

**VALUE CHAIN ANALYSIS OF SAGAR AND SABRI BANANA IN
NARSINGDI DISTRICT OF BANGLADESH**

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**VALUE CHAIN ANALYSIS OF SAGAR AND SABRI BANANA IN NARSINGDI
DISTRICT OF BANGLADESH**

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CERTIFICATE

This is to certify that the thesis entitled “**Value Chain Analysis of Sagar and Sabri Banana in Narsingdi District of Bangladesh**” submitted to the Department of Agribusiness & Marketing, Faculty of Agribusiness Management, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE IN AGRIBUSINESS & MARKETING**, embodies the result of a piece of bona fide research work carried out by **MD. Mohiuddin**, Registration No. **10-04192** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

Dated: December, 2018

Dhaka, Bangladesh

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**Dedicated
to My
Beloved Parents**

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The Author

ABSTRACT

The present study was designed to measure the value chain analysis of Sabri Banana and Sagar Banana in Narsingdi District of Bangladesh. Primary data were collected from the Banana growing area of Shilmandi and Sadar under Narsingdi district. Thirty farmers of Sagar banana, thirty farmers of sabri banana and thirty traders of both sagar and sabri banana were selected through convenience sampling procedure. Simple descriptive methods were used to analyze the data. Among many cultivars, Sabri and Sagar had been selected for this research work. The major findings of the study revealed that Banana production was profitable. In the production and marketing system of banana, many value chain actors were involved such as Bepari, Arathdar, and retailer. Demographic characteristics of banana farmers were categorized into age, education, farming experience, farm size and family size. In this study sabri banana farmer average age was 39.5 and Sagar banana farmers average age was 41.3 years. Farming experience of sabri Banana farmers was 17.2 and Sagar banana farmer farming experience was 20.93. Farmers of sabri banana sold per dozen TK.59.4 and farmers of Sagar banana sold per dozen TK.54.3. In this study, Cob Douglas Production Function was analyzed to see the effect of different input variables like fertilizer, sucker, laboretc on the production of banana .Farmers total cost of production for sabri banana was TK.241267.8 for per hectare of land. Return from sabri banana was TK. 686408.6.Farmers total cost of production of sagar banana was TK. 239704.7.Return from sagar banana was TK. 532167.2.Total cost for per 6426 dozen sabri banana marketing for arotddar was TK.4650.Arotdder of sabri banana revenue per dozen was TK7.7.Different intermediary got profit from banana business but they have some problems too. Lack of different input ,labor cost,lack of training facility, transportation facility and cost etc was some of the main problems. So the producer and marketers gave some suggestions to overcome those problems. Such as good quality sakar, reduced cost of fertilizer, reduced and good transportation facility, availability of market information , storage facility etc.

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ABBREVIATIONS

BCR	Benefit-Cost Ratio
BBS	Bangladesh Bureau of Statistics
FC	Fixed Cost
GR	Gross Return
HA	Hector
%	Percentage
Tk	Taka
DAE	Department of Agriculture Extension

Chapter 1

Introduction

Bangladesh is an agricultural country and most of the inhabitants are involved in agriculture directly or indirectly for their livelihood. The country possesses very fertile land in which diversified crops grow very easily. Banana is one of the top listed fruit crops, which is available throughout the year and consumption rate is higher than any other fruits. It has great economic importance as well as nutritional value. Banana is a very popular fruit due to its low price and is used both as vegetable and as a dessert fruit. It is a rich source of carbohydrate and having plenty of vitamins particularly vitamin B. It is also a good source of potassium, phosphorus, calcium and magnesium (Hossain, 2014). Ripe banana mixed with rice and milk is the traditional dish for the Bangladeshis.

Banana (*Musa paradisiaca*, family Musaceae) is a central fruit of the tropical and subtropical regions of the world grown on about 8.8 million hectares (Mohapatra et al., 2010). It is possibly the world's oldest cultivated plants (Kumar et al., 2012). Bangladesh produces nearly 1.00 million tonnes of bananas annually (Hossain, 2014). It is also a nutritious fruit in the world and grown in many tropical areas where they are used both as a staple food and dietary supplements (Assani et al., 2001). The total per capita consumption of banana in Bangladesh is about 4.7 kg per year. This is very much lower than that consumed by Europe especially Belgium (26.7 kg), Sweden (16.7 kg) and Germany (14.5 kg) while USA consumed 13.1 kg and UK at 10.5 kg (SitiHawa, 1998).

Banana is mainly cultivated for its ripen fruits, cooked vegetables and leaves in India and many other countries including Bangladesh (Khanum et al., 2000). It is the second largest produced fruit after citrus, contributing about 16% of the world's total fruit production (FAO, 2009). Banana is highly nutritious (Sharrock and Lustry, 2000) and it is more easily digestible than many other fruits including apple (Mohapatra et al., 2010). Banana is cultivated almost everywhere in Bangladesh round the year. The foremost banana growing areas in Bangladesh are Narsingdi, Gazipur, Tangail, Rangpur, Bogra, Natore, Pabna, Noakhali, Faridpur and Khulna. Also, Sylhet, Moulvibazar, Netrokona,

Rangamati, Khagrachhari and Bandarban are wild grown banana area in Bangladesh. In 2015-2016, the total production of banana in Bangladesh was 798012 metric tons and the cultivated area was about 117159 acres and 2016-2017, the total production of banana in Bangladesh was 807104 metric tons where the cultivated area was 120203 acres (BBS, 2017) . So we found that the production of banana in Bangladesh was increasing and more area was using to cultivate banana .The banana fruit is variable in size, color and taste, but is usually elongated and curved, with soft flesh rich in starch covered with a rind which may be green, yellow, red, purple, or brown when ripe. The fruits grow in clusters hanging from the top of the plant. As a diet, banana is an affluent source of carbohydrate with calorific value of 67 calories per 100 g fruit and is one of the most well-liked and widely traded fruits across the world (Emaga et al., 2008; Kumar et al., 2012). Banana is a rich source of calories, as well as most of the vitamins essential for human nutrition. Bananas are also rich in carbohydrate, potassium and vitamins, including A, C and B6. They are a good source of fat-free dietary fiber. Banana is often the first solid food fed to infant. It is the second largest produced fruit after citrus with a global annual production of about 145.4 million metric tons, of which Asia contributes 69 million tons (FAO,2011).

As people of Bangladesh largely depend on agriculture and about 65% of the total population in Bangladesh live in the rural areas (WB, 2017). There is a lack of food security for all of these people. In this regard, Banana can play an important role. The edible parts are nutritious, easily digestible, rich in carbohydrate and minerals and even rich in calorie value than potato. Banana is also a high source of Potassium and low in Salt which reduce blood pressure and protect against heart attract and stroke. It also has several medicinal uses. Besides, banana can adapt in all farming system even a piece of homestead land of marginal farmers. Banana is also grown in the well-drained high land which is also suitable for growing other important cash crops. In addition, the financial return of the fruit crop is also high (Haque, 1983). There is a high demand for the banana in the domestic market and there is also an export possibility of banana in its bulks to the foreign. One can easily be self-employed and solvent by the cultivation of banana as it grows in large quantity round the year.

Banana, essentially a tropical yield, develops well in a temperature scope of 15°C – 35°C with relative mugginess of 75-85%. It lean towards tropical sticky swamps and is developed from the ocean level to a height of 2000m. abovem.s.l. In Bangladesh, this harvest is being developed in atmosphere running from moist tropical to dry mellow subtropics through choice of suitable assortments. Chilling injury happens at temperature below 12°C. high speed of wind which exceeds 80 km/hr. harms the harvest. Four months of rainstorm (June to September) with a normal 650-750 mm. precipitation are generally significant for enthusiastic vegetative development of banana. At higher elevations, banana development is confined to a couple of assortments like “Hill banana”. Profound, rich loamy soil with pH between 6.5–7.5 is generally favored for banana development. Soil for banana must have good drainage, adequate fertility and moisture. Saline strong, calcareous soils are not appropriate for banana development. A soil which is neither too acidic nor excessively antacid, wealthy in natural material with high nitrogen content, sufficient phosphorus level and a lot of potash is useful for Banana cultivation.(BBS, 2013).

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

Therefore the value chain analysis is essential to know the production and marketing channel clearly which will provide not only the production condition of banana but also can clearly observe the value addition channel . In value chain analysis we also know the input channel and output channel, cost of production, profitability of farmer and also different middleman who took great impact in value chain of banana.

Research Objective

1. To identify socioeconomic characteristic of farmers in the study area
2. To examine the cost and revenue of Sagar and Sabri banana in the study area
3. To identify input output relationship of Sagar and Sabri banana production
4. To examine the marketing cost and margin of different intermediaries
5. To identify the banana production and marketing problems and provide suggestion to improve the situation.

Chapter 2

Review of literature

2.1 Introduction

The main purpose of this chapter is to review the available studies related to present research. In any research review of literature is essential; because it provides a scope for reviewing the stock of knowledge and information relevant to the proposed research. In the business literature of Bangladesh, there is little information on Banana value chain. The studies in Bangladesh and different countries of the world which have relevance to the present study, are reviewed here in brief.

2.2 Study conducted on banana

Branson and Norvel (1983) defined the marketing system in terms of what is otherwise known as supply chain. In broad terms, marketing system may be defined as the totality of product channels, market participants and business activities involved in the physical and economic transfer of goods and services from producers to consumers.

Islam et al. (2001) said marketing system operates through a set of intermediaries performing useful commercial functions in chain formations all the way from the producer to the final consumers.

Rahman and Akbar (1989) conducted a study on Banana marketing in Narsingdi District. They reported that the farmer's share of the consumer's taka spent on bananas varied between 42 to 62%. The intermediaries appropriated a marketing margin of 38 to 56% from marketing cost and profit.

Roy (1996) conducted a study that comparative economic analysis of banana and their crops production in Mymensingh district to determine the cost and return as well as the relative profitability of banana growers. He observed per hectare gross expense of banana

production was taka 65583.13, while per hectare gross return, net return above gross expenses is stood at taka 111191.24 and 12514.11 respectively.

Hoque (1983) conducted a research on some technological aspects for the commercial production of banana during the period from 1981 to 1983 at Bangladesh Agricultural University (BAU), Mymensingh, he reported that the best period of banana plantation was September to November.

Bairagi (1980) conducted a study to determine the profitability of banana production in Jhenaidah District of Bangladesh. He found that per hector costs and returns on banana production were taka 53714.50 and 116674.84 respectively.

Kamal (1996) conducted a survey in some selected areas of Jaypurhat and found that banana production was profitable. Per hectare net returns of banana was taka 67650.10.

Nargis (1997) conducted a study on comparative economic analysis of growing banana and banana with other vegetables in some selected area of Muktagacha Thana. The major findings of the study were that per hectare costs of production of sole banana were taka 121438 and taka 92011, respectively considering full cost and cash cost.

Hoque (1988) conducted a research Bangladesh Agricultural University (BAU), Mymensingh during October 1987 to November, 1988. He examined the economic performance of banana production. He found that per hector cost and net return of banana production were taka 103, 614.88 and 1, 61, 386.12 respectively.

Octavio Damiani (2001) investigated that organic production of banana had great positive impacts on the incomes and quality of life of small farmers in Talamanca.

Mudyazvivi and Maunze (2007) was conducted to evaluate the banana industry in Zimbabwe focusing on postharvest losses along the value chain (VC). Total postharvest losses for 2011-2012 were estimated to be 24-27 per cent of total production with a minimum economic loss of USD 69,983/annum/firm, and a total loss of more than USD 500,000/annum between the VCs analyzed. The bulk of the losses occurred at farm level during handling and transportation. The major factors contributing to banana postharvest

losses were: unreliable transport, poor communication and coordination between producers and processors; lack of or inefficient temperature management and poor sanitation.

Hanumantharaya et al. (2009) conducted a study based on data collected from 80 farmers in 12 villages of two taluks in Tungabhadra and Malaprabha command areas of Karnataka. Results of the study revealed that, in crop-I, per ha production cost of sucker banana was Rs. 82,298 and tissue culture banana was Rs. 1,17,563. The gross returns obtained were Rs. 1,60,113,81 and Rs. 1,97,295.94, respectively. The net returns obtained were Rs. 77,815.81 and Rs. 79,732.94, respectively. In crop-II, production cost of sucker banana was Rs. 55,073 and tissue culture banana was Rs. 57,561.30. The gross returns realised were Rs. 1,70,596.56 and Rs. 1,85,953.07, respectively and the net returns were Rs. 1,15,523.56 and Rs.1,28,391.77, respectively. In sucker banana cultivation, regression coefficient of plant nutrients (0.35) was significant at five per cent and that of plant protection chemicals and bullock labor were non-significant.

Ouma and Jagwe (2010) was investigated that Smallholder farmers in developing countries need to improve their position in food value chains in order to improve their margins and as a strategy for coping with agricultural food price volatility through innovations within the chains. Value chain mappings and gross margin analysis were employed to assess constraints and opportunities for existing value chains for bananas in Central Africa using market survey data. The results showed weak linkages within the banana value chains with poor integration of value chain actors and minimal involvement with regional markets and high-value domestic chains such as supermarkets. Value addition in terms of agro processing was carried out at small scale levels using rudimentary techniques limiting the final product to low value markets. Transaction costs comprising transport, handling and storage comprised a high proportion of cost items in the value chain. Generally, the findings suggest that efforts aimed at strengthening linkages within the value chains, collective marketing, penetration into high-value chains and improved processing techniques may provide a potential avenue for enhancing banana value chains in Central Africa.

Raymon (2003) illustrated that marketing efficiency refers to the efficient allocation of resources to achieve the greatest possible consumer satisfaction. Efficiency of agricultural marketing refers to the efficiency with which resources are used in marketing, in terms of physical input and output ratios. An efficient firm or market produces the maximum possible output from the input used, given location and environmental constraints, and it minimizes resource inputs for any given output.

Rietveld et al., (2013) investigated a study that Beer banana farming systems in central Uganda are important for the livelihoods of smallholder farmers, especially for those that process the bananas into beer and spirits, but also for rural retailers that sell the products. It was an exploratory study focusing on the different actors involved in the beer banana value chain, on its importance for those actors and on the dynamics within the chain. The value chain of banana beer and spirit is short and local, with most of these products being consumed in the locality. Only small amounts of banana beer and spirit from central Uganda find their way to urban centers such as Kampala. The bacterial disease *Xanthomonas* wilt has greatly affected the production of beer bananas, and we report production declines of 65% in two of the study sites. Improved linkages between nonbrewers and brewers and between brewers and markets could assure supply and increase prices, giving an incentive for both brewers and non-brewers to invest more in disease control and in quality production.

Ann & Ajjan (2014) conducted a study and it reveals that two banana value chains (BVC), are illustrated based on research conducted in South India in 2014. BVC1 is the traditional value chain that sources bananas from small farmers for distribution through nearby destination markets in South India. BVC2 - the state-of- art value chain that includes farmers supplying to both major and independent retailers in South India, through a wholesale agencies with some farmer ownership. Farmers in both chains live in relative isolation from the main markets for their bananas. Prices for their bananas depend on the market prices in the city, upon which they have little control. This research paper focuses on how farmers are distanced from key markets; deal with buyers to receive fair prices. In both chains, most cash dealings between farmers and their buyers were completed through a relative/fixed pricing system with little bargaining effort from

the farmers. Because of their relative seclusion, farmers relied on the buyers to offer them fair prices that reflect market movements in the city. Farmers in BVC1 based their trust on traditional ethical values to secure banana supply in the villages. In BVC2, farmers' trust in their intermediary developed over time in their relationships and by making comparisons between the prices farmers received for their bananas and the market information they have.

Alex et al. (2015) investigated that Smallholder banana farmers depend almost entirely on fresh banana for their livelihoods in Uganda. Similarly, other banana value chain (BVC) actors specialize in the trade of the fresh fruit for income and employment. Therefore, improving the efficiency of market access options in Uganda's banana subsector is one way that banana value chain actors can benefit through the sale of their banana products. In order to achieve this, the actors need to be innovative; departing from dependence on the same product and traditional markets/approaches that limit available benefits. This paper is aimed at identifying innovative market access options among the banana value chain actors in Uganda as a basis for projecting the potential. Cross-sectional research design incorporating 240 value chain actors was employed for the study. The major innovative market access options assessed during the study were collective marketing, contract farming, mobile phone platforms, value addition options and supermarkets. The study discovered that innovative market access options such as farmer associations/collective marketing groups, use of mobile phone tools and value addition among banana actors were vital in improving market access but were underutilized. As such, there was need to develop a specific banana value chain development strategic framework in order to tap up innovations among the value chain actors and promote their diffusion across key banana growing districts in Uganda.

Gebre (2016) assesses the sustainability performance of the banana value chain by comparing and discussing 25 attributes owing to different sustainability dimensions. The paper identified critical aspects and provides a qualitative assessment of the sustainability performances of banana chains at the local level. The study found economic, social, and environmental indicators have moderate sustainability performance in the Arba Minch, Ethiopia. The chain had an advantage in terms of profitability, employment, and emission

of air pollutants; and constraints in terms of coordination, value share, profit margins, market diversity, product and market information, transportation, waste management, and safety and hygiene.

Tadesse&Temesgen (2019) was conducted a study and its aimed was to analyze the value chain of banana in Mizan-Aman town, Bench Maji zone with specific objectives of describing important marketing channels and actors involved on banana value chain, dealing the determinant of supply of banana and identify constraints in value chain of the banana. The data were collected from both primary and secondary sources. The primary data for this study were collected through application of appropriate statistical procedures. The data were analyzed by using both descriptive and Econometric models. Accordingly, the value chain activities in the survey period were production, marketing and consumption. To identify factors affecting farm level marketable supply of banana, OLS regression analysis was employed. About 10 variables were hypothesized to affect farm level of marketable supply of banana in the study area. Age of respondent, experience, family size, education level of the household head, market information and distance to the market affects farm level marketable supply of banana positively and negatively. The study result exhibited also that banana producers are faced lack market, lack of cooperatives and low price of banana. The result revealed that banana passes through several intermediaries with little value being added before reaching the end users. Therefore, farmers are forced to capture a lower share of profit margin. The highest marketing cost is incurred by wholesalers and the highest market profit is shared by retailers. The value chain analysis revealed that the major actors in the area are producers, local collectors, wholesalers, retailers and consumers. The study showed that Input Suppliers, Improved infrastructure and strengthening the linkage/interaction among value chain actors is necessary for good marketing of banana

2.3 Concluding comments

The above review shows that a couple of studies have been led on banana production, economic efficiency, technical efficiency, Profitability and numerous different terms. The consequence of these investigations fluctuates generally in various reasons. A large portion of the investigations manage generation and worth chain of Banana. Although

these studies are important from the marketing point of view but the study on supply chain is also of great importance for market participants and policy makers. Results of the study can help to identify the stakeholders of the Banana chain and their role in the marketing system, estimate the value addition of Banana at different stages and examine the post-harvest loss and its impact on farmer's net price. Thinking about the above point of view, the present examination has been attempted. It is normal that the present investigation will fill in as the base for further examinations in this practically undiscovered yet beneficial and potential zone of the business. In addition, it will add to the supply of existing information, particularly in the field of Value chain of Banana and worth option at various levels.

Chapter 3

Materials and Methods

3.1 Location of the study area

In this study primary data were collected from Narsingdi district. A large number of people are engaged in banana production in this district and easy accessibility and good communication facilities were prevailing in this area. Shilmandi, charnagardi union of Narsingdi sadarupazila were selected for data collection. Different types of map was showed the study area properly.

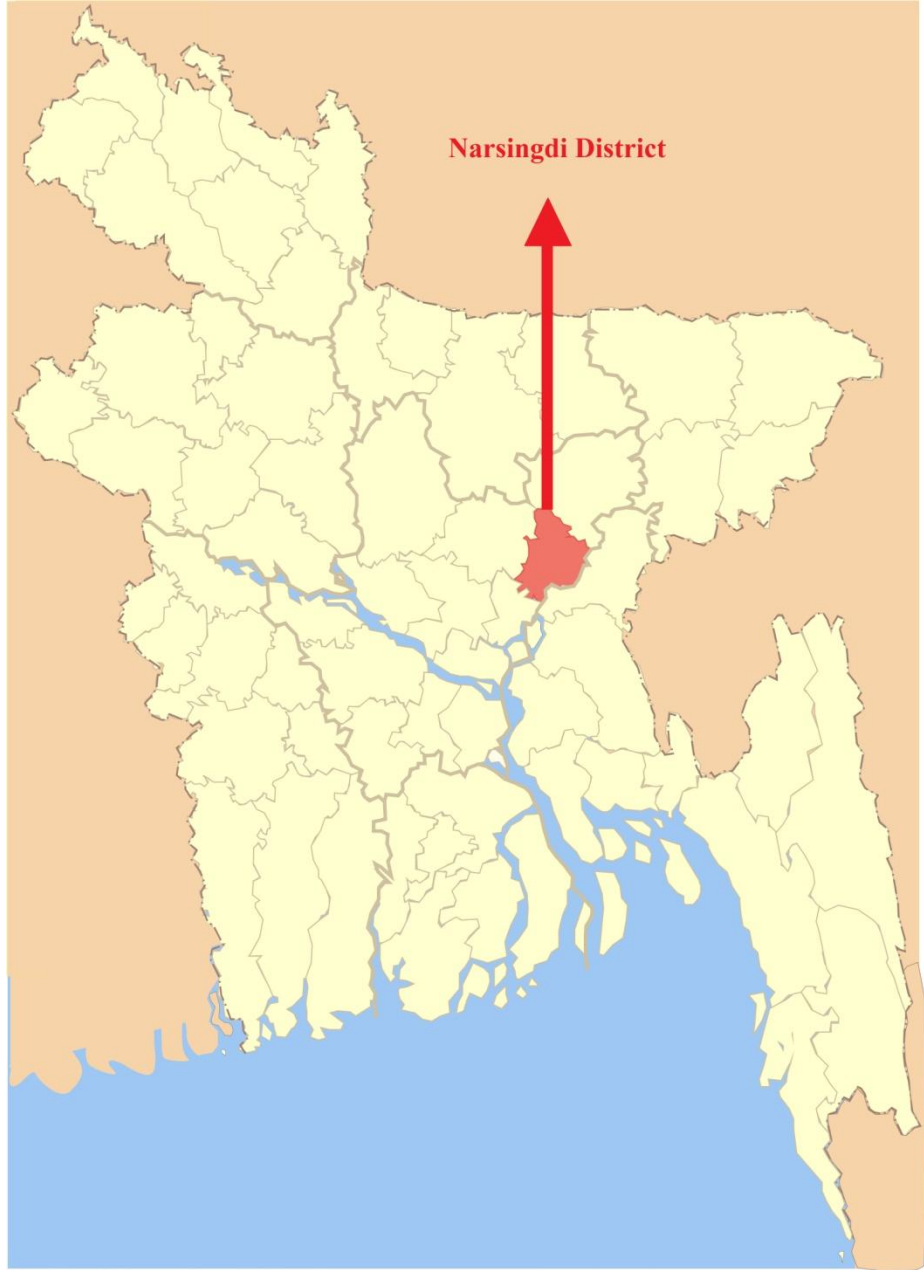


Figure 3.1. A map of Bangladesh showing Narsingdi district

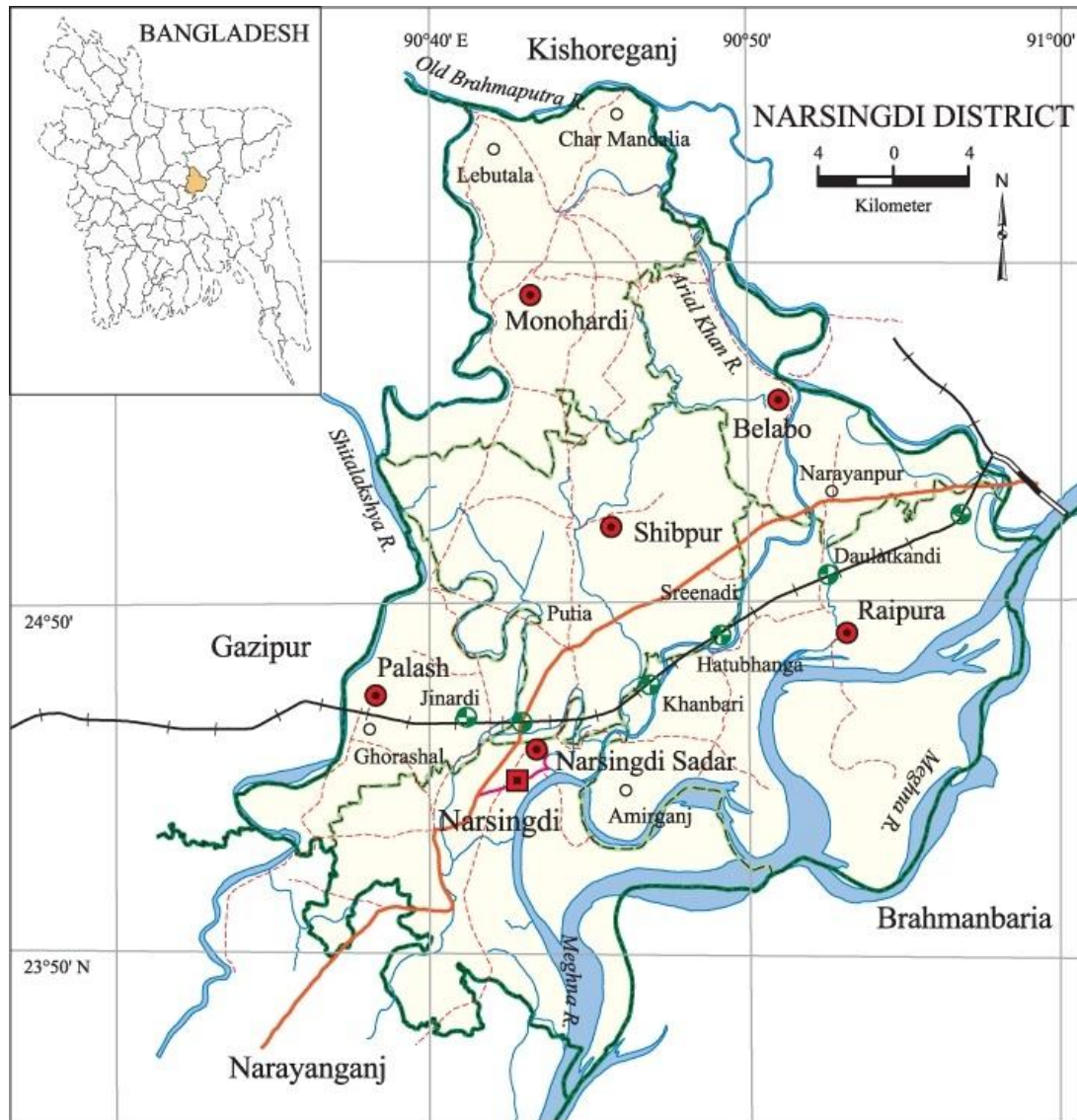


Figure 3.2. A map of Narsingdi district showing sadar upazila

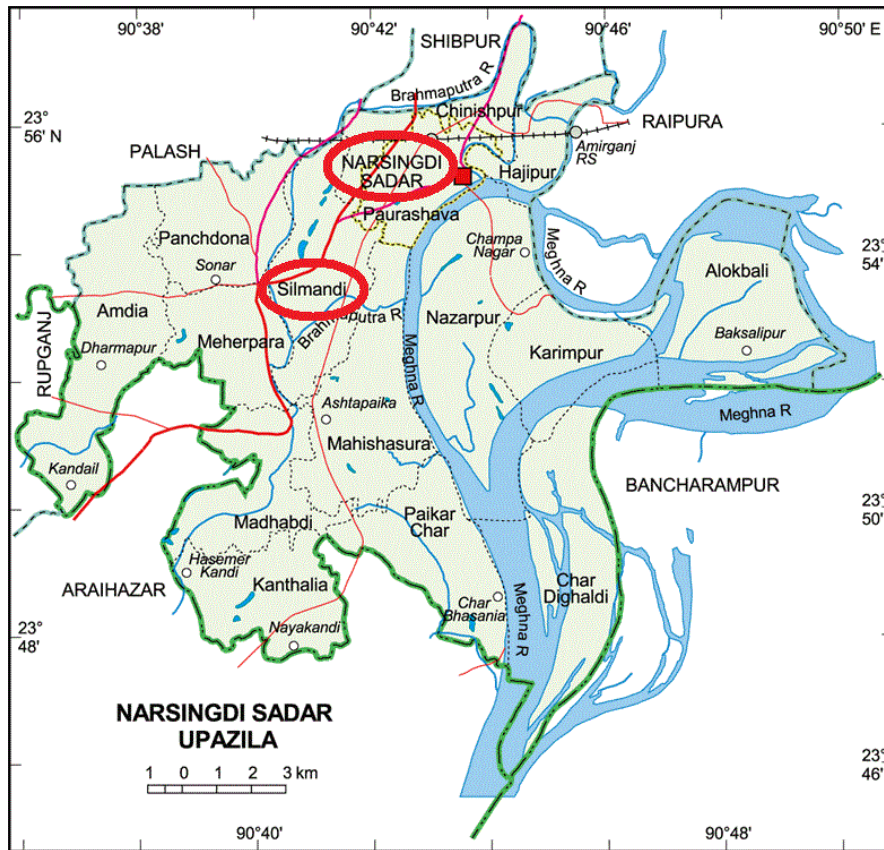


Figure 3.3. A map of sadar upazila of Narsingdi district showing study area

3.2 Selection of banana producers and traders

For directing the review at family and market level, a total rundown of farmers cultivating banana was set up with the assistance of Sub assistant agricultural officer personnel. The interviews are divided into four major groups: the farmers, wholesalers, arotdar and retailers. In this study, the farmers, wholesalers, arotdar and retailers of sagar and sabri banana were considered as the population of the study. Purposive sampling technique was used. Total sample size 90 and it was allocated to 30 farmers of sagar banana, 30 farmer of sabri banana, 5 wholesalers of sabri banana, 5 wholesalers of sagar banana, 5 arotdars of sabri banana, 5 arotders of sagar banana, 5 retailers of sabri banana, 5 retailers of sagar banana .

3.3 Period of study

Essential information were gathered by meeting banana farmers and traders utilizing an organized and pre-tested meeting plan during mid-september to mid-october, 2019. The researcher himself alongside trained enumerators gathered information and data for this study. Essential remedies, changes and augmentations were made in the meeting plan based on aftereffects of pre-test. The meeting plan was then imprinted in its last structures. Fundamental photocopies were then made.

3.4 Survey structure and information assortment

3.4.1 Interview plan structure

For the assortment of essential information two sets of interview schedule were prepared , one set to gather the data from farmers with respect to production and marketing of banana and another set to gather the data from traders . Various factors were distinguished and interview schedules were prepared accordingly.

3.4.2 Strategies and systems of data analysis

Primary data gathered from the field overview and different methods were coded, organized and broke down by utilizing Microsoft Excel and Statistical Package for Social Sciences (SPSS).

3.5 Production cost

The cost of banana production calculated by fixed and variable cost. here actually calculated cost of two type of banana, one is sagar banana and other is sabri banana. On the return side we have considered two type of revenue, one from sagar banana and other from sabri banana. So the cost of land preparation, manure, fertilizer, plant protection, labor, planting materials, land rent etc. was focused on determining cost of production of two type of banana .

3.6 Total cost calculation

For total cost calculation we calculated fixed cost and variable cost for two type of banana. So the measurement can be written as

1. Variable cost

2. Fixed cost = Interest on operating capital + Land use cost

3. Total cost = Variable cost + Fixed cost

TC = Total cost

3.7 Variable costs

Total variable cost is two part one is total input cost and other is total labor cost. we got total input cost one for sagar banana and other for sabri banana as well as total labor cost one for sabri banana and other for sagar banana.

3.8 Total input cost

To measure total inputs cost the variables were suckers cost, Power tiller cost, Irrigation cost, fertilizers cost, cow dung cost, organic fertilizer cost, insecticide cost, fungicide cost, bamboo cost, measured separately for sagar banana farmers and sabri banana farmers then averaged every variable for 30 farmers of sagar banana and sabri banana.

3.9 Total labor cost

Measuring total labor cost the variables were hired labor cost, labor cost for fertilizer application, labor cost for cow dung application, labor cost for organic fertilizer application, labor cost for insecticide cost, labor cost for fungicide application, labor cost for bamboo setting, measured separately for 30 sagar banana farmers and 30 sabri banana farmers .

3.10 Total fixed cost

Calculated total fixed cost by summation of interest on operating capital and land use cost per hactor.

Formula of interest on operating capital = Total variable cost $\times 0.13 \times 4 / (2 \times 12)$

Total fixed cost = Interest on operating capital + land use cost

3.11 Profit analysis

In calculation of profit the cost and revenue have measured. In here we got profit for banana. Profit is the difference between total cost and total revenue. Net profit for any farm business can be written as

$$NP = TR - TC$$

Here, NP= net profit, TR=total revenue, TC= total cost

3.12 Gross income analysis

Gross margin is difference between total revenue and total variable cost. Reason to choose this analysis was that the farmers of Bangladesh are very eager to know their return over total variable cost. For gross return analysis we got two gross return one for sagar banana ,one for sabri banana. The formula is

Gross Farm income = total revenue from banana and saker - total variable cost

3.13 Net farm income

Per hectare net return was defined by subtracting the total cost (variable cost + fixed cost) from the total return obtained from banana production. The formula is

Net farm income = total revenue from banana and saker - total cost

3.14 Net profit per dozen

To calculate net profit per dozen we got that by the difference of of banana sold per dozen and the cost to produce per dozen. In calculation we got two net profit per dozen of banana one was for sabri banana another for sagar banana. The formula is

Net profit per dozen = Sell per dozen of banana- cost per dozen of banana

3.15 Benefit cost analysis

For benefit cost analysis, total cost of production of banana and total gross return from produce were used. For calculating gross return, income from produce sale was accounted. In here we measured tow type of benefit cost ratio one was benefit cost ratio on the basis of variable cost and benefit cost ratio on the basis of total cost for banana. So the benefit cost ratio was calculated using the following formulas:

BCR on the basis of variable cost = Total revenue/ Total variable cost

BCR on the basis of total cost = Total revenue / Total cost

3.16 Input- output relationship

To estimate the effects of key variables on production process of banana was chosen Cobb Douglas Production Function . The Cobb-Douglas form of production function has properties that justify its wide application in economic literature (Henderson and Quandt1971). It is a homogeneous function that gives a scale factor empowering to gauge the profits to scale and to translate the elasticity coefficients with relative ease. The capacity is anything but difficult to gauge and control numerically. The Cobb Douglas production function works under a few restrictive presumptions. Firstly, it expect that the elasticity coefficients are steady, inferring consistent offers for the sources of info.

Besides, it accept that elasticity of substitution among factors is solidarity. In addition, the function being direct in logarithm, the yield is zero if any of the information sources is zero, and the yield extension way is accepted to go through the inception. So production (in dozen) was accounted as the dependent variable ,while the labor, Sakar, powertiller irrigation, Urea, TSP, MP, Zinc, Gypsum, cowdung ,organic fertilizer, incseticide, fungicide, bamboo as the explanatory variables. The double log form of the Cobb-Douglas proved to be superior alternative theoretical and econometric grounds. The specification of Cobb-Douglas production functions as follows:

$$y = a x_1^{b_1} x_2^{b_2} x_3^{b_3} x_4^{b_4} x_5^{b_5} x_6^{b_6} x_7^{b_7} x_8^{b_8} x_9^{b_9} x_{10}^{b_{10}} x_{11}^{b_{11}} x_{12}^{b_{12}} x_{13}^{b_{13}} x_{14}^{b_{14}} e^u$$

By taking log on both sides Cobb-Douglas production functions written as

$$\ln y = \ln a + b_1 \ln x_1 + b_2 \ln x_2 + b_3 \ln x_3 + b_4 \ln x_4 + b_5 \ln x_5 + b_6 \ln x_6 + b_7 \ln x_7 + b_8 \ln x_8 + b_9 \ln x_9 + b_{10} \ln x_{10} + b_{11} \ln x_{11} + b_{12} \ln x_{12} + b_{13} \ln x_{13} + b_{14} \ln x_{14}$$

List of Variable Corresponding to Banana Production

y= Banana production dozens per hectare

x₁= labor

x₂= Sakar

x₃= Powertiller

x₄= Irrigation

x₅= Urea

x₆= TSP

x₇=MP

x₈=Zinc

x₉=Gypsum

x₁₀=Cowdung

x_{11} =Organic fertilize

x_{12} =Insecticide

x_{13} =Fungicide

x_{14} =Bamboo

Chapter 4

Result and discussion

4.1 Socioeconomic characteristic of farmers cultivate sabri banana

Table 1 shows the socio-economic profile of the sample farmers who cultivate sabri banana in the research areas. Farmers average age is 39.5 and years of schooling is 3.3. The average age of farmer's wife is 30.4 and years of schooling is 1.13. Types of farmer in the research areas are three types owner operator, pure tenant, owner cum pure tenant. There are 4.57% of farmer are owner operator, pure tenant are 6.67% and the farmer owner cum pure tenant are 88.76%. The average total family member of the farmer is 4.7. Farmers receive agricultural training yearly on an average .37 and the number of extension contact is 84.9. the farming experience is 17.2 on the average. Most of the farmers use indigenous variety sakar about 95.99 on an average. Farmer use tv 86.7% and use mobile 93.3.

Table 4.1. different characteristic of banana farmers and farmers wife

Items	Farmer	Farmer wife
Age (years)	39.5	30.4
Studied level	3.3	1.13
Types of farmer	Average	Percentage
Total family member	4.7	
No. of agricultural training (yearly)	0.37	
No. of extension contact	84.9	
Year of farming experience	17.2	
Indigenous variety sakar	95.99	
Organic fertilizer	100	
TV		86.7
Mobile		93.3
Owner operator		4.57

Pure tenant(%)		6.67
Owner cum pure tenant(%)		88.76

(Source: Field survey, 2019)

4.1.1 Land utilization pattern of sabri banana farmer

Average homestead area of farmer is 0.02 ha and farm size is .98 ha. Where the banana cultivation land is 0.42 ha. Average sabri banana yield 11556.55 dozen per hector.

Table4. 2. Average land utilization of sabribanana farmer

Items	Value
Homestead area(ha)	0.02
Farm size(ha)	0.98
Banana cultivation land(ha)	0.42
Banana yield per hector(dozen)	11556.55

(Source: field srvey, 2019)

4.1.2 Farmer's children educational situation

Average age of sabri banana farmer's son was 16.4 years and they have is 6.3 years education. Average years of education of farmer's daughter was 5.1 years.It had been found 15.57% farmer's son provide labor in banana production on the other hand 2.5% farmer's daughter provide labor in banana production.

Table4.3.different characteristic of sabri banana farmer's son &daughter

Items	son	Daughter
Age (years)	16.4	12.6
Education (years)	6.3	5.1
Agriculture labor		
Yes	15.57	2.5
No	84.43	97.5

(source: Field survey, 2019)

4.1.3 Input cost calculation of farmer cultivate sabri banana

Total sakar quantity was 1474.2 and the price per sakar was TK. 7.1. Total cost for sakar was TK. 10466.82 per hectare . Total cost for power tiller was TK.1670. Total cost of irrigation per hectare was TK.3356.68.Total Urea need per hectare 442.5 kg and per kg Urea cost TK.16.5 and total cost for Urea TK.6971.25.Total TSP need per hectare 375.2kg and the total cost of TSP was TK.8254.4.Total MP need per hectare 421.14kg and total cost for MP TK.7580.52.Total cost for Zinc was Tk845 per hectare. Total Gypsum Cost per hectare was TK.1926.Total cost for cowdung per hectare 494.Total organic fertilizer cost per hectare TK.39388.8.Total insecticide cost per hectare TK.3355.33.Total fungicide cost per hectare was TK.714.22.Total bamboo cost per hectare was TK.34520.The overall total input cost was TK. 119543.4.

Table4.4.Input cost of farmer cultivate sabri banana

Items	Price	Quantity	Value
Saker	7.1	1474.2	10466.82
Power tiller	288	5.8	1670.4
Irrigation	270.7	12.4	3356.68
Fertilizer			
Urea	16.5	422.5	6971.25
TSP	22	375.2	8254.4
MP	18	421.14	7580.52
Zinc	130	6.5	845
Gypsum	30	64.2	1926
Cow dung	2.5	197.6	494
Organic fertilizer	16	2461.8	39388.8
Insecticide cost	277.3	12.1	3355.33
Fungicide cost	274.7	2.6	714.22
Bamboo cost	200	172.6	34520

a.Total inputs cost			119543.4
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(source: Field survey, 2019)

4.1.4 Labor cost of farmer For sabri banana production

Total hired labor need per hectare land was 35.3 and cost per labor was TK.500 and the total hired labor cost was TK. 17650.TK. 300 per labor for fertilizer application and total labor need per hectare was 11.2 and the total cost for labor for fertilizer application was TK.3360 .Total labor cost for coudung application was TK.3330.The total labor cost for organic fertilizer application was TK.3690.Total labor cost for Insecticide application was TK.5760.Total labor cost for fungicide application was TK.4020.Total labor cost for Bamboo setting was TK.8825. Accumulated total labor cost was TK46635.

Table 4.5: Labor cost of farmer For sabri banana production

Items	price	Quantity	Value
Hired labor	500	35.3	17650
Labor cost for fertilizer application	300	11.2	3360
Labor cost for cow dung application	300	11.1	3330
Labor cost for organic fertilizer application	300	12.3	3690
Labor cost for insecticide cost	300	19.2	5760
Labor cost for fungicide application	300	13.4	4020
Labor cost for bamboo setting	250	35.3	8825
b.Total labor cost			46635

(source: Field survey, 2019)

4.1.5 Profitability of farmer for sabri banana production

Total Variable cost was TK.166178.4.Interest on working capital wasTK,3624.1.Land use cost per hectare was TK.71465.3.Total fixed cost TK.75089.4.Accumulated total cost was TK. 241267.8 .Banana production per hectare 11555.7 dozen.Price per dozen banana was TK.59.4. Total revenue from banana TK. 686408.6.Sakar quantity sold by farmer was 263.5 and sell per sakar 7.3.Revenue from sakar was TK.1923.55.Total revenue from

banana and sakar was TK. 688332.1. Gross farm income was TK.522153.7. Net farm income TK. 447064.3. BCR on the basis of variable cost was TK.4.14 means variable cost was TK.1 then the profit was TK.4.14. BCR on the basis of total cost means if total cost is TK.1 then the profit was TK.2.85

Table 4.6: Profitability of farmer for sabri banana production

Items	Price	Quantity	Value
Total variable cost (a+b)			166178.4
c.interest on operating capital			3624.1
d.Land use cost per ha			71465.3
Total fixed cost (c+d)			75089.4
Total cost			241267.8
Banana quantity		11555.7	
Banana price	59.4		
Total revenue from banana			686408.6
Saker quantity		263.5	
Saker price	7.3		
Revenue from saker			1923.55
Total revenue from banana and saker			688332.1
Gross farm income (total revenue from banana and saker - total variable cost)			522153.7
Net farm income (total revenue from banana and saker - total cost)			447064.3
BCR on the basis of variable cost			4.14
BCR on the basis of total cost			2.85

(source: Field survey, 2019)

4.1.6 Cost & revenue of farmer per dozen sabri banana production

Total banana production dozen per hectare 11555.7. Price per dozen TK.59.4. Revenue from banana TK. 686408.6 .Sakar quantity 263.5 sakar price 7.3 revenue from sakar TK.1923.55. Total revenue from banana and sakar was TK. 688332.1.Total cost TK.

241267.8.Net revenue from bananaTK. 445140.8.Coast per dozen of banana 20.87. Net profit per dozenTK. 38.52

Table 4.7: Cost & revenue of farmer per dozen sabri banana production

Items	Price	Quantity	Value
Total banana production dozen per ha			11555.7
Banana price			59.4
Revenue from banana			686408.6
Saker quantity			263.5
Saker price			7.3
Revenue from saker			1923.55
Total revenue from banana and saker			688332.1
Total cost			241267.8
Net revenue from banana (revenue from banana - total cost)			445140.8
Cost per dozen banana (total cost/total banana production)			20.87
Net profit or loss per dozen			38.52

Source: Field survey 2019

4.1.7 Input output relation of sabri banana production

In order to determine the contribution of inputs like labor, tillage, seed, bamboo, fertilizers, insecticide and irrigation for banana, Cobb-Douglas production function was used. The estimated values of co-efficient and related statistics of Cobb-Douglas production function have been presented in table 4.8. The coefficient of MP is positive and significant at 1% level.If we increase 1% of MP and other inputs remaining constant would increase the yield of sabri banana by0 .31%.There is an opportunity to increase those inputs for increase sabri banana yield.

The value of the coefficient of determination (R^2) is 0.91, which indicated that around 91% of the variation in yield was explained by the independent variables included in the model. The value of F is 11.29 which is significant at 1% level.

Table 4.8: Estimated coefficients and their related statistics of production function for sabri banana

Explanatory variables	Coefficient	P value
intercept	5.25	.001607
Labor(x_1)	0.32	0.17
Sakar(x_2)	0.29	0.02
Powertiller(x_3)	0.06	0.09
Irrigation(x_4)	0.08	0.34
Urea(x_5)	0.17	0.19
TSP(x_6)	0.02	0.78
MP(x_7)	0.31	0.01
Zinc(x_8)	0.01	0.49
Gypsum(x_9)	-0.02	0.39
Cowdung(x_{10})	-0.002	0.88
Organic fertilizer(x_{11})	-0.003	0.97
Insecticide(x_{12})	-0.05	0.28
Fungicide(x_{13})	-0.004	0.87
Bamboo(x_{14})	-0.563	0.02
R^2	.91	
F value	11.29	

Source: Field survey 2019

Notes:*** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.1$

4.1.8 Major obstacles of sabri banana production

Different types of problems were found to produce Sabri banana at farmer level. Farmer responded such main problems are seven. From the table 6 we got “lack of skilled labor”

was ranked 1st, high price of fertilizer ranked 2nd, lack of training facility ranked 3rd, disease attack ranked 4th, lack of quality saker ranked 5th, high transportation cost ranked 6th, and lack of family labour ranked 7th.

Table4. 9: Major constrains of Sabri banana production

Problems	% response of farmer	Rank order
lack of quality saker	23.33	5
lack of skilled labor	86.67	1
disease attack	37.47	4
lack of family labor	11.67	7
high price of fertilizer	73.33	2
high transportation cost	26.67	6
lack of training facility	66.67	3

Source :Field survey 2019

4.1.9 Solution of the problems for Sabri banana production

Solution of the problems were presented in table7 where required fertilizer at reasonable price considered as ranked 1st and need skilled labor was ranked 2nd is the opinion of the farmer. Need training facility, reduce transportation cost, need good quality saker, need market facility, need family labor were also considered as the important step to be followed to remove the problems at farmers level.

Table 4.10: Ranking of suggestion to solve Sabri banana farmers

Possible suggestion	% response of the farmer	Rank order
Need good quality saker	20.45	5
need marketing facility	16.67	6
need training facility	61.23	3
Need family labor	6.67	7
reduce transportation cost	23.45	4
required fertilizer at reasonable	73.33	1

price		
Need skilled labor	65.33	2

Source : Field survey 2019

4.1.10 Profitability of Arotdar selling sabri banana

Table 8 the total cost of arotder was TK.4665 which was converted to per dozen cost as TK. .73. Purchase price per dozen banana was TK.74.4 and selling price is TK. 82.1. The revenue is TK. 7.7 and the profit per dozen was TK.6.97.

Table4.11: Cost and margin of Arotdar

Items	Total cost per 6040 dozen	Cost/dozen
Transport related cost		
Labor cost	660	0.1
Transportation	1110	0.17
Market related cost		
Loading & unloading	630	0.1
House rent	600	0.1
Electricity	960	0.15
Arotdari commission	240	0.04
Other cost		
Weastage	307	0.05
Personal expanse	95	0.01
Mobile bill	63	0.01
b.Total cost	4665	0.73
Revenue of arotdar		
Purchase price		74.4
Sell price		82.1
Revenue		7.7

Source : Field survey 2019

4.1.11 Problems of Arottdar of sabri banana

Problems of arottdar of sabri banana during marketing were ranked in number . In table 4. 12 shows that “quality deteriorate at the time of marketing” was ranked 1st,”Unstable price of banana”, “high wastage of banana”, “lack of credit”, “highstorage cost”, “lack of storage facility”, lack of transportation facility were ranked as 2nd,3rd,4th,5th,6th, and 7th respectively.

Table4. 12:Problems of Arottdar of sabri banana during marketing

Problems	%response of arottdar	Rank order
Lack of transportation facility	15.33	7
Lack of storage facility	26.58	6
Lack of credit	66.87	4
High storage cost	36.29	5
Unstable price of banana	76.27	2
High waste of banana	69.33	3
Quality deteriorate at the time of marketing	79.23	1

Source : Field survey 2019

4.1.12 Solution of the problems of Arottdar of sabri banana

In Table 4.13 shows that “need stable price of banana was ranked 1st of the problems solution. They need packaging facility,need credit facility, available market information, reduce storage cost , storage facility, transport facility to solve their problems.

Table4.13:Rank of problems to be solved of Arottdar

Problems	%response of the farmer	Rank order
Need transport facility	13.21	7
Need storage facility	24.31	6
Reduce storage cost	35.29	5

Need credit facility	62.45	3
Need stable price of banana	74.69	1
Need packaging facility	71.45	2
Need available market information	40.36	4

Source : Field survey 2019

4.1.13 Marketing margin of Bepari of sabri banana

Profitability measurement of bepari selling sabri banana by Bepari was shown in Table 4.14 the cost and profit earned by bepari of sabri banana. We saw the total cost of bepari was 3162.4tk which was converted to dozen and that was .84tk. we here measured the profit of bepari in dozen sell. So the purchased price of banana per dozen was 59.47tk and sold at 69.57tk. Then the revenue is 10.1tk and the profit is 9.26tk.

Table 4.14: Cost and profit of Bepari selling sabri banana

Items	Total cost per 3650 dozen	Tk/dozen
Transport related cost		
Labor cost	380	0.1
Transportation	1070	0.3
Market related cost		
Loading & unloading	360	0.09
Market fee	112	0.03
House rent	530	0.14
Electricity	440	0.11
Other cost		
Weastage	137.4	0.04
Personal expanse	87	0.02
Mobile bill	46	0.01
b.total	3162.4	0.84
Revenue of arottdar		

Purchase price		59.47
Sell price		69.57
Revenue		10.1
Profit per dozen		9.26

Source : Field survey 2019

4.1.14 Problems of faced by Bepari for sabri banana marketing

Table 4.15 the problems faced by bepari of which came first was “lack of credit” that ranked 1st , “high transportation cost” ranked 2nd, “quality deteriorate at the time of marketing” ranked 3rd, and high storage cost, unstable price of banana, Lack of market information, seasonal supply, lack of storage facility, were ranked 4th,5th,6th, 7th, 8th respectively.

Table4. 15: Ranking of the problem

Problems	%response of Arotder	Rank order
High transportation cost	72.53	2
Lack of credit	78.33	1
High storage cost	67.23	4
Unstable price of banana	58.29	5
Quality deteriorate at the time of marketing	70.33	3
Lack of market information	51.37	6
Seasonal supply	33.33	7

Source : Field survey 2019

4.1.15 Solution of the problems suggested by Bepari for sabri banana marketing

Table 4.16 shoes the solution of the problems suggested by Bepari for them “need credit facility”, considered as ranked 1st, where,reduce transport cost ,reduce storage cost, Need stable price of banana,Need available market information, Need packaging facility, seasonal supply” were also considered important step to remove existing problems of the bepari of sabri banana were ranked as 2nd 3rd 4th 5th 6th7th respectively.

Table 4.16: Ranking of the suggestion to solve of Bepari problems

Possible suggestion	%response of the farmer	Rank order
Reduce transport cost	72.36	2
Seasonal supply	30.26	7
Reduce storage cost	65.33	3
Need credit facility	75.65	1
Need stable price of banana	57.33	4
Need packaging facility	43.23	6
Need available market information	56.58	5

Source : Field survey , 2019

4.1.16 Marketing margin of Retailer of sabri banana

Table4.17 shows the marketing margin of retailer for sabri banana selling. The total cost of retailer TK.244.2 which was converted in dozen per at.TK.75.The purchase price per dozen sabei banana isTK. 68.6 and sold price TK.85.1 per dozen .So the revenue was TK.16.5 where the profit was TK.15.75 per dozen.

Table4.17: Cost and profit of retailer for Sabri banana selling

Items	Total cost	Tk/dozen
Transport related cost		
Labor cost	54	0.16
Transportation	42	0.13
Market related cost		
Loading & unloading	35	0.11
House rent	43	0.14
Electricity	34	0.1
Other cost		
Weastage	3.8	0.01
Personal expanse	24	0.07

Mobile bill	8.4	0.03
b.Total cost	244.2	0.75
Revenue of arottdar		
Purchase price		68.6
Sell price		85.1
Revenue		16.5
Profit per dozen		15.75

Source : Field survey 2019

4.1.17 Problem face by Retailer for sabri banana selling

Table 4.18 shows the problems faced by retailer Sabri banana selling high wastage of banana was 1st ranked problem then “Quality deteriorate at the time of marketing”, “Seasonal supply”, “Lack of credit”, “Unstable price of banana”, “Lack of market information” ranked as 2nd,3rd, 4th, 5th,6th respectively.

Table 4.18: Problem of Retailer of sabri banana

Problems	%response of arottdar	Rank order
Lack of credit	55.23	4
Unstable price of banana	46.87	5
High waste of banana	82.33	1
Quality deteriorate at the time of marketing	75.58	2
Lack of market information	41.38	6
Seasonal supply	68.29	3

Source : Field survey, 2019

4.1.15 Solution of the problem of Retailer for sabri banana selling

Table 4.19 shows the solution of the problem of retailer for Sabri banana selling we got the first ranked solution the retailer sought out among various was “need packaging facility”, , there are some other important solution that retailer told as mentioned need credit facility, Increase seasonal supply, Need stable price of banana, Need available

market information, and need transport facility is the 7th are also important step to remove the existing problems of retailers of sabri banana.

Table4. 19: Ranking of problem to besolved

Problems	%response of the farmer	Rank order
Need transport facility	43.87	6
Need credit facility	68.97	3
Need stable price of banana	59.23	4
Need packaging facility	81.75	1
Need available market information	53.63	5
Increase seasonal supply	72.33	2

Source : Field survey 2019

4.2 Socioeconomic characteristic of farmers cultivate sagar banana

Table 4.20 shows the socio-economic profile of the sample farmers who cultivate sagar banana in the study area. Farmers average age is 41.3 years and years of schooling is 4.03. The average age of farmer's wife is 31.96 years and years of schooling is 1.06. 30% of farmer are owner operator , 36.67% pure tanent and 33.3% are the farmer owner cum pure tanent. The average total family member of the farmer is 4.4. Farmers received 0.46 and farmers number of extension contact is 98.8, farmers have 20.93 years of farming experience. Most of the farmers use indigenous variety sakar which was 93.33%. 93.33% farmers use TV and 86.7% use mobile phone.

Table4. 20. Different charecteristic of banana farmers and fermers wife

	Farmer	Farmer wife
Age	41.3	31.96
Education	4.03	1.06
Types of farmer	average	Percentage
Ownwr operator	30	
Pure tanent	36.67	

Owner cum pure tanent	33.3	
Total family member	4.4	
No.of agricultural training	0.46	
No.of extension contact	98.8	
Year of ferming experience	20.93	
Indegenious variety sakar	93.33	
Organic fertilizer	100	
TV		93.33
Mobile		86.7

Source : Field survey ,2019

4.2.1 Land utilization pattern of sagar banana farmer

Table 4.21 shows land utilization pattern of sagar banana. Average homestade area of sagarbanan farmer was 0.017 ha and averagethe size of farm was 0.71 ha. average cultivated sagar banana was 0.29 ha land. Sagar banana yield per ha was 9800.55 dozen.

Table 4.21: Land utilization pattern of Sagar banana farmer

Items	Value
Homestade area(ha)	0.017
Farm size(ha)	0.71
Banana cultivation land(ha)	0.29
Banana yield per hector(dozen)	9800.55

Source : Field survey, 2019

4.2.2 Sagar banana farmer's son & daughter educational level

Table 4.22 shows sagar banana producing farmer's son and daughter educational status. Average age of sabri banana farmer's son was 15.6 and education was 8.53.Farmer's son who give labor in banana cultivation is 13.97%.On the other hand average age of sagar farmer's daughter was 16.98 and average education is 8.5.Farmer's daughter don't any agricultural labor with their father.

Table4. 22. Different characteristic of farmer's son & daughter

Items	Son	daughter
Age	15.6	16.98
Education	8.53	8.5
Agriculture labor		
Yes	13.97	0
No	86.03	100

Source : Field survey, 2019

4.2.3 Input cost of farmer for the cultivation of sagar banana

Table 4.23 all inputs measure for per hectare land. Total cost for saker was TK.8954.8. total cost for power tiller TK.1336.335. Total cost for irrigation TK.3275.79. Total Urea cost TK.11581.35. Total TSP cost TK.10951.6 . Total MP cost TK.9759.6. total Zinc cost TK.2171. Total Gypsum cost TK.5595. Total Cowdung cost TK.2429.28. Total Organic fertilizer cost TK.27153.6. Total Insecticide cost TK. 3703.88. Total Fungicide cost TK. 952. Total Bamboo cost TK. 33592. Total input cost TK.121456.2

Table4. 23. Inputs cost of farmer for the cultivation of sagar

Items	price	Quantity	Value
Saker	6.1	1468	8954.8
Power tiller	300.3	4.45	1336.335
Irrigation	246.3	13.3	3275.79
Fertilizer			
Urea	16.5	701.9	11581.35
TSP	22	497.8	10951.6
MP	18	542.2	9759.6
Zinc	130	16.7	2171

Gypsum	30	186.5	5595
Cow dung	2.1	1156.8	2429.28
Organic fertilizer	16	1697.1	27153.6
Insecticide cost	298.7	12.4	3703.88
Fungicide cost	280	3.4	952
Bamboo cost	200	167.96	33592
a.Total inputs cost			121456.2

Source : Field survey, 2019

4.2.4 Labor cost of farmer for sagar banana production

Table 4.24 shows total hired labor cost TK.18030. Labor cost for fertilizer application TK.3810. Labor cost for cowdung application TK.3510. Labor cot for organic fertilizer application TK.3870. Labor cost for insecticide application TK.5340. Labor cost for fungicide application TK.3990.Labor cost for bamboo setting TK.2850.Total labor cost TK. 41400.

Table 4.24: Labor cost of farmer for sagar banana production

Items	Price	Quantity	Value
Hired labor	500	36.06	18030
Labor cost for fertilizer application	300	12.7	3810
Labor cost for cow dung application	300	11.7	3510
Labor cost for organic fertilizer application	300	12.9	3870
Labor cost for insecticide cost	300	17.8	5340
Labor cost for fungicide application	300	13.3	3990
Labor cost for bamboo setting	250	11.4	2850
b.Total labor cost			41400

Source : Field survey, 2019

4.2.5 Profitability of farmer for Sagar banana production

Table 4.25 shows total variable cost TK. 162856.2. Interest on operating capital TK. 3571.8. Land use cost per hectare TK.3571.8. Total fixed cost TK. 76848.5. Total cost of production TK.239704.7. Banana quantity dozen per hectare production 9800.5. Total revenue from banana TK.532167.2. Revenue from saker TK.1520.532. Total revenue from banana and saker TK.533687.7. Gross farm income TK. 370831.4. Net farm income TK.293982.9. BCR on the basis of variable cost 3.28. BCR on the basis of total cost 2.23

Table 4.25: Profitability of farmer for Sagar banana production

Items	Price	Quantity	Value
Total variable cost (a+b)			162856.2
a.interest on operating capital			3571.8
b.Land use cost per ha			73276.7
Total fixed cost (a+b)			76848.5
Total cost			239704.7
Banana quantity		9800.5	
Banana price	54.3		
Total revenue from banana			532167.2
Saker quantity		200.07	
Saker price	7.6		
Revenue from saker			1520.532
Total revenue from banana and saker			533687.7
Gross farm income			370831.4
Net farm income			293982.9
BCR on the basis of variable cost			3.28
BCR on the basis of total cost			2.23

Source : Field survey, 2019

4.2.6 Cost & revenue of farmer per dozen Sagar banana production

Table 4.26 shows total banana production dozen per hectare 9800.5. Banana price per dozen TK.54.3. Revenue from banana TK.532167.2. Saker quantity 200.07. Saker price

TK.7.6. Revenue from saker TK.1520.532. Total cost TK. 239704.7. Net revenue from banana TK.292462.5. Cost per dozen banana TK.24.46. Net profit per dozen TK.29.84.

Table 4.26: Cost & revenue of farmer per dozen Sagar banana production

Items	Price	Quantity	Value
Total banana production dozen per ha			9800.5
Banana price	54.3		
Revenue from banana			532167.2
Saker quantity		200.07	
Saker price	7.6		
Revenue from saker			1520.532
Total revenue from banana and saker			533687.7
Total cost			239704.7
Net revenue from banana			292462.5
Cost per dozen banana			24.46
Net profit or loss per dozen			29.84

Source : Field survey 2019

4.2.7 Input output relation of sagar banana production

In order to determine the contribution of inputs like labor, tillage, seed, bamboo, fertilizers, insecticide and irrigation for bottle gourd, Cobb-Douglas production function was used. The estimated values of co-efficient and related statistics of Cobb-Douglas production function have been presented in table 4.27. The coefficient of MP is positive and significant at 5% level. If we increase 1% of MP and other inputs remaining constant would increase the yield of sagar banana by 0.14%. There is an opportunity to increase those inputs for increase sagar banana yield. The value of the coefficient of determination (R^2) is 0.75, which indicated that around 75% of the variation in yield was explained by the independent variables included in the model. The value of F is 3.20 which is significant at 1% level.

Table 4.27: Estimated coefficients and their related statistics of production function for sagar banana

Explanatory variables	Coefficient	P value
intercept	7.61	0.014753
labor(x ₁)	-0.06	0.61
Sakar(x ₂)	0.08	0.81
Powertiller(x ₃)	0.007	0.71
Irrigation(x ₄)	0.04	0.30
Urea(x ₅)	-0.004	0.97
TSP(x ₆)	0.03	0.70
MP(x ₇)	0.14	0.02
Zinc(x ₈)	-0.03	0.54
Gypsam(x ₉)	-0.03	0.67
Cowdung(x ₁₀)	0.02	0.31
Organic fertilizer(x ₁₁)	0.05	0.20
Incseticide(x ₁₂)	-0.001	0.97
Fungicide(x ₁₃)	0.01	0.60
Bamboo(x ₁₄)	-0.05	0.62
R ²	0.75	
F value	3.20	

Source : Field survey ,2019

Notes:***p≤ 0.01, **p≤ 0.05, *p≤ 0.1

4.2.8Problems face by sagar banana farmer

Different types of problems were found with poduce at sagar banana farmer level. Farmer responded such main problems are seven. These are the main problem of farmers. From the table 22 it is found “disease attack” was ranked 1st, lack of skilled labor 2nd,lack of training facility was ranked 3rd, high price of fertilizer was ranked 4th,lack of quality sakar was ranked 5th, high transportation cost was ranked 6th and lack of family labor was ranked 7th.

Table 4.28: Problems of sagar banana farmer

Problems	% response of farmer	Rank order
Lack of quality saker	33.33	5
Lack of skilled labor	77.67	2
Disease attack	83.33	1
Lack of family labor	13.67	7
High price of fertilizer	59.34	4
High transportation cost	26.67	6
Lack of training facility	66.67	3

Source : Field survey 2019

4.2. 9 Solution of the problem of farmer for Sagar banana production

Solution of the problems were measure in table 29 where “Need skilled labor” considered as ranked 1st and “need training facility” was ranked 2nd is the opinion of the farmer. Another suggestion were reduce transportation cost, need good quality saker, need market facility, “need family labor” were also considered as the important step to be followed to remove the problems at farmer level.

Table 4.29: Solution of problem suggested by sagar banana farmer

Problems	% response of farmer	Rank order
Need good quality saker	31.23	4
Need marketing facility	13.78	6
Need training facility	73.56	2
Need family labor	11.33	7
Reduce transportation cost	25.38	5
Required fertilizer at reasonable price	58.33	3
Need skilled labor	81.54	1

Source : Field survey 2019

4.2.10 Profitability analysis of sagar banana Arottdar

Table 4.30 shows the profitability of Arottdar for selling Sagar banana different types of cost such as transport related cost, market related cost and other total cost of Arottdar was TK.4730 which was converted to per dozen cost as TK. 0.8. Purchase price per dozen banana was TK.63.53 and selling price is TK.69.13. So the revenue is TK. 5.6 and the profit per dozen was TK. 4.8.

Table 4.30: Cost and profit analysis of arottdar of sagar banana

Item	Total cost per 6420 dozen	Cost/dozen
transport related cost		
labor cost	800	0.14
transportation	1020	0.17
market related cost		
loading & unloading	610	0.1
house rent	580	0.1
electricity	980	0.16
arottdari commission	250	0.05
other cost		
wastage	313	0.05
personal expense	106	0.02
mobile bill	71	0.01
b.total	4730	0.8
revenue of arottdar		
purchase price		63.53
sell price		69.13
revenue		5.6
profit per dozen		4.8

Source : Field survey 2019

4.2.11 Problem face by Arotder for selling sagar banana

Problems of Arotder for sellingsagar banana during marketing were ranked in table 4.31 it was found “quality deteriorate at the time of marketing” was ranked 1st,”Unstable price of banana”, “high wastage of banana”, “high storage cost”, “Lack of transportation facility”, “lack of storage facility”, Lack of credit , “Lack of market information” were ranked as 2nd ,3rd ,4th , 5th , 6th , 7th , 8th respectively.

Table 4.31: Problem face by Arotdar of sagar banana

Problems	%response of arotder	Rank order
Lack of transportation facility	50	5
Lack of storage facility	40	6
Lack of credit	33.33	7
High storage cost	63.33	4
Unstable price of banana	73.33	2
High waste of banana	70	3
Quality deteriorate at the time of marketing	80	1
Lack of market information	30	8

Source : Field survey 2019

4.2.12 Possible suggestion mentioned by Arotder

To solve the problem of arotder of sagar banana they gave many solution of that the most important were ranked here. In table 4.32 “Need credit facility” ranked 1st, “Need storage facility” ranked 8th, Need available market information, Need stable price of banana, Reduce storage cost, Need packaging facility, Need transport facility, Reduce wastage of banana, Need storage facility were ranked 2nd ,3rd ,4th ,5th ,6th ,7th , respectively.

Table4.32: Possible suggestion mentioned by Arotder

Possible suggesion	%response of the farmer	Rank order
Need transport facility	40	6
Need storage facility	26.66	8
Reduce storage cost	50	4

Need credit facility	66.66	1
Need stable price of banana	56.33	3
Need packaging facility	43.33	5
Need available market information	63.33	2
Reduce wastage of banana	36.66	7

Source : Field survey 2019

4.2.13 Profitability analysis of Bepari for selling sagar banana

The profitability analysis of Bepari for selling Sagar banana the total cost of Bepari was TK.3136.2 which was converted to dozen and that was TK.0.86. we here measured the profit of bepari in dozen sell. Purchased price of bananaper dozen was TK.57.49 and sold at TK. 65.66. Then the revenue was TK. 8.17 and the profit was TK. 7.31.

Table4.33: Cost and revenue of bepari of sagar banana

Item	Total cost per 3650 dozen	Tk/dozen
Transport related cost		
Labor cost	380	0.1
Transportation	1150	0.32
Market related cost		
Loading & unloading	320	0.09
Market fee	108	0.03
House rent	520	0.14
Electricity	390	0.11
Other cost		
Weastage	140.2	0.04
Personal expanse	85	0.02
Mobile bill	43	0.01
b.Total (marketing cost)	3136.2	0.86
Revenue of arotdar		
Purchase price		57.49

Sell price		65.66
Revenue		8.17
Profit per dozen		7.31

Source : Field survey 2019

4.2.14 Problem face by Bepari during marketing of sagar banana

Problems of Bepari during marketing of sagar banana were ranked in the table4.34 . Table 4.34 shows that lack of credit, high storage cost, high waste of banana, quality deteriorate at the time of marketing, high transportation cost, lack of storage facility, lack of market information, seasonal supply ranked 1st,2nd,3rd,4th,5th,6th,7th,8th, respectively.

Table4.34:Problems of bapari for selling sagar banana

problems	%respons of arotder	Rank order
High transportation cost	60	5
Lack of storage facility	56.66	6
Lack of credit	86.66	1
High storage cost	83.33	2
High waste of banana	76.66	3
Quality deteriorate at the time of marketing	63.33	4
Lack of market information	50	7
Seasonal supply	40	8

Source : Field survey 2019

4.2.15 Solution of the problem suggest by Bepari for sagar banana marketing

Table 4.35 shows the possible solution of problems.The table shows that Beparis suggestion need credit facility, reduce storage cost, reduce transport cost, need storage facility, need packaging facility, increase seasonal supply, need available market information, ranked 1st,2nd,3rd,4th,5th,6th,7th, respectively.

Table4. 35: Possible suggestion suggested by Bepari for Sagar banana marketing

Problems	%response of the farmer	Rank order
Reduce transport cost	66.66	3
Need storage facility	63.33	4
Reduce storage cost	73.33	2
Need credit facility	76.66	1
Need packaging facility	60	5
Need available market information	40	7
Increase seasonal supply	56.66	6

Source : Field survey, 2019

4.2.16 Profitability of retailer for selling sagar banana

Table4.36 shows profitability of retailer for selling sagar banana. Total cost of retailer was 265.6 tk which was converted to dozen and that was 0.79 tk. we here measured the profit of bepari in dozen sell. So the purchased price of bananaper dozen was 68.1 tk and sold at 82.7 tk. Then the revenue is 14.6 tk and the profit is 13.81 tk.

Table4.36: Cost and revenue of retailer for sagar banana marketing

Item	Total cost per 360 dozen	Tk/dozen
Transport related cost		
Labor cost	54	0.16
Transportation	58	0.17
Market related cost		
Loading & unloading	37	0.11
House rent	52	0.16
Electricity	33	0.1
Other cost		
Weastage	4.2	0.01
Personal expanse	20	0.06
Mobile bill	7.4	0.02

b.Total cost	265.6	0.79
Revenue of arottdar		
Purchase price		68.1
Sell price		82.7
Revenue		14.6
Profit per dozen		13.81

Source : Field survey 2019

4.2.17 Problem faced by retailer for selling sagar banana

Problems of bepari of sagar banana during marketing were ranked in number .so in table 31 there we found High waste of banana, Quality deteriorate at the time of marketing, Unstable price of banana, High storage cost, Lack of market information, Lack of credit ranked 1st,2nd,3rd,4th,5th,6th, respectively.

Table 4.37: Problem faced by retailer for selling sagar banana

problems	%response of arottdar	Rank order
Lack of credit	20	6
High storage cost	40	4
Unstable price of banana	60	3
High waste of banana	80	1
Quality deteriorate at the time of marketing	65	2
Lack of market information	35	5

Source : Field survey, 2019

4.2.18 Possible solution suggest by retailer for selling sagar banana

Table 4.38 shows the possible solution of the problem.Possible solution suggested by retailer describ need credit facility, reduce storage cost, need stable price of banana, need packaging facility, need available market information, ranked 1st,2nd,3rd,4th,5th, respectively. Table 4.38: Possible suggestion to solve retailer's problem

Problems	%response of the farmer	Rank order
Reduce storage cost	60	2
Need credit facility	80	1
Need stable price of banana	55	3
Need packaging facility	40	4
Need available market information	20	5

Source : Field survey 2019

Value chain maps of Sagar banana: Narsingdi is one of the major production of banana in Bangladesh . The Study area is most famous for sagar and sabri banana.. Farmers sell their produce to *Bepari*, and local *Arathdar*. Local retailers and consumers also buy banana directly from farmers.Total production is moves from farmers to consumers through four major chains.

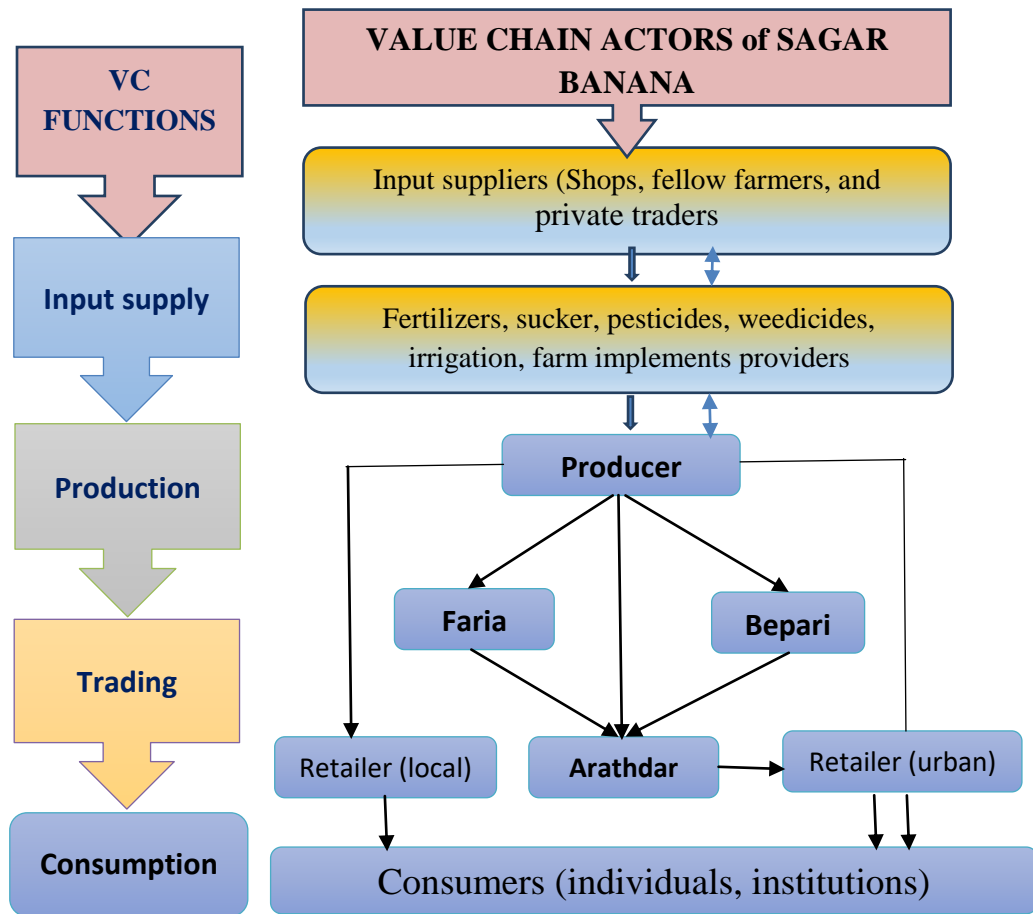


Figure 4.1: Value chain map of Sagar banana in the study areas

Value chain maps of Sabri banana: Narsingdi is one of the major production of banana in Bangladesh. The Study area is most famous for sagar and sabri banana. Farmers sell their produce to *Bepari*, and local *Arathdar*. Local retailers and consumers also buy banana directly from farmers. Total production is moves from farmers to consumers through four major chains. The map of value chain is more or less same.

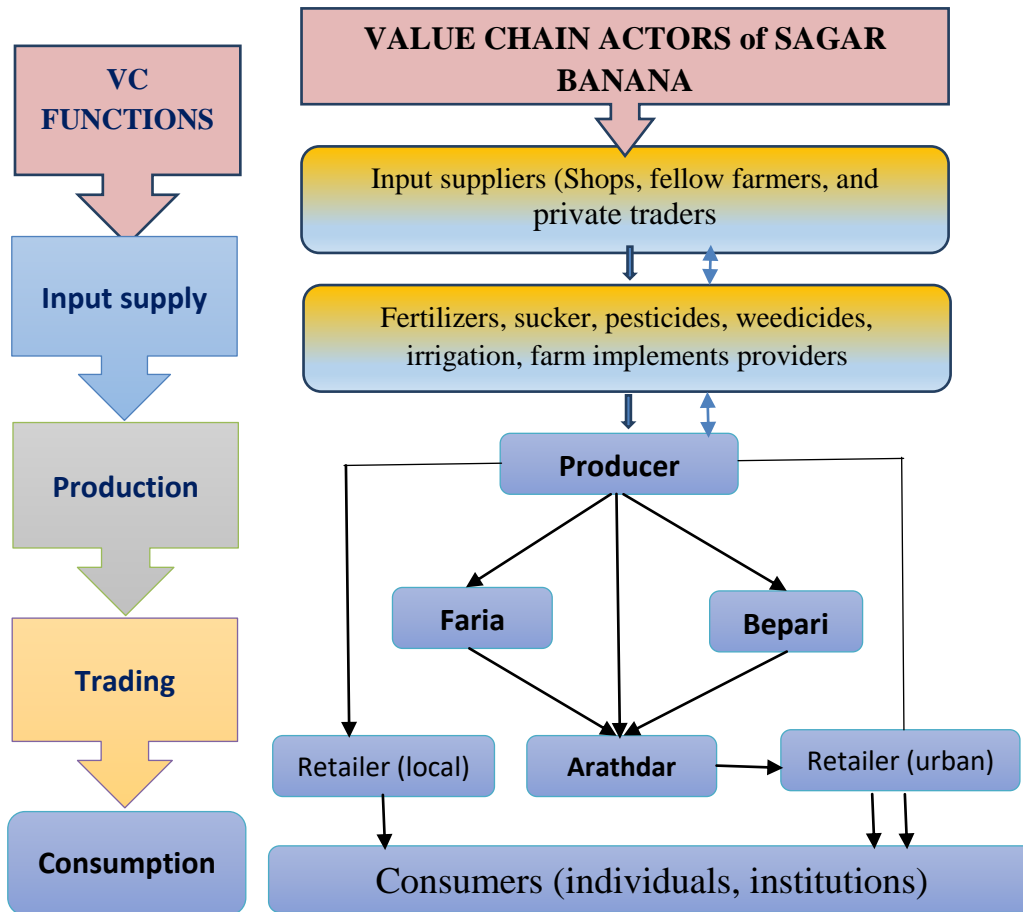


Figure 4.2: Value chain map of Sabri banana in the study areas

Chapter 5

Conclusion and Recommendation

5.1 Conclusion

Banana production was profitable in the study areas, although farmers were faced different problems. Cobb-Douglas production function showed that farmers of cultivate sabri banana are under use of sakar, power tiller, MP and there is an opportunity for the farmers to use those inputs. On the other hand farmer are over used Gypsum, cowdung, organic fertilizer, insecticide, fungicide which reduce production. Lack of skilled labor is first rank problem and high price of fertilizer is second rank problem. For farmers produce sagar banana are under use of MP and there is an opportunity to increase sagar banana production, on the other hand Urea, Zinc, Gypsum, insecticide are over used by farmer which reduce production. Disease attack is first rank problem of sagar banana farmer. For Arotder of sabri banana quality deteriorate at the time of marketing is the first rank problem. Lack of credit is the first rank problem for farmers for sabri banana. High wastage of banana is the first rank problem for retailer of sabri banana. Quality deteriorate at the time of marketing first rank problem for Arotder of sagar banana. Lack of credit is the first rank problem for bepari of sagar banana. High waste of banana is the first rank of problem for retailer of sagar banana.

Recommendation

Recommendation for farmer

1. For the use of indigenous variety of banana, production is less. So farmer should introduce high yield variety of sagar and sabri banana to increase production.
2. Farmers have less tendency of training for that it had been found of improper use of inputs in banana production. Improper use of inputs is deter from increase production. So farmers need proper training which can provide by DAE to increase banana production.

3. In banana production need more labor so a large amount of money need in labor cost. If the contribution of family labor can increase labor cost may decrease.
4. Banana farming is profitable but it need much amount of investment than other fruit farming so government and other NGOs can introduce micro credit finance for banana production .
5. Government should take necessary measures to lower the price of inputs which have positive significant impact on yield. It will increase the net benefit of banana producers.
6. As banana is profitable enterprise, government and concern institutions should provide adequate extension program to expand their area and production.

Recommendation for Traders

1. Development of transportation system is essential for the improvement of trading and reducing cost of banana.
2. Storage is so important for trader for reduce loss. An appropriate storage scheme should be developed to reduce loss.
3. Good packaging system need to introduce to get more profit.
4. Market cost may reduce by adequate information, infrastructure and transportation.
5. Wastage of banana is high. So scientific method of preserve banana like other developed countries may introduce to reduce loss.

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APPENDICES

Appendix I: Questionnaire for interview at farmers' level

Department of Agribusiness & Marketing

Sher-e- Bangla Agricultural University, Dhaka-1207

Questionnaire for farmer

Title: Value Chain Analysis of Sagar and Sabri Banana in Narsingdi District of Bangladesh

Serial No.

Date:

1. Name of respondent

2. Age:

3. Education level:

4. Gender:

5. Address:

Village:

Upazila:

District:

6. Types of farmer:

a. Owner operator b. Pure tenant c. Owner cum tenant

7. Farm size

a) Small: (.5-2.49 acre)=1 b) Medium: (2.50- 7.49) = 2 c) Large: (7.50 +)=3

8. Banana production: a) Yes b) No

9. Banana variety: a) Sagar b) Sobri

10. Family member information:

Member	Age	Years of schooling	Agriculture labour
1. Wife			
2. Son			
3. Son			
4. Son			
5. Daughter			
6. Daughter			
7. Daughter			
Total family member			

11. Different characteristic of farmer

Characteristics	Value
No. of agricultural training	
From whom do you get training	
No. of extension contact	
Years of farming experience	
Farmer's has access to TV(yes/no)	
Farmer's has mobile phone(yes/no)	
Homestead area (decimal)	
Farm size (decimal)	
Banana cultivation land	
Banana yield(dozen/ 100decimal)	
Farmer's used modern variety seedling (yes/no)	
Farmer's use organic fertilizer (yes/no)	

12. Cost of banana production (Tk. /acre)

Cost items	Price	Total quantity	Total cost
Labor cost a. Family labor b. Hired labor			
Seedling cost			
Power tiller cost			
Labor cost weeding			
Irrigation cost			
Fertilizer cost a. Urea b. TSP c. M.P. d. DAP e. Zinc f. Zypsum			
Cow dung			
Organic fertilizer			
Insecticide cost			
Weedicide cost			
Fungicide cost			
Labor cost for insecticide application			
Labor cost for weedicide application			
Labor cost for fungicide			

application			
Labor cost for harvesting			
Bamboo cost			
Land use cost			

13. Profitability of banana production in 1 acre

Items	No	Per unit price	Value
Banana (dozen)			
Banana tree			
Banana sacker			
Total			

14. Problems of farmer:

Types of problem	Tick mark
Lack of quality seedling	
Lack of skilled labor	
Low price of banana	
Disease attack	
Lack of family labor	
High price of fertilizer	
Lack of irrigation facility	
High transportation cost	
Lack of storage facility	
Lack of training facility	

15. Solutions of problems:

Solution of problem	Tick mark
Need good quality of seedling	
Need training Facility	
Need storage facility	
Need transport facility	
Required fertilizer at reasonable price	
Reduce cost of pesticide	

Signature of the interviewer

Appendix II: Questionnaire for interview at traders' level

Department of Agribusiness & Marketing

Sher-e-Bangla Agricultural University, Dhaka

Questionnaire for Aratder/Bepari/ Retailer

Title : Title: Value Chain Analysis of Sagar and Sabri Banana in Narsingdi District of Bangladesh

Serial No.

Date:

1. Name of respondent

2. Age:

3. Educational level:

4. Address:

Village:

Upazila:

District:

5. Marketing cost of different intermediaries

Items	Cost(TK. /Dozen)
1. Transportation related costs	
a. Labor	
b. Transportation	
2. Market related cost	
a. Loading& Unloading	
b. Packaging	
c. Grading	
d. Market fee	
e. House rent	
f. Electricity bill	
g. Aratdari commission	
h. Trade association fee	
3. Other cost	
a. Wastage of banana	
b. Personal expenses	
c. Mobile bill	
Total Marketing Cost	

6. Marketing margin of different intermediaries:

Items	
Purchase price (Tk./Dozen)	
Sell price (Tk. / Dozen)	
Margin	
Margin/purchase price (%)	

7. Problems of marketing:

Type of problems	Tick mark
Lack of transportation facility	
Lack of storage facility	
High storage cost	
Lack of credit	
Low price of banana	
Unstable price	
High wastage of banana	
Quality deterioration at the time of marketing	
Lack of market information	
Seasonal supply	

8. Solution of problems:

Solution of problem	Tick mark
Need transport facilities	
Need storage facility	
Reduce storage cost	
Reduce transportation cost	
Need credit facility	
Need stable price of banana	
Need packaging facility	
Need available market information	

Signature of the interviewer

