farmer and sold them to different buyers such as *Bepari*, local *Arathdar* and local agent of the mango pulp factory. *Faria* sold nearly 64.1% mangoes to local *Arathdar* followed by *Bepari* (30.5%) immediately after purchase. Retailer, an important trader in the mango supply chain, purchase mangoes from different types of traders where they get good products with lower price. However, retailer purchased the highest volume of mangoes (56.1%) directly from farmers followed by local *Arathdar* (39.7%) and *Faria* (4.2%). They sold their entire volume of mangoes to the final consumers (Table 2).

Table 1. Total volume of mangoes bought from different sellers at intermediaries' level

Key players	Peak season		Off season		Total	
	Quantity (ton)	Percent	Quantity (ton)	Percent	Quantity (ton)	Percent
A. Faria buys from:	832.36	100	258	100	1090.36	100
1. Farmer	832.36	100	258	100	1090.36	100
B. Bepari buys from:	8633	100	2249	100	10882	100
1. Farmer	5186	60.1	1576	70.1	6762	62.1
2. Faria	3447	39.9	673	29.9	4120	37.9
C. Retailer buys from:	121.44	100	14.92	100	136.36	100
1. Farmer	70.20	57.8	6.32	42.4	76.52	56.1
2. Local Arathdar	45.52	37.5	8.60	57.6	54.12	39.7
3. Faria	5.72	4.7	--	--	5.72	4.2

Source: Field survey, 2015.

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[*] The peak and lean seasons are ranged from Mid June-Mid August and Mid August to Mid September for Chapai Nawabganj district

Table 2. Total volume of mangoes sold to different buyers at intermediaries' level

Key players	Peak season		Off season		Total	
	Quantity (ton)	Percent	Quantity (ton)	Percent	Quantity (ton)	Percent
B. Faria sold to:	823.72	100	257.96	100	1081.68	100
1. Bepari	159.00	19.3	171.00	66.3	330.00	30.5
2. Local Arathdar	609.46	74.0	83.26	32.3	692.72	64.1
3. Local retailer	38.90	4.7	2.50	0.9	41.40	3.8
4. Local agent of pulp centre	16.36	2.0	1.20	0.5	17.56	1.6
A. Bepari sold to:	8230.92	100	2302.24	100	10533.16	100
1. Arathdar	8214.32	99.8	2293.24	99.6	10507.56	99.8
2. Local agent of pulp centre	16.60	0.2	9.00	0.4	25.60	0.2
C. Retailer sold to:	117.52	100	13.16	100	130.68	100
1. Consumer	117.52	100	13.16	100	130.68	100

Source: Field survey, 2015.

Buying and Selling Price of Mango

The price of mango depends on its season, variety, size, colour, freshness, and nature of supply in the market. Irrespective of these factors, the average purchase price of mango in the peak season was estimated at Tk. 37202, Tk. 37810, and Tk. 41538 per ton respectively for *Faria, Bepari,* and retailer. However, the price of mango estimated at the lean season was higher compared to peak season. In the lean season, the average purchase price of mango was estimated at Tk. 52224, Tk. 43256, and Tk. 65920 per ton respectively for *Faria, Bepari,* and retailer. There is an inverse relationship between demand and supply of mango (i.e. low supply vs high demand) exists in the lean season for which the price remained high. More or less similar trend was observed in the selling price of mango in the study areas (Table 3).

Table 3. Buying and sell price of mango in the study areas

Cost headings	Purchase price (Tk/ton)			Sell price (Tk/ton)		
	Minimum	Maximum	Average	Minimum	Maximum	Average
A. Peak season						
Faria	13435	51731	37202	34588	63654	46524
Bepari	32234	48745	37810	44583	59772	51027
Retailer	19500	75000	41538	35000	85000	51043
B. Lean season						
Faria	29688	75000	52224	37813	80833	59969
Bepari	37281	50500	43256	52000	62519	58881
Retailer	27500	105700	65920	33750	112500	73093

Source: Field survey, 2015.

Monthly Price Variation of Mango

The monthly price variations of different varieties of mango in Chapai Nawabganj district were recorded by Bangladesh Bureau of Statistics (BBS, 2013). The mango varieties Guti, Gopalbhog, Himsagar and Langra were found available in the market during May-July, and the price variation of these varieties ranged from Tk.33.97 to Tk.81.58 per kg. The variety Fazli remained available during June-September and its price ranged from Tk. 47.55-Tk.81.45 per kg. The late variety Ashina was found available during July in the market until September and its price ranged from Tk. 41.31-Tk.63.53 per kg. In the months of August and September, only two varieties namely Fazli and Ashina remained available in the market (Fig 2). The sale price of Ashina variety is significantly higher during these months only because of its late arrival in the market, although it is relatively a poor quality mango (i.e. less sweet, less taste, less nutrition, less customer appeal). This variety requires less care. Therefore, the number of Ashina orchard is increasing year after year since the growers receive more profit than other varieties that have more suppliers and market competition (Hassan *et al*., 2014).

Fig 2. Monthly price variation of different mango varieties, 2013
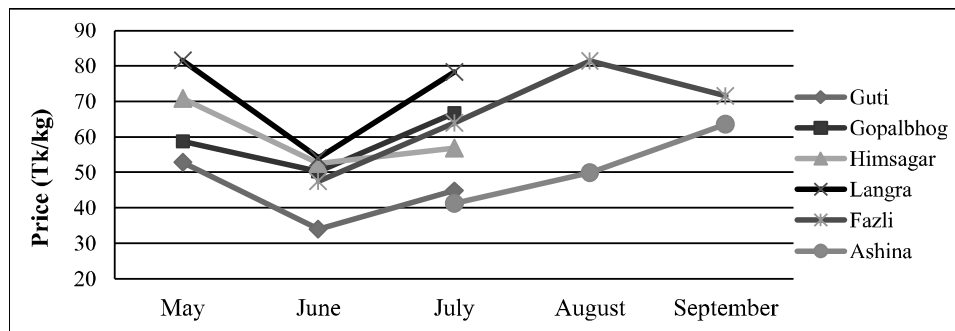
Month	Guti	Gopalbhog	Himsagar	Langra	Fazli	Ashina
May	52.84	58.69	70.85	81.58	--	--
June	33.97	50.28	52.55	54.10	47.55	--
July	44.81	66.75	56.86	78.25	63.99	41.31
August	--	--	--	--	81.45	49.94
September	--	--	--	--	71.56	63.53

Source: BBS, 2013.

Factors Influencing Mango Price

It has been stated earlier that mango price is depended on many factors. Mango size was one of the most important characters that highly influenced its price. On an average, about 87% traders mentioned this character that influence mango price. The second highest influencing factor was mango variety which was reported by 84.2% traders in the study areas. Most of the traders (71%) also mentioned that growing or harvesting season influenced mango price to some extent. The price remained very high during early season and late season when the supply of mango remained low, whereas the price remained low in the peak season. Product quality is also important to influence mango price. The other factors that influence price were reported to be bad weather and difficulties in transportation (Table 4).

Table 4. Factors influencing the price of mango

Influencing factors	% of responses by traders			
	Faria *(n=15)*	Bepari *(n=10)*	Retailer *(n=13)*	All trader *(n=38)*
1. Product size	93.3	70.0	92.3	86.8
2. Mango variety	86.7	80.0	84.6	84.2
3. Season	73.3	50.0	84.6	71.0
4. Product quality	26.7	40.0	53.8	39.5
5. Bad weather	13.3	40.0	--	15.8
6. Transportation defect	6.7	--	15.4	7.9

Source: Field survey, 2015.

Marketing Costs and Margins

The costs and margins in mango marketing for different traders are shown in Tables 5 and 6 respectively. Mango traders spent on various activities during mango marketing. Among different traders, *Bepari* incurred the highest average marketing cost of Tk. 7337.9 followed by retailer (Tk.1217.9) and *Faria* (Tk.738.2). *Beparis* incurred the highest costs due to higher *Arathdar* commission (Tk.4509.2/ton) and transportation (Tk.2083/ton). The table further reveals that transportation shared the highest cost to the total costs for retailer and *Faria* followed by personal expenses.

Table 5. Marketing cost of mango at traders level

Cost headings	Faria		Bepari		Retailer	
	Amount (Tk/ton)	Percent	Amount (Tk/ton)	Percent	Amount (Tk/ton)	Percent
1. Arathdar commission	--	--	4509.2	61.4	--	--
2. Transportation	431.3	58.3	2083.0*	28.4	738.7	60.7
3. Loading & unloading	5.6	0.8	401.4	5.5	--	--
4. Cleaning & grading	40.0	5.4	103.3	1.4	--	--
5. Basket/cartoon	16.3	2.2	65.2	0.9	--	--
6. Shop rent	--	--	76.1	1.0	181.0	14.8
7. Market toll	67.9	9.3	8.5	0.1	38.4	3.2
8. Electricity charge	--	--	7.6	0.1	62.4	5.1
9. Sweeping	1.7	0.2	5.1	0.1	9.5	0.8
10. Personal expenses	175.5	23.8	78.5	1.1	187.9	15.4
Total cost	**738.2**	**100**	**7337.9**	**100**	**1217.9**	**100**

* Transport mangos from Chapai Nawabganj to Dhaka for *Bepari*.

Source: Field survey, 2015.

The highest gross margin was estimated for *Bepari* (Tk. 13,549.23/ton) followed by retailer (Tk. 8,978.16/ton) and *Faria* (Tk. 8,961.49/ton). Again, *Faria* received the highest net margin (Tk. 8,067.76/ton) and *Bepari* received the lowest margin (Tk. 5,393.47/ton). The highest net margin for *Faria* was due to lower marketing cost and lower postharvest losses. Generally *Faria* performed both buying and selling activities in the same day and that's why their cost of transportation along with postharvest losses remained low. *Farias* purchase the entire volume of mango directly from farmers and sell it to *Bepari* and other customers immediately after

purchase. On the contrary, the volume of transaction was the highest for *Beparis*, but their net margin was the lowest (Tk. 5,393.47/ton) due to higher marketing cost. Generally, retailers receive highest net margin in other business, but in mango marketing retailers were found to receive a reasonable net margin (Tk. 6,601.36/ton) due to higher postharvest loss (Table 6).

Table 6. Marketing margin and profit of different intermediaries

Trader type	Average purchase price (Tk/ton)	Average sale price (Tk/ton)	Gross margin (Tk/ton)	Average marketing cost (Tk/ton)	Average postharvest loss (Tk/ton)	Net profit (Tk/ton)
I	*II*	*III*	*IV=(III-II)*	*V*	*VI*	*VII=(IV-V-VI)*
Faria	37905.75	46867.24	8961.49	738.20	155.53	8067.76
Bepari	38303.92	51853.15	13549.23	7337.90	817.86	5393.47
Retailer	43146.83	52124.99	8978.16	1217.90	1158.90	6601.36

Source: Field survey, 2015.

Type of Packaging Used

Good packaging is very much important for maintaining product quality, transport to distant places, and reduce postharvest losses. Majority of the mango growers and traders agreed that good packaging has crucial role in maintaining product quality and attracting consumers. Currently, the use of conventional packaging has reduced to a great extent. On an average 69.1% key stakeholder in the mango supply chain used plastic crates with paper lining as packaging instrument. A good percentage of mango growers and local traders (*Faria*) used wooden box with tiny hole for packaging mango. Mango growers and *Faria* do not require transport mangoes to the distant places or markets. Generally, *Beparis* need transport mangoes carefully from assemble market to distant wholesale markets. That's why most of the *Beparis* (90%) used plastic crates for packaging mangos. Except *Faria*, some growers and traders also used thick/solid paper carton for packaging mangoes (Table 7).

Table 7. Type of packaging used for maintaining mango quality

Particulars	% of responses				
	Farmer *(n=30)*	Faria *(n=15)*	Bepari *(n=10)*	Retailer *(n=13)*	All *(n=68)*
1. Plastic crates with paper lining	76.7	20.0	90.0	92.3	69.1
2. Wooden box with tiny hole	56.7	53.3	--	15.4	39.7
3. Thick/solid paper carton	3.3	--	30.0	23.1	10.3

Source: Field survey, 2015.

Mode of Transportation

The key actors in the supply chain used different types of vehicles to transport mango. The use of vehicles varied from traders to traders and the length of destination markets. Farmers transported mango by using different local low-cost carriers like bicycle, rickshaw, van, and push cart. Trucks and vans were mostly used for mango transportation from the assemble markets to the destination wholesale markets. Majority of the *Farias* and retailers used rickshaw/van and *Nosimon* (5 wheeler local vehicle) to transport their mangoes. Table 8 revealed that 60% of *Farias* used rickshaw/van and the rest of them used bicycle to carry mangoes from garden to assemble markets. All the *Beparis* used truck to transport mangoes from assembles market to distant wholesale markets. *Beparis* also used rickshaw or van to transport purchased mangoes from assembles place to local *Arath* or near to truck. The highest percentage of retailers used rickshaw or van followed by bicycle for transporting mangoes from purchase place to their permanent shops.

Table 8. Mode of transportation of the traders

| Mode of transport	% of responses by traders		
	Faria *(n=15)*	Bepari *(n=10)*	Retailer *(n=13)*
1. Truck/pick up	--	100.0	7.7
2. Rickshaw/van	60.0	--	76.9
3. Bicycle	40.0	--	15.4

Source: Field survey, 2015.

Disposal Pattern and losses of Mango at Farm Level

The highest quantity of mango was produced and sold in the peak season. The highest percentage (81.12%) of mango was sold by the growers at assemble market. About 3% of the total mangos were used for family consumption and 2.03% was gifted to their relatives or others (Table 9). On an average, the total postharvest loss of mango at farm level was 14.11% of the total production. Among the losses, 7.2% was completely spoiled which had no market value at all, whereas 6.91% were blemished (semi-spoiled) that could sell half of the price. The main postharvest losses occurred at farm level was due to cut, spotted, cracks, bruising, disease infected, and insect-pest damage found at harvest those were discarded from good ones during sorting and grading. Losses were also occurred due to improper packing and transportation system at farm level. Figure 3 reveals that the perceived damages during sorting & grading and transportation were estimated to be 6.16% and 1.04% respectively. Again, 6.75% of the total loss was semi-damaged during sorting & grading and 0.16% was due to improper transportation. However, the rate of damage in peak season was higher compared to lean season.

Table 9. Disposal pattern and postharvest losses of mango at farmers' level

Key players	Peak season		Lean season		All season	
	Quantity (ton)	% of total	Quantity (ton)	% of total	Quantity (ton)	% of total
Sale	161.68	81.25	14.48	79.74	176.16	81.12
Consumption	5.20	2.61	0.76	4.19	5.96	2.74
Gift	3.80	1.91	0.60	3.30	4.40	2.03
Damage	28.32	14.23	2.32	12.78	30.64	14.11
Rotten	14.52	7.30	1.12	6.17	15.64	7.20
Blemish	13.80	6.93	1.20	6.61	15.00	6.91
Total	**199.00**	**100**	**18.16**	**100**	**217.16**	**100**

Source: Field survey, 2015.
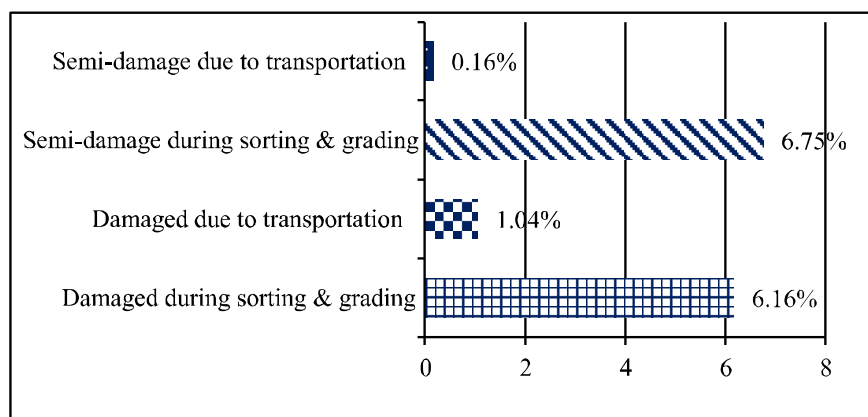
Fig 3: Percent of postharvest losses of mango at farm level.
Source: Field survey, 2015.

Postharvest Loss at Traders' Level

Table 10 showed that the total postharvest loss at trader's level was estimated at 9.61% which consisted of completely damaged mango (3.04%) and partial damaged mango (6.57%). Partial damaged mangoes could be sold at reduced price (e.g. in the study areas, it was sold at 50% of the selling price). Among intermediaries, the highest loss was recorded for retailer (4.64%) followed by *Bepari* (3.95%) and *Faria* (1.02%). The level of postharvest loss is dependent on various factors such as length of selling, type of transportation used, packaging system, etc. The volume of transaction of retailer is much lower, but the length of selling is higher compared to other intermediaries. Therefore, retailer's loss was reported to be the highest among intermediaries. Most of the *Beparis* currently

used plastic crates to transport mango from assemble market to distant wholesale market that ensure lower transportation loss in the study areas.

Table 10. Total postharvest losses of mango at traders' level

Key players	Complete damage			Partial damage			Total damage		
	Total loss (ton)	Loss (kg/ ton)	% of total purchase	Total loss (ton)	Loss (kg/ ton)	% of total purchase	Total loss (ton)	Loss (kg/ ton)	% of total purchase
Faria	0.44	0.55	0.05	8.24	9.69	0.97	8.68	10.24	1.02
Bepari	131.12	13.00	1.30	217.72	26.54	2.65	348.84	39.54	3.95
Retailer	2.12	16.87	1.69	3.56	29.48	2.95	5.68	46.35	4.64
Total	133.68	30.42	3.04	229.52	65.71	6.57	363.2	96.13	9.61

Source: Field survey, 2015.

All the intermediaries stated that the loss incurred in the supply chain due to spoilage (not suitable for marketing) caused by short-time storage (1-2 days), improper handling during sorting & grading, transportation, and delayed sell. The percentage shares of postharvest losses at different stages in the supply chain are shown in Fig 4. It was revealed that *Faria* had no postharvest loss at storage level because they did not need storage at all. The highest loss at transportation level (2.91%) was incurred for *Bepari* due to unsuitable transportation. In the case of *Faria*, the highest loss (0.73%) incurred during sorting and grading due to inappropriate handling. The postharvest loss due to delayed sell (2.82%) was found to be the highest for retailer. Irrespective of traders, the highest loss was due to transportation (3.19%) followed by delayed sell (3.12%) and sorting & grading (1.85%).
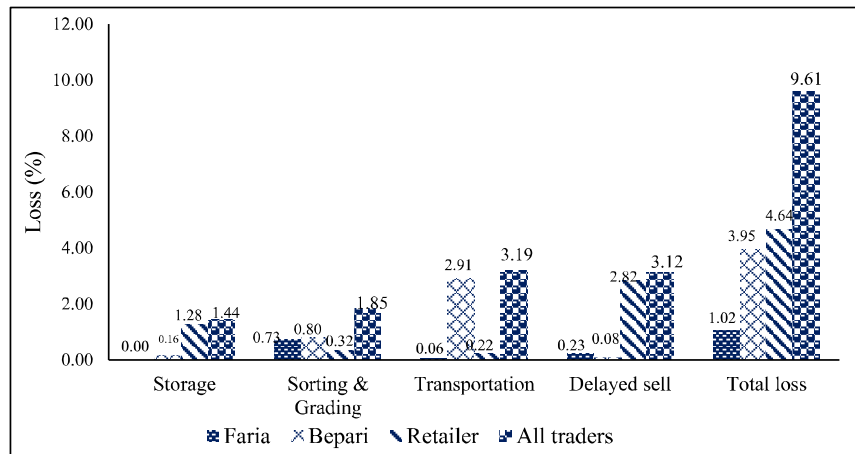
Fig 4. Postharvest losses at different stages of mango supply chain.
Source: Field survey, 2015.

Problems of Mango Marketing

The key actors in the supply chain encountered various problems with the produce on arrival at the market. The highest reported problem was delayed sale (57.9%) and lack of buyers (47.3%) for unstable supply. *Beparis* and retailers faced these two problems to a great extent compared to *Faria*. All the traders experienced partial damage of produces to some extent. Only 10% *Beparis* encountered mostly damage problem with their produce on arrival at the market (Table 11).

Table 11. Major problems encountered with the produce on arrival at the market

Major reason	% of responses by traders			
	Faria *(n=15)*	Bepari *(n=10)*	Retailer *(n=13)*	All trader (n=38)
1. Delayed sale	40.0	70.0	69.2	57.9
2. Lack of buyer	33.3	50.0	61.5	47.3
3. Partial decay/rotten	6.7	30.0	15.4	15.8
4. Mostly damage	--	10.0	--	2.6

Source: Field survey, 2015.

Conclusions and Recommendations

Conclusions

Mango is one of the popular fruits in Bangladesh. Due to the lack of appropriate pre- and postharvest measures, a plenty of mangoes are blemished every year. A number of middlemen are involved in the mango supply chain. Mango marketing in different chains is profitable, but it faces different problems in various stages of its marketing. However, this study identifies eight supply chains for mango marketing. The longest and dominant channel is *Farmer>Bepari>Urban Arathdar> Urban Retailer>Urban Consumer.* All the stakeholders in the mango supply chain added a good amount of net margin. *Faria* receives the highest net margin due to lower marketing cost and spoilage followed by retailer and *Bepari*. The marketing cost of mango for *Bepari* is the highest than the *Faria* and retailer due to transportation cost because they cover a long distance. Farmers and *Farias* use different local carriers like bicycle, rickshaw, and van (manual cart) to transport mango. Trucks and pick up van have been mostly used by *Bepari* to transport mango from assemble markets to urban wholesale markets. *The average postharvest losses are 14.11% and 9.61% at grower and traders' level respectively. These losses occurred due to cut, cracks, bruising, insect-pest infestation, which are discarded during sorting & grading after harvest. Transportation and delayed sale are the two main causes of losses at traders'*

level. Major marketing problems in the supply chain are delayed sale and lack of buyers.

Recommendations

Based on the findings of the study, the following recommendations are required to reduce postharvest losses, increase profitability and improve marketing system of mango.

1. Donor agency and the government would make arrangement for funding to perform the pilot project establishing pack house and cool chain management system for fresh fruits in order to reduce postharvest spoilage.

2. Technical know-how and technology related to postharvest management and nutrition should be disseminated by Bangladesh Agricultural Research Institute (BARI) and other related agencies through TV, radio, billboard, video, brochure, and mobile phone apps etc., which would have much impact on the reduction of postharvest losses.

3. The concerned authority may undertake pilot projects to establish limited number of low temperature storage facilities in production catchment areas and wholesale markets for high-value crops including mango.

4. Entrepreneurs should come forward to establish more small-scale processing plants in the intensive growing areas to minimize wastage of mango.

5. BARI and Agricultural Universities in Bangladesh should strengthen their existing capacity in terms of postharvest research and development.

End Note:

Advance buyer: Selling mango garden in advance during flouring stage by its owner is a common and dominant system in the study areas. Sometimes first advance buyer hands over the garden to second buyer with desired profit just after one or two months later. Finally, advance buyer looks after the garden throughout the season.

Faria: *Faria* is a small scale businessman that purchases produces from the farmers at village or local assemble market, and offer the same to the *Bepari* or *Arathdar*. Sometimes, he sells his produces directly to the local retailers or consumers. Their volume of purchase is generally low and use small local vehicle for transporting produces from field to assemble market.

Bepari: *Bepari* is a professional wholesale trader who makes his purchase from producer or *Faria* at the local assemble market, bring their consignment to the urban wholesale market and sell them to *Paikar* and retailer through *Arathdar*. Their volume of purchase is generally high and use truck for transporting produces from assembles market to distant wholesale markets.

Arathdar: *Arathdar* is a commission agent who has a fixed establishment and operates between *Bepari* and retailer, or between *Bepari* and *Paiker*, or between *Faria* and *Bepari*. They take commission from both of the parties but generally they do not follow any standard rule to take commission. The rate of commission in the study areas varied from 8-10% of the total sell.

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