

**A STUDY ON PROFITABILITY, RESOURCE USE EFFICIENCY AND  
MARKETING OF STRAWBERRY CULTIVATION IN RAJSHAHI  
DISTRICT**

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**DECEMBER, 2018**

**A STUDY ON PROFITABILITY, RESOURCE USE EFFICIENCY AND  
MARKETING OF STRAWBERRY CULTIVATION IN RAJSHAHI  
DISTRICT**

**BY**

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A Thesis

Submitted to the Faculty of Agribusiness Management  
Sher-e-Bangla Agricultural University, Dhaka-1207  
in partial fulfillment of the requirements

For the degree of

**MASTER OF SCIENCE  
IN  
AGRICULTURAL ECONOMICS  
SEMESTER: DECEMBER, 2018**

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### CERTIFICATE

*This is to certify that the thesis entitled "A STUDY ON PROFITABILITY, RESOURCE USE EFFICIENCY AND MARKETING OF STRAWBERRY CULTIVATION IN RAJSHAHI DISTRICT" submitted to the Faculty of Agribusiness Management, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE in AGRICULTURAL ECONOMICS**, embodies the result of a piece of bona fide research work carried out by **RUMANA KHATUN**, Registration No. **12-05127** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.*

*I further certify that such help or source of information, as has been availed of during the course of this investigation has duly been acknowledged.*

**Dated: 02 December, 2019**  
**Place: Dhaka, Bangladesh**

\_\_\_\_\_  
**Dr. G M Monirul Alam**  
**Supervisor**



**DEDICATED TO  
MY  
BELOVED PARENTS**

## ABSTRACT

The present study was aimed to determine the profitability, resource use efficiency and marketing of strawberry cultivation in Rajshahi district of Bangladesh. The survey data were collected from 60 strawberry farmers using structure questionnaire in 2019. The study reveals that strawberry production is profitable to the farmers: the gross return was Tk. 1075000 per acre whereas total cost was Tk. 500521.40 per acre. The Benefit Cost Ratio (BCR) estimated at 2.14. Econometric analysis shows that cost of human labour, seed, manure, TSP and insecticide had significant positive contribution to gross return of strawberry cultivation. In regards of resource use efficiency, manure and TSP were under used whereas seed and human labor was over utilized in strawberry cultivation. The study explored five important marketing channels for strawberry. This study also identified some of the problems and constraints associated with strawberry cultivation such as storage problem, lack of quality seed, capital and training, and also low price of product during harvesting period. Developing new varieties of strawberry, access to credit and extension services and training on production and marketing issue are important to enhance the economic return of strawberry farmers.

## ACKNOWLEDGEMENT

*At the inception, all praises to “The Almighty Allah subhanahuwata-ala, the omnipotent and the merciful”, without whose immeasurable grace and profound kindness the author would have never been able to pursue the higher studies in this field of Agricultural Economics and to carry out the whole research and to build up this thesis for the degree of Master of Science (MS) in Agricultural Economics.*

*This research has grown out precious contributions made by many individuals although it is not possible to mention the names of all individuals who contributed in materializing the research, however, it would be an act of ungratefulness if contributions of some individuals were not acknowledged.*

*The author feels proud to convey her sincere and deepest appreciation to her respected teacher and supervisor, Dr. G M Monirul Alam, Head, Department of Agribusiness, Bangabandhu Sheikh Mujibur Rahman Agricultural University, for accepting her as his research student.*

*The author remains enormously grateful to him for his indefatigable efforts, keen interest, inspiration, constant encouragement, conscientious guidance, support and invaluable suggestions, constructive criticism and provisions of facilities and supports throughout the course of this research work, without which it was not possible to complete the thesis.*

*The author would like to express her sincere thankfulness and unfathomable indebtedness to her reverend teacher and co-supervisor, Prof. Dr. Md. Mizanur Rahman Sarker, Dean, Faculty of Agribusiness Management, Sher-e-Bangla Agricultural University, Dhaka, for his valuable advice and nice comments in throughout the research work.*

*The author expresses her cordial thanks to honorable teachers of Department of Agricultural Economics, Sher-e-Bangla Agricultural University, Dhaka, for their valuable advice and constant inspiration throughout the period of the study.*

*I would also like to extend my appreciation to Professor Gazi M. A. Jalil, Chairman, Department of Agricultural Economics, Sher-e-Bangla Agricultural University, Dhaka, for his sincere cooperation, valuable suggestions and encouragement at every stage of this thesis.*

*The author's immense thanks go to the people of the research areas, especially the strawberry farmers who gave him access and information regarding the cultivation of strawberry. The author would never forget the hospitality and sincerity of strawberry farmer Mr. Jubair Islam Rony of Charghat, Rajshahi.*

*The author feels much pleasure to acknowledge the liberal help and cooperation of friends who come forward for help, co-operation, accompany and motivation throughout the research period.*

*Last, but not the least, the author is ever indebted to her beloved parents Most. Nargis Parbin and Mr. Md. Rahamat Ullah, who have sacrificed a lot to allow him to continue the higher study and husband Dr. Md. Mossabbir Hossain for his heartiest blessings and encouragement throughout the entire period of academic life. The author believes all of her achievements are entirely because of their constant inspiration and therefore she is forever in their debt.*

*Rumana Khatun*

*December, 2018*

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## ABBREVIATIONS AND ACRONYMS

BARI	: Bangladesh Agricultural Research Institute
BBS	: Bangladesh Bureau of Statistic
BCR	: Benefit Cost Ratio
BDT	: Bangladeshi Taka
BER	: Bangladesh Economic Review
DAE	: Department of Agricultural Extension
<i>et al.</i>	: and Others (at elli)
GR	: Gross Return
Gm	: Gram
Ha	: Hectare
HIES	: Household Income and Expenditure Survey
HYV	: High Yielding Variety
IOC	: Interest on Operating Capital
Kg	: Kilogram
MoP	: Muriate of Potash
Mt	: Metric Ton
NGO	: Non-Government Organization
T	: Ton
TC	: Total Cost
TFC	: Total Fixed Cost
Tk.	: Taka
TSP	: Triple Super Phosphate
TVC	: Total Variable Cost
US	: United States
USDA	: United States Department of Agriculture
\$	: Dollar



## INTRODUCTION



# CHAPTER I

## INTRODUCTION

### 1.1 Background

Strawberry is one of the most popular fruits in the world. Strawberries have been introduced in Bangladesh recently and getting popularity day by day. Different regions of Bangladesh are suitable to cultivate strawberry in terms of photoperiod, temperature and humidity (Emdad et al., 2013). It is the time to research for improving strawberries cultivation in our environment. Since it is adaptable, strawberry has an expand culture in the world. On the other hand, since fruits can be obtained early in the seasons where there is no fresh fruit in the market its marketability is also high. Another important aspect is that it can bring back the investment in a short period therefore it is suitable for farming. Due to all these advantages in production strawberry area is gradually increasing in Bangladesh. To meet the increasing demand in our local market traders import large amount of strawberry from different foreign countries.

### 1.2 Agriculture in Bangladesh

It is anticipated by different International development agencies that Bangladesh will stand apart by developing a record of 8% GDP growth in 2019 and 2020, making it the quickest developing economy in Asia-Pacific. When the worldwide monetary standpoint is challenging, and development is relied upon to direct crosswise over the greater part of creating Asia at 5.7% in 2019 and 5.6% in 2020, Bangladesh will keep on being the quickest developing economy in the Asia-Pacific region (ADO, 2019). Today, Bangladesh is seen as a model for growth even in this difficult global economic outlook. And in this growth story, agriculture is an important sector for Bangladesh. The country has gained significant success in agriculture, achieving third fastest growth in vegetable production, fourth position in rice production, third

in fish production from inland water bodies, fifth in aquaculture production and seventh position in mango production in the world. The country is now self-sufficient in rice and fish production.

Bangladesh is mainly an agricultural country. Agriculture is the single largest producing sector of the economy and contributes about 14.70% to the total Gross Domestic Product (GDP) of the country in 2017 (BBS, 2017). This sector also accommodates around 40.7% of labor force. GDP growth rate of Bangladesh mainly depends on the performance of the agriculture sector (BBS, 2017). The economic development is inextricably linked with the performance of this sector. The performance of this sector has an overwhelming impact on major macroeconomic objectives like employment generation, poverty alleviation, human resources development and food security. Moreover, agriculture is the source of wide range of agricultural commodity markets, especially in rural areas. . In Bangladesh, food security of the vast population is associated with the development of agriculture. Besides this, agriculture has a direct link to the issues like poverty alleviation, improved standard of living and employment generation. In order to ensure long-term food security for the people, a profitable, sustainable and environment-friendly agricultural system is critical (Sarker et al., 2019). Broad agriculture sector and rural development sector have been given the highest priority in order to make Bangladesh self-sufficient in food production.

In recent years, there has been a tremendous increase in food grain production. Agricultural holding in Bangladesh is generally small but use of modern varieties, inputs and equipment is gradually increasing. Rice, jute, sugarcane, potato, pulses, wheat, tea and tobacco are the principal crops of Bangladesh. Crop diversification program, credit supply, extension work, research and input distribution policies pursued by the government are yielding positive results. The country is now on the threshold of attaining self-sufficiency in food grain production.

### 1.3 Contribution of Agriculture to GDP

Until the 1980s, share of the crop and horticulture sector to the total Agricultural GDP was slightly less than eighty percent. Forestry contributed about 5.5 percent to the agriculture sector in the early seventies which has gradually increased to about 11 percent in 2016/17. Animal farming particularly poultry, dairy, egg production and animal fattening for meat production has contributed towards many-fold increase in livestock production. Small scale commercial poultry farming has expanded in the periphery of towns and cities. Share of animal farming to the Agricultural GDP has increased from about 7 percent in the seventies to about 11 percent in 2016/17. In the early seventies, fisheries sector contributed about 10 percent which was declining in the seventies and eighties. Fisheries sector contributed about 23 percent of the total agricultural GDP in the recent years.

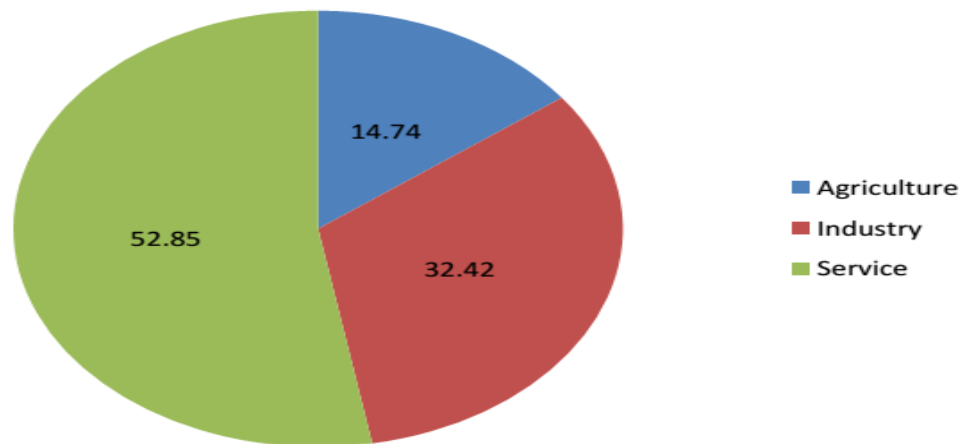


Figure 1.1 Sectorial Share of GDP at Constant Price, 2018

Source: BER, 2018

Figure 1 shows that during 2009-10 to 2016-17 the share of agricultural GDP has decreased. In 2009-10 the share of agriculture in GDP was 18.38%, but in 2016-17 this share has fallen to 14.74%. Figure 2 shows that the largest share of GDP is by the service sector. The growth rate also shows the same evident (Figure 2).

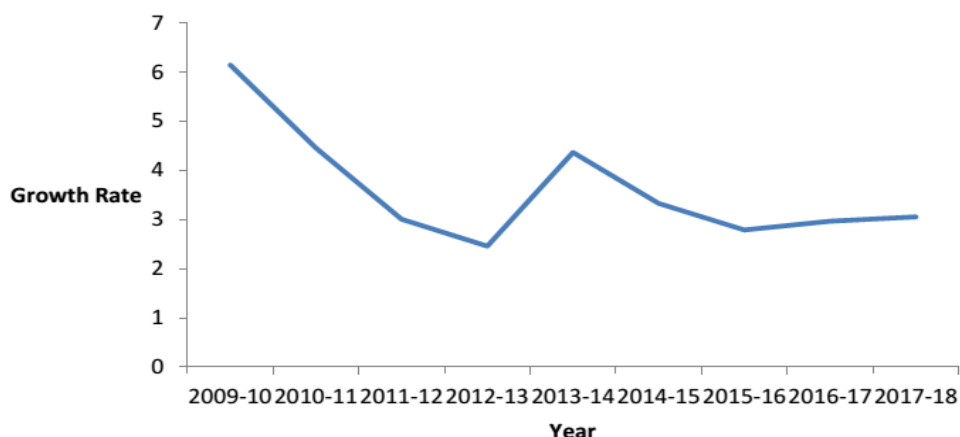


Figure 1.2: Growth rate of agricultural GDP at Constant Price, 2009-2018

Source: BER, 2018

Though share and growth rate of agricultural GDP compared to other sector has decreased in last few decades but in terms of volume agricultural GDP shows an increasing trend. In 2009-10 agricultural GDP was 1065108 million BDT, but in 2016-17 it becomes 1340511 million BDT (Figure 1.3).

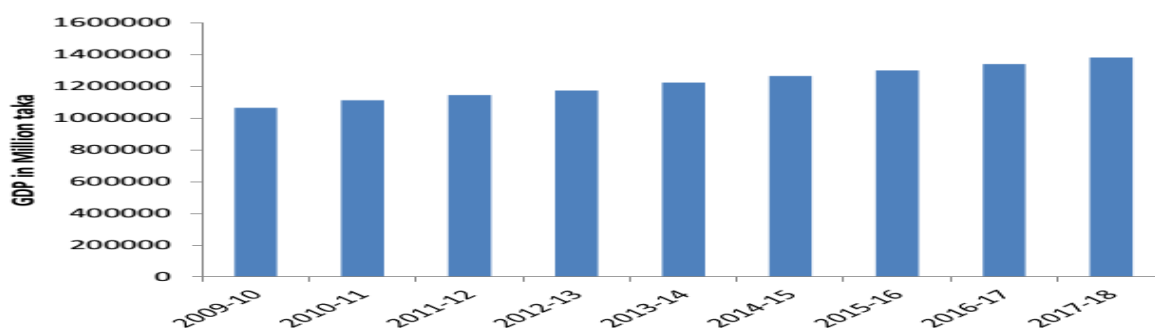


Figure 1.3: Trends in Agricultural GDP at Constant Prices

Source: BBS, 2018

In terms of growth, Bangladesh agriculture performed remarkably well both in the long-term (FY1973/74 to FY2007/08) and in the short term or recent years (FY2008/09 to 2014/15). Annual growth rate in the overall agriculture sector ranged between 1.6 percent in FY2013 and 4.4 percent in FY2014. For crop & horticulture subsector it varied between 0.6 percent (in FY2013) and 3.9 percent (in FY2011). Animal farming experienced annual growth between 2.6 percent (in FY2011) and 3.1

percent (in FY2015). On the other hand, forest and related services had annual growth in the range of 5.0 percent in FY2014 and 6.0 percent in FY2012. Fishing had annual growth between 5.3 percent in FY2012 and 6.5 percent in FY2015 (Deb, 2016).

#### **1.4 Present Status of Crop in Bangladesh**

Priority of agriculture today has been shifted towards nutritional security for its growing population. Demand for diversified food items is a newer challenge to agriculture. On the other hand development of climate smart agriculture added to the development agenda that the science is focusing today. In Bangladesh, only nine crops- rice (73.94%), wheat (4.45%), jute (3.91%), rape and mustard (3.08%), lentil (1.54%), chickling vetch (1.25%), potato (1.13%), sugarcane (1.12%), and chilli (1.05%) are grown on 1 percent or more of the crop acreage (14.61 million ha) and considered as major crops (Banglapedia).

Rice dominates the cropping pattern throughout Bangladesh. It has been broadly divided into three classes viz, aman (transplanted and broadcast varieties), boro, and aush according to the season in which they are harvested, namely, in December-January, March-May and July-August respectively. Again, of these varieties transplanted aman is the most important and covers about 46.30% of the paddy area, followed by boro (26.85%), aus (17.59%) and broadcast aman (9.26%). Transplanted aman is grown almost everywhere in Bangladesh, while broadcast aman is mostly grown in the low-lying areas of the south and northeast. Boro is grown to a certain extent in every district, especially in the irrigated part, while aus is a well scattered crop (Banglapedia).

Next to rice, wheat is the most important crop in Bangladesh. It is grown mainly in the drier parts of the north and is cultivated only as a winter crop. Jute leads the country's list of export crops but is ranked third in terms of area cultivated. It is confined mainly to the low-lying areas of the Brahmaputra-Jamuna and Padma floodplains. Mustard (including rape) is the fourth important crop. It is also grown mainly in the low-lying areas of Brahmaputra-Jamuna and Meghna floodplains.

Masur (lentil) and khesari (chickling vetch) are the two important varieties of pulses produced in Bangladesh. Masur is mainly grown in the Gangetic delta while khesari is a well-scattered crop in the islands and chars (any accretion in the riverbed, usually sandy islands).

Potato is the most important of the winter vegetables and is widely grown. At present potato is a most important crop to Munshiganj, Comilla, Rajshahi, Rangpur, Dinajpur, Bogra, Joypurhat and Nilphamari districts. Sugarcane is the eighth important crop the country. It grows best in Rajshahi, Natore, and Chuadanga districts. Although chilli is produced to a certain extent in every district of the country, the cultivation is mainly concentrated in the southern districts including Bogra, Sirajganj and Pabna.

Minor crops that are grown on less than one percent of the gross cropped area (GCA) of a country. In Bangladesh gram (0.78%), millets and maize (0.60%), onion (0.58%), black gram (0.51%), sweet potato (0.45%), groundnut (0.40%), green pea (0.36%), sesame (0.33%), linseed (0.30%), garlic (0.20%), pea (0.12%), barley (0.10%), etc, are usually considered as minor crops. In addition, some crops, including vegetables, spices, etc, occupy a very insignificant proportion of the GCA (ie less than 0.10% to each crop), and they altogether account for 1.57 percent (Hasan 2015).

## **1.5 Fruits in Bangladesh**

Bangladesh abounds with a large variety of tropical and sub-tropical fruits. The most widely cultivated fruits are mango, jackfruit, black berry, pineapple, banana, litchi, lemon, guava, custard apple, wood apple, elephant apple, golden apple, Indian berry, papaya, tamarind, melon, watermelon, cashew nut, pomegranate, palmyra, plum, rose apple, Indian olive, and Indian jujube. There are many minor edible fruits that are locally available in the wild and are also cultivated, such as latkan, monkey jack, uriam, rattan, river ebony, garcinia, water coconut, wild date palm, etc (Banglapedia). In recent time, Strawberry cultivation became popular among the farmers.

May, June and July are specially treated as fruit festival months in Bangladesh when almost all the major and minor fruits are matured and available. A few fruits are available throughout the year. These are the papaya, sapodilla, coconut and banana. The common imported fruits are orange, apple, pomegranate, grape, date, and mandarin.

In Bangladesh the cultivation of temperate fruits has been unsuccessful, except for grapes in some places. Oranges are cultivated only in a very limited areas in Sylhet and in remote areas of Rangamati (Sajeek) and Bandarban (Ruma) districts (Alam et al., 2019).

**Table 1.1: Production of Fruits (temporary) in Bangladesh**

Year	Area (Acres)	Production (MT)	Per Acre Yields (Kg)
2015-16	200000	1343000	6715
2016-17	234000	4392000	1877
2017-18	194000	1286000	6428

Source: Agriculture year book 2017-18

From the Table 1.1 it is showed that, yield of temporary fruits per acre is decreased in 2017-18 than 2015-16 and the total land of temporary fruits cultivation is decreased than 2015-16 but in case of permeant fruits it is increased.

**Table 1.2: Production of Fruits (Permanent) in Bangladesh**

Year	Area (Acres)	Production (MT)	Per Acre Yields
2015-16	167000	3466000	2075
2016-17	180000	3704000	2058
2017-18	128000	3662000	2843

Source: Agriculture year book 2017-18

## **1.6 Strawberry**

Strawberries are growing in many areas of Bangladesh and gaining popularity day by day. However, the production of strawberry in Bangladesh is not so much, but amount of production is increasing day by day. Our farmers as well as our Government & NGO are trying to produce it rapidly. The main strawberry variety RABI-3 which is catering to the weather of Bangladesh.

During early years of strawberry cultivation in Bangladesh, many predicted that the practice would change the agriculture sector, and create a new export industry. However, the data indicates that current production is still very low to catch up with the rising local demand. Instead, the country is importing strawberries. According to National Board of Revenue (NBR), Tk 700 thousand (7 lakh) worth of strawberries were imported into Bangladesh in 2014. Demand rose between July and December in 2015 and this led to the import of Tk. 1.35 million (13.5 lakh) worth of strawberries. With a sizable amount of demand being met with imports, it is clear that there is a large demand especially in the urban markets. Assuming a stable demand growth, domestic strawberry production could be increased in competition with imports.

## **1.7 Production**

Bangladesh is still a minor strawberry-producing nation with relatively few years of experience in growing this crop compared to other nations. There is a lack of advanced machinery and tools for adaptation and cultivation that compromise productivity and quality. With high quality strawberries being produced in mid-sized economies such as Turkey, Spain and Mexico, there is barely any international demand for Bangladeshi strawberries. At this stage the country is unable to compete in the international market, which is dominated by strawberries from the United States. Furthermore, Bangladesh lacks the proper infrastructure for storage and freezing (e.g. warehousing and cold storage) required by this delicate fruit, which precludes the viability of mass production.



China is a large country in strawberry production. China produced 3.8 million tons of strawberries in 2016, which is 42% of the global strawberry production volume. Other primary strawberry producing countries are the USA (16%), Mexico and Egypt (5% each), and Turkey and Spain (4% each) (Bizcommunity, 2018). Spain, the USA, Mexico and The Netherlands are responsible for 70% of global strawberry export. The global strawberry export volume reached 86 thousand tons in 2016 and has shown a steady growth in the last few years, especially between 2007 and 2011. In 2012 the global export volume of strawberries suddenly increased by 18% and has fluctuated mildly until 2016.

In 2017, world production of strawberries was 9.22 million tons, led by China with 40% of the total, and the United States with 16%. From Table 1.3, shows that the USA is the top strawberry producing country and Germany ranked number 10 for strawberry production.

**Table 1.3: Top ten country of strawberry production in world**

Rank	Country	Production (in tons)
1	USA	1312960
2	Turkey	302416
3	Spain	262730
4	Egypt	240284
5	Mexico	228900
6	Russia	184000
7	Japan	177300
8	South Korea	171519
9	Poland	166159
10	Germany	154418

Source: Sawe, 2017.

## 1.8 Justification of the Study

Strawberry cultivation is an untapped market in Bangladesh, given its health benefits, employment opportunities and growing demand backed by rising middle class income people in the country. If the shortcomings in terms of advanced technology, resources, and an effective storage system to maintain the quality of strawberries are overcome, Bangladesh can move towards mass production and cultivation of the fruit, thereby achieving economies of scale and making it a more profitable venture. The government should help set up an efficient distribution channel with the application of mobile technology which will bring pricing transparency and keep the farmers well informed about the market (Alam et al., 2017). This will help check the unfettered price setting often done by the middlemen in Bangladesh. Strawberries have a short shelf life. By cutting down on the logistical costs, the pricing and quality of the fruit will be more palatable to the consumers. Furthermore, proper storage and freezing facilities can extend the shelf life whereby the consumers can potentially buy strawberries throughout the year.

With an efficient production and supply-chain management, it may be possible to fully meet the local demand, which so far has not been met by a huge margin. Capturing export markets in addition to meeting rising local demand will be the way out for this sector to generate more revenue and create employment to help boost the economy.

In Bangladesh it can be grown everywhere during the month of October to April. Strawberry cultivation was successful in different zone of our country. However, our farmers are new in this field for successful commercial strawberry production. In addition, farmers are facing some sorts of problems such as lack of suitable variety and knowledge of intercultural operation.

Profitability is an important aspect of production decision for the semi-subsistence farming system in Bangladesh. But a few studies are found to analyze the profitability of strawberry cultivation and resource use efficiency (see, review of literature section for details). Therefore, this study has been taken to analyze the

profitability of strawberry cultivation among farming groups and the problems associated with its marketing in Rajshahi district of Bangladesh.

### **1.9 Objectives of the Study**

**The specific objectives are**

- i. To determine the profitability of strawberry cultivation among farming groups;
- ii. To analyze the resource use efficiency of the farmers; and
- iii. To identify the constraints associated with the strawberry cultivation and its marketing in the study areas.

### **1.10 Organization of the Study**

#### **1.10 Organization of the Study**

The study consists of 5 chapters. Chapter 1 describes introduction of the study. Relevant review of literature is presented in Chapter 2, methodology in Chapter 3, results and discussion in Chapter 4 and summary, conclusion and recommendations are presented in Chapter 5.



## REVIEW OF LITERATURE

## CHAPTER II

### REVIEW OF LITERATURE

#### **2.1 Introduction**

A literature review is a text of a scholarly paper, which includes the current knowledge including substantive findings, as well as theoretical and methodological contributions to a particular topic. It is a critical analysis of a segment of a published body of knowledge through summary, classification, and comparison of prior research studies and theoretical articles. It is an evaluative report of information found in the literature related to the selected area of research which is more than the search for information and goes beyond being a descriptive annotated bibliography. A literature review is a critical and in depth evaluation of previous research. It is a summary and synopsis of a particular area of research, allowing anybody recognizing this particular research program, and includes the identification and articulation of relationships between the literature and the field of research. The review of literature will be helpful to justify the research and outline gaps in previous research.

#### **2.2 Literature Related to profitability and economics analysis of strawberry**

**Muliar and Sheikh** (2017) found that the costs of cultivation and returns of strawberry is higher with the size of the orchard while an economic appraisal of strawberry orchard in Meghalaya. Further, the benefit cost ratio of the categories proven that large categories are more beneficial irrespective to its investment. The payback period of strawberry cultivation indicated that large category takes minimum time to meet their expenditure as compared to the other categories of strawberry orchard. However, the constraints regarding the adaptation of strawberry cultivation shows that the unavailability of runners was the major problem for the farmers to adopt the crop. The economics study of the crop

indicated that strawberry fruit is very much profitable so they suggested that efforts should be made through various channels to encourage the farmers for strawberry cultivation for betterment of their economic condition.

**Shaiynti** (2014) has studied the entitled research paper on “Strawberry cultivation: Horticultural Revolution in Meghalaya” This papers objective of the study to highlight how horticultural revolution in the state whit reference to strawberry cultivation has made a drastic change in income, employment opportunities and on the overall socio -economic condition of the people engaged in its cultivation. This paper based research methodology used for mostly primary and secondary sources. The author has analyzed the success of horticulture revolution in strawberry cultivation provides an incentive to the development of other organic and traditional horticulture crops of the state like ginger and vegetables to larger, scale of production and productivity.

**Lesanthanes and Peres** (2013) have studied strawberry production in Brazil of South America. In this article describes the strawberry Industry in Brazil and America. They have analyzed the strawberry produced in all South American countries are for the fresh market and sold locally. However, there is a modest amount of fruit exported to Europe. Authors have estimated annual area of strawberry planting to about 11884, hectares and fruit productions 318 686 metric tons. Argentina and Brazil are the most importer strawberry producers in South America. Authors have estimated annual ara of strawberry planting is about 3500 h.a. where 103,000 metric tons are produced with the fresh market being the major outlet Brazilian strawberry export is modest in 2004 a year that Brazilian export were significant 180 metric tons were France (40%) Spain 12% and Germany 6%. The Argentine market was the principle destination in southern hemisphere.

**Aidoo R. et.al.** (2012) have studied estimation of margin and efficiency in the Ghanoin yam Marketing chain have studied main objectives of paper was to examine the cost, returns and efficiency levels obtained by key players in the Ghanoin yam marketing chain the total of 320 represents in the Ghanoin yam industry were selected. From four districts, they have selected multistage sampling.

Author have analyze the study found out that net marketing margin has highest for cross border yam traders followed by wholesalers. Yam marketing activities among retailers, wholesalers and cross border traders were found to be highly efficient with efficiency ratio in excess of 100%. However, yam marketing amount producer sellers was found to be interpretation with efficiency ratio of about 86%. Author have suggested that recommended policies and strategies to be adopted by central and local government authorities to address key constraints. Such as poor road network limited financial resource poor storage facilities.

**Hoq and Raha et.al.** (2012) described in their study value addition in vegetables production, processing and export from Bangladesh has studied the research paper highlights the Bangladesh has immense prospect for exporting vegetables to the world market and it has also produced high quality exportable fresh vegetable. Although the share of export earning in vegetables increasing day by day but export is constrained by several issues. Thus the present study was undertaken to determine the value addition, cost and return of vegetables production and export at different levels and also suggest some policy implication for improving the present system. The study was based on both primary and secondary data. The sample included vegetables producer, suppliers, and exporters. Vegetable producers and suppliers were selected from Ulokhola of Kaligonj Upazila and exporters were selected from Dhaka city (Motijheel, Kakrail, Shantinagar, Khilgaon, and Sham Bazar). Applying conventional profitability analysis the study noticed that per hectare production cost for cowpea, snake gourd, and bitter gourd were estimated at Tk. 73838, Tk.72,029 and Tk.1,04,644 respectively and value addition for cowpea, snakeroot, and bitter gourd were calculated at Tk.86,162, Tk.1,52,611 and Tk.2,37,356 respectively by farmers. The average estimated marketing costs incurred by suppliers were Tk.2906 per ton. The value addition by suppliers was Tk.3094 per ton. The average estimated marketing cost incurred by different exporters for UK, Saudi Arabia, Kuwait, and Qatar were Tk.1,69,442, Tk.98,429, Tk.1,03,499, and Tk.85,324 per ton, respectively. The value addition by different exporters for UK, Saudi Arabia, Kuwait, and Qatar were Tk.55,778, Tk.16,661, Tk.16,902, and Tk.23,754 per ton respectively. Among all the cost items, airfreight charge was the highest. It was

revealed from the study that bitter gourd cultivation is more profitable and BCR is also highest (3.27) and UK market was more profitable.”

**Banaeian, et.al** (2011) stated in their study entitled Improvement of cost efficiency in strawberry Greenhouses, They Data envelopment analysis become a central technique in productivity and efficiency analysis used in different aspect of economics and management sciences. It is focused on comparing and optimizing the performance of greenhouses. Required data were collected face to face questionnaire from personal of 25 greenhouses Analyzed were based on the amount of four important inputs human labour, fertilizers, capital, and other expenses as input and gross returned produced strawberry as output. According to the average technical (0.73) and pure technical (0.96) efficiency, there is a suitable potential for more efficient and sustainable input utilization in production. Comparison between the Present and target amount of inputs demonstrated that the differences caused by the lack of inputs consumption management and calculate that on overage 54716.65 \$. The has interpreting that if greenhouses follow recommendation and use the projected amount of inputs can save 54716.65 Analysis showed that the most wastage of cost is fertilizers and greenhouses can save (29%) of by the improving management practices.

**Roy** (2011) in their article strawberry revolution has reported the strawberry cultivation in sohliya village the Raibhai district of Meghalaya state. The cultivation of strawberry in solihya was started in 2003. After one decade the income of farmers has been increased from Rs 400 per week to nearby 9000 Rs per week. 99% village households are now growing strawberries. The employment provided to 200 people at wage of Rs70 per day. Rs 200 per kg is price given to the strawberry because its quality.

**California strawberry Export Report** (2011) has published from California Strawberry Commission. In the Report 2011, the Strawberry Export Report reflects trends to total fresh and frozen exports and major exports countries. From the year 2011 report all data for the years 2006-2010 are changing some export trends. In 2010 California exported 246 million pounds of fresh Strawberries and 30.1 million



pounds of frozen Strawberries, with a combined value of \$ 340.9 million. California fresh Strawberry represented 15.1 per cent of the state's fresh crop and 7.2 per cent of frozen production. In 2010 frozen Strawberry export decreased by 3.4% to 2009 and increased 11% compared to 2009. In 2010 fresh exports to Canada increased by 7% compared to 2009. Canada is the largest export market for California Strawberries. Fresh exports to Mexico decreased by 25.1 per cent in 2010 when compared to 2009. In 2010 exports to Japan by 12.6% compared to 2009.

**Payman et. al.** (2010) entitled Energy used and economic analysis of strawberry production in Sanandai zone Iran. In this study was to determine the energy consumption and economics analysis for strawberry production. The data were collected from growing strawberry in the sanriandai zone of Iran by using a face to face questionnaire. The plowing operation at the study area was done by two methods manually Plow (P,) and non-pumping irrigation (NP) Uni variance analysis of variance was used for finding the differences among the total energy used for production and profitability of this crop in the difference method at the 5%, 1% level. At this study the total energy used was 53,605 MJ. ha. In various farm operation during strawberry production „the average annual yield of strawberry farms was 9125, 4 kg, ha, energy output was 17338 MJ. Ha. Energy productivity calculated as 0.17 k.g. MJ and energy efficiency were 0.32 „The benefit cost ratio, productivity, and net profit in the strawberry production were 1.2, 0.99 and 1,825 \$ ha respectively.

**Afridi G et al,** (2009) have made a study “Cost Revenue Analysis of Strawberry Production in the Subtropical Areas NWFP”. The study was conducted in the subtropical areas of NWFP namely Jadai District Mardan and Sarkai in order to trace out the comparative advantages of strawberry cultivation in the Rabbi season; Data were collected through a comprehensive interview schedule to cover almost all the strawberry growers. Author showed that strawberry was cropped on 0.91 acres (25%). The gross revenues per acre of strawberry are estimated at Rs. 154751. In this Research work for production of sapling locally, importing training to the formers in appropriate packing material is strongly recommended for the development of this

valuable crop in the area and due to high capital requirement the strawberry growers should be provided with financial support.

**Ashbin P. et. al** (2004) have studied Economic Feasibility of Producing Strawberries in a passively ventilated Greenhouse in North-Central Florida. Author studied the economic feasibility of a 1-ha greenhouse strawberry enterprise was analyzed. Results from greenhouse studies conducted at the UF protected Ag Project indicated that average yields of 11 kgm<sup>-2</sup> (110 tons per ha) can be obtained under north-central Florida conditions. These yields are 3-4 times greater than those obtained from field-grown strawberries in west-central Florida. Based on average yields of 11 Kgm<sup>-2</sup> from November to March, and average market prices ranging from \$2.10Kg in March to \$3.81 Kg in December, a gross income of \$32.31m<sup>2</sup> or \$762,760/ha and the annual depreciation cost on the initial investment was estimated at \$6.70/m<sup>2</sup> or \$66,976/ha. The variable cost for producing strawberries in a 1-ha passively ventilated greenhouse at a plant density of 22 plants per m<sup>2</sup> and average yields of 500 g per plant (11 Kg m<sup>-2</sup>) was estimated at \$20.91/m<sup>2</sup> or \$209,075/ha. The total cost (annual depreciation on fixed cost + variable cost) for producing 1 ha of greenhouse strawberries was \$28.54/m<sup>2</sup> or \$285, 351/ha. With average yields of 11 kg m<sup>-2</sup> and monthly market prices ranging from \$2.10kg in March to \$3.81Kg in December, a net annual income.

**Charles and Barchy** (2004) have studied, "Cost and Return of Direct Marketing Strawberry Crop." In this study the cost analysis presented here on a complete cost model for a plastic culture production system developed for a 5 acre Strawberry planting. In the research study the equipment cost was based on 2001 purchase prices for New Equipment. The equipment for this analysis included some machinery that could be used for farming enterprises other than growing Strawberries on a typical diversified farm. **Diane** (1995) has studied the U.S. strawberry industry from 1970 to 1993 and has emphasized the changes that have affected the availability and prices of strawberry. The report compares the cultural, practical and marketing season of the major producing states California, Florida and Oregon.

**Fresh Market / World Production and Provide / U.S. Trade Report (1994-2003)** published today's market. According to this report in the last ten years Strawberry harvested area went from 202 thousand hectares in 1994, to a maximum of 232 thousand hectares in 2000, maintaining 230 thousand hectares in 2001 and falling the last two years by around 10%. 20 countries, all from the Northern Hemisphere amounted to 81% at the world Strawberry harvested area in 2003 a high concentration of harvested area that has continued for the last ten years. Six countries Poland, U.S., Russia, Germany, Turkey and Serbia and Montenegro added up to 52% of the World Strawberry harvested area in 2003. Poland has topped statistics of Strawberry harvested areas for the past ten years. After achieving 65 thousand hectares in 2001, it reduced its harvested areas to 39 thousand hectares in the last two years.

**Georg, et.al (2002)** has studied 'Strawberry Enterprise Cost Analysis' In his study. It is observed that the production of Strawberry has been increased in term of acreage from gate value. This is due to high profit potential for small farmer and pre-pick retails sales market production.

**Olga Sydorovych et al. (2002)** have studied "Yield and Pricing Affect Revenue for a direct market Strawberry Business". The study included consumer survey conducted in 1999, which revealed the significant variations in the prices from \$0.70 to \$ 1.05 per pound on an average \$0.88 per pound while fruit stand berries sold for \$ 0.40 more per pound than the PYO berries.

**Jessica Z. et al. (1999)** have studied the prices, volumes and promotions in the fresh Strawberry market, which links the observation from interviews with the producer, managers in local super market with data regarding strawberry prices, volumes and promotions from the berry report issued by the USDA's Federal State Market News Services.

### 2.3 Economics of Strawberry Production

**Prakash and Sarkar** (2017) observed that the overall average cost of strawberry production in Haryana was found to be 937.18 thousand per hectare. The total cost of cultivation was higher in case of large category growers followed by medium and small category. The overall net return earned by strawberry growers was 1174.80 thousand per hectare. Cost of production of strawberry was highest in large 78.57 per kg, followed by medium 74.33 per kg and small 71.34 per kg. Benefit-Cost ratios of strawberry cultivation over Cost A, Cost B and Cost C were 2.79, 2.56 and 2.25, respectively.

**Galic et al.** (2014) made an experiment on financial results achieved in short day strawberry production. The total cost of short-day strawberry production was 54,370 \$CAD/ha. The production and harvest costs in the first and second years were 20,812 \$CAD/ha and 16,930 \$CAD/ha, respectively, and accounted for 69.42% of the total. Pre-plans operations were the least expensive procedures costing 8.13%, while planting and care of young plant made up 22.45% of the total costs. The total income of growing short-day strawberries under a matted-row system was 76,671 \$CAD/ha (the first and second production years 41,330 \$CAD/ha and 35,341 \$CAD, respectively). The short-day strawberries in matted-row system, with average yield of 15,722 kg/ha, generated net revenue of 22,300 \$CAD/ha.

**Loghmanpor et al.** (2013) in their study on input-output energy and economic analysis of strawberry production in Iran, found out the total cost of production of strawberry was as \$ 61.66 thousand per ha and the net return were as 23.33 thousand per ha. Further, the study also concluded that the estimated benefit/cost ratio, and productivity and net profit in the strawberry production were as 1.37, 1.1 kg and 23.33 thousand \$ per ha respectively.

**Jafar and Patil** (2013) conducted a study in three villages of Mahabaleshwer Taluka of Maharashtra state and found that the total cost of production of strawberry for the selected villages were estimated to be 2.64 lakh per acre of which, 39.83 per cent which accounted as cost of planting. They estimated that the profit of strawberry

production is 1.04 lakh per acre. Hence, the study concluded that even though, the cost of production of strawberry was high, estimated volume of production was high which yield maximum profit to the growers.

**Kumar et al.** (2012) conducted a study on production and economics of strawberry at Jammu & Kashmir and suggested that the total cost of production of strawberry was estimated as 3.66 lakh per ha and net returns were estimated as 6.28 lakh per ha. However, the cost benefit ratio was estimated at 2.70 shows the economic profitability of the crop.

**Singh et al.** (2012) in their study in Meghalaya found that the total cost of cultivation of strawberry was 33.75 thousand per ha and the net profit was 14.08 thousand. The study concluded that the cultivation of strawberry on half acre to three acres of land gave an estimated average annual income of 25000-50000 to the growers; which has encouraged the growers to produce strawberry to get remunerative income for their livelihood.

**Banaeian et al.** (2011) worked out to determine the energy use pattern, energy use efficiency, and economic analysis in greenhouse strawberry production in Iran. Data used in this study were obtained from 25 greenhouse strawberry growers using a face to face questionnaire method. The results indicated that greenhouse strawberry production consumed a total energy of 12891.33 MJ per ha. About 78 per cent of this was generated by diesel fuel, 10 per cent from chemical fertilizers, and 4.5 per cent from electricity. Energy ratio, specific energy, net energy and energy intensiveness of greenhouse strawberry production were 0.15, 12.55 MJ per kg, -6, 83,488.37 MJ per ha and 8.18 MJ per \$ and the benefit-cost ratio was found to be 1.74. The mean net return and productivity from greenhouse strawberry production was obtained as 1, 51,907.91 \$ and 0.59 kg per ha, respectively.

**Banaeian et al.** (2011) in their study in Iran found that the total cost of production of strawberry was estimated \$ 1.079 lakh per ha of which 76 per cent of the total expenditure was as variable cost and 24 per cent was fixed cost. The yield estimated as 64 ton per ha and the sale price was estimated as \$ 4.05 per kg. However, the

study also estimated that the gross returns and the net revenue from strawberry production was as \$ 1.774 lakh and \$ 1.519 lakh per ha, respectively.

**Paranjpe and Cantliffe** (2004) conducted a study on economic feasibility of producing strawberry in a passively ventilated greenhouse in North-Central Florida and observed that the total cost of production of strawberries per ha in greenhouse condition was as \$ 2.85 lakh in which the fixed cost was accounted as \$ 76.27 thousand and variable cost \$ 2.09 lakh per ha and the net income from strawberry cultivation was accounted to be \$ 37.74 thousand per hectare.

**Sasane** (1998) studied the strawberry growing enterprise in Satara district of Maharashtra. The study was conducted to estimate per hectare operational cost of strawberry cultivation, to examine the marketing cost, margins, price spread and channels involved in marketing of strawberry and also to identify the problems involved in production and marketing strawberry. The finding of the study showed that the overall per hectare production of strawberry was 102.02 quintals and per hectare total cost of cultivation was ₹ 20,499.06. Per kilogram marketing cost and price realized at the overall level was ₹ 14.81 and ₹ 51.15, respectively. The major constraints faced by the strawberry growers were predominance of commission agents in the market, non-availability of new varieties, lack of cold storage facilities in producing areas, etc.

**Ambad et al.** (1995) worked on input use and strawberry production in Mahabaleshwar area and observed that the yield is 5 to 7 tonnes of strawberry fruit/ha from an Australian cultivar, while the production of Chandler cultivar was about 20 t/ha. The estimated cost of strawberry per kg for Australian cultivar was ₹ 12 to ₹ 20 while that of Chandler cultivar was ₹ 30 to ₹ 40. **Kharse et al.** (1995) estimated per hectare Cost A, Cost B and Cost C of strawberry. They found that these costs were ₹ 1,59,595, ₹ 2,55,387 and ₹ 2,69,854 per hectare, respectively and the estimated value of main produce and by produce together was ₹ 5,66,463. Per kg cost of cultivation of strawberry was estimated at ₹ 15.51. The cultivator received the net profit of ₹ 1,25,851 which worked out to be ₹ 11.72 per kilogram.

**Naikwadi** (1995) worked on strawberry cultivation in Pune and observed that per hectare cost of cultivation of strawberry was 5, 95,011. The average yield of strawberry per hectare was 14,470 kg and the average price of strawberry received per kg was 62.73. The value of main produce was 9, 07,800/ha. The average per kg cost of production was worked out as 52.63 and the net profit was 10.10 per kg.

**Kharche (1994)** studied various details of strawberry production and its economics and recorded the strawberry yield and runners are 15 ton/ha and about 2.5 lakh runners/ha. The value of main produce was worth 15, 00,000/ha, while the value of runners was worth 5, 00,000/ha. The total cost of cultivation of strawberry crop was 12, 27,862/ha. The estimated net profit from strawberry under ideal condition was 7, 72,138/ha. Mali and Kharse (1994) found that per hectare cost of cultivation of strawberry in Pune district was 7, 46,349/ha. Average per hectare yield was 20 metric tonnes and average price received was 60 per kilogram. Gross returns were 19, 50,000, while cost of production was 10,10,949 leaving a net profit of 9, 3,051/ha.

## **2.4 Process of Marketing of Strawberry**

It was mentioned earlier that production process is not considered as complete until the product does not reach to end users. Marketing has to play a significant role in agricultural produce especially fruits. Because fruits are perishable in nature and the volume of production is very high.

**Barat** (2011) in his study in Arkansas observed three stages of marketing chain of strawberry. The first stage was the shipping point that represents the major production regions and the closest point to the farm, second stage was the terminal market represent the wholesaler and that of third stage was the retail market. He further, estimated the margin obtained from various channels and concluded that the margin from shipping points to retail point was 51 per cent, from shipping to terminal was 23 per cent and that from terminal to retail market was 26 per cent and he also indicated that the channel from shipping point to retail market gives maximum profit to the strawberry growers.

**Engelseth et al.** (2011) studied the actors involved for distribution of strawberry in Norway were Farmers → Cooperative → Wholesaler → Industrial Processors and Farmers → Cooperative → Wholesaler → Retailers/HoReCa (Hotel, Restaurant, Catering) and suggested coordinate a set of terminal and handling facilities and facilities through transportation for the actors involved in supply of fresh strawberry.

## **2.5 Marketing Costs, Margins and Price Spread in Marketing of Strawberry**

**Jafar and Patil** (2013) studied the price behavior of strawberry and its various influencing factors in Mahabaleshwar taluka of Satara district. The result of the study showed that prices of strawberry were highly fluctuating and were influenced by freshness, industrial grade and different classes of product. They observed that during the year 2008-09 average prices received by the growers were 87.85 per kg for fresh strawberry.

**Singh et al.** (2012) conducted a study on strawberry growers in Meghalaya and indicated that the state strawberry commanded a higher price in the market and found that the Ri-Bhoi strawberry growers association acted as the main players for marketing. The farm price was estimated to be 120 for grade A and 110 for B and 50-90 for C per kg respectively. The Market price was found to be 300-320 for grade A, 240-260 for B and 200-220 for C per kg. The study also found that enough marketable surplus. Further, the study suggested that government machinery were required to look into production, marketing and credit constraint of strawberry growers.

**Ballington et al.** (2008) in their study on day-neutral strawberry production for season extension in the mid-south of North Carolina found out that on direct-marketing of strawberry produced the marketing cost of strawberry was accounted to be \$ 33.46 per ha, the average marketable yield was 1 kg per plant, average price in the market was \$ 3.31 per kg and the net revenue was estimated as \$ 25.25 thousand per ha.



**Bruchhaus** (2005) in his study on assessment of consumer preferences for strawberries in Louisiana observed two types of marketing chain i.e. direct sale and wholesale. Direct sale includes fruit, vegetable stand, and peddlers pick their own. The fruit and vegetable stand was distributed (20%) on which farmers received less profit, 15 per cent disposed through peddlers, 15 per cent disposed from farmer to market which estimated higher price to the farmers and 10 per cent was distributed through pick their own. Hence, 40 per cent of fruit were disposed through wholesale which on the other hand gives large sale, low marketing cost but estimated low price to strawberry growers.

**Safley et al.** (2004) conducted a study on what makes direct-market strawberry farms successful? In North Carolina and estimated the marketing cost of strawberry was \$ 13.54 thousand per acre. The marketable yield of 12 thousand pound per acre of strawberry and net revenue was estimated of \$ 0.85 to \$ 1.40 per pound and concluded that the total profit received by the growers was \$ 1.38 per pound when the produce was marketed in the local market.

**Sasane** (1998) studied the marketing of strawberry in Satara district of Maharashtra and observed that the total quantity sold in wholesale market was 94.97 per cent, followed by only 5.03 per cent in local market. Per kilogram marketing cost and price realized at the overall level was 14.81 and 51.15, respectively. The major items of cost were packing material, transportation and commission. In all, three channels were observed in marketing of strawberry. About 85.16 and 9.81 per cent of the total quantity was sold through channel-I and II in Mumbai market. The producer's net share in consumer's rupee was 50.21 per cent in channel- I.

**Chavan** (1997) studied the marketing of strawberry in Satara district of Maharashtra and examine the marketing services, market channels and price spread. The study revealed that the maximum quantity (about 48 per cent) of strawberry was sold in Mumbai market, followed by Mahabaleshwar market (about 34 per cent) and remaining 18 per cent of the quantity was sold to the processing units through co-operative marketing society. The grade I quality fruits were sold in Mumbai and Mahabaleshwar market and the entire grade II quality fruits were sold to the

processing units. The producer's share in consumer's rupee was 34.05 per cent, 70.80 per cent and 13.40 per cent in case of Mumbai markets, Mahabaleshwar market and selling to the processing units, respectively.

## **2.6 Problems Faced by the Producers and Traders**

**Prakash et al.** (2018) found that establishment cost at the initial stage of strawberry cultivation was the major financial constraints for resource-poor farmers---. About 96 percent strawberry growers stated that lower success rate of runners is one of the main problems in strawberry. The high cost of runners was reported by 95 percent. About 93 percent of the growers reported that disease and pest problem. More than 90 per cent respondents reported that scarcity of labour and 85 percent stated that unfavourable climatic conditions are the major problems. As far as marketing problems of strawberry is concerned, 100 percent of strawberry growers were reported that lack of scientific storage facilities followed by non-availability of agro-processing units (97 percent), lack of provision of minimum support price (92 percent), lower of prices due to seasonal glut (81 percent), delay in payment by the wholesaler/retailer (72 percent) etc. They also found that traders are facing some problems during the marketing of strawberry. Retailers of strawberry were reported that lack of scientific storage facilities followed by wastage and spoilage (95 percent), highly perishable nature of strawberry fruit (92 percent), lower demand by consumers in local markets (82 per cent) and non-availability of agro-processing units (52 percent) are the major problems.

**Bachhal** (2016) worked on problem and prospect of strawberry cultivation in Haryana. The study revealed that constraints faced by the farmers are high labour charge, non-availability of quality material, high cost of production due to unsuccessful sprouting, lack of MSP, high transportation cost, high fruit perishability, lack of marketing facilities, lack of procurement policy by government, lack of trained extension staff to provide appropriate technical knowledge etc.

**Kumthekar and Jafar** (2010) worked on problems of strawberry production in Satara district in which 330 strawberry growers were selected and data were collected by using a face to face interview schedule. The major problems they identified were lack of awareness of technical knowledge of farming, new technical expertise, poor knowledge for strawberry farming etc.

**Kambara and Shelley** (2002) conducted a study on direct marketing of strawberry in California; USA reported shortage of labour (32.80%), excessive bureaucracy (20%), lack of access to operating capital (19.60%), lack of marketing outlets (15.20%), lack of transportation (15.20%), poor management (8.40%), lack of water (4.40%) and too much competition (3.60%), respectively. Further, the study reported that the most of the farmers quit farming as due to burden of the various constraints.

**Naikawadi** (1995) elaborated the marketing problems experienced by the strawberry growers. These were lack of cold storage, pre-cooling facilities at the village level and predominance of commission agents in marketing of produce. Local demand for the fruit was limited. The study suggested developing cooperative marketing so that the distant markets for the produce could be identified for better return to the growers.

**Kharse et al.** (1995) stated that strawberry should be sold in a very short period of time due to its high perishability. In order to earn more profit, cold storage facilities along with proper transport and market information, etc. will be more helpful. There is a lot of scope for establishing processing industries for preparing strawberry products like jam, jelly, ice-cream, etc.

## **2.7 Concluding Remarks**

Based on the past studies discussed above, it can be concluded that Strawberry is a very remunerative crop revealed by many studies in other country context. However, there are very limited studies on strawberry cultivations in the context of Bangladesh. Moreover, there is hardly any study that investigates the profitability of strawberry cultivation among farming groups and the factors affecting their inefficiency and the problems associated with marketing of strawberry. Therefore, this study has been taken to address the research gap using Rajshahi as a case study for further development of strawberry cultivation in the country.



## MATERIALS AND METHODS

## CHAPTER III

### MATERIALS AND METHODS

#### 3.1 Introduction

Research is a logical and systematic search for new and useful information on a particular topic. It is a search for knowledge, that is, a discovery of hidden truths. Research methods are the various procedures, schemes and algorithms used in research by a researcher during a research study. They are essentially planned, scientific and value-neutral. They include theoretical procedures, experimental studies, numerical schemes, statistical approaches, etc. Research methodology is a systematic way to solve a problem and to study how the research is to be carried out. Essentially, the procedures by which the researcher goes about his/her work of describing, explaining and predicting phenomena are called research methodology. Keeping this view in mind, the researcher took paramount care for using proper methods in all aspects of this research within the encirclements of limited resources, materials and time. The chapter is composed of the methodology of the research, significance and strategies for combining qualitative and quantitative approaches which is intended to show how the research areas were chosen and sampling techniques were used. Besides this, delineation of descriptive statistics, the model for data processing, and so on were also mentioned here.

#### 3.2 Research Design

A research design is the plan, structure and strategy of investigation conceived so as to obtain answers to research questions and to control variance. It is a framework or blueprint for conducting the research. It details the procedures necessary for obtaining the information needed to structure or solve research problems. The function of a research design is to ensure that requisite data in accordance with the problem at hand is collected accurately and economically. Research design is needed

because it facilitates the smooth sailing of the various research operations, thereby making research as efficient as possible yielding maximal information with minimal expenditure of effort, time and resource. It stands for advance planning of the methods to be adopted for collecting the relevant data and the techniques to be used in the analysis. Research design has a significant impact on the reliability of the results obtained. It thus acts as a firm foundation for the entire research. Figure 3.1 displays the design of the present research.

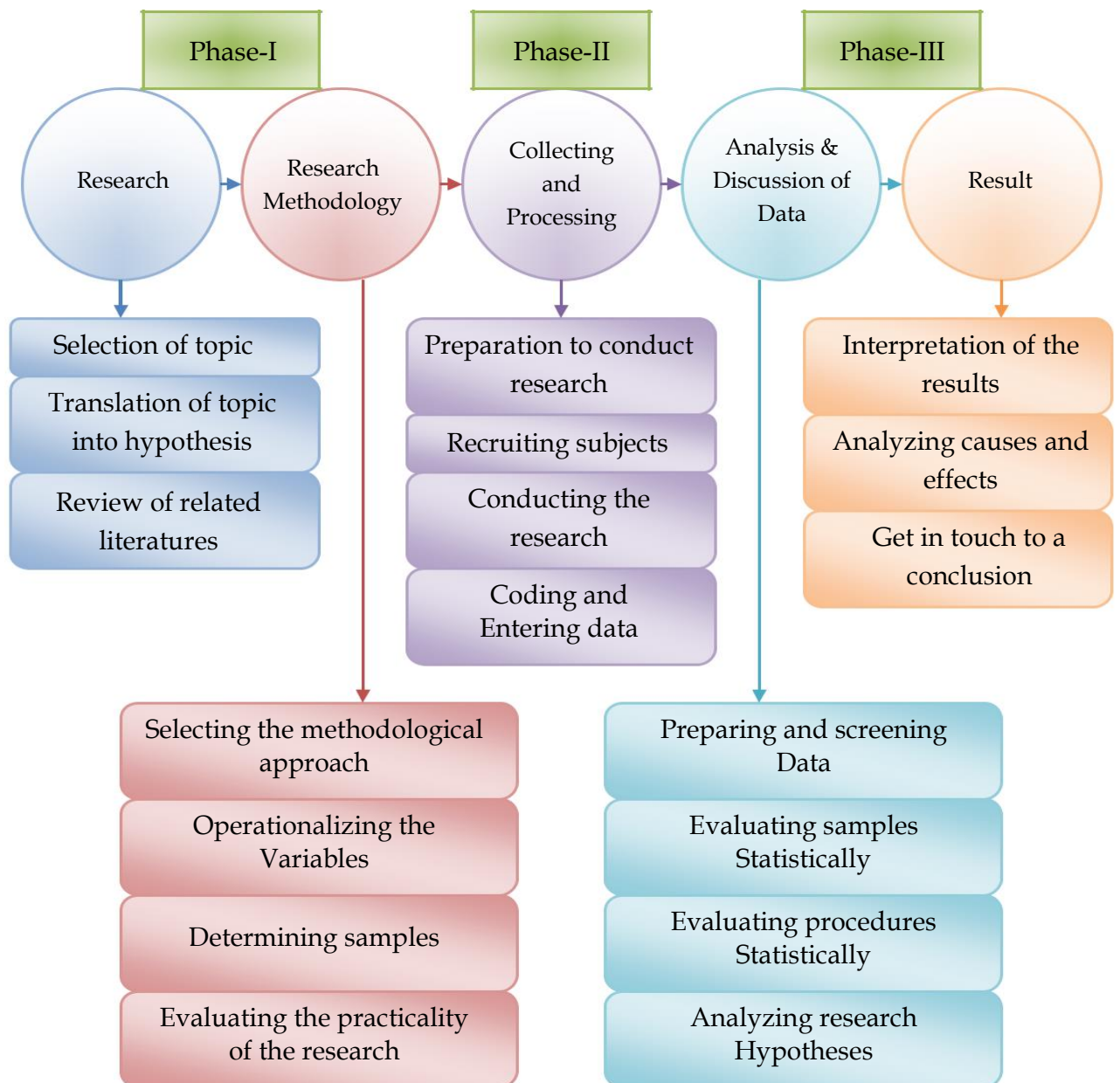


Figure 3.1: The research design

### 3.3 Topography of Bangladesh

The location of the country in South Asia is between 20°34' and 26° 38' north latitude and 88°01' and 92°41' east longitude (BBS, 2017). Bangladesh is a subtropical monsoon country. The average winter temperature is 17-20.6°C, average summer temperature remains at 26.9-31.1°C and average rainfall varies across regions (Shahid, 2010; Shahid and Behrawan, 2008).

### 3.4 Selection of the Research Areas

A research area is geography for which data are analyzed in a report or map. Selection of the research areas is an important step for research. A researcher requires the selection of the areas where the objectives of the research can be fulfilled. According to **Yang** (1965), "The area in which a business survey is to be carried out depends on the particular purpose of the survey and the possible cooperation from the farmer".

For this study three upazilas of Rajshahi district of Bangladesh were selected purposively. The study areas are popular for strawberry cultivation. For marketing analysis, data was collected from the faria of Rajshahi Sadar. Data were also collected from aratdar, wholesaler and retailer from Kawranbazar of Dhaka city.

The main reasons for selecting the villages were as follows:

- i. These villages had some identical characteristics e.g. homogeneous soil type, topographical and climatic conditions those are favorable for producing strawberry.
- ii. The study areas were well communicated with researcher's house that helped her in data collection. It was also easier and less expensive to collect data from that areas.
- iii. The large number of respondents and reliable sources of data were expected to obtain under these study areas.





Figure 3.2: Map of Bangladesh indicating the selected research areas

Legend: ★ Research areas

### 3.5 Selection of Sample and Sampling Techniques

An important part of research work is the selection of sample. Sample is defined as a representative part or a single item from a larger whole or group especially when presented for inspection or shown as evidence of quality. Sampling is concerned with the selection of a subset of individuals from a statistical population to estimate characteristics of the whole population. Population is the entire pool from which a statistical sample is drawn. Each observation measures one or more properties of

observable bodies distinguished as independent objects or individuals. The purpose of sampling is to provide various types of statistical information of a qualitative or quantitative nature about the whole by examining a few selected units.

In this study a multistage sampling technique was applied. At first, Rajshahi district was selected purposively. After that, among nine upazillas in Rajshahi district, three Upazillas were selected purposively considering the intensity of strawberry cultivation. Respondents were selected randomly from the list of growers. The study upazilas were Chorghata, Puthia, and Bagha (Table 3.1).

**Table 3.1:** Selection of research areas and contact persons

Research areas	Contact/Communication
Rajshahi (Chorghata)	Farmers
Rajshahi (Puthia)	Farmers
Rajshahi (Bagha)	Farmers
Rajshahi (Sadar upazila)	Faria
Dhaka (Kawranbazar)	Aratdar, Wholesaler, Retailer

### 3.6 Sample Size

It was not possible to include all the farmers in the study area due to limitation of time, money and personnel. Here a reasonable size of sample was taken into account to satisfy the objectives of the study. In total 60 farmers were selected to achieve the ultimate objective of the study. To get the desired sample at first the list of strawberry cultivator were collected from the agricultural extension officer of the selected upazilas agricultural office. A total of 160 farmers were found to cultivate strawberry in the areas.

The next task was to identify small farmers (having land 0.05 to 2.49 acres) who cultivated strawberry minimum for three years. Out of 160 farmers 110 farmers were identified as small farmer who cultivated strawberry minimum for 3 years. Then a total of 60 farmers were selected randomly from the selected villages.

### 3.7 Preparation of Survey Schedule and Pre-testing

Preparation of the survey schedule is very important in any farm management or production economics study. The main consideration in this respect is to obtain reliable data from the respondents for the preparation of a suitable survey schedule. In conformity with the objective of the study a draft survey schedule was prepared in such a way that reliable data could be collected from the farmers. Then the draft schedule was tested and attention was paid for inclusion of new information which was not included in the draft schedule. The draft survey schedule was pre-tested by researcher herself. The draft survey was conducted among 5 strawberry producers of small farmers in selected areas. Thus the draft schedule was improved, rearranged and modified in the light of the actual and practical experience gained during the pre-test.

After making necessary adjustment a final survey schedule was developed in logical sequence. The final schedule included the following information parts:

- i. General information of respondents
- ii. Land Ownership pattern
- iii. Annual Income
- iv. Overall livelihood status of the households
- v. Human labor used in different operation
- vi. Cost of animal or mechanical powers used
- vii. Materials inputs cost of production
- viii. Total production
- ix. Marketing of strawberry
- x. Distribution of strawberry
- xi. Marketing cost of strawberry for farmers
- xii. Marketing cost of strawberry for intermediaries
- xiii. Marketing margins of strawberry for intermediaries
- xiv. Problems of strawberry production faced by farmers.

### **3.8 Period of the Study**

The researcher collected necessary data through face-to-face interviews with the selected farmers. Data were collected during the period from 15th July to 15th August 2019.

### **3.9 Collection of Data and Accuracy of Data**

Collection of accurate and reliable data and other necessary information from the field is not an easy task. It must be done properly since the success of the survey depends on the reliability of data. The researcher collected the relevant data from the farmers through face to face interview using structured questionnaire. After fixing the survey schedule, the researcher herself stayed in the respective areas and collected the primary data from individual households. Before conducting actual interviews, the whole academic purpose of the present study was clearly explained to the respondents. Initially, the farmers hesitated to answer the questions but when they were assured that the study was purely an academic one and it would not affect them adversely then they were cooperative with the researcher. Farmers were requested to provide correct information as far as possible. Usually, the respondents do not keep records of daily/ annual transactions of their activities. Hence, it was very difficult to collect actual data and the researcher has to rely on the memory of the respondents. Questions were asked systematically in a simple manner and explanation was made whenever felt necessary. After each interview was over, the schedule was checked so as to ensure that information to each item had properly recorded. If there were such items which was over looked or contradictory were corrected by another interview. In order to minimize the errors, data were collected in local unit and later those were converted into standard international units. In the case of any inconsistency and lapses, the neighboring farmers were asked for necessary verification and data were checked and corrected through repeated visits.

### **3.10 Entry and Processing of Data**

For the sake of consistency and completeness each survey schedule was verified after data collection. For proper editing the filled interview schedules were sorted, scrutinized and checked to avoid inconsistency. The data were then transferred from the interview schedule to MS Excel sheet and analysis was done by using STATA and SPSS.

### **3.11 Analytical Techniques**

Data were analyzed with the purpose of fulfilling the objectives of the study. Both descriptive and statistical analysis was used for analyzing the data.

#### **3.11.1 Descriptive Analysis**

Tabular technique of analysis was generally used to find out the socio-demographic profile of the respondent, to determine the cost, returns and profitability of strawberry farm enterprises. It is simple in calculation, widely used and easy to understand. It was used to get the simple measures like average, percentage etc.

#### **3.11.2 Production Function Analysis**

The production function represents the technological relationship between output and factor inputs. To estimate the production function, one requires development of its properties leading to specification of an explicit functional form. One of the most widely used production function for empirical estimation is the Cobb Douglas production. This function was originally used by C.W. Cobb and P.H. Douglas in twenties to estimate the marginal productivities of labor and capital in American manufacturing industries. Their main purpose was to estimate the shares of labor and capital in total product; hence they used this function with the constraint that the sum of elasticities or regression coefficients should total one. Later on, they

relaxed this restraint. Cobb and Douglas originally fitted the function to time series 1930s and 1940s; the same form was used for cross section of industries. This form of the function was subsequently used in many production function studies for technical units (crops, livestock) and farm-firms in agricultures. The popularity of this function is because of the following characteristics of the function:

- i. It directly provides the elasticities of production with respect to inputs;
- ii. It allows more degrees of freedom than other algebraic forms (like quadratic function) which allow increasing or decreasing marginal productivities, and
- iii. It simplifies the calculations by reducing the number of regression to be handled in regression analysis. The original form used by Cobb and Douglas was

$$Q = aL^{\beta}K^{1-\beta}U$$

The Cobb–Douglas production function, in its stochastic form, may be expressed as-

$$Y_i = \beta_1\beta_2X_{1i} \beta_3X_{2i} \beta_4X_{3i} \beta_5X_{4i} \beta_6X_{5i} \beta_7X_{6i} \beta_8X_{7i} \beta_9X_{8i}e^{u_i} \dots\dots\dots (3.1)$$

From Eq. (3.1) it is clear that the relationship between output and the four inputs is nonlinear. However, if we log-transform this model, we obtain:

$$\ln Y_i = \ln\beta_1 + \beta_2\ln X_{1i} + \beta_3\ln X_{2i} + \beta_4\ln X_{3i} + \beta_5\ln X_{4i} + \beta_6\ln X_{5i} + \beta_7\ln X_{6i} + \beta_8\ln X_{7i} + \beta_9\ln X_{8i} + u_i \dots\dots\dots (3.2)$$

Where,

Y = return (tk/acre)

X1= Human labor (tk/man\_days)

X2= cost Tillage (tk/acre)

X3 =cost Seed (tk/acre)

X4 = cost Urea (tk/acre)

X5 = cost TSP (tk/acre)

$X_6$  = cost MOP (tk/acre)

$X_7$  =cost Manure (tk/acre)

$X_8$  =cost Insecticide (tk/acre)

$\beta_1, \beta_2, \dots, \beta_9$ = Coefficient of relative input to be estimated

$u$  = stochastic disturbance term,

$e$  = base of natural logarithm.

The properties of the Cobb–Douglas production function are quite well known and are therefore a linear regression model. Notice, though, it is nonlinear in the variables  $Y$  and  $X$  but linear in the logs of these variables. In short, (3.2) is a log-log, double-log, or loglinear model, the multiple regression counter part of the two-variable log-linear model.

The properties of the Cobb–Douglas production function are quite well known:

1.  $\beta_2$  is the (partial) elasticity of output with respect to the human labor input, that is, it measures the percentage change in output for, say, a 1 percent change in the human labor input, holding the other input constant.
2.  $\beta_3$  is the (partial) elasticity of output with respect to the tillage cost, holding the other input constant.
3.  $\beta_4$  is the (partial) elasticity of output with respect to the seed input, holding the other input constant.
4.  $\beta_5$  is the (partial) elasticity of output with respect to the urea input, holding the other input constant.
5.  $\beta_6$  is the (partial) elasticity of output with respect to the TSP input, holding the other input constant.
6.  $\beta_7$  is the (partial) elasticity of output with respect to the MOP input, holding the other input constant.

7.  $\beta_8$  is the (partial) elasticity of output with respect to the Manure input, holding the other input constant.

8.  $\beta_9$  is the (partial) elasticity of output with respect to the Insecticide input, holding the other input constant.

9. The sum  $(\beta_2 + \beta_3 + \beta_4 + \beta_5 + \dots + \beta_9)$  gives information about the returns to scale, that is, the response of output to a proportionate change in the inputs. If this sum is 1, then there are constant returns to scale, that is, doubling the inputs will double the output, tripling the inputs will triple the output, and so on. If the sum is less than 1, there are decreasing returns to scale doubling the inputs will less than double the output. Finally, if the sum is greater than 1, there are increasing returns to scale doubling the inputs will more than double the output.

Before proceeding further, note that whenever a log-linear regression model involving any number of variables the coefficient of each of the X variables measures the (partial) elasticity of the dependent variable Y with respect to that variable. Thus, a k-variable log-linear model is:

$$\ln Y_i = \beta_0 + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \dots + \beta_k \ln X_{ki} + u_i \dots \dots \dots (3.3)$$

Each of the (partial) regression coefficients,  $\beta_2$  through  $\beta_k$ , is the (partial) elasticity of Y with respect to variables  $X_2$  through  $X_k$ . Assuming that the model (3.2) satisfies the assumptions of the classical linear regression model; we obtained the regression by the OLS.

### 3.11.3 Specification of the Cobb-Douglas Production Function

The input-output relationships in strawberry farming was analyzed with the help of Cobb-Douglas production function approach. To determine the contribution of the most important variables in the production process of strawberry farming, the following specification of the model was used.

$$Y = aX_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} X_6^{b_6} e^{u_i} \dots \dots \dots (3.4).$$



The Cobb-Douglas production function was transformed into following logarithmic form so that it could be solved by ordinary least squares (OLS) method.

$$\ln Y_i = \ln \beta_1 + \beta_2 \ln X_{1i} + \beta_3 \ln X_{2i} + \beta_4 \ln X_{3i} + \beta_5 \ln X_{4i} + \beta_6 \ln X_{5i} + \beta_7 \ln X_{6i} + \beta_8 \ln X_{7i} + \beta_9 \ln X_{8i} + u_i \dots\dots\dots(3.5)$$

Where, Y = return (tk/acre)

X1= Human labor (tk/man\_days)

X2= cost Tillage (tk/acre)

X3 =cost Seed (tk/acre)

X4 = cost Urea (tk/acre)

X5 = cost TSP (tk/acre)

X6 = cost MOP (tk/acre)

X7 =cost Manure (tk/acre)

X8 =cost Insecticide (tk/acre)

B1,  $\beta_2$ .....  $\beta_9$ = Coefficient of relative input to be estimated

u = stochastic disturbance term,

e = base of natural logarithm.

### 3.12 Multicollinearity Test

Economic variables usually exhibit a certain degree of interdependency mostly due to the general interdependence of economic phenomena. However, it becomes difficult to disentangle the effects of each of the explanatory variables on the explained variable where the explanatory variables are highly inter-correlated. The practical question that needs to be asked is how these inter-correlations can be a problem in our inference about the individual parameters and what needs to be

done to redress this problem. In case of two explanatory variables one can judge whether there is a colinearity problem by looking at the correlation coefficient between the two variables. When there are more than two explanatory variables, the simple correlations among them become meaningless. There are several rules of thumb that have been suggested in the literature to detect when multicollinearity can be treated as a serious problem. For instance Klein says, "An inter correlation of variables is not necessarily a problem unless it is high relative to the overall degree of multiple correlation." By Klein's rule multicollinearity would be regarded as a problem only if  $R_{2y} R_{2iy}$  is the squared multiple correlation coefficient between y and explanatory variables.  $R_{2y}$  is total explanatory power of the equation and  $R_{2i}$  represents the squared multiple correlation coefficient between  $x_i$  and other explanatory variables. Following this method  $R_{2i}$ 's is estimated and compared with the  $R_{2y}$ 's for selected explanatory variables for strawberry production function.

### **3.13 Measurement of Resource Use Efficiency**

In order to test the efficiency, the ratio of Marginal Value Product (MVP) to the Marginal Factor Cost (MFC) for each input were computed and tested for its equality to 1. i.e.,

$$\text{MVP/MFC} = 1.$$

The marginal productivity of a particular resource represents the additional to gross returns in value term caused by an additional one unit of that resource, while other inputs are held constant.

When the marginal physical product (MPP) is multiplied by the product price per unit, the MVP is obtained. The most reliable, perhaps the most useful estimate of MVP is obtained by taking resources ( $X_i$ ) as well as gross return (Y) at their geometric means.

In this study the MPP and the corresponding values of MVP were obtained as follows:

$$MPP_{xi} \times P_{yi} = MFC,$$

Where,

$$MPP_{xi} \times P_{yi} = MVP$$

$$\text{But, } MPP = b_i \times (Y/X_i),$$

$$\text{So, } MVP = b_i \times (Y/X_i) P_{yi}$$

Y = Mean output

$b_i$  = regression coefficient per resource

$X_i$  = Mean value of inputs

$P_{yi}$  = price of output

MFC = price per unit of input.

### 3.14 Decision Criteria

The decision criteria for choosing efficiency will be-

**Table 3.1:** Criteria and decision of resource efficiency

Criteria	Decision
$\frac{MVP}{MFC} = 1$	Efficiently used
$\frac{MVP}{MFC} > 1$	Underused
$\frac{MVP}{MFC} < 1$	Overused

\*When the ratio of MVP and MFC is equal to unity indicates that the resource is efficiently used.

\*When the ratio of MVP and MFC is more than unity implying the resource is underutilized.

\*When the ratio of MVP and MFC is less than unity implying the resource is overused.

### **3.15 Profitability Analysis**

Cost and return analysis is the most common method of determining and comparing the profitability of different farm household. In the present study, the profitability of strawberry farming is calculated by the following way

#### **3.15.1 Calculation of Gross Return**

Per acre gross return was calculated by multiplying the total amount of product and by-product by their respective per unit prices.

Gross Return= Quantity of the product × Average price of the product + Value of byproduct.

#### **3.15.2 Calculation of Gross Margin**

Gross margin is defined as the difference between gross return and variable costs. Generally, farmers want maximum return over variable cost of production. The argument for using the gross margin analysis is that the farmers are interested to get returns over variable cost. Gross margin was calculated on TVC basis. Per acre gross margin was obtained by subtracting variable costs from gross return. That is, Gross margin = Gross return - Variable cost.

#### **3.15.3 Calculation of Net Return**

Net return or profit was calculated by deducting the total production cost from the total return or gross return. That is,

Net return = Total return - Total production cost.

### **3.15.4 Undiscounted Benefit Cost Ratio (BCR)**

Average return to each taka spent on production is an important criterion for measuring profitability. Undiscounted BCR was estimated as the ratio of total return to total cost per acre.

$$\text{BCR} = \text{Total Return} / \text{Total Cost}$$

### **3.16 Problem Faced in Collecting Data**

During the period of data collection, the researcher faced the following problems.

- i. Farmers thought that, researcher will use these data for government resource allocation. For that, they were not willing to provide data.
- ii. Most of the farmers are not aware about record keeping of their farm. So, collecting data from them is tough.
- iii. Collecting data by single visit is very hard as, the farmers were busy with their works.



## RESULTS AND DISCUSSION

## CHAPTER IV

### RESULTS AND DISCUSSION

#### 4.1 Socio-Economic Features of Farmers

##### 4.1.1. Age Distribution

The farmers of the research areas were divided into various age groups as displayed in Table 4.1. It is apparent from the table that the majority of the farmers were moderately aged. About 15 percent were in the age group 18-25 years, 67 percent were in the age group of 26-45 years and 18 percent fell into the age group of over 45. This suggests that a larger part of farmers were in the most dynamic age group of 26-45 years showing that they gave progressively physical endeavors to cultivating strawberry.

**Table 4.1** Age Distribution

Age category	Percent (%)
18-25 years	15
26-45 years	67
Above 45 years	18

Source: Field Survey, 2019.

##### 4.1.2. Educational status

Education expands the productivity of human. Education of farmers helps to adopt environmental change and new technology (Alam et al., 2016). Table 4.2 shows that about 11 percent farmers were illiterate, 45.32 percent farmers had primary education, 28.45 percent farmers had high school education and 15.23 percent farmers had finished their education above Secondary School Certificate.

**Table 4.2** Educational status

Level of education	Percent (%)
Illiterate	11.00
Primary school certificate	45.32
Junior school certificate	28.45
Above Secondary School Certificate	15.23

Source: Field Survey, 2019.

#### 4.1.3. Occupational Status

In the research area, the study farmers were managed their livelihood with different kinds of occupations alongside agricultural work. It was seen that, agriculture was the main occupation for strawberry farmers. Some of them had the chance to be occupied with different activities. Table 4.3 showed that 75.90 percent farmers were engaged with agriculture and others were associated with fisheries (8.9%), livestock and poultry (6.30%), services (2.43%) and other profession (6.47%).

**Table 4.3** Occupational status

Types of occupation	Percent (%)
Agriculture	75.90
Fisheries	8.90
Livestock, poultry and duck	6.30
Service	2.43
Others (Rickshaw, van pulling, Business etc)	6.47

Source: Field Survey, 2019.



#### 4.1.4 Gender and marital status

Table 4.4 shows the marital status and gender of the respondents about 97.63 percent of farmers were male and 2.77 percent were female. About 94.37 percent of the farmers were married and 5.63 percent were unmarried.

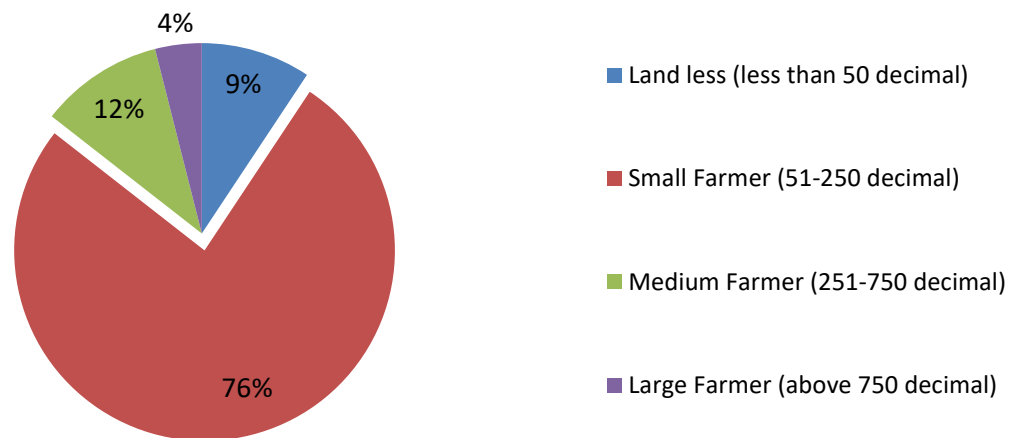
**Table 4.4** Gender and marital status

Particulars	Percent (%)
Male	97.63
Female	2.37
Married	94.37
Unmarried	5.63

Source: Field Survey, 2019.

#### 4.1.5 Farm size and ownership

Farmers of study area were categorized as: landless farmers (less than 49 decimal), small farmer (50-249 decimal), medium farmer (250-749 decimal) and large farmer (above 750 decimal) (GOB, 2009). The Figure 4.1 indicates that 76.23 percent were small farmer, 10.50 percent were medium farmer, only 3.95 percent were large farmer where 9.32 percent farmers were landless. (Source: Field Survey, 2019.)



**Figure 4.1:** Land ownership of the respondents

#### 4.1.6 Income status

Table 4.6 indicates that most of the farmers were belonged to the income category of Tk 150,000 to Tk 250,000 per year that was 63.65 percent of the respondents. About 32.97 percent farmers were in group who earned less than Tk. 150,000 per year and 3.38 percent of the farmers were earned above Tk. 251,000 per year.

**Table 4.6** Income status of farmers

Level of income	Percent (%)
Less than 150,000 Tk.	32.97
151,000-250,000 Tk.	63.65
Above 251,000 Tk.	3.38

Source: Field Survey, 2019.

#### 4.1.7 Dependency Ratio

The average family size of the respondents is 5. In this study the average dependency ratio was found 1.71.

**Table 4.7** Present the depending members per income earner.

Types of farmers	Number
Total family members	310
Total dependent members	196
Total earning members	114
Dependency ratio	1.71

Source: Field Survey, 2019.

#### 4.1.8 Sources of Credit Facilities of the farmer

Funding is an important factor for farming operation. The sources of credit facilities for the strawberry producing farmers include Banks, NGOs, relatives and also their own funding. In the study area different NGOs such as TMSS, BRAC, ASA, CARE, Grameen Bank etc are operating their services for providing loan to the poor farmers, so they can use this fund in the strawberry farming business. But, farmers of the study area are not interested to take loan from financial organization as they thought banking and NGO's procedure are not easy. About 5.32 percent farmers were taken loan from Banks, 16.73 percent farmers were taken credit from NGOs and 23.65 percent farmers were taken loan from their relatives as reported by the sample farmers. And 34.45 percent farmers were used their own funding (Table 4.8).

**Table 4.8 Sources of Credit Facilities of the Sample Farmers**

<b>Financial Organization</b>	<b>Percent (%)</b>
Bank	5.32
NGOs	16.73
Relatives	23.65
Own	54.30

Source: Field Survey, 2019.

#### 4.1.9 Women Involvement

As half of the population of our country is women, they need to join with the main work force. Now, the situation of whole Bangladesh is changing and in our study area 28.53 percent farmers used at least 1 women labor in their farm, 56.23 percent farmers used at least 2 women labor in their farm and only 15.24 percent farmers did not involve women for their work (Table 4.9). So the result implies that involvement of women in strawberry farming activities were good nowadays. Most of the farmers were consulted with their wife for making decision regarding strawberry cultivation and marketing.

**Table 4.9** Involvement of Women

Items No.	Percent (%)
No women involvement	15.24
One women involvement	56.23
Two women involvement	28.53

Source: Field Survey, 2019.

#### 4.1.10 Size of Land Holdings of the Sample Farmers

The size of land holdings of the strawberry producing farmers are classified into different categories. Size of land holdings includes homestead area, orchard, pond, cultivated land, fellow land, leased in, leased out and mortgage in as reported by the sample farmers. It is evident from the Table 4.10 that the average homestead area, cultivated land, leased out and leased in area were 17.25 decimal, 82.36 decimal, 17.17 decimal, 25.10 decimal respectively.

**Table 4.10** Size of Land Holdings of the Sample Farmers

Types of land	Average area (Decimal)
Homestead	17.25
Orchard	4.50
Pond	6.23
Cultivated land	82.36
Fellow land	0.53
Leased in	25.10
Leased out	17.17
Mortgage in	20.14
<b>Total</b>	<b>173.28</b>

Source: Field survey, 2019

## **4.2 Cost and Return of Strawberry Farmers**

### **4.2.1 Variable cost**

#### **4.2.1.1 Cost of human labour**

In case of strawberry cultivation human labour is the vital input that bears a large portion of total cost of strawberry cultivation. For various tasks like land preparation, weeding, fertilizing, using insecticides and herbicides, harvesting etc farmers need human labour. There were two sources of human labour in the study area, one was family supplied labour and another one was hired labour. The valuation of hired labour was done as the nominal cash wages paid to the farmers. It can be seen from Table 4.11 that the amount of human labour used for strawberry cultivation was 325-man days per acre. Total cost of human labour amounted to Tk. 81250 per acre.

#### **4.2.1.2 Cost of tillage**

From the Table 4.11, the cost for tillage was Tk 10000.

#### **4.2.1.3 Cost of seeds**

For strawberry cultivation 7500 seed is needed per acre land. Cost per seed is 50 tk. Table 4.11 stated that total cost of seed for strawberry cultivation is Tk 375000 which is 77.83 percent of total cost.

#### **4.2.1.4 Cost of fertilizers**

Usually farmers used Urea, TSP, MOP for strawberry cultivation. Total cost for fertilizer for per acre production was Tk 11050 (Table 4.11).

#### **4.2.1.5 Cost of manure**

Along with chemical fertilizer, farmers were also used manure for their strawberry production. From Table 4.11, it is shown that, the cost for manure was TK 8000.

**Table 4.11** Variable cost of strawberry cultivation/ acre

Items of returns/costs	Unit	Quantity	Price per unit (Tk)	Total value (Tk)	Percentage of variable cost
Human (hired) labour	Man-day	200	250	50000	10.38
Human (family) labour	Man-day	125	250	31250	6.49
<b>Labor (Total cost)</b>		-	-	<b>81250</b>	16.86
Tillage	Tk	-	-	10000	2.08
<b>Seeds</b>	<b>Pcs</b>	<b>7500</b>	<b>50</b>	<b>375000</b>	77.83
Urea	Kg	250	22	5500	1.14
TSP	Kg	150	25	3750	0.78
MOP	Kg	120	15	1800	0.37
<b>Fertilizer (Total cost)</b>				<b>11050</b>	2.29
Manure	Kg	2000	4	8000	1.66
Insecticides	Tk	n.a	-	6500	1.35
<b>Total</b>	<b>Tk</b>	-	-	<b>481800</b>	100.00

Source: Field Survey, 2019

#### **4.2.1.6 Total variable cost**

The total variable cost for per acre strawberry cultivation was Tk 481800.

#### **4.2.2 Fixed Cost**

##### **4.2.2.1 Interest on operating capital**

Enthusiasm on working capital was determined by considering all the working expenses acquired during the production time of strawberry. Per acre interest on operating capital was Tk 2221.40 for strawberry production.

#### 4.2.2.2 Land use value

The value for using land for strawberry cultivation was Tk 16500.00 per acre of land.

**Table 4.12: Fixed cost of strawberry cultivation**

Items of returns/costs	Unit	Quantity	Price per unit (Tk)	Total value (Tk)
Interest on OC	Tk	22214	@10%	2221.40
Land use value	Tk	1 ha	16500.00	16500.00
<b>Total</b>	<b>Tk</b>	-	-	<b>18721.40</b>

#### 4.2.3 Total cost

As the total cost is the sum of variable cost and fixed cost of strawberry cultivation. In order to estimate total cost per acre all the resources used in strawberry production has been recapture together. Table 4.13 showed that, per acre total cost of strawberry production was Tk. 500521.40.

**Table 4.13: Total cost for strawberry cultivation**

Items of returns/costs	Unit	Variable cost	Fixed cost	Total (Tk)
<b>Total cost</b>	Tk	481800	18721.40	500521.40.

Source: Field Survey, 2019

#### 4.2.4 Gross returns

Gross returns of the strawberry production are the sum of main product and by-product. Strawberry is becoming very popular day by day. The main return of strawberry production is its main product not byproduct. The valuation of by-product of strawberry is very little. Total value of by products is Tk. 25000.00. The

quantity of main product is 2500 Kg. If the price of the strawberry per kg is 420 Tk, then it becomes the total value of strawberry main product is Tk. 1050000. So the gross return of the strawberry production is (1050000.00+ 25000.00) Tk 1075000 per ha.

**Table 4.14:** Gross returns

Items of returns/cost	Unit	Quantity	Price per unit (TK)	Total value(Tk)
Main product	Kg	2500.00	420	1050000
By-product	TK	n.a	-	25000
Total returns	TK	-	-	1075000

Source: Field Survey, 2019

#### 4.2.5 Net return

Net return of the strawberry production is the substitution of total cost from gross return. The net return for strawberry production is Tk. 574478.60.

**Table 4.15:** Net return of strawberry cultivation.

Items of returns/costs	Unit	Gross Return	Total cost	Total value
Net return	Tk	1075000.00	500521.40	574478.60

Source: Field Survey, 2019

#### 4.2.6 Undiscounted BCR

Benefit cost ratio implies return per taka investment. It was calculated by dividing gross return by gross cost or total cost. It helps to analyze financial efficiency of the farm. It was evident from the study that the benefit cost ratio of strawberry farming



was accounted for 2.14 implying that Tk. 2.14 would be earned by investing Tk. 1.00 for strawberry production. So, the strawberry farming was found to be profitable for farmers (Table 4.16).

**Table 4.16:** Undiscounted BCR

<b>Items of returns/cost</b>	<b>Gross Return</b>	<b>Gross cost</b>	<b>Ratio</b>
Undiscounted BCR on full cost	1075000.00	500521.40.	2.14

Source: Field Survey, 2019

#### **4.3.1 Functional Analysis for Measuring Production Efficiency**

Production function is a relation or a mathematical function specifying the maximum output that can be produced with given inputs for a given level of technology. Keeping this in mind, the objectives of the study and considering the effect of explanatory variables on output of strawberry farming, four explanatory variables were chosen to estimate the quantitative effect of inputs on output.

Management factor was not included in the model because strawberry specification and measurement of management factor is almost impossible particularly in the present study, where a farm operator is both a labor and manager. Other independent variables like weeding, machineries, time etc., which might have affected production of farm enterprises, were excluded from the model on the basis of some preliminary estimation. A brief description is presented here about the explanatory variables included in the model.

### 4.3.2 Estimated Values of the Production Function Analysis

- i. F-value was used to measure the goodness of fit for different types of inputs. The coefficient of multiple determinations ( $R^2$ ) indicates the total variations of output explained by the independent variables included in the model.
- ii. Coefficients having sufficient degrees of freedom were tested for significance level at 1 percent, 5 percent and 10 percent levels of significant.
- iii. Stage of production was estimated by returns to scale which was the summation of all the production elasticity of various inputs.

The estimated coefficients and related statistics of the Cobb-Douglas production function for strawberry production are shown in Table 4.17.

**Table 4.17** Estimated Values of Coefficients and Related Statistics of Cobb-Douglas Production Function Model for strawberry.

Explanatory variables	Values of coefficients	Standard error	P value
<b>Intercept/Constant</b>	11.002	1.320	<b>0.000</b>
<b>Human labor</b>	0.613***	0.319	<b>0.000</b>
<b>Seed</b>	0.367***	0.079	<b>0.000</b>
<b>Manure</b>	0.032**	0.015	<b>0.032</b>
<b>TSP</b>	0.186**	0.880	<b>0.026</b>
<b>Urea</b>	0.153	0.087	<b>0.101</b>
<b>MOP</b>	0.272	0.197	<b>0.029</b>
<b>Insecticide</b>	0.046**	0.022	<b>0.047</b>
<b>F value</b>	28.121		
<b>R2</b>	<b>0.724</b>		

\*p < 0.10

\*\*p < 0.05

\*\*\*p < 0.001

**Source: Authors Estimation**

### **4.3.3 Factors Affecting of Strawberry Production**

#### **4.3.3.1 Effect of Human labor:**

From the Table 4.18 it can be seen that the value of the coefficient was positive and significant at 1 percent level of significance. One percent level of significant indicates that the 1 percent increase in the cost of human labor keeping others factor remaining constant would increase the return of strawberry by 0.613 percent.

#### **4.3.3.2 Effect of seed:**

The value of the coefficient of seed was positive and significant at 1 percent level of significance. One percent level of significant indicates that the 1 percent increase in the cost of seed keeping others factor remaining constant would increase the return of strawberry by 0.363 percent.

#### **4.3.3.3 Effect of Manure:**

It was observed from the regression that the coefficient of the use of manure was positive and significant at 5 percent level of significance. Five percent level of significant indicates that the 5 percent increase in the manure of urea keeping others factor remaining constant would increase the return of strawberry by 0.023 percent.

#### **4.3.3.4 Effect of TSP:**

It was observed from the regression that the coefficient of the use of manure was positive and significant at 5 percent level of significance. Five percent level of significant indicates that the 5 percent increase in the manure of urea keeping others factor remaining constant would increase the return of strawberry by 0.186 percent.

#### **4.3.3.5 Effect of Insecticide:**

It was observed from the regression that the coefficient of the use of insecticide was positive and significant at 5 percent level of significance. Five percent level of significant indicates that the 5 percent increase in the insecticide of urea keeping others factor remaining constant would increase the return of strawberry by 0.046 percent.

#### **4.3.4 Value of R square**

The multiple co-efficient of determination ( $R^2$ ) is a summary measure which tells how the sample regression line fits with the data. In this table the value of  $R^2$  was 0.724 that means the variables considered in the models can explain 72 percent of the variation in yield explained by independent variables include in the model.

#### **4.3.5 Value of F**

In the table the F value was found 28.121 which is significant at one percent level implying that the explanatory variables included in the model were important for explaining the variation in gross return of strawberry production the variation of yield mainly depends on the explanatory variables include in the model.

### **4.4 Resource Use Efficiency in Strawberry Production**

In order to identify the status of resource use efficiency, it was considered that a ratio equal to unity indicated the optimum use of that factor, a ratio more than unity indicated that the yield could be increased by using more of the resources. A value of less than unity indicated the unprofitable level of resource use, which should be decreased to minimize the losses of strawberry because farmers over used this variable. The negative value of MVP indicates the indiscriminate and inefficient use of resource.

The ratio of MVP and MFC of human labor (0.032) for strawberry production was positive and less than one, which indicated that in the study area human labor was over used (Table 4.18). So, farmers should increase the use of human labor to attain efficiency considerably.

Table 4.18 showed that the ratio of MVP and MFC of seed (0.030) for strawberry production was positive and less than one, which indicated that in the study areas

seed for strawberry production was over used. So, farmers should decrease the use of seed to attain efficiency level.

The ratio of MVP and MFC of manure and TSP was found to be 1.075 and 2.12 respectively for strawberry production which indicated that in the study areas use of manure and TSP for strawberry production was underused (Table 4.18). So, farmers should increase the use of fertilize for strawberry production to attain efficiency considerably.

**Table: 4.18** Estimated Resource Use Efficiency in Strawberry Production

Variables	Geometric mean (GM)	Y(GM)/X <sub>i</sub> (GM)	Co-efficient	MVP (Xi)	MFC	r= MVP/MF C	Comment
<b>Yeild</b>	1075000						
<b>Labour</b>	81250	13.23	0.613***	8.11	250	0.032	Over utilized
<b>Seed</b>	375000	2.87	0.367***	1.05	50	0.030	Over utilized
<b>Manure</b>	8000	134.37	0.032**	4.30	4	1.075	Under utilized
<b>TSP</b>	3750	286.67	0.186**	53.32	25	2.12	Under utilized

Source: Field survey, 2019

#### 4.5 Channels of strawberry marketing

Marketing channel is the process through which a product flows on its way to the ultimate consumers. A number of intermediaries were found in strawberry marketing channels. They were faria, bepari, aratdar, wholesaler and retailer. They performed the marketing function of buying and selling, assembling, grading,

storage, transportation, risk bearing etc.

The typical model of strawberry marketing channels in the study areas are shown below:

Channel 1: Producers→ Faria→ Aratdar→ Retailer→ Consumer.

Channel 2: Producers→ Wholesaler→ Retailer→ Consumer.

Channel 3: Producers→ Bepari→ Wholesaler→ Retailer→ Consumer.

Channel 4: Producers→ Retailer→ Consumer.

Channel 5: Producers→ Wholesaler→ Distant Wholesaler→ Retailer→ Consumer.

#### 4.5.1 Farmer's place for sale of strawberry

For the constrains in transportation farmers prefer to sale maximum amount of their production in local market: 65% of strawberry were sold in the local market to the bepary or faria at a lower price than market price. Only 20% farmers sale their product to upazila market with higher price.

**Table 4.19:** Place for sale of strawberry.

Place of sale	Percentage	Price/kg	Reason of sale
Local market	65	420	Easy to transport
Upazila market	20	440	High price
Kawranbazar	10	460	Higher price
Farmgate, Dhhaka	5	520	Higher price

#### 4.5.2 Marketing cost of strawberry for farmers (per kg)

**Table 4.20:** Marketing cost of strawberry for farmers for marketing channel 3

Item of cost	Amount (tk/kg)
Transportation	10
Commission of dalal	20
Market toll	20
Personal	30
Others	20

#### 4.5.3 Marketing cost of strawberry for intermediaries

From the Table 4.23 it is observed that, on an average, the marketing cost of strawberry for wholesaler was Tk. 16.67/kg. The marketing cost for aratder, bepari, faria and retailer was Tk 18.94, Tk 13.67, Tk 9.09 and Tk 11.59 per kg respectively (table 4.21).

**Table 4.21:** Marketing cost of strawberry for intermediaries (per kg)

Cost of item	Faria	Bepari	Aratder	Wholesaler	Retailer
Labour changes (loading, unloading & grading)	2.30	4.70	5.12	4.70	2.30
Transportation	1.45	3.03	2.68	2.03	1.45
Tolls & taxes (market & road taxes)	0.25	0.87	0.79	0.87	0.25
Cost due to spoilage	1.25	2	3	4	1.25
Commissions of dalal	1.34	2.32	2.55	2.32	1.34
Establishment	1	3	2	1	2.50
Personal expences	1	1.25	1.80	1.25	2
Others	0.50	1.50	1	1.50	0.50
Total	9.09	13.67	18.94	16.67	11.59

#### 4.5.4 Marketing margin of intermediaries

Table 4.21 showed that, bepari purchased from farmers or from farias at Tk. 440 per kg and sold to aratdar at Tk. 470. Wholesaler purchased at Tk. 510 and sale at Tk.550. Retailer purchased at Tk. 550 and sale at Tk.600. So, gross margin of bepari, aratdar, wholesaler, and retailer were Tk. 30, Tk.40, Tk.40 and Tk. 50 respectively. Retailer is the highest gross margin earner.

**Table 4.22:** Gross marketing margin of intermediaries/kg

Intermediaries	Purchase price	Sale price	Gross margin
Faria	420	440	20
Bepari	440	470	30
Aratdar	470	510	40
Wholesaler	510	550	40
Retailer	550	600	50

#### 4.5.5 Net marketing margin of intermediaries

Table 4.21 indicated that the net market margin of faria, bepari, aratdar, wholesaler, and retailer was Tk. 10.91, Tk. 16.33, Tk. 21.06, Tk.23.79 and Tk 38.41 respectively. Retailer achieved higher net marketing margin.

**Table 4.23:** Net marketing margin of intermediaries/kg

Intermediaries	Purchase price	Sale price	Gross margin	Marketing cost	Net margin
Faria	420	440	20	9.09	10.91
Bepari	440	470	30	13.67	16.33
Aratdar	470	510	40	18.94	21.06
Wholesaler	510	550	40	16.21	23.79
Retailer	550	600	50	11.59	38.41



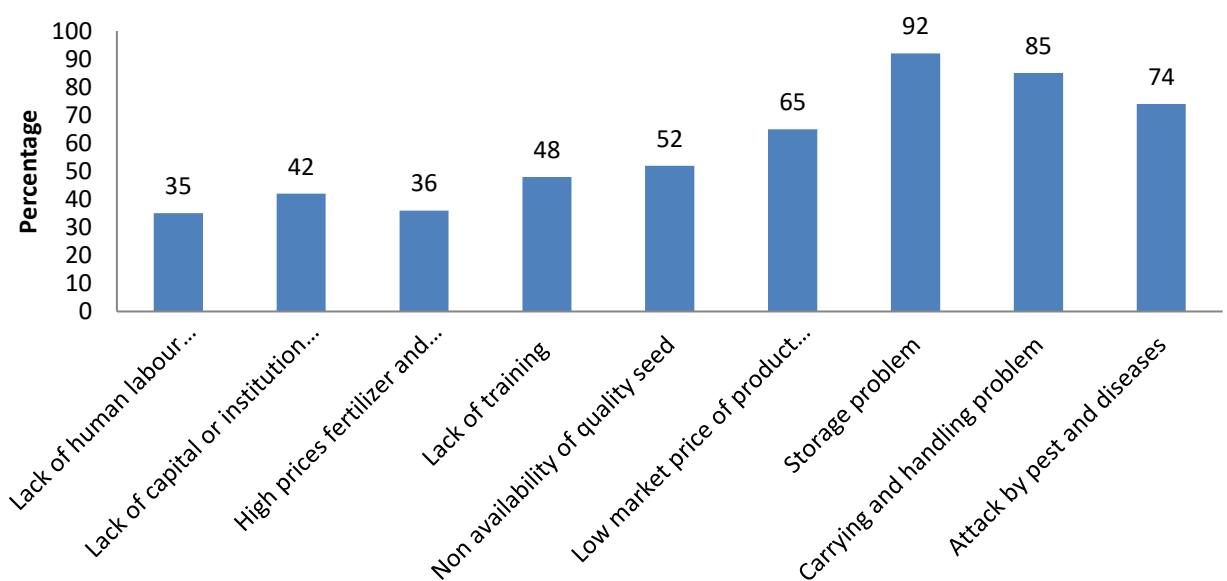
## 4.6 Constraints Associated With Production and Marketing of Strawberry

### 4.6.1 Lack of human labour availability

Strawberry cultivation was labour intensive. Non-availability of human labour was one of the major problems faced by the strawberry growers. It was observed from figure 4.2 that about 35 percent of the selected strawberry growers faced acute shortage of human labour in strawberry production.

### 4.6.2 Lack of financial capital or institutional credit

Production of selected winter vegetables needs proper doses of fertilizer, irrigation water and insecticides in addition to special agronomic care and therefore strawberry growers need sufficient money to buy the necessary inputs. In the study area about 42.00 percent of total growers reported that they did not have adequate amount of operating capital (Figure 4.2). Most of the growers did not get institutional credit and therefore, they had to borrow money from neighbors, relatives, bank and moneylenders at exorbitant rate of interest. Financial disability and pressing need for cash money forced them to borrow money from non - institutional sources.



**Figure 4.2:** Major problems faced by the farmers Source: Field survey, 2019

#### **4.6.3 High price of fertilizers and insecticides**

Fertilizer and insecticides are vital inputs in the production of strawberry. During cultivation period, the prices of fertilizers and insecticides went up due to profit making motive of both retail and wholesale. About 36 percent strawberry growers complained about high price rate of fertilizers and insecticides.

#### **4.6.4 Lack of Training**

Training is very essential to increase productivity. Training develops the skill of farmers which ultimately increases the productivity. About 48 percent of the selected strawberry growers reported that the productivity of strawberry was low due to lack of training.

#### **4.6.5 Non-availability of quality seeds and high price of seed/seedlings**

Non-Availability of improved seeds was another limiting factor in producing strawberry. About 65 percent farmers reported this as a problem (Figure 4.2). Most of the growers purchased seeds but they opined that in many cases, the seeds were not good quality and the price of seed was too high during the planting period.

#### **4.6.6 Low market price of product at harvesting period**

It was observed that the prices of strawberry in the harvesting period were very low. About 65 percent of the selected strawberry growers reported that the price of strawberry was low during the harvesting period and soon after the harvesting period it went up. Many of the farmers were compelled to make distress sale in order to meet the urgent needs of cash for their day - to -day's household expenditures that led to increase the supply of their products in the village market at harvesting period and thereby lowering the selling price per unit.

#### **4.6.7 Storage Problems**

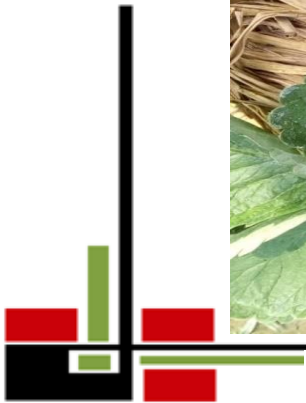
Lack of proper storage facilities was the most important problem regarding selected strawberry marketing. In fact 92 percent of strawberry growers complained against the storage problem (Figure 4.2). Storage of strawberry is not possible under ordinary condition because strawberry fruits are highly perishable. Therefore, due to lack of proper storage facilities the farmers did not get fair prices.

#### **4.6.8 Carrying and handling problems**

Due to carrying and handling problem the growers used to sell their product to 'paikar' at the local markets and a few growers sold their products at farm gate. Figure 4.2 showed that about 85 percent of the strawberry growers treated about carrying and handling as a problem. Farmers also reported that they could not take advantage of the higher price prevailing at distant market due to lack of carrying and handling facilities. Adequate carrying and handling facilities at reasonable cost would improve the efficiency of strawberry marketing.

#### **4.6.9 Attack by disease and pest**

Farmers mentioned that considerable amount of yield of strawberry were lost by the attack of pests and diseases. In the study area about 74 percent strawberry growers faced this problem (Figure 4.2).



**SUMMARY, CONCLUSION  
AND POLICY RECOMMENDATION**

# **CHAPTER V**

## **SUMMARY, CONCLUSION AND**

### **POLICY RECOMMENDATION**

#### **5.1 Introduction**

This section delivers the summary, conclusion, policy recommendations and limitations of the research with germane structures of introduction, methodology, socioeconomic characteristics, and main findings.

#### **5.2 Summary of the Research Findings**

Between 1973/74 and 2016/17, agricultural GDP has increased by 5.8 times. Value of agriculture GDP has increased from 5.21 billion dollars to 28.92 billion dollars. All sub-sectors of agriculture (crop, livestock, fisheries and forestry) have increased substantially. Crop GDP has increased by 4.4 times, livestock GDP has increased by 5.8 times and forestry GDP has increased by eight times.

Strawberry is relatively new crop introduced in Bangladesh in extremely little scale. Various areas of Bangladesh are reasonable to develop strawberry as far as photoperiod, temperature and dampness. It is an ideal opportunity to explore for improving strawberries assortments which are developed in our condition. On the other hand, since fruits can be obtained early in the seasons where there is no fresh fruit in the market its marketability is high. Another important aspect is that it can bring back the investment in a short period therefore it is suitable for farming. Apart from these, the incomes per unit area are high in strawberry cultivation. Due to all these advantages strawberry area is gradually increasing in Bangladesh.

The study was conducted to achieve the following objectives-

- To compare the profitability of strawberry cultivation among farming groups
- To analyze the resource use efficiency of the farmers
- To identify the constraints associated with the strawberry cultivation and its marketing in Bangladesh.

The study was mainly based on primary data, which were collected by the researcher herself through interviewing the sample farmers. A total of 60 strawberry farmers were selected from Rajshahi district, the most important area for strawberry cultivation. Three uazillas of Rajshahi district were selected purposively as the study area. Survey method was followed to collect data while, simple random sampling technique was used to select the farmers. Tabular as well as statistical technique was followed to fulfill the objectives of the study. Data was collected from July to August 2019. Besides, a descriptive tool and tabulation technique was also used in the study. Primary data were recorded into Microsoft excel and economic analysis was carried out to STATA for determining factor affecting strawberry cultivation. In this study, cost and return analysis were done on both variable and total cost basis.

With respect to socioeconomic features of the sample farmers, the findings revealed that about 67% of the farmers were in the age group of 26-45 years. This suggests that a larger part of the study farmers were in the most dynamic age group of 26-45 years showing that they would give progressively physical endeavors to cultivating.

Out of 60 sample farmers, 9 percent farmers were illiterate, 52.80 percent farmers had primary education, 31.50 percent farmers had finished Secondary School Certificate and 6.40 percent farmers had finished their education above Secondary School Certificate.

In the research area, the chosen farmers were managed their livelihood in with different kinds of occupations alongside agricultural work. It was seen that, agriculture was the main occupation (75.90%) for strawberry farmers. Some of them had the chance to be occupied with different activities such as fisheries, livestock, services and other profession.

To determine the profitability of strawberry both the inputs and outputs were valued at market price during the study period. For analytical advantages, the cost item was identified as human labor, seed, fertilizer, insecticides, land use cost, and interest on operating capital. Cost and returns were worked out to estimate profitability of strawberry production. The yield of strawberry was 2500 kg per acre and price of per kg was Tk.420. So the gross return was Tk 1075000. Net return of the strawberry production was Tk. 590978.60.

Benefit cost ratio implies return per taka invested. It was calculated by dividing gross return by gross cost or total cost. It helps to analyze financial efficiency of the farm. It was evident from the study that the benefit cost ratio of strawberry farming was accounted for 2.14 implying that Tk. 2.14 would be earned by investing Tk. 1.00 for strawberry production. So, the strawberry farming was found to be profitable for farmers.

In this study, Cobb-Douglas production function model was used to determine the effects of key variable cost. It was observed that cost of seed, fertilizer and human labor was significant at 1%, 5% and 10% level and the other cost like wedding and insecticides were insignificant. The value of  $R^2$  was 0.724 that means the variables considered in the models can explain 72 percent of the variation in yield explained by independent variables include in the model. The F value was found 28.121 which are significant at one percent level implying that the explanatory variables included in the model were important for explaining the variation in gross return of strawberry production.

The ratio of MVP and MFC of human labor (0.032) for strawberry production was positive and less than one, which indicated that in the study area human labor was over used (Table 4.18). So, farmers should increase the use of human labor to attain efficiency considerably.

Table 4.18 showed that the ratio of MVP and MFC of seed (0.030) for strawberry production was positive and less than one, which indicated that in the study areas

seed for strawberry production was over used. So, farmers should decrease the use of seed to attain efficiency level.

The ratio of MVP and MFC of manure and TSP was found to be 1.075 and 2.12 respectively for strawberry production which indicated that in the study areas use of manure and TSP for strawberry production was underused (Table 4.18). So, farmers should increase the use of fertilize for strawberry production to attain efficiency considerably.

This study also identified some of the problems and constraints associated with strawberry farming. Farmer faces several types of problems from production period to harvesting period. For example, lack of human labour availability, lack of capital or institution credit, high prices of fertilizer and insecticides, lack of training, non-availability of quality seed, low market price of product during harvesting period and storage problem.

### **5.3 Conclusions**

Strawberries are growing in many areas of Bangladesh. This study investigates the production and marketing issue of Strawberry in Rajshahi district using survey data. It is evident from the Cobb-Douglas production function model, that the variables included in the model had significant and positive effect on strawberry production except the negative and insignificant effect of pesticide. Resource use efficiency indicated that in case of seed, fertilizer and human labour; the resources were under used for strawberry production. In case of seed and pesticide the resources are over utilized. So there is a positive effect of key factors in the production process of year round strawberry cultivation. And by profitability analysis, this is found that, the strawberry cultivation as a profitable business for farmer. So it has a great potential in future profit margin of the farmer. There is an ample opportunity to improve per acre yield of year-round strawberry production. To enhance the productivity, efficiency and effectiveness of strawberry farming, the following recommendations



are made for enhancing strawberry production in Rajshahi district in particular and Bangladesh in general.

#### 5.4 Recommendations

The researcher had conducted a small piece of experimental research which could not make available all the needed information to understand the appropriate impact of strawberry cultivation on the farming community. Therefore, keeping different internal and external factors in contrast, a set of policy actions are suggested in the context of Bangladesh which is presented here in the form of recommendation matrix:

**Table 5.1** Recommendation matrix indicating issues that needed further research, extension and policy recommendation

Facts of consideration	Recommendations		
	Research needed	Extension needed	Policy intervention needed
Nourishment of farmers' knowledge	√	√	
Involvement of government and non-government organizations to provide basic acquaintance to the farmers			√
Arrangement of training programs by different local, national and international institutions	√	√	
Regular extension contact from the view point of extension agents		√	
Ensuring the availability of agricultural inputs at the time of requirement	√		√
Enhancing direct input support as well as input subsidy programmes for the betterment of the farmers	√		√
Providing farmers' access to modern agricultural equipments and machineries to facilitate the practice of conservation agriculture		√	√
Inspiring the farmers to use organic fertilizers instead of synthetic fertilizers	√		√
Accessibility of the farmers to institutional credit			√
More accessibility of the farmers to extension services		√	√

## 5.5 Limitations of the Research

The limitations of the research are those characteristics of design or methodology that had an impact or influence on the interpretation of the findings from the research. They are the constraints on generalization, applications to practice and utility of the findings that are the result of the ways in which the design of the study and the methods used to establish internal and external validity were initially chosen. However, to conduct the research in a meaningful and manageable way, it is necessary to confess some limitations which are as follows:

- The research areas were cramped to Rajshahi district. Agricultural characteristics of these research areas might not represent a generalized picture of the country.
- Socioeconomic characteristics of the farmers included a wide range of variation. Time and resource constraints did not allow the researcher to incorporate all of them. Hence, only few usual characteristics of the farmers were selected for investigation.
- Sometimes, the farmers could not remember some information in accurate manner which was exactly needed to the researcher. In case of that situation, the researcher noted the information based on the ideas of the respondents.
- For some cases, the researcher faced startling intrusion from over interested side talkers while collecting data from the respondents. However, the researcher tried to overcome this problem as far as possible with ample skill and proficiency.
- Moreover, academic and research institutions such as Rajshahi University and Bangladesh Agricultural Research Institute (BARI) should work to innovate and help attain genetic diversity in strawberries, which is one of the primary needs in the strawberry cultivation sector. If done so, new and enhanced standards could make Bangladeshi strawberries cost competitive in the international market and thus pave the way for export opportunities while meeting local demand.

## 5.6 Scope for Further Study

Although the present study is intended to provide some valuable information for the guidance of farmers, extension workers, policy makers as well as researchers, it is not free from criticisms. Due to limitation of time and resources this study could not cover some important areas. The weaknesses of the present study, of course, open avenues for further research which are given below:

- i. A broad based study in this line may be undertaken for better understanding not only to study relative profitability of strawberry but also with other crops.
- ii. A further study can be undertaken by taking into account different farm sizes to assess the impact of profitability of strawberry on income and employment opportunity.
- iii. The study of other varieties of strawberry may be conducted individually to assess their comparative profitability.
- iv. Acreage response, growth and instability of strawberry can be studied with respect to Bangladesh.



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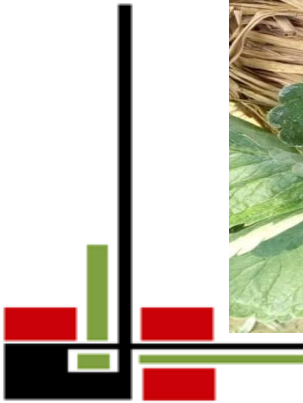
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## APPENDIX

## APPENDIX

**Department of Agricultural Economics**  
**Sher-e-Bangla Agricultural University**  
 An Interview Schedule on  
**Profitability and Marketing of Strawberry Cultivation in Rajshahi District**

**Address:** \_\_\_\_\_ **Contact Number:** \_\_\_\_\_ **Serial No.:** \_\_\_\_\_  
**Village:** \_\_\_\_\_ **Union/Pourashova:** \_\_\_\_\_ **Upazilla:** \_\_\_\_\_

### 1. General information of the Respondent.

<b>Name of the Respondent:</b>	
<b>Gender:</b> Male/Female	<b>Age:</b>
<b>Education:</b>	
<b>Marital status:</b> Unmarried= 1, Married = 2, Widow = 3, Divorced = 4	
<b>Family Size:</b> Male-    Female-    Children-    Old (60)-    Earning members:	
<b>Main occupation:</b>	<b>Secondary occupation:</b>
<b>Farming experience:</b> .....Years	

### 2. Land Ownership pattern.

Types of land	Area (acres)
a. Own Cultivated Land	
b. Rented In	
c. Rented Out	
d. Mortgaged In	
e. Mortgaged Out	
f. Fellow Land	
<b>Total land</b>	

### 3. Annual Income

Sector of Income	Source of income	Annual income
Agriculture	1.Rice	
	2.Wheat	
	3.Fisheries	
	4.Livestock	
	5.Others farm	
	6. Fruits	

	7.Vegetables	
	8.Homestead	
	9.Forest	
	10.others	
Total income from agriculture		
Non-Agriculture	1.Service	
	2.Business	
	3. Remittance/Pension	
	3.Others (selling labour, rickshaw pulling etc)	
Total annual Income from non-agricultural sector		

#### 4. Overall livelihood status of the households.

Questions on livelihood status	YES	NO	If NO, why ?
Does your family use sanitary toilet?			
Does your family use tube well water?			
Does your family use electricity?			
Does your family buys new clothes during festivals?			
Does your family offers gifts to relatives during different social events?			
Do you adopt any contraceptive method?			
What type of doctors do you normally visit while you are sick?	(a) MBBS, (b) Village doctor (c) Homeopathic, (d) Quack		
Does your family send children to school?			
Are you a member of any cooperative society?			
Have you any saving accounts?			
Are your family members a member of cooperative society?			
Do you explore and utilize information technology for professional, health and family planning activities			
Have you received any training in your profession			
Do you get cooperation from other village people in case of your need?			
Do you adopt zero tillage cultivation			
Do you adopt new cropping practice			
Do you adopt improved management of weeds			
Do you adopt improved management of manure			

Do you adopt IPM			
Do you cultivate multiple crops			
Do you allow women in decision making process			
Do you have contract with NGO Workers?			
How do you get information related to Agriculture? A. Radio NGO Workers D. Extension Workers E. Neighbors F. Local Elite G. Own			
Year of experience in main profession	.....Years		

### Land under Strawberry

#### 6. Human Labor used in different operation

Name of items		Strawberry production				
		No. of labor		Taka/labor	Total	(Tk)
		Own(family)	Hired			
Land preparation	M					
	F					
Manure & fertilizer	M					
	F					
Weeding	M					
	F					
Irrigation	M					
	F					
Pest management	M					
	F					
Harvesting	M					
	F					
	F					
Total	M					
	F					

#### 7. Cost of animal or mechanical powers used

Name of practices	Strawberry production				
	Name of Machine/ Animal			Rent per machine/animal (Taka)	Total (Tk)
		Own	Hired		
Tillage					
Weeding					

Spraying					
Total					

### 8. Materials inputs cost of production

Inputs	Unit Price	
	Own	Hired
Seed		
Manure		
Fertilizer		
a. Urea		
b. TSP		
c. MP		
d. Gypsum		
e. Zinc		
Pesticide		
Irrigation		
Others (specify)		
Total		

### 9. Total Production.

Items	Quantity	Price/Return
Main product		
By product(leaf)		
Total		

### 10. Where and to whom did you sale your Strawberry?

Place of sale	Percentage	Price/unit	Reason of sale	Actors	Percentage	Price/unit	Reason of sale
Farm gate				Bepari			
Local market (Village)				Paiker			
Upazila Market				Retailer			
				Consumers			
				Restaurants			

### Distribution of product

Items	Amount (Kg)
Total Production	
Consumption	
Distribution	
Wastage	
Total sales	

### 12. Marketing cost of Strawberry for farmers.

Item of cost	Amount(tk)
Transportation	
Commission of dalal	
Market toll	
Personal	
Others (specify)	

### 13. Marketing cost of Strawberry for Intermediaries.

Cost of Item	Faria	Bepari	Aratdar	Wholesaler	Retailer
Labour changes (loading, Unloading & grading)					
Tolls & Taxes (market & road taxes)					
Transportation					
Cost due to spoilage					
Commissions of dalal					
Establishment					
Personal expenses					
others					

### 14. Marketing Margins of the Strawberry Intermediaries.

Intermediaries	Purchase price	Sale price
Faria		
Bepari		
Aratdar		
Wholesaler		
Retailer		

What is your source of capital?

Source	Interest rate	Source	Interest rate
Own fund = 1	Nil	NGO = 5	
Bank loan = 2		Friends and relatives = 6	
Money lenders = 3		Other (Specify) = 7	
Traders (Aratdar) = 4			

- b) Do you get loan from Bank for your agricultural activities/ production of Strawberry? Yes = 1, No = 0
- c) If no, why: Lending institution is far (distance) = 1, Lack of guarantees/collateral = 2, Non-cooperation from the financial institutions = 3, Others (specify) = 4

#### 16. Problems of Strawberry production faced by farmers.

Items	Rank
Lack of quality seed	
Lack of capital	
Lack of technical knowledge	
Lack of labor availability	
Lack of bullock availability	
Higher price of inputs	
Storage problems	
Lack of fertilizer	
Natural calamities	
Lack of irrigation	

Code: Problems: high=1, moderate=2, low=3

#### 17. Problems of Strawberry marketing faced by farmers.

Items	Rank
Poor communication & transport facilities	
Dominance of intermediaries	
High rate of brokerage	
Lack of capital	
Lack of adequate storage facilities	
Lack of market facilities	
Low price in the peak period of harvesting season	



18. Problems faced by Strawberry intermediaries:

Items	Faria	Bepari	Aratdar	Wholesaler	Retailer
Storage of operating capital					
Poor communication and transportation facilities					
Absence of storage facility					
High rates of commission					
Lack of adequate market information					

19. Suggestions for improving the efficiency of production and marketing of Strawberry.

- 1.
- 2.
- 3.

Thank you for your kind co-operation

Date.....

Signature of the interviewer