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Market Assessment with Food Chain System and Export Potentiality of Horticultural Crops in Bangladesh

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University of Rajshahi

MARKET ASSESSMENT WITH FOOD CHAIN SYSTEM AND EXPORT POTENTIALITY OF HORTICULTURAL CROPS IN BANGLADESH

A thesis submitted for the degree
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BY

Rumman Shafi Quaderi
Roll No. 10610
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DEPARTMENT OF CROP SCIENCE AND TECHNOLOGY
UNIVERSITY OF RAJSHAHI
RAJSHAHI, BANGLADESH

PH. D. THESIS

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DEDICATED

TO MY

BELOVED PARENTS

DECLARATION

I, Rumman Shafi Quaderi, hereby declare that this thesis has been written independently. It has not been published anywhere before. Due references and acknowledgement have been stated properly where materials of other Authors were used.

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CERTIFICATE

This is to certify that the thesis entitled **"MARKET ASSESSMENT WITH FOOD CHAIN SYSTEM AND EXPORT POTENTIALITY OF HORTICULTURALCROPS IN BANGLADESH"** submitted to the Department of Crop Science and Technology, University of Rajshahi, Rajshahi in partial fulfillment of the requirements for the degree of **Doctor of Philosophy** embodied the result of a piece of bonafide research work carried out by **Rumman Shafi Quaderi** bearing Roll No. 10610, Registration No.0041 under my supervision and guidance. No part of the thesis has been submitted for any other degree.

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BIOGRAPHICAL SKETCH

The author is the first son of Late Parvez Lutfe Quaderi and Milu Parvez . He was born on 2nd February 1972 in Dhaka. He completed his Secondary Education from Willes Little Flower School, Dhaka in 1988 and Higher Secondary Education from Adamajee Cantonment College, Dhaka in 1990. He acquired Bachelor of Science in Agriculture (B.Sc.Ag,) Hons from Bangladesh Agricultural University(BAU) in 1995 and Mastersin Crop Botany (MS in Crop Botany)from the same University in 2002. He achieved MBA in Human Resources Management(HRM) from International Islamic University Chittagong in 2005. He obtained Post Graduate Diploma from Bangladesh Institute of Management(BIM) with Major in Personnel Management(PM) in 2010.

The author started his professional career from 2008. He worked with different Multinational Company, National NGO, Group of Companies, PrivateCompany. He attended many Symposium, Workshops, Training and courses in reputed centers like: BARD in Comilla, Proshika, American Embassy, British High Commission etc.

The author already published 03 books in “21 February Book Festival” by Bangla Academy. Two are Novel and another one is Poetry book. The author is an active member of different social organizations. He is the Executive member of “Mohammadia Housing KollayanShomitee” and “Social Development Co-operation”.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTOGRAPHS

ABSTRACT

The present study was conducted from 2010 to 2014 attempt to forecast the domestic market chain and export status of horticultural crops specially the fruits and vegetable production, estimation of domestic demand, determining the nature of market, integration of domestic and international markets, estimating growers profitability, identifying the efficient marketing channel and examining export potentials of fresh vegetables and fruits including their problems and prospects. Vegetables are occupied 5.45% & fruits are occupied 0.94% of the total cultivated land of the country. Farmers of Bangladesh are handicapped by inadequate knowledge of efficient harvest and storage practices. Market information is frequently unavailable, and harvest timing is asynchronous with market requirements. Vegetable production without supervision causes poor quality production, high percentages of rejected vegetables due to poor post-harvest handling, rough transportation and also related to the presenting irregular shape and size, different maturity indices, insects and diseases infestation, mechanical injury and moisture losses.

The low level of consumption of horticultural products in the value chain that are hindering the retail prices of fruits and vegetables. About one third of total grown fruits and vegetables are lost during transport from producers to consumers, which is affecting negatively on prices. Another reason for higher prices at the retail level are the profit earned by middlemen, who play an important role in Bangladesh in bringing fruits and vegetables from producers to markets. Finally, prices increase due to the absence of modern storage and transportation facilities such as cold stores and refrigerated vans. As a result, retailers of fruits and vegetables gain a larger profit margins, and the growers on average can receive only 71% and 48% of retail prices for fruits and vegetables respectively compared in the case of cereals. Several measures could be adopted for improving the value chain of fruits and vegetables. In order to encourage small and medium scale farmers to grow fruits and vegetables the government and non-governmental organizations could promote the formation of marketing groups and cooperatives.

The volume of exported vegetables has been increasing day by day. So it has a great prospect to earn foreign exchange by exporting vegetables from Bangladesh. All categories of exporters reported that many a times, the quality of Bangladeshi

vegetables is not acceptable by the foreign buyers and some of the countries have stopped importing Bangladeshi vegetables because of poor quality standards. 21% GDP of Bangladesh comes from agro based productions, 48% labor force are involved for agro production and the export value of agricultural products is 12%.More than 100 horticultural crops are exported from Bangladesh. Export of fresh fruits and vegetables (FFVs) from Bangladesh increased from 9,000 tons in 1992-93 to 48428 tons in 2010-2011. The major export market comprises UK (46%), Italy (8%), other EU countries (3%) and Middle East countries (43%). Export of vegetables in UK market is highly profitable and also value added but it has lengthy customs procedure. Although, a high amount of vegetable was exported in the Middle East countries due to its easy customs procedure and high value addition. More than 50 fresh fruits and vegetables are exported to UK alone**.** Besides, fresh fruits and vegetables, frozen products about 250-300 tons at a value of about US$ 3 million are exported for both ethnic and mainstream markets. The quantity of total exported fruits and vegetables were 29100 MT in 2004-2005, 33626 MT in 2007-2008 and 48428 MT in 2010-2011 with a value of US$ 4640000, US$ 69120000 and US$ 109410000 respectively. However, the trends of increasing horticultural crops occupy a significant position in our export earnings.

Development of the horticultural sector depends to a large extent on the existence of the development of the value-chain of the products and on the efficiency of the marketing system. While little value addition takes place in the form of sorting, grading, quality control and packaging, etc. for fresh products, the semi processed and processed products have reached the branding stage. Special zones for vegetable and fruits exporting can be encouraged by the government providing various services in these zones including cooling chain arrangements, development and growth of packaging and infrastructure facilities. A big stimulus can also be provided by quickly disbursing the money given as export subsidies in this sector and institutional support throughout the marketing chain.

LIST OF ABBREVIATIONS

BAFFA	Bangladesh Freight Forwarders Association
BARI	Bangladesh Agricultural Research Institute
BARC	Bangladesh Agricultural Research Council
BBS	Bangladesh Bureau of Statistics
BFVAPEA	Vegetable and Allied Products Exporters Association
BRAC	Bangladesh Rural Advancement committee
CAAB	Civil Aviation Authority of Bangladesh
DAC	Dhaka
DCCI	Dhaka Chamber of Commerce & Industry
ERB	Export Promotion Bureau
FAO	Food & Agricultural Development
FFVs	Fresh Fruits & Vegetables
GDP	Gross Domestic Production
IATA	International Air Transport Authority
LCR	Letter of Credit
ME	Middle East
MRLs	Maximum Residual Levels
OSSADP	Osun State Agricultural Development Program
PGR	Plant Growth Regulator
RMG	Ready Made Garments
UK	United Kingdom
VCA	Value Chain Analysis
VEP	Vegetable Export Potentiality
ZYL	Sylhet Osmani International Airport
BG	Biman Bangladesh Airlines
EK	Emirates Airlines
SV	Saudi Airlines
KU	Kuwait Airlines
QR	Qatar Airways
TG	Thai Airlines
SQ	Singapore Airlines
GF	Gulf Airlines
MH	Malaysian Airlines
TK	Turkish Airlines
MU	China Eastern
IT	King Fisher airlines
4H	United Airlines
CZ	China Southern

CHAPTER 1
INTRODUCTION

1.1 General Baground

Fruit and vegetable consumption have been growing rapidly in recent years in Bangladesh, as the economy grows and consumers diversify their diets. This trend is likely to continue in the future. Furthermore, domestic agricultural markets have undergone modernization due to rapid urbanization, agro-industrialization, rise of super markets and trade liberalization, and the procurement system is gradual shifting of procurement system from traditional wholesale markets toward vertically coordinated supply chains.

At present, Bangladesh's agricultural marketing system is often accused in the popular press of being inefficient. In the case of vegetables, Aratdars and Beparis have been found to be critical players in the market. Their margin is between 17-18% of the retail value and their return on working capital was found to be exceptionally high (Ref: Export promotion Beuro). Although it is possible that the high margins are due to high marketing costs, which are in turn due, for example, poor infrastructure. Inefficient marketing systems reduce demand from consumers and participation by farmers, who face significant challenges in seizing opportunities to participate in growing markets for high value, nutritious crops like fruits and vegetables. Marketing constraints include both high costs and risk. High marketing costs often stem from poor transportation networks, lack of market information, and sometimes from lack of competitiveness in the market. Production of fruits and vegetables can be very susceptible to pest outbreaks, and spoilage after harvest is an important problem due to the highly perishable nature of most fruits and vegetables. These factors in turn can lead to highly variable prices. If these constraints can be removed,

farmers will earn more by specializing in crops for which they have a comparative advantage. Given the increased importance of fruits and vegetables in nutritionally balanced diets, it will be important to have efficient marketing systems that reduce risk and allow higher prices for farmers and lower prices for consumers. Indeed, the National Food Policy Plan of Action (2008-2015) as well as the Country Investment Plan place stress on strengthening the food marketing system and improving value chains as a measure for improving food security and increasing incomes among the poor. This research, by collecting and disseminating essential data on costs and returns within the marketing systems, will identify the most cost-effective options for improving marketing system performance and propose improved policies and better exporting of fruits and vegetables from Bangladesh can prove to be very gainful activities for creating value chains and employment extensively at the grass roots level. Unlike in other-export oriented industries, the retention of value-added earnings from the export of fruits and vegetables can be one hundred percent or nearly so. This is because the import contents for large scale export of indigenously produced fruits and vegetables, unlike in the other export-oriented sectors, would be nothing or negligible.

Bangladesh climate (both tropical and sub-tropical) and soils are suitable for wide range of horticultural crops cultivation. High and medium high lands are mostly suitable for fruits and vegetables production. More than 100 vegetables, 70 fruits and 60 spices are produced represented by different species and varieties. Vegetable production is 2.9 million tons from 0.356 million ha in 2010 while fruit production is 4.2 million tons from 0.142 million ha in 2010 of land (Ref: Bangladesh Beuro of statistics 2011). Some major vegetables are egg plants, cucurbits, yard long bean, okra, radish, cauliflower, cabbage, tomato, beans, aroids, carrot, leafy vegetables etc.,

fruits namely various kinds of citrus, jackfruit, mango, pine apple, papaya, guava, banana, melon, water melon, litchi, ber, hog plum etc. and spices namely onion, garlic, ginger, turmeric, green chili and coriander etc.

Growing seasons are winter, summer and year round of distinct varieties and species. Vegetables are in winter and fruits in summer. Farming is blending of indigenous and improved varieties and technologies. Liberal seed policy facilitated introduction of exotic varieties/hybrids and strengthened research program of Research Institute and Agricultural Universities, promoted more development of varieties/hybrids of horticultural crops. Horticultural crops have market value both in domestic and export markets.

Development of the horticultural sector depends to a large extent on the existence of the level /development of the value-chain of the horticultural product and on the efficiency of the marketing system. While value addition takes place in the form of sorting, grading, quality control and packaging, etc. for fresh product, the semi processed and processed products have reached the branding stage and are considered growth products.

So far, considerable achievement has been made in the production, exports and technological realm of the sector. However, the broader goal of farmer's sustainability through successful marketing is yet to be achieved. A strategic shift is, therefore, demanded from production and technological orientation to marketing orientation. As such one needs to identify the bottleneck that is impeding growth of the sector. The cropped area under cultivation for fruits and vegetables is less then 5% and that too is seasonal in nature. The percentage of the total cropped area for vegetables is less than 2%

and the overall production and productivity have remained fairly stable. Although the overall production of fruits has also increased marginally, the yield per acre has declined.

The advantages of supply chain management are numerous, like the reduction of product losses, increase in sales, reduction of transaction costs, a better control of product quality and safety, and the dissemination of technology, capital and knowledge among the chain partners. Supply chain management tools have been developed and implemented throughout the chain to guarantee optimal chain performance. Supply chain development not only benefits the private sector but also creates spin-offs that stimulate social, economical and environmental sustainable development in the region (employment generation, added value, decreases of product losses, etc.). Public support (e.g. development of the institutional infrastructure) plays an important role to create an enabling environment for private sector development. Public support might take the form of a public private partnership in a supply chain to share experiences, risks and bottlenecks. In Bangladesh however, supply chain development is often hampered due to lack of governmental support. Institution building, raising awareness, pilot chain projects and the development are important activities to foster supply chain development. This study reviews the issues of the development of supply chains with special emphasis on challenges for vegetables retailer in Bangladesh.

Efficient agricultural marketing is critically dependent on efficient transport system. Inefficient transport service coupled with poor storage, can lead to losses as certain crops (such as milk, vegetable, fish) deteriorate quickly over time. On the other hand many developing countries like Bangladesh suffer from monopolistic, low volume, and high cost transport and marketing system. Weak transport and marketing system are hindering agricultural development means hindering the country's development.

However vegetables are generally more costly to produce per hector than traditional crops. The value or quality of vegetable will decrease rapidly once they are harvested and will keep decaying when being supplied. The revenue of food supplier will depend on the condition of the products when the foods are received. Thus, timely production and delivery of perishable foods significantly affect the supplier's revenue. In this study, efforts have been made to address the present supply chain system of perishable product (especially vegetable) implication, difficulties to change the present system and recommendation the improvement of supply chain.

1.2 Supply Chain Management and its Benefits

Managing supply chains requires an integral approach in which chain partners jointly plan and Control the flow of goods, information, technology and capital from 'farm to fork', meaning from the suppliers of raw materials to the final consumers and vice versa. In order to react effectively and quick to consumer's demand, supply chain management is consumer-oriented. It aims at coordination of production processes. Supply chain management results in lower transaction costs and increased margins. Because of the involveness of many activities and aspects it demands a multidisciplinary approach and sustainable trade relations. Supply chain partnerships are based on interdependence, trust, open communication and mutual benefits. The advantages of the supply chain management approach are numerous. Some important advantages are:

1. Reduction of product losses in transportation and storage.
2. Increasing of sales.
3. Dissemination of technology, advanced techniques, capital and knowledge among the chain partners.
4. Better information about the flow of products, markets and technologies.

5. Transparency of the supply chain.
6. Tracking & tracing to the source.
7. Better control of product safety and quality.
8. Large investments and risks are shared among partners in the chain.

1.3 Supply Chain in Agriculture in Bangladesh

Intermediaries make link between farmer and consumer. Number of intermediaries in the supply chain is a function of product type, accessibility of market, etc. Earlier studies on Bangladesh food supply chain claim that there are many intermediaries involvement and they are slicking off. A major portion of the consumers' price as profit. There are four intermediaries in the major distribution channel and they are as follows:

Faria:

Faria are small traders who dealt in product within three or four local markets and handled a small volume of product. They purchase product from farmer and sold that product either to the Beparies or the consumer. They are usually landless labourers or small farmers having no full timework on the farm (Tasnoova et al, 2006). Their volume of business is small because they possess a little capital.

Beparies:

Beparies are professional traders who purchase agricultural products from the farmers or Fariasinthe local market or in the village. They handle larger volume of product than Faria. Beparies sell their product to Arathdar.

Arathdar:

Arathdar serve as a fixed commission agent who have fixed establishment and operate between Bepari (incase of paddy miller) and retailer and charge a fixed commission by providing storage facilities.

Retailers:

Retailers are the last link in the marketing channel. They buy product fromBeparies through Arathdar and sell them to the consumer.

Bangladesh is endowed with a fertile land and favorable climate for the production of various agricultural products. Considering its potentiality, the Government has given much emphasis on the development of agricultural products and agro-based industries in the country. Vegetables, fruits, aromatic fine rice, tea and other agro products are exported regularly. Before liberation vegetables were exported in a very limited scale but export has increased remarkably in the late 1980s. The Government has taken various steps to explore the opportunities related to the export of agricultural products. The government and private sectors are working together to set up export villages for the production of quality fruits and vegetables in the country. Diversification into vegetables, crops and increasing commercialization can support the development of the agricultural sector in several ways. Vegetables constitute an important share in the total agricultural exports from Bangladesh. Vegetables also share about 11.70% to the agricultural GDP (Bangladesh Economic Review-2008).

The volume of exported vegetables has been increasing day by day. So it has a great prospect to earn foreign exchange by exporting vegetables from Bangladesh. Vegetables are occupied 5.45% & fruits are occupied 0.94% of the total cultivated land of the country (BBS 2011). Total quantity of the fruits and vegetables in the year 2004 -2005 were exported 29100 MT & value was 4640000 US$. But it increased gradually year after year & found in 2007-2008 was 33626 MT with value 69120000 US$. The country exported fruits & vegetables in the year 2010-2011 was 48428 MT with value 109410000 US$. Therefore, the vegetable sector occupies a more or less significant position in our export earning. Export of vegetables in UK market is highly

profitable and also value added but it has lengthy customs procedure. So, a high quantity of vegetables are exported in the Middle East countries due to its easy customs procedure and high value addition. Different types of vegetables and their main export market are shown in this thesis. In a developing country like Bangladesh where the number of exportable items are not many, international trade is mainly import based and the country faces serious balance of payment problems. Fluctuations in vegetable production, variation in international prices, adjustments in exchange rates and finally the variable values of export earnings are grim concerns for developing countries of South Asia and South East Asia. The fresh vegetable and fruits export have now been facing stiff competition from their counterparts from Pakistan, India and Kenya in Middle East markets including United Arab Emirates, Qatar, Kuwait, Pakistan & Indian exporters for their close proximity are able to send their goods at cheap prices through the sea route while Bangladeshi exporters have to relay on expensive air shipment. Although several studies have been conducted earlier to highlight the profitability of vegetables cultivation and to show the socio-economic consequences of the same, problem and prospect of vegetable export but the number of studies on the area of value addition, cost and return at different levels of vegetable export is vary scanty.

According to an estimate, Bangladesh can earn over a billion US dollars by exporting fruits. Thailand earns presently several billion US dollars from fruit and fruit products alone. Bangladesh can nearly match Thailand's performance in this field because this country has a bounty of tropical fruits which can be extremely satisfying to foreign customers such as mangoes, pineapples, black berries, bananas, etc. Both in whole form or in sliced and juiced forms, the fruits and fruit products in cans can fetch huge

amounts of foreign currencies for the country. But the high potentials in this area have been hardly tapped so far. Similar, if not greater potentials exist also for the export of vegetables from Bangladesh. Cumulatively, export of fruits and vegetables directly and in processed forms can help the country earn a substantial amount fairly soon provided operators in this sector are self-guided with a vision and are directed and motivated to these ends also by the government through supportive policies and infrastructural developments.

Leaders of the Bangladesh Fruits, Vegetables and Allied Products Exporters Association (BFVAPEA) have submitted recently a list of demands to the government. The demands of the association are mainly in the area of air freighting. Fast and less costly air freighting of their perishable products is the key to expanding their businesses. But it is formidably constrained by lack of air freighting capacities or high charges. Some months ago the government waived the ground handling charge of any aircraft carrying fruits and vegetables cargoes. An immediate reaction of this policy decision was seen in some foreign airlines that previously refused to carry such cargoes from Bangladesh, from their agreeing to do so in the light of the new decision. However it is ironical that while foreign airlines have been activated by the government's decision, Bangladesh Biman authorities have not yet implemented it.

Thus, Biman authorities need to be obliged to implement the decision at the fastest. The national airline at present has very limited capacities for carrying fruits and vegetables and its charges are also irrationally high. A big boost to vegetable export can take place from Biman increasing its carrying capacities and reasonably scaling down its charges. There is no reason why Biman should not take such measures because freighting these perishable products round the world would helpthe enhancestate income -- a

supplementary contribution that would justify the continuing of Biman existence. Business operators in this sector are all for chartering private carriers. But they can only viably materialize these plans after the government decision to reduce airport and other charges significantly for such private chartered flights.

Government's supports should be quickly extended in providing training to people already involved in the sector or having the potential to do so. Special exporting zones for Vegetable and fruits can be encouraged with the government helping out in the matter through providing various services in these zones including cooling chain arrangements. Government may also encourage and provide concessions for the development and growth of packaging and infrastructure facilities in this sector. A big stimulus can also be provided by quickly disbursing the money given as export subsidies in this sector and situational support throughout the marketing chain.

Bangladeshi business men despite slow growth in exports of fresh vegetables and fruits are optimistic of the potentials of these sectors. According to the recent media reports, they believe they would be able to export more fresh products if they get 'one modern processing Centre' for testing, sorting packaging facilities and efficient and hassle-free airport services. They are for a modern processing Centre to help them export more fresh produces by meeting requirements of buyers, especially in the European markets. The Bangladesh Vegetable and Allied Fruits Exporters Association has sought technical and financial supports besides allocation of land from the government for the Centre.

The fresh vegetable and fruit exporters have now been facing stiff competition from their counterparts from Pakistan, India and Kenya in Middle-East markets including

United Arab Emirates, Qatar and Kuwait. Pakistani and Indian exporters for their close proximity are able to send their goods at cheap prices through the sea-route while Bangladesh exporters have to rely on expensive air shipment. Even then the export of fresh vegetables and fruits from the country has got good market as Bangladeshi expatriates are the main buyers who prefer home-grown produces.

According to local exporters, Bangladeshis in many European cities look for fresh Bangladeshi vegetables and fruits. Earlier Britain was the major destination for local fresh vegetables and fruits. For the past few years Bangladesh has been exporting such consignments to Italy and France. According to the Export Promotion Bureau's latest data, fresh products worth US$10 million was exported in two months – July and August of the current fiscal year, nearly 7 per cent less than the export of the corresponding period of last year. The reasons were attributed to lack of modern processing Centre and timely supports from the government besides shortage of cargo services.

More than 100 horticultural crops are exported from Bangladesh. Export of fresh fruits and vegetables (FFVs) from Bangladesh increased from 9,000 tons in 1992-93 to 48428 tons in 2010-2011The major export market comprises UK (46%), Italy (8%), other EU countries (3%) and Middle East countries (43%). More than 50 fresh fruits and vegetables are exported to UK alone**.** Exports are targeted for ethnic market. Besides, fresh fruits and vegetables, frozen products about 250-300 tons at a value of about 3 million US$ are exported for both ethnic and mainstream markets. 21% GDP comes from agro based productions. 48% labor force are involved for agro production. Agricultural products export value is 12%. (Buero of statistics Bangladesh 2012).

The Horticultural sector in Bangladesh, according to a generally accepted definition, includes therange of fruits, vegetables and spices that are grown locally and sold to the final consume at various stages of processed conditions. The stated objective of this study is to identify the opportunities for further development in the Horticulture sub-sector and the constraints that prevent its development. In addition, an outline of possible interventions and results to be expected is provided in the study. Due to the wide range of fruits, vegetables and spices available and their varying requirements, this study only provides a general look across total value addition chain to identify the potential opportunity are as for development and the constraints that must be overcome to achieve that potential . The author approaches was to use a combination of primary and secondary information to gather the information that is presented in this document. The study clearly shows that the potential for the horticultural sector of Bangladesh to further develop is very attractive; yet, considering the land availability, frequency of natural calamities and international standards, it is not likely that the overall exports for the entire range of horticultural products is likely to prosper in the near future. However, a long term plan with particular focus on selected products for the local market with gradual expansion into the export market is more feasible approach.Presently the export market for Bangladeshi fresh fruits and vegetables is limited to the ethnic markets and experts believe that restrictions will be imposed on exports from Bangladesh if increasingly strict international standards are not met. Unsurprisingly however, the exporters strongly Horticulture Study believe that they are capable of adjusting to the international requirements. With regard to fresh horticultural products, transportation (air transport) is highlighted as the bottle neck, which under the present trade scenario is difficult to address. However that perspective comes from the exporters. The transporters view is that the value, quantity, return trips and to a certain extent quality of packaging of the product

is sub-standard and results in them incurring a cost to carry. Manufacturers of processed products claim they have issues with local sourcing and production. Based on identified issues, it appears that identifying and solving the issues within the local value-chains of specific fruits and vegetables will go a long way toward spurring the development of the Horticulture sub-sector as a whole. Specific products to consider are tomato, banana, bitter gourd, okra, turmeric, coriander and mango. Individual analysis of these items value chains and targeted solutions applied to them will produce results that can easily be quantified. Solutions to these items problems will spill over into others and will serve to lift the productivity of those other value-chains as well.

Export growth of fruits and vegetables was phenomenal during the period 1997-98 (300%) however, the decline during 1999-2003 has also been alarming (145%). This shows both the potential as well as vulnerability of the sector. Key export destinations are UK (28%), Saudi Arabia (23%), UAE (14%), Kuwait (13%), Qatar (6%), Bahrain (6%), and Oman (5%). The target market is primarily ethnic population. Only recently BRAC has initiated entry in the EC market through ensuring EUREP-GAP standards (Airport Records).

CHAPTER 2
REVIEW OF LITERATURE

The aim of this chapter is to review the results of some of the previous studies, which were related to the present research works. Many researches have been conducted research on vegetable production in various parts of the world. Few literatures are available on marketing and shelf life extension of vegetables. Bangladesh and many of the reports are not with adequate details and inconclusive. It is hard to find comprehensive study that has analyzed the process of marketing of Horticultural crops from the growers level to the retailers level vis-à-vis efficiency in terms of marketing system, price spread, marketing performance and postharvest behavior of those crops. Nevertheless, it would be worth while to review the available literature on these aspects.

2.1 Postharvest losses

The postharvest losses of vegetables are higher than any other cereal crops. Such losses are attributed to the perishable nature of vegetables, which causes deterioration more quickly. Losses can vary from 25 to 40% depending on the type of vegetables (Singh and Chandha, 1990). According to Rashid (1998) the total value of vegetables, produced in Bangladesh are around TK 19400 million, calculated at average retail price. About 70% of the vegetables pass through the marketing channels. If the spoilage is 10%, the loss comes to TK 1462 millions. These losses are due to inadequate knowledge on harvesting, carrying, packaging, transport and storage techniques. In the vegetable marketing channels, traders suffer from maximum losses,

because they handle and transport more quantities from one place to another than any other intermediaries (Rashid, 1998).

Pal *et.al.*(2002), were conducted an experiment in Orissa, India to determine the extent of postharvest losses occurring at different stages of handling and transportation of perishable commodities, namely tomato, cabbage and cauliflower. Total losses on these vegetables during different postharvest operations were found to be 30.3-39.6, 24.9-30.4 and 28.6-35.1% respectively. The maximum quantity of losses occurred during transportation from rural markets to urban markets. Experiments were also conducted to evaluate the qualitative losses such as change in moisture content, pH, total soluble solid, total sugar and ascorbic acid content of these commodities while storing for 20 days in ambient condition (26-32°C, 60-80%RH) reduction in moisture content of the cauliflower was found to be highest followed by the cabbage. The loss of water from tomato was less due to its comparatively impermeable outer skin. The pH value remained almost constant in the case of the tomato and cauliflower, whereas it decreased slightly in case of the cabbage. Total soluble solids and total sugar content were found to increase with the storage period, whereas a decreasing tend was observed in the case of ascorbic acid in all the cases.

Studying postharvest activities, particularly prevention of losses within a marketing context, will provide needed information and guiding principles for loss-reducing activities, as well as a potential to increase the benefits of reduced losses, higher quality and higher prices. Losses from producer to the consumer may be as high as 50%. Postharvest losses, which decrease returns of farmers for vegetables, occur mainly because of the lack of infrastructure and/or poor handling and marketing know-how (Prigojin e*t al.*2005). Training is an essential step to reduce postharvest losses and improve fresh product quality. Kader (2005) mentioned important

strategies to reduce postharvest losses in developing countries. The strategies include: (i) application of current knowledge to improve the handling systems (especially packaging and cold chain maintenance) of horticultural perishables and assure their quality and safeties (ii) overcoming the socioeconomic constraints, such as inadequacies of infrastructure, poor marketing systems and weak research and development capacity and (iii) encouraging consolidation and vertical integration among producers and marketers of horticultural crops.

A report of FAO (1997) indicated that, traders in Dhaka region incurred 9.14 % losses of the total quantities of vegetables they handled. In Chittagong region, retailers suffered maximum losses in country bean and yard long bean (10% in peak period and 7% in the lean period). In Rajshahi region, the losses of traders were higher for tomato in both peak (8%) and lean period (6%) where's-traders in Khulna region suffered 7-20% losses in certain vegetables. The main reasons for such losses of the vegetables were reported to be the physical damage, bad handling and inability to sell in time. According to Sabur (1992), on an average the loss of the marketed vegetables was 14.5%, which included 3.1% at wholesale level and 11.4% at retail level. Most of this loss was due to rots, resulted due mainly to unscientific storage method adopted by the retailers. A series of studies on vegetable marketing systems in Sindh prvince of Pakistan were carried out by Siddiqui (1977), Memon (1978), Siddiqui (1979) and Abid (1980). All these had almost the same objectives and adopted the same same research methodology. The main objectives of these studies were (i) to evaluate various marketing organization (ii) to determine the present marketing conditions, and (iii) to assess the supply and demand of major agricultural products in iternal and external markets. In fact, these studies have explained that vegetables are traded through centralized marketing systems. In the producing area,

assembly markets are functioning, markets are functioning, these markets are the main sources to supply vegetales to the terminal markets to fulfill the demand of the consumption areas. More than 85% of the vegetables are transported from assembly markets to the terminal markets. Kader *et.al* (1989) carried out and experiment and showed the performance of the MAP varies due to several factors such as initial fruit quality, maturity stage, and rate of respiration, film permeability and handling condition. Most tropical fruits are highly respiring produce, which require a highly permeable film to allow more O_2 and CO_2 transmission across the film. The permeability of most available LDPE films is not permeable enough to create an optimum MA condition of 2-5% O_2 and 5-10% CO_2 needed for most tropical fruits.

2.2 Marketing and food chain system of vegetables & fruits

Tareq *et al.* (2007) conducted a study of marketing of selected surplus fruits and vegetables in Pakistan. This study was conducted to determine the efficiency of marketing system of selected surplus vegetables and fruits of Dir District, Pakistan in 2005. Data were gathered from 360 growers of selected fruits and vegetables and 170 market functionaries. The study revealed that the existing marketing system is generally capable of handling the surplus of selected products: onion, tomato, okra, citrus, persimmon, peas, walnuts in a normal year and its efficiencies are wise nearly at par with the corresponding system in the province. It has evolved over a long period and is largely compatible with the characteristics of the project area's agricultural sector. The preharvest sale , especially of fruits the heavy dependence on Bepari, the heavy postharvest losses, and occasional scarcity of transport at peak season and when there is bumper harvest, the poor physical conditions of wholesale

market centers are the major problem areas. Price information of small farmer is not good, and the surplus product is mostly marketed in far market centers through old connections with "Arthi (Middleman) and wholesalers, which may not necessarily fetch the best possible price. Farmer's net revenue from their selected surplus produce can be improved by 15-20% by undertaking marketing system improvements through public-private sector cooperation. Farmers association needs to be formed through the existing village organizations in the project area, so as to bring about efficiency in the farming sector, embracing all aspects of production and marketing.

Osotimehin *et al* (2007)studied the market chain analysis of okra production understood that how an enterprise fits within a market chain, and the numerous links that connect all participants and transactions involved in the movement of agricultural goods from farm to consumer, allows better decisions to be made on how to produce most efficiently. Problems encountered by participants in the okra market chains were identified. The rapid market survey methodology was employed for the collection of primary data. Data were analyzed using descriptive statistics, budgetary analysis, and pair-wise ranking. The main participants in the industry were producers, traders (wholesalers and retailers), and transporters, while the main governmental agency is the Osun State Agricultural Development Program (OSSADP). Common problems confronting in the main participants in the industry were lack of access to funds, especially from formal institutions. Technical assistance needs to be provided in production and marketing of okra and access to funds has to be improved to participants to improve the market chain. OSSADP could play the role of co-coordinator among the participants in the industry.

Lohano and Mari (2005) in a study on onion market integration in Pakistan used error correction model in the presence of stationary, and concluded strong market

integration in regional markets of Pakistan. Lohano and Mari (2005) in their study on spatial price linkages in regional markets in Pakistan used classical regression model for estimation of long run equilibrium in prices across regional markets and found strong-run relationship across markets in Pakistan. Due to scarcity of information on marketing costs and margins in developing countries, FAO carried out a survey in a number of countries during 1979 to 1980. In many countries, transport cost accounted for a third of the marketing margin between producers and consumers. The reason for this fact (in Pakistan) is the comparatively higher transportation costs per kg due to long distance. Marketing costs and margin of vegetables and fruits also vary according to the perish ability and market value of the commodity. There are differences in marketing services involved, which have an effect on the share of marketing margin in relation to consumer price. Selling good quality produce in supermarkets is more expensive than selling average quality in simple market conditions. Thus there are major deficiencies in the available literature on agricultural marketing systems in Pakistan. All previous research comprised mainly descriptive analysis and used of secondary data.

Singh (2005) conducted and economic study on production and marketing of vegetables in Madhy Pradesh, India. He used data collected for the 1997-98. The study analyzed the data on Brinjal, tomato, onion Arvin, Okra and potato. He examined production costs and returns, marketable and marketed surplus, marketing costs, channels, margins and efficiency.

Economics of production and marketing of vegetables in Madhya Pradesh, India was studied by Singh (2005). This study analyzed the production and marketing of selected vegetables (tomato, Onion, Okra, Brinjhal and Potato). Parameters investigated were production costs and returns, marketable and marketable surplus,

marketing costs, channels, margins and efficiency and production and marketing problems. Minimization or elimination of the postharvest losses would also lead to increase in supply of vegetables in the market without bringing additional land into production and without using additional production inputs. According to Ahmed (1992), there are three principal types of vegetables, such as local regional and interregional. 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, whereas, 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. The major vegetable growing areas of Bangladesh are Jessore, bogra, Commilla and Chittagong and a major part the vegetables produced in these areas are transported to the capital or other cities as soon as possible through different marketing channels (Ahmed 1992, Hossain 1974)

Davaraja (2004) conducted a study of producers vs consumers price party for vegetables in rural and urban markets of southern Karnataka. This study estimated the per quintal cost of marketing of selected vegetables (tomato, cabbage, cauliflower, aborigine and okra) in rural (Mysore) and urban (Bangalore) markets in Karnataka, India. It also estimated the net prices received by growers and paid by the consumers for the vegetables in these markets. It was also revealed that the marketing channels differed for different vegetables. The per quintal cost of marketing is higher in Bangalore than in Mysore, the consumer price is comparatively higher in Bangalore than in Mysore for all vegetables due to differences in transport costs, commission charges and cost of packing material and the producer's share of the consumer's rupee is higher in Mysore than in Bangalore for all vegetables.

Wadhwani *et al.*(2004) conducted a study of economics analysis of postharvest management of seasonal vegetables in Western,U.P This study was conducted to (1) Estimates the marketed surplus of principal vegetables and identifies the determinats and (2) to examine the present status of postharvest management of important vegetables grown in western Uttar Pradesh, India during cropping season 1996-97. Results of the statistical analysis revealed that the marketed surplus was more than 95% in vegetables like bottle gourd, pumpkin, aborigine, tomato cauliflowers, cabbage, carrot and radish. Lower marketed surplus in case of potato, okra and pumpkin is justifiable as on farm consumption of these vegetables is expected to be more than other vegetables. It was found increasing with farm size in most of the vegetables.

Pramanik *et al.,* (2003) made a study which was undertaken to determine the enocomics of production and marketing of vegetables in 2 villages (Maccapahar and Calicut) in Andaman and Nicobar Islands, India. The result indicated that the yield of ginger was the highest, followed by cucumber, bitter gourd chili and ridge gourd. The total cost of cultivation was highest for ginger, followed by Bitter gourd, Chili, Brinjal and okra. The yield of all the vegetables was higher in hilly land than in valley land. The cost benefit ratio was the highest for chili, followed by cucumber, Brinjal, Cowpea and Snake gourd and higher in hilly land than in valley land for all the vegetables. The margin to both the wholesaler and the retailer was highest in ginger (RS 14.10 and 32.50kg, respectively).

Halder (2003) conducted study on marketing of winter vegetables in selected areas of Bangladesh. The study revealed that per quintal marketing cost of tomato was higher than that of Rabi-Brinjal, cauliflower and cabbage. But per hectare marketing cost was higher for Rabi-brijal than that of tomato, cauliflower and cabbage. The net

return was higher for Rabi-Brinjal than cauliflower, cabbage and tomato. Rabi-Brinjal was more profitable than cauliflower, tomato and cabbage. She also found that marketing loss of selected winter vegetables at different level of marketing shows that average 17 percent marketd vegetables were lost of which 11 percent at retail level. Higher loss at wholesale levels was mainly due to the insufficient transport facilities, movement for long distance and unskilled handling of products at wholesaler's level. Marketing loss should be reduced by helping improve proper storage, handling and transportation facilities. Department of Agricultural Marketing of the Ministry of Agriculture should arrange training of vegetables traders on post production handling and storage of vegetables on scientific basis as to reduced post production losses; as vegetables markets appear competitive, framers may be advised to diversity crop production activities particularly of off-season growing of vegetables or cultivating early season varieties of vegetables as to fetch higher product prices.

Rashid *et al*., (2002) conducted a study on an economics of Brinjal cultivation at Jessore region in Bangladesh. They conducted that the profitability of the input utilization patterns in and the constraints to Brinjal (*Solanum melongena*) cultivation in Jessore, Bangladesh were examined. Data for the crop year 1999-2000 were obtained from a sample of 100 Brinjal farmers. Brinjal cultivation was profitable in the study area. Excessive use of insecticides and fertilizers, lack of quality seeds and high cost of seedlings were some major production constrains of Brinjal production.

Singh *et al.,*(2001) conducted a study on an organic farming technology sustainable vegetable production in Himachail Pradesh. The pointed that the glorious food grain production could not save our majority of population from malnutrition problem due to inadequate consumption. Organic farming was used to develop an alternative eco-friendly technology for sustainable vegetable production.

Sayeed (1999) conducted a study on selected winter vegetables in some selected areas of jessore district. He pointed that the highest profit was enjoyed by the small farmsagainst other groups of farmers in vegetables cultivation. He observed that marketing cost was higher for tomato that of cauliflower and Rabi-Brinjal. The net margin was higher fro retailer than that of Paikers, because return on investment was higher for retailers thatn that of Paikers. In this study, the marketing margin was higher for retailers than that of other intermediaries. He found that lack of capital, low price harvesting period, lack of storage facilities, under developed communication system high rate of market tolls and Aratdar's commission etc. were some major problems in vegetables marketing. Institutional credit facilities should be made available to the selected vegetables fanners to supplement their cash needs for the production and marketing of selected vegetables and also the same facilities should be made available to selected vegetable marketing. Development of transportation system is essential for the improvement of trading and reducing marketing cost of the selected vegetables. Physical facilities should be increased at the market places by the local authority. The retailers and the Paikers should form their own associations to act against the anti marketing forces. Marketing tolls should is fixed certain reasonable level by the local authorities etc. were the major recommendation in vegetables marketing.

According to FAO (1997) the vegetable produce moves from the producers to the consumers through a number of market intermediaries. A Large number of vegetable marketing channel were identified of which 13 were within and between the assemble markets and 19 were from assembly markets to the city markets. Out of 19 only three channels did not appear in Dhaka region.

Marothia *et al.,*(1996) in a study entitled vegetables marketing a case study of two markets in Chhattisgarh region Madhya Pradesh. The study examined the marketing pattern of vegetables assessed the marketing cost margins and price spread in different marketing channels and suggested more policy measures to improve vegetable marketing. Two markets in Chhattisgarh region of Madhya Pradesh, India were selected (Shastri market in Rajpur district and Subhash market in Durg district). A sample of 40 and 32 vegetable growers, 6 and 4 commission agents and 15 retailters each was selected in Shastri market and Subhash market, respectively. Growers were categorized as small, medium or large based on the quantity of vegetables sold during one visit. The study indicated that the percentage are under Vegetables was decreasing at both locations as size of holdings increased. While the small vegetable grower preferred to sell their vegetables directly to consumers, the medium and large growers sold their produce to retailers through commission agents.

Agarwall and Saini (1995) conducted a study entitled vegetable marketing (a case study of Jaipur market Rajashtan). This research investigated the institutions, agencies and channels involved in the marketing of brassica crops and assesses the price spread in different marketing channels. The village (Mahapura and Bhankrota) in the area of Krishi Upaj Mandi Samiti, Jaipur and Rajsasthan India ere selected for the study. The sample consists of 50 growers comprising 18 small, 12 semi-medium and 16 medium and large farm. Estimation of price spread indicated a low share for grower (52%-54%) due to high marketing costs and margin charged by intermediaries.

Mohammad *et at.,* (1995) conducted a research and pricing efficiency of the Malaysian vegetable market. The existence of price asymmetry at the farm wholesale and retail levels is examined for 11 selected vegetables in Peninsular Malaysia. The selected vegetables were chines cabbage, tomato, chili, cucumber long beans, French

beans, spinach, Chinese mustard, Kangkong, Okra and aborigine Data were for the period January, 1989 to November, 1992 comprising 204 weekly observations. Asymmetry is tested for the timing or speed of price passed through and the amount of price adjustments. The analysis was based on Wolfram's technique for segmenting aggregate on independent variables in regression analysis. The results suggest that asymmetric price transmission exists between the market level for most of the vegetables examined. Sharma *et al., (*1995) conducted study on marketing of vegetables in Himachal Pradesh. The study showed that the highest percentage of losses occurred during assembly and transportation for tomato and capsicum, where assembly and market operations caused major losses for beans and peas. Increased productions with minimum losses are important factors for increasing marketed surplus. Costly wooden boxes, time consuming manual, grading, distant markets, high transportation charges, malpractices in the market and lack of market information were the major problems faced by growers.

Padmanaban *et al.,*(1994) studied on fresh vegetables of carrots, bitter gourds, lab lab bean, Brinjal, okra, beet roots, tomatoes, chilies and peas stored in polyethylene bags together with vials containing fused $CaCl_2$ at 15 g/kg with perforated lids or loose under ambient conditions (25-31ºC and 70-85% RH) . Storage in polybags increased shelf life in all cases. Storage of okra seed under ambient conditions was studied by Padma and Reddy (2004). They found that the seed with 10.0 and 7.14% seed moisture could be stored for 22 and 26 months in cloth bag, respectively. The same seed could be stored in container and poly pouch for 30 and 32 months, respectively and up to 50 months in polythene bag and aluminum foil pouch. Reducing the seed moisture beyond certification standard did not show any beneficial effect on seed longevity (except for cloth bag storage) under sub-tropical climate of Rajendranagar.

Park and Kang (1993) studied on 16 vegetables, including cauliflower, brijal, okra and tomato stored under different packing methods i. e. polyethylene film or none at a room temperature of 4º C. They reported that, weight loss and detrimental changes in general appearance were reduced by storage in PE film, which and were most market at 4°C. They found that the storage life of the vegetable at room temperature was 5-6 days after harvest. While that of PE-packed vegetables at 4°C was 15-24 days.

Baten (1993) conducted a study on marketing of vegetables in some selected areas of Mymensingh district with the objectives of identifying marketing channels and the intermediaries involved therein, marketing costs and margins of selected vegetables at different stages of the marketing channel identifying problems of marketing faced by the growers and the traders, found that in Gaffargaon market, producers received about 41 percent of consumers price and in markets of Dhaka city, producer's share of consumer's price was only 19 percent. This indicated that producer's share with the increase of intermediaries in the marketing channel. The retailer's average margin was Tk. 46.45 of which 41 percent was cost and 59 percent was profit. Retailer's margin was high income locality and low in low income locality, which indicated that existence of imperfection in retail trade of vegetables. He suggested for cooperative marketing for small farmers for better prices. Producers share was suggested to improving by providing physical facilities and eliminating unnecessary middlemen from the marketing channel, less relation between the rural markets call for improving, market infrastructure in the rural areas.

Elias (1992) concluded that marketing system for vegetables in Bangladesh was not efficient. Due to existence of a chain of middle man, grower received relatively lower price for selling their products. Moreover, the price varied greatly market to market and season to season. Sabur (1992) made another study on the vegetables marketing

system in Dhaka city. He found that marketing cost was higher for "Bepari" followed by the retailers, wholesaler, "Faria" and "Aratdar" but their profit margins as percentage for cost were 93% for "Aratdar", 79% for "Faria"75% for wholesaler, 33% for "Bepari" and 20% of retailers. The intermediaries received higher marketing margin in lean period than that in peak period. The findings reflect the need for improvements of marketing infrastructure in the rural area.

Ahmed *et al*., (1990) studied the marketing system of winter vegetables in Jessore, Bogra, Comilla and Dhaka districts during 1989-90. They identified five important marketing channels for radish, cabbage, cauliflower, okra and tomato. Those were i) Grower-consumers ii) Growers-retailers-consumer, iii) Growers-Bepari-Aratdar-Retailers-Consumers iv) Growers-agent-exporer and v) Growers-Aratdar-exporter.

The studies conducted by Lale (1997, 1971) and Lale (1997,1971) and Lale and Tyler (1988) focused on measuring marketing efficiency in India. The vegetavles marketing performance was analyzed in five primary markets and two terminal markets. Weekly wholesale prices in various markets from 1988 to 1993 were collected and analyzed to address two measures of efficiency one to measure the coefficients to test the hypothesis that, Agricultural commodity markets are closely related to each other. Another was to examine the marketing margins and price spread between primary and terminal markets to test hypothesis that Price differences between markets do not tend to be significantly greater than transport costs. The researchers concluded that the analysis supported both hypothesis i,e. markets are integrated (correlation coefficients ≥ 0.09) and the marketing system is competitive. Limitations of the findings resulted from a lack of scientific grading of produce.

Gupta and Ram (1979) analyzed the performance of vegetable marketing in Delhi. The price spread was measured by tracing specific lots of vegetables, through the

marketing channel until they reached the final consumer. The data were collected from a sample of market intermediaries using and econometric model measure the effects of consumer price variations on margin and costs. The results revealed that producers received 38% of the consumer price and middlemen margins were excessive due to the risk they have taken and services they have provided. The analysis showed that the establishment of cooperative at both producer and consumer levels was required and that it was the government's responsibility to make available more market information, storage facilities and processing plants to increase the market efficiency of vegetables. Movement of fresh vegetables in Bangladesh involves the main stages from Arat center to retail market. However all the stages are not always followed strictly. A minor proportion of the vegetable passes through the local retailers directly from the growers. Besides a small proportion passes from "Bepari" via "Aratdar" (commission agent) through "Paiker" (wholesaler)" to the consumers. Marketing channel refers to the sequential arrangement of various marketing intermediaries involved in the movement of products from producers to consumers (Rashid 1999).

Mondal (1975) conducted a study on marketing margins of some vegetables in selected areas of Mymensingh district. He found that the producers's selling costs of vegetables at the primary markets were not very high. The retailing costs of vegetables were higher than wholesaling costs mainly because of high loses and more time involved in retailing vegetables. The gross and net retail margins were higher than the gross and net wholesale margins, respectively. The retail margin at Mymensingh market was higher than that in the primary markets due to comparatively higher costs of living and price consciousness of the retailer in the Mymensingh market. Sabur (1990) conducted a study on price spread and price

structure vegetables in Bangladesh. In this study on the basis of net return, the small growers were more efficient against other groups of growers in vegetables cultivation due to their better management practices. He found that in local markets, producers received about 49% of consumers price and the market of Dhaka city producers share consumers price was only 27%. The study also revealed that marketing loss of vegetables at different stages of marketing was on an average 14.5% of marketed vegetables of which 3.1% at wholesale level and 11.4% at retail level. The findings reflect that higher loss at retail level was mainly due to unscientific storage system used by the retailers.

Hossain (1974) conducted a short analysis of consumer demand for brijal in Mymensingh town. The elasticity of Brinjal has been estimated to be from 0.38 to 0.94 which indicated that one percent increase (or decrease) in consumers aggregate expenditure would bring less than one percent increase (or decrease) in the quantity Brinjal demanded. The computed elasticity with respect to aggregate expenditure indicated that Brinjal has an inelastic demand with per capita daily consumption of Brinjal was estimated to be 0.93 seer during its peak supply period. The income elasticity of Brinjal for the urban panel consumers was estimated to from 0.38 to 0.94 which indicated that Brinjal was a normal good and not luxury food item of urban consumers. Price elasticity's of Brinjal ranged from -0.56 to -1.26 for low income people and it ranges from -0.61 to -0.95 for high income people.

Baten (1993) conducted a study on marketing of vegetables in some selected areas of Mymensingh District. He found that in Gafargaon market, producers received about 41% of consumer's price and in the markets of Dhaka city, producers share of consumer's price was only 19%. This indicates that producers' share decreases with the increase of intermediaries in the marketing channel. Mazumder (1998) conducted

a study on cabbage and cauliflower marketing in some selected areas of Comilla district. He observed that net return per hectare of cauliflower was higher (TK 115426) than that of cabbage (TK 68609). He observed that the net returns of retailers for cabbage per quintal was lower (TK 75). He also found that lack of capital, lack of storage facilities, price fluctuation and weak communication systems were the major problems in vegetable marketing.

Despite the criticisms of correlation coefficients and marketing margin analysis, they are the most commonly used measures in assessing the market performance. Assessment of market integration through correlation coefficient analysis has been criticized by, for example, Haris (1979) but others are still using this technique to evaluation the efficiency of the marketing system. Also marketing margin analysis is a useful tool to examine the nature of the marketing system, particularly when marketing margins are deconstructed into various functions performed by the market traders. Therefore, information of the marketing system is needed before the marketing integration, efficiency and competiveness of the system can be inferred from the price data. These considerations are taken into account for the subsequent analysis of the efficiency and competitiveness of the vegetable production and marketing system in Bangladesh. The use of combinations of alternative techniques to assess the efficiency of the marketing system is adopted to overcome any shortcomings of one specific mode.

From the above discussion it is clear that several studies have been better on selected vegetables marketing of Bangladesh. Finding of the review would help conceptualization on the important aspects of the Brinjal marketing system in general and understanding functions of the market actors in brinajl marketing in the selected areas in particular. The reviews of literature would also help computation of

marketing cost and marketing margin of different intermediaries as of latest market prices to understand the limitation of the previous useful information, which will be helpful for the policy makers and the researcher for further research in this direction.

Vegetables contain vitamins, minerals and other nutrients. Vitamins are greatly decline from the time of harvesting to consumers. To assess the nutritional losses of vegetables several works have been carried out. The farmers consume vegetables almost everyday and fruits two days a week depending on availability (INFS 2004). The process of washing and cooking vegetables lead to considerable loss of vitamin C and B complex vitamins (FAO, 2007).

Investigating the trends of ascorbic acid reduction in fruits at low temperature storage would importantly elucidate the reasons for occurrence of chilling injury and physiological disorder. *Cucurbita* fruits stored at 5, 10 and 20º C were analyzed for ascorbic acid content and activities of ascorbate oxidase, ascorbate oxidase, ascorbate peroxidase and monodehyfroascorbate reductase. Chilling injury was observed in cucumber fruits when held at 5º C. The cucumber fruits at held 10ºC developed core browning. Ascorbic acid contents decreased in cucumbers when the fruits were stored at 5 and 10°C (Tatsumi *et at.,2006*).

The chilling injury and storage properties of cucumber stored at 2ºC were studied after exogenous polyamine treatments. Cucumber chilling injury at 2ºC was delayed for 2 days by the exogenous polyamine treatment. The chilling injury and index of cucumber were remarkably different from those of the control. The content of chlorophyll in cucumber declined slowly in low-temperature storage after the polyamine treatment compare to the control. The decrease in the contents of total acids and total soluble solids the degradation of vitamin C and the drop of pulp firmness in cucumber were also delayed by the polyamine treatment. There were

remarkable differences in cucumber quality factors on the 8th day of storage at 2°C between the polyamine treatment and the control (Qiao *et.al*,2005).

Bose *et al*.,(1986) in their studies concluded that there is much variation in the chemical constituents in fruits of different cultivars and chlorophyll, true protein and total phenols are influenced by other constituents of the fruits besides the effect of dry matter, especially on anthocyanin and orthodihyroxy phenols. The amount of the total vitamin C content of cucumber is 7 mg per 100g of edible portion. Irrigation has a variable effect on the mineral composition and vitamin (ascorbic acid, nicotinic acid and P-active substances) contents of Brinjal fruits. They reported that in most cases the content of dry matter, total sugars, protopectins, cellulose, acids and total fat were reduced but water soluble pectin content was increased by the application of irrigation. The changes in vitamin C contents of broccoli influenced by parts of leaves, weather conditions, time, day and temperature of storage. The temperature considerably influenced the level of vitamin C. The content of vitamin C was fairly stable during 10 days at 0ºC but fell at 10°C and fell more rapidly at 20ºC. Brinjal contains 120 mg of vitamin C,0.11 mg of riboflavin and 0.9 mg of iron per 100g of edible portion.

Temperature management is the single most effect tool for maintaining postharvest quality by extending the shelf life of fresh horticultural produce. The optimum temperature for Brinjal storage is 5-10°C. Exposure of Brinjal to undesirable temperatures will result in bleaching, surface burring or scalding, shriveling, excessive softening and desiccation (Cantwell and Trevor,2002). Temperature also influences the effect of ethylene, reduces oxygen, elevates carbon dioxide levels and affects pathogen spore germination and growth rate. Low temperature will reduce the effects of pathogen on fresh produce. For instance cooling commodities below 5°C

immediately after harvest reduces the incident or Rhizopus rot (Brackett,1993). However, extremely low storage temperatures can also effect the quality of certain vegetables. Brinjal is rapidly chill damaged when stored at temperatures less than 5ºC for an extended period (Perkin, Veazie and Collins,1992). The symptoms of chilling injury include surface and inernal discoloration (browning), pitting, water soaked areas, off flavor development and accelerated incidence of surface molds and decay, especially organisms not usually found growing on healthy tissue(Mitvhel and Kader, 1992). Apart from temperature, water loss from fresh produce also causes deterioration through wilting and shriveling, loss of textural quality (softening, flaccidity, limpness, loss of crispness and jiciness) and nutritional quality (Thompson, 1996). The rate of water loss from fruits and vegetables including Brinjal depends on the vapor pressure deficit between the commodity the surrounding air conditions, which is influenced by temperature and relative humidity. At a given relative humidy, water loss increases with the increase in temperature (Shewfelt, 1993). In fresh produce like Brinjal, water loss is influenced by internal factors (morphological and anatomical characterizes, surface area to volume ratios, surface injuries and maturity stage) and external or environmental factors (temperature, relative humidity, air movement and atmospheric pressure) (Crisosto, 1993).

Park and Kang (1993) studied on 16 vegetables, including cauliflower, Brinjal okra and tomato stored under different packing methods i.e. polyethylene film or none at a room temperature of 4°C. They reported that weight loss and detrimental changes in general appearance were reduced by storage in PE film, which and were most market at 4ºC. They found that the storage life of the vegetables at room temperature was 5-6 days after harvest. While that of PE-packed vegetables at 4°C was 15-24 days.

Fresh vegetables like carrots, hitter gourd, lab-lab bean, Brinjal okra, beet roots, tomatoes, chilies and peas were stored in polyethylene bags together with vials containing fused $CaCl_2$ or $CaCO_3$ At 15g/kg with perforated lids or loose under ambient conditions (25-31ºC and 70-85°C RH) by Padmanaban *et al.,*(1994). They found that storage in polybags increased shelf life in all cases. Poubol *et al.,*(1999) conducted an experiment for extending shelf life of Brinjal by using by perforated plastic bags. Firmness, fiber content, weight loss gas composition, visual appearance, and shelf life of Brinjal were determined during storage. Brinjal packed in polypropylene bags perforated with four holes had the best visual appearance and lower weight loss than the other treatments and resulted in an extension of the shelf life of good quality Brinjal from 6-to 16 days. Singh *et at.,*(1979) studied the effect of pre-packing materials on the storage life of fresh Brinjal. They found that, Brinjals packed in 400 gauge polyethylene at room temperature had the longest shelf life (9 days) and the control fruits kept for only 2-3 days greatest at the 2 higher temperatures, but there was no significant difference between the cultivars.

Padmanaban *et al.,*(1994) studied on fresh vegetables or carrots, bitter gourds, lab lab bean, Brinjal okra, beet roots, tomato chilliest and peas stored in polyethylene bags together with vials containing fused $CaCl_2$ at 15g/kg with perforated lids or loose under ambient conditions (25-31ºC and 70-85% RH). Storage in polybags increased shelf life in all cases. Storage of okra seed under ambient conditions was studied by Padma and Reddy (2004). They found that the seed with 10.0 and 7.14% seed moisture could be stored for 22 and 26 months in cloth bag, respectively. The same seed could be stored in container and poly pouch for 30 and 32 months respectively and up to 50 months in polythene bag and aluminum foil pouch. Reducing the seed

moisture beyond certification standard did not show any beneficial effect on seed longevity (except for cloth bag storage) under subtropical climate of Rajendranagar.

From the above reviews it is clear that large number of research works have been done across the globe regarding postharvest loss, marketing and shelf life extension of different vegetables. However the relevant investigations and findings are still unnoticeable in Bangladesh. Furthermore, the shelf life extension and maintenance of quality vegetables at the postharvest level and the export potentiality of vegetables market. Therefore, the present study was designed to study the marketing channels, marketing actors, cost and margin of market intermediaries and the possible ways and means to extend the shelf life of Brinjal by using non-chemical and environmentally friendly measures.

Ahmed (2003), in a review paper stated that the overall export earnings of Bangladesh during 2001-2002 compared to 200-2001 have declined by 8%. But in horticulture, export value has gone up by 12% compared to 2000-2001 and 2001-2002 with USD 15.0 million earning. Therefore, it is quite justified to view this as ahighly potential source of export earning specially in the face of current economic recession. He also stated that BRAC earned TK 64.81 million by exporting vegetables and potatoes during 2004 of which TK 9.74 million was higher than the previous year.

In India, Bansal (1994) conducted a study on “Export of fruits and vegetables problems and prospects in and found that India produces nearly 100 million tons of fruits and vegetables, 18 percent of gross value of agriculture output. However, approximately one percent of this is exported. This paper notes the general importance of export to the Indian economic and the developmet of schemes by the Indian Governments to increase the amount of fruit and vegetables exported. This paper presents information on the present exports including poor post harvest

management, inadequate cold storage facilities, and inadequate processing facilities, under developed market infrastructure, inadequate market information services, low levels productivity and fragmented holding. Prospects for increasing export include the comparative advantage that India has in the production of Many Asian vegetables and the increase importance that has been accorded to farm exports under the new agricultural policy.

In a study conducted by Saha (2000) on export marketing of fresh vegetables in Bangladesh found that vegetables flow through two kinds of marketing channels in Bangladesh for local consumption and for export. In the export marketing channels the vegetables producers sell their vegetables to Faria 15%, Paikers 10% and Beparies/selected agents 75%. The Beparies/selected agents who work for exporters collect vegetables from the production areas. The exporters are investing money through Beparies/selected agents for export quality vegetables. After sorting and some times packing, the Beparies /selected agents had over the vegetables to the exporter.

CHAPTER 3
MATERIALS AND METHODS

Methodology consist of methods and procedures of data collection, data analysis and measurement of variables. More appropriate the methodology more accurate the research.

3.1 Locale of the study

The study was conducted in the years form 2010 to 2014 in 11 districts all over the country. The below chart shows the district, upazila and village where the study was conduted.

Table: 3.1 The name and location of the studied

Village	Upozila	Districts
Pandhoa	Savar	Dhaka
Kolma Uttorpara	Savar	Dhaka
Masundi	Gaptoli	Bogra
Malgram(moddhopara)	Dupchachia	Bogra
Gopinathpur	veramara	Kushtia
Shibshagorpari	Godagari	Rajshahi
Gorer Math	Godagari	Rajshahi
Chanpara	sribordi	Sherpur
Shimultoli	sribordi	Sherpur
chang Para	Sribordi	Sherpur
Vangar Para	Sribordi	Sherpur
Bajukathi	pirojpur	Pirojpur
Udoy kathi	pirojpur	Pirojpur
Baju kathi	pirojpur	Pirojpur
Kalakhali	Pirojpur	Pirojpur
Pantadubi	Pirojpur	Pirojpur
Kishamot shorbanondo	Shundorgonj	Gaibandha
shorbanondo	shundorgonj	Gaibandha
Kashimbazar	shundorgonj	Gaibandha
Kochua	Joltap	Nilphamari
Garal Choki	Nageshori	Kurigram
Garal Choki	Nagesshor	Kurigram
Joyda	Muktagasa	Mymensingh
Yousufpur	Debiddar	Comilla

Figure 3.1: Map of the Peopl's Republic of Bangladesh.

3.2 Map of the studied area

Figure 3.2: Studied area under Dhaka district.

Figure **3.3**: Studied area under Comilla district.

Figure 3.4: Studied area under Nilphamari District.

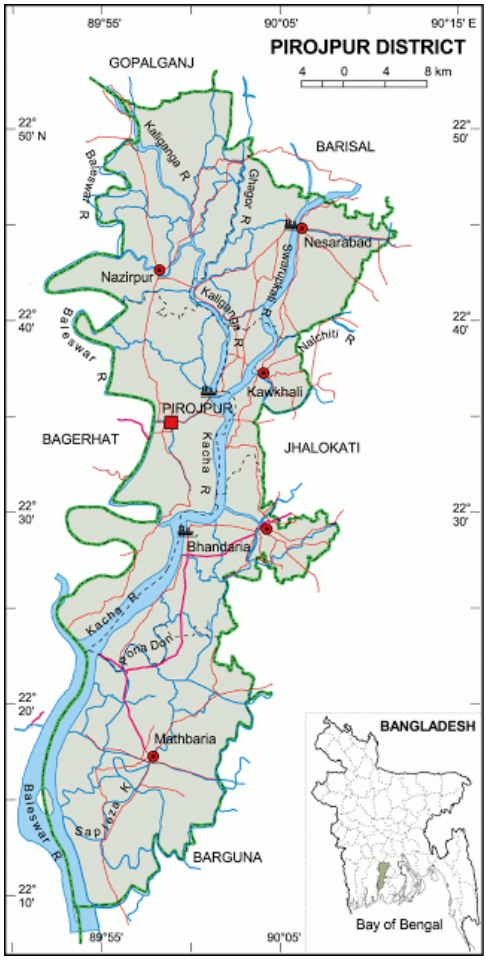


Figure 3.5: Studied area under Pirojpur district.

Figure 3.6: Studied area under Rajshahi District.

Figure 3.7: Studied area under Sherpur District.

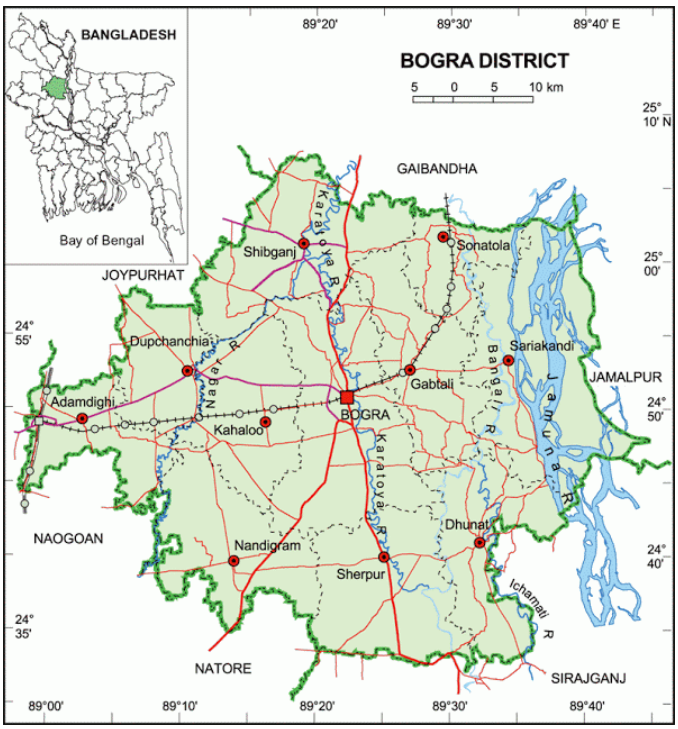


Figure 3.8: Studied area under Bogra District.

3.3 Sample size

Farmers of above studied area constituted the population of the study. An updated list of 1040 farmers under the projects from the selected upazila was prepared with the help of the coordinator of this project. Around 10% of the populations were randomly selected as the sample of the study by using random sampling method. Thus 104 farmers constituted the sample of the study. A reserve list of 45 farmers was also prepared by the same method so that the respondents of this list could be used for interview if the respondents included in the original sample were not available at the time of data collection. The distribution of the population sample and number of respondent farmers in the reserve list are given in Table 3.2

Table. 3.2 Distribution of the population sample and number of farmers in the reserve list

Name of Districts	Primary selection (No of farmers)	Final selection (No of farmers)	No of farmers in the reserve list
Bogra	110	11	45
Comilla	100	10	
Dhaka	100	10	
Gaibandha	60	6	
Kurigram	100	10	
Kushtia	90	9	
Mymensingh	100	10	
Nilphamari	100	10	
Pirojpur	100	10	
Rajshahi	90	9	
Sherpur	90	9	

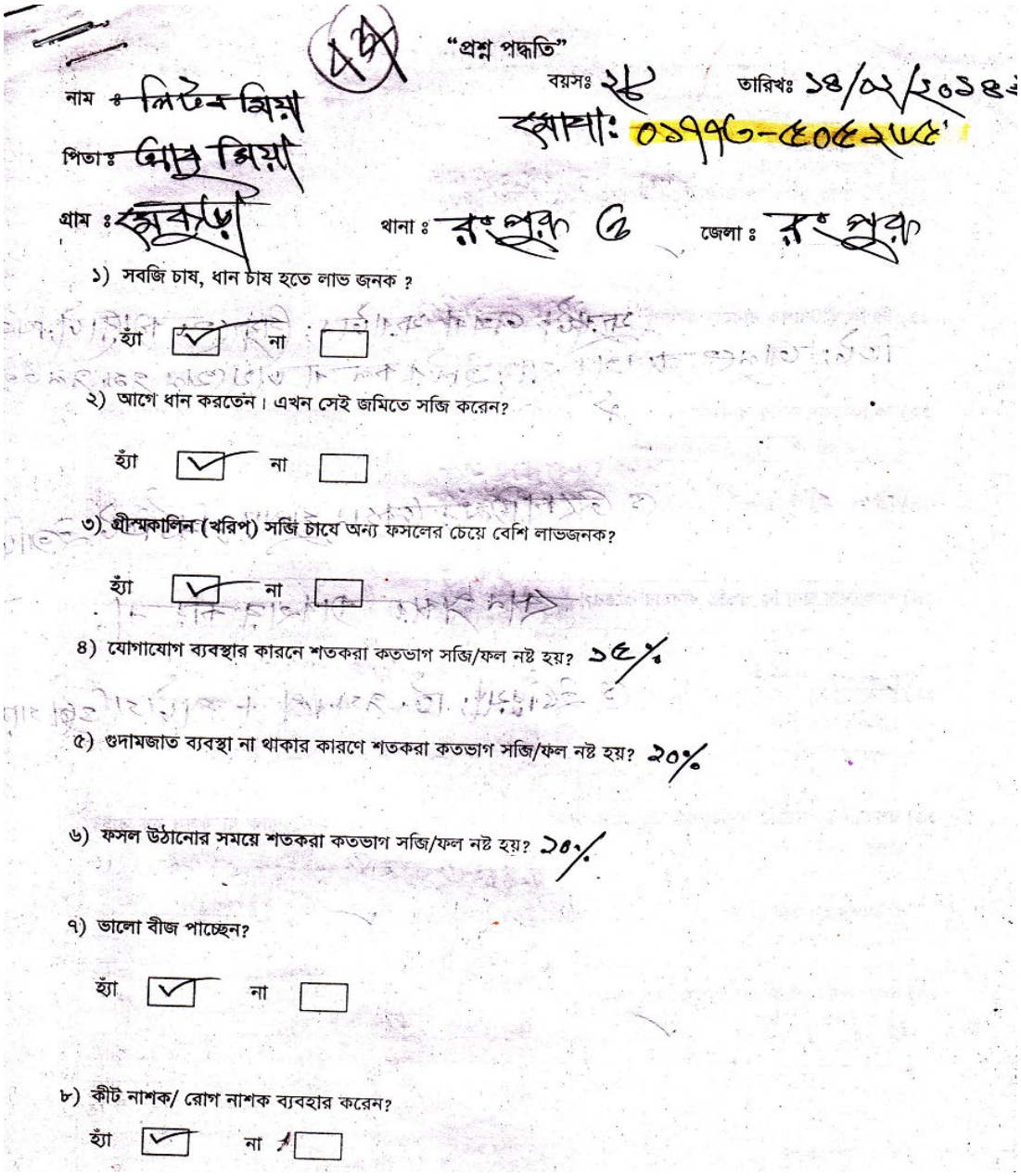
3.4 The research instrument:

A well structured interview schedule was developed based on the objectives of the study for collecting information containing direct and simple questions in open form and close form keeping in view the dependent and independent variables. Appropriate scales were developed to measure both independent and dependent variables.

The questionnaire had been pre-tested with ten farmers to get the actual situation before it was finalized for collecting data. Necessary corrections, additions, alternations, rearrangement and adjustments were made in the interview schedule based on pretest experience. The questionnaire was then multiplied by printing in its final form. A copy of the interview schedule is presented below:

3.5 INTERVIEW SCHEDULE

The following questionnaires format based on the objectives of the study information is given below:



"প্রশ্ন পদ্ধতি"

নাম ঃ লিটন মিয়া

বয়সঃ ২৮ তারিখঃ ১৪/০২/২০১৪

পিতা ঃ মোঃ মিয়া

গ্রাম ঃ হরিণ

থানা ঃ রংপুর ৬ জেলা ঃ রংপুর

১) সবজি চাষ, ধান চাষ হতে লাভ জনক ?

হ্যাঁ ☑ না ☐

২) আগে ধান করতেন। এখন সেই জমিতে সব্জি করেন?

হ্যাঁ ☑ না ☐

৩) গ্রীষ্মকালিন (খরিপ) সব্জি চাষে অন্য ফসলের চেয়ে বেশি লাভজনক?

হ্যাঁ ☑ না ☐

৪) যোগাযোগ ব্যবস্থার কারনে শতকরা কতভাগ সব্জি/ফল নষ্ট হয়? ১৫%

৫) গুদামজাত ব্যবস্থা না থাকার কারণে শতকরা কতভাগ সব্জি/ফল নষ্ট হয়? ২০%

৬) ফসল উঠানোর সময়ে শতকরা কতভাগ সব্জি/ফল নষ্ট হয়? ১০%

৭) ভালো বীজ পাচ্ছেন?

হ্যাঁ ☑ না ☐

৮) কীট নাশক/ রোগ নাশক ব্যবহার করেন?

হ্যাঁ ☑ না ☐

৯) কীটনাশক/রোগ নাশক প্রয়োগে নিজ অভিজ্ঞতা আছে?

হ্যাঁ ☐ না ☑

১০) কীটনাশক/রোগ নাশক প্রয়োগে বিশেষজ্ঞের সহযোগিতা পান?

হ্যাঁ ☐ না ☑

১১) কি কি কীটনাশক ব্যবহার করেন? ফুরাডান অথবা ফুরাডান; সিয়াচেঃ ক্যারাটে; থিওভিট; অ্যালুমে ব্যবহার হয়; ইন্টির কল বা ডায়থেন এম. এল ইত্যাদি

১২) কি কি রোগ নাশক ব্যবহার করেন? ×

১৩) কি কি হরমোন ব্যবহার করেন? ① সেকোট্রিন; ডেকাসন সুপার; থিওভিট ইত্যাদি

১৪) পাকানোর জন্য কি পদ্ধতি ব্যবহার করেন? কোন প্রকার ব্যবহার করি না;

১৫) জমিতে কি কি সার ব্যবহার করেন? ③ ইউরিয়া; টি. এস. পি + পটাসিয়াম সার;

১৬) রফতানির ব্যাপারে সব্জি/ফল এর ভিন্ন কোন গুনাগুনের প্রয়োজন আছে কিনা? নাকি যা ফসল হয় তাইই ভালো

যা উৎপন্ন হয় তাই ভালো ☐ আরো উন্নত মান দরকার ☑

১৭) দালাল/ফরিয়ার কারণে ফসলের মূল্য কম পান?

হ্যাঁ ☐ না ☑

সব্জি/ফল অধিক ফলন হবে কি কারনে?

ক) ভালো বীজ পেলে।

খ) সময়মত সার পেলে।

গ) বিশেষজ্ঞের পরামর্শ পেলে।

ঘ) গুদাম থাকলে ।

ঙ) বিনামূল্যে কীটনাশক/রোগ নাশক পেলে ।

ক) ক থেকে ঙ পর্যন্ত অগ্রাধিকার ভিত্তিতে ১ম,২য়,৩য়,৪র্থ ও ৫ম নম্বর দিতে হবে। তবে বোঝা যাবে কোনটি জরুরী বেশি কৃষকের কাছে।

১৯) কৃষকের বিক্রি রেট?

প্রতি কেজি অথবা প্রতি পিছ মূল্যঃ সবজি

ক্রম	সবজি/ফল	বিক্রয় মূল্য(টাকা)	ব্যবহৃত ঔষধ	ব্যবহৃত সার
১	কাচা পেপে	৫/৬টাকা (কে.জি)		
২	টমেটো	১০/১৫ ,, ,,		
৩	ঢেরস	১৫/২০ ,, ,,		
৪	ফুলকপি বর্তমান	১০/১৫ ,, ,,		
৫	বাধাকপি ,,	৫/৮ ,, ,,		
৬	বেগুন ,,	২০/৩০ ,, ,,		
৭	লাউ ,,	২০/৩০ ,, পিচ		
৮	ছোট মিষ্টি কুমড়া ,,	৬/৮ ,, পিচ		
৯	করল্যা	২০/২৫। কে.জি		
১০	চালকুমড়া	১০/১৫ পিচ		
১১	চিচিংগা			
১২	কাকরোল	২০/২৫ (কে.জি)		
১৩	ঝিংগা			
১৪	সীম	২০/২৫ ,,		
১৫	পটল			
১৬	কচুরলতি	১০/১৫ ,,		
১৭	ধুন্দল			
১৮	মুখি কচু/বই কচু	১৫/২০ ,,		
১৯	গোল আলু ব্যানহাম	৪/৫ ,,		
২০	ডাটা	৮/১০ ,,		
২১	পুই শাক বর্তমানজুড়ি	৬/৮ ,,		
২২	লাল শাক	৫/৮ ,,		
২৩	পালং শাক	৫/৮ ,,		
২৪	মুলা বর্তমান	৬/৮ ,,		

ফল

ক্রম	ফল	বিক্রয় মূল্য(টাকা)	ব্যবহৃত ঔষধ	ব্যবহৃত সার
২৫	আম (মৌসুম)	৩০/৪০ ,,		তব সার ,,
২৬	জাম	১৫/২০ ,,		,,
২৭	ডাব	১পিচ=১০/১২ ,,		,,

ক্রম	ফল	বিক্রয় মূল্য(টাকা)	ব্যবহৃত ঔষধ	ব্যবহৃত সার
২৮	নারকোল	১পিচ=১০/১২ ॥	কেমন লাগে না	কেমন ও বাসায় নিক সার;
২৯	জামবুরা	১ ॥ ১০/১২ ॥		
৩০	অমলকি			
৩১	বাইগুল / বড়ই বর্তমান	২০/৩০টাকা কেজি		
৩২	জামরুল			
৩৩	কলা পাকা	১পিচ ১২ টাকা		
৩৪	পেয়ারা বর্তমান	২০/২৫ টাকা		
৩৫	লটকন			
৩৬	আনরস	২৫/৩০টাকা		
৩৭	কাঁঠাল মৌসুমে	২৫/৩০ ॥		
৩৮	লিচু ॥	১০০পিচ=১৫০০		
৩৯	কমলা ॥	৪টি=৪০/৫০/-		
৪০	কৎবেল			
৪১	বেল বর্তমান ॥	৬/৮টাকা		
৪২	সফেদা			
৪৩	আমড়া মৌসুমে	১৫/২০ ॥ (কাচি)		
৪৪	জলপাই ॥	১০/১৫ ॥ ॥		
৪৫	পেপে পাকা	পিচ ১৫/২০ ॥		
৪৬.	মাল্টা/কমলা ॥	প্রতিহালি=২০ ॥		
৪৭.	আপেল	১ কা.বি=২৫০/২৭০/-		

চাষকৃত ভুমি সমূহ

ফসলের নাম	জমির পরিমান
আলুর চাষ:	১বিঘা তে ৬৫ থেকে ৭০কেজি;
কলা ॥	৩ ॥ ৯০০ থেকে ১,০০০গাছ;
ধান ॥	১ ॥ ১বিঘা ২০-২৪মন;

৩ বছরে চাষকৃত ফসলের ধরনঃ

সাল	কি কি ফসল চাষ করা হয়েছে
২০১৩	আলু চাষ করা হয়েছে ১বিঘা; কলা ॥ ॥ ॥ ৩বিঘা; ধান ॥ ॥ ২ ॥
২০১২	কলা, আলু, বড়ই ধান, পুই শাক;
২০১১	ঐ

3.6 Processing of the Data

The collected raw data were examined thoroughly to detect errors and omission. As a matter of fact the researcher made a careful scrutiny while completing the interview schedule to make sure that the information were entered as completed as possible and well arranged to facilitate coding and tabulation. Minor mistakes were detected, which were corrected very promptly.

Having consulted with the research supervisor a detailed coding plan was made. All the responses in the interview schedule were given numerical values. Local units were converted to the standard units. All the individual responses of the questions of the interview schedule were transferred to a master sheet to facilitate tabulation. In the case of qualitative data, appropriate scoring technique was followed to convert the data into quantitative forms. These were then tabulated.

3.7 Measurement of Variables

The variable is a characteristic, which can assume varying or different values in successive individual case. A research work usually contains at least two important variables viz. independent and dependent variables. An independent variable is that factor which is manipulated by the researcher in his attempt to ascertain its relationship to an observed phenomenon. A dependent variable is that factor which appears, disappears or varies as the researcher introduces, removes or varies the independent variable (Townsend, 1953). The independent variables were: Date of interview, name, father's name, age, adress etc.

3.8 Measurement of independent variables

The characteristics of the farmers mentioned above constitute were the independent variables of this study. The following procedures were followed for measuring the independent variables.

Age :

Age of a respondent farmer was measured by the period of time from his/her birth to the time of interview and it was measured in terms of complete years on the basis of his/her response.

Fathers name: The names of the respondent's father were noted down.

Addresses of the respondents: The adresses of the respondent farmers were recorded in the specific interview schedule.

Data Collection:

Data were collected with the help of local leader, Member of Union Porishod. To get valid and relevant information, all possible efforts were made to explain the purpose of the study to vegetable farmers. Appointments for the interviews were made in advance with the help of the agricultural experts and opinion of local leaders helped the investigation in this regard. Appointments with the interviewees were made in advance with the help of the concerned supervisor and local agricultural experts. While starting interview with any respondent the researcher took all possible care to establish with him, so that vegetable farmers did not feel hesitation to furnish proper data. In that way, data for this study were collected through personal interview during October 2010 to December 2013.

A single interview was carried out with each respondent and thus great reliance was placed on the ability of farmers to recall the relevant information. The respondents were assured about the confidentiality of their information.

3.9 Measurement of dependent variable

Farmarsnature of cultivation, crop choice, cultivation pattern, matterials implimentation in the field etc are the dependent variables. In this study samples were analysed through SPSS method. Positve answer was scored as 01 and negetive answer was scored as 02 marking. Attitude of the farmers towards their cultivations mean how much the degree to which each farmers relatively expresses about the program. The procedure for measuring the dependent variables was as follows:

In this study, farmers attitude and cultivation patterns or farmers choice were measured on the basis of some related issues. Initially 21 statements were taken under consideration. Questions were measured through farmers strongly agree, agree, no opinion, disagree, strongly disagree etc.

3.10 Hypothesis of the study

In the present study the following null hypothesis were formulated:

There was no relationship between each of 9 selected characteristics of the farmers and their attitudes towards “Vegetable export potentiality program.

3.11 Data collection procedure

Data were collected from the sample respondent farmers through personal contact with the help a pre-tested interview schedule from October 2010 to December 2013. Whenever any respondent faced difficulty in understanding questions, more attention was taken to explain the same with a view to enabling the farmers to answer properly. No serious problem was faced during data collection rather cooperations were received from the respondents. Data were collected on the basis of objectives to test the hypothesis.

3.12 Data processing

The following steps were followed for data processing and analysis.

Compilation of data

After completion of field survey all the interview schedules were complied, tabulated and analyzed according to the objectives of the study. In this process all the responses in the interview schedule were given numerical coded values. The responses to the questions in the interview schedule were transferred to a master sheet to facilitate tabulation. Tabulation was done on the basis of categories developed for the research.

Categorization of respondents

For describing the various independent and dependent variables the respondents were classified into various categories. In developing categories the nature of data and general consideration prevailing in the social system were considered.

Data analysis

Collected data from the respondents were compiled, coded, tabulated and analyzed in accordance with the objectives of the study. Various statistical measures such as frequency counts, percentage distribution, average and standard deviation were used in describing data Statistical analysis following SPSS (version 11.5)computer program was used for analyzing the data. The categories and tables were also used in presenting and describing data for better understanding.

Pearson Product Moment Correlation was used for determining the relationship of the selected characteristics of the respondent farmers with their attitudes towards “vegetable export potentiality” program. Five percent (0.05) level of probability was used as the basis for rejecting any null hypothesis.

3.13 Occupied land by various crops in Bangladesh.

The economy of Bangladesh is predominantly agricultural. Since the birth of Bangladesh, the country has achieved an incredible growth in food production and reached towards self-sufficiency by the year 1990. As per export promotion buero report about 80 percent of the total population lives in rural areas, and 62 percent of them are directly, and others are indirectly engaged in a wide range of agricultural activities. The agricultural sector contributes around 29 percent of the country's Gross Domestic Product (GDP) and generates employment for 63 percent of the total labor force. The general agricultural sectors are Rice crops, Jute, Cotton, Sugarcane, Flower, Sericulture, Horticulture, Fisheries, Vegetables, Livestock, Soil Development, Seed development and distribution. Nuclear Agriculture has brought a new dynamic change in the agricultural sectors of Bangladesh.

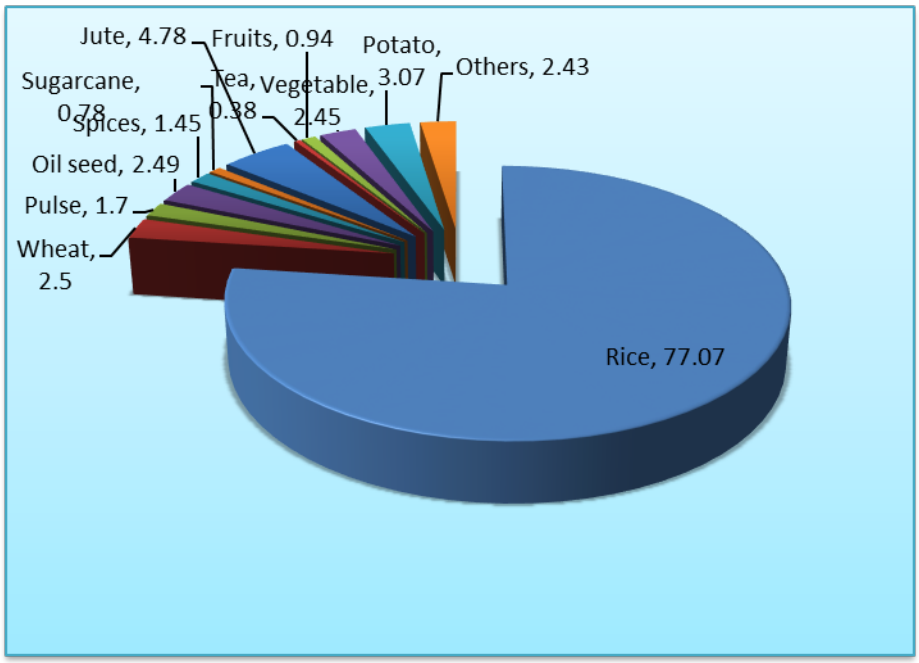


Figure 3.9: Occupied land by various crops in Bangladesh.
Source: Annual report of BBS, 2011.

3.14 Division wise distribution of different vegetables and fruits in Bangladesh

Dhaka Division:

Dhaka division has been selected as the ideal areas for export vegetable zones. Whilst they are relatively close to the airport and are traditionally significant areas of vegetable production. They are extremely low lying areas subject to frequent cyclones and flooding. Late rains have caused considerable damage to early sown crops in the past and this could give rise to an unpredictable start to the export season.

Sylhet Division:

Sylhet is the centre for tea production and an area of gentle hills but perhaps the wettest region in Bangladesh. Farms are very small and whilst fruit crops are grown on hill farms and most appear to be small private gardens; none of the crops seen offered any potential forexport.

Rajshahi Division:

The ideal areas for large-scale fruit and vegetable production are in this North West region particularly in the northern areas of Bogra and Rangpur. These areas have a drier climate with less wind and although six to seven hours drive from Dhaka airport. Banana production is carried out on a very large scale and in the far north there are well-managed orchards of mango and lychee. This is perhaps the area offering the highest potential for Horticultural development.

Khulna and Barisal Divisions

A major area for fish and shrimp farming and a center for betel leaf and betal nut production, but the whole area is very low lying, damp and very humid. Tropical flowers such as dendrobium, anthurium and heliconia could be produced in this area but it seems unsuitable for export production of fruit and vegetables.

Chittagong Division

It is claimed that this region is one of the main fruit and vegetable growing regions of Bangladesh supplying the major markets of Dhaka and Chittagong. Whilst vegetable production appears well organized and productive, the standard of production on the fruitfarms was very poor. Most of the farms appear to be mixed farms, poorly managed and badly laid out and many of which are owned by absentee landlords. Few of the crops seen offered no export potential. Many of the treesare old and overgrown and the quality of thecrops seen was very poor due to mismanagement and negligence. Pineapple grows well in theregion but it appears to be a crop grown as an under-crop in mature tree orchards on small scale holdings. Pineapple is a plantation crop and grown as an inter crop. It cannot compete with the highly specialized plantation crops of competing countries. The croppatterns and seasons are similar to the other regions of Bangladesh and the variety of crops grown are traditional.

3.15 Institutional Support:

The Ministry of Agriculture, has to be applauded for its commitment to the rural farmer and its dedication for improving the income of rural farmers and rural communities by extension programme based on educating the rural farmer through best agronomic practices targeting to increased crop yield by judicial application of fertilizers and pest and disease control.

BARI –Bangladesh Agricultural Research Institute– Horticultural Research Centre

This organization has developed many new varieties and cultivars of fruits and vegetables and has focused on introducing internationally accepted varieties of mango and lychee and cross breeding these varieties with local cultivars. Dedicated staffs highly knowledgeable in their fields appear constrained by lack of funds and guidance

for a clear integrated National Research Strategy to address the key issues such as Post Harvest Handling and International Market Preferences to provide the necessary research back up for a commercially based export oriented horticultural industry.

HORTEX Foundation

Hortex was founded in 1993 with the main objectives to assist and promote horticultural products and facilitate export opportunities. The Foundation successfully implemented a 3-year IDA funded project "Support for Export Development" and a follow up 3 year project"Agricultural Services Innovation and Reform Project". Hortex has Memorandum of Understanding (MOU's) with 16 private sector companies, 6 NGO's and one public sector body to cooperate in crop modernization, technology transfer and export promotion. Among its achievements to date are:

- The export of 1200 MT of high value horticulture products valued at TK 54.23 million toEurope, Middle East, Singapore and Hong Kong.
- Successful trial shipments of orchids and tube rose to the Netherlands
- The introduction of new varieties – fine beans and chilli
- The introduction of quality packaging
- The purchase of 3 refrigerated trucks to assist in the development of cool chaindistribution
- Market information services
- Conducting training programmes
- Publishing an excellent quarterly Newsletter

Hortex is attempting to introduce modern commercialactivities in an industry that is primarilyhigh fragmented, disorganized, no awareness of quality standards and unresponsive to long overdue changes in distribution and post harvest practices.

However, Hortex hasplayed a leading role within the horticulture industry and is to be applauded in attempting to introduce market led export initiatives exemplified by the successful export of non-traditional crops such as fine bean and chilli and developing the model export production zone in cooperation with BRAC in Chandina and Comilla. There is within Hortex (and by all concerned with Bangladesh's Horticulture) a clear lack of market awareness and understanding of the world market dynamics. Assumptions on crops of export potential seem based upon crops currently grown and popular in Bangladesh, crops such as banana, mango, papaya, pineapple and citrus and brassicas and gourds with little or no understanding of the competition.

Export Promotion Bureau (EPB)

EPB is entrusted with the responsibilities of promoting export of the country and has an active Horticultural Unit entrusted with responsibility to develop Horticultural exports. The Board is mainly responsible for:

- Coordinating export development.
- Formulating and adopting policy and programmes for active promotion of exports.
- Coordinating, monitoring and evaluating national export performance and analyzing export trends.
- Carrying out promotional activities in product development & expansion of supply sidecapacity.
- Exploring export markets for exportable products abroad.
- Collecting and disseminating trade information.
- Organizing participation in international trade fairs.
- Imparting training for HRD

- Conducting studies, surveys, & research etc. for expansion and diversification

The Horticulture sector is one of the Governments priority "Thrust" sectors and is working with the private sector to set up "Export Villages" for the production of high quality fruits and vegetables.

The Dhaka Chamber of Commerce & Industry (DCCI) serves SMEs as the first point of business contact for penetration into new market. DCCI was established in 1958 and is a very active Chamber providing all the necessary services for the sector and assistance in facilitating exports.

NGO's activities

Bangladesh Rural Advancement Committee, BRAC apart from providing micro finance through BRAC Bank is actively involved in the production and export marketing of introduced non-traditional crops such as fine bean KATALYST is funded by DFID, SDC, SIDA and CIDA and is implemented by Swiss contact and GTZ International Services and works together with the Bangladesh Ministry of Commerce. It is actively engaged in Horticultural development activities working with rural farmers and small businesses.

PROSHIKA's objectives are: i) structural poverty alleviation; ii) environmental protection and regeneration; iii) improvement in women's status; iv) increasing people's participation in public institutions; and v) increasing people's capacity to gain and exercise democratic and human rights.

Producer and exporter organizations:

There are two principal organisations actively involved in horticultural products export:

Bangladesh Fruits and Vegetables & Allied Products Exporters Association BFVAPEA has 736 members as per mentioned in its website http://bfvapea.com/

Bangladesh Agro-Processors' Association (BAPA) a non profitable organization in the National level with a commitment to organize, promote, co-relate all the activities of the new actors in the screen of this emerging sector, already recognized by the Govt. as the 'Thrust Sector'. Its website: http://bapabd.org/

3.16 Vegetable value chain in domestic & international segment.

Rural farmers are the producer of vegetable. These harvested vegetables are purchased by primary intermediers and then by secondary intermediers and send to terminal whole sale market. After processing it is forwarded to freight forwarding agent to sale abroad.

Vegetables Value Chain

Domestic segment

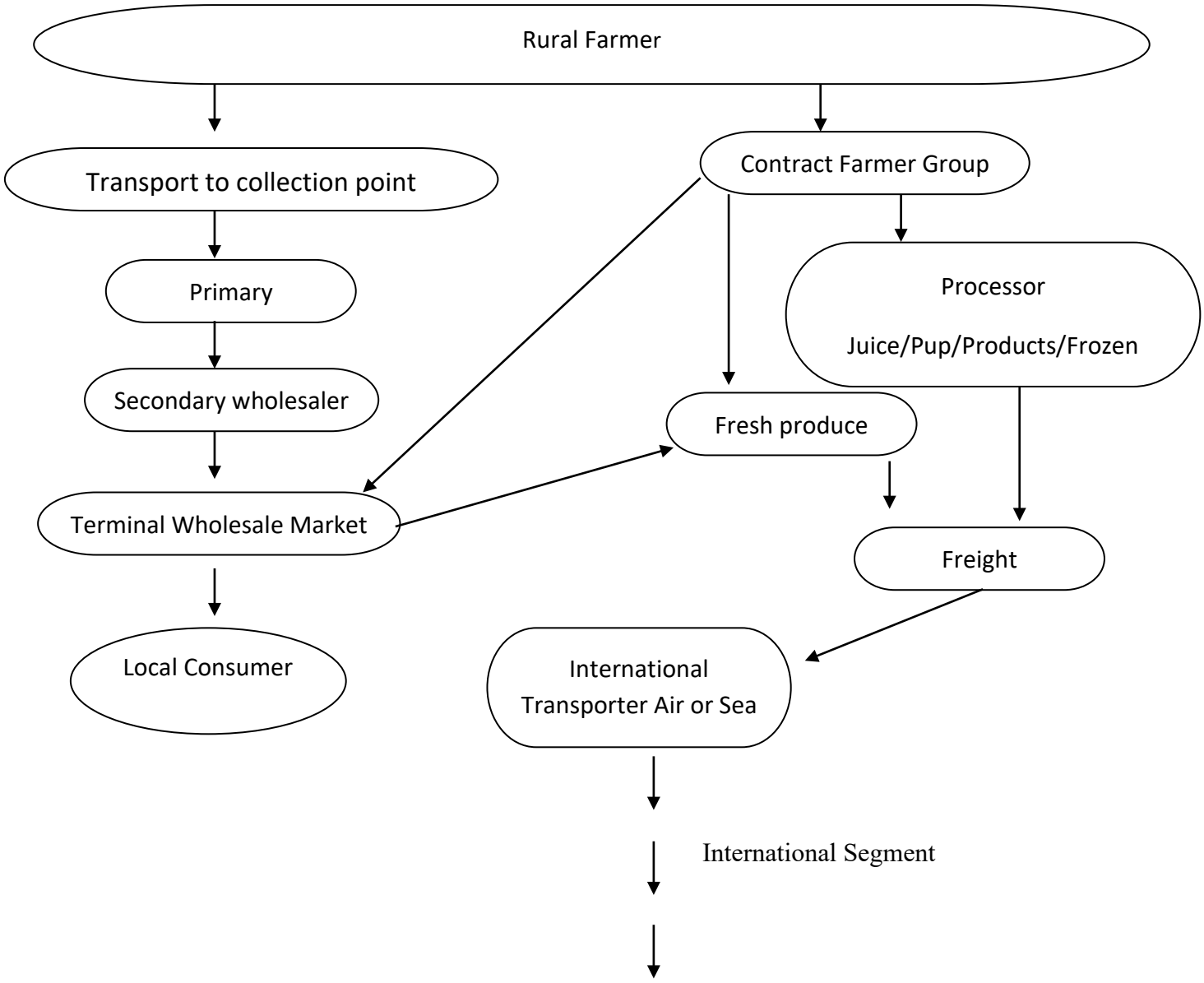


Figure 3.10 Internal Value chain of Vegetable

After reaching foreign country Bangladeshi vegetables are carried toimporter of that country by clearing agent through transporter. The importers of that countries sale it to the distributers. The distributers sale it to whole saler, then secondary whole saler, and finaly reached to the super market or retailer for end stage to the consumers for consuming.

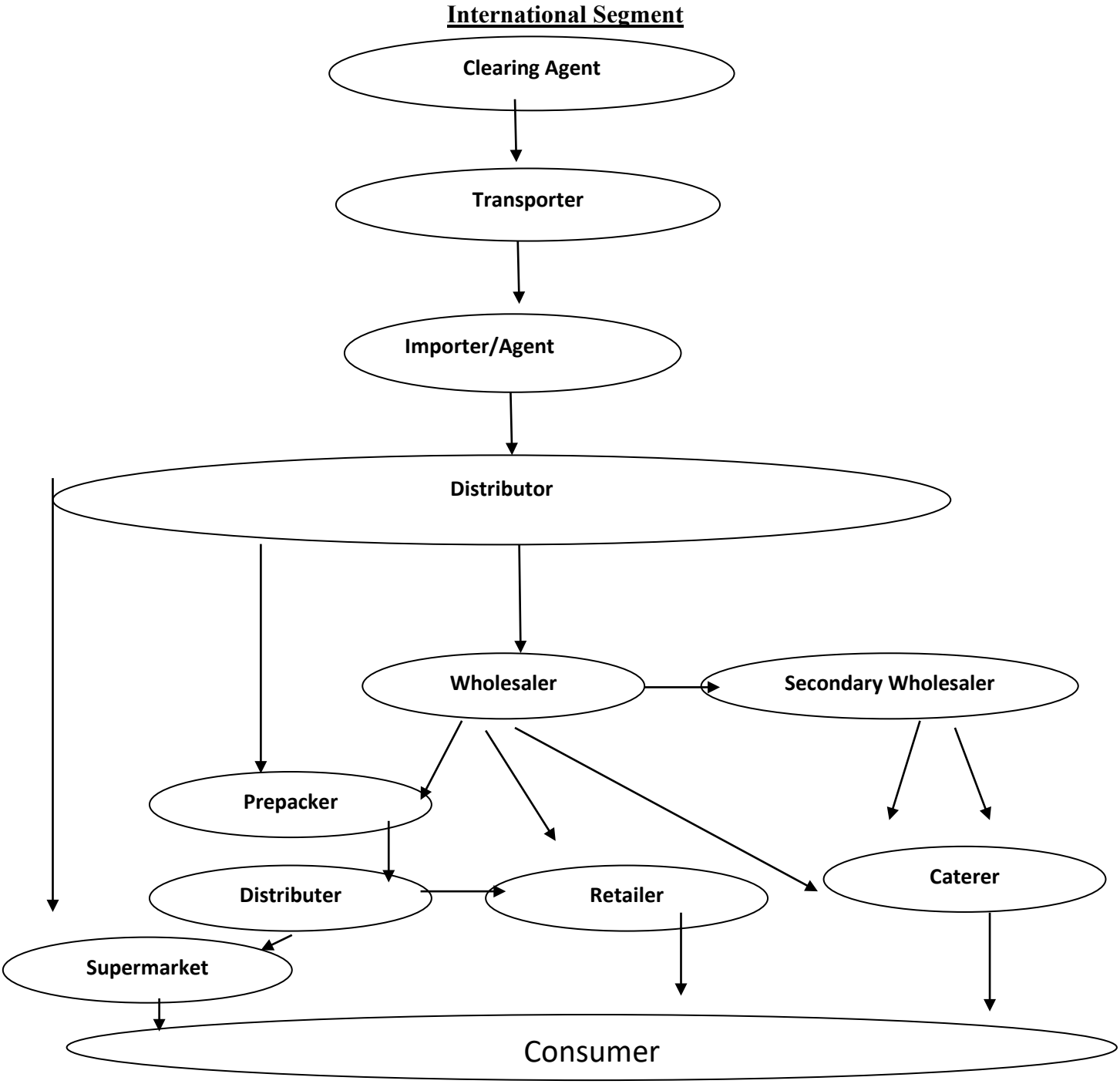


Figure 3.11 International segment of vegetable value chain.

3.17 Assessment of some horticultural crops exported through Hortex

Fruit:

1. **Mango:** Over 30 countries now supply the market. India is the world's largest producer but is a minor player on most of the developed international markets as its main variety Alphonso is not in great demand and shipping costs are high. Pakistan (variety: Langra) and India (variety: Alphonso) are just 3 days sailing to the Gulf where large qualities of mango are shipped by open dhow at very low cost. Low cost sea freighted Tommy Atkins from Brazil dominates world trade. There is a short gap in the Brazilian season late July, August and September when prices are high and there is a growing preference within the catering trades for flavour as opposed to appearance. It may be that there is opportunity in Bangladesh for late season crops of highly flavoured local varieties. Sadly the mission found from anecdotal evidence fromthose involved in mango research that the late varieties lack flavour. Opportunity: a crop of very limited export potential that would require extensive promotion of its organic pedigree and unique flavour and FairTrade credentials for success.
2. **Banana:** There are two distinct types of banana grown in Bangladesh:

i) The traditional long banana ii) the small, very sweet, banana known as the "Apple Banana" locally or "baby" in the trade. It is unlikely that Bangladesh could compete with the major banana producing Countries in a trade dominated and to a certain extentcontrolled by the vertically integrated "dollar" producer, shipping, ripening and marketing conglomerates such as Dole, Chiquita and Del Monte.

Opportunity: No potential for the mainstream long banana. Apple banana may have Possibilities if it's FairTrade and organic credentials and its flavour and use are heavilypromoted.

Photograph 3.1: Multiple cropping of Papaya and Banana in Bogra

3. **Citrus**: Bangladesh does not enjoy the ideal Mediterranean climate favorable for these crops; crops that are now grown on a very large commercial and mechanised scalein countries enjoying a favorable climate.Opportunity: There is no potential for orange, mandarin, grapefruit or tangerine. There may be very limited opportunity for Pomello as an exotic fruit.
4. **Papaya:** This crop is grown extensively in Bangladesh and is used in its green state as a vegetable as such it has no demand on international markets. There is a market for the small "Solo" cultivars currently not grown in Bangladesh. Opportunity: Of no commercial export potential other than the traditional ethnic overseas Bangladeshi market.
5. **Pineapple**: This crop requires a dry climate for success and is extensively grown on a large commercial scale by the conglomerates in Asia, Africa and South

America. Smooth Cheyenne is the preferred variety as it is the best variety for canning and travels well. The fresh market is moving towards better tasting varieties such as "Queen". Europe is supplied by West Africa and the Middle East by S.E Asia. It is now a highly competitivemarket dominated by the conglomerates. Opportunity: None for the mainstream crop but there is growing interest in Baby pineapple providing the quality and taste is exceptional.

6. **Jackfruit:** Popular in Bangladesh but insignificant on the world market. Jackfruits being large and bulky are difficult to export cost effectively and exports are limited to neighbouring countries. Opportunity: Little opportunity for whole fresh fruit. There may be an opportunity for prepared, prepacks in the developed markets as an alternative exotic fruit

7. **Exotics:** Lychee, Carambola, and Sapodilla: Lychee is becoming a minor

Mainstream fruit in all the developing markets. Judging from the appearance of trees seen in the field and the extensive new planting Lychee grown in Bangladesh may be of the qualityacceptable on the markets. Carambola and Sapodilla are still back yard crops and quality could be variable. Opportunity: The exotic fruits market is expanding in all the developed markets, as consumers demand a wider choice. If marketed and promoted well therecould be opportunity for these fruits but compared to the mainstream fruit crops this segment will always remain a small niche market.

Vegetables

The majority of vegetables grown in Bangladesh are the Asian vegetables, Long bean, the gourds, okra and aubergine (egg plant or "Brinjal"), and the domestic staples such as tomato, cucumber and the brassicas (Cabbage and Cauliflower).

1. **The Asian Vegetables**: These are grown extensively through out the region and Africa. The varieties of eggplant grown in Bangladesh are not in demand other

than by the expatriate ethnic consumers, the market demanding the large perfectly formed purple varieties grown extensively in Europe and North Africa and under protection in the Middle East. High quality Okra is in demand, particularly in the Middle East but competition is fierce from local production and production in neighbouring countries such as Iran, Lebanon, Syria, Turkey, Egypt and Jordan.

Opportunity: The market for Asian and Japanese green vegetables although relatively small, is expanding in both Europe and the Middle East driven by adventurous chefs and consumers wanting variety. There may be opportunity to widen the range currently grown in Bangladesh specifically aimed at the wider Ethnic markets.

Photograph 3.2: Vegetable field in Pirojpur. Farmar created High land called "Mada" (Local Language) to overcome the flash flood.

2. **Brassicas:** Cabbage, Cauliflower and broccoli; these crops are grown extensively during the winter season (November to March) in the Middle East and during Spring/summer months March to October in Europe and North Africa.

Opportunity: Very little for the mainstream crops but there may be opportunity to widen the range to include the more exotic Chinese leaf brassicas and the use of cauliflowerand broccoli florets in mixed packs or as baby vegetables.

3. **Tomato and Cucumber**: All the main developed markets are well supplied from local production. The developed markets demand extremely high quality that is locally produced preferring the long "European cucumber", the perfectly formed round tomato, the large "beef" tomato and the small "cherry" tomato. The Middle East demands the smaller cucumber typical of the region and North Africa and is well supplied from local production and production in low cost neighbouring countries. **Opportunity:** None

4. **The non-traditional vegetables:** Fine bean, bobby bean, snow pea, mangetout, baby corn, sugar peas and green/red chilli peppers. These crops are in demand on all the export markets particularly from the catering sector that are mainly supplied from East and North Africa. Political uncertainties e.g. Zimbabwe, and a degree of climatic uncertainties (drought and off-seasonal rain) have caused supply interruptions and buyers are always looking for alternative secure sources. They are all high labour demanding crops both in production and packing which is why production has moved from the importing countries to low cost producing countries.

Opportunity: These crops offer, perhaps, the best opportunity for export horticulture inBangladesh providing the production and post harvest satisfies the high quality demands and exporters can satisfy the service demands.

5. **Aromatics:** Lemon grassthis is widely used in Indian and Chinese cooking and is becoming popular with many chefs. Opportunity: Very limited as it is easily grown and widely produced.

Floriculture crops:

Although floriculture is outside the brief to focus on the Fruits and Vegetable sector it is amajor Horticulture sector that is actively being promoted by Hortex.

Cut flower production is perhaps the most demanding of all horticulture crops in regard to climatic conditions. Any deviation from the ideal for each crop compromises quality, bud size, petal count and stem length. Many crops such as chrysanthemum are photoperiodic and temperature sensitive and will not flower if exposed to high temperature or equal day/night sunlight. Most are perennial and intolerant of wet damp or waterlogged conditions. Whilst many of the crops are grown in gardens in Bangladesh, the climate in Bangladesh is not suitable for the production of the mainstream crops such as roses, carnations, lily, or chrysanthemum. Gladioli and Gerbera have been identified as potential cut – flower export crops. Both demand dry conditions for successful production. Gerbera (naturally a desertplant) is a perennial that is intolerant of wet conditions. It is one of the most difficult crops to pack as the flower head is at right-angles to the stem. As cut flowers are air freighted and asall airlines calculate freight costs on a volumetric rather than weight basis the low stem count/volume kg of gerbera means that transportation costs per stem is very high. Gladiolus is grown in Bangladesh for the domestic market but the climate is not ideal and it is a crop widely grown in countries closerto the major importing countries. Tropical exotics – the tropical orchids, - dendrobium, moccara, -, heliconia, and tuberose are currently being grown in Bangladesh but the quality is not up to world standard. The rangecould be extended by introducing, oncidium, vanda and phalaenopsis. Anthodium and Ginger lily could be grown in the southern regions. The market for tropical orchids is large but supplies are adequate dominated by Thailand's highly developed production and marketing.

The export market for anthurium is dominated by very high quality flowers grown in theNetherlands and from exports from low cost Mauritius and Caribbean producers. Unless there is considerable investment in commercializing the production and marketing effectively to compete with the current major players it is very unlikely that floriculture crops have potential in Bangladesh.

3.18 Potential breed of vegetables, fruits & flowers invented by BARI to chase international market

Bangladesh Agricultural Research Institute (BARI) is the main research & development center for vegetables, fruits & flowers production in Bangladesh. It has 28 research stations including 03 southern hilly districts in Bangladesh. Every year new & developed varieties launch in the market. The verities are rich in quality & more sustainable in adverse climate condition. They are also adopted in different seasons. So, that the quality vegetable is now under cultivation all around the country to compete the international market. Specially the summer season is the most important season in our country. Once summer season means no vegetable season in the country. But in summer, the western countries required more vegetable import from the tropical country. Summer is the high season for vegetable export. BARI has given focus to invent vegetable production in summer season. Actually BARI is successful in their mission. Some of their introduced verities are in following:-

Breed invented by Bangladesh Agricultural Research Institute:			
Sl. No	**Name of the Crop**	**Varity Name**	**Development Year**
1	Brinjal	BARI Bt Begun 4	2013
2	Brinjal	BARI Bt Begun 3	2013
3	Brinjal	BARI Bt Begun2	2013
4	Brinjal	BARI Bt Begun-1	2013
5	Leafy Amaranth	BARI Leafy Amaranth-1	2006
6	Jack Bean	BARI Jack Bean-1	2011
7	Tomato	BARI Hybrid Tomato 8 (summer)	2011
8	Tomato	BARI Hybrid Tomato 7	2011
9	Country Bean	BARI Sheem 7(summer)	2011
10	Korola	BARI Hybrid Korola 1	2011
11	Sbake gourd	BARI Chichinga-1	2011
12	Brinjal	BARI Hybrid Begun-4	2011
13	Brinjal	BARI Hybrid Begum3	2011
14	Water melon	Padma (F1 Hybrid)	1993
15	Chinakopi	BARI Chinakopi - 1	1996
16	Brinjal	BARI Begun -3 (Shuktara)	1992
17	Giant grandilla	BARI Sita lau 1	2011
18	Jack bean	BARI Jack Sheem 1	2011
19	Hyacinth bean	BARI Sheem 6	2011
20	Hyacinth bean	BARI Jharsheem 3 (Khaishya)	2011
21	Bottle gourd	BARI lau-4	2010
22	Bottle gourd	BARI Lau-3	2010
23	Capsicum	BARI Mistimorich 1	2009
24	Dwarf Bean	BARI Sheem 5 (Dwarf)	2009
25	Brinjal	BARI Begun-10	2009
26	Brinjal	BARI Begun-9	2009
27	Tomato	BARI Tomato-15	2009
28	Lettuce	BARI Lettuce-1	2007
29	Brinjal	BARI Begun-2 (Tarapuri), Hybrid	1992
30	Brinjal	BARI Begun-1 (Uttara)	1986
31	Brinjal	BARI Begun-4 (Kazla)	1998
32	Brinjal	BARI Begun-5 (Nayantara)	1998
33	Brinjal	BARI Begun-6	2006
34	Brinjal	BARI Begun-7	2006
35	Brinjal	BARI Begun-8	2006
36	Tomato	BARI Tomato-1 (Manik)	1986
37	Tomato	BARI Tomato-2 (Ratan)	1986
38	Tomato	BARI Tomato-3	1996

39	Tomato	BARI Tomato-4	1996
40	Tomato	BARI Tomato-5	1996
41	Tomato	BARI Tomato-6 (Chaiti)	1998
42	Tomato	BARI Tomato-7 (Apurba)	1998
43	Tomato	BARI Tomato-8 (Shila)	1998
44	Tomato	BARI Tomato-9 (Lalima)	1998
45	Tomato	BARI Tomato-10 (Anupama), summer hybrid	1998
46	Tomato	BARI Tomato-11 (Jhumka)	2000
47	Tomato	BARI Tomato-12 (Sidur)	2000
48	Tomato	BARI Tomato-13 (Shraboni), summer hybrid	2000
49	Tomato	BARI Tomato-14	2007
50	Tomato	BARI Hybrid Tomato-3 (summer)	2006
51	Tomato	BARI Hybrid Tomato-4 (summer)	2006
52	Tomato	BARI Hybrid Tomato-5	2008
53	Tomato	BARI Hybrid Tomato-6	2008
54	Cauliflower	BARI Phulkopi-1	1998
55	Cauliflower	BARI Phulkopi-2	2006
56	Cabbage	BARI Badha kopi-1(Provati)	1996
57	Cabbage	BARI Badha kopi-2 (Agradut)	1998
58	Radish	BARI Mula-1 (Tasaki Mula)	1983
59	Radish	BARI Mula-2 (Pinky)	1996
60	Radish	BARI Mula-3 (Druti)	1998
61	Radish	BARI Mula-4	2008
62	Batishak	BARI Batishak-1	1984
63	Chinashak	BARI Chinashak-1	1985
64	Bottle gourd	BARI Lau-1	1996
65	Bottle gourd	BARI Lau-2	2006
66	Bitter gourd	BARI Karola-1	2006
67	Pumpkin	BARI Misti Kumra-1	2007
68	Ash gourd	BARI Chal Kumra-1	2006
69	Pumpkin	BARI Misti Kumra-2	2007
70	Ridge gourd	BARI Jhinga-1	2008
71	Pointed gourd	BARI Potol-1	2007
72	Country Bean	BARI Sheem-1	1996
73	Pointed gourd	BARI Potol-2	2006
74	Country Bean	BARI Sheem-2	1996
75	Country Bean	BARI Sheem-3 (summer)	2006
76	Country Bean	BARI Sheem-4	2007
77	Garden Pea	BARI Motor shuti-2	1996
78	Garden Pea	BARI Motor shuti-3 (Aguri)	1999

79	Yard Long Bean	BARI Borbati-1	2006
80	Bush bean	BARI Jhar Sheem-1	1996
81	Bush bean	BARI Jhar Sheem-2	2002
82	Kangkong	BARI Gimakalmi	1983
83	Ladys finger	BARI Dherosh-1	1996
84	Garden Pea	BARI Motor shuti-1	1996
85	Indian spinach	BARI Puishak-1 (Chitra)	1983
86	Indian spinach	BARI Puishak-2	2006
87	Green Amaranth	BARI Sabuj Danta shak-1	2006
88	Red Amaranth	BARI Lalshak - 1	1996
89	Stem Amaranth	BARI Danta -1 (Laboni)	2000
90	Stem Amaranth	BARI Danta -2	2006

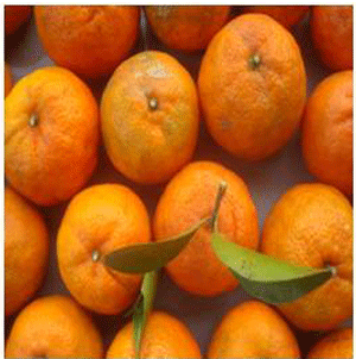
Fruits Development by BARI			
Sl. No	**Name of the Crop**	**Varity Name**	**Development Year**
1	Ber	BARI Ber-4	2013
2	Mandarin	BARI Mandarin-2	2013
3	Wax Jambu	BARI Wax Jambu-2	2012
4	Sweet Lime	BARI Sweet Lime-1	2012
5	Lichu	BARI Lichu-5	2012
6	Banana	Basrai	1976
7	Mango	BARI Aam-10	2012
8	Aonla	BARI Amloki - 1	2011
9	Jack fruit	BARI Kanthal-2	2011
10	Velvet Apple	BARI Biltigab-1	2011
11	Mango	BARI Aam 9	2011
12	Rambutan	BARI Rambutan-1	2009
13	Mango	BARI Aam-8	2009
14	Mango	BARI Aam-7	2009
15	Mango	BARI Aam-6	2009
16	Mango	BARI Aam-5	2009
17	Burmese grape (Lotkan)	BARI Lotkan-1	2009
18	Carambola	BARI Kamgranga-1	2007
19	Strawberry	BARI Strawberry-1	2007
20	Passion fruit	BARI Passion Phal-1	2003
21	Pear	BARI Nashpti-1	2003
22	Golden apple	BARI Amra-2	2011
23	Banana	BARI Kola-4	2007
24	Lichu	BARI Lichu-4	2007
25	Jack fruit	BARI Kanthal-1	2009
26	Tamarind	BARI Tentul-1	2009
27	Carambola	BARI Kamranga-2	2010
28	Longan	BARI Anshphal-2	2010
29	Sapota	BARI Sofeda-3	2009
30	Ber	BARI Kul-3	2009
31	Mango	BARI Aam -3	1996
32	Mango	BARI Aam -4 (Hybrid)	2002
33	Mango	BARI Aam -1	1996
34	Mango	BARI Aam -2	1996
35	Sapota	BARI Safeda-2	2003
36	Sapota	BARI Safeda-1	1996
37	Mandarin	BARI Kamala 1	1996
38	Ber	BARI Kul-2	2003
39	Ber	BARI Kul-1	2003
40	Lemon	BARI Lebu-3	1996
41	Satkara	BARI Satkara-1	2005
42	Toikar	BARI Toikar 1	1996

43	Coconut	BARI Narikel -2	1996
44	Coconut	BARI Narikel -1	1996
45	Malta (Sweet orange)	BARI Malta-1	2005
46	Longan	BARI Anshphal -1	1996
47	Wax Jambu	BARI Wax Jambu-1	1996
48	Golden Apple	BARI Amra -1	2003
49	Lemon	BARI Lebu-1	1996
50	Banana	BARI Kola -1	2000
51	Lemon	BARI Lebu-2	1996
52	Banana	BARI Kola -2	2000
53	Lichu	BARI Lichu -1	1996
54	Banana	BARI Kola -3	2005
55	Lichu	BARI Lichu -2	1996
56	Guava	BARI Peyara -3	2003
57	Guava	BARI Peyara -2	1996
58	Guava	Kazi Peyara	1984
59	Lichu	BARI Lichu -3	1996
60	Pummelo	BARI Batabilebu-4	2004
61	Pummelo	BARI Batabilebu-3	2003
62	Pummelo	BARI Batabilebu-2	1996
63	Pummelo	BARI Batabilebu-1	1996
64	Papaya	Shahi Pepe	1992

Description of New varieties invented by BARI

BER	
Name of the Crop	Ber
Varity Name	BARI Ber-4
Development Year	2013
Variety Image	
Developed By	ARS, Raikhali, Chandraghona, Rangamati
Identifying Character	• Fruit is oval shaped • Ripe fruit is attractive yellowish green in color • Average individual fruit weight is 36 g • High edible portion (96%) • Sweet in taste (TSS 15%) • Fruit is enriched with high vitamin C (65 mg/100 g) and β-carotene (16.93 µgm/100g) • Seed is small and oval-blunted • Number of fruits from a three to five years old plant is 5321-5855
Crop Duration	Perennial. Flowering occurs after 3-4 years of planting. The crop shows its full bearing potentiality after 6-7 years of planting and produced fruits
Yield	40-50 t/ha (188-210 kg/plant)
Fruit Size	34-40g
Fruit Colour	Attractive yellow colour at full ripe
Suitable Area	All over the Bangladesh

Mandarin

Name of the Crop	Mandarin
Varity Name	BARI Mandarin-2
Development Year	2013
Variety Image	
Developed By	Hill Tract Agricultural Research Station, BARI, Khagrachari
Identifying Character	Fruits are small (35-40 g) Very sweet (TSS 12-13.3 %) Pulp colour is deep yellow. High edible portion (70-73 %) Reach in vitamin C (21.66 mg/100 g of juice)
Crop Duration	Perennial, Flowering occurs after 2-3 years of planting. The crop shows its full bearing potentiality after 8 years of planting and produced fruits up
Yield	900-1000 kg/ha (4 years plant)
Fruit Size	35-40 g
Fruit Colour	Orange at full ripe
Suitable Area	Hilly area

Lichi

Name of the Crop	Lichu
Varity Name	BARI Lichu-5
Development Year	2012
Variety Image	
Developed By	Hill Agriculture Research Station, Khagrachari
Identifying Character	Identifying character: High yielding (3400 fruits weighing 77.8 kg) from 15 years old plant and regular bearing late season variety. Sweet (TSS 17.5%). Fruits are medium (21.80g), oval in shape, deep red in colour at ripening stage. Proper harvesting period is 1st week of June. Pulp is white and edible portion is 70%. Tolerant to major disease and insect pests. Yield is 11.56 t/ha in 15 years old tree.
Crop Duration	Perennial
Yield	11.56 t/ha in 15 years old tree
Fruit Size	Length 3.3 cm and Breadth 3.3 cm
Fruit Colour	Deep red
Suitable Area	Hill tract region of Bangladesh

Mango

Name of the Crop	Mango
Varity Name	BARI Aam-10
Development Year	2012
Variety Image	
Developed By	Hill Agriculture Research Station, Khagrachari and Regional Horticulture Research Station, Akbarpur, Moulvibazar
Identifying Character	Identifying character: High yielding (290 fruits weighing 72.5 kg at Khagrachari and 250 fruits weighting 63.0 kg at Akbarpur from 10 years old plant) and regular bearing mid season variety. Sweet (TSS 18%), juicy and fibreless. Fruits are medium sized (average wt. 210-250g) at mature stage, oval in shape, skin medium thick and yellow in colour at ripening stage. Proper harvesting period is 2nd week of June Pulp is deep yellow in colour and edible portion is 67-72%. Yield : 9.87 ton/ha at Akbarpur and 11.33 ton/ha at Khagrachari from ten years old trees. Tolerant to major disease and insect pests.
Crop Duration	Perennial
Yield	8.0-9.5 t/ha (10 years old plant)
Fruit Size	Length 9.0 cm and Breadth 7.7 cm
Fruit Colour	Light yellow

Jack fruit

Name of the Crop	Jack fruit
Varity Name	BARI Kanthal-2
Development Year	2011
Variety Image	
Developed By	Fruit Division, HRC
Crop Duration	perennial tree
Yield	38-58 t/ha
Fruit Size	6.95 kg
Fruit Colour	Green
Suitable Area	All over Bangladesh
Harvesting Time	January to April

Ber

Name of the Crop	Ber
Varity Name	BARI Kul-2
Development Year	2003
Variety Image	
Developed By	Fruit Research Station, Binodpur, Rajshahi
Yield	19t/ha, 95kg/plant
Fruit Size	Oblong (large)
Fruit Colour	Greenish yellow
Suitable Area	All over the country

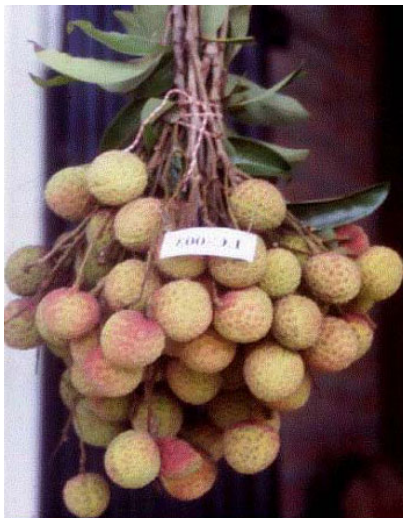
Coconut

Name of the Crop	Coconut
Varity Name	BARI Narikel -2
Development Year	1996
Variety Image	
Developed By	Regional Agriculture Research Station, Rahamatpur, Barishal
Yield	74 Fruits/ Plant
Fruit Size	Ovoid (large)
Fruit Colour	Brown
Suitable Area	All over the country

Banana

Name of the Crop	Banana
Varity Name	BARI Kola -1
Development Year	2000
Variety Image	
Developed By	Horticulture Research Centre, Joydebpur, Gazipur
Yield	50 ton/hectare or 150-200/ finger/ bunch
Fruit Size	Long
Fruit Colour	Bright yellow (ripen)
Suitable Area	All over Bangladesh

Lichi

Name of the Crop	Lichu
Varity Name	BARI Lichu -2
Development Year	1996
Variety Image	
Developed By	Fruit Research Station, Binodpur, Rajshahi
Yield	3000 fruits/tree
Fruit Size	Oval
Fruit Colour	Pink (rippen)
Suitable Area	All over the country

Papaya

Name of the Crop	Papaya
Varity Name	Shahi Pepe
Development Year	1992
Variety Image	
Developed By	Horticulture Research Centre, Joydebpur, Gazipur
Yield	40 -50 ton/heater
Fruit Size	Oblong
Suitable Area	All over the country

Malta (Sweet orange)

Name of the Crop	Malta (Sweet orange)
Varity Name	BARI Malta-1
Development Year	2005
Variety Image	
Developed By	Horticulture Research Center
Yield	64-33 fruits/ Plant (14.35kg/plant)
Fruit Size	100- 120g/fruit
Fruit Colour	Yellowish green
Suitable Area	Sylhet and Chittagong region

Aonla

Name of the Crop	Aonla
Varity Name	BARI Amloki - 1
Development Year	2011
Variety Image	
Developed By	Fruit Division, HRC
Crop Duration	Perennial Tree
Yield	26 t/ha
Fruit Size	30 g
Fruit Colour	Light Green
Suitable Area	All over Bangladesh

Guava

Name of the Crop	Guava
Varity Name	Kazi Peyara
Development Year	1984
Variety Image	
Developed By	Horticulture Research Centre, Joydebpur, Gazipur
Fruit Size	Pear/Near to round
Fruit Colour	Yellowish Green

Details Vegetables of BARI

Brinjal

Name of the Crop	Brinjal
Varity Name	BARI Bt Begun-1
Development Year	2013
Variety Image	
Developed By	Olericulture Division, HRC, Gazipur
Identifying Character	A popular variety of Brinjal in Bangladesh having prostrate type plant, stem Purple brown, Cluster type of flower, fruit elliptical, Purple and Glossy. resistant to Brinjal shoot and fruit borer (BSFB) high yielding cluster type eggplant/Brinjal variety, prolific bearer, 80-100 fruits/plant, yield is about 28-30 t/ha (marketable yield). Reduces 54-70 % yield loss by BSFB infestation.
Crop Duration	150-180 days (DAT)
Yield	28-30 (t/ha)
Fruit Size	Medium long/Cylindrical
Fruit Colour	Pink
Suitable Area	All over Bangladesh

Tomato

Name of the Crop	Tomato
Varity Name	BARI Hybrid Tomato 8 (summer)
Development Year	2011
Variety Image	
Developed By	Olericulture Division, HRC, Gazipur
Identifying Character	Heat tolerant hybrid tomato variety without hormone spray, Number of fruits per plant 40-45, Avg. fruit weight 60-70g, Higher shelf life
Crop Duration	90-100 days (DAT)
Yield	35-40 (summer)
Fruit Size	Flattened round shaped
Fruit Colour	Red
Suitable Area	All over Bangladesh

Country Bean

Name of the Crop	Country Bean
Varity Name	BARI Sheem 7(summer)
Development Year	2011
Variety Image	
Developed By	Olericulture Division, HRC, Gazipur
Identifying Character	Able to produce flower and set pod at high temperature, Flat type pod, Number of pod per plant 300-400, Deep green flat wide pod, Can be grown year round specially recommended for summer-rainy season
Crop Duration	150-180 days
Yield	All over Bangladesh
Fruit Colour	Deep green
Suitable Area	All over Bangladesh

Brinjal

Name of the Crop	Brinjal
Varity Name	BARI Hybrid Begum3
Development Year	2011
Variety Image	
Developed By	Olericulture Division, HRC, Gazipur
Identifying Character	Intermediate growth habit with deep lobed leaves, Long cylindrical deep purple fruits, Tolerant to bacterial wilt, prolific bearer (40-50 fruits/plant),, Average fruit weight 90-110 g, Fruits can be harvested in 55-65 days, Yield 55-60 t/ha
Crop Duration	140-150 days
Yield	55-60
Fruit Size	Long Cylindrical
Fruit Colour	Deep purple
Suitable Area	All over Bangladesh

Jack bean

Name of the Crop	Jack bean
Varity Name	BARI Jack Sheem 1
Development Year	2011
Variety Image	
Developed By	Olericulture Division, HRC, BARI, Gazipur
Identifying Character	Plant is dwarf (100-110/cm) erect Deep rooted plants. Can be grown without trellis Number of pods/plant : 45-55 Pods are like as sword Pods are soft, fleshy and less fibrous Pod length is 20-24 cm and breadth is 1.8-2.0 cm Pod yield (18-20 t/ha) Year round production Grown in dry and wet climatic condition
Crop Duration	March-November
Yield	18-20 t/ha
Fruit Size	Length is 20-24 cm and breadth is 1.8-2.0 cm
Fruit Colour	Green

Tomato

Name of the Crop	Tomato
Varity Name	BARI Hybrid Tomato-6
Development Year	2008
Variety Image	
Developed By	Olericulture Division, HRC, Gazipur
Identifying Character	Recommended for winter season, Large round fruit with attractive red flesh colour 90-95g, Very good shelf life, Resistant to bacterial wilt and Yellow Leaf Curl Virus
Crop Duration	120-130 days (DAT)
Yield	90-95
Fruit Size	Round
Fruit Colour	Red
Suitable Area	All over Bangladesh

Cauliflower

Name of the Crop	Cauliflower
Varity Name	BARI Phulkopi-1
Development Year	1998
Variety Image	
Developed By	Olericulture Division, HRC, Gazipur
Identifying Character	Open pollinated tropical cauliflower variety, Produces abundant seed under local condition (500-600 kg/ha), White coloured compact curd.
Crop Duration	95-105 days
Yield	28-30
Fruit Colour	White
Suitable Area	All over Bangladesh

Cabbage

Name of the Crop	Cabbage
Varity Name	BARI Badha kopi-2 (Agradut)
Development Year	1998
Variety Image	
Developed By	Olericulture Division, HRC, Gazipur
Identifying Character	Open pollinated tropical cabbage variety with the capability of seed production under Bangladesh climate, Head is compact and flat, Average head weight is 2-2.4 kg, Becomes harvestable after 70-80 days after transplanting, Seed yield is 600-650 kg/ha.
Crop Duration	100-110 days
Yield	65-70
Fruit Size	Flattened round
Fruit Colour	Light green
Suitable Area	All over Bangladesh

Radish

Name of the Crop	Radish
Varity Name	BARI Mula-2 (Pinky)
Development Year	1996
Variety Image	
Developed By	Olericulture Division, HRC, Gazipur
Identifying Character	Tropical OP radish variety and Produce seeds under local climatic condition, Root are cylindrical with attractive pink colour, Becomes ready for harvest after 50-55 days of sowing, Remains edible up to 75 days, Average root wt. 900g.
Crop Duration	45-70 days
Yield	60
Fruit Size	Cylindrical
Fruit Colour	Pink
Suitable Area	All over Bangladesh

Bottle gourd

Name of the Crop	Bottle gourd
Varity Name	BARI Lau-1
Development Year	1996
Variety Image	
Developed By	Olericulture Division, HRC, Gazipur
Identifying Character	Fruits are light green long slender bottle shaped, Each plant produces 10-12 fruits, Average fruit wt. 1.5 kg.
Crop Duration	120-140 days
Yield	42-45
Fruit Size	Long, slender, bottle shaped
Fruit Colour	Light green
Suitable Area	All over Bangladesh

Stem Amaranth

Name of the Crop	Stem Amaranth
Varity Name	BARI Danta -2
Development Year	2006
Variety Image	
Developed By	Olericulture Division, HRC, Gazipur
Identifying Character	Lower 2/3 rd of stem is light purple and the rest upper part is green, Leaves are green, Very quick growing
Crop Duration	50-60 days
Yield	30-32
Suitable Area	All over Bangladesh

Yard Long Bean

Name of the Crop	Yard Long Bean
Varity Name	BARI Borbati-1
Development Year	2006
Variety Image	
Developed By	Olericulture Division, HRC, Gazipur
Identifying Character	Number of fruits per plant 60-70, Pod length 45cm and colour is light green
Crop Duration	200-220 days
Yield	15-20
Fruit Size	Long
Fruit Colour	Light green
Suitable Area	All over Bangladesh

Garden Pea

Name of the Crop	Garden Pea
Varity Name	BARI Motor shuti-2
Development Year	1996
Variety Image	
Developed By	Olericulture Division, HRC, Gazipur
Identifying Character	The edible podded pea variety is free from any disease and pest, Pod at green stage is edible like country bean, Pods are light green, fibreless and flat type unlike garden pea, The pod length is 8 cm and width is 2 cm, The average number of pod/plant is 25.
Crop Duration	65-70 days
Fruit Colour	Light green
Suitable Area	All over Bangladesh

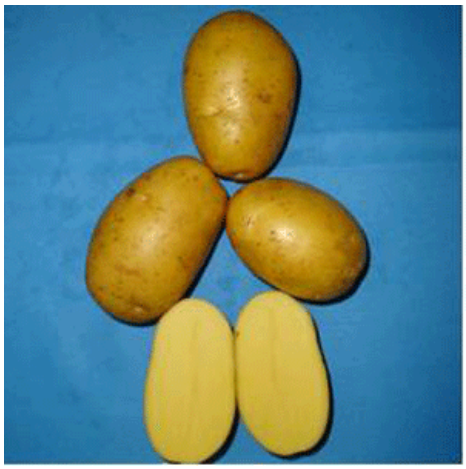
Bottle gourd

Name of the Crop	Bottle gourd
Varity Name	BARI Lau-2
Development Year	2006
Variety Image	
Developed By	Olericulture Division, HRC, Gazipur
Identifying Character	Light green colour, Fruit shape is like ash gourd, ProfUse of fruiting, number of fruits per plant 15-20, Average fruit weight 1.5 kg
Crop Duration	120-140 days
Yield	45-50
Fruit Size	Fruit shape is like ash gourd (square shape)
Fruit Colour	Light green
Suitable Area	All over Bangladesh

Tomato

Name of the Crop	Tomato
Varity Name	BARI Tomato-8 (Shila)
Development Year	1998
Variety Image	
Developed By	Olericulture Division, HRC, Gazipur
Identifying Character	Longer shelf life (15-20 days under normal room temperature), Suitable for transportation due to its compactness and thick, hard skin, Average fruit weight is about 100-115 gm
Crop Duration	110-120 days (DAT)
Yield	100-115
Fruit Size	Roundish
Fruit Colour	Light red
Suitable Area	All over Bangladesh

Potato

Name of the Crop	Potato
Varity Name	BARI Alu-45 (Steffi)
Development Year	2012
Variety Image	
Developed By	Tuber Crops Research Centre
Identifying Character	Identifying character : Medium plant height with intermediate type of stem. Growth habit semi-erect. Stem green with weak anthocyanine coloration on the base of the stem; Medium green leaf. Leaf with no anthocyanine coloration of mid rib. Weak waviness of margin of the leaflet; Short oval to oval shaped, medium size, yellow colour tuber with shallow eye depth. Flesh clour light yellow.
Crop Duration	90-95 days
Yield	25,000-50,000 kg/ha
Fruit Size	Medium
Fruit Colour	Yellow
Suitable Area	All over the country

Deatils of Flowers

Gladiolus

Name of the Crop	Gladiolus
Varity Name	BARI Gladiolus-3
Development Year	2009
Variety Image	
Developed By	Floriculture Division, HRC
Identifying Character	Long flower stalk with 12-14 florets Florets are white in colour Vase life is 8-9 days
Crop Duration	4-5 months
Yield	1,75,000 (Stick /ha)
Fruit Size	9.2 - 9.4 cm
Fruit Colour	White
Suitable Area	All over the Bangladesh

Chrysanthemum

Name of the Crop	Chrysanthemum
Varity Name	BARI Chrysanthemum-2
Development Year	2009
Variety Image	
Developed By	Floriculture Division, HRC
Identifying Character	Possesses attractive white colour flower of 7.0 cm across Flower number per plant is 45 Vase lofe is 14 days
Crop Duration	3-4 months
Yield	39,50,000 (number/ha)
Fruit Size	7.0 cm
Fruit Colour	White
Suitable Area	All over the Bangladesh

Gerbera

Name of the Crop	Gerbera
Varity Name	BARI Gerbera-1
Development Year	2009
Variety Image	
Developed By	Floriculture Division, HRC
Identifying Character	Possesses attractive red colour flower of 9.5 -10 cm across Stalk length is 35-40 cm Vase life is 8-9 days
Crop Duration	110-120 days
Yield	9,60,000
Fruit Size	9.5-10 cm
Fruit Colour	Red
Suitable Area	All over the Bangladesh

3.19 Methods of fruits ripening conducted on the stages of food chain

Both conventional and chemical ripening methods are used in Bangladesh. Synthetic chemicals are especially used for large scale and commercial fruit ripening. Immature andpremature fruits are the main targets for enhanced ripening to obtain early price.

Conventional methods of fruit ripening

Conventional methods of fruit ripening include:

(i) Application of heat (Banana and papaya; (Fig8.2.1),

(ii) Polyethylene covering and application of heat by lighting candles(Banana),

(iii) Fruit piercing through enlarged fleshy peduncle (Jackfruit; Plate 12.5),

(iv)Home fruit ripening by incorporating high concentration ethylene-liberating fruits Likebanana and apples in enclosed container of climacteric fruits (mango, banana and papaya)to be ripened.

Chemical methods of fruit ripening

Usually, ethylene (CH2=CH2), a natural gaseous hormone, is used for fruit ripening.

Photograph 3.4 Heat chamber is used for accelerated Banana ripening (Karwan Bazar, Dhaka).

Usually, ethylene (CH2=CH2), a natural gaseous hormone, is used for fruit ripening. Application of ethylene gas at recommended concentration is the worldwide-used methodfor large-scale and commercial fruit ripening. Application of ethylene gas at a concentration of 0.1-1.0 µL/L for 24 h is sufficient to hasten full ripening of climactericfruits (Wills *et al.* 2004).

Fruit-ripening chemicals in Bangladesh

In Bangladesh, plant growth regulators and calcium carbide (banned) are used in fruit ripening. Different types of synthetic formulations (Ripen-15, Harvest, Profit andPromote) containing ethephon (2-chloroethylphosphonic acid) as active ingredient areavailable in the market (Pic 6.2). Ethephon penetrates into the fruit and decomposes toethylene, which accelerates ripening.

Photograph 3.5: Ripening chemical called 'Promote' is on sale in retail shop (Bogra).

Chemical properties of active ingredients of ripening agents

Active ingredient : Ethephon

Other names : **Chlorethephon**

Chemical name : **2-Chloroethylphosphonic Acid**

Potential health hazard (MSDS, Material Safety Data Sheet)

- Eye irritation
- Skin irritation
- Ingestion: Gastrointestinal irritation with nausea, vomiting, diarrhea,cardiac.
- Disturbances central nervous system depression.
- Inhalation: cardiac abnormalities, high concentration causes CNS depression
- Toxicological information: Oral, rat: LD50 = 3400 mg/kg

Calcium carbide: Properties and mode of action

Calcium carbide produces acetylene gas after absorbing moisture. Acetylene is an analogue of ethylene, the ripening hormone. Calcium carbide poses dangers of explosionand carries toxic materials to the consumers.

$CaC2 + H2O > CaCO3 + CH{\equiv}CH$

Chemical name

Acetylenogen/Calcium acetylide

Physical properties

- Grey-brown solid (rock-like) with garlic odour(Acetylene)

Potential health hazard (MSDS, Material Safety Data Sheet):

- Swallowed: Gastrointestinal tract burns
- Eye: Severe eye burns, blindness
- Skin: Irritation and skin burns
- Inhaled: Severe irritation of the respiratory tract and possible burns

Chapter 4

Results & Discussions of Food Chain System

Vegetable supply chain has been developed to graphically present all the actors in the value chain. Figure 4.1 illustrates channels of activity with various scenarios of effort as they proceed from input supply to production, post harvest handling and distribution to the final consumer. This supply chain diagram shows that assembly traders purchase directly from the field in certain cases. Farmers of large holdings sell their products through middleman (farias) and store for future marketing. Some farmers of small holding also sell to farias. From the primary markets, middlemen take the product to assembly markets and from there to urban of semi-urban markets. The channel has hundreds of producers/growers, hundreds of primary and secondary markets of traders, farias and wholesalers and thousands of retailers.

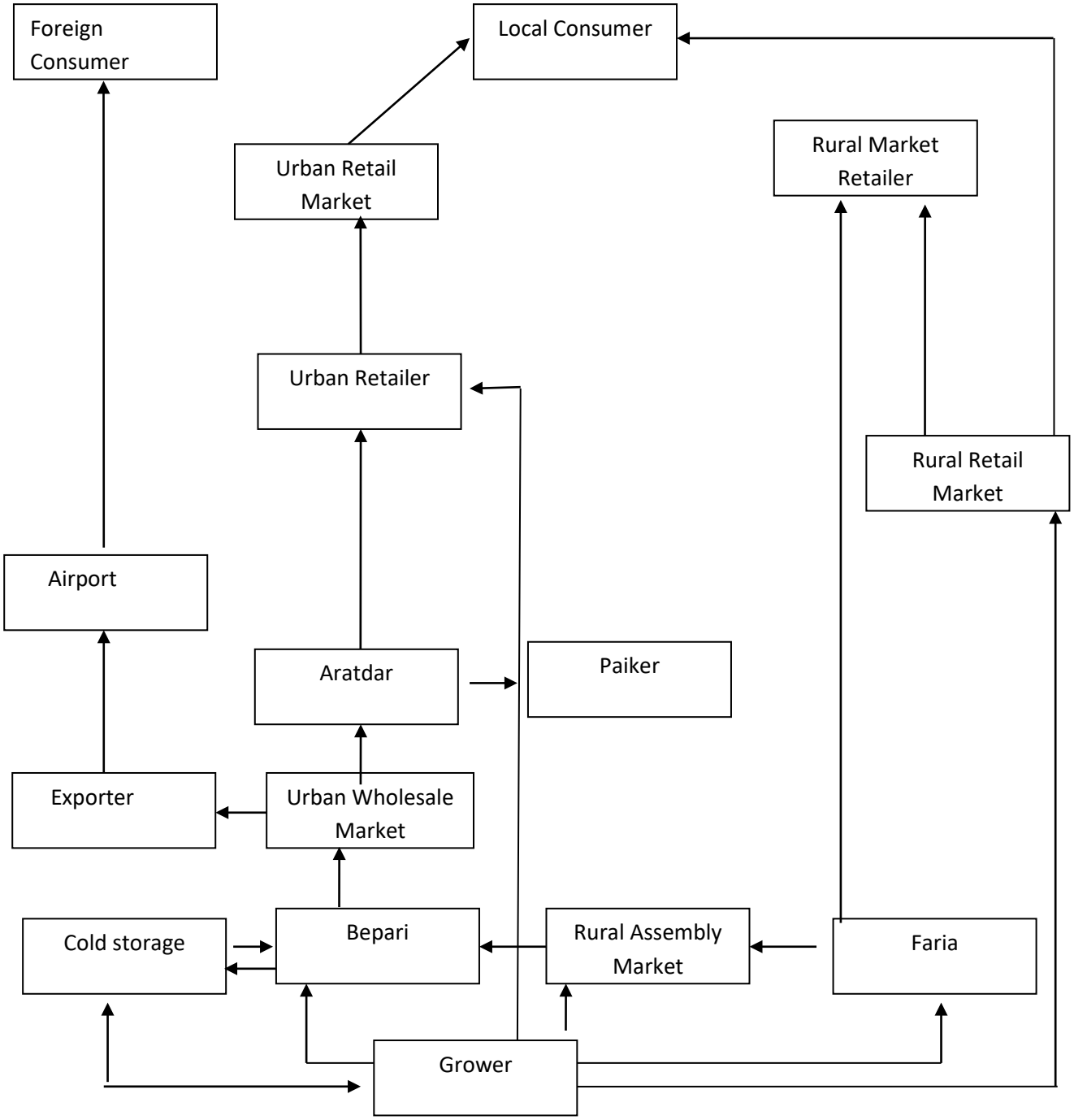


Figure 4.1: Generalized supply chain of vegetables market from grower to foreign/local consumer.

4.1 Supply Chain Management

In Bangladesh the linkagesamong farmers, traders and processors along the supply chain are extensive but not strong, and there exists a significant degree of mistrust between market participants. If level of trust between the actors can be increased and coordination between different levels of the supply chain be improved then stakeholders are more likely to be willing to coordinate activities (Figure 4.2)

Handling Media Systems Activities

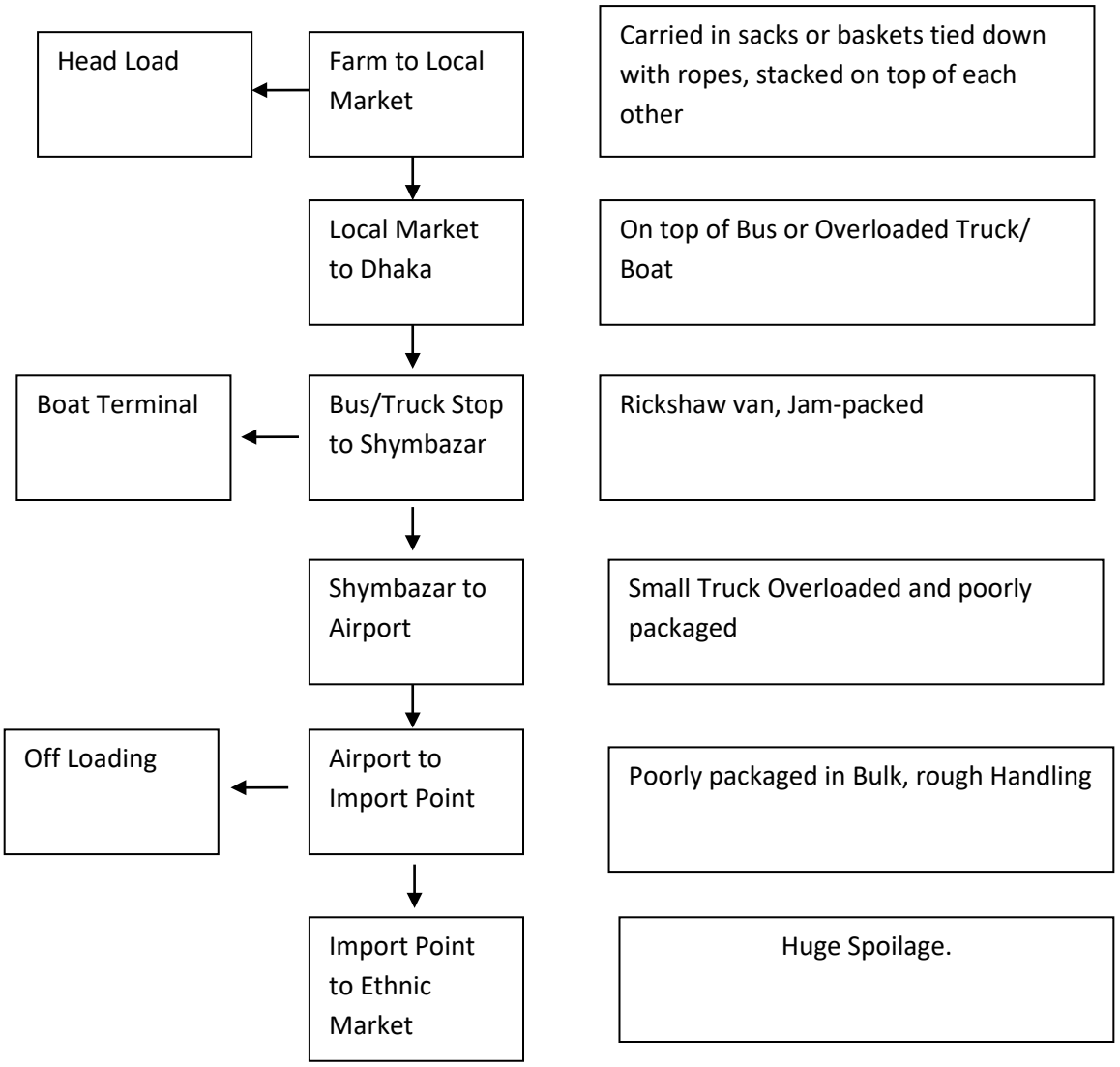


Figure 4.2: Media system activities in the supply chain

Hence there are no strong linkages between the higher and lower levels of the marketing chain, the marketing system in Bangladesh often relies on an extensive network of middleman to coordinate between the different levels and to move goods and services between the different stakeholders. But the endresult is not for onlyan inefficient marketing system, but also there are high levels of post-harvest losses.

The usual supply chain is that middlemen collect orders from exporters, go to producing areas, collect crops from farmers/local markets and arrange to deliver the same to the exporters on the of shipment. The packaging materials are very poor quality. The transportation used is usually on bus top or heavily loaded truck. Neither cool chain is used nor any standard post-harvest handling practices followed. As a result, post-harvest losses are enormous, sometimes more than 10% of the volume exported which in term of estimated value is about US$1.32 million.

4.2 Farmers lose due to middle man interception:

Farmers do not get proper rate due to middle man interception while they take their crops in the local market. Out of 104 respondent 91.3% farmers agree that the middle man interception in the market chain creats the profit curtle of the production. (Table 4.1, Figure 4.3)

Table: 4.1 Farmer's profit curtail due to Middleman interception

Districts	Yes		No		Total	
	N	%	N	%	N	%
Bogra	11	100.0	0	0.0	11	100.0
Comilla	10	100.0	0	0.0	10	100.0
Dhaka	7	70.0	3	30.0	10	100.0
Gaibandha	4	66.7	2	33.3	6	100.0
Kurigram	10	100.0	0	0.0	10	100.0
Kushtia	9	100.0	0	0.0	9	100.0
Mymensingh	10	100.0	0	0.0	10	100.0
Nilphamari	10	100.0	0	0.0	10	100.0
Pirojpur	10	100.0	0	0.0	10	100.0
Rajshahi	8	88.9	1	11.1	9	100.0
Sherpur	6	66.7	3	33.3	9	100.0
Total	**95**	**91.3**	**9**	**8.7**	**104**	**100.0**

This primary data support the secondery data in the following table, where 105 % price increases due to middleman interception. (Table 4.2)

Table 4.2 Percent Increase of commodity price from harvest to retail sale

Products	Harvest price	Retail price	Per cent increase
Mango Tk/kg	41.49	59.96	44.52
Banana Tk/Bunch	145.25	275.00	89.48
Jackfruit Tk/Fruit	26.57	60.81	128.87
Pineapple Tk/Fruit	10.94	25.00	128.52
Litchi Tk/100 Fruit	281.33	481.57	71.18
Papaya Tk/Fruit	16.04	34.70	116.33
Orange Tk/Fruit	5.8	10.23	76.38
Tomato Tk/kg	8.12	17.9	120.44
Okra Tk/kg	15.00	27.96	86.40
Cauliflower Tk/kg	7.58	13.88	88.13
Brinjal Tk/kg	18.95	28.36	49.66
Cucumber Tk/kg	9.14	17.76	94.31
Red amaranth Tk/kg	5.52	19.65	235.32
Average increase			105.29

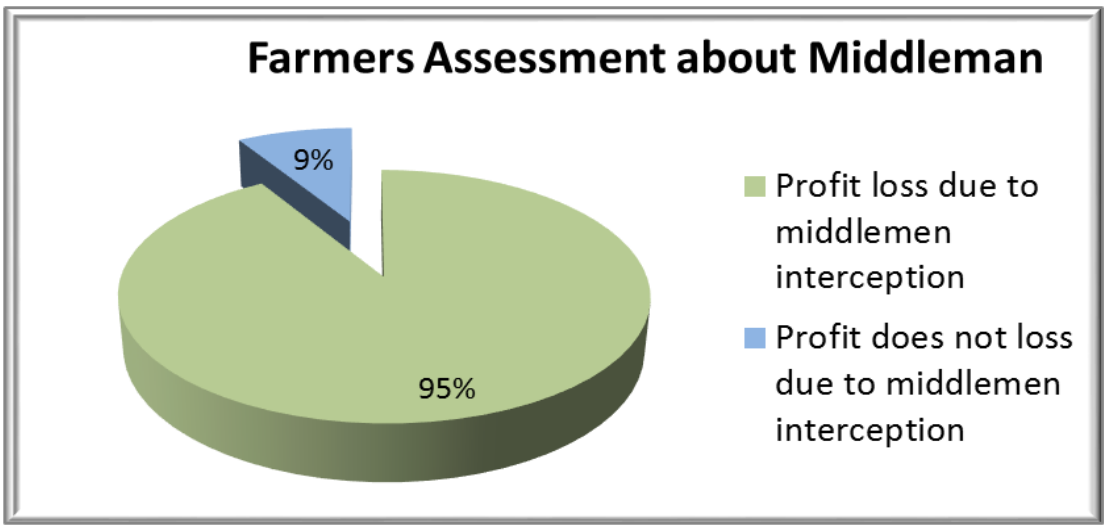


Fig: 4.3: Farmers assessment about the loss for midlemen Interception

4.3 Some vegetables'supply chain in Bangladesh

Yard Long Bean:

The supply chain of yard long bean for export entirely depends on the producer. Exporters collect beans from producer and bring the beans to the packinghouse where produces ate received and value adding activities such as, sorting/cleaning, grading, cooling, packing, transport to airport through truck. The French beans in bunches (wrapped in rubber bands) are kept in corrugated fiberboard boxes weighing 2.3-5.0 kg. Traditional exporters usually export French bean. In the yearly, around 81.0 ton were exported to Singapore, Italy and Malaysia with export quantity of 48.46%, 47.25% and 4.29% respectively.

Value Chain Analysis (VCA) for Yard Long bean suggests, land preparation and planting (26.67%), fertilizing (18.89%), weeding (3.69%) and harvesting (26.72%) to be over 75% of the total value added for yard long bean production. A breakdown of land preparation costs indicates that 73.62% of costs are made up for seeds only. A breakdown of land preparation indicates that labor, seed and other inputs account for TK 20,539.50/ha of which seed and labour represent the two highest cost components in the VCA with cost of TK 15,121.50(73.62%) and TK 4,658.00/ha (22.68%) respectively. The second highest cost producers are fertilizer, which represent about 18.89% of total cost of production. According to the VCA, Yard long bean farmers apply as much as 1,187kg/ha of fertilizers, which is equal to TK 14,552.50/ha. Harvesting represents about 26.72% of all Yard long bean production costs of all harvesting costs, labour cost is TK 16,343.00/ha which is about 79.4% workers engaged in yard long bean harvest are paid fixed wage of TK 2.00/kg. Generally, 16-22 workers/ha harvest the produce. Exporters buy the extra fine quality of beans (5-6mm diameter) paying TK 20.00/kg and about 35% of total produce fall in this grade.

For fine quality (6-7 mm diameter) pays TK 15.00/kg and about 35% of the harvest produce fall in this grade and the rest 30% of harvested produce are rejected.

Total Cost of production : TK 77,032.50/ha

Total selling value : TK 1,95,357.60/ha(per kg=Tk17.76)

Cost/kg :TK 7.0

Net profit/Kg :TK 10.76

The farmers are producing beans at cost of TK 77,032.50/hectare and with an average yield rate of 11.0 MT/ha, this translates to a production cost of TK 7.00/kg. The average selling price of farmer was TK 195.357.60/ha (TK 17.76). The net profit of Yard long bean was calculated to be TK (10.76/kg, TK 1,18,360.00/ha)

Export value chain of Yard long bean

The cost of airfreight is highest (64.68%) of all costs followed by raw material price (15.39%). The export net profit was TK 12.27/kg. Offering lower price and constant supply of good quality produce is an easier strategy, which might help a longer vision to be the market leader and alsoto be the sustainable supplier in the foreign markets.

It appears that yard long bean exports are highly remunerated for both farmers and exporters. The returns for alternative use of farmland are believed to be much lower and so is the gross profit margin to exporters for alternative winter crops. The country as a whole also benefits in terms of foreign exchange earnings from exporting Yard long bean. It is clear that this new non-traditional horticultural crops can be successfully grown in Bangladesh and effectively marketed abroad. The success of Yard long bean export has acted as an eye-opener to horticultural producers and exporters and built confidence among all agencies that Bangladesh can successfully make a dent in the upper segment of export market with variety of high horticultural produces.

Supply and Value Chain of Okra

The area and production of okra were 6,475 hectare and 20,667 tons respectively. The average yield/ha of okra was 7.9 tons. In general the supply chain of okra comprise by any of the following channel. Okra is an important export item of Bangladesh. It is exported by both traditional exporters and BRAC to ethnic markets. Traditional exporters collect from the local market directly and also from Kawranbazar and Shambazar of Dhaka city. The produces are sorted, graded and packed in bamboo basketsand old paper carton boxes are sent to airport without maintaining any cool chain for airshipment to the destination market. The market is confined to ethnic consumers and fetches low prices due to supply of low quality produces in a poor packaging. The wholesale export price of okra was TK 85.00/kg and TK 130/kg in Saudi Arabia and UK respectively. Here as the price of okra exported from Thailand to UK, Denmark, Kenya to Uk and Holland was TK 233.00, TK 340.00, TK 197.00 and TK 248.00/kg respectively. The lower price of Bangladesh produce might be due to poor quality and packaging. Quality improvement of production and packaging may increase the export value, which needs urgent intervention to exporting by organizing quality production through the contract farmers. Okra exports in ethnic markets of Europe, Middle East and South-East Asia. Fresh okra for export is packed incarton (40×30×16cm) weighing about 500g and each carton contains 5 kg net weight of produce.

Value chain analysis of Okra

The value chain analysis revealed that the land preparation was 22.94% of total cost of production followed by fertilizing (23.43%) and marketing (11.08%) of okra. A breakdown of land preparation indicates that (40.94%) of land preparation costs are made up for seeds and 37.42% for labour. The breakdown of spraying indicates that

82.42% cost was incurred for fungicides and pesticides only. The cost of inputs such as seeds, fertilizers and agro-chemicals are high and are not available in due time which leads to adulteration and higher prices. Developing awareness on quality inputs and developing capacities to provide knowledge and information on quality inputs and their appropriate usage is urgently needed. The cost of production of Okra was TK 25,308.00 per hectare and average yield rate 7.9MT/ha. Average net return was TK 5.86/kg average production cost/kg of green Okra was TK 3.20/kg. The margin selling price of farmers was TK 71,590/ha (TK 9.06/kg)

Supply and Value chain of Green Chili

Green chili is an important export item of Bangladesh. Traditional exporters green chilli export to ethnic market. Traditional exporters collect from the local market directly from producers through agents. The produces are sorted, graded and packed in bamboo baskets and paper carton carton boxes for sending to the airport without maintaining any cool chain for airshipment to the destination market. At present exporters is exporting chilli in ethnic markets of Europe, Middle East and some countries of South-East Asia. Full telescoPhotograph: cartons made of high quality kraft paper from virgin pulp are used for export packaging of international standard. Carton size is 40×30×16 cm weighing about 500g and each carton contains 5 kg net weight of green chilli.

Value chain analysis of Green Chili

Value chain analysis suggests, costs of fertilizing (36.20%) and marketing (12.15%) constitute over 48% of the total value added for green chili production. A breakdown indicates that 51.96% of land preparation costs are made up for labours only. Similarly, a breakdown of marketing costs indicates that 55.56% and 20.19% of cost

are spent for transport and labor respectively. On an average, the marketing cost per hectare was worked out to be Tk.3.283. The cost of production of chilli was Tk. 27,071.00 per hectare and average yield rate 6.00 MT/ha average net return was Tk.7.26/kg. average production cost/kg of green chili was Tk.4.51/kg. the margin selling price of farmers was Tk.70,600/ha (Tk11.77/kg).

The net profit of green chili was calculated as Tk. 7.26/kg. it should be noted that low yield rate and low margin of profit of farmers is a reflection of improper and inadequate application of fertilizers and poor quality of agro chemicals , which limit the use of such inputs. This deserves attention for necessary intervention. Price margin varies according to verities and quality of the produce from location to location and season to season. The price variation of market information was collected from different channels and summarized. The most common channels are discussed. From the analysis of marketing cost and margin indicates that decreasing the number of intermediaries in the existing marketing system may increase the producers 'share in consumers' price. Seasonal variation, undeveloped marketing and transport systems, poor infrastructure and insufficient storage facilities intensify price volatility.

4.4 Preharvest factors effect on the quality of Horticultural crop in food chain system:

The postharvest quality of fruits and vegetables are largely determined by preharvest factors such as production location, soil type, irrigation, rootstock, shading and nutrition.

Temperature

Atmospheric temperature has been found to influence fruit shape, size, color and other quality parameters. Temperature variation during the early stage of fruit development Caused variation in shape of orange fruit (Monselise and Goren 1987). Temperature

caused undesirable thick peel and puffiness in citrus (Pantastico 1975). Pineapple fruits grown in winter months or in cool growing areas had reduced eating qualities due to lower sugar /acid ratio (Hofman and Smith 1998).

Relative humidity

Relative humidity plays an important role in determining fruit quality. Higher relative humidity around the fruit reduces water and Ca movement into the fruit. In contrast, higher relative humidity around the plant increases Ca accumulation into the fruit by reducing leaf evapotranspiration (Hofman 1998). Similar results have been observed intomato fruit, where higher relative humidity around the plant increases fruit Ca, and decreases shelf life due to Ca toxicity (Adams and Holder 1992; De Kreij *et al*. 1992). High relative humidity around the plant has also been reported to be associated with increased maturity bronzing in banana fruit (Campbell and Williams 1976).

Nutrition

Several nutrient elements, especially N, Ca, Mg and K have been found to influence thequality attributes of fruits. The application of Ca and high fruit Ca concentration resultedin increased firmness; reduced disease incidence, chilling injury, physiological disorders (skin splitting) and ripening; and improved storability (Hofman 1998).

Irrigation

Irrigation has immense influence on fruits and vegetables quality. Generally, the excessive availability of water can result in larger fruit, reduced firmness and flavor, and moredisorders. Ebel *et al*. (1993) reported that excessive irrigation decreased fruit firmness through increased fruit size. Water stress also affects fruit qualities. Sirkul and Turner (1995) showed that low irrigation reduced fruit growth rate and green life of bananas. Incase of mango, lowering irrigation during rapid fruit expansion stage reduced storage duration and fruit Ca concentration (Simmons *et al*. 1995).

Plant growth regulators (PGR)

The application of plant growth regulators in the fruit development stage has important effects on the quality parameters of fruits. In Bangladesh, PGRs are used in horticultural crops to increase the size of the edible portion of fruits and vegetables and to obtain early bearing. In the case of mango, maximum growers of Chapai Nowabgonj and Rajshahi apply PGRs from the stage offlowering to entire harvesting season. The PGRs, namely Biogeem, Ferti and Yield areused in the production of mango in Chapai Nowabgonj and Rajshahi districts.In case of banana, majority of growers of Ghatail and Shakhipur Upazillas under Tangail district apply plant growth regulators to banana crops from the stage of flowering to the entire harvesting season at a rate of 5-15 mL/10-16 L of water. Among different plant growth regulators, Okozim, Planofix, Agron and Voxal Super are commonly used by the banana growers. Similar findings were also reported by Bhuiyan *et al.* (2009), who mentioned that 40.7 and 30.7% of the banana growers were found to be the low to mediumusers of PGRs in banana cultivation, especially for quick maturity and high yield.

Photograph 4.1 :Plant growth regulators, Biogeem (A), Ferti (B) and Yield (C), which arecurrently used by the mango growers of Rajshahi and Chapai Nowabgonj, Bangladesh. Litchi is one of the most important commercial fruits of Bangladesh that received largeamounts of PGRs of various trade names. The PGRs used for litchi are Okozim, Planofix, Pencozeb, Litosen, Voxal Super, Vitaplus, Phenphen and Folimore.

Harvest maturity

The stage of maturity at harvest affects fruit quality. Generally, the fruits harvested at the advanced stage of maturity have increased fruit size and eating qualities (taste and aroma) but decreased shelf life. Mango fruits harvested 7days before optimum maturity showed better storage performance but failed to arrest skin discolouration, and caused uneven ripening (Hassan *et al*. 1998)

4.5 Effects of pestson fruits and vegetables in food chain system

Insect pests, diseases and disorders are serious problems in growing fruits and vegetables.

Pests of Mango:

Insect

Presently, the most serious insect of mango in the leading growing areas is mango hopper. Hopper attack is found to be the highest in Gomostapur of Chapai Nowabgonj. Hopper contributes to shooty mould problem that seriously affects fruit set. Fruit fly is also aserious pest of mango. The highest fruit fly incidence is observed in Bholahat and thelowest in Gomostapur of Chapai Nowabgonj. Nowadays, stem borer also seems to be an important pest of mango in the Chapai Nowabgonj and Rajshahi districts (Hassan 2010).

Diseases

The most serious field diseases of mango are dieback and gummosis in Chapai Nowabgonjand Rajshahi (Photograph: 5.2). The highest dieback infected area is Chapai Nowabgonj Sadarand Gomostapur, whereas the highest gummosis affected area was Bagha of Rajshahi. The minimal gummosis severity was noticed in Charghat Upazilla under Rajshahi district.

Photograph: 4.2 Gummosis (stem bleeding) (A) and die back (B) of mango, the predominant field diseases in Chapai Nowabgonj and Rajshahi districts.

Pest of banana:

Insects

The most serious insect of banana is the banana leaf and fruit beetle in Tangail (Photograph: 4.3). Banana weevil is also found to be a serious pest of banana.

Photograph 4.3 Banana fruits damaged by banana fruit beetle.

Diseases

The most serious disease of banana is Sigatoka leaf spots (caused by *Mycosphaerella musicola*). According to 64-68% of the growers of Tangail, Sigatoka is the most serious disease of banana. Panama caused by *Fusarium oxysporum* f.sp. *cubense* (longitudinal splitting of pseudostem) is also a serious disease of banana in the Tangail region of Bangladesh.

Pest of litchi:

Insects

The predominant insect pests of litchi are: litchi mite and fruit borer. Other problems are related to fruit fly, ant, cutworms and caterpillars.

Diseases and disorders

Ruptured skin, sun burn, fruit rot and fruit drop are the most prevalent in Dinajpur, the leading litchi growing district of Bangladesh. Sun burn and fruit cracking are physiological disorders, which are attributed to the scorching sunshine along with high temperature and excessive use of growth regulating chemicals, respectively.

Diseases

The most serious disease of banana is Sigatoka leaf spots (caused by *Mycosphaerella musicola*). According to 64-68% of the growers of Tangail, Sigatoka is the most serious disease of banana. Panama caused by *Fusarium oxysporum* f.sp. *cubense* (longitudinal splitting of pseudostem) is also a serious disease of banana in the Tangail region of Bangladesh.

Photograph 4.4 Fruit cracking due to the use of higher doses of application of plant growth regulators (A). Application of plant growth regulators and pesticides to the litchi fruit using foot pump (B, Masimpur, Dinajpur).

Pest of Jackfruit:

Insect

The most serious insect pests of jackfruit in Mymensingh and Gazipur districts are fruitborer and trunk borer (Photograph: 4.5). Half to three-fourth of the jackfruit growers haveproblems with fruit borer, whereas one-fourth to half of the growers have problems with trunk borer infestation. The trunk borer bores into the tender shoots and buds. The affected parts should be nipped off and destroyed.

Photograph 4.5: Damage to jackfruit by borer (A) and the most serious pest of jackfruit, the fruit borer (B).

Photograph 4.6 Damaged portion of Jackfruit is scrapped out followed by the application of limepest to stop further spread of damage and rot (A & B). These fruits lost their market valueby almost cent percent but sold to people who could not afford to buy good quality jackfruit.

Pest of pineapple

Pineapple is a hardy plant and infestation with insect pest is not a serious problem. But physiological disorders, especially sunscald (Photograph: 4.7) is observed to be the most serious problem in pineapple production in Tangail district. Growers mentioned that sunscald may cause damage by 100% if proper measure is not taken.

Photograph. 4.7 Damages to pineapple fruits due to sun burn.

Pest of papaya

In papaya, red mite and fruit fly are found to be the predominant insect pests in Pabna. Papaya mosaic and leaf curl are also found to be the most serious diseases in the papaya plantation in Ishurdi of Pabna, one of the leading papaya growing zones in Bangladesh.

Pest of orange

Different types of bugs and beetles are found to cause damage to orange plants in Moulvibazar. Die back is observed to be the most serious disease in orange plantation inthe Juri and Borolekha Upazillas of Moulvibazar.

Pest of Brinjal

Insects

Insects of different kinds are found to cause serious problems to Brinjal crop. The most serious insect of Brinjal is shoot and fruit borer. To control insect damage, higher doses of insecticides with shorter intervals are very often practiced by the growers.

Diseases

In the case of Brinjal, the major disease is wilt (64% in Raipura and 52% in Shibpur Upazillas of Norshingdi district).

Pest of okra

Insects

Insects of different kinds are found to cause serious problems to okra crop. Fruit borer is found to be the major insect which causes severe damage to okra pods in Comilla. Higherdoses of the insecticides are applied with shorter intervals to control insect pests by the growers.

Diseases

Diseases, namely yellow mosaic, rots and leaf curl are found to cause serious damage tookra crop. However, the most serious problem of okra cultivation is due to the infection byYellow Mosaic Virus

Pest of Tomato

The important insect pests of tomato are fruit borer, aphid and fruit fly. Leaf miners are serious pests of summer tomato in Bagharpara of Jessore.Leaf curl, a viral disease, isfound to be the most serious pest that causes damage to tomato crop. In Bogra, 62% of the tomato growers are found to apply pesticides to control insect pests. Only 36% of the growers are found to use pesticides.

Pest of cauliflower

The most serious pest of cauliflower is the caterpillar of cabbage butterfly. Almost all thegrowers have the problem with this caterpillar. In case of disease, leaf curl is the mostserious problem.

4.6 Insects of vegetables in Bangladesh

Vegetable Insects and their Management

Though vegetables are cultivated all over in our country but there are shortage of vegetables because a large portion of vegetables are damaged by insects and these insects are directly involbed in loosing crop production as well as in the Market Chain. Insects damage vegetables mainly in the field, more than during storage. Several insects damage our vegetable crops. How insects damage our vegetable crops that is damage symptoms and their management describe bellow-

Insect Pest of Leguminous Vegetables

Bean Aphid:

Systematic position:

Scientific name: *Aphid medicagenis*

Order: Homoptera

Family: Aphididae

Pest status:

Aphids are major pests of beans. In Bangladesh *Aphis medicageni s*mainly reported. Many leguminous crops and some oil seed crops are infested by Aphids.

Effected Inflorescence

Bean Aphid

Effected Twig

Photograph 4.8: Bean Aphid

Symptoms of Damage:

- Nymphs and adults are destructive. They causes damage in a number of ways.
- They suck up the plant sap particularly from leaves, young shoots, inflorescence and developing seedpods.
- Injection of saliva sometimes phytotoxic to plants.
- Formation of flowers and pods is adversely affected.
- Aphids as a group of are responsible for the transmission of a large number of plant viruses like bean mosic virus than any other single group of insect.
- The presence of aphids on vegetables reduces acceptability to the customers.

Management:

Biological control**:**

- Many parasitoids and predators like wasp, syrphid-fly larvae, aphid lions, lady bird bettel setc attack on aphid and control them.

Chemical control:

- Aphids can be controlled by spraying soap-water @ 25ml liquid detergent per liter of water.
- Spraying with water extract of the neem seed kernels also give effective control of aphids.
- Spraying of 0.05% Malathion at the 15 days intervals control effectively.
- Spring with Sumithion 50EC 454ml per acre.
- Spring with Parathion 40EC 454ml per acre.

Insect of Cucurbitaceous Vegetables:

There are three insects known as major pest of Cucurbitaceous vegetables-

1. **Fruit flies**
2. **Pumpkin beetle**
3. **Epilachna beetle**

1. **Cucurbit fruit Fly:**

Scientific name: a) *Bactrocera cucurbitae b) B. ciliatus*

Family: Tephritidae

Order: Diptera

Pest status*:* Most damaging for *cucurbtaceous crops.*

Symptoms of Damage:

Larvae
During oviposition

Cucurbit fruit fly

Damaged fruit

Photograph 4.9 : Cucurbit fruit fly& larva

- Adult female flies select soft and young fruits for oviposition by punctuing the rind with the ovipositor. Such damaged fruits show signs of raised and brown resinous encrustation at the site of oviposition.
- Infested fruits are either rotten or deformed in shape.
- Infested fruits with apparent firmness and growth show internal dcay and foul smell when cut open.

- Before fruit setting the female lay eggs into the flowers and the larvae feed on and destroy the flowers.

Poison bait containing
sex pheromone cue lure

Photograph 4.10: Cucurbit fruit fly

- Characteristics galls are formed on the stems when eggs are laid there.

Management:

- To avoid infestation by fruit flies, growing of resistant or early maturing varieties has been recommended.
- Sowing date should be changed where infestation observed.
- Bagging the valuable fruits.
- Frequent raking of soil under the vines.
- Using sex pheromone like "cuelure" may help to reduce the pest population.
- Flies can be controlled by using poison bait.

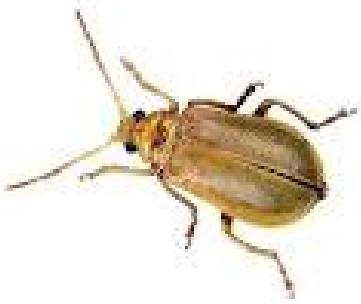
Red pumpkin beetle:

Scientific name: *Aulocophorafoveicollis*

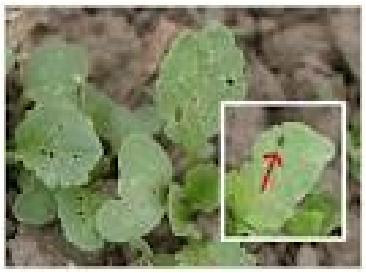
Order: Coleoptera

Pest status*:* The population of blue pumpkin beetle is low and its ncidence is sporadic. The red pumpkin beetle is a serious pest of cucurbitaceous plant, excepting bitter gourd.

Damaging Stem



Adult Beetle



Beetle on leaf

Photograph 4.11 Red pumpkin beetle

Symptoms of Damage:

Damaging the cotyledon stage

- Adult beetles feed voraciously on the leaf lamina by making irregular holes.
- The maximum damage is done when the crop is in the cotyledon stage.
- The adult insect also feed on the leaves of grown up plants by scrapping off their chlorophill and make the leaves net like appearance.
- The larvae causes damage in various ways by boring the roots and the underground stem portion and by feeding on the leaves and fruits line in contact with the soil.
- The damage roots and the underground stem portion may rot due to infestation by thesaprofitic fungi.

Management:

1. A few scattered plants should be grown quite early in the season to attract the beetle as soon as they come out of their winter niches
2. Infested field plowed to kill the grubs in the soil.
3. Beetles, being consPhotograph:uous can be collected easily in the morning when they are sluggish and kill them.
4. Spraying of Mipcin75 WP or Fenetrithion 59 EC reduce the infestation at 7 days interval.

3. Epilachna beetle:

Scientific name: a) *epilachna dodecastigma*

b) Epilachna vigintioctopunctata

Family: Coccinellidae

Order: coleoptera

Pest status: This beetle are the major pest of teasel gourd, cucumber, bitter gourd, watermelon, muskmelon, and other cucurbitaceous crops as well as brinjal, potato and tomato and leguminous crops like hyacinth bean and cow pea.

Adult feeding on leaf

Photograph 4.12: Ephilachna beetle feeding on leaf.

Symptoms of damage:

- Both the adult and grub stages feed on the leaf surfaces and skeletonize the leaves.
- The attacked leaves turn brown, dry up, and fall off.
- In case of sever infestation crops look like unhealthy and the vigourity of plants adversely affected.

Grub Feeding on leaf

Beetle

Photograph 4.13: Epilachna beatle

Management:

1. This pest can be controlled by regular killing and Photograph:king of eggs grubs and adults if the cropped area small.
2. Also the larvae and adults can be shaken down in container of kerosinized water early in the morning.
3. To control the pest Malathion / Fyfanon / Zithion50 EC @ 2ml of water can be sprayed.

Insect of Solanecious Vegetables:

There are three insects known as major pest of Solanecious vegetables-

1. Brinjal shoot and fruit borer
2. Potato tuber moth and
3. Tomato fruit borer

Brinjal Shoot & Fruit Borer

Scientific name :*Leucinoid sorbonalis*

Family : Pyralidae

Order :Lepidoptera

Pest Status: It is the one of the major pest of brinjal, potato and other solanaceouscrops.

Symptoms of damage:

Adult insect

Photograph 4.14: Brinjal shoot and fruit borer (adult moth)

- The % infesting of fruit is more than shoot infestation.
- The infested shoot droop and subsequently wither.
- Larvae bore into young shoot petiole and midrib of large leaves.

Damaged shoot

Photograph 4.15: Damage shoot of Brinjal by shoot & fruit borer.

Management:

Biological control:

- Avoid the ratooning of the brinjal crop.
- Uproot and burn the plant parts of previous planting.
- Collection and destruction of fallen leaves and infested fruits.

Chemical control:

- Recommended pesticide like Ripcord, Cymbus, Diazinonetc Could be sprayed as foliar spray at an interval of 7-14 days.
- Granular formulation of carbofuran has also been found effective@1kg/h at flowering time and after 1 month of first application.
- Sex pheromone is also effective to control this pest.

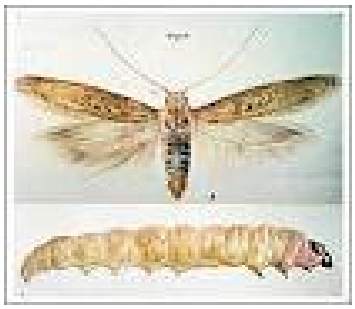
Scientific name: *Gnorimoschema operculella*

Family: Gelechidae

Order: Lepidoptera

Pest Status: Potato tuber moth is one of the major pest of potato and other solanaceous crops.

Symptoms of damage:



Moth and caterpillar

Infected tuber

Photograph 4.16: Potato tuber moths.

- The insects occasionally infest potato plants in field but serious pest in storage.
- The larva mines into the leaves or bores into the developing tuber.
- Infest in storage may range 30-70%.tuber of potato are borrowed by caterpillars.

Management:

- The microbial pesticide like *Bacillus thuringiensis* and the nuclear polyhedrosis are being used for the control of the pest.
- Synthetic pyrethroids @ 1ml/liter can be used for the control of the pest.

Tomato Fruit Borer

Scientific name: *Helicoverpa armigera*

Family: Noctuidae

Order: Lepidoptera

Pest Status: The tomato fruit borer is one of the major pest of tomato and wide range of crops chick pea, cotton, maize and various leguminous crops.

Symptoms of damage:

- The borer bore into the fruit and damage the internal tissues.

Internal damage

Adult Moth

Infested Moth

Photograph 4.17: Infested fruit by Tuber moths

- The larvae keep their abdominal segments including the anal end outside the bored fruit.

Management:

- The microbial pesticide like *Bacillus thuringiensis* and the nuclear polyhedrosis are being used for the control of the pest.
- Synthetic pyrethroids @ 1ml/liter can be used for the control of the pest.

Insect Pests of Malvaceous Vegetables:

There are three insects known as major pest of Malvaceous vegetables-

1. Shoot and fruit borer of okra
2. Cotton jassid
3. White fly

Fruit and shoot borer of Okra

Scientific name: *Eariasvittella*

Family: Noctuidae

order: Lepidoptera

Pest Status: The okra shoot and fruit borer is the most damaging insect pest of okra. It also infests cotton.

Symptoms of damage:

- The larvaebore into the shoots and fruits.
- It also damage theflower buds and flowers.

Adult moth

Photograph 4.18 Fruit and shoot borer of Okra

Management:

1. Spraying the chemical insecticide should be timed with the egg laying by the insect.
2. Synthetic pyrethroids @ 1ml/liter can be used for the control of the pest.

Cotton Jassid:

Scientific name: *Amrascadevastas*

Family: Cicadellidae

order: Hemiptera

Pest Status: It is the major pest of cotton and okra. It also infestbrinjal, cucurbits, potato, sunflower and various malvaceous plant.

Symptoms of damage:

- The adult and nymph damage leaves by sucking the plant sap.
- Infested leaves show downward curling and yellowing.
- Heavily infested leaves turn dark brick-red and ultimately dry up.

Infested Plant

Sucking Plant Sap

Adult

Photograph 4.19: Cotton Jassid

Management:

- Carbosulfan, dimethoate, phosphamidon, and other systematic inscecticides are used for the control of the pest.

White Fly:

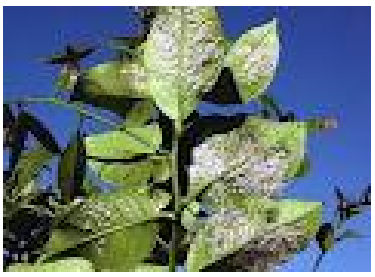
Scientific name: *Bemisca tabaci*

Family: Aleurodidae

Order: Homoptera

Pest Status: It is the major pest of okra. It also infest cotton, brinjal, cole crops, potato, tomato, beans etc.

Symptoms of damage:



Sucking plant sap

Adult Insect

Photograph 4.20: White Fly

- It suck the plant sap and transmit curl virus.
- Infested plant looks yellowish and dry.

Management:

- Yellow sticky- traps can be used for trapping the white fly adults**.**
- Dimethoate 40 EC @ 2ml/l of water can be used to control.

Insects of Cruciferous Vegetables:

There are two insects known as major pest of Cruciferos vegetables-

1. Diamondback moth
2. Cabbage butterfly/caterpillar

Diamond back moth

Scientific name: *Plutellaxylostella*

Family: Yponomeutidae

Order: Lpidopter

Pest Status: It is the major pest of Cabbage in Bangladesh. It also the major pest of Cauliflower, broccoli, mustard under a wide range of climates.

Symptoms of damage:

- Damaged leaf of cabbage becomeriddle with holes.
- The larvae feed from the underside of leavesof cabbage and other hosts.

Photograph 4.21 Riddle with holes

Adult

infected leaf

Management:

- Weekly applicationof Cypermethrin 10EC @ 1ml/l of water.
- Yet organophosphate insecticide also can be used.

2**. Cabbage Buttrfly/caterpillar:**

Scientific name: *Pierisbrassicae*

Family: Pieridae
order: Lpidoptera

Pest Status: It is a major pest of cabbage, Caterpillar and other cruciferous vegetables.

Symptoms of damage:

- They (caterpillars) feed voracious lyon leaves and shoot of cabbage, cauliflower etc.
- Head of cabbage and cauliflower become smaller and can not attain its full size.

Damaged head

Infected leaf

Caterpiller

Fig: 4.22: Cabbage butterfly

Management:

- Spraying diazinon/sabion 60EC @ 680ml/acer.
- Spraying with Malathion/Fufanon/ Zithiol 57 @ 454mml/acre.

4.7 Nature of damage of fruits and vegetables effects on export potentiality

Different types of damage of horticultural produce are observed in the entire marketing Channel. The major damages include bruises, cuts and rots for most horticultural produce, and latex injury for mango, banana and papaya. The important damages of fruits and Vegetables in the supply chain are briefly discussed in this chapter.

Mango

Postharvest damages of mango fruits include bruises, cuts and sap burn. Bruises are the major causes of postharvest damage at the growers' hand. This is probably due to the conventional harvesting methods, ignorance of the Photograph:kers, and most importantly due tothe carelessness of the Photograph:kers. Substantial loss occurs at the intermediary levels mainly due to inadequate and faulty transport system.

Banana

During harvest, cuts and bruises cause damage to banana fruits. Substantial loss occursfrom 'Bepari' due to improper transport system. Although different types of damage occur, bruises are observed to be the major reasons of postharvest. Considerable damage also occurs due to latex injury, particularly at the 'Bepari' level. Atthe wholesale and retail levels, rots due to fungal infections also cause substantial loss.

Photograph 4. 23 Postharvest bruises (A &B) and microbial damage (C) of banana fruits.

Litchi

Ruptured skin, fruit rot and pericarp browning are the major causes of spoilage of litchi.At the growers' level, the major causes of damage are due to the ruptured skin (66.80-100%) and detachment of fruits from the peduncle (Photograph 4.24). At the 'Bepari' level, bruises, rots and vibration damage are the major causes of spoilage. No notice able precautionary measures were adopted by the 'Bepari' to reduce damage except the use of ample litchi leaves inside the bamboo package.

Photograph 4.24 Attractive litchi fruits (A) becomes unsalable due to skin cracking (B).

Pineapple

Cuts and bruises are found to be the principal causes of spoilage of pineapples at the growers' hands in the Tangail district. Similarly, bruises and vibration damage are also found to cause damage pineapples at the intermediary levels.

Jackfruit

The principal causes of damage of jackfruits are due to different types of bruises. At the'Bepari' level, bruises and vibration damage are mostly found. At the retailers' level, different types of rot and diseases are the major reasons of postharvest losses.

Photograph **4.25** Damage to Jackfruit by fungal pathogen (A); damage becomes serious due torain water (B); damage due to vibration during transport (C).Damage by cuts & brushes

Papaya

The principal causes of damage to papaya fruits at the growers' level are due to different types of bruises and latex injury. At the 'Bepari' level, bruises, latex injury and vibration damage are mostly found. At the wholesaler' level, latex injury and diseases are found tobe the major reasons of damage. Similar nature of damage is also found at the retailers 'level, where diseases are found to be serious problems.

Orange

As usual, bruises are found to be the major reason of damage to orange at the growers 'level. Similar nature of damage is also observed at the retailers' hand, where bruises, vibration damage and diseases are observed to cause substantial spoilage.

Tomato

At the growers' level, cuts and bruises are the predominant types of spoilage similar types of damage occur to tomato fruits at the 'Bepari'level during long distance transportation. The 'Bepari', however, occasionally use padding materials to reduce

mechanical damage during transportation.Noticeably, most 'Bepari'involved in summer tomato trade use bamboo and plastic crates along with straw and shredded papers to reduce loss. Postharvest damage also occurs due to lower prices at thepeak season and lack of low temperature storage and processing facilities

Photograph.**4.26** Highly nutritious and antioxidant rich Tomato fruits are lost after harvest (Sayedabad wholesale market, Dhaka; and Nimshar Bazar, Comilla).

Cauliflower

At the growers' levels, cuts and over maturity of the curds are the major problems. At the 'Bepari' level, the discolouration of the curds is observed to be the most serious problem in cauliflower transportation. Presently, almost all the 'Bepari' use individual paper wrap to reduce transport damage, weight loss and discolouration. Discolouration isalso the major kind of damage to cauliflower curd at the retailers' levels that renders the curds unsaleable and ultimately causes loss. Red rot, characterized by pinkishor rusty brown colours on the curd surface due to boron deficiency.

Photograph 4.27 Discoloration (A) and red rot (B) of cauliflower curd.

Brinjal

In the case of Brinjal, detachment of fruit from the stalk is found to be the major cause ofpostharvest damage. Majority of the retailers experience damage due to fruit separation from the stalk. Other damages include shrinkage, bruises, cuts and diseases.

Cucumber

In the case of cucumber, the maximum damage occurs due to cuts. Huge losses are facedby the 'Bepari' every year due to lack of proper transport system. Maximum loss ofcucumber occurs due to bruises and vibration damage during transportation. Shrinkage isalso an important postharvest problem for cucumber due to weight loss.

Okra

Most of the commercial growers Photograph:k okra carefully by hand with protective gloves put onto protect hands from irritation and infection. Some growers harvest okra with the help ofsharp knife. Therefore, damage to okra pods during harvest is negligible. During transportation, considerable losses of okra pods occur at the hands of 'Bepari' every yeardue to bruises particularly due to lack of proper transport system. Broken pods are alsofound to be important problems during transportation. In case of retailers, the maximum damage occurs to okra pod due to bruises. Other damages include cuts, rots, discoloration, over maturity (fibrousness), shrinkage and insect infestation.

4.8 Ripening of fruits and vegetables

Middleman and Faria are usually adulterate fruits & vegetable for getting higher price. It causes our health hazards as well as bad impact to foreign buyers.

Banana

Climacteric fruits like bananas are subjected to chemical treatments for uniform ripening. Growers adopt different methods to accelerate banana ripening, and they mostly follow conventional methods of ripening. The 'Bepari' and whole salers in the banana supply chain are mostly involved in artificial fruit ripening. All 'Bepari' are involved in banana ripening either by using conventional or chemical methods. The conventional ripening methods include application of heat and piling of fruits followed by covering with polyethylene sheet. With regard to chemical use, the maximum 'Bepari' use Harvest to accelerate banana ripening (Photograph:5.30). Other ripening chemicals include Profit, Tomtom, Ripen 15, and Harvest. In a survey, Hassan (2010) observed that 60-70% of the whole salers were involved in accelerated banana ripening. Among them, 36% were engaged in chemical fruit ripening, and among the chemicals, Harvest was the mostly used followed by Ripen-15 and Tomtom. The present findings arein support of those of Bhuiyan *et al*. (2009) who reported that three-fourth of the banana whole salers were involved in the use of different types of ripening agents. In contrast with Bhuiyan *et al*. (2009), Hassan (2010) did not find any use of calcium carbide and formalin in banana ripening and preservation, respectively. Most strikingly, the immature and premature bananas are mainly sprayed with chemical ripening agents.

Photograph 4.28: Immature banana ripening in the assemble market of Madhupur, Savar.

Mango

Hassan (2010) reported that 4-16% of the growers were involved in ripening of mangousing chemicals. Calcium carbide was used by 4-20% mango growers followed by Ripen-15 (0-12%). Results also showed that 4-32% growers used straw for enhancing ripening, and they (60-92%) mainly sold unripe mature-hard mangoes. It was found that 8-20% ofthe 'Bepari' was involved in chemical fruit ripening, whereas the value was 6-8% in case of the whole salers.

Photograph: 4.29: Mango fruits spread on the floor and ready to receive chemical spray for accelerated ripening (A) and mango fruits were subjected to chemical spray for accelerated ripening (B)

Jackfruit

In the case of jackfruit, both conventional and chemical ripening methods are used. Conventional methods include piling of fruits and covering with thick polyethylene sheet (Photograph: 4.30). Another method is fruit piercing using iron stick through the large fleshy peduncle (Photograph: 4.32). These methods are harmless if no additional chemicals are applied.In terms of chemical ripening, Ripen-15 is mainly sprayed over jackfruits, especially bythe 'Bepari' and wholesalers. Sometimes, chemicals are sprayed after piercing the fruit through the fleshy peduncle. As a result, the chemicals directly penetrate into the fruit that ripen at a faster rate but pose great danger of leaving chemical residues higher than maximum residue levels (MRLs) and ultimately affect consumers' health.

Photograph 4.30: Jackfruits that received chemical spray were covered by Polyethylene sheet and leaves to raise temperature and accelerate ripening.

Photograph 4.31: jackfruits are pierced.

Photograph 4.32: Jackfruit piercing in Arad (Storage)

Pineapple

Pineapple is one of the very important fruits of Bangladesh, and the production is mainly oncentrated in Tangail, Chittagong Hill Tracts and Sylhet. Pineapple is a non-climacteric fruits (Wills *et al.* 2004), and should be harvested when the fruits are fully mature and ripein the plants for proper taste, flavour and quality. Strangely, a number of plant growth. regulators are currently being used by the pineapple growers for accelerated ripening while the fruits are still attached with the plants (Photograph: 4.33). They generally sell the immature or pre-mature fruits to catch the early market and obtain more profit. Hassan (2010) in a survey found that only the growers were

involved in the use of ripening chemicals for pineapple, and this finding contrasts those of other fruits like mango, banana, jackfruit, papaya and tomato. It was observed that 80-90% of the growers were involved in spraying ripening chemical called Ripen-15. The actual figure may be moresince many of the growers do not reveal the actual practice owing to fear of police harassment and related problems. The recommended dose of use as per the company suggestion is 10 mL/16 L of water, but in many cases they use 50 mL/water (i.e. full bottlein 16 L water).

The ripening chemical has two-fold negative effects on pineapple fruit quality in particular. Firstly, pineapple is non-climacteric fruit, and ripening rate (rates of respiration and ethylene production) remains mostly unchanged even though ripening agents are exogenously sprayed on the fruits. The chemicals only contribute to change in the fruitpeel colour from green to yellow resembling complete fruit ripening, since the active ingredient, ethephon, is a degreening agent and has senescence properties. Secondly, the consumers are deprived from obtaining the optimum taste, quality and flavour of this delicious fruit. Many of the growers admitted that these chemicals are harmful and should not be used. They also mentioned that these fruits lack taste and flavor, and the consumers purchase fruit once would not purchase pineapple again. Interestingly, the growers themselves do not consume the fruits that were subjected to chemical spray. The growers, and other stake holders of the pineapple supply chain also speculated that the heritage of pineapple in Tangail would be irreversibly lost if measures are not taken immediately.

Photograph 4.33: Immature pineapple being sprayed for degreening (Madhupur, Tangail).

Papaya

For papaya ripening, heating is used by the wholesalers. No chemicals were found to apply to accelerate fruit ripening.

Photograph 4.34: Papaya fruit ripening using traditional method of piling paper wrapped fruits (A) followed by placing heat source (B) and covered by thick polyethylene sheet (Sham Bazar,Dhaka).

Tomato

Use of ethylene gas is a recommended practice world wide for uniform ripening, especially for commercial purposes. Tomatoes are generally harvested at mature-green or breaker orturning pink stage and exposed to ethylene. The fruits are uniformly ripened and quality is not affected. However, the practice of using ripening agent in Bangladesh is different. Here the fruits are harvested at immature conditions

at the same time and held in the growers' house where the fruits receive chemical spray. The fruits ripen with beautiful redcolor, but the actual taste, flavor and quality are lacking due to the pre-mature harvesting (Photograph: 4.35). The advantage from the intermediaries' perspective is that the labor cost is minimized due to the same time harvest of all fruits, ripe fruits remain firm for quite along period of time, and the loss is minimal. Unfortunately, these benefits are at the cost of quality and consumers' satisfaction.

Photograph 4.35: Immature Tomato ripening in Bogra.Fruits, ripened chemically, are simply recognized by observing uniform and bright red peel colour development.

Photograph. 4.36: Growth regulators, namely Tomatotone (A) and Joar (B) are used for fruit of summer tomato.

Photograph 4.37: Use of plant growth regulators (A) and polytunnel (B) to grow summer Tomato.

Photograph 4.38: Stage of sorting (B), grading(C) and packaging (D).

From the above discussion, it can be inferred that use of ripening agent is absolutely required for horticultural produce marketing in commercial purposes. Uniformity in fruitcolor, taste and flavor is prerequisite for commercial purpose. However, we must becareful not to misuse the technology. So far, the government of Bangladesh has not given registration to any chemicals for absolute use for fruit ripening purposes. Some of the chemicals, for example ethephon, might have been given registration for early flowering or other purposes. But these chemicals are being misused. Therefore, the government should take appropriate initiatives to introduce ethylene-induced ripening technology,optimize to the local socio-economic conditions and extend it to the relevant stakeholders.This would help to safe guard and prevent exposure to hazardous chemicals and enable consumers to enjoy the real taste and flavour of the delicious local fruits.

4.9 Author's sugessions to be considered for transporting fruits and vegetables:

- Random & vast awareness training should be conducted for farmers and wholesaler.
- Cargo shuttle service should be arranged during Photograph:k season.
- The transport vehicle should not be overloaded.
- Strong and durable packages should be used.
- Need to make heavey duty road and street in every rural area.
- Rough handling during loading and unloading should be avoided.
- Container should be aligned properly.
- Vibration damage would be reduced by using plastic crates, liners and padding.
- Ventilation should be ensuder to prevent heat generation during transportation.
- The packages should be loaded in uniform stacks and braced securely.
- Shock absorber carrineg containers and packeges should be supplied.
- Workers should not stand upon the produce during loading and unloading.
- The entire load should be covered with a silver or light color canvas.

- Agro transport management curriculam should be introduced in diploma or graduation in agricultural subjects.

4.10 Author's Sugessions to overcome fruits and vegetables adultration:

- Government law & enforce dept may strict to implement law & ansure the punishment example.
- Random raid in the wholesale & paiker Arod/Godown to findout chemical spraying activities.
- Awareness and motivationl campaign through media and NGO's.
- Restriction on supplying or selling chemical in the market.
- Develop the storage system maintain the adultration.
- Recommendate dose of fertilizer & pesticide should be declared to the DAE so that they can train the farmers.
- Marketing channel should be developed.
- Controlling middleman activities.

4. 11 Post harvest loss of fruits and vegetables in food chain system

Due to tropograph and sub-tropographical climates, a range of nutritionally rich and delicious fruits. And vegetables are grown in Bangladesh. Unfortunately, a considerable proportion of the Harvested products never reaches the consumers mainly because of postharvest losses and 25-40% as reported by Amiruzzaman (1990) and Miaruddin and Shahjahan (2008), respectively. So, there is no doubt that enormous amounts of fruits and vegetables are lostevery year. The present Chapter describes the postharvest losses of the commercially important fruits and vegetables as estimated in the USAID andEC-funded research projectas mentioned earlier. The postharvest losses of individual fruits and vegetables were estimated using structured

and pre-tested interview schedules at four stages of supply chain including growers, 'Bepari' (large-scale trader), wholesalers and retailers. This is indeed a timely approach when the government of Bangladesh underscored the needs for assuring food and nutritional security of the people of Bangladesh, and there is no scope for food losses in the country.

Postharvest quantitative loss

Postharvest losses of fruits and vegetables in supply chain were separately calculated and presented in Table 4.5 In general, the losses were greater at the hands of the intermediaries, especially the 'Bepari' and wholesalers. However, in case of jackfruit and litchi, the losses were higher at the growers' level. The higher postharvest lossat the intermediary levels would possibly due to the lack of proper transportation and storage facilities. On the other hand, the higher losses of jackfruit and litchi at the growers'levels could be attributed to the fact that these fruits are seriously damaged by fruit borer (jackfruit), and fruit cracking and pericarp browning (litchi), and these affected fruits are often unmarketable.

A huge amount of Horticultural crops (vegetable) wastes due to mishandle and misuse during transportation in the market chain:

Table 4.4 Farmers measurement of vegetable wastes while transporting.

District	average wastes	STD	N
Bogra	10.4	.8	11
Comilla	8.8	2.1	10
Dhaka	8.0	2.3	10
Gaibandha	16.7	6.8	6
Kurigram	9.5	4.4	10
Kushtia	9.8	1.4	9
Mymensingh	7.1	2.2	10
Nilphamari	9.3	3.7	10
Pirojpur	9.2	4.3	10
Rajshahi	10.2	.7	9
Sherpur	6.3	2.2	9
Total	**9.3**	**3.7**	**104**

Table 4.5: Postharvest losses at different levels of supply chain (percentage)

Commodity	Postharvest losses at different levels of supply chain (%)			
	Growers	'Bepari'	Wholesalers	Retailers
Fruits				
Mango	4.4	8.1	8.1	6.8
Banana	7.7	5.1	8.6	3.2
Jackfruit	16.1	11.4	9.2	6.8
Papaya	6.1	13.7	12.2	7.9
Litchi	8.5	5.1	6.1	5.1
Pineapple	10.4	11.6	14.1	7.0
Orange	5.2	5.7	4.0	8.7
Vegetables				
Tomato	6.9	9.1	8.0	8.9
Cauliflower	4.2	9.2	10.3	10.7
Okra	9.4	9.8	4.9	8.3
Brinjal	6.9	7.4	8.4	6.6
Cucumer	7.2	4.5	10.7	4.7
Redamaranth	5.5	9.2	7.8	6.1
Mean	7.6	8.5	8.6	7.0

Ref: Hortex foundation

4.12 Economic loss due to postharvest spoilage

The postharvest quantitative losses as shown in Table 4.6 were converted to economic values.

Table 4.6 Post harvest quantity loss of vegetables

Fruits & Vegetable	Production in metric ton	Actual Loss (%)	Harvest Price Tk/kg	Retail Price/kg	Loss based on harvest Price (Core Tk)	Loss based on retail Price (Core Tk)
FRUITS						
Mango	767000	27.4	44.99	62.74	949.5	1318.53
Jackfruit	926000	43.5	6.48	14.37	261.02	578.83
Banana	1005000	24.6	12.1	22.92	299.15	566.65
Litchi	44000	24.9	130	293.59	142.43	321.66
Pineapple	238000	43	5.68	9.7	58.13	99.27
Papaya	96000	39.9	16.05	34.7	61.47	132.91
Orange	12000	23.6	43.8	69.48	12.4	19.68
Sub-total(Fruits)					1784.1	3037.53
VEGETABLES						
Tomato	143000	32.9	12.85	16.58	60.46	78
Cauliflower	156000	34.3	9.33	15	49.92	80.26
Brinjal	222000	29.4	18.95	28.36	123.68	185
Okra	39000	32.3	15	27.96	18.9	35.22
Cucumber	53000	27.1	9.45	17.76	13.57	25.51
Sub-total(Vegetables)					266.53	403.99
GRAND TOTAL					2050.63	3441.52

Ref: Hortex foundaion

4.13 Constraints of stakeholders in horticulturalsupply chainin Bangladesh

Mango

At the growers' levels, the problems are mainly related to unavailability, high price andpoor quality of fertilizers, lack of irrigation water, insect infestation and disease attack.Irrigation problem occurs because of higher temperature and low precipitation in theChapai Nowabgonj and Rajshahi districts and due to higher price of fuel to operate shallow and deep tubewells.

Banana

The major problem of the growers is related to fertilizers (availability, price and adulteration). The floor of most of the assemble markets are so dirtyespecially during the rainy season, the 'Bepari' and other stakeholders cannot performtheir works properly. In addition, the produce comes in contact with the mud and dirt, which expose the produce to hazardous chemicals and harmful microorganisms. So, thefloors of the assemble markets should be smoothly constructed for easy and rapid movement of the produce. Inadequate supply of banana is observed to be the most important problem of the banana retailers.

Litchi

At the growers' levels, availability of agricultural inputs are found to be the major concerns, whereas at the intermediary levels, lack of storage and transport facilities andpericarp browning are observed to be the major constraints. The problems related to skinbrowning and lack of storage are also acknowledged by the retailers of litchi fruits.

Pineapple

The major constraints of the growers of pineapples are related to agricultural inputs like adequate supply of good quality fertilizers, pesticides and planting materials. The growers also have strong demand of a cold storage facility for short-term storage of pineapples sothat they could temporarily store pineapples during lower demands and unfavorableweather condition, and subsequently sell their fruits at reasonable prices. The 'Bepari' andthe wholesalers have particular problems with cold storage and transportation.

Jackfruit

The growers of jackfruit are found to be very ignorant in relation to their problem. Theyare mostly incapable of identifying their problems as up to 60% of the growers of Mymensingh and Gazipur districts do not know their constraints. However, lack of fund, storage and training are observed to be the major constraints in jackfruit production in Mymensingh and Gazipur districts. At the 'Bepari' level, 80-90% of the 'Bepari' have problem with lack of adequate transport facility. The transport problems are concerned with unavailability, high price and the hegemony of the local transport brokers. The wholesalers also have problems in relation to the lack of storage.

Papaya

Lack of fund and high prevalence of insect pests and diseases are observed to be the principal constraints of the papaya growers in the Ishurdi region of Pabna district.Inadequate and faulty transportation and lack of short and long-term storage facilities arethe major constraints of the 'Bepari' and wholesalers of papaya.

Orange

The Orange growers of the Moulvibazar are facing the challenge of irrigation crisis to grow orange. Water is very scarce over there, especially at the top of the hills. They alsohave no other improved irrigation systems like drip or trickle irrigation suitable for uneven topography. However, the growers apply different types of mulching materials, especially straw to conserve moisture in the soil. Insects and diseases are also found as important problems in orange growing region. Lack of transport and storage facilities are again the principal constrains in carrying out orange business as experienced by the intermediaries.

Tomato

For the tomato growers, the predominant problem is the high level of infection by viraldiseases, especially the tomato mosaic virus. Problems are also concerned with insect and irrigation. Lack of storage and inadequate transportation are observed to be the constraintsof the tomato 'Bepari' and wholesalers. The retailers of tomato also have problems with lack of storage and transport facilities.

Cauliflower

The growers experience mainly the problems related to insect damage and over maturityor discoloration of the curd. Over maturity, curd discoloration (red rot due to borond eficiency), and lack of storage, transportation and fund are observed to be the major constraints of the intermediaries engaged in the cauliflower supply chain.

Okra

At the growers' level, insect pests and diseases are observed to be the major problems. Apart from pests and diseases, other problems are related to seeds, water and fertilizers.As okra pods are very tender and highly perishable, numerous problems are

faced by the inter mediaries. Among the problems, lack of proper transport system is the main concern of the 'Bepari'. As a result, huge loss occurs, especially when the produce could not be delivered to the destination markets at the right time. In that situation, the 'Bepari' are compelled to sell their produce at throw-away prices, and often the produce become sunsalable, i.e. cent percent loss occurs. Other problems are quality deterioration of okrapods by rots and discoloration due to absence of proper storage facility.

Brinjal

At the growers levels, the pests and diseases are found to be the main concerns. Otherwise, there is very little other problem. The inter mediaries have problems with transportation and storage. Fruit separation from the stalk is the major problem of the retailers. Generally, the consumers prefer to buy Brinjal with calyx and peduncle attached with the fruit.

Cucumber

The growers' problems are related to insect pests, diseases and lack of other inputs. Mostof the wholesalers have no proper knowledge on storage and transportation of cucumbers. A considerable proportion of the retailers have problems in relation to quality deterioration due to water loss and subsequent shrinkage that render the cucumber unsalable. Systems are also crucial.

4.14 Post harvest handling of fruits and vegetables

Post harvest supply chain

Post harvest handling operations mainly include: sorting, grading, cleaning and sanitation, packaging, transportation and storage. The harvested produces are firstly dumped in aPlace, and from where other operational steps are sequentially started

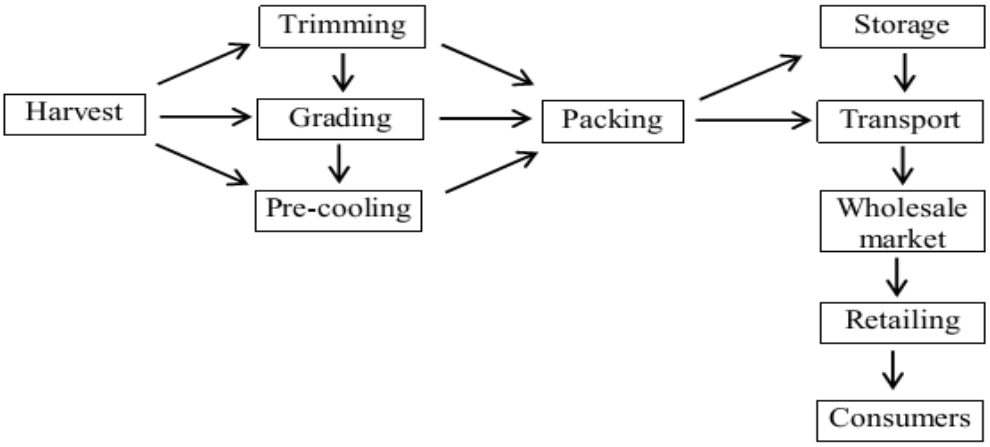


Fig 4.5: Post harvest supply chain

Marketing of fruits and vegetables

The changing demand in domestic and international markets for high-value product creates challenges and opportunities. Majority of the horticultural commodities like fruits and vegetables are produced by small and marginal holders, but due to weak and fragmented value-chain, only a small percentage of the produce reaches the urban market (Minten *et al*. 2010). Appropriate marketing infrastructure is crucial for efficientmarketing of fruits and vegetables. Adequate transportation and product handling are also important for the trade of agricultural products and important factors in assuring good prices and poverty alleviation (Khandaker *eta* lk.2009). Investment

is required for improved maintenance of road and port infrastructures. In addition to infrastructure development, modification of policies and management are also needed to improve appropriate and timely shipping of perishables (World Bank2005).

Present horticultural marketing channel in Bangladesh

The present marketing channel of fruits and vegetables in Bangladesh is quite outdated and there is no sign of improved systems in operation as seen in many of the developed and developing countries. The growers generally sell their produce either to the 'Faria' intheir own field or to the 'Bepari' in the nearby rural assemble markets. In the assemble markets, the 'Bepari' pays a certain percent of commission (≈5%) to the local commission agent. The produce is then loaded onto the transport vehicle and carried to the different wholesale markets in the big cities including Dhaka, Rajshahi, Chittagong, Khulna, Sylhet, Barisal, and also to other district towns based on demands. The 'Bepari' also pays acertain percentage of commission (≈5%) to the commission agent called 'Aratdars' in the distant wholesale markets. In most cases, the whole salers do nothing. They only take the Commission in exchange of giving his place ('Arat') to be used by the 'Bepari' to keep their produce until sold to the 'retailers' or consumers. The retailers finally sell their produce to the consumers. An interesting observation is that the use of ripening chemicalsis particularly concentrated in the rural assemble markets and whole sale markets for Mango, Banana, Jackfruit and Tomato. In contrast, the ripening chemicals are used by the growers in case of pineapple. The following marketing channel (Fig.5.2) is observed formost of the horticultural commodities with some exception.

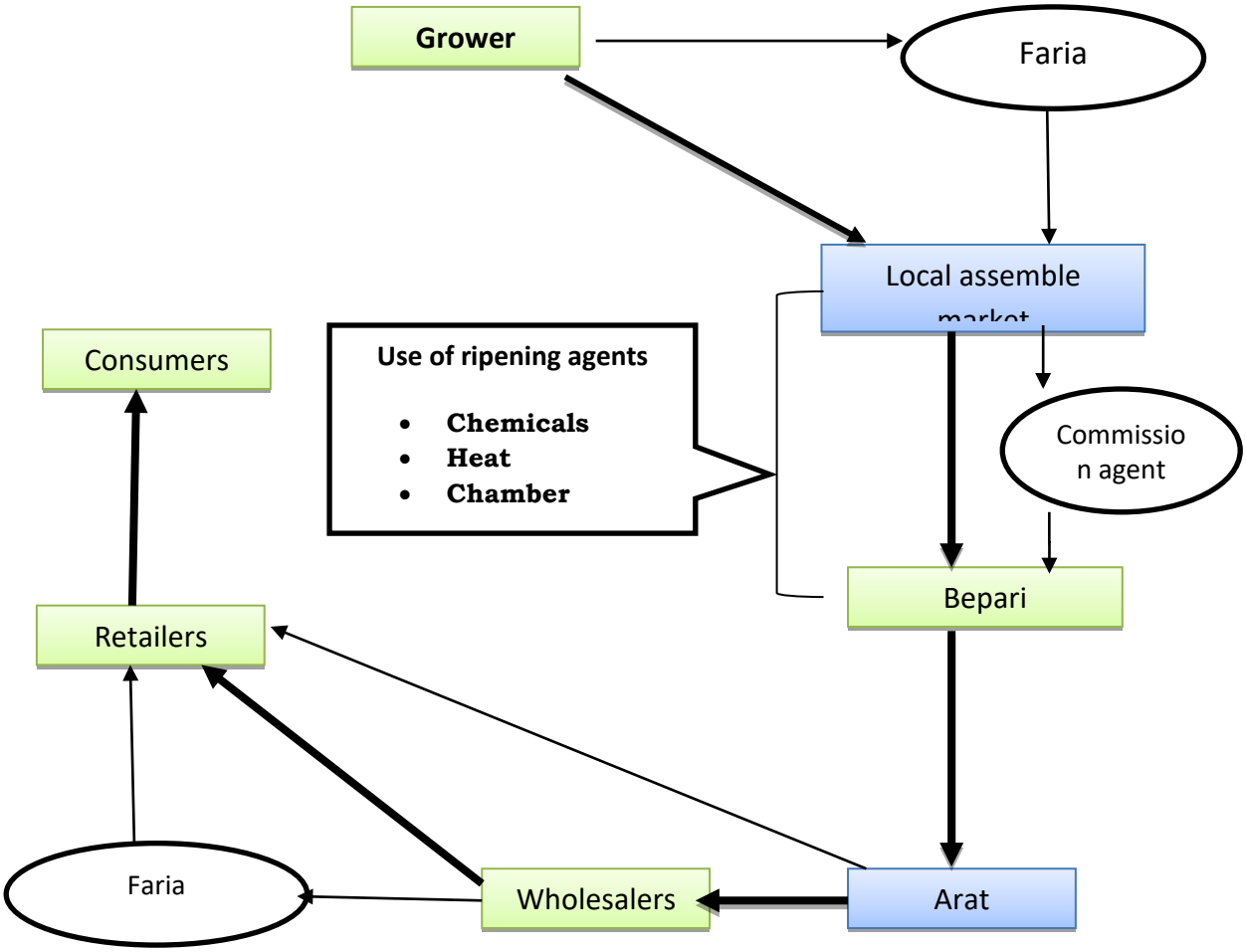


Fig 4.6: Horticultural Marketing Channel in Bangladesh

In the entire marketing channel, there is no facility for short and long term storage of perishables. Ideally, storage facilities should be located at each of the loading and unloading points, and in the wholesale markets. This is a critical problem in the present marketing system, especially for the perishables like fruits and vegetables.

Price variation of horticultural produce in supply chain

Price of commodity at different levels of supply chain is very important in Bangladesh, where the commodity price varies quite significantly due to the engagement of numerous intermediaries in the system. Generally speaking, the price of produce is pretty high at there tailers' level as compared to that of the growers'

level. The price increase of produce ranged from 44.52% in mango to 252.35% in red Amaranth in the marketing channels before the produce reaches the consumers. High price increase of a particular commodity at the retail level is possibly attributed to the less market integration and vice versa. More than 100% price increase is observed in Pineapple, Jackfruit and Tomato. The levels of price increase in Cucumber, Banana, Cauliflower and Okra were 94, 90, 88 and 86%, respectively. The average increase in price of fruits and vegetables is 105% in the marketing channel before reaching the consumers. This may be because of the fact that the growers are not interested to sell their produce to the consumers. Sometimes, unnecessary hassles and inadequacy of transport facility encourage the growers to sell their produce either to the 'Faria' or to the 'Bepari' in the nearby assemble markets. In addition, strong trade organization of the intermediaries and no or weak organizations of the growers further compound the problems. However, government-assisted growers' society orsimilar society would greatly help the growers to receive reasonable price for their Produce.

Model of Vegetable exports potentiality and Market chain Analysis

From 2004-05 fiscal year to 2010-11 fical year the the exported vegetables amount was 29100 MT and 48428 MT respectively. By this export the country earns 46410000 $ and 109410 $ respectively.

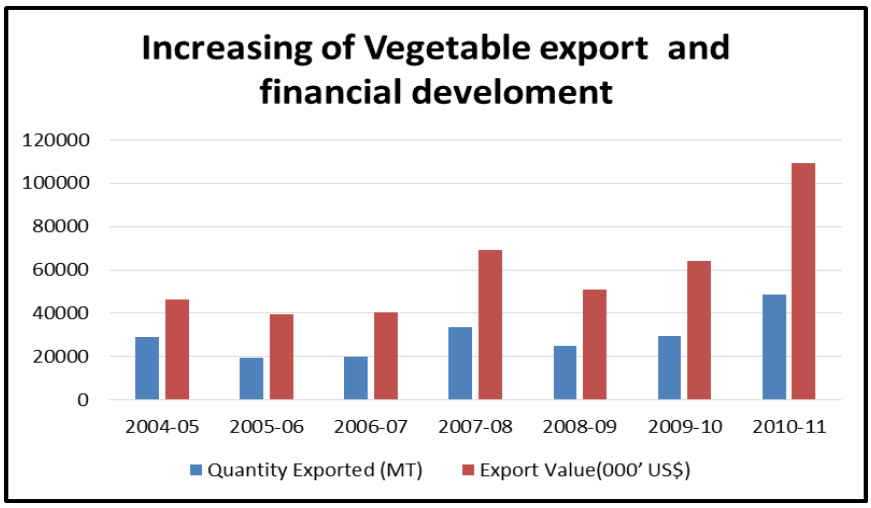


Figure 4.7: Increasing of vegetable export and financial development

The above table shows the graphical analysis of increasing vegetables exports and the volume of earning foreign currency.

From above three tables it is stablished that: the motivation to farmers of vegetable cultivation effects practically in the field and finally day by day the progress of cultivation increases as well as the currency.

4.14 VEP MODEL:

Vegetable Export Potentiality (VEP) is a diagram model consist of farmers psychological & physical activities which creates a continuous process to be motivated & cultivate vegetables for foreign export.

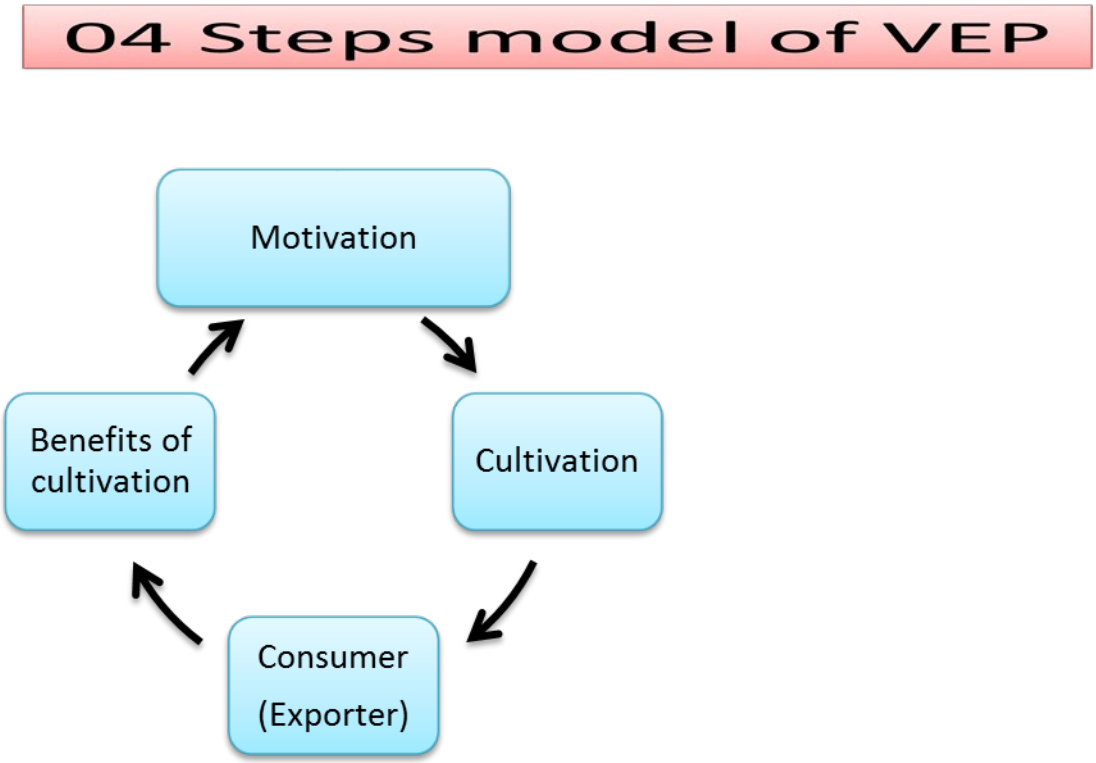


Fig 4.8: 04 Steps VEP model

The diagram process gets the power from the Global demand. Global demand is the power house. Demand hits the consumer/exporter stage. Consumer/Exporters collects commodity (vegetables) from the markets to export. Thus demand explores. Demands & Benefits are proportionately increase or decrease. If price increases farmers psychologically motivated to cultivate the product (vegetable). To increase the production and to enter in the market farmer's cultivation goes under substitution or parallel grown with other commodity.

4.15 Steps of VEP Model

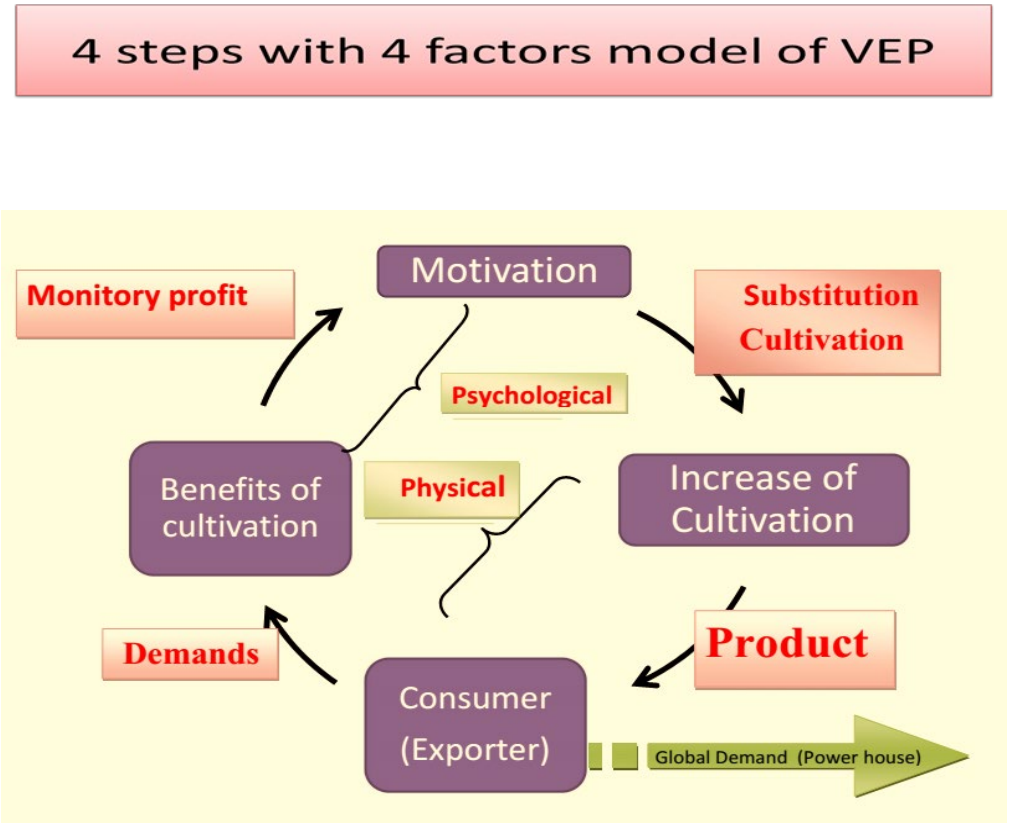


Fig 4.9: 04 steps with 04 factors model of VEP.

The diagram process gets the power from the Global demand. Global demand is the power house. Demand hits the consumer/exporter stage. Consumer/Exporters collects commodity (vegetables) from the markets to export. Thus demand explores. Demands & Benefits are proportionately increase or decrease. If price increases farmers psychologically motivated to cultivate the product (vegetable). To increase the production and to enter in the market farmer's cultivation goes under substitution or parallel grown with other commodity.

4.16:Theory of VEP Model

1. Steps started from bottom effecting clockwise cyclic order in one direction.
2. Steps are in two grand parts: Psychological, Physical activities.
3. Any of the steps resulted positive or negative the rest of next all steps will be effected proportionately.
4. Expression of the effect of total cycle requires one season of time.
5. The power house of the cycle is Global Demand.
6. Factor develops from backward & ended up in upward stage.
7. Each factor is the value of two steps.

4.17 Explaination of VEP Model:

Explanation of VEP according to the Primary & Secondary data

Table 4.7: Table shows the volume of vegetable export increasing year after year.

Fiscal Year	*Quantity Exported (MT)*	*Export Value(000' US$)*
2004-05	29100	46410
2005-06	19460	39590
2006-07	19805	40530
2007-08	*33626*	69120
2008-09	24670	50710
2009-10	29370	64210
2010-11	48428	109410

Global Demand

Global demand is the power house of the VEP model. According to the secondary data Table: 4.7 we see 2004-05 quantity of veg exported 29100 MT. By which earnig currency US$ 46410000. It gradualy increases & in 2007-2008 exported amount 33626 MT and by which earning currency US$ 69120000. It follows and finaly exported 48428MT in 2010-11 by which earns US$ 109410000. So, 2004-05 to 2010-11 fiscal year the volume increases 48428-29100=19328 MT and currency increase US$ 63000000 within 06 years.

Benefits of cultivation

Cent percent respondent in 11 district over the country exposes that their understanding vegetable cultivation is profitable than paddy. This understanding to them through vegetable productin experience and market observation.

Table 4.8: Farmers understanding in the benefit of cultivation vegetable than paddy.

District	Yes		No		Total	
	N	%	N	%	N	%
Bogra	11	100.0	0	0.0	11	100.0
Comilla	10	100.0	0	0.0	10	100.0
Dhaka	10	100.0	0	0.0	10	100.0
Gaibandha	6	100.0	0	0.0	6	100.0
Kurigram	10	100.0	0	0.0	10	100.0
Kushtia	9	100.0	0	0.0	9	100.0
Mymensingh	10	100.0	0	0.0	10	100.0
Nilphamari	10	100.0	0	0.0	10	100.0
Pirojpur	10	100.0	0	0.0	10	100.0
Rajshahi	9	100.0	0	0.0	9	100.0
Sherpur	9	100.0	0	0.0	9	100.0
Total	104	100.0	0	0.0	104	100.0

Motivation

The survey reports in below table shows 439.4% vegetable cultivated & increased to 482.7% in the next year 2012. Finally the percentage increased to 670.2%.So, the result is significant that from 2011 to 2013 within 03 years vegetable cultivation in percentage under constant respondent increased 670.2-439.4=230.8%

Table 4.9 Survey shows the cultivation in percentage significantly Increase year after year.

District	2013		2012		2011	
	N	%	N	%	N	%
Bogra	47	45.2	29	27.9	27	26.0
Comilla	82	78.8	65	62.5	60	57.7
Dhaka	74	71.2	55	52.9	61	58.7
Gaibandha	29	27.9	33	31.7	29	27.9
Kurigram	75	72.1	56	53.8	50	48.1
Kushtia	55	52.9	32	30.8	18	17.3
Mymensingh	65	62.5	49	47.1	41	39.4
Nilphamari	74	71.2	57	54.8	61	58.7
Pirojpur	104	100.0	67	64.4	57	54.8
Rajshahi	36	34.6	25	24.0	18	17.3
Sherpur	56	53.8	34	32.7	35	33.7
Total	104	670.2	104	482.7	104	439.4

Note: This table is shown in no of respondent

Increase of cultivation

The survey reports in below table indicates that individual farmer over the country adding newer type of vegetable under cultivation year after year. In 2011, 457 vegetables counted over 11 district & 104 farmers. In 2012 vegetable number increases to 502. In 2013 vegetable cultivated 697. Within 3 years increased number is 697-457=240. So the status is very significant to say that the cultivation of vegetable is rapidly increasing year after year.

Table 4.10 Table shows that total number of vegetables cultivation significantly Increases (in constant percentage) year after year.

District	2013		2012		2011	
	N	%	N	%	N	%
Bogra	47	6.7	29	5.8	27	5.9
Comilla	82	11.8	65	12.9	60	13.1
Dhaka	74	10.6	55	11.0	61	13.3
Gaibandha	29	4.2	33	6.6	29	6.3
Kurigram	75	10.8	56	11.2	50	10.9
Kushtia		7.9	32	6.4	18	3.9
Mymensingh	65	9.3	49	9.8	41	9.0
Nilphamari	74	10.6	57	11.4	61	13.3
Pirojpur	104	14.9	67	13.3	57	12.5
Rajshahi	36	5.2	25	5.0	18	3.9
Sherpur	56	8.0	34	6.8	35	7.7
Total	697	100.0	502	100.0	457	100.0

Note: This table is shown in respect to total respondent

4.18 LCR (Principle of Loss &Cost Reduction) Model

Principle of Loss & Cost Reduction (LCR) Model through combination of Primary & Secondary data

Table 4.11: Product loss in Market Chain System :

Loss due transportation		Cost increase due Middle man interception	
Secondary Data	Primary Data	Secondary Data	Primary Data
7.9 %	9.3	105%	91.3% farmers admire that selling price reduces due middleman interception.

A huge amount of Horticultural crops (vegetable) wastes due to mishandle transportation in the market chain:

Table 4.12: Farmers response vegetable wastes while transporting

District	average westages	STD	N
Bogra	10.4	.8	11
Comilla	8.8	2.1	10
Dhaka	8.0	2.3	10
Gaibandha	16.7	6.8	6
Kurigram	9.5	4.4	10
Kushtia	9.8	1.4	9
Mymensingh	7.1	2.2	10
Nilphamari	9.3	3.7	10
Pirojpur	9.2	4.3	10
Rajshahi	10.2	.7	9
Sherpur	6.3	2.2	9
Total	**9.3**	**3.7**	**104**

Primary data varies from the secondary data about 1.7%. which minimum and can be accepted as perfect result and jenune fact.It is very logic that in farmers level 9.3% lost creats the lose of vegetable in huge amount all around the country. If we can overcome it through awareness or making infra structure of roads and highway we can get more profit day by day.

Table 4.13: Postharvest losses in different stages of supply chain(in percentage)

Commodity	Postharvest losses at different levels of supply chain (%)			
	Growers	'Bepari'	Wholesalers	Retailers
Fruits				
Mango	4.4	8.1	8.1	6.8
Banana	7.7	5.1	8.6	3.2
Jackfruit	16.1	11.4	9.2	6.8
Papaya	6.1	13.7	12.2	7.9
Litchi	8.5	5.1	6.1	5.1
Pineapple	10.4	11.6	14.1	7.0
Orange	5.2	5.7	4.0	8.7
Vegetables				
Tomato	6.9	9.1	8.0	8.9
Cauliflower	4.2	9.2	10.3	10.7
Okra	9.4	9.8	4.9	8.3
Brinjal	6.9	7.4	8.4	6.6
Cucumer	7.2	4.5	10.7	4.7
Redamaranth	5.5	9.2	7.8	6.1
Mean	7.6	8.5	8.6	7.0

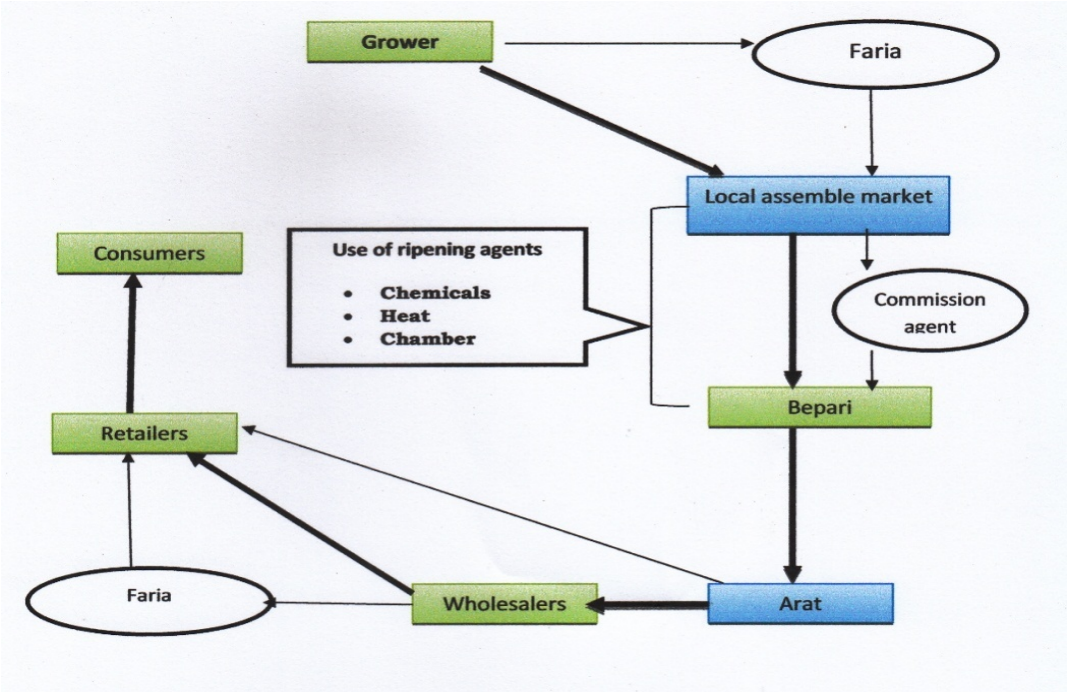


Fig 4.10 : Vegetable market chain

Loss and Cost Reduction (LCR) Principle

1. Middle man/intermedier remove from the market chain means mishandle transport lose 7.9% reduces from the market chain.
2. 50% price loss can be recovered to Farmer, if atleast 02 Middle men/intermediers are removed from the Market chain.
3. Middle man/intermedier means: Faria, Commission Agent,Bepari etc.
4. Remove 01 middle man means to forward the product to the next stage by ignoring the current stage.
5. Arrange transport to collect products from Grower & supply directly to whole sale market "Faria + Bepari" will skip away.
6. Due to skip Faria & Bepari fruit ripening activities will stop significantly, as the activities are shown major portion at the stage

of Faria and Bepari under their custody. Storage maintenance cost will overcome.

Cost Reduction

Profit increase

Chapter 5
Results & Discussions of Export Potentiality

The fresh vegetable and fruit exporters have now been facing stiff competition from their counterparts from Pakistan, India and Kenya in Middle-East markets including United Arab Emirates, Qatar and Kuwait. Pakistani and Indian exporters for their close proximity are able to send their goods at cheap prices through the sea-route while Bangladesh exporters have to rely on expensive air shipment. Even then the export of fresh vegetables and fruits from the country has got good market as Bangladeshi expatriates are the main buyers who prefer home-grown produces.

According to local exporters, Bangladeshis in many European cities look for fresh Bangladeshi vegetables and fruits. Earlier Britain was the major destination for local fresh vegetables and fruits. For the past few years Bangladesh has been exporting such consignments to Italy and France. According to the Export Promotion Bureau's latest data, fresh products worth US$10 million was exported in two months – July and August of the current fiscal year, nearly 7 per cent less than the export of the corresponding period of last year. The reasons were attributed to lack of modern processing centre and timely supports from the government besides shortage of cargo services.

5.1 Some primary & secondary data resulted cultivation of vegetable is increasing year after year in area & also volumetric measurement:

Workingwith 104 respondents in a research areas in 11districts farmers responding in growing vegetables in their fellow land.

Table 5.1 Farmers responding in growing vegetables in their fellow land

District	Yes		No		Total	
	N	%	N	%	N	%
Bogra	11	1.0	0	0.0	11	1.0
Comilla	9	.9	1	0.1	10	1.0
Dhaka	10	1.0	0	0.0	10	1.0
Gaibandha	6	1.0	0	0.0	6	1.0
Kurigram	10	1.0	0	0.0	10	1.0
Kushtia	8	0.9	1	0.1	9	1.0
Mymensingh	10	1.0	0	0.0	10	1.0
Nilphamari	9	0.9	1	0.1	10	1.0
Pirojpur	10	1.0	0	0.0	10	1.0
Rajshahi	9	1.0	0	0.0	9	1.0
Sherpur	9	1.0	0	0.0	9	1.0
Total	101	1.0	3	0.0	104	1.0

In 11 Districts 104 farmers responding 97.1% agreed that they cultivates vegetables in the field where previously they were used to cultivate rice only.

Year Wise Cultivated Area (Lakh Ha), Production (Lakh MT) and Yield (MT/ha) of Vegetables & some selected spices

Name of Crops	2011-12			2012-13		
	Area (Lakh ha)	Production (Lakh MT)	Yield (MT/ha)	Area (Lakh ha)	Production (Lakh MT)	Yield (MT/ha)
Vegetables(Winter)	**4.73**	**88.30**	18.67	**4.94**	**92.30**	18.68
Vegetables(Summer)	**2.68**	**37.50**	13.99	**2.72**	**39.91**	14.67

Ref: Agriculture Statistics: Dept.of Agriculture Extension

Table 5.2 Number of farmers believe cultivation of vegetables is profitable than Paddy.

District	Yes		No		Total	
	N	%	N	%	N	%
Bogra	11	100.0	0	0.0	11	100.0
Comilla	10	100.0	0	0.0	10	100.0
Dhaka	10	100.0	0	0.0	10	100.0
Gaibandha	6	100.0	0	0.0	6	100.0
Kurigram	10	100.0	0	0.0	10	100.0
Kushtia	9	100.0	0	0.0	9	100.0
Mymensingh	10	100.0	0	0.0	10	100.0
Nilphamari	10	100.0	0	0.0	10	100.0
Pirojpur	10	100.0	0	0.0	10	100.0
Rajshahi	9	100.0	0	0.0	9	100.0
Sherpur	9	100.0	0	0.0	9	100.0
Total	104	100.0	0	0.0	104	100.0

Table 5.3: Exporting status of vegetable crops in different years.

Fiscal Year	***Quantity Exported (MT)***	***Export Value(000' US$)***
2004-05	29100	46410
2005-06	19460	39590
2006-07	19805	40530
2007-08	*33626*	69120
2008-09	24670	50710
2009-10	29370	64210
2010-11	48428	109410

Source: Export Promotion Beuro (EPB)2011, Bangladesh.

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104 respondent cultivating vegetable in fellow land or as substitute in the rice field.

Table 5.4: Yearwise increasing vegetable cultivation in different districts.

District	2013		2012		2011	
	N	%	N	%	N	%
Bogra	47	6.7	29	5.8	27	5.9
Comilla	82	11.8	65	12.9	60	13.1
Dhaka	74	10.6	55	11.0	61	13.3
Gaibandha	29	4.2	33	6.6	29	6.3
Kurigram	75	10.8	56	11.2	50	10.9
Kushtia	55	7.9	32	6.4	18	3.9
Mymensingh	65	9.3	49	9.8	41	9.0
Nilphamari	74	10.6	57	11.4	61	13.3
Pirojpur	104	14.9	67	13.3	57	12.5
Rajshahi	36	5.2	25	5.0	18	3.9
Sherpur	56	8.0	34	6.8	35	7.7
Total	697	100.0	502	100.0	457	100.0

Note: This table is shown in respect to total respondent

Which show the number of vegetables cultivation by individual famer increasing year after year. In 2011, 2012, 2013 the number of vegetable crops increases 457,502 & 697respectively. This outcome of research significantly prove the secondary data (Annual Report of BBS) in the table below:

Table 5.5: Area & Production of Fruits in different years in Bangladesh (Winter)

2008-2009 to 2010-11

(Area in Acre, Production in Metric Tone)

	2006-2007		2006- 2008		2008 - 2009		2009 - 2010		2010 - 2011	
Name of Crops	**Area**	**Production**	**Area**	**Production**	**Area**	**Production**	**Area**	**Production**	**Area**	**Production**
Banana	14280	1004520	131636	877123	132414	836183	133305	818254	13058	800840
Mango	71899	78196	78196	802750	76715	828161	79066	842312	67842	889176
Painaple	41935	238360	39385	210283	38989	229068	39583	234493	37037	218582
Jack Fruit	24654	925965	24621	976320	22814	974760	256615	1005164	26310	961821
Ripe Papaya	2734	95785	4918	103609	2750	129559	2790	112770	3052	124764
Water Melon	23250	105830	30986	204593	31249	200238	32713	216497	29848	204514
Lichi	4286	43565	5789	43767	3973	55288	4259	64995	4602	66510
Guava	13764	151790	14885	151549	14764	160927	12542	181950	12061	271309
Orange	413	866.51	912	1558	947	2062	806	2666	853	2998
Lime & Lemon	4831	37770	4170	52801	4567	55594	5280	53987	4083	54895
Bangi	11425	42815	9684	35975	10122	37054	11376	43279	11479	45895
Tetul	328.76	9210	140	9077	140	9579	225	11077	181	11114
Jamrul	377	12395	137	10355	104	10659	66	10584	85	10490
Black Berry	488	37685	542	43660	749	45212	161	46666	336	51772
Kamranga	186	6995	130	9203	131	10309	101	11335	94	11841
Wood apple	651	30330	397	26423	220	25545	177	25859	140	25259
Green coconut	4760	436845	4953	321647	5629	380736	5800	389094	4923	375845
Jalpai	377	9420	304	14311	231	14406	230	14623	227	14892
Amra	460.19	26734	794	21763	482	26044	424	32028	358	33197
Total	**221098.95**	**3295076.51**	**352579**	**3916767**	**346990**	**4031384**	**585519**	**4117633**	**216569**	**4175714**

Ref: Annual report of BBS,2011

Table 5.6 : Area & Production of Kharif (Summer) Vegetablesin different years in Bangladesh.										
2008-2009 to 2010-2011										
(Area in Acre & Production in Metric Ton)										
Name of Crops	**2006 - 2007**		**2007 - 2008**		**2008 - 2009**		**2009 - 2010**		**2010 - 2011**	
	Area	**Production**	**Area**	**Production**	**Area**	**Production**	**Area**	**Production**	**Area**	**Production**
Pumpking	23670	77595	26081	82520	27505	92519	27424	92900	27602	95420
Brinjal	44015	110910	45417	122730	44737	123779	44377	125080	44268	124384
Patal	23510	68415	24048	70367	24558	72473	24749	78084	24655	83246
Lady's Finger	23180	38715	24171	38508	24969	40462	25204	42366	25570	43212
Jhinga	20985	36595	22340	40995	2280	41610	23039	44064	23563	45942
Karala	19635	34445	21240	39648	21688	40127	22143	41419	22793	45097
Arum	48840	156725	52566	179866	56539	209048	58736	224546	59402	238645
Chal Kumra	16240	44380	19355	52660	21077	57308	22527	62673	23418	64898
Cucumber	16750	23480	17930	36740	17891	43902	18935	55152	19030	48448
Barbati	13820	18590	14139	19844	14468	21348	1488	21178	15347	22259
Puisak	19105	52195	21276	55339	21937	63001	22604	66705	23255	66994
Chichinga	13475	24430	14485	216934	15193	29211	15741	30339	16245	31426
Danta	22450	56715	24933	75115	25100	65177	25463	65987	25845	67358
Kakrol	9140	17415	10600	22121	10620	22992	11215	24564	11202	14141
Dundal	8375	15430	8381	14807	8124	14642	8318	15250	8389	15290
Kachur Lati	15980	35870	16528	36004	1660	36890	17008	38502	16750	38461
Sajna	149	18250	112	17369	98	19014	19014	23025	19014	23025
Kacha Papaya	425	153284	1599	168928	4952	192949	192944	204221	192949	2042211
Green Banana	32590	231585	33917	301065	30319	218840	27818	156965	25258	158365
Total	372334	1215024	399118	1591560	**373715**	**1405292**	**608747**	**1413020**	**624555**	**3268822**

Ref: Annual report of BBS,2011

Table 5 .7 : Area in Acre & Production in Metric Ton in different years in Bangladesh.

2008-2009 to 2010-2011

Name of Crops	2006 - 2007		2007 - 2008		2008 - 2009		2009 - 2010		2010 - 2011	
	Area	Production	Area	Production	Area	Production	Area	Production	Area	Production
Rabi Brinjal	71205	22110	72514	215282	70376	213789	71047	216182	70750	215490
Cauli Flower	36605	143206	39137	156483	39933	153226	41211	160040	40901	168238
Cabbage	37760	182685	40094	211097	40791	205627	41182	219958	39015	206851
Water Gourd	31910	117120	33021	125949	34176	131716	34446	1343459	35278	137301
Rabi Pumkin	30715	103840	32259	107214	32933	116014	34908	124534	33847	122747
Tomato	47960	136935	48538	143058	50470	150720	58854	190213	61213	232459
Radish	62585	235815	68058	267048	65480	257371	66954	259743	65384	256711
Palong Sak	38175	82980	38519	82872	19809	42898	20215	45251	19959	43193
Lal Sak	18375	38205	19258	44030	24350	41583	24877	44329	25118	42810
Carrot	22760	37415	24733	41189	3109	11380	3496	14075	3423	15021
Lauslak	2745	9855	2850	10430	13715	22549	13959	22816	13830	23026
Bean	13660	20445	13954	22403	20213	88386	40992	88581	42760	94756
Total	**414455**	**1130611**	**432935**	**1427055**	**415355**	**1435259**	**452141**	**2729181**	**451478**	**1558603**

Ref: Annual report of BBS,2011

5.2 Export supply chain of Okra

There are several actors involved in the production and marketing of okra e.g.input suppliers, traders, processors and exporters. In general the supply chain of okra comprise by any of the following channel.

Channel-1: Direct marketing to consumers at primary markets by the producers to village traders of retail sales to rural consumers.

Channel-2: Farmgate sales to collectors, traders, commission agents or buyers, or

Channel-3: Sales to traders and wholesalers at assembly markets.

Where greater quantities of produce are disposed of either by producers themselves or by village traders, though take the produce back to village hats or by commission agents and semi-wholesalers, who brings it to other secondary markets or to terminal markets(urban wholesale, wholesale/retail and retail markets of large consumption areas) within and outside the region. The supply chain represents the overall market position where the actors ate present. The study revealed that the growers consumed 7.8% and 92.2% of produces are sold out. The producer sold the produce just immediately after harvest. It was found that 28% farmers sold okra at Farmgate and 72% sold in the local markets.

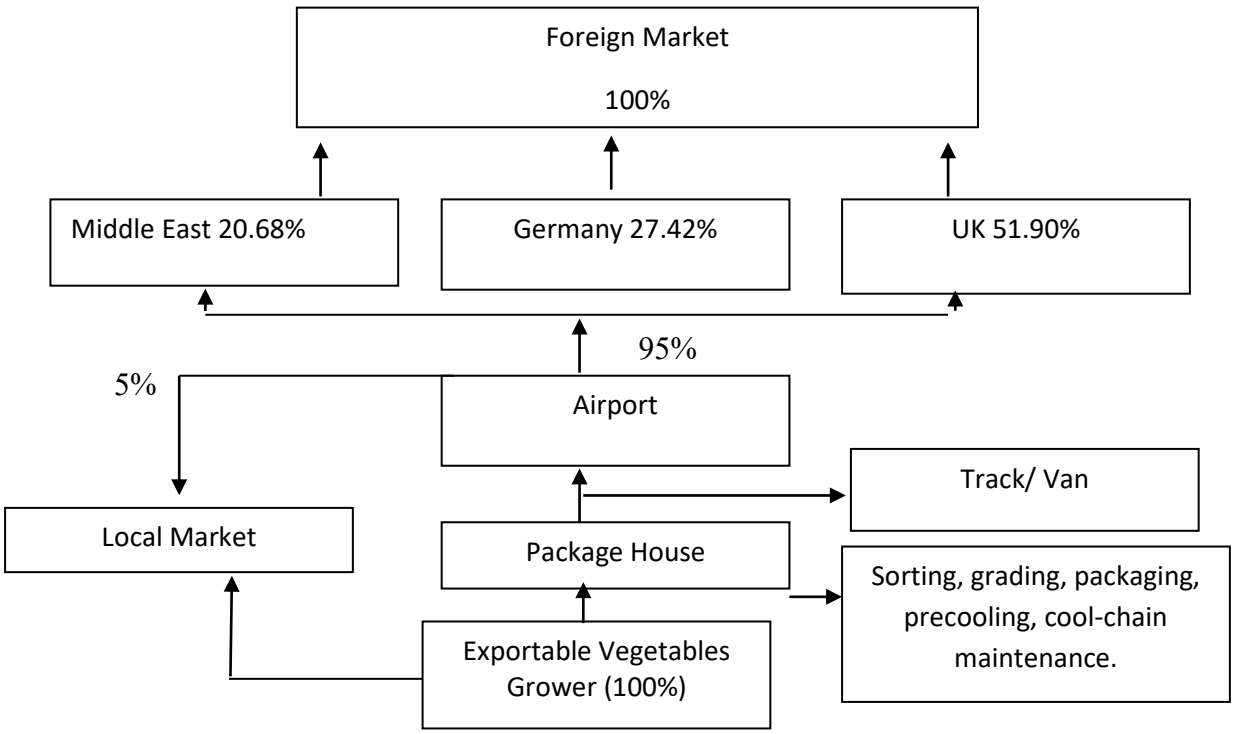
5.3 Export value chain of Okra

The cost of airfreight is highest (63.97%) of all costs followed by raw material price (16.85%). The export net profit was TK 15.77/kg. Offering lower price and constant supply of good quality produce is an easer strategy, which might help a longer vision to be the market leader and also to be the sustainable supplier in the foreign markets.

5.4 Export supply chain of Green chii

The supply chain of chilli for export basically depends on the producer. The exporters collect Beans from producer and bring the chili to the packinghouse where the

producer received and value adding activities such as, sorting/clearing, grading, cooling, packing, transport through truck. The green chili in bunches (wrapped in rubber bands kept in corrugated firverboard boxes weighing 4.0-5.0 kg. the export supply chain of green chilli is presented in Figure 4. Traditional exporters usually green chili. In the year average exported about 75 tons in Middle East, Germany and UK with export quantity20.68%, 27.42% and 51.90% respectively. (Fig. 5.1)



Ref: Export Promotion Beuro (EPB)

Figure 5.1: Export supply chain of Green Chii.

5.5 Export value chain of Green chili

The cost of airfreight is highest (60.55%) of all costs followed by raw material price (19.18%). The exporter net profit was TK13.42/kg. Offering lower price and constant supply of good quality produce is and easier strategy, which might help a longer vision to be the market leader and also to the sustainable supplier in the foreign markets

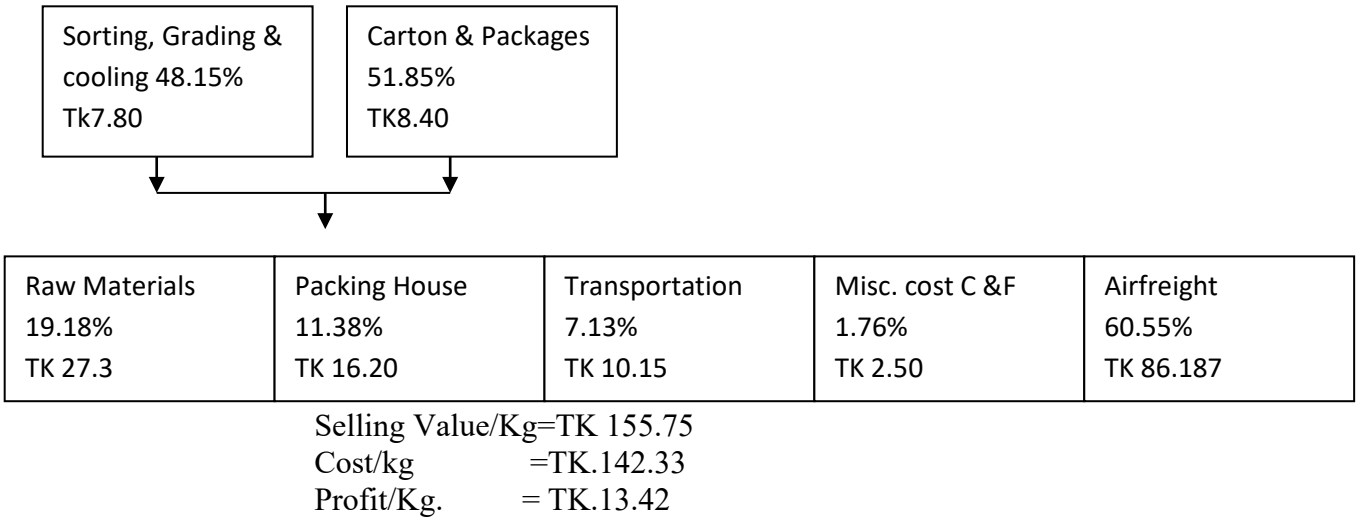


Fig 5.2. Export value chain of Green Chili.

5.6 Problems of Vegetables Export From Bangladesh

Present positions of Bangladesh fresh vegetables in both the UK and Middle East markets are quite comparable. Vegetables are positioned in the lowest market segment in terms of quality and price. Product range is limited to South Asian vegetables. During peak season, shortage of cargo space is the main obstacle. The present study was undertaken to identify the major problems faced by these who were involved in exporting vegetables. The major problems to the development of vegetables export trade in Bangladesh are discussed as follows:

Poor quality of Vegetables

Scrupulous application of health regulations and rigorous quality control and inspection methods are adopted in the UK, Netherlands, Belgium, France, USA and other foreign countries. Overall quality of the Bangladeshi vegetables is poor considered by the importers as one of the major constrains, especially during the summer months shelf life of the vegetables becomes extremely limited. All categories of exporters reported that many a times, the quality of Bangladeshi vegetables is not

acceptable by the foreign buyers and some of the countries have stopped importing Bangladeshi vegetables because poor quality standards. Poor quality cause no supervise vegetables production, high percentages of rejected vegetables due to poor post-harvest handling, rough transportation and also related to the presenting irregular shape and size, different maturity indices, insects and diseases infestation, mechanical injury and moister losses.

High market competition

Market competition is very high for vegetables. Main competitors of Bangladeshi vegetables are our neighboring countries like India, Kenya, Thailand, Srilanka, and Pakistan. During the Bangladeshi vegetables production season, aside from Kenya and India, major competitors are francophone the French franc and more or less independent of the US dollar.

Poor post harvest handling

Firstly, packers should have enough knowledge about post harvest handling practice such as sorting, grading, trimming, packaging, washing etc of vegetables before quality determination. The importance of grading is unbounded in international level. In our country, grading means to arrange the short and bad quality vegetables in the lower level of the carton or baskets and good quality vegetables in upper level of the carton or baskets. But internationally, grading is done on the basis of shape, weight, length, color and diameter and so on. But the exporters of our country did not follow this grading system.

Seasonality of production and high domestic prices.

In Bangladesh, there is no certainty of vegetables supply all the year round. The fresh vegetables of Bangladesh have created their own demand in different countries of the world. But demand for fresh vegetables is not fulfilled round the year due to lake of

production plan, variety and mouthed of cultivation. By observing the export market, it was seen that the demand for primitive vegetables of Bangladesh was more. Among the main export items, most are mighty seasonal and very few are available year round. The domestic prices of the seasonal vegetables are often too high during the early part of the season marketing it unprofitable for the exporters. According to he Beparies/selected agents and all types of exporters, items like French, bitter gourd, yard long bean, snake gourd, stolon of taro, teasle gourd, green chili etc. have very good demand throughout the year but cannot be supplied due either to high domestic prices or non availability. Exporters reduces shipment when they cannot make profit or suffer loss sending vegetables.

Export price

Export price are not fixed until the market situation of the day and most importantly, the quality of the vegetables is assessed and the export price may also be influenced by the international demand as well as the international market price (Table 5.8). Some times the price is set by the Middle men or the intermediator. Some times the price vary due to the variation of the supply of the products.

Poor quality of packaging

Packaging is one of the major marketing problems in the export of vegetables from Bangladesh. The package attracts attention, describes product futures, gives confidence to the consumer and makes favorable impression. But the surveyed exporters reported that, they could not treat this function properly due to lack of proper packaging materials. Foreign retailers always prefer to display their saleable vegetables in an attractive package. Bangladeshi vegetables make a poor presentation in the UK, UAE and other foreign markets and cannot compete in the foreign general market. Packaging of Bangladeshi export vegetables consist mainly of round bamboo

baskets and second hand cartons of different shapes. As a consequence, the vegetables are not properly positioned and for instance. The second hand cartons usually have no ventilation holes and do not have the necessary strength, which causes bruising of the vegetables. Moreover, the irregular shapes of the cartons gives scope for rough handling by airlines staff. Apart from impact on quality the present packaging is very unattractive to foreign buyers and promotes an extremely poor image of Bangladeshi vegetables.

The lack of cargo space capacity

Volume of air space in regular flights from Bangladesh is relatively very low, due to the lack of cargo space capacity for exporting vegetables in the airplanes was mentioned as the main problem. The exporters have to pay a high rate of airfreight charge for the space in the airplanes. Bangladesh has no special cargo planes. So, cargo space depends on number of passengers in the aircraft, if passengers are not more than cargo space become more vice-versa.This problem particularly arises during the hot season from June till October, when according to all exporters, demand for their products is almost double the existing cargo capacity. The exporters collect vegetables only after getting indent from abroad. They cannot often supply vegetables according to orders due to lack of synchronization among collection, availability of cargo space and time of flights a small number of flights. Biman Bangladesh airlines fills its cargo space with perishables on 5 of its weekly passenger flights to UK Emirates Airlines fully stopped for carrying any perishable product in any destination of the world since 2003-2004. Meanwhile, the other direct airlines, British airways fill its cargo space with perishables on 2 of its weekly (Monday and Friday) passenger flight to UK and other countries. Singapore Airlines occasionally carries fresh vegetables. Gulf Air and other airlines also transport some Volume to UK, Middle

East and other destination by indirect connections via the gulf countries. Export of garments, which can pay a high freight, seasonally creates a severe competition for air space. This is problem is most prominent during the months of august/September and February/March.

Vegetables and Fruits airfreight charge in Bangladesh

Table 5.8 : Airfreight charge/kg of vegetable and fruits.

Sector	Air freight	Fuel charge	X-ray charge	THC(Terminal Handling charge)	Total Rate
Dhaka to Middle east	usd 1.10	usd 0.50	usd 0.04	usd 0.08	**usd 1.72**
Dhaka to Europe	usd 1.30	usd 1.00	usd 0.04	usd 0.08	**usd 2.42**
Dhaka to Canada	usd 1.70	usd 1.00	usd 0.04	usd 0.08	**usd 2.82**

Inadequate market information

All types of exporters, Beparies/selected agents reported that there is alack of adequate information to the vegetables growers, middlemen and exporters about demand schedule of the importing countries. The exportable vegetables price in major foreign markets depends on numerous day to day market factors whereas the exporters do not get any current market information on regular basis on several marketing variables like price, quality, promotion, distribution channels, consumers choice, legal requirements and so on.

Lack of insufficient storage facilities

According to the Beparies/selected agent and exporters, post-harvest storage facilities is not available at the field level. After collection of vegetables from the field, is no appropriate system to make them reach direct to the airport or exporters godown for which vegetables are often wasted.

Lack of domestic transportation

All the exporters and Beparies/selected agent reported that the quality of vegetables is quite well but the transportation of vegetables from their place of production to the exporters godown is inefficient, costly and slow resulting in quality deterioration and lower profit for the exporters. Bangladeshi exporters cannot compete in the world market, as the modes of domestic transports are not specially designed for carrying the vegetables for farm gate to export point.

5.7 Suggession to be considered during harvesting & Transporting of horticultural crops:

- Bangladesh Agricultural Extension Department should arrange random training of awareness for farmers in every rural area.
- Produce should be handled with care to avoid injury and damage.
- Market demands in terms of size and stage of maturity should be considered.
- Containers and harvesting tools should be clean and free from rough edges.
- Containers and tools making industry should be developed with govt. subsidee.
- Stackable and nestable plastic crates could be used as field containers during harvest. Plastic crates are durable, reusable and can easily be cleaned.
- Need cargo suttle service to carry farmers harvested products to Whole sale market to overcome the middle point and their handling stage.
- Harvesting and handleing tools & equipement should be delivered vast and free to farmers.
- Produce that has fallen or touched the ground not be harvested.
- Rural area local roads and streets need to build with heavy shock tempered.

- Shade should be provided over the harvested produce to prevent heat and sun damage and reduce nutrition degradation.
- Suitable time of harvesting horticultural produce is the early morning.
- The harvesting tools and equipments should be disinfected with chlorine water.

5.8 Suggession tobe considered for packaging of fruits and vegetables:

Although of perishables is not quite satisfactory in Bangladesh but there are ample scopes to introduce and expand the use of improved packaging to reduce postharvest loss and maintain quality. The following points should be considered during packaging of fruits and vegetables.

- Bangladesh Agricultural Extension Department should arrange random training of awareness for farmers in every rural area.
- Improved packaging such as plastic crates (stackable and nestable), woven plastic sacks, plastic net bags and corrugated fibreboard cartons should be used instead of the convetional bamboo made packages, which cause subsatial damage to the produce during handling. The use of plastic crates in increasing, especially for high value produce like mango and tomato.
- Packeging tools making industry should be developed with govt. subsidee.
- Packages should be strong so as to withstand repeated postharvest handling.
- Packages should not be very large or voluminous. In Bangladesh the “Bepari”very often use large and extra large packages (made of bamboo and jute sacks) with capacity varies from approximately 300-600 kg per package, and there is high risk of damage to the produce during transportation and subsequent handling.

- Packegeing tools & equipement should be delivered vast and free to farmers.
- The packages should not be overloaded and the produce should not be held too tightly or too loosely to minimize damage during transportation and handling.
- Packages should have ventilation holes to allow aeration.
- In every rural market packaging center should be developed.
- Different types of packaging accessories like cups, wraps, foam nets, liners and cushioning (Shredded papers, leaves, vines, etc) should be used to protect the produce during transportation and handling.
- The packages should have label with farm logo and other relevant information for value addition and enhanced marketing.
- Harvesting, Packeging, Carrying methods oriented curriculam should be included in diploma or graduation level in agricultural studies.

5.9 Present situation of vegetables export from Bangladesh

Now a days quantities of fresh vegetables are traded internationally. The rules and regulations of their markets are stringent and demanding high quality. Excellent earning can made by exporting produces as very high quality, but poor or unacceptable produces as a very high quality, but poor or unacceptable produces in lead to a serious earning loss. Before liberation, vegetables were exported in a very limited scale. It is in the mid seventy when export of fresh vegetables drew the attention of the exporters. At that time a great numbers of Bangladeshi went abroad in general and to Middle East in particular for employment. Generally export is made under letter of credit (LC) system through Banks. But exports of perishable items like vegetables are being undertaken on consignment basis. As such it is absolutely a business between a seller a seller of Bangladesh and the buyer in the foreign countries. In these types of business personal relation and trust play vital role.

Table 5.9: Export status of vegetable from Bangladesh

Fiscal Year	***Quantity Exported (MT)***	***Export Value(000' US$)***
2004-05	29100	46410
2005-06	19460	39590
2006-07	19805	40530
2007-08	*33626*	69120
2008-09	24670	50710
2009-10	29370	64210
2010-11	48428	109410

Export from vegetables however, started declining thereafter initially due to the long duration flood situation in the country in late 1998 and subsequently because of its impact on loss of markets. This downward trend reached the bottom level of an export earnings of US$13 million only in the year 2002-03. The situation again started

improving from the year 2003-04 by exporting of vegetable.In course of time more diversification is taking place. This process was further boosted up and export of vegetables reached an all-time high record level of volume 29,100 tons and value of US$46million in 2004-05, thereby registering a growth rate of 84% over the last year. If this positive trend can be maintained through streaming the supply chain and fulfilling the continuously changing market access requirements, vegetables and fruits from Bangladesh are likely to emerge as high export in years to come.

5.10 Export markets outlets

Bangladesh exports vegetables mainly to the UK and Middle East (ME) countries like Saudi Arabia, UAE, Kuwait, Qatar, Bahrain and Oman. Ethnic markets of these ME countries consume more than 93% of vegetables exported from Bangladesh. Over the years there has not been any structural change in the export pattern of vegetables. These seven markets used to play the important role as of today, always lifting more than 90% of the total vegetables from Bangladesh. In terms of ranking, however, there had been occasional changes among the ME countries, Saudi Arabia (20.36%) and Kuwait(8.89%) always holding the second and third positions respectively and UK the topmost position (38.48%)(Table 6.16)

Table 5.10. Ranking of seven top market outlets of vegetables Export from Bangladesh:

Rank	Country	Value in US$ Million	Share % of total Export
1st	UK	9.50	38.48
2nd	Saudi Arabia	5.03	20.36
3rd	Kuwait	2.20	8.89
4th	UAE	2.18	8.83
5th	Qatar	2.09	8.33
6th	Bahrain	1.57	6.34
7th	Oman	0.64	2.57
	Sub total	23.21	93.80
	Others(18)	1.49	6.20
	Total	24.70	100

Source: Export Promotion Bureau.

Table: 5.11. Ten major export items of vegetables and fruits exported to the United Kingdom (UK)

Ranking	Name of Crop	Volume '000' kg	Value %
1	Green Chili	67,150	16.5%
2	Jack Fruit	54,340	13.4%
3	Lemon	36.020	8.9%
4	Stolon of Taro	27,020	6.7%
5	Taro Tuber	26,540	6.5%
6	Egg plant	24,800	6.1%
7	Snake Gourd	21,700	5.3%
8	Yard Long Beans	18,550	4.6%
9	Bottle Gourd	18,000	4.4%
10	Green Papaya	15,280	3.8%
11	Others	96,770	23.8%
Total	406,170		

Table 5.12 Ten Major export items of vegetables and fruits exported to the Middle East.

Ranking	Name of Crop	Volume	
		'000' Kg	%
01	Bitter Gourd	2,086	16.6%
02	Yard Long Beans	1,827	14.5%
03	Green Chilli	1,135	9.0%
04	Potato	1084	8.6%
05	Snake Gourd	795	6.3%
06	Stolon of Taro	658	5.2%
07	Pointed Gourd	600	4.8%
08	White/Wax	505	4%
09	Gourd	438	3.5%
10	Green Papaya	418	3.3%
11	Others	3048	24.2%
12	Total	12,597	100%

According to the study among 10 major crops dominate in export to the UK and ME countries. All types of vegetables are exported out, the top ten of which are green chili, jackfruit, lemon, stolon of taro, taro tuber, okra, snake gourd, yard long beans, bottle gourd and green papaya for the UK market and bitter gourd, yard long beans, green chili, potato, snake gourd, stolon of taro, pointed gourd, white/wax gourd, teasel gourd and green papaya for the Middle East market.

5.11 Bangladesh air export market

The market of international air cargo is fast expanding industry in Bangladesh. In Bangladesh there is an outgoing cargo volume of average 400 metric tons per day and approximate 250 metric tons of incoming cargo per day. There are 26 online carriers operating into Dhaka and 4 online carriers operating into Chittagong (Table 5.14).

- ✓ Biman Bangladesh Airlines
- ✓ Qatar Airways
- ✓ Saudi Arabian Airlines
- ✓ Emirate Airlines

- ✓ Turkish Airlines
- ✓ Etihad Airways
- ✓ Cathay Pacific
- ✓ Singapore Airlines
- ✓ Malaysia Airlines
- ✓ Kuwait Airway
- ✓ Pakistan Int'l Airlines
- ✓ Gulf Air
- ✓ Jet Airways
- ✓ Thai Airways
- ✓ China Eastern Airlines
- ✓ Srilankan Airlines
- ✓ Few others online also

5.12: Air freight seasons in Bangladesh

High Season:	June, July, August, September
Shoulder Season:	March, April, May, October, December
Low Season:	November, January, February

5.13 Air export process

Documentation fore Export:

Which the goods are being sent, these documents will include some or all of the following: consular invoice, commercial invoice, certificate of origin, bill of lading, packing list, health certificate, import license, and insurance certificate. In general, their purpose is to provide the foreign Customs authority with a complete, detailed description of the goods so that the correct import duty can be levied.

Sometimes they are required for the administration of exchange control regulations or import quotas and depending on the product, to safeguard public and animal health and prevent the spread of plant diseases. Statistical information about a country's imports is also based on these documents. Failure to complete the forms properly may lead to a fine and/or unnecessary delay in clearing the goods through foreign Customs. If the information given is found false, heavier fines may be imposed and/or the goods confiscated.

The preparation of such documentation is one of the tasks of an export firm's or of a shipping agent, known as a freight forwarder, whose services may be employed for a fee. In addition to the documents required by the foreign country, the exporter must also provide an export declaration.

Other countries require that a mark of origin be placed on imported goods, if its absence would create a false impression about the origin of such goods. This can occur if the goods show the place of manufacture with the same name as that of place from the importing country (e.g., Toronto, Japan, compared with Toronto, Canada). Or when the label contains only the name of the importer or import agent, rather than that of the foreign manufacturer.

Marking methods

Each country has regulations governing the manner in which imported goods should be marked, including the size of the letters. Some countries require, in addition to the name of the country of origin, the words ″**Made in**″ or″ **Produced in**″.

Sometimes, the language of the importing country must be used. As well as being legible and conspicuous, the mark should be non-erasable.

Labeling for export

The exporter must also comply with any labeling requirements for its product in the importing country. These often exist for prepared goods, beverages, and pharmaceutical and toilet preparations. Usually, the label must show the manufacturer's name and address, a list of the ingredients, the weight or volume of the contents, and other relevant information.

Cargo delivery to the Dockside / Airport :

One way is to use the service of a freight forwarder for the sea freight or air freight. The shipping or Airlines company's representative checks the number of items, their condition, shipping marks, number of carton, weight and volume, and perhaps size, and then issues a *"***dock receipt***"* *or "****House air waybill"***. The exporter keeps this dock receipt or *House air waybill* until the goods are loaded aboard the ship or Aircraft. After this has been done, the shipping company or Airlines issue an ***ocean bill of lading*** or **Air waybill** on the base ofsea freight or air freight.

5.14 Infrastructures of Air Export

Export Getaway:

- **Main Export Getaway: Hazrat Shahjalal Int'l Airport (DAC) Location: Dhaka** 21 km/13 Miles N of the City including Cargo Complex.
- **Others Getaway :** Chittagong - Shah Amanat Intl (CGP, Sylhet - Osmany/ Osmani Intl (ZYL)

Airlines in Bangladesh:

- **Online carrier**: There are 26 online carriers operating to/from Bangladesh including national carrier Biman Bangladesh Airlines.

- **Offline Carrier** : There are several offline airlines carrying cargo by utilizing online carrier as a first carrier from Bangladesh,offline carriers are American Airlines, Air Canada, Air France, Continental Airlines, Delta Airlines, KLM, Swiss Air, United Airways, etc.

- **Cargo Aircraft, freighter:**

An aircraft, which is either newly constructed, or permanently or temporarily converted from passenger service, which is dedicated to carrying cargo with no passenger complement. During peak season few schedule carrier like Saudi Arabian Airlines, Qatar Airways, Emirate Airlines, Turkish Airlines, Etihad Airways, Cathay Pacific, Singapore Airlines, Air France, etc are operating freighter to and from Dhaka.

Some Bangladeshi freighter company like Bastille Airways, Z-Airways, Best Aviation and few forwards also operate their own charter freighter using the license of one of this local freighter company, Who gives facilities them in getting necessary permission from **Civil Aviation Authority of Bangladesh**.(CAAB) and Ground handling authority of Bangladesh Biman as well as Hazrat Shahjalal International Airport offices.

Cargo agents and forwarders:

- IATA Agent: Being officially appointed IATA Agent by the IATA, the freight forwarder is in a position to receive air consignments and dispatch air shipments with any air carrier, to issue air waybills and to collect charges as shown on the AWB. **There are 27 IATA**

- None IATA Agent : and 700 Non- IATA Cargo agents and forwarders operating cargo business under membership of **BAFFA "**Bangladesh Freight Forwarders Association"

- Regular active Cargo agent in market 360

5.15 Marketshare by Carrier:

Airline Market Share (Carrying %) **in Bangladesh**

Table: 5.13 Market Share in careerwise

Airlines Name	Market Share %
Biman Bangladesh Airlines	15%
Saudi Arabian Airlines	12%
Qatar Airways	11%
Emirate Airlines	10%
Turkish Airlines	4%
Etihad Airways	6%
Cathay Pacific	8%
Singapore Airlines	6%
Malaysia Airlines	4%
Kuwait Airway	4%
Pakistan Int'l Airlines	2%
Gulf Air	2%
Jet Airways	3%
Thai Airways	3%
China Eastern Airlines	2%
Srilankan Airlines	1%
Others & Off Line Carriers	7%

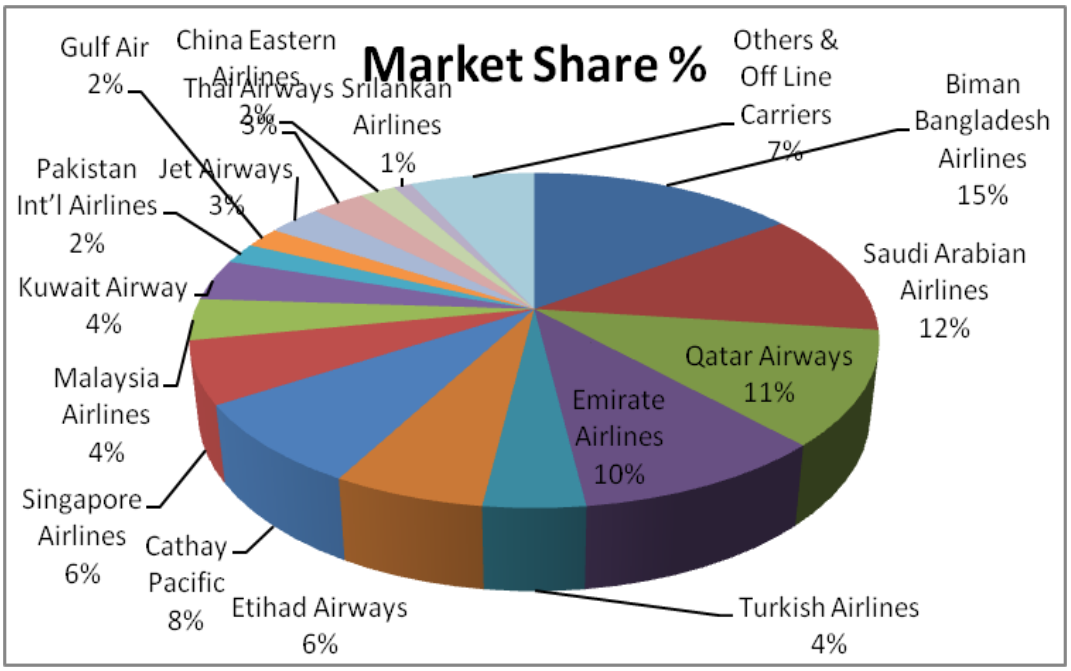


Fig: 5.3: Market share by air career through Pie graph chart.

5.16 Major export destination from Dhaka:

Europe: London, Manchester, Frankfurt, Munich, Paris, Amsterdam,Brussels, Hamburg, cologne, lille, rome, Milan, Zurich etc.

USA/ Canada: New York, Leangles, Miami, Atlanta, Boston, Dallas, Chicago, Montreal, Toronto etc

Africa: Cairo, Casablanca, Khartoum, etc

Indian Subcontinent: Delhi, Kochi, Colombo, Maldives, Kath undo, yungon,etc

South East-Asia: Bangkok, Singapore, Kuala Lumpur, SEL, Osaka, JKT etc.

Middle East: Dubai Doha, Beirut, Damascus, amman, Tehran, Kuwait, Bahrain, Abudhabi, Dammam, Riyadh, Jeddah, sanaa, Muscat, mashad.

5.17 Export commodity from Bangladesh:

- Our main export commodity is **garments (RMG)** which contributes over 73% of the total national export earnings. Other export items are **frozen fish, fresh fruits & vegetables, pharmaceutical products, jute goods, leather and leather products, tea etc.**

Cargo density: From Bangladesh major export products are RMG, Leather & Leather Goods, Vegetable & Fruits, Medicine & Handicrafts, etc. Among these goods vegetable & fruits position is second.

Table: 5.14 Usualy cargo space compare to other Goods with fruits and vegetable carry for export.

A.	RMG:	1 CBM = 200Kgs (Jeans Item)
		1 CBM = 180Kgs (Shirts, T-shirts, & Trousers Item)
		1 CBM = 125Kgs (Sweater & Others Woolen Items)
B.	Leather & Leather Goods:	1 CBM = 265Kgs
C.	Perishables (Veg. & Fruits):	1 CBM = 300Kgs
D.	Others (Medicine, Handicrafts, etc)	1 CBM = 175Kg

***Volume / Weight ratio**: 1 cbm = 167 kgs. As per method.

CHAPTER 6
CONCLUSION

Vegetables and fruits are being an important component of agricultural production of Bangladesh in terms of area, production, value addition to GDP and export earnings. There was an increasing trend of area, production and value addition to GDP for different types of winter and summer vegetables in Bangladesh. Aggregate data on winter and summer vegetables also showed that there was an increasing trend of area and value addition to total cropped area and agricultural value addition.

The limited availability and use of reliable planting materials and hybrid seed are a major challenge for fruits and vegetable production which resulted in very low productivity. Poor access to high quality seed and planting materials are continuing bottleneck the percentage of vegetable and potato seed supplied from "Formal" or professional sources. The use of substandard seed reduces the yield and quality of produce and ultimately reduces farmers profits. Only about 50 percent of vegetable seed is obtained from formal sources.

The research focused on improving the yields and adaptability of horticultural crops, as well as on preventing postharvest losses and reductions in quality. If horticulture is to be developed to its potential, Bangladesh requires a research system that can address the full range of constraints and opportunities that horticulture represents for the national agricultural economy.

Despite steady growth in domestic demand, there are numerous factors which have constrained the growth in production volumes. Product losses occur across the entire supply chain. Farmers are handicapped by inadequate knowledge of efficient harvest

and storage practices. Market information is frequently unavailable, and harvest timing is asynchronous with market requirements. Overland transportation is frequently slow, and invariably unrefrigerated. Road conditions are often difficult, and slow transits are rendered even slower by numerous stops for the negotiation and collection of informal tolls. Wholesale markets are poorly equipped to hold and store product beyond the day of receipt. Detailed studies by the Bangladesh Agricultural Research Institute in 2006 indicated that post harvest losses ranged from a low of 14 percent, in the case of chilies, to a high of 37 percent in the case of tomatoes.

Assembly and wholesale markets typically play vital roles by preserving the quality of primary products, facilitating smooth transactions, packaging and pre shipment treatment and shipping to destinations inside and outside the country. Yet the highly congested urban markets of Bangladesh are generally old, dirty and lack of basic support facilities as godowns, cold or cool storage, potable water, drainage, and access for vehicles to load and unload produce. Inadequate post harvest technology and poor market infrastructure enhances to high losses of fruits and vegetables while transported from farm to market.

Evidence suggests that the low level of consumption of horticulture products is in the value chain that are driving up the retail prices of these fruits and vegetables by 83% and 63% of farm prices respectively. Among the main obstacles for better performance are food losses, market distortions through intermediaries and the absence of modern market infrastructure.

Studies found out that about one third of fruits and vegetables are lost during transport from producers to consumers, which is affecting negatively on prices. Another reason

for higher prices at the retail level are profits earned by middlemen, who play an important role in Bangladesh in bringing fruits and vegetables from producers to markets. Finally, prices increase due to the absence of modern storage and transportation facilities such as cold stores and refrigerated vans. As a result, retailers of fruits and vegetables gain a larger profit margins than in the case of cereals.

Prices also surge because growers cannot sell their product directly to local buyers due to informal agreements between local commission agents and buyers. What is more, local buyers frequently delay their purchase orders in order to force the farmers to sell their products at a lower price. As a result, growers on average receive only 71% and 48% of retail prices for fruits and vegetables respectively compared to 79% in the case of rice.

Without proper marketing infrastructure, horticulture products are also subject to sharp seasonal price variation. For example, prices of brinjals and bananas fluctuated by 35 % and 26% throughout the year, compared to only 3 percent in the case of rice. This high price variability has two main effects. Firstly it lowers the consumption of horticultural products in the off-season when prices tend to be high. Conversely, it discourages producers to grow horticulture products because of the lower prices during harvest.

Several measures could be adopted for improving the value chain of fruits and vegetables. In order to encourage small and medium scale farmers to grow fruits and vegetables, the government and non-governmental organisations could promote the formation of marketing groups and cooperatives through different projects. These will strengthen the bargaining power of growers and help them to achieve better prices for

their produce. Cooperatives would also improve market access as farmers could send their products jointly to distant markets.

Contract farming constitutes another option to increase market access of small and medium scale farmers. By facilitating the development of supermarkets and other large-scale retail centres that could have direct agreements with local producers, small farmers could be better integrated into the value chain while the influence of market intermediaries would be effectively reduced.

Another necessary improvement needs to tackle food losses and deterioration during transport. Strengthening the packaging sector and introducing cold transport facilities constitute essential steps in order to reduce the loss of perishable goods. For the same reason, modern post-harvest technologies like low temperature storage facilities need to be promoted, while improved marketing facilities such as forklifts for loading and unloading, and weighing machine would further reduce the losses.

In order to address the seasonal price variation of fruits and vegetables, new varieties would need to be developed by research institutes like BARI and BINA so that they can be harvested in the off/slack seasons. In addition, improved market information systems, including public displays of current price levels of agricultural commodities, would increase market transparency and reduce the mismatch between producer decisions and consumer demand.

Vegetable export also increased over the period though the agricultural export declines. Research and extension program may be one cause of increasing vegetable production in the latter period. The other cause may be export promotion activities by the government. Among the factors affecting production of vegetables policy variable

showed statistically significant role for most of the vegetables production. If government takes some necessary measures to activate buy-back mechanism and ensures quality of these products then Bangladesh may take the significant share of $2000 billion vegetable export market. Policy reform in terms, of research and extension program, export promotion in terms of attracting foreign investment through buy back mechanism may accelerate vegetable production in a further extent.

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APPENDIX

Name of the Agents exporting Vegetables to abroad

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Proprietor
M/S Alam Overseas
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Tel: +88-02-9343996; 8117587
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Proprietor
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56/57 Motijheel, Sharif Mansion (6 th floor)
Dhaka 1000
Tel: +88-02-7162674
Mob.: 8801819239544

Md. Masood Ur Rahman
Proprietor
M/S Shoranika Enterprise
144. DIT Ex. Road , Fakirapool, Dhaka
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Fax: +88-02-8316294
Mob.: 8801711536127

Abdul Hamid
Proprietor
M/S Muhit International
6-D, VIP Tower , 51/1 VIP Road
Nayapaltan, Dhaka
Tel: +88-02-8318514;
Mob.: 8801819258309

Monjoor Hasan Poltu
Proprietor
M/S Monjoor trading International 25/ A Dilo Road , Mogbazar, Dhaka
Tel: +88-02-9341711
Mob.: 880171154447

Md. Delower Hossain
Proprietor
M/S Eva Enterprise
11/12 pratapdas Lane, Sutrapur, Dhaka
Tel: +88-02-7117042
Mob.: 8801711524697

Mr. Abdur Rashid
Proprietor
M/S F.S International
Tel: +88-02-9011939
Mob.: 8801716107639

Mr. Iqtadul Hoque
Proprietor
M/S Ahmed & Company
Capasia Gazipur
Mob.: 8801819404957

Md. Jamal Uddin Ahmed
Proprietor
M/S Sonargoan International
28/1/C, Toyenbi Circular Road
Motijheel (3 rd floor), Dhaka
Tel: +88-02-7162654; 9564267
Mob.: 8801711739857

Moinul Islam
Proprietor
M/S Moinul Islam & Company
Mob.: 8801715086325

Md. Abdul Barek
Proprietor
M/S Barkot Traders
139 Sadharon Bima Bhabon (Ground Floor)
Motijheel, Dhaka
Tel: +88-02-9571759
Mob.: 8801711855270

Md. Omar Faroq
Proprietor
M/S Aline Foods
56/57, Motijheel, Sharif Mansion (6 th floor)
Dhaka 1000

Zahid Hasan Jinnah
Proprietor
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28/1/C Toyenbee Circular Road (3 rd Floor)
Motijheel, Dhaka
Tel: +88-02-7162654
Fax: 88-02-7161985
Mob.: 8801819189980

Haji Md. Kabir
Proprietor
M/S Oliva International
Asulia, Savar

Md. Sahabuddin
Proprietor
M/S Green Trade House
21, Santinagor, Dhaka
Tel: +88-02-8317169
Fax.: 88-02-8315280

Md. Jewel Khan
Proprietor
M/S Romal Enterprise
139, Shadharon Bima Bhabon (Ground Floor) Motijheel Dhaka
Tel: +88-02-9571759

Md. Tazul Islam
Proprietor
M/S Katha Enterprise
102, K.B Road
Gandaria, Dhaka
Mob.: 8801715007460

Md. Tanvir Ahmed
Proprietor
M/S Five Star Syndicate
153, Khilgoan Dhaka
Mob.: 8801713043082

Md. Abdus Satter
Proprietor
M/S Simky Trade International
14, Purana Polton, Dhaka
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Proprietor
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Md. Golam Sarif Chowdhury
Proprietor
M/S Pranto Traders
56/57, Motijheel, Sharif Mansion (6 th Floor)
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Mr. Liton Debnath
Proprietor
M/S A.H Trade International
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Proprietor
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Axowara Bhaban, House # 13, Matuail Uttar Para
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Mr. Paritos Chandra Das Manik
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M/S Dip International
89, Motijheel (1 st floor), Room# 206, Dhaka
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Md. Mahabul Alam
Proprietor
M/S Mim Syndicate
6/1, Madon Mohon Saha Lane
Sutrapur, Dhaka
Mob.: 8801718384552

Md. Fazlul Amin
Proprietor
M/S Karnafully Enterprise
16, Mawla Box Sardar Road , Dhaka
Mob.: 8801819148375
Mrs. Sahim Monsur
Proprietor
M/S R.R Trade Syndicate
31, Hatkhola Road , Dhaka
Tel: +88-02-7120871, Fax: 88-02-7117473

Md. Harun-or-Rashid
Proprietor
M/S Al Harun Enterprise
168/1 North Sajahanpur , Dhaka-1217
Tel: +88-02- 8359116
Mob.: 8801713004296
Md. Mostafizur Rahman (Khokon)
Proprietor
M/S Sadman International
144, DIT Ex. Road , Fakirapool, Dhaka
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Mob.: 8801715032100
Mr. Gobinda Chandra Saha
Proprietor
M/S Rajdhani Enterprise
11, Farashgonj Sutrapur, Dhaka
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Fax; 88-02-7116654
Mob.: 8801715005134
Mob.: 8801711533764
Abdul Gaffer Sahed
Proprietor
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Dagair Naton Para , Basher Pool
Demra, Dhaka
Tel: +88-02-7401043
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Mr. Uttam Saha
Proprietor
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Md. Salim
Proprietor
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Mob.: 8801819254264
Md. Nazim Uddin
Proprietor
M/S N N Agro Trade
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Shek Zakir Hossain
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List of Exported Horticultural Crops from Bangladesh

Serial Number	Crops		Availability	
	Local name	English & Botanical /Scientific name	From	To
Vegetables				
1.	Karala	Bitter gourd ***Momordica charantia***	Throughout the year	
2.	Uchchay	Small bitter gourd ***Momordica charantia***	March - May	
3.	Jali kumra/Chal kumra	Ash/Wax gourd ***Benincasa hispida***	Throughout the year (Peak time: April-October)	
4.	Kohi/Chichinga	Snake gourd ***Trichosanthes anguina***	Throughout the year (Peak time: April – October)	
5.	Kadhu/Lao/Dudi	Bottle gourd ***Lagenaria siceraria***	Throughout the year (Peak time: November-April)	
6.	Kakrol	Teasle gourd/Kantola ***Momordica dioica***	April - October	
7.	Misti Kumra	Pumpkin (green) ***Cucurbita moschata***	Throughout the year	
8.	Purol/Dundul	Sponge gourd ***Luffa cylindrica***	Throughout the year (Peak time: March – October)	
9.	Patol	Pointed gourd/ Tinduri/Palwal ***Trichossanthes dioica***	Throughout the year (Peak time: April – November)	
10.	Shosha	Cucumber ***Cucumis sativus***	February	
11.	Paka Chal Kumra	Matured Wax gourd ***Benincasa hispada***	Throughout the year	
12.	Jinga/Tury	Ridged/Ribbed gourd ***Luffa acutangula***	Throughout the year (Peak time: March – October)	
13.	Khira	Small Cucumber ***Cucumis sativas***	October	
14.	Begun	Brinjal/Egg plant/Aubergine ***Solanum melongena***	Throughout the year	
15.	Lubiya/Barbati	Yard Long bean ***Vigna sesquipedalis***	Throughout the year (Peak time: June-December)	
16.	Deshi Seem	Hyacinth bean ***Lablab niger***	October -December	

17.	Deshi Seem Bichi	Hyacinth bean seed ***Lablab niger***	November
18.	French bean	French bean ***Phaseolus vulgaris***	Mid-November to March
19.	Motor Shuti	Pea seed ***Pisum sativum***	January-March
20.	Lota/ Kachur Lati	Stolon of Taro ***Colocasia esculenta***	Throughout the year (Peak time: July – October)
21.	Mukhi Kachu (cv. Bilashi)	Eddo ***Colocasia esculenta***	Throughout the year (Peak time: June – November)
22.	Pani kachu	Taro ***Colocasia esculenta***	Throughout the year
23.	Dudhkachu	Coco Yam ***Xanthosoma violaceum***	Throughout the year
24.	Moulavi kachu	Yautia ***Xanthosoma atrovirens***	Throughout the year
25.	Mankachu	Giant Taro ***Alocasia macrorrhiza***	Throughout the year
26.	Kachu	Aroid ***Typhonicum trilobatum***	Throughout the year
27.	Olkachu	Elephant foot Yam ***Amorphophallus campanulatus***	June -September
28.	Kachu Pata	Leaves of Aroid ***Colocasia esculenta***	Throughout the year
29.	Kachur Doga	Stem of Aroid ***Colocasia esculenta***	Throughout the year
30.	Gool Alu	Potatoes ***Solanum tuberosum***	Throughout the year (Supply availability for export March - October)
31.	Misti Alu	Sweet Potato ***Ipomoea batatas***	March-May
32.	Mattya Alu	White Yam ***Dioscorea alata***	Throughout the year
33.	Pesta Alu	Air Potatoes ***Dioscorea bulbifera***	April
34.	Misti Alu	Sweet Potatoes ***Ipomoea batatas***	March
35.	Data	Stem Amaranth ***Amaranthus lividus***	Throughout the year
36.	Marich	Green Hot Chili ***Capsicum frutescens***	Throughout the year
37.	Naga Marich	Naga Hot Chill ***Capsicum chinense***	Throughout the year
38.	Capsicum	Capsicum ***Capsicum annuum***	January – March

39.	Derosh	Okra ***Abelmoschus esculentus***	Throughout the year
40.	Kacha Papay	Green Papaya ***Carica papaya***	Throughout the year
41.	Shajna	Drumstick ***Moringa oleifera***	April-June
42.	Kathaler Bichi	Jackfruit seed ***Artocarpus heterophyllus***	April-September
43.	Kacha Kola	Plantain ***Musa paradisiaca***	Throughout the year
44.	Kolar Thor/Mocha	Banana Flower ***Musa paradisiaca***	Throughout the year
45.	Kolar Anaj	Steam of Banana ***Musa paradisiaca***	Throughout the year
46.	Broccoli/ Sabuj Phulcopy	Broccoli ***Brassica oleracea var. botrytis; sub var. cymosa***	December-March
47.	Shabuj Pui shak	Indian Spinach (green) ***Basella alba***	Throughout the year
48.	Lal Pui shak	Indian Spinach (Pink) ***Basella rubra***	Throughout the year
49.	Sharisa shak	Mustard green ***Brassica campestris***	Throughout the year
50.	Data shak	Steam Amaranth leaf ***Amaranthus lividus***	Throughout the year
51.	Lal shak	Red Amaranth ***Amaranthus gangeticus***	Throughout the year
52.	Piaj pata	Onion Leaf ***Allium cepa***	December-March
53.	Shapla	Water Lily ***Nymphaea stellata***	June-August
54.	Palong shak	Spinach ***Spinacia oleracea***	Mid November – Mid March
55.	Gimakalmi shak	Kangkong ***Ipomoea reptans***	Throughout the year
56.	Misti alu pata	Sweet Potato Leaf ***Ipomoea batatas***	Throughout the year
57.	Lao shak	Bottle gourd leaf ***Lagenaria siceraria***	Throughout the year
58.	Patpata	Jute leaf ***Corchorus capsularies***	March – July
59.	Coriander leaf	Coriander leaf ***Coriandrum sativum***	Throughout the year

60.	Thankuni pata	Thankuni ***Centella asiatica***	Throughout the year
61.	Deki shak	Fern ***Dryopteris filix-mas***	Throughout the year
62.	Rajat Pata	Rajat Pata	Throughout the year
63.	Baby corn	Baby corn ***Zea mays var. saccharata***	Throughout year
64.	Brussels sprout	Brussels Sprout *Brassica oleracea var. gemmifore*	December -March
65.	Bean sprout (Mung bean)	Bean Sprout	Throughout the year
66.	Squash	Squash	December - March
67.	Mula	Radish ***Raphanus sativus***	October-March
68.	Gajor	Carrot ***Daucus carota var. sativa***	November-March
69.	Ada Lebu	Ada Lebu ***Citrus limon***	Throughout the year
70.	Jara Lebu	Jara Lebu ***Citrus limon***	Throughout the year
71.	Elachi Lebu	Lemon ***Citrus limon***	Throughout the year (Peak time: May – October)
72.	Satkora	Satkora ***Citrus macroptera***	Throughout the year (Peak time: April – October)
73.	Kagozi Lebu	Lime ***Citrus aurantifollia***	Throughout the year (Peak time: April-November)
74.	Toikor	Toikor ***Garcinia pedunculata***	November – December
75.	Batabi Lebu	Pummelo ***Citrus grandis***	Mid-August - Mid-October
76.	Kathal	Jackfruit (Matured) ***Artocarpus heterophyllus***	May- July
77.	Kacha Kathal/Echar	Jackfruit (Immature) ***Artocarpus integrifolia***	Mid-March –Mid May
78.	Deshi Amra	Hog plum ***Spondias pinnata***	May - October
79.	Belati Amra	Golden Apple ***Spondias guajava***	July - October
80.	Peyara	Guava (summer) Guava (Winter) ***Psidium guajava***	July -September February-March

81.	Kalo Jam	Jamon ***Syzygium cuminii***	Mid-May – Mid-July
82.	Zamrul	Wax apple ***Eugenia javanica***	June-July
83.	Bel	Wood Apple ***Aegle marmelos***	April-June
84.	Litchu	Litchi ***Litchi chinensis***	Mid-June - July
85.	Kothbel	Elephant foot apple ***Feronia limonia***	September- December
86.	Lotkon	Lotkon ***Baccaurea sapida***	June - July
87.	Kamranga	Carambola ***Avverrhoa carambola***	November -July
88.	Anarosh	Pineapple ***Ananas comosus***	Throughout the year, ***for Baby Pine Apple (Peak Season: May – July)***
89.	Kul/Boroi	Ber/Jujube ***Zizypus mauritiana***	December - March
90.	Jalpai	Indian Olive ***Elaeocarpus floribundus***	August – December
91.	Teatul	Tamarind ***Tamarindus indica***	January - March
92.	Karamcha	Karanda ***Carissa caranda***	Mid-August – Mid October
93.	Chalta	Indian dellenia ***Dellenia indica***	August - December
94.	Sharifa	Custard apple ***Annona squamosa***	August -October
95.	Kaupha	Mangosteen/Cowa ***Garcinia cowa***	June - July
96.	Amloki	Aonla ***Emblica officinalis***	August-September
97.	Daophal	Daophal ***Cearcinia xanthochymus***	Mid July- Mid September
98.	Aam	Mango ***Mangifera indica***	May-July
99.	Kacha Aam	Green Mango ***Mangifera indica***	April- May
100.	Champa kola	Apple Banana ***Musa sapientum***	Throughout the year
101.	Narikel	Coconut ***Cocos nucifera***	Throughout the year
102.	Pan	Betel Leaf ***Piper betel***	Throughout the year

103.	Supari	Betel Nut (Kacha) ***Areca catechu***	Throughout the year

Airlines at Shahjalal International Airport Dhaka with logo and brand

Name	Logo	
Bangladesh Airlines	Biman BANGLADESH AIRLINES	BG
Emirates	Emirates	EK
Saudi Arabian Airlines	الخطوط الجوية العربية السعودية SAUDI ARABIAN AIRLINES	SV
Kuwait Airways	KUWAIT AIRWAYS الخطوط الجوية الكويتية	KU
Malaysian Airlines	malaysia AIRLINES	MH
Gulf Airlines	طيران الخليج Gulf Air	GF
Qatar Airways	QATAR AIRWAYS القطرية	QR
Thai Airways	THAI	TG
Singapore Airlines	SINGAPORE AIRLINES	SQ
Srilankan Airlines	SriLankan Airlines	

Airlines with their branding logo

Name	Logo	Code
Turkish Airlines	TURKISH AIRLINES TÜRK HAVA YOLLARI	TK
China Eastern	中國東方航空 CHINA EASTERN	MU
	Lufthansa	
Kingfisher Airlines	KINGFISHER AIRLINES	IT
United Airways	United AIRWAYS ইউনাইটেড এয়ারওয়েজ ... Fly your own Airline	4H
Jet Airways	JET AIRWAYS	
Cathay pacific	CATHAY PACIFIC	
China Southern	CHINA SOUTHERN	CZ

Cargo Aircraft activities at Airport

Photograph : Major online Airlines in Bangladesh:

- Cargo / shipments loading into the Aircraft. **Biman Cargo Village (**Main Air export gateway in Bangladesh)

All Airlines using the cargo holds of its passenger aircraft and freighter to ship freight to international destinations.It has established Cargo Village at Hazrat Shahjalal International Airport where the cargo is labeling, weighing, handover to airlines, scanning before being loaded onto its aircraft.

Photograph: Cargo Village in Shah Jalal International Airport, Dhaka.

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