

**MARKETING ACTIVITIES AND POST HARVEST LOSSES OF
MANGO IN CHAPAI NAWABGANJ DISTRICT OF
BANGLADESH**

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**MARKETING ACTIVITIES AND POST HARVEST LOSS OF
LANGRA VARIETY MANGO IN SELECTED AREAS OF
CHAPAI NAWABGANJ DISTRICT**

BY

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CERTIFICATE

This is to certify that the thesis entitled “**MARKETING ACTIVITIES AND POST HARVEST LOSSES OF MANGO IN CHAPAI NAWABGANJ DISTRICT OF BANGLADESH**” submitted to the Department of Agribusiness & Marketing, Faculty of Agribusiness Management, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **MASTER OF BUSINESS ADMINISTRATION (MBA)** in **MARKETING**, embodies the result of a piece of bonafide research work carried out by **MD. ABUL KALAM**, Registration No. **11-04635** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that any help or source of information, received during the course of this investigation has been duly acknowledged.

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**Dedicated to
My
Beloved Parents**

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The Author

MARKETING ACTIVITIES AND POST HARVEST LOSSES OF MANGO IN CHAPAI NAWABGANJ DISTRICT OF BANGLADESH

ABSTRACT

Mango is the one of the most important fruits in Bangladesh. A research was conducted at the Shibganj upazila under Chapai Nawabganj District. Chapai Nawabganj is the leading districts of mango production all over in the Country. A total of 80 respondents taking 40 farmers and 40 traders were interviewed from Chapai Nawabganj. The data were collected from Chapai Nawabganj districts during the period of mid-June to mid-July, 2018. The results revealed that all farmers (100%) and traders (100%) showed positive attitudes towards safe mango, and role of good packaging, and took various pre- and postharvest measures for keeping mangoes safe for the consumers. The estimated average postharvest losses were 4.82% and 5.67% at farm and traders' level respectively. At farm level, these losses occurred during time of collection (harvesting), cleaning, transportation time , late sell and natural reason but at traders' level, losses occurred due to bad road infrastructure, chemical use, bad weather and less market demand which are discarded during sorting & grading after harvest. The highest loss was occurred at Wholesaler (6.17%) followed by Retailer (6.10%). This study identifies supply chains for mango marketing. The longest and prominent channel is Farmer→ Faria → Bepari → Wholesaler →Retailer. Farmers and Middleman use different local carriers like bicycle, rickshaw, and van (manual cart) to transport mango. Retailer receives the highest net margin (154617.32 Tk./T) due to lower marketing cost and spoilage and higher selling rate followed by Bepari and Faria. Major problems to run business at traders' level are lack of information, lack of capital and unstable market price. Most of the consumers purchase mangoes from retailers. Good quality and price are the two major factors that influence them to purchase mango.

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ABBREVIATIONS AND ACRONYMS

AEZ	=	Agro-Ecological Zone
BBS	=	Bangladesh Bureau of Statistics
BCSRI	=	Bangladesh Council of Scientific Research Institute
cm	=	Centimeter
CV %	=	Coefficient of Variation Percent
T	=	Tone
DMRT	=	Duncan's Multiple Range Test
<i>et al.</i> ,	=	And others
e.g.	=	exempli gratia (latin), for example
etc.	=	Etcetera
FAO	=	Food and Agricultural Organization
g	=	Gram (s)
i.e.	=	idlest (latin), that is
Kg	=	Kilogram (s)
LSD	=	Least Significant Difference
m ²	=	Meter squares
ml	=	Millilitre
M.BA.	=	Master of Business Administration
No.	=	Number
SAU	=	Sher-e-Bangla Agricultural University
var.	=	Variety
°C	=	Degree Celsius
%	=	Percentage
NaOH	=	Sodium hydroxide
GM	=	Geometric mean
mg	=	Milligram
P	=	Phosphorus
K	=	Potassium
Ca	=	Calcium
L	=	Litre
µg	=	Microgram
USA	=	United States of America
WHO	=	World Health Organization

CHAPTER I

INTRODUCTION

Mango (*Mangifera indica*) belongs to the family Anacardiaceae, is an important and popular fruit of Bangladesh. It has a unique position in respect of nutritional quality, taste, consumer's preference etc., among the fifty kinds of fruits grown in Bangladesh (Ahmad and Sing, 2000). The fruit is believed to have originated in the Eastern India, Asam, Burma or in the Malayan region. It has been cultivated for more than 4000 years (Candole, 1984). The main mango producing countries of the world are India, Pakistan, Mexico, Brazil, Haiti, Philippines etc. India is the largest producer who alone can produce 9.30 million tons followed by Brazil, Pakistan, Mexico, Philippines, Indonesia, Haiti, China, Bangladesh, Egypt, Sudan, Srilanka and Cuba (Jacobi *et al.* 2001).

It is commercially grown in more than 40 countries. Asia is the main producer with 76.9% of the world production, followed by USA with 13.38%, Africa with 9% and less than 1% for Europe (Jacobi *et al.* 2001). It is the national fruit of India, Pakistan and the Philippines. Mango is now recognized as one of the choicest fruits in the world market for its excellent flavor, attractive color and delicious taste. It has medium calorie and high nutritional values.

Its food value is greatly dependent on its chemical composition, such as dry matter, titrable acidity, total sugar, total soluble solid and ascorbic acid which facilitates development of postharvest quality, intrinsic quality such as flavor and taste, transportability and processing. Carbohydrate content in ripe mango pulp is 16.9%. Besides, mango contains appreciable quantity of pro- vitamin A, vitamin C and soluble sugar. The unripe fruits contain nearly 50% more vitamin C than the ripe ones and the mineral content, mango holds an average position among fruits and in containing iron (Salunkhe and Desai, 1984). The fruit has really of immense value with respect of money and prosperity. In Bangladesh it is called as "King of the fruit".

In Bangladesh, mango ranks first in terms of area and seventh in terms of production. It occupies an area of 37,830 hectares of land with an annual production of 1161685 metric ton (MT) (BBS, 2017). In respect of total fruit production, it ranked seventh position among the major fruits grown in Bangladesh (BBS, 2017).

Mango grows in almost all of Bangladesh but commercial and good quality mangoes grown in the North-Western districts of the country. The leading mango growing districts of the country are Rajshahi, Chapainawabganj and greater Dinajpur. Mango is seasonal cash crop of North-Western region of Bangladesh which dominates the economy of Rajshahi and Chapainawabganj district.

Chapainawabganj is called the capital of the mango in Bangladesh. In the summer, mango businesses lead the economy of this district. Most of the farmlands of this district are full of mango orchards where various kinds of mango are producing by farmers. Chapainawabganj alone produces almost 152,285 MT of mangoes on 44,430 hectares of land (BBS, 2017). The main parts of the mango production area are Shibgonj, Bholahat and Gomastapur upazilla.

More than 50 varieties of sweet edible mangoes can be found in Rajshahi and Chapainawabganj district. It is estimated that around 85% people of the mentioned districts are directly or indirectly dependent on mango cultivation and business. Among the different varieties of mango, Mango resides in a great importance regarding production quantity, quality, taste and flavor and also unit price (Sultana *et al.*, 2018). Successful business mainly depends on proper marketing system which provides the products to consumers timely and also minimizes post-harvest loss (Hossain *et al.*, 2017).

Mango production provides more income to the farmers than any other crops. Mango production of the areas now on danger by different constraints like a high rate of pesticides, fertilizers, lack of fruit processing and preserving system, marketing facilities. Lack of fruit processing and preserving system of mango is one of the major constraints which favor a considerable postharvest losses of mango.

Scientists claim that a considerable portion of the world's total food supply and that 30 to 40 % of the crop produce harvested in the developing countries never reach to the consumer mainly because of pre and postharvest losses (Miller *et al.*, 1986). As estimated by Lashley (1984), approximately 30 to 50% of fruits go waste during postharvest handling, storage and ripening. The per capita availability of fruit is further reduced due to a high level of postharvest losses. Postharvest loss of fresh fruit is one of the important problems in the tropics. A huge quantity of nutritious fruits goes waste due to lack of proper postharvest handling and postharvest disease.

The characteristics of agricultural commodities like fruits are bulky in production and perishable in nature. The surplus production of different fruits grown in different regions is not marketed in proper time due to lack of transport and infrastructural facilities. Due to seasonal glut and absence of proper marketing system, bulk amount of harvested produce gets wasted every year. Postharvest losses occur at different points from fruit harvest to marketing chain. The extent of loss varies with the type of commodity and its level of management. In most of the developing countries, the postharvest loss is very high and it is about 50% of fresh fruits and vegetable production. Even in developed countries like USA, Postharvest loss is up to 20% (Yahia and Oubahou, 2001). The postharvest loss of fruits and vegetables in Bangladesh ranged from 23.6% to 43.5% which accounts for an annual loss Tk. 3442 crore (Hassan, 2010). Similar losses of fruits and vegetables have also been reported from other Asia-Pacific countries, for example, 40% in India, 20-50% in Indonesia, 20-50% in Korea, 27-42% in the Philippines, 16-41% in Sri Lanka, 17-35% in Thailand and 20-25% in Vietnam (Rolle, 2006). In general, the postharvest losses of fruits and vegetables in the developing countries are substantial (24-40%) as compared to the developed countries (2-20%) (Sirivatanapa, 2006).

The loss of any harvested crops has enormous negative impact on the economy of the country. By developing marketing system and adopting the appropriate techniques of postharvest technologies, a large amount of money can be saved annually which can make a significant contribution in case of food security of Bangladesh. Improved postharvest practices will bring financial gain to the farmers as well as satisfaction to the traders and consumers.

There are ample scopes for expansion of mango cultivation in Bangladesh if we can be aware about these problems. Therefore, the specific objectives of the study were to:

- a) To identify socio-economic profile of mango farmers in the study areas.
- b) To estimate pre and postharvest management and marketing activities by the mango farmers.
- c) To expose socio-economic profile of mango traders.
- d) To find out marketing activities and postharvest losses of mango by mango traders.

CHAPTER II

REVIEW OF LITERATURE

Mango is one of the favorite and delicious fruits of Bangladesh. Mango grows all over the country but cultivation of good quality mangoes with known varietal name is concentrated in the North- Western regions of Bangladesh. Postharvest management knowledge for mango is very important at producers' and various stakeholders' levels for reducing postharvest losses and ensuring food safety for the consumers. But, there have been very few systematic attempts to assess the knowledge, attitude and practices of key stakeholders (producers, traders and consumers) toward food safety, food quality, postharvest handling, and postharvest losses in mango supply chains. Unfortunately, a considerable proportion of the harvested produce never reaches the consumers mainly because of postharvest losses. The estimated postharvest losses of fruits as reported from overseas are 15-50% (Okezie 1998). Appropriate marketing infrastructure is also crucial for efficient marketing of perishable agricultural commodities. Numerous research works have been conducted on different aspects of postharvest management of fruits and marketing systems across the globe. However, little information is available on the magnitude of postharvest quantitative and qualitative losses of fruits and marketing systems at different stages of supply chain, especially in Bangladesh. Some of the available research findings pertinent to the present study have been reviewed in this section.

2.1 Postharvest quantitative loss of fruits

Estimates of postharvest losses of fruits vary widely both in the developed and developing countries (Paull 1993). Postharvest food losses have been quoted as being 15-50% for horticultural products and 10-20% for grains and oil seeds (Okezie 1998).

However, the levels of postharvest losses of horticultural products have been reported differently by different authors, for instances, 20-40% (Wills *et al.*, 2004) and 5-100% (NAS, 1978).

More specifically, the postharvest losses of banana, citrus, grapes, apples, avocado, and papaya were reported to be 20-80%, 20-95%, 27%, 14%, 43%, and 40-100%, in the developing countries, respectively (NAS,1978), Singh (1960) reported from India that the postharvest loss of fresh mango fruit due to microbial decay varied from 20-33%. Srinivas *et al.*, (1996) provided more specific reports on postharvest losses of mango of varieties 'Totapuri' and 'Alphonso', where the losses were 17.9% (3.5% in orchard, 4.9% during transportation, 4.1% in storage, and 5.4% in retail level) and 14.4% (1.9% in orchard, 3.7% during transportation, 3.7% in storage and 5.3% in retail level), respectively.

The postharvest losses of fruits and vegetables in Bangladesh have not been reliably documented. Nonetheless, there are some sporadic reports, in relation to postharvest losses, especially on a few fruit commodities. For example, postharvest loss in banana was 25-50% (Amiruzzaman, 1990), and the losses in mango were reported as 0-16.3% by Quroshi and Meah (1991), 30-35% by Mondal *et al.*, (1995) and 27.2% by Azad (2001). There is no dispute that postharvest losses of perishables are enormous throughout the world. However, there is also speculation that many of the reported figures regarding postharvest loss are guesses, and in many cases. The postharvest loss in terms of quantity and quality of fruits and vegetables occurred at all stages in the postharvest system from harvesting to consumption. Mango showed highly prominent postharvest loss because of its high perishability and climacteric pattern of respiration.

The perishability of fruits greatly varies with types. Kader (1993) categorized fruits into 4 groups in decreasing order of perishability as: 'Very High' (potential storage life less than 2 weeks; examples are tomato, cauliflower, broccoli, spinach, mushroom and sweet corn) 'High' (potential storage life 2-4 weeks; examples are banana, grapes, guava, mandarin orange, mango, papaya, melons, cabbage, green beans, brinjal and okra) 'Moderate' (potential storage life 4-8 weeks; examples are apple, pomegranate, carrot, radish and potato) 'Low' (potential storage life 8-16 weeks; examples are potato, dry onion, garlic, sweet potato, pumpkin, taro and yam).

Therefore, more emphasis should be given to those fruits of the categories, 'Very High' and 'High' perishability. Sikder (1985) conducted a survey on marketing of mango in Bangladesh which revealed the extent of damage and rotting of mango fruits transported by rail and truck varied from 8 to 12%, respectively due to different duration of time required for transshipment. In case of boat, 10-15% damage occurred due to a relatively longer time taken in transit.

A survey was conducted by Madan and Ullasa (1991) in mango orchards, markets to determine the extent and causes of postharvest losses of mango. They found that modern postharvest technology to reduce losses had not been used by the growers and other players in the mango supply chain. Postharvest losses of up to 49% were estimated at the processing end of the marketing system. The major cause of losses was identified as postharvest diseases including stem end rot and anthracnose.

Quroshi and Meah (1991) made a survey on postharvest losses in 18 mango varieties in 161 temporary storage of wholesalers and retailers at 20 spots in six districts of Bangladesh during May-August, 1987. The average loss was 12.5 percent. In different varieties the losses varied from 6.3%, with a maximum in Dudshor and Kohitor (16.3%), followed by Himsagar (15.4%). The popular varieties Fazli and Aswina suffered losses from 6.2-17.0% and 7.5-17.5%, respectively in six districts. A linear relationship between the per cent fruit loss and the transport distance was reported. The maximum loss was recorded in Chittagong (16.2%) followed by Comilla (15.6%), the most distant retailing spots and the minimum in Chapai Nowabganj (7.6%), the production area.

Losses during the harvesting and road transport of the fruits of mango cultivars Totapuri and Alphonso were studied in Karnataka, India. The percentage of losses in terms of fruits and monetary value was evaluated immediately after harvesting in the farm, and during the transport of fruits to markets in Sri nivasapur and Bangalore by farmers and preharvest contractors. With the preharvest contractors, harvesting losses reached 3.39% for Totapuri and 2.0% for Alphonso. With the farmers, harvesting losses reached 3.62% for Totapuri and 2.0% for Alphonso. The greater losses during the transport of fruits to Bangalore were due to the longer distance between the market site and the farm.

In general, the fruits were harvested by farmers mostly by hand using a long bamboo stick with a knife and cloth bag tied at the tip. The minimum mechanical aid under such method increased the percentage of fruit losses, unlike with pre-harvest contractors who were more cautious and strict in terms of the harvesting procedure (Reddy *et al.*, 2002). Experience, area, picking stage, picking technique, number of workers and training of workers had significant effect on post-harvest losses of mango at farm level while education of producer/contractor, picking time, variety combination and average distance of farm to market had non-significant effect on losses (Mustaq *et al.*, 2005).

Postharvest losses of mangoes can vary by country, by season, and by the data collection method. Pre-harvest factors, such as insect infestation and rainfall, can have a major impact on postharvest losses. In Benin, Vayssieres *et al.*, (2008) estimated postharvest loss of mango at 17% in early April, but in mid-June this loss was very high (70%) due to attack of fruit flies. Interviews conducted in Ethiopia reported postharvest loss of mango at 26.3% (Tadesse, 1991). In Brazil, Choudhury and Costa (2004) estimated postharvest loss of mango at the rate of 28% of the total production using survey method. In Pakistan, Mushtaq *et al.*, (2005) estimated postharvest loss of mango at 31% using survey method, but this loss was little bit higher (36.1%) when it was measured by sampling technique in 2008 (Malik and Mazhar, 2008).

WFLO (World Food Logistics Organization) (2010) Appropriate Postharvest Technologies Planning Project, undertaken for the Bill and Melinda Gates Foundation, measured postharvest physical and quality losses for different fruits and vegetables in four countries. It provided detailed measurements of percentage of physical losses, percentage of mechanical damage and percentage of decay losses at the farm, wholesale and retail levels. In India, the rates of physical losses (sorted and discarded) of mango were 6.5% at farm level, 7.9% at wholesale market, and 7.1% at retail market. In the case of quality losses (% of mechanical losses), the estimates were 10.5%, 7.5% and 16% at farm, wholesale and retail market levels respectively. Another type of quality losses (% of decay) were estimated at 5%, 7% and 8.5% at farm, wholesale and retail market levels respectively.

Hasan *et al.*, (2014) estimated postharvest losses of fruits and vegetables in Bangladesh ranged from 23.6 to 43.5% of total production. The total loss of mango was estimated to be 27.4% (at growers' level 4.4%, bepari 8%, wholesaler 8% and retailer level 7%). This was probably due to conventional harvesting methods, ignorance of the pickers, and most importantly due to the carelessness of the pickers.

Damages of mango fruits included bruises, cuts, sap burn and fruit cracking. Bruises were the major cause of mango postharvest damage at the growers (51-88%) and bepari (28-100%). 24-88% bepari used straw in the bamboo basket to reduce postharvest loss during transport from one place to another, whereas 12-56% of the bepari used paper during packaging of mango. The losses are due mainly to the sub-standard postharvest practices, inadequate transport, lack of storage facility, and ignorance of the stakeholders.

From the foregoing literature it is clear that quite a large number of research works have been carried out in Bangladesh and elsewhere in the world. However, reports on important fruit mango is lacking, and a systematic approach to estimate their losses in quantitative and economic terms is the need of the time in Bangladesh.

2.2 Marketing and supply chain of fruits

Appropriate marketing infrastructure is crucial for efficient marketing of perishable agricultural commodities. Efficient transportation and product handling are needed for the trade of agricultural product and is an important factor in assuring good prices and poverty alleviation in rural areas (Khandaker *et al.*, 2009). Government should invest more for improved maintenance of road and port infrastructures. Improvements in railway container handling and enhancement of air cargo facility should also be addressed. In addition to infrastructure development, modification of policies, processes and management are also important consideration to improve timely shipping of high-value products like fruits and vegetables (World Bank, 2005). According to Ahmed (1992), there were three principal types of marketing channels in the domestic market of vegetables, such as local, regional and inter-regional.

The first type of channel is characterized by the intervention of fewer middlemen between vegetable producers and consumers; regional marketing channels consist of an extended chain of intermediaries than the local marketing channels, and the inter-regional channels are the most lengthy, both in terms of the number of traders involved between producers and consumers, and the distance over which the vegetables are transported.

A research project was carried out in Chapainawabganj district to develop suitable packages to minimize long distance transportation loss of mango during June to August 2004. In Bangladesh, fruits are generally handled and transported from one place to another in bulk in gunny bags, bamboo baskets and temporarily packing with leaves. As a result, a significant amount of fruits are damaged, and also qualitative loss occurs.. Four different types of packages, namely corrugated fiber board cartons, wooden boxes, plastic crates and bamboo baskets were used for the transportation of mango. (Roy 2005) No transportation loss was observed in any packages. Better quality mangoes were obtained after transportation in corrugated cartons, wooden boxes and plastic crates compared to traditional bamboo baskets. Additional costs of 2-3 Tk./kg for packaging can be offset by premium prices of good quality mangoes. For bulk carrying of mangoes, 20 kg plastic crates and 25 and 30 kg cartons, and for supermarket selling, 5 and 10 kg cartons were found suitable. In terms of packaging cost, the plastic crate was the cheapest and can be used for 5 to 6 years. Though bamboo baskets are cheaper and traditionally used, quite significant loss of fruits occurred.

An investigation was carried out by Yadav *et al.*, (2007) to assess the level of knowledge of mango orchardists regarding postharvest processing and marketing practices in Saharanpur and Bulandshahr districts of western Uttar Pradesh, India. The percentages of the orchardists had knowledge on postharvest management and grading were 52.13% and 51.06%, respectively. Most of the orchardists (60.64%) were not familiar with storage of fruits after harvesting. Ledger (2003) investigated mango supply chain in Australia to identify where and why quality loss occurred. Fruit temperature varied considerably with many loads fluctuating from high to low temperatures.

The changing demand in domestic and international markets for high-value product creates challenges as well as opportunities for existing supply chain. It is estimated that 70% of the jobs related to agro processing in Bangladesh are generated in rural areas. Majority of the horticultural produces like fruits are produced by small and marginal holders, but due to weak and fragmented value-chain, only small percentage of the produce reaches the growing urban market. Greater attention is required for certification and quality enforcement to ensure premium quality and safety standards of fruits in the value chain.

Initiatives are needed to improve controls over pesticide use, increase food safety standard, and reduce contamination of heavy metals for both international and domestic trades (Minten *et al.*, 2010). Kapse and Katrodia (1997) carried out an investigation on long distance road transshipment of mango. They reported that the fruits packed in corrugated fiber board boxes were the best.

The important methods of storage of perishable horticultural produce include low temperature storage (Hassan *et al.* 1998; Kader 2002) modified atmosphere (MA) storage (Hassan and Shipton 2006; Hassan and Shipton 2006a; Hassan *et al.*, 2009a; Hassan *et al.*, 2009b), controlled atmosphere (CA) storage (Wills *et al.*, 2004), use of heat treatments (Ledger 2004; Hassan *et al.*, 2004), use of ethylene scavenging chemicals (Jiang *et al.*, 2000; Hofman *et al.*, 2001; Reid 2002; Wills *et al.*, 2004) and use of application of recommended fungicides (Ogawa and Manji 1984; Ledger 2004).

Matin *et al.*, (2008) estimated the marketing cost of mango at growers' level was Tk. 133 per quintal. Among the cost items, transportation incurred the major shares, which were about 45% of the total cost. Most beparis (wholesaler) purchased mango from farmers through local arathdar (commission agent) and sold it to retailers through urban arathdar. Their average marketing cost was Tk. 446 per quintal. Beparis gross margin and net margin were Tk. 1,037 and Tk.591 respectively for transacting one quintal of mango. Retailers purchased mango from beparis through urban arathdar and sold it to the consumers. Their gross margin and net margin were about Tk. 498 and Tk. 261 per quintal respectively.

Haque and Hossain (2001) analyzed the marketing system of major fruits such as pineapple, banana, mango, guava, jackfruit and papaya both at farmers' and intermediaries' level. Four major channels were identified in fruits marketing system among which the channel-I (Farmer-Faria-Bepari-Arathdar-Retailer-Consumer) was ranked first. High price gap was found between farmers and consumers level at peak harvesting period. The postharvest losses of pineapple, banana, mango, guava, jackfruit and papaya were 13.8, 19.9, 18.7, 6.4, 10.9 and 21.7% respectively of total fruit transaction.

Ahmed and Islam (1989) assessed the impact of weather and market price on the production of mango instability. The popular varieties of mango namely, Gopalvog, Fazli, Langra, Khirshapti and Arshina were taken into consideration. The average cost of production was Tk. 10,532/ha including "on year" and "off year" period. Econometric analysis showed that 80% of the inter district variations in instability in mango output were accounted by January-February, March–April, and May-June rainfall. Market price had no significant effect on output instability. Factors associated with instability in mango production were weather, unfavorable environmental condition, attack of insects and diseases, and increasing number of aged trees.

2.3 Food quality and safety

Quality control is very important in both domestic and international trades. Care must be taken to maintain the quality of foods at all levels of marketing (assembling, cleaning, sorting, packaging and processing). Formulation of uniform arrangement, setting of standards, capacity strengthening of grades and standards of food products, investment in packing and packaging, safe storage and develop and enforce appropriate regulatory mechanism to control indiscriminate use of harmful additives, preservatives and toxic elements in production and in the marketing chain of food stuffs are required (NFP 2006). Food safety and quality is critical to nutrition security and to ensure access to food that is nutritious and adequate quality.

The present food safety issues are mainly concerned with food-borne illness, safe use of pesticides and chemicals, and detection and assessment of food adulteration. Revision, enforcement and enactment of present laws dealing with food safety issues are of crying need, and such laws include Bangladesh Pure Food (Amendment) Act 2005 and Consumers' Rights Protection Act 2009. Research and development of practical testing kits to identify use of chemicals, pesticides, insecticides, additives, preservatives and toxic elements at the production, processing, distribution and consumption levels is essential. The kit should be made available to the sanitary inspectors, law enforcing agencies, food processor, consumers, and so on in the food supply chain.

Food safety is presently a global concern. There is public outcry on the indiscriminate use of chemicals in fruits and vegetables production and postharvest stages. The import of synthetic chemical pesticides is in increasing trend. However, non-chemical alternative in combating pests has been incorporated into the presently used chemical control measures.

As an alternative, sex pheromone trap has been found to be cost-effective and useful to grow poison-free fruits. However, the growers express little interest in adopting this technology (Hossain 2010). In addition, exploitation of natural disease tolerance of fruits can reduce the dependency on chemical control (Hassan *et al.*, 2007; Hassan *et al.*, 2009). To go along with the increasingly important food safety requirements for high-value products, investments are needed in the laboratory and testing infrastructure to make them compatible with international standards. This will require modern equipment, skilled manpower, and enforcement of HACCP (Hazard Analysis and Critical Control Points) in order to control all types of food contamination during the entire supply chain (Minten *et al.*, 2010).

CHAPTER III

MATERIALS AND METHODS

3.1 Study Area Selection

Mango is considered as king of fruits which is very important fruit crop in Bangladesh. It grows more or less every parts of the country. However, Chapai Nawabganj, an extensive mango growing district, was purposively selected for conducting the survey on marketing system and postharvest losses of variety mango. Again, suitable upazila in terms of the availability of data, ease of data collection, accessibility, and logistic support from each district were selected in consultation with DAE personnel and BARI scientists for administering market and survey program.

3.2 Sampling Procedure

For conducting the survey at household and market level, a complete list of farmers cultivating mango was prepared with the help of DAE personnel. At first, a total of 40 mango farmers were selected from the list for interview by applying simple random sampling technique to collect primary data. Secondly, it was planned that a total of 80 key actors in the mango supply chain will be selected and interviewed, but due to the unavailability of some key actors the actual number of sample size was 40. All the actors were purposively selected and interviewed from different assemble, wholesale, and retail markets.

3.3 Period of study

Primary data were collected by interviewing mango farmers and traders using a structured and pre-tested interview schedule during mid-June to mid-July, 2018. The researcher himself along with trained enumerators collected data and information for this study.

3.4 Assessment of postharvest losses of mango

Postharvest loss assessment was carried out using pre-tested questionnaire at the different steps in marketing of fruits. The steps included growers, ‘Bepari’, wholesalers and retailers. Separate sets of interview schedules were used for each of the respondents to obtain necessary information in order to assess losses at harvest and subsequent postharvest handling stages.

3.5 Analytical Technique

The collected data were edited, tabulated and analyzed applying simple descriptive methods. However, marketing margins of the key actors in the mango supply chain were calculated by the following equations.

$$i) GM_i = PR_i - PP_i \dots\dots\dots (1)$$

Where,

GM_i = Gross margin (Tk./ton) for i^{th} intermediary

PR_i = Price received (Tk./ton) for i^{th} intermediary

PP_i = Price paid (Tk./ton) by i^{th} intermediary

$$ii) NM_i = GM_i - MC_i - CPL_i \dots\dots\dots (2)$$

Where,

NM_i = Net margin (Tk./ton) for i^{th} intermediary

MC_i = Marketing cost incurred (Tk./ton) by i^{th} intermediary

CPL_i = Cost of postharvest loss incurred (Tk./ton) by i^{th} intermediary

$$iii) CPL = Q_{cd} \times P_p + Q_{pdu} \times P_p - Q_{pds} \times 0.5P_s \dots\dots\dots (3)$$

Where,

$iCPL$ = Cost of postharvest loss (Tk./ton)

Q_{cd} = Quantity damaged completely (ton)

P_p = Average purchase price (Tk./ton)

Q_{pdu} = Quantity damaged partially that could not be sold (ton)

Q_{pds} = Quantity damaged partially that could be sold with less price (ton)

P_s = Average sell price (Tk./ton)

CHAPTER IV
RESULTS AND DISCUSSION

This chapter deals with the result and discussion of present research work. Necessary explanations and appropriate interpretations have also been made showing possible and logical basis of the findings. Survey was conducted on Marketing system and post-harvest loss of variety mango in selected areas of Chapai Nawabganj district. Two levels of interview as farmers’ level and traders’ level were conducted. However, for convenience of the discussions, the findings are systematically presented in the following sections.

4.1 Farmers level

Tabulated data at farmers’ level are presented under the following headings

4.1.1 Age

Age of the farmers varied from 38 to 63 years, the average age being 47.80 years with the standard deviation of 6.04. According to their age, the farmers were classified into three categories as “young aged” (up to 35 years), “middle aged” (36- 50 years) and “old aged” (above 50 years). The distribution of the farmers according to their age is shown in Table 1.

Table 4.1. Distribution of the respondents according to their age

Categories	Basis of categorization (year)	Respondents		Mean	SD
		Numbers	Percent		
Young	up to 35	0	0	47.80	6.04
Middle aged	36-50	30	75		
Old	Above 50	10	25		
Total		40	100		

(Source: Field survey, 2018)

Data represented in Table 1 indicate that 75% of the farmers were middle aged as compared to 25 percent being old and there was no young aged farmer.

4.1.2 Level of education

Education level of the respondents ranged from 0.5-16 in accordance with year of schooling. The average education score of the respondents was 6.40 with a standard deviation of 4.04. On the basis of their level of education, the farmers were classified into five categories as shown in Table 4.2.

Table 4.2 Distribution of the respondents according to their level of education

Categories	Basis of Categorization (schooling years)	Respondents		Mean	SD
		Numbers	Percent		
Illiterate	0	0	0	6.40	4.04
Can sign only	0.5	2	5		
Primary	1-5	18	45		
Secondary	6-10	14	35		
Above secondary	above 10	6	15		
Total		40	100		

(Source: Field survey, 2018)

Data shown in the Table 4.2 indicated that 45 percent of the farmers had primary level of education compared to 35 percent secondary, 15 percent could above secondary, 5 percent had can sign only and 0 percent had illiterate.

4.1.3 Experience

Experience scores of the farmers about experience in mango cultivation of 4 to 25 years with a mean of 11.48 and standard deviation of 4.64. On the basis of mango cultivation experience, the farmers were classified into three categories as follows in Table 4.3.

Table 4.3 Distribution of the farmers according to their experience

Categories	Basis of categorization (year of mango cultivation)	Respondents		Mean	SD
		Numbers	Percent		
Low	up to 8	14	35.00	11.48	4.64
Medium	9-16	21	52.50		
High	Above 16	5	12.50		
Total		40	100		

(Source: Field survey, 2018)

Data contained in Table 4.3 showed that 52.50 percent of the farmers had medium mango cultivation, processing and postharvest operational experience, whereas 12.50 percent had high experience and 35 percent had low experience.

4.1.4 Pesticide application

Production of insect and disease free mango is an important task for getting quality mango and higher price. Variation was observed in spraying pesticide at farmers' level. Two levels of spraying were found at field level such as up to bloom and after bloom to last (Table 4.4). Up to bloom, 2-4 times spray was done by the farmers. Among them 60% farmers applied 2 times pesticide spray, where 35% farmers prefer 3 times spray and only 5% farmers prefer 4 times pesticide spray before blooming. In terms of pesticide spray after bloom to last, 52% farmers applied 5 times spray, where 40% farmer spray 4 times. Only 2.5% farmers applied 6 times pesticide spray after bloom to last.

Table 4.4 Use of pesticides at farmer's level to keep mango insect and disease free

Particulars	No. of respondents (n=40)	% respondents
A. Up to bloom		
2 times	24	60.00
3 times	14	35.00
4 times	2	5.00
Total	40	100
B. After bloom to last		
3 times	2	5.00
4 times	6	40.00
5 times	21	52.50
6 times	1	2.50
Total	40	100

(Source: Field survey, 2018)

4.1.5 Mode of harvesting of mango

Harvesting of crop in the right way maximizes crop yield and minimizes crop losses and quality deterioration. Mango growers in the study areas are very much cautious about mango harvesting. They know well that mango quality completely depends on the proper harvesting. However, all respondent farmers harvested mango with the help of basket/jalta.

Farmers generally harvest those mangoes by hand picking which are within reach. Under the present study, for mango harvest all the respondents (100%) farmers use both baskets/jalta and by hand picking system. Only 22.50% farmers use other process for mango collection. But maximum mango harvested (89.38%) was done by means of basket/jalta where by hand picking was only 9.35% (Table 4.5).

Table 4.5 Mode of harvesting of mango in the study areas

Means of harvesting	Number of respondents	% respondents
By hand	15	37.5
Basket/jalta	25	62.5
Others	0	0
Total	40	100

(Source: Field survey, 2018)

4.1.6 Placing of mango immediate after harvest

In practice, majority of the mango growers performed different actions to make mangoes clean for the consumers. Ninety percent of the respondent growers placed mangoes on open ground after harvest, whereas 55% used plastic crates for keeping mangos clean. Forty percent growers used unfold above gunny/plastics, whereas 27.50% used cleaned plastic's bag/jute's bag and only 7.5% farmers used container for immediate after harvesting to keep mango clean (Table 4.6).

Table 4.6 Placing of mango immediate after harvest

Type of container	No. of respondent (<i>n</i> =40)	% of responses
Open ground	36	90.00
Unfold above gunny/plastics	16	40.00
Bamboo's basket/cage	6	15.00
Karret	22	55.00
Plastic's bag/Jute's bag	11	27.50
Container	3	7.50

(Source: Field survey, 2018)

4.1.7 Status of mango production

Fruits are highly valued in human diet mainly for vitamins and minerals. In the study area the total collection of mango was 3.64 tones, where 0.172 tones was unsuitable to sell due to cause of postharvest fault and total postharvest loss was 0.1742 tons of mango (Table

4.7). The total amount to sell was 3.64 tones, where total selling price was Tk. 1504617.329 per tones. Production of mango in our country is not sufficient. Moreover, a large quantity of mango was gone to damage. So, proper care should be taken about postharvest handling of mango.

Table 4.7 Mango Production and selling status by the selected mango farmers

Production and selling status of mango	Amount (T)	% of total	Average selling Price (Tk./T)
Total collection (T)	3.64	100	1504617.329
Unsuitable to sell (T)	0.172	4.72	
Total amount of sell (T)	3.52	96.70	
Amount of post-harvest losses (T)	0.1742	4.82	

(Source: Field survey, 2018)

4.1.8 Post harvest losses of mango at farmers' level

Postharvest losses of mango in farmers' level were separately calculated and presented in Table 5. The higher postharvest loss at the farmer's levels would possibly due to the lack of timely harvest of mango, transportation, storage facilities etc. The highest postharvest loss at farmers' level was estimated due to cause of collection time (3.945 tones out of 6.969 i.e. 56.61% of total postharvest loss) where 15.05%, 11.45%, 7.62%, 5.80% and 3.47% postharvest loss was occurred due to cause of Transportation time , Cleaning, Causes of late sell, Natural reason and others, respectively (Table 4.8).

Table 4.8. Factors contributing to postharvest loss of mango at farm levels

Types of loss	Unsuitable to sell (T)	% of total loss
Collection of time	3.945	56.61
Cleaning	0.798	11.45
Transportation time	1.049	15.05
Causes of late sell	0.531	7.62
Natural reason	0.404	5.80
Others	0.242	3.47
Total loss (T)	6.969	100.00

(Source: Field survey, 2018)

4.1.9 Selling of mango to different traders

Results from the present study showed that 34.57% (1206 maund) mango was sold to Arathdar from mango producer which was highest among the total sell with average selling value of 1562.31 Tk./maund (Table 6). Farmers' sell to Arathdar was highest followed by Bapari (28.62%), Faria (27.03%), Wholesaler (8.55%) and Retailer (1.23%) with selling rate of 1524.88, 1436.80, 1644.82 and 1710.00 Tk./maund respectively. Total selling price was also highest to Arathdar (Tk. 1841143) from farmers followed by Bapari, Faria and Wholesaler. Average selling distance from farm to different traders was also highest to Arathdar (3.8 km) from farm where lowest distance was measured for Faria (0.43 km).

Table 4.9 Selling distance and total volume of mangoes sell to traders at farmers' level

To sell from farmers/ Key players	Buy mango from farmers				Selling distance (Km) from
	Amount (T)	% of total	Average Selling rate (Tk/T)	Total selling (Tk.)	
Faria	37.71	27.03	35920.00	1354538	0.43
Bapari	39.93	28.62	38122.00	1522206	3.23
Arathdar	48.24	34.57	39057.75	1884143	3.8
Wholesaler	11.93	8.55	41120.50	490568	3.25
Retailer	1.72	1.23	42750.00	73530	0.4
Total	139.53	100.00		5496644	--

(Source: Field survey, 2018)

4.1.10 Transportation cost of mango at farmers level

Results revealed that in the study area, highest amount of mango transportation (1309.96 maund i.e. 37.55% of total) from farms to selling point was done through van followed by Pick-up (30.19%), bicycle (21.94%) and Auto-Ricksha (17.57%). Average cost for transportation was lowest through Pick-up (16.00 Tk./maund) where the highest was by head (24.20 Tk./maund). No transportation of mango was done by bus. A considerable amount of mango can be transported through Auto-Ricksha, Van and Pick-up with

average transport cost of 17.25, 16.67 and 16.00 Tk./maund. Considering this situation, van could be select for low transportation cost (Table 4.10).

Table 4.10 Mode of transport and cost regarding amount at farmers' level

Mode of transport	Transportation cost			
	Transport in total mango (maund)	% of total	Total cost with total amount (Tk.)	Average cost (Tk./maund)
Auto-Ricksha	612.75	17.57	10570	17.25
Van	1309.96	37.55	21837	16.67
Bus	0.00	0.00	0.00	0.00
Pick-up	1053.13	30.19	16850	16.00
Bicycle	765.33	21.94	15842.25	20.70
By head	43.39	1.24	1050	24.20
Total	3488.25	100.00	66149.25	18.96

(Source: Field survey, 2018)

4.1.11 Different activities for marketing of mango at farmer's level

Cost for marketing of mango at farmer's level is very important. After processing of mango before marketing, unit price of mango might be increased. But processing cost is a considerable fact for the farmers. Different task was done by the farmers for marketing of their mangoes (Table 4.11). Among different task, cost of collection of mango was highest (20.93) followed by packaging cost (14.14%).

Table 4.11 Cost of processing and regarding of mango marketing at farmers' level

Category of activities	Processing cost	
	Cost estimated (Tk./T)	% of total cost
Collection of mango	22745.88	20.93
Labor Cost	10116.76	9.31
Grading	8976.65	8.26
Binding	9549.45	8.79
Packaging	15369.51	14.14
Loading	10166.21	9.35
Unloading	9986.26	9.19
Tax/tole	9774.73	8.99
Personal expense (in case of total mango)	7554.95	6.95
Others expense	4436.81	4.08
Total	108677.20	100.00

(Source: Field survey, 2018)

4.1.12 Problems related to marketing at farmers' level

Various problems were found for mango marketing with produce at farmers' level. Seven problems were selected responded by the farmers. All the problems are serious. Among the problems, some are more serious compared to others (Table 4.12). Results obtained from the study area revealed that the problem 'syndicate and dishonesty' was ranked 1st for mango marketing followed by 'preservation' system and 'restriction' to sell which are ranked 2nd and 3rd respectively. 'costing' of mango, 'quality and grading of mango', 'transportation' facilities and 'marketing distance' were also considered as serious problems which was ranked as 4th, 5th, 6th and 7th respectively.

Table 4.12 Problems of mango marketing with the produce arrival at farmers' level

Problems	% response of the farmer	Rank order
1. Marketing distance	12.49	7
2. Transportation	12.58	6
3. Quality and grading of mango	13.70	5
4. Costing	14.70	4
5. Syndicate and Dishonesty	16.24	1
6. Preservation	15.30	2
7. Restriction to sell	14.99	3
Total	100	

(Source: Field survey, 2018)

4.1.13 Steps should be taken to solve problems

To remove these problems, various steps could be made at farmers' level (Table 4.13). Among different steps of removing problems, 'remove syndicate and dishonest mind' considered as ranked 1st where 'reduce unnecessary cost' was ranked 7th opined by the farmers. 'improve the quality of the mango and sell grading system', 'manage preservation system', 'improve infrastructure and transportation', 'market should be available', and 'mango collection period should not restricted' were also considered as important steps to remove existing problems regarding mango marketing at farmers' level.

Table 4.13: Ranking of problems to be solved

Problems	% response of the farmer	Rank order
1. Market should be available	14.15	5
2. Improve infrastructure and transportation	14.80	4
3. Improve the quality of the mango selling	15.60	2
4. Reduce unnecessary cost	11.00	7
5. Manage preservation system	15.10	3
6. Remove syndicate and dishonest mind	16.10	1
7. Mango collection period should not restricted	13.20	6
Total	100	

(Source: Field survey, 2018)

4.1.14 Safe food issue

All the respondents related to mango production in the study area believed that adequate measures should be taken to keep mangoes toxic free for the consumers. They suggested a number of measures that will ensure mangoes toxic free for the consumers. All the farmers (100%) showed positive response in favor of toxic free mango production (Table 4.14).

Many steps could be measured for toxic free mango production. Among them The highest reported measures were ‘cultural practice’ (23.17%) which ranked 1st activity to obtain toxic free mango opine by farmers followed by ‘keep garden neat and clean’, ‘expire the period of poisonous toxicity’, ‘low toxic chemical use’ and ‘spray water’ which were ranked as 2nd, 3rd, 4th and 5th respectively (Table 4.14).

Table 4. 14 Measures could make mango poison free (safe) for the consumers

Particulars	% response of the farmer	Ranks
A. Should mango keep toxic free?		
Positive response	100%	1
Negative response	0	2
B. Measures to keep mango toxic free		
1. Spray water	15.33	5
2. Low toxic chemical use	16.17	4
3. Keep garden neat and clean	23.00	2
4. Cultural practice	23.17	1
5. Expire the period of poisonous toxicity	22.33	3

(Source: Field survey, 2018)

4.1.15 Steps to keep mango neat and clean

The mango growers in the study areas were asked about the significance of keeping mangoes clean for the consumers. All the growers reported that proper measures should be taken to make mangoes clean for the consumers. In practice, majority of the mango growers performed different actions to make mangoes clean for the consumers. Among the 100% respondents, 25% respondents was in favor of Regular water spray to keep mango neat and clean and this step also ranks 1st according to the opinion of the farmers. Packaging materials used was ranked 5th but it was evident that all the steps mentioned here to keep mango neat and clean are important (Table 4.15).

Table 4.15 Practices done at farmers levels to keep mango neat and clean

Type of practice	% response of the farmer	Ranks
1. Net use	18.50	4
2. Cultural practice	20.80	3
3. Regular water spray	25.00	1
4. Packaging	13.50	5
5. Chemical powder use	22.00	2
Total	100	

(Source: Field survey, 2018)

4.1.16 Collection and exchange information

Different farmers collected information relevant to mango production and marketing system from various sources. At farmers level, related information relevant to production and processing of mango, shared with each other. A large volume of farmers (87.50%) collected relevant information from other farmers where 55% farmers collect information from newspapers. About 57.5% farmers collect relevant information from other sources like TV, radio etc. Faria, Bepari, Arathdar, other merchant and participate in training were also a good source of information at farmers level (Table 4.16).

Table4. 16. Collection and exchange information at farmers' level

Sources of information	No. of respondents (n=40)	% respondents
Farmer	35	87.5
Faria	13	32.5
Bepari	8	20.0
Arathdar	8	20.0
Other merchant	14	35.0
Newspaper	22	55.0
Participate in training	20	50.0
Other sources	23	57.5

(Source: Field survey, 2018)

4.2.1 Trader's level

4.2.1.1 Age

Age of the respondents (traders') varied from 30 to 60 years, the average being 43.66 years with the standard deviation of 7.19. According to their age, the respondents were classified into three categories as "young aged" (up to 35 years), "middle aged" (36- 50 years) and "old aged" (above 50 years). The distribution of the farmers according to their age is shown in Table 4.17.

Table 4.17. Distribution of the respondents according to their age

Categories	Basis of categorization (year)	Respondents		Mean	SD
		Numbers	Percent		
Young	up to 35	8	20	43.66	7.19
Middle aged	36-50	26	65		
Old	Above 50	6	15		
Total		40	100		

(Source: Field survey, 2018)

Data represented in Table 4.17 indicate that 65% of the traders were middle aged as compared to 20 percent being young and 15 percent old. Findings again revealed that about (85 percent) of the respondents were young to middle aged.

4.2.1.2 Level of Education

Education level of the respondents ranged from 0.5-12 in accordance with year of schooling. The average education score of the respondents was 4.73 with a standard deviation of 3.03. On the basis of their level of education, the farmers were classified into five categories as shown in Table 4.18.

Table 4.18. Distribution of the respondents according to their level of education

Categories	Basis of Categorization (schooling years)	Respondents		Mean	SD
		Numbers	Percent		
Illiterate	0	0	0	4.73	3.03
Can sign only	0.5	2	5		
Primary	1-5	24	60		
Secondary	6-10	12	30		
Above secondary	above 10	2	5		
Total		40	100		

(Source: Field survey, 2018)

Although only 30 percent traders had secondary education but they are engaged in mango marketing system .60 percent trader's had primary education.

4.2.1.3 Business experience

Computed scores of the traders about experience in mango trading to 20 years with a mean of 8.93 and standard deviation of 4.53. On the basis of business experience, the respondents were classified into three categories as follows in Table 4.19.

Table 4.19. Distribution of the respondents according to their experience

Categories	Basis of categorization (year of business)	Respondents		Mean	SD
		Numbers	Percent		
Low	up to 6	13	32.50	8.93	4.53
Medium	7-13	20	50.00		
High	Above 13	7	17.50		
Total		40	100.00		

(Source: Field survey, 2018)

The result showed that 50 percent of the respondents had medium business experience, where as 17.50 percent had high experience and 32.50 percent had low business experience.

4.2.1.4 Distribution of traders

Under the present study, at trader's level, 40 respondents were interviewed to observe the present mango marketing situation. Four categories of mango traders were considered as Faria, Bepari, Wholesaler and Retailer. Each of business group, 10 respondents were selected and was interviewed (Table 4.20).

Table4.20: Distribution of the mango traders according to their business type

Traders name	Number of traders	
	Number	% of total
Faria	10	25
Bepari	10	25
Wholesaler	10	25
Retailer	10	25
Total	40	100

(Source: Field survey, 2018)

4.2.1.5 Buying of mango

Table 4.21 revealed that the volume of mango bought by the traders varied remarkably due to availability of products depends on proper timing and many other reasons (Table 4.21). Under the present study, 5 weeks mango collection (buying) by different traders was studied and found that mango buying at 4th week was highest followed by 3rd week and in 1st week was lowest (Table 4.21).

Table 4.21: Weekly buying of mangoes bought from different sellers at intermediaries' level

Traders level	Week wise buying of mango (Last 5 weeks) by traders (maunds)					Total (maunds)
	1 st week	2 nd week	3 rd week	4 th week	5 th week	
Faria	440	428	510	473	468	2319
Bepari	568	645	580	655	677	3125
Wholesaler	3430	3650	3590	3670	3400	17740
Retailer	133.5	130.5	130.5	94.5	101	590
Total	4571.5	4853.5	4810.5	4892.5	4646	23774

(Source: Field survey, 2018)

Total buying of mango at traders' level, the highest collection was by Wholesaler which was 74.62% of total buying of mango at trader's level. Retailer showed the lowest percent of mango collection (2.48%) followed by Faria (9.75%) (Table 4. 22). Average unit buying price was highest at Retailer (1642 Tk./maund) level where the lowest was recorded from Faria(1320 Tk./maund). Generally, retailer do not buy products from farmer's level directly, for this reason unit price at retailer level might be high. Local Beparis, Wholesaler also supplied mangoes to the Retailer (Table 4.22).

Table4. 22: Total buying of mango at different traders level

Traders level	Total buying of mango					
	Total collection (maund) a	% of total collection	Average buying price (Tk./maund) b	Average distance (Km)	Total buying price (Tk.) (axb)	Total Transportation cost (Tk.)
Faria	2319	9.75	1320	3	3068886	111
Bepari	3125	13.14	1338	3	4198860	0
Wholesaler	17740	74.62	1418	291	24897522	0
Retailer	590	2.48	1642	7	970007	0
Total	23774	100.00	1430	76	33135275	111

(Source: Field survey, 2018)

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 Wholesaler and local Retailer. Faria sold mangoes to local Wholesaler or Retailer and Bepari 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, Wholesaler purchased the highest volume of mangoes (74.62%) directly from Bepari and Faria. They sold their entire volume of mangoes to the national market (Table 4.22).

4.2.1.6 Selling of mango

The process of mango selling started with the producers to traders and continued through certain channels until the produce reached the final consumers. Direct and indirect transactions between the producers and consumers were found in mango marketing system. A number of intermediaries such as Faria, Bepari, Wholesaler and Retailer were involved in the marketing system of selling mango. It was found that the highest weekly selling was owned by Wholesaler and it was highest in 4th week (3557 maund) followed by 2nd week (3516 maund) followed by Bepari where the lowest was from Retailer in the 1st week (Table 4.23).

Table 4.23 Weekly selling of mangoes to different consumers at intermediaries' level

Traders level	Week wise selling of mango (Last 5 weeks) by traders (maunds)					Total (maunds)
	1 st week	2 nd week	3 rd week	4 th week	5 th week	
Faria	433	421	521	463	459	2296
Bepari	550	631	570	642	664	3056
Wholesaler	3312	3516	3382	3557	3286	17053
Retailer	101	113	114	135	122	584
Total	4396	4680	4586	4797	4531	22989

(Source: Field survey, 2018)

The highest average transportation cost related to mango selling was found from Wholesaler followed by Bepari and Faria (Table 4.24). Bepari and Faria were the most important media in the process of mango marketing in the study area. Bepari traded a large volume of mangoes in the seasons. Faria traded volume was much lower than Bepari. Usually they do not store mangoes for even one night. Wholesaler simply plays their role as a commission agent.

Table 4. 24 Total selling of mango at different traders level

Traders level	Total selling of mango					
	Total selling amount (maund) a	% of total sell	Average selling price (Tk./maund) b	Average distance (Km)	Total selling price (Tk.) (axb)	Average Transportation cost for selling of mango (Tk./T)
Faria	2296	9.99	1491	2	3430887	4418.10
Bepari	3056	13.29	1528	3	4737464	5496.80
Wholesaler	17053	74.18	1618	1	27372665	90885.50
Retailer	584	2.54	3067	4	1797390	941.70
Total	22989	100.00	--	2	37338405	101742.00

(Source: Field survey, 2018)

4.2.1.7 Postharvest losses of mango

Postharvest losses of mango in supply chain were separately calculated and presented in Table 4.25 and 4.26. In general, the losses were greater at the hands of the intermediaries, especially the 'Wholesaler (64.30 kg/1000 kg) and Retailer (59.80 kg/1000 kg). The

higher postharvest loss at the intermediary levels would possibly due to the lack of proper transportation and storage facilities. The lowest postharvest loss at trader's level was estimated by Faria (27.50 kg/1000 kg) followed by Bepari (32.40 kg/1000 kg). Among the total postharvest losses, the intermediary, Wholesaler was accounted 6.17% followed by Retailer where Faria level showed only 2.96% postharvest losses of total purchase (Table 4.26).

Table 4.25 Damage of mango per 1000 kg at different stages of marketing at traders' level

Damages of mango due to	Damage of mango per 1000 kg at traders level			
	Faria (n=10)	Bepari (n=10)	Wholesaler (n=10)	Retailer (n=10)
Loading and unloading	2.80	4.00	6.00	4.60
Sorting	1.80	2.30	2.75	3.40
Cleaning	1.80	2.40	2.70	3.60
Grading	1.80	2.70	5.15	2.60
Preserving	2.30	2.60	9.70	3.90
Packaging	3.00	3.00	2.90	5.20
Transporting	2.40	4.20	10.30	10.70
Late selling	3.50	3.50	10.20	6.00
Weight loss	3.10	4.50	8.40	13.90
Spoiled(rotten)	3.30	2.50	5.70	4.00
Others	1.70	0.70	0.50	1.90
Total	27.50	32.40	64.30	59.80

(Source: Field survey, 2018)

Table 4.26 Total postharvest damage of mango at different stages of marketing at traders' level

Traders level	Total damage of mango					
	Damage/1000 kg mango	Average cost of damage/1000 kg mango (Tk)	Total damage (Kg)	Average damage (Kg)	% of total damage	% of total purchase
Faria	27.50	1025.063	2746	274.60	5.27	2.96
Bepari	32.40	1237.68	4153	415.30	7.97	3.32
Wholesaler	64.30	2600.935	43763	4376.30	83.99	6.17
Retailer	59.80	4585.165	1440	144.00	2.76	6.10
Total	--	--	52103	--	100.00	--

The level of postharvest loss is dependent on various factors such as loading and unloading, grading, late selling, type of transportation used, packaging system, etc. The volume of transaction of Wholesaler 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 Faria and Beparis currently used plastic crates to transport mango from assemble market to distant wholesale market that ensure lower transportation loss in the study areas.

Under the present study, the reasons which are responsible for postharvest losses of mango, loading and unloading during transportation ranked first compared to other reasons followed by less market demand and Bad road infrastructure (Table4.27).

Table 4.27 Reasons of mango damage and ranking of damage reasons

Reasons	% response of the traders	Ranks
1. Bad road infrastructure	17.97	3
2. Use of chemicals	15.97	4
3. Bad Weather	12.65	5
4. Less market demand	26.12	2
5. Loading and unloading	27.29	1
Total	100	

(Source: Field survey, 2018)

Different steps can be taken to minimize postharvest loss of mango at traders' level. The selected 5 steps, 'Good storage ability' was remarked as 1st ranked step and 'Development of road infrastructure' was considered as 5th ranked. 'Carefully loading and unloading', 'Collection of mango due to market demands' and 'Less or no chemical use' were prioritize as 2nd, 3rd and 4th ranked steps respectively (Table 4. 28).

Table4.28 Steps should be taken to minimize loss

Particulars	% response of the traders	Ranks
1. Development of road infrastructure	11.81	5
2. Less or no chemical use	17.97	4
3. Collection of mango due to market demand	21.30	3
4. Carefully loading and unloading	24.46	2
5. Good storage ability	24.50	1
Total	100	

(Source: Field survey, 2018)

4.2.1.8 Marketing cost and margins at trader's level

The costs and margins in mango marketing for different traders are shown in Table 4.29 and 4.30 respectively. Mango traders spent on various activities during mango marketing. Among different traders, Wholesaler incurred the highest average marketing cost of Tk. 158885.30 followed by Bepari (Tk. 15870.81) (Table 29), Faria (Tk. 13345.95) and Retailer (Tk.2376.95). Wholesaler incurred the highest costs due to higher Transportation cost (Tk. 57.40/maund) and Packaging(with goods) cost (Tk. 6.10/maund). The table further reveals that transportation shared the highest cost to the total costs for Faria, Retailer and Bepari.

Table 4.29: Marketing cost of mango at traders' level

Items/costs	Running marketing cost of mangoes in different stages at traders' level (Tk./maund)			
	Faria (n=10)	Bepari (n=10)	Wholesaler (n=10)	Retailer (n=10)
Transportation	23.00	21.00	57.40	20.30
Loading of vehicles	4.10	2.90	4.10	0.30
Unloading of vehicles	3.10	2.30	3.00	0.50
Labour (wages)	2.80	3.00	3.00	0.40
Cleanining and grading	2.40	2.10	1.90	0.30
Packaging(with goods)	3.30	2.30	6.10	0.20
Preservation/storing	2.90	2.60	2.40	0.40
Spoiled and shortage	2.30	2.10	2.10	0.50
Commissaion(arathdar)	2.50	2.90	2.10	0.60
Market's tax	3.80	2.90	3.20	15.10
Market's tole	3.40	2.60	2.30	1.70
Weighting	3.40	2.90	2.00	1.00
Others	1.60	2.10	3.20	0.00
Total	58.60	51.70	92.80	41.30

(Source: Field survey, 2018)

Table 4.30: Total marketing cost at traders' level

Traders level	Total marketing cost (Tk.)				
	Total marketing cost/maund (Tk.)	Total amount of mango sell (T)	Total running marketing cost (Tk./T)	Average running marketing cost (Tk./T)	% of total running marketing cost
Faria	58.60	2295.5	133459.50	13345.95	7.01
Bepari	51.70	2796.3	158708.10	15870.81	8.33
Wholesaler	92.80	17053	1588853.00	158885.30	83.41
Retailer	41.30	584	23769.50	2376.95	1.25
Total	--		1904790.10	--	100.00

(Source: Field survey, 2018)

The highest gross margin was estimated for Retailer (Tk.1425/maund) followed by Wholesaler (Tk.200/maund) and Bepari (Tk.190/maund). Again, Retailer received the highest net margin (Tk.1200.29/maund) and Wholesaler received the lowest margin (Tk. 3.16/maund). The highest net margin for Retailer was due to lower marketing cost and lower postharvest losses. Generally Retailer performed both buying and selling activities in the same day and that's why their cost of transportation along with postharvest losses remained low. They 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 Wholesaler, but their net margin was the due to higher marketing cost. Bepari and Faria received a reasonable net margin (Tk.88.79 and 71.40 /maund respectively) from mango marketing (Table 31).

Table4.31. Marketing margin and profit of different intermediaries

Trader type	Average purchase price (Tk./maund)	Average sale price (Tk./maund)	Gross margin (Tk./maund)	Average marketing cost (Tk./maund)	Average postharvest loss (Tk./maund)	Net profit (Tk./maund)
I	II	III	IV=III-II	V	VI	VII=IV-V-VI
Faria	1320.00	1491.00	171.00	58.60	41.00	71.40
Bepari	1338.00	1528.00	190.00	51.70	49.51	88.79
Wholesaler	1418.00	1618.00	200.00	92.80	104.04	3.16
Retailer	1642.00	3067.00	1425.00	41.30	183.41	1200.29

(Source: Field survey, 2018)

4.2.1.9 Problems to run business and steps to solve

It is an established fact that there were some problems to run a business about mango marketing (Table 4.32). Some problems are very serious and some are less important and also manageable. According to different traders opinion, Lack of information about mango marketing is a crucial problem which is ranked 1st among the 5 selected problems. Lack of capital, unstable price and Selling in credit were ranked as 2nd, 3rd and 4th respectively where the problem High transportation cost was ranked as 5th position.

Table 4.32 Problems to run business at traders' level

Problems	% response of the traders	Rank order
1. Unstable price	16.83	3
2. Selling credit	16.67	4
3. Lack of capital	18.17	2
4. High transportation cost	16.17	5
5. Lack of information	32.17	1
Total	100	

(Source: Field survey, 2018)

Some steps could be made to solve the existing problems to run a business related to mango marketing (Table 4.33). Among the proposed 5 solutions against the problems, the 1st priority solution was 'Stable unit price' opined by the traders. The other proposed steps 'Market should be available', 'minimization of transportation cost', 'selling on cash' and 'adequate capital' also prioritized by the traders as 2nd, 3rd, 4th and 5th position respectively.

Table 4.33 Steps should be taken to solve problems to run a business

Items	% response of the traders	Rank order
1. Stable unit price	23.67	1
2. Selling on cash	19.00	4
3. Adequate capital	18.83	5
4. Market should be available	19.33	2
5. Minimize transportation cost	19.17	3
Total	100	

(Source: Field survey, 2018)

4.2.1.10 Response of the traders to cleaning of mango

Cleaning of mango after purchasing is a sensitive issue regarding postharvest loss or marketing cost or as safe food issue. At trader's level, all the traders showed negative response on cleaning of mango after purchasing (Table 4.34). This response might be due to cause of extra marketing expense.

Table 4.34 Measures could make mango neat and clean after purchasing

Particulars	% response of the farmer
Positive response	0
Negative response	100%

(Source: Field survey, 2018)

4.2.1.11 Packaging issue

Good packaging clearly communicates its product's features and allows the product to be displayed in the best possible way to highlight those features. It is also very much important for maintaining product quality, transport to distant places, and reduce postharvest.

Majority of the traders agreed that good packaging has crucial role in maintaining product quality and attracting consumers. All the traders (100%) showed positive response on role of good packaging (Table 4.35).

Most of the traders (100%) opined that plastic crate and bamboo basket was the most important packaging instrument that could maintain product quality to a great extent during transportation and handling (Table 4.35). Due to the lower cost of packaging, some Faria and retailers mentioned bamboo basket with straw lining as a good packaging instrument for mango transportation. However, 100% mango growers preferred Plastic carrate and Bamboo basket for mango packaging.

Table4.35 Role of good packaging and type of packaging used for maintaining product quality

Particulars	% of responses by traders			
	Faria (n=10)	Bepari (n=10)	Wholesaler (n=10)	Retailer (n=10)
A. Role of good packaging				
Positive response	100	100	100	100
Negative response	--	--	--	--
B. Type of packaging needed				
1. Plastic carrate	100	100	100	100
2. Bamboo basket	100	100	100	100

(Source: Field survey, 2018)

4.2.1.12 Chemical use to prevent mango rotten

The perceptions of traders on consumers' awareness about food safety in the mango marketing system are very important in promoting any product in the market. At present harmful chemical use in fruits is serious issue. Chemical use is not harmful when it is used in limit. Under the present study, 100% traders showed positive response to chemical use against mango rotten (Table 4.36).

Table4.36 Chemical use to prevent mango rotten at traders' level

Particulars	% of responses by traders			
	Faria (n=10)	Bepari (n=10)	Wholesaler (n=10)	Retailer (n=10)
Chemical use against mango rotten				
Positive response	100	100	100	100
Negative response	--	--	--	--

(Source: Field survey, 2018)

Particular steps might be considered in the local market which may ensure safe food to consume. According to the traders opinion, 'cleaning' is considered as 1st ranked step to ensure the quality and safe mango in local market among the 5 proposed terms. The other proposed steps 'damage free mango', 'insect and disease free mango', 'mature fruit' and 'no chemical use' also prioritized by the traders as 2nd, 3rd, 4th and 5th position respectively (Table 4.37).

Table 4.37 Steps should be taken to ensure the quality and safe mango practicing in local market

Particulars	% response of the traders	Ranking
1. Cleaning of mango	24.46	1
2. Damage free mango	20.33	2
3. No chemical use	17.52	5
4. Insect and disease free mango	19.67	3
5. Mature fruit	18.02	4

(Source: Field survey, 2018)

4.2.1.13 Receive information about mango business

Different traders collected information relevant to mango marketing system from various sources. Most of the traders (100%) collected relevant information from Newspaper. Faria do not depend on Arathdar for any information but 100% Faria collect information from newspapers followed by other sources of information and farmers (Table 4.38). Similarly, the trader, Bepari, Wholesaler and Retailer also depends on newspapers (100%) for information. Bepari also get more information relevant to mango marketing from training participation (90%), other sources (70%), and other Bepari (70%). In case of Wholesaler more relevant information also supplied from (80%) and training participation (80%). Retailer also gets more information from Faria (70%) and Bepari (70%).

Table 4.38 Sources of information relevant to mango marketing system

Sources of information	% information received by traders			
	Faria (n=10)	Bepari (n=10)	Wholesaler (n=10)	Retailer (n=10)
Farmer	60.00	60.00	40.00	40.00
Faria	40.00	50.00	80.00	70.00
Bepari	30.00	70.00	10.00	70.00
Arathdar	--	30.00	20.00	50.00
Other merchant	30.00	--	10.00	20.00
Newspaper	100.00	100.00	100.00	100.00
Participate in training	50.00	90.00	80.00	30.00
Other sources	80.00	70.00	60.00	40.00

(Source: Field survey, 2018)

Reliable information is urgently needed to mango marketing system. According to traders opinions, information achieved over mobile phone was the most reliable which was ranked 1st followed by newspaper, Bepari, Arathdar and other merchant (Table 4.39). Other information without cited these sources ranked last as reliable sources of information.

Table 39: Reliable source of information about business

Problems	% response of the traders	Ranking
1. Mobile phone	25.70	1
2. Other merchant	11.70	5
3. Arathdar	15.00	4
4. Bepari	18.00	3
5. Newspaper	21.50	2
6. Others	7.50	6

(Source: Field survey, 2018)

4.2.1.14 Necessity of communication

Keep good communication is very important of mango marketing system. The traders (Faria, Bepari, Wholesaler and Retailer) showed 100% positive response on necessity of communication and no traders showed negative response (Table 4.40).

Different media is also very important to keep good communication with different traders related to mango marketing system. TV was considered as the best communication media related to mango marketing system which was 100% supported by all traders. Radio also supported by all traders (100%) except retailer (10%). According to the traders, Poster, Billboard and Pamphlet was not good media to keep good communication (Table 4.40).

Practical training is the most necessary item opinioned by Faria(90%), Bepari (100%), Wholesaler (90%) and Retailer (100%) to reduce postharvest damage of mango during mango marketing procedures followed by Regular communication with the Agriculture extension officer and Discuss with farmer and other businessmen (Table 4.40).

Table4.40: Necessity of communication related to mango marketing

Particulars	% of responses by traders			
	Faria (n=10)	Bepari (n=10)	Wholesaler (n=10)	Retailer (n=10)
A. Necessity of communication				
Positive response	100	100	100	100
Negative response	--	--	--	--
B. Which media liked most				
1. TV	100	100	100	100
2. Radio	80	100	90	20
3. Poster	0	0	0	10
4. Billboard	0	0	0	0
5. Pamphlet	0	0	0	0
6. Mobile message	70	60	70	80
7. Others	70	50	60	40
C. Which instruction is necessary to reduce damage of mango				
1. Practical training	90	100	90	100
2. Discuss with farmer and other businessmen	60	60	30	50
3. Regular communication with the Agriculture extension officer	80	80	70	70
4. Study tour	0	0	0	0
5. Others	70	80	50	20

(Source: Field survey, 2018)

CHAPTER V

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusions

Mango is one of the popular fruits in Bangladesh. Due to the lack of appropriate pre- and postharvest measures and inefficient marketing system, a plenty of mangoes are blemished every year. Sufficient data and information on these areas are lacking in Bangladesh. Therefore, an attempt was taken to assess the post-harvest operation in mango supply chains.

The study reveals that most of the stakeholders (both of farmers and traders) in the mango marketing system show positive attitudes towards safe mango production, clean and fresh mango, good packaging and consumers' awareness, and take various postharvest measures keeping mangoes safe for the consumers. In most cases mango growers harvest mangoes at mature stage and used open place and bamboo basket and kerret for placing mangoes immediate after harvest.

Most growers do not use chemicals at farm level, but traders apply it against mango rotten for profitable marketing and higher price. In order to reduce spoilage and keep mango safe, most traders (Faria, Bepari, Wholesaler and Retailer) use plastic crates and bamboo basket to transport mango from assemble markets to urban wholesale markets.

The average postharvest losses were 4.82% and 5.67% at grower and traders' level respectively. These losses occurred at farmers' level due to time of collection, cleaning, transportation time, late sell and natural reason but at trader's level, losses occurred due to bad road infrastructure, chemical use, bad weather and less market demand which are discarded during sorting & grading after harvest.

Loading and unloading fault, less market demand i.e. delayed sale and bad road infrastructure are the main causes of losses at traders' level. The highest loss has been recorded for Wholesaler (6.17%) followed by Retailer (6.10%).

This study identifies eight supply chains for mango marketing. The longest and prominent channel is Farmer → Faria → Bepari → Wholesaler → Retailer. Farmers and Middleman use different local carriers like bicycle, rickshaw, and van (manual cart) to transport mango. Auto rickshaw, Van and pick up have been mostly used by traders to transport mango from assemble markets to urban wholesale markets. Retailer receives the highest net margin due to lower marketing cost and spoilage and higher selling rate followed by Bepari and Middleman. Major problems to run business at traders' level are lack of information, lack of capital and unstable market price. Most of the consumers purchase mangoes from retailers. Good quality and price are the two major factors that influence them to purchase mango.

5.2 Recommendations

Based on the findings of the study, a number of measures are required to reduce postharvest losses and supply safe and quality mangoes for the consumers.

1. Mango growers should adopt Good Agricultural Practices (GAP) during pre- and postharvest management activities (less use of pesticides, proper harvesting, harvest at mature stage, harvest at least 20 days after applying pesticides, use of clean container, hot water treatment etc.). The Horticulture Research Centre of BARI in collaboration with Department of Agriculture Extension (DAE) may arrange pre- and postharvest management training and demonstration for the stakeholders in the mango value chain.
2. The total postharvest loss of mango at farm and traders level is about 10%. A huge amount of monetary loss is occurred every year due to postharvest spoilage. Hence, loss reduction strategies need to be introduced in the value chain. Therefore, the donor agencies and the government would make arrangement for funding to perform the pilot project establishing packhouse and cool chain management system for fresh fruit.

3. The concerned authorities (Market Development Committee, Agriculture Information Service and Department of Agricultural Marketing, etc.) should take necessary steps for creating awareness about postharvest losses among the stakeholders in the supply chain. In this regard, technical know-how and technology related to postharvest management and nutrition should be disseminated through TV, radio, billboard, video, brochure, and mobile phone apps etc., which would have much impact on the reduction of postharvest losses.
4. Government should render due importance on the establishment of low temperature storage facility both at assemble and wholesale levels. 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.
5. To minimize wastage of mango, more small-scale processing facilities should be established in the intensive growing areas. Employment generation and women's involvement will be enhanced through this initiative.
6. Proper safety measures should be adopted in the assembled, wholesale and retail markets in order to ensure the nutrition and food safety for the consumers. The dosages of the recommended ripening chemicals need to be ascertained by continuous monitoring of DAE and law enforcing authority. The government and donor agencies should take initiative to establish ethylene gas based ripening chamber at assembled/wholesale market levels.
7. Continuous research is essential to mitigate diverse problems prevailing in the mango supply chain in Bangladesh. Therefore, BARI and Agricultural Universities in Bangladesh should strengthen their existing capacity in terms of postharvest research and development.

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APPENDICES

Appendix I: Questionnaire for interview at farmers' level

**Department of Agribusiness & Marketing
Sher-e-Bangla Agricultural University,
Dhaka-1207**

Questionnaire for Farmers

**Title: Marketing Activities and Post Harvest Losses of Mango in Chapainawabganj
District of Bangladesh**

Date:

Serial No:

01. Farmer's introduction:

Name:..... Age:

Educational qualification:

Experience of mango productionYear

Village:..... Upazila:

02. Total mango production and distribution:

Number of tree (productive) :.....

03. Fruits come in which month, amount of fruit (kg) and selling status:

Collection of time (weeks)	Total collections (Maund)	Unsuitable to sell (Kg)	Total sell (Maund)	Selling of Mango (Tk./maund)
First				
Second				
Third				
Fourth				
Fifth				
Total				

04. The amount of postharvest lost of mango at different phases

Types of loss	Unsuitable to sell (Kg)
Total loss (Kg)	
Collection of time	
Cleaning	
Transport's time	
Causes of late sell	
Natural reason	
Others	

5. By whom to sell mango?

Buyer's name	Amount of sell (maund)	Distance (Km)	Price (Tk./maund)
1) Faria			
2) Bapari			
3) Arathdar			
4) Wholesaler			
5) Retailer			
Total			

(1) Middleman, (2) Bepari, (3) Arathdar, (4) Wholesaler, (5) Retailer.

6. Types of transportation mode and expenses of selling mang:

Details	Auto-Ricksha	Van	Bus	Pick-up	Bicycle	By head
Transport in total (maund)						
Transportaion cost (Tk./maund)						

Types of transportation (1) Auto-Ricksha (2) Van; (3) Bus ; (4) Pick-up (5) Bicycle; (6) By head

7. Marketing cost of langra mango (in case of market selling)

Details	Total workers (person)	Wages (Tk./day)	Total cost (Tk.)
Collection of mango			
Choosing			
Grading			
Binding			
Packaging			
Loading			
Unloading			
Tax/tole			
Personal expense (in case of total mango)			
Others expense			

8. Problems to marketing langra mango and its rank

Problems	Ranking
1. Marketing distance	
2. Transportation	
3. Quality of mango and grading	
4. Costing	
5. Syndicate and dishonesty	
6. Preservation	
7. Restriction	

9. What steps should be taken you think to solve the above problems?

Suggestions	Ranking
1. Market should be available	
2. Improve infrastructure and transportation	
3. Improve the quality of the mango and sell grading system	
4. Reduce unnecessary cost	
5. Manage preservation system	
6. Remove syndicate and dishonest mind	
7. Mango collection period should not restricted	

10. Should not we keep the mango free from poisons? Put (√)

Yes No

If yes, what should be done to keep the mango free from poisons?

Particulars	Ranking
1. Spray water	
2. Low toxic chemical use	
3. Keep garden neat and clean	
4. Cultural practice	
5. Expire the period of poisonous toxicity	

11. What types of work you have taken to keep the mango neat and clean?

Particulars	Ranking
1. Net use	
2. Cultural practice	
3. Regular water spray	
4. Packaging	
5. Chemical powder use	

12. How do you collect langra mango from garden? Put (√)

i) By hand ----- (%), ii) Baskets/jalta----- (%), iii) Others ----- (%)

13. Where do you keep langra mango after collecting from garden? Put (√)

i) Open ground, ii) Unfold above gunny/plastics iii) Bamboo's basket/cage

iv) Karret v) Plastic's bag/Jute's bag (v) container

14. Information about the insecticides and pesticides used in the garden

Uses period	Uses number (frequent/season)
Up to bloom	
After bloom to last	

15. Collection & exchange information:

Where do you get the information about the cultivation of langra mango? Put (√)

Source of information	How frequent	Source of information	How frequent
<input type="checkbox"/> Farmer		<input type="checkbox"/> Other merchant	
<input type="checkbox"/> Middleman		<input type="checkbox"/> Newspaper	
<input type="checkbox"/> Bepari		<input type="checkbox"/> participate in training	
<input type="checkbox"/> Arathdar		<input type="checkbox"/> Other sources	

Thank you for your kind information

Name of the enumerators.....

Date

Appendix II: Questionnaire for interview at traders' level

**Department of Agribusiness & Marketing
Sher-e-Bangla Agricultural University,
Dhaka-1207.**

Questionnaire for Traders

**Title: Marketing Activities and Post Harvest Losses of Mango in Chapainawabganj
District of Bangladesh**

Date:

Serial No.....

1. Trader's introduction:

Name: Age:.....

Educational qualification:Business experience :..... Years

Market's name:

Upazila: District:

2. Businessman's Nature:

Faria Bepari Wholesaler Retailer

3. Information of buying langra mango (last 5 weeks)

Buying period (weeks)	Buying types (code-1)	Buying place (code-2)	Buying amount (maund)	Buying price (Tk./maund)	Transportation mode (code-3)	Distance (km)
First						
Second						
Third						
Fourth						
Fifth						
Total						

(code-1): (1) Farmer, (2) Middleman, (3) Bepari, (4) Arathdar, (5) Wholesaler, (6) Retailer

(code-2): (1) Farmer's house, (2) Primary market, (3) secondary market

(code-3): (1) Auto-Ricksha, (2) Van/auto van, (3) Bus, (4) Pick-up/troli, (5) Bicycle, (6) Truck; (7) others

4. Information of selling langra mango(last 5 weeks)

Selling period (weeks)	Buying types (code-1)	Selling place (code-2)	Selling amount (maund)	Selling price (Tk./maund)	Transportation mode (code-3)	Distance (km)	Transportation cost (Tk./maund)
First							
Second							
Third							
Fourth							
Fifth							
Total							

(code-1): (1) Consumer, (2) Middleman,(3) Bepari, (4) Arathdar, (5) Wholesaler, (6) Retailer

(code-2): (1) Farmer's house,(2) Primary market, (3) secondary market

(code-3): (1) Auto-Ricksha, (2) Van/auto van, (3) Bus , (4) Pick-up/troli, (5) Bicycle, (6) Truck; (7) others

5. The total damages in the phase of collecting and marketing of 1000 (kg) langra mango.

Step of loss	Amount of damages(kg)
Loading & unloading	
Sorting	
Cleaning	
Grading	
Preserving	
Packaging	
Transporting	
Late selling	
Weight loss	
Spoiled(rotten)	
Others	

6. What are the reasons of excess amount of damages?

Reasons:

Name	Ranking
Bad road infrastructure	
Use of chemicals	
Bad Weather	
Less market demand	
Loading and unloading	

How to minimize the losses:

Name	Ranking
Development of road infrastructure	
Less or no chemical use	
Collection of mango due to market demand	
Carefully loading and unloading	
Good storage ability	

7. Marketing cost of mangoes in different stages:

Selling place:

Distance:

Ruts in expenses	How many (maund)	How much expenses (Tk./maund)	Ruts in expenses	How many (in units)	How much expenses (Tk.)
Transportation cost			Shop's fare	Monthly	
Loading of vehicles			Fixed/current capital interest	Monthly	
Unloading of vehicles			swiper	Monthly	
Labour(wages)			Electricity bill	Monthly	
Cleanining & grading			generator cost	Monthly	
Packaging(with goods)			Mobile cost	Monthly	
Preservation/storing			Invitation cost	Monthly	
Spoiled & shortage			Account's expense	Monthly	
Commissaion(arathdar)			Personal cost		
Market's tax			Others cost		
Market's tole					
Weighting cost					
Others					

8. What are the problems arise to run the business of langra mango:

Problems	Ranking
Unstable price	
Selling credit	
Lack of capital	
High transportation cost	
Lack of information	

9. How to solve the above problems?

Name	Ranking
Stable unit price	
Selling on cash	
Adequate capital	
Market should be available	
Minimize transportation cost	

10. Should not we keep neat and clean after purchasing the mango? Yes No

(a) If yes, what should be done to keep the mango neat and clean?

.....

(b) What type of work you have done to keep the mango neat and clean?

.....

11. Have any role to keep good quality for packaging? Yes No

(a) If yes, what kinds of package should be used for transport?

Name	Ranking
Plastic carrate	
Bamboo basket	
Others	

12. Have any chemical use to prevent from the mango rotten? Yes No

If yes, what kinds of chemical use?

Chemical's name	How to use?	Doses (ml/L)

13. What are you think to ensure the quality and safety of mango practicing in local market?

Name	Ranking
Cleaning	
Damage free	
No chemical use	
Insect and disease free	
Mature fruit	

14. Collection & exchange information

(a) Where are you getting the information about the business related news of langra mango?

Source of information	How frequent	Source of information	How frequent
<input type="checkbox"/> Farmer		<input type="checkbox"/> Other merchant	
<input type="checkbox"/> Middleman		<input type="checkbox"/> Newspaper	
<input type="checkbox"/> Bepari		<input type="checkbox"/> participate in training	
<input type="checkbox"/> Arathdar		<input type="checkbox"/> Other sources	

(b) Which source is more reliable and believable for interchanging the business related information and why?

Source name	Reasons of Reliable and Believable
Mobile phone	
Other merchant	
Arathdar	
Bepari	
Newspaper	
Others	

15. Necessity of communication:

(a) Do you have any necessity to increase the safety and quality of mango and reduce the amount of damages? Yes No

(b) After harvesting of mango to increase the safety and quality of mango and reduce the amount of damages which media you like most.

TV Radio Poster Billboard Pamphlet Mobile message Others

(c) To increase the Safety and quality of the mango and reduced damages which instruction is necessary?

Practical training Discuss with farmer and other businessmen Regular communication with the Agriculture extension officer Study tour Others

Thank you for your kind information

Name of the enumerators.....

Date