PROFITABILITY ANALYSIS OF CHILLI PRODUCTION IN SOME SELECTED AREAS OF SINGAIR UPAZILA

MD. ASHIK IMAM

DEPARTMENT OF DEVELOPMENT AND POVERTY STUDIES

SHER-E-BANGLA AGRICULTURAL UNIVERSITY

SHER-E-BANGLA NAGAR, DHAKA -1207

JUNE, 2021

PROFITABILITY ANALYSIS OF CHILLI PRODUCTION IN SOME SELECTED AREAS OF SINGAIR UPAZILA

BY

MD. ASHIK IMAM

REGISTRATION NO.: 14-06292

A Thesis
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

DEVELOPMENT AND POVERTY STUDIES

SEMESTER: JANUARY-JUNE, 2021

Approved by:

Md. Mahbubul Alam, PhD **Professor** **Dept. of Agricultural Extension and Information System** **Sher-e-Bangla Agricultural University** **Supervisor**	**Md. Abdul Latif** **Professor** **Dept. of Agricultural Statistics** **Sher-e-Bangla Agricultural University** **Co-supervisor**

Fatema Sarker
Chairman
Examination Committee
Department of Development and Poverty Studies
Sher-e-Bangla Agricultural University

Department of Agricultural Extension and Information System

CERTIFICATE

This is to certify that the thesis entitled "**PROFITABILITY ANALYSIS OF CHILLI PRODUCTION IN SOME SELECTED AREAS OF SINGAIR UPAZILA**" submitted to the Department of Development and Poverty studies, Sher-e-Bangla Agricultural University, Dhaka-1207, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (MS) in DEVELOPMENT AND POVERTY STUDIES**, embodies the result of a piece of bona fide research work carried out by **MD. ASHIK IMAM**, Registration No. **14-06292** under my supervision and guidance. To the best of my knowledge, no part of the thesis has been submitted for any other degree or diploma.

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

Dated:

Dhaka, Bangladesh

(Md. Mahbubul Alam, PhD)
Professor
Dept. of Agricultural Extension and Information System
Sher-e-Bangla Agricultural University,
Dhaka 1207.
Supervisor

DEDICATED

TO

MY BELOVED PARENTS

ACKNOWLEDGEMENT

To begin, I would want to express my gratitude to Allah, the most compassionate and kindhearted, the most kind and benevolent, who deserves all praise. All thanks is due to the almighty, omnipresent, and omniscient Allah, who allowed me to continue my studies in Development and Poverty Studies and to successfully finish the research and writing of my thesis for the Master of Science in Development and Poverty Studies degree.

Now, I would like to express my inexpressible gratitude to my Supervisor, **Md. Mahbubul Alam, PhD**, Professor, Department of Agricultural Extension and Information System, Sher-e-Bangla Agricultural University, Dhaka-1207, for his ever-inspiring guidance, scholarly comments, and constructive suggestions throughout the research process and thesis preparation. Without his insightful intellectual counsel, precise constructive criticism, and assistance, this job would never have been completed. I would like to express my gratitude to my respected Co-supervisor, **Md. Abdul Latif**, Professor, Department of Agricultural Statistics, Sher-e-Bangla Agricultural University, Dhaka-1207, for his proper guidance, inspiring co-operation, and encouragement throughout the research process and thesis preparation.

I would want to convey my appreciation to the 100 chilli producing farmers who participated actively in this survey and, more significantly, helped me understand their efforts and actions linked to chilli farming in general and to chilli farming in particular. Their amazing assistance throughout the data gathering procedure is much appreciated.

I am at a loss for words to express my gratitude to my parents for their unwavering devotion and unflinching support, for their sacrifice and unflinching efforts to accomplish my ambition of obtaining a higher education. They served as a continual source of inspiration throughout the most trying periods of my study.

The Author

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

BRRI	: Bangladesh Rice Research Institute
BBS	: Bangladesh Bureau of Statistic
BCR	: Benefit Cost Ratio
BDT	: Bangladeshi Taka
BER	: Bangladesh Economic Review
DAE	: Department of Agricultural Extension
et al.	: and others (at elli)
GR gm	: Gross Return : Gram
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
SRC	: Spices Research Center
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

PROFITABILITY ANALYSIS OF CHILLI PRODUCTION IN SOME SELECTED AREAS OF SINGAIR UPAZILA

- MD. ASHIK IMAM

ABSTRACT

Chilli is a valuable spice and also one of the most important cash crops grown in Bangladesh. The main objective of this research was to determine the profitability of chilli production by examining the socio-demographic profile of chilli farmers. The Singair upazila was chosen for the research due to its considerable chilli production. Through an interview schedule, data were collected from 100 sample farmers using a random sampling approach. After analyzing the data, it was determined that the gross return, gross margin and net return were found to be Tk. 367683.60, Tk. 271776.35 and Tk. 226520.05 per hectare respectively. Average total cost of chilli were estimated to be Tk. 141163.55 per hectare. The Benefit Cost Ratio (BCR) for chilli cultivation was determined to be 2.60. While the regression coefficients for land preparation cost, cost of seed , cost of cow dung and pesticide cost were all positive, the coefficients for cost of MoP and irrigation cost were all negative and significant at 1% ,5% and 10% level of significance. The human labor, cost of Urea, and cost of TSP were determined to be insignificant in relation to the return on chilli cultivation. The positive indication shows that the return on chilli can be enhanced by raising land preparation cost, cost of seed, cost of cow dung and pesticide cost, while the negative sign suggests that the return on chillis may be decreased by lowering cost of MoP and irrigation cost. It was discovered that chilli cultivation was very lucrative. Additionally, this research highlighted a number of problems and constraints related to chilli production. These were lack of operating capital, high price of quality seed, high cost of irrigation water, low price of output, attack of pest, lack of quality seed, lack of scientific knowledge of farming, shortage of human labor, adulteration of fertilizer, insecticides, and pesticide, poor storage facilities in house and natural calamities etc.

CHAPTER 1
INTRODUCTION

1.1 General Background

Bangladesh is mostly an agricultural nation. Agricultural being the economic engine, there is no other way to alleviate poverty except to improve the agriculture sector. Because the supply of food security, the enhancement of living standards, and the formation of job opportunities for our people are all closely related to the growth of agriculture. The Government has made sustained efforts to promote the entire development sector. Agriculture is the primary engine of economic development of Bangladesh. Agriculture contributed 13.35 percent to GDP in FY 2019-20 (BBS 2020).

In Bangladesh, agriculture is mostly dependent on rice. Increased rice production has resulted in a fall in the acreage devoted to spices, legumes, and other minor crops. To determine the potentials and possibilities for expanding the acreage and production of spices and pulses, it is necessary to assess the crops performance, profitability, and marketing as well as processing systems. These initiatives will disseminate critical information to farmers, market intermediaries, researchers, and planners, among others, who may take further initiative to enhance both the acreage and output of spice crops such as chilli.

Chilli is a valued spices and one of the most significant cash crops of Bangladesh. It is found in green, dried, and powdered forms. It has developed into a staple element in Bangladeshi cuisine. Most of our houses usually have a stack of fresh spicy green chillies at available, and use them to spice most curries and dry meals. Typically, it is briefly cooked in oil during the earliest stages of dish preparation.

Chilli is the most vital and valuable spice crop. Chilli production is highly dependent on the use of fertilizers, irrigation, and pesticides, among other factors. The Government of Bangladesh has consequently prioritized agriculture in order to improve Chilli output by providing farmers with subsidies on various inputs such as seeds, fertilizer, and irrigation in order to attain self-sufficiency in chilli production.

Poverty cannot be eradicated without boosting agricultural output and ensuring that farmers get a fair price for their commodities. Natural disasters such as draught, flood, cyclone, and tornado are a highly common occurrence that ignificantly impair agricultural productivity. Cultivable land is being depleted as a result of the pressures of rapid population growth. As a consequence, food security is jeopardized, and the likelihood of poverty increases.

1.2 Present Status of Chilli in Bangladesh

Chillies are a very important crop in terms of both food and medicinal. Chillies are often used in food preparation and flavoring. Additionally, it may be used to alter the appearance of food by adding color. According to BBS 2020, the area planted with chillies was 96.72 thousand hectares in 2019-20 and would increase to 99.95 thousand hectares in 2020-21. Chilli output also grew from 158 thousand to 493 thousand metric tons in 2020-21 (Table 1.1).

Table 1.1 Area and production of chilli and condiments in different years, (2010-11 to 2020-21)

Year	Area ('000' hectares)	Production ('000'metric tons)
2010-11	104.81	176
2011-12	97.12	126
2012-13	93.48	102
2013-14	89.84	110
2014-15	92.27	123
2015-16	101.98	130
2016-17	103.20	137
2017-18	103.20	141
2018-19	96.72	149
2019-20	96.72	158
2020-21	99.95	493

Source: BBS, 2021

The area of cultivable land for Chilli production is decreasing day by day whereas the production of chillli is increasing. Unfortunately, the production cannot meet the demand. For meeting the demand of our country, we import large amount of chilli in each year. The main reason behind low yield is we have no sufficient land for chilli production. Another reason is the uses of low yielding variety that cannot produce good yield.

1.3 Area, Production and Productivity of Chilli in Bangladesh

Chilli is a tropical and subtropical plant. It thrives in warm, humid climates. For good development, the crop prefers deep, loamy, fertile soils that are high in organic matter. Additionally, the crop requires well-drained soils with an acceptable amount of soil moisture for growth. Chilli thrives in the arid and semi-arid regions of the nation. Chilli plants should be placed in an area that gets enough of light. Chillies should not be placed in an area where the night time temperature drops below 12°C. Temperatures below 15°C will hinder growth. Chilli plants are a sort of seasonal crop (annual plant) that survives for just one season. If nurtured, this plant will continue to grow and yield for many months after planting until dying.

Regular watering of chilli plants is necessary to prevent 'flooding' them at irregular intervals. Regularly overwatering will result in root formation. Allow flowers to grow on the plants and they will die after a few weeks, resulting in the formation of chillies. Once the plants begin to bear fruit, the needed quantity of organic liquid fertilizer should be administered every few weeks to ensure that the plants produce an abundance of fruit.

Chillies are collected when they are green or red in color. Red chillies have a higher heat level than green chillies. Allow green chillies to grow as big as possible if anybody want to collect them. chillies should be harvested as they begin to turn red. Chillies should be removed from the plant by cutting the stems around the point where they link to the main branch. Bangladeshi chilli growers cultivate indigenous varieties with very poor yields. The primary causes of poor yield are a scarcity of high yielding cultivars and insufficient irrigation infrastructure.

Though the area and production have been raised but per unit yield of chilli is very low. In Bangladesh, chillies are grown in all the districts but plenty of chillies are produced in the district of Bogura, Rangpur, Kurigram, Jamalpur, Natore, Manikganj and Jessore. Farmers of Bangladesh are growing chillies following indigenous methods with the poor yield rate. The reasons behind such low yield due to lack of high yielding variety and method of production practices followed by the local growers.

1.4 Economic Importance of the Chilli

Chilli is a valuable cash crop. In our country, chilli is mostly regarded as a spice crop. It is highly sought after both raw and cooked. Raw chillies are a good source of vitamins

A and C. Chilli is a necessary component of daily cooking since it adds diversity in terms of color, taste, and flavor. In our country, it is unthinkable to prepare any vegetable without using chilli. Additionally, there is a high demand for chilli sauce to improve the flavor of various cuisines. Morever, it has therapeutic benefits. It is grown in practically every location. Chilli production, on the other hand, is greater in char regions. It is the primary agricultural crop in many char zones of Bangladesh. Additionally, it is commercially grown in North Bengal and Chittagong.

Chilli is bitter due to the presence of the chemical capsaicin and brilliant and red due to the presence of the pigment capsaicin. Improved production technologies, such as optimum plant spacing, may boost the output of chilli. Farmers should expect a rather nice harvest if nature cooperates.

1.5 Production Value of Chilli in Bangladesh

Table 1.2 shows the per-acre benefit-cost ratio of chilli crops by season and division. The highest benefit-cost ratio is found in Sylhet division (2.41), followed by Chittagong division (2.25), and Khulna division at (2.10).

Table 1.2 Per acre benefit cost ratio of chilli by divisions

Division	Per acre production		Benefit Cost Ratio
	Cost (Tk.)	Value (Tk.)	
All	45242	99059	2.19
Barisal	31553	68340	2.17
Chittagong	47878	107887	2.25
Dhaka	45424	97763	2.15
Khulna	49449	104072	2.10
Rajshahi	49205	106479	2.16
Rangpur	41811	93485	2.24
Sylhet	41673	100334	2.41

Source: BBS 2014

The benefit-cost ratio of chilli cultivars is shown in table 1.3 for both summer and winter. It is the most critical component of production since it dictates whether or not the producer will continue producing the crop. If the benefit cost ratio of a chilli crop is higher than one, the producer benefits and is motivated to continue production; if it is less than one, the producer loses and is motivated to discontinue production. As shown in the table 3, the benefit-cost ratio of chilli crops is 2.19 at the national level, 2.13 during the summer season, and 2.23 during the winter season. This suggests that the benefit-cost ratio is higher than one throughout both seasons, indicating that farmers

profit from chilli production. At the national level, the hybrid chilli has the highest benefit-cost ratio of 2.32, while other varieties have the lowest benefit-cost ratio of 2.12.

Table 1.3 Per acre benefit cost ratio of chilli by season and varities

Varieties of Chilli	All Areas	Summer	Winter
	Benefit Cost Ratio	Benefit Cost Ratio	Benefit Cost Ratio
All	2.19	2.13	2.23
Local	2.16	1.69	2.23
Hybrid	2.32	2.37	2.29
Others	2.12	2.19	1.73

Source: BBS 2014

1.6 Uses and Nutritive Value of Chilli

Chilli has a wide variety of applications. Green chillies are used as a flavoring and garnishing agent in a variety of cuisine items and salads. In tropical and sub-tropical nations, dry chillies and chilli powder are used as spices in various sorts of curried meals.

Chillies have been used as a food, a spice, and a herbal medicine. They are claimed to be beneficial to the kidneys, spleen, pancreas, lungs, and heart. Chillies were treasured in Victorian England for their warming powers, which were used to cure arthritis, cold, rheumatism, sprains, and depression. The US National Library of Medicine has over 3,000 research publications supporting the use of chillies in preventing and reversing a variety of common health problems Chillies may help prevent cancer, heart disease, stroke, blood clots, obesity, hypertension, hypercholesterolemia, bronchitis, emphysema, coughs and colds, and stomach ulcers. Chillies also serve as an internal disinfectant, detoxifying the colon and aiding with elimination.

Red chiles are high in vitamin C and low in carotene (pro-vitamin-A). Green chilli peppers (unripe fruit) have far less of both chemicals. Additionally, peppers are a strong source of the majority of the B vitamins, particularly vitamin B6. They have a high concentration of potassium, magnesium, and iron.

Table 1.4 Nutritive value of green and dry chillies per 100 grams of edible portion

Nutrient constituents	Green Chilli	Dry Chilli
Water (g)	73.5	10.0
Total Mineral (g)	1.0	6.1
Fiber (g)	6.8	30.2
Energy (g)	103.0	245.0
Protein (g)	1.6	15.9
Fat (g)	0.1	6.2
Carbohydrate (g)	23.7	31.6
Calcium (mg)	11.0	160.0
Iron (mg)	1.2	2.3
Carotene (µg)	2340.0	345.0
Vitamin-B1 (mg)	0.17	0.93
Vitamin-B2 (mg)	0.16	0.43
Vitamin-C (mg)	125.0	50.0

Source: Quasem and Bhuyan, 2000

1.7 Justification of the Study

Economic growth in an agro-based nation like Bangladesh is mostly dependent on agricultural development. Agro-climatic conditions of Bangladesh are favorable for the growth of a broad range of crops, although 80 percent of gross cultivated land is now devoted to cereal crops, mostly rice (WB, 2017).

Demand for cereal foods rose dramatically as the population expanded. However, their output and availability per capita have been declining over the last decades. To meet this need, land formerly used for spice production is being converted to cereal food crop cultivation. Bangladesh benefits from an ideal climate and soil for the cultivation of spices. Chilli is a significant spice crop in Bangladesh, which is frequently farmed throughout the winter. Spices Research Centre (SRC), BARI has developed two new summer chilli varities. They believed that chlli production would continue to grow in the area as a result of the additional push being provided to the sector by different groups, and that the crop would now be planted twice a year during the summer and winter seasons, rather than only once during the winter.

The amount of cultivable land available for crop cultivation and chilli production is diminishing daily. Demand for chilli continues to grow, but supply cannot keep up with demand. To close the shortfall, the Bangladeshi government must import a big quantity of chilli and many important crops at the expense of hard-earned foreign cash. To alleviate pressure on foreign currency, the output of spices must be boosted to fulfill

domestic demand. Prior to focusing on chilli production, it needs relevant and suitable knowledge on many elements of agricultural development.

Such production information is also crucial for farmers to make informed decisions, particularly when several choices are available. However, neither the government nor private groups have conducted comprehensive economic studies on chilli production in order to meet the need of extension workers, policymakers, research professionals, and farmers. Agricultural productivity may be constrained by a variety of variables, including institutional, economic, physical, and natural catastrophes.

To the knowledge of the author, there have been few studies on the profitability of chilli production in Singair upazila in the past. Previous study was not conducted on the Singair upazila. As a result, this research attempts to determine the profitability of chilli production in the Singair upazila. The study may be instructive in this subject and may act as a springboard for the researchers to do other research. Finally, it is anticipated that the study results will assist individual farmers in boosting their productive efficiency via proper operation and administration of their farms, as well as policymakers and extension workers in framing a meaningful policy.

1.8 Objectives of the Study

i. To describe the socio-economic status of chilli growing farmers in the study area;
ii. To estimate the profitability of chilli production;
iii. To determine the major factors affecting the gross return of chilli production; and
iv. To identify the problems faced by the fermers in chilli production.

1.9 Assumption of the Study

An assumption is a presumption that an apparent fact or principle is true in light of the facts available (Goode and Hatt, 1952).The researcher made the following assumptions while conducting this study.

The respondents chosen for the study were able to respond appropriately to the questions on the interview schedule.

1. The information provided by the respondents was accurate. They were truthful about their involvement in income-generating activities.
2. The information provided by the sampled respondents was representative of the entire population of the research area.
3. The data were non-biased and normally distributed.
4. The respondents were able to provide proper replies to the interview questions.
5. The researcher was familier with the social environment of the study area.
6. The researcher who conducted the interviews was well-acquainted with the social context of the area. As a result, the data gathered from the respondents was free of biased.

1.10 Limitations of the Study

There are some limitations of the study thus are indicated below.

a. The majority of data was gathered via interviews with farmers, who were not always cooperative with the interviewer.
b. The information was acquired mostly from the farmers' recollections, which were not always accurate.
c. Due to budget and time restrictions, a comprehensive and in-depth examination was somewhat limited.

1.11 Definition of Terms

A researcher needs to know the meaning and contents of every term that he uses. It should clarify the issue as well as explain the fact to the investigator and readers. However, for clarity of understanding, a number of key concepts/terms frequently used throughout the study defined are interpreted as follows:

Assumption

"The supposition that an apparent fact or principle is correct in light of the available evidence," according to the definition of an assumption (Goode and Hatt, 1952).

Respondent

Respondents are those who have answered questions for a social survey from an interviewer.

Farmers

The people who were engaged with cultivating exercises are called farmers. They took an interest in various homestead and network level exercises like harvests, animals, fisheries, other cultivating exercises and so forth. In this examination chilli cultivators were treated as farmers.

Age

Age of a respondent defined as the span of his/her life and is operationally measured by the number of years from his/her birth to the time of interviewing.

Education

Education referred to the development of desirable knowledge, skill, attitudes, etc. of an individual through the experiences of reading, writing, observation and related matters. Education was measured by number of years of schooling.

Farm size

Farm size referred to the total area on which a family of farmer carries on farming operations, the area being estimated in terms of full benefit to the family of farmer.

Annual family income

Annual income referred to the total annual earnings of all the family members of a respondent from agriculture, livestock and fisheries and other accessible sources (business, service, daily working etc.). Income was measured in Tk.

Agricultural knowledge

It is the extent of basic understanding of the respondents in different aspects of agricultural subject matters i.,e., crop, vegetables, livestock, fisheries and forestry.

Extension media contact

It refers to an individual (farmer) exposure to or contact with different communication media, source and personalities being used for dissemination of new technologies. Example: contact with AEO, watching TV, listening radio, attending group meeting etc.

Organizational participation

Organization participation of an individual refers to his participation in various organizations as ordinary member, executive committee member or executive officer within a specified period of time.

Problem faced

Problem faced referred to the degree of difficulties faced by concerned people in accomplishment of particular project activities. In this study problem faced meant extent of problem chilli growers faced problems in chilli cultivation.

CHAPTER 2
REVIEW OF LITERATURE

In this chapter, an attempt has been made to review of pertinent literature keeping in view the problem entitled, "Profitability analysis of Chilli production in some selected areas of Singair Upazila**"** Again, although some of these studies are not totally relevant to the current investigation, their results, analytical methods, and recommendations all had a significant effect on the current study. A few attempts have been made to determine the profitability of chilli production. This chapter is divided into three sections that are given below:

2.1 Profitability and Production of Chilli in Bangladesh

Islam et al. (2011) determined the productivity, profitability and resource use efficiency of four promising spices crops such as garlic, chilli, ginger and turmeric. The average estimated technical efficiencies for garlic, chillies, ginger and turmeric were respectively 88, 80, 69 and 79% which indicated that garlic production could be increased by 12%, chilli by 20%, ginger by 31% and turmeric by 21% with the same level of inputs without incurring any additional cost.

Meoya (2011) found that the per hectare total cost of chilli production for small, medium & large farmers were Tk. 119909, 134222 and 123626 respectively. Net return per hectare Tk. 88718 for medium farmers, Tk. 62491 for small farmers & Tk. 56014 for large farmers.

Monalisa (2011) determined that the per hectare yield of green chilli was 7.06 metric ton in the study area. The net return per hectare on full cost basis & cash cost basis were tk. 9155.22 & tk. 30247.62 respectively for green chilli.

Huda et al. (2008) estimated that the financial profitability of ginger appeared to be highly profitable spice crops having net return Tk. 2,82,011 per hectare followed by chilli (Tk. 71,441 per hectare), turmeric (Tk. 65,423 per hectare), garlic (Tk. 50,281 per hectare) and onion (Tk. 38,281 per hectare) accordingly.

Hoq et al. (2014) observed that the green chilli cultivation is profitable and per hectare net return is Tk.92,250 and BCR is 1.64. The farm level net marketing margin per quintal of green chilli was Tk.1105.25 after post-harvest losses. At

intermediaries' level highest net margin was Tk.333 for retailer (Dhaka) and lowest was Tk.120.5 for Arathdar.

Hasan and Banik (2015) determined that the net benefit of Tk. 813.12 million (USD 10.42 million) from investment in chilli R&D. The net present value and present value of research cost were estimated at Tk. 289.14 million (USD 3.71 million) and BDT 78.49 million (USD 1.01 million), respectively. The internal rate of return and benefit cost ratio were estimated to be 55 percent and 5.48, respectively. This indicates that investment in chilli R&D was profitable. The seed production program for BARI-Chilli-1should be done to increase production by increasing its area of adoption.

Ila et al. (2019) examined that the total cost (TC) for green Chilli is Tk. 128011.13; gross return (GR) of Green Chilli is Tk. 240864; gross margin (GM) for green Chilli is Tk. 137698. All the calculations are based on per hectare. Thus, producing green Chilli net return (NR) is Tk. 112852.87. The green chilli is attractive for farmers to produce as its benefit cost ratio (BCR) shows 1.88 in our study.

2.2 Profitability and Production of Chilli in other Countries

Jagtap et al. (2012) examined that Cost 'C' was found to Rs. 40541.72, Rs. 42811.07 and Rs. 53421.29 per acre for small, medium and large farmers respectively. Net returns over cost 'C' was Rs. 19329.52, Rs. 24114.79 and Rs. 21400.51 per acre and input-output ratio at cost 'C' was 1:1.48, 1:1.56 and 1:1.40 for small, medium and large farmers respectively.

Sanusi and Ayinde (2013) found that the variable and fixed cost were N 228,293.06 (US$ 1,521.95) and N 9,765.49 (US$ 65.10), respectively to receive the average revenue of N 622,847.56 (US$ 4,152.32). The return to investment ratio was 2.62.

Olayiwola (2014) determined that total cost per acre was estimated for small (34,225.05 Naira), medium (38,612.48 Naira) and large (42,086.84 Naira) farmers. The gross income was higher for large farmers (73,883.49 Naira) and the lowest for small (49,104.38 Naira) farmer. Similarly, large farmers had higher benefit cost ratio (1.91) as compared with medium (1.87) and small (1.56) farmers.

Daundkar and Bairagi (2015) explored that the total cost was Rs. 125,260 with net

returns (Rs. 273,388) and input-output ratio (3.11).

Velayutham and Damodaran (2015) demonstrated the economic performance of chilli production in India. Regression coefficients of Cobb-Douglas model were positive for labor man-days (0.406), manure (0.0778), fertilizer (0.368) and chemicals (0.251).

Patel et al. (2015) revealed that average cost of cultivation of chilli was estimated as Rs. 122935.62 per hectare and observed the highest i.e. Rs. 130302.58 per hectare at small farms. The yield of green chilli was observed 95.81 quintal per hectare, 107.11 quintal per hectare, 123.50 quintal per hectare and 141.31 quintal per hectare at marginal, small, medium and large farms respectively along with 117.40 quintal per hectare on an average. The gross return from chilli crop was observed as Rs. 257072.66 per hectare across the farms. The net return from this crop was calculated as Rs. 127451.60 per hectare while farms are spent on an average of Rs. 1047.15 for producing the one quintal of chilli. The average ratio of input-output was estimated as 1:2.04 across the different farms of district which shows cultivation is profitable to the farms of the district.

Jorwar et al. (2018) examined that cost 'C' was found to Rs. 168507.96, Rs. 181705.77and Rs 184739.08 per hectare for small, medium and large growers respectively. Net returns over cost 'C' was Rs. 80619.40, Rs. 93008.90 and Rs. 107722.00 per hectare and input-Output ratio at cost 'C' was 1.48, 1.51 and 1.58 for small, medium and large growers respectively.

Channa et. al. (2020) investigated that the yield of chillies obtained was 1785.53 (Kgs) per acre and price per (Kg) was Rs. 102.81. Total cost of production of chilli with opportunity cost was Rs. 102543.44 and Rs. 85334.45 without opportunity cost per acre. Moreover, per acre revenue was Rs. 183506.74, similarly net return of chilli with opportunity cost was Rs. 80963.30 and without opportunity cost was Rs. 98172.29 per acre, respectively.

Geo et al. (2020) found that the annual net returns of the red chilli farming, on an average, was RP. 42,632,440 per hectare, with R/C ratio being 2.92. Production factors of land size, seeds, fertilizer, pesticide, and the number of labors jointly had a significant and positive effect on red chilli production. Partially, they also had

significant and positive effect on the production, except for the use of pesticide. Red chilli farming is profitable and financially feasible.

Tsope and Murry (2020) examined that on an average per hectare total cost of chilli cultivation was Rs.1,38,596.67 with a gross income of Rs.3,00,440.00. The average yield of chilli was found to be 75.00 q per ha. Considering the prevailing price of chilli in the study area which is Rs.4,000.00 per q the gross income was found that the average net return from chilli cultivation Rs.1,52 888.66. Out of the total cost, the share of variable cost and fixed cost constitute 93.59 percent and 6.41 percent respectively. whereas the benefit cost ratio was found out to be 2.24.

Shaker et al. (2021) found that the cost 'C' was found to be Rs. 393952.74, Rs. 416867.20 and Rs 420907.37 per hectare for marginal, small and big farmers respectively. Economic analysis of data indicated that the total cost of chilli cultivation per ha was Rs 393952.74, 416867.20 and 420907.37 for marginal, small and big farmers respectively. Labor cost, seed, plant protection chemicals, manures and fertilizer constituted the major portion of the total cost of cultivation. Net returns over cost 'C' was Rs. 118641.01, Rs. 137170.30 and Rs. 168030.13 per hectare and input-Output ratio at cost 'C' was 1.30, 1.33 and 1.40 for marginal, small and big farmers respectively.

2.3 Problems and Constraints to Chilli Production

Shrivastava (2003) revealed that the important problems were high cost of fertilizers followed by high cost of plant protection chemicals and insecticides (98.33 percent), insects and diseases attack (96.67 percent), unavailability of irrigation facility (67.00 percent), lack of proper guidance by RAEOs about recommended chilli production technology (56.67 percent) and effect of climate (55.00 percent) .

Hanumanaikar et al. (2006) revealed that cent percent (100 percent) of the respondents expressed the problems of increased insect and disease infestation to the chilli crop which forced them to use the excess pesticide doses. Ninety percent of the respondents expressed their inability to read the instructions given by the manufactures on the label of containers about the right uses of pesticides due to illiteracy and language problem.

Rajput et al. (2007) revealed that the following factors were responsible for the

declining of chilli area. These constraints were technical aspects (85.14 percent), economic aspect (85.33 percent), lack of information sources (70.00 percent), non-availability of labor (67.32 percent), and erratic climatic condition (94.66 percent) .

Venkataramalu et al. (2010) revealed that the majority of the respondents (95.83 percent) faced problems of water scarcity for irrigation and 82.50 percent faced constraints to high incidence of pests and diseases. Whereas 68.33 percent and 48.53 percent respondents faced problems of price fluctuation and lack of technical guidance, respectively as important constraints in chilli cultivation.

Patel et al. (2015) revealed that the problem of insect- pest and diseases, lack of soil testing facilities and scarcity of labor are the some major problems which were faced by the farmers during production of chilli crop are observed in the district.

Geetha and Selvarani (2017) found that the emerging evil of majority of farmers in the study area was that of unfavorable system of processing which has become the major problem in production of chilli. Inadequate traders, price fluctuation, delay in payment were other problems in marketing of chillies.

Rais et al. (2021) determined that major constraints were insect pests and disease problem (82%), lack of modern irrigation system (76%), imbalance use of fertilizer and pesticide (75%), lack of training (70%) respectively. In marketing side major constraints were commission agent charges are not reasonable (76%), price fluctuations (56%) and lack of proper storage facilities (47%) recorded in Sindh. Furthermore lack of grading facility (90%) was the major constraints faced by the chilli traders in study areas. Lack of storage facility (77%) was recorded as a second highest constraints faced by the traders followed by high risk is involved in selling of chillies distant places (73%) in Sindh. Based on the findings it is suggested that proper trainings and extension services may be started with special reference to proper production technology. Chilli farmers are also suffering due to improper weight and measure by traders and commission agent, it is therefore suggested commercial bank, regulated markets and co-operative marketing society should adopt flexible lending policy to suit the need of the farmers on the security of chilli crop.

The above reviewed literature indicated that very few study on profitability analysis of Chilli in Selected Areas had been conducted. But this study is of great importance for

policy makers. Considering the perspectives the present study has been undertaken to fill up the knowledge gap. It is expected that the present study will serve as the base for further studies in this almost untapped but profitable and potential areas of the business.

2.4 Conceptual Framework of the Study

When properly developed, a research hypothesis includes at least two key elements: "a dependent variable" and "an independent variable. A dependent variable is a factor that arises, eliminates, or changes as the researcher presents, removes, or changes the independent variables (Townsend, 1953). An independent variable is a factor that the researcher manipulates in order to determine its relevance to an observed phenomenon. The causes are the variables, and the phenomena are the effect, therefore there is a cause-and-effect relation everywhere in the cosmos. While making structural arrangements for the dependent and independent variables, the conceptual framework of Rosenberg and Hovland (1960) was kept in mind. The purpose of this study is to determine the major factor affecting the gross return of chilli production. As a result, the dependent variable was the gross return, whereas the independent variables were 9 specific variables. Individual perception can be influenced by the interactions of several independent variables. In a single study, it is impossible to address all independent variables. For this study, it was necessary to limit the independent variables, which included human labor, land preparation cost, cost of seed, cost of urea, cost of TSP, cost of MoP, cost of cowdung, irrigation cost and pesticide cost. A conceptual framework for this study has been constructed based on the above-mentioned debate. This is depicted in the following figure 2.1.

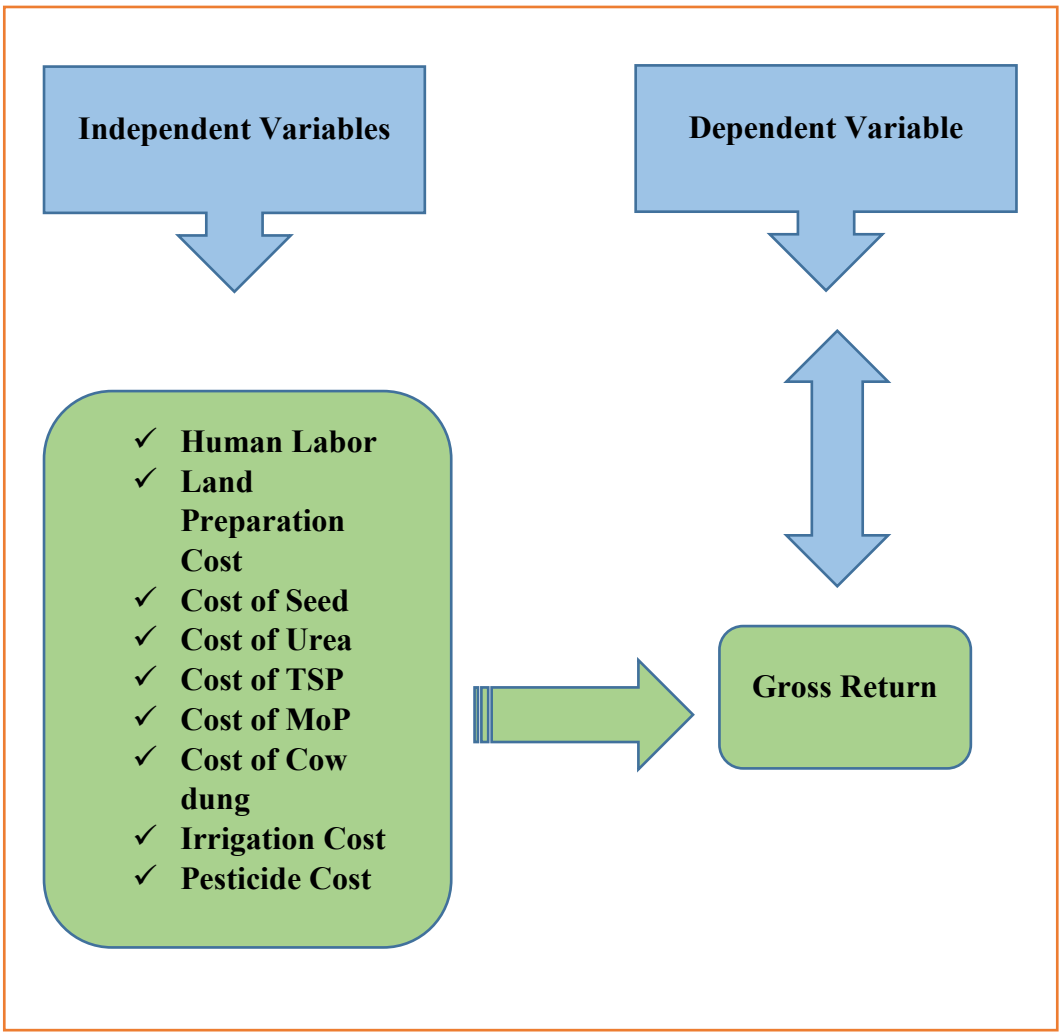

Figure 2.1 The conceptual framework of the study

CHAPTER 3
METHODOLOGY

3.1. Introduction

The validity of farm management research is contingent upon the research approach. Appropriate technique is a precondition for doing sound research. The design of every survey is largely governed by the nature, purpose, and goals of the study. Additionally, it is contingent upon the availability of required resources, supplies, and time. There are a variety of data collection techniques available for farm management studies. A farm business research often entails the gathering of data from individual farmers; data collection for farm business analysis requires the analyst to use judgment in selecting data collecting techniques within the constraints given by the available resources for the assignment (Dillon and Hardaker 1993). The "survey approach" was mostly used in this research for two reasons:

i. Survey enables quick investigations of large number of cases; and
ii. Its results have wider applicability.

To address this issue, frequent trips to the research region were conducted to gather data, and in the event of any omission or contradiction, farmers were contacted to get the 'missing and/or correct information. The following stages were used in designing the survey for this investigation.

3.2. Selection of the Study Area

The study area selection is a critical stage in conducting a farm management research. The region chosen suited both the specific objective of the study and the possibility of cooperating with the farmer. Although chilli is planted across Bangladesh, the Singair upazila is one of the most prominent upazilas for chilli cultivation. Thus, two unions, namely Jamirta and Joymontop under Singair upazila, were purposefully chosen for the research based on their greater concentration of chilli output. Singair is an upazila under Manikganj District in Dhaka Division. 23.8167°N and 90.1500°E are the latitude and longitude, respectively of Singair. It has a population of 44151 and a total area of 217.38 km^2. Singair had a population of 461628 people as per the 1991 Bangladesh census. Males account for 50.47 percent of the population, while females account for 49.53 percent. The population of this Upazila is 267789 adults. Average literacy rate (7+ years) of Singair is 71.1 percent, compared to the national average of 74.9 percent

(BER, 2021). Singair Upazila is split into the municipality of Singair and 11 union parishads: Baldhara, Bayra, Chandhar, Charigram, Dhalla, Joymontop, Jamirta, Jamsha, Saista, Singair, and Talibpur. 137 mauzas and 241 villages make up the union parishads. The municipality of Singair is split into nine wards and fourteen mahallas. The main reasons in selecting the study area were as follows:

a) The study area contained a large number of chilli growers;

b) These villages shared some physical characteristics, such as topography, soil composition, and climatic conditions conducive to chilli production;

c) No previous study of this type was conducted in these areas;

d) These villages were easily accessible and had adequate communication facilities; and

e) The cooperation of respondents was anticipated to be strong in order to collect trustworthy data.

Figure 3.1 A map of Singair upazila showing the study area

3.3. Sampling Technique and Sample Size

Two criteria must be considered while choosing samples for a research. The sample size should be as big as possible while yet providing sufficient degrees of freedom for statistical analysis. On the other hand, field research administration, data processing, and analysis should be doable within the constraints of physical, human, and financial resources. However, due to the variety of the technological and human environments, it is required to sample a representative sample of the population before drawing any conclusions. Thus, objective of sampling is to choose a subset of the population that is representative of the whole population (Kabir, 2016).

Due to time, financial, and manpower constraints, it was not feasible to enroll all of the farmers of study area. A total of 100 farmers were chosen at random. The current research used a simple random sampling to save costs and time and to accomplish the final aims of research.

Table 3.1 Distribution of sample size of respondents in two selected union of Singair upazila

Upazila	Union	Sample Size
Singair	Jamirta	50
	Joymontop	50
Total		100

3.4. Preparation of the Survey Schedule

A draft questionnaire was developed for the purpose of gathering data from the sample farms. With the study aims keep in mind, the questionnaire was pre-tested by interviewing 100 farmers who grew chilli, and any required revisions, additions, or alternations were made before the draft questionnaire was finished.

Three areas of information were included in the final questionnaire. The first category objective was to elicit information about the farmers' socioeconomic circumstances. The second group included data on expenses and returns. The final type of information included the limits and difficulties encountered by farmers while growing chilli.

3.5. Period of the Study

Data collection took place during 12 June and 11 July of 2021. Throughout this period, data on inputs and outputs were gathered by periodic visits to the research region.

3.6. Data Collection Methods

The current research gathered data from chilli cultivating farmers through a field survey. The researcher gathered the necessary data directly from the chosen chilli farmers. Prior to interviewing, chosen farmers were contacted to arrange for interviews at their convenience. During the interview, the researcher asked systematic questions and discussed the goals and objectives of the study as needed. The farmers were informed that the investigation was completely academic in nature. Each time an interview concluded, the interview schedule was reviewed to ensure that all pertinent information was accurately documented for each item. If any such things were missed or were contradictory, they were fixed on a revisit.

3.7. Processing, Tabulation and Analysis of Data

Manual editing and coding of the gathered data occurred. The acquired data was then meticulously compiled and analyzed. Additionally, data analysis were conducted using the appropriate tools, Microsoft Excel and STATA. It should be remembered that information was first gathered in local units. After required checks, it was converted to international standard units.

3.8. Analytical Techniques

The data were evaluated with the goal of attaining the objectives of the study. Numerous analytical techniques were used in this investigation. A significant portion of the data analysis was conducted using the tabular form. This approach is widely utilized because it has the natural ability to provide the most accurate image of the agricultural economics in the simplest manner. To evaluate data and define socioeconomic features of chilli producers, input consumption, expenses and returns on chilli production, and to determine the undiscounted benefit cost ratio, relatively basic statistical methods such as percentage and arithmetic mean or average were used (BCR). To estimate the major factor affecting the gross return of chilli production, a stochastic frontier production function of the Cobb-Douglas type was used in this work.

3.8.1. Economic Profitability Analysis

The net economic returns of chilli were estimated using the set of financial prices. The financial prices were market prices actually received by farmers for outputs and paid for purchased inputs during the period under consideration in this study. The cost items identified for the study were as follows-

- Land preparation
- Human labor
- Seed
- Urea
- TSP
- MoP
- Pesticide
- Irrigation
- Interest on operating capital
- Land use

Cost of Land Preparation

Land preparation considered one of the most important components in the production process. Land preparation for chilli production included ploughing, ridge preparation, earthing up and other activities needed to make the soil suitable for planting seedling. It was revealed that the number of ploughing varied from farm to farm and location to location.

Cost of Human Labor

Human labor cost was considered one of the major cost components in the production process. It is generally required for different operations such as land preparation, sowing and transplanting, weeding, fertilizer and pesticide application, irrigation, harvesting and carrying, threshing, cleaning, drying, storing etc. In order to calculate human labor cost, the recorded man-days per hectare were multiplied by the wage per man-day for a particular operation.

Cost of Seed/Seedlings

Cost of seed/seedlings varied widely depending on its quality and availability. Market prices of seed/seedlings of respected chilli were used to compute cost of seed. The total quantity of seed/seedlings needed per hectare was multiplied by the market price of

seed/seedlings to calculate the cost of seeds for the study areas.

Cost of Urea

Urea was one of the important fertilizers in chilli production. The cost of urea was computed on the basis of market price. In order to calculate cost of urea the recorded unit of urea per hectare were multiplied by the market price of urea.

Cost of TSP

The cost of TSP was also computed on the basis of market price. In order to calculate cost of TSP the recorded unit of TSP per hectare were multiplied by the market price of TSP.

Cost of MoP

Among the three main fertilizers used in chilli production, MoP was one of them. To calculate the cost of MoP per hectare, the market price of MoP was multiplied by per unit of that input per hectare for a particular operation.

Cost of Pesticides

Farmers used different kinds of pesticides for 5-7 times to keep their crop free from pests. Cost of pesticides was calculated based on the market price of the pesticides which was used in the study areas per hectare.

Cost of Irrigation

Water management helps to increase chilli production. Cost of irrigation varies from farmers to farmers. It was calculated based on how many times irrigation needed per hectare and how was its cost.

Interest on Operating Capital

Interest on operating capital was determined on the basis of opportunity cost principle. The operating capital actually represented the average operating cost over the period because all costs were not incurred at the beginning or at any single point of time. The cost was incurred throughout the whole production period; hence, at the rate of 10

percent per annum interest on operating capital for four months was computed for Chilli. Interest on operating capital was calculated by using the following formula:

IOC= AIit

Where,

IOC= Interest on operating capital

i = Rate of interest

AI= Total investment /2

t = Total time period of a cycle

Land Use Costs

Land use cost was calculated on the basis of opportunity cost of the use of land per hectare for the cropping period of four months. So, cash rental value of land has been used for cost of land use.

Calculation of Returns

Gross Return

Per hectare 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 by- product.

Gross Margin

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

Gross margin = Gross return – Total Variable cost

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

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 hectare.

BCR = Total return (Gross return)/ Total cost

3.8.2 Statistical Analysis

Due to its mathematical features, ease of comprehension, and computational simplicity, the Cobb-Douglas production function is arguably the most extensively used form for fitting agricultural output data (Heady and Dillion, 1969; Fuss and Mcfadden, 1978). Although the Cobb-Douglas function contains convex isoquants, it does not account for technically independent or competitive variables, nor does it account for Stages I and III in addition to Stage II. That is, MPP and APP are monotonically declining functions for every X, implying that the whole factor-factor space is Stage II-given 0 to 1, as is often the case.

Cobb-Douglas, on the other hand, may be a reasonable approximation for production systems in which components are imperfect replacements across a wide range of input values. Additionally, the Cobb-Douglas is generally straightforward to estimate since it is linear in parameters in logarithmic form; it is parsimonious in parameters (Beattie and Taylor, 1985).

A stochastic Cobb-Douglas production frontier model is denoted by the following formula:

$Yi = f(Xi, \beta) \exp(Vi-Ui)$ $i = 1, 2, 3, \ldots\ldots\ldots, N$

Where the stochastic production frontier is $f(Xi, \beta) \exp.(Vi)$, Vi having some symmetric distribution to capture the random effects of measurement error and exogenous shocks which cause the placement of the deterministic kernel $f(Xi,\beta)$ to vary across firms.

The technical inefficiency relative to the stochastic production frontier is then captured by the one-sided error component Ui > 0.

The explicit form of the stochastic Cobb-Douglas production frontier is given by

$$Y_i = \alpha X_{1i}^{\beta 1}\, X_{2i}^{\beta 2}\, X_{3i}^{\beta 3}\, X_{4i}^{\beta 4}\, X_{5i}^{\beta 5}\, X_{6i}^{\beta 6}\, e^{ui}$$

Where Y is the frontier output, X is physical input, b is the elasticity of Y with respect to X, a is intercept and Ɛ = V-U is a composed error term as defined earlier. For simplicity, we have ignored the subscript.

Specification of Production Model

We have specified the Cobb-Douglas Production Function in order to estimate the major factor affecting the gross return of chilli production. The functional form of stochastic frontier is as follows:

$Y = \beta_0 X_1 \beta_1 X_2 \beta_2 \ldots\ldots\ldots X_9 \beta_9 eV_i\text{-}U_i$

The above function is linearized double-log form:

$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7 + \beta_8 \ln X_8 + \beta_9 \ln X_9 + u_i$

Where,

Y = Gross return from chilli production (Tk/ha)

X_1 = Human labor (man days/ha)

X_2 = Land preparation cost (Tk./ha),

X_3 = Cost of Seed/Seedlings (Tk./ha)

X_4 = Cost of urea (Tk/ha)

X_5 = Cost of TSP (Tk./ha)

X_6 = Cost of MoP (Tk./ha)

X_7 = Cost of Cowdung (Tk./ha)

X_8 = Pesticide cost (Tk./ha)

X_9 = Irrigation cost (Tk./ha).

$B_0, \beta_1, \ldots\ldots\ldots\ldots, \beta_9$ = Co-efficient of respected independent variables

u_i = error term

3.8.3 Percentage Formula

Problems faced by the chilli farmers and some socio-economic characteristics were shown in percentage which was calculated by using following formula:

$$P = \frac{F}{N} \times 100$$

Here,

P = Percentage

F = Frequency/sample of the respondent

N = Total number of respondent

CHAPTER 4
SOCIO-ECONOMIC PROFILE OF CHILLI FARMERS

4.1 Introduction

The purpose of this chapter is to provide a quick overview of the socioeconomic features of the chilli producers. Socio-economic characteristics of farmers may be interpreted in a variety of ways, depending on aspects such as their standard of living, the financial situation in which they live, and the kind and extent to which growers support national progress efforts. Due to time and asset constraints, it was difficult to collect full data on the financial characteristics of the sample farmers. The financial situation of the example farmers is critical in the event of study planning, as there are several connected and component aspects that identify a person and have a substantial influence on the development of his/her behavior and character. Individuals differ in their financial viewpoints. Nonetheless, for the sake of this study, a few of the financial characteristics have been considered for exchange.

4.2 Age

The farmers ranged in age from 35 to 62 years. The average age of the participants was 46.45 years, with a standard deviation of 6.60. Farmers were categorized into three groups according to their ages, as indicated in table 4.1.

Table 4.1 Distribution of the respondents according to their age

Category	No. of Farmers	Observed range	Mean	Standard Deviation
Young Aged (Up to 40)	28	35-62	46.45	6.60
Middle Aged (41-50)	37			
Old Aged (51 & above	35			
Total	100			

According to the data in table 4.1, the majority of respondents (37%) were in the medium age group, followed by 35 percent in the elderly age category and 28 percent in the young age category.

4.3 Education

Growers' education levels varied from 0 to 8. The mean was 1.79, and the standard deviation was 2.63. Growers were grouped into four groups based on their score, as indicated in table 4.2.

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

Categories	No. of farmers	Observed range	Mean	Standard deviation
Illiterate	53	0-8	1.79	2.63
Can Sign Only	20			
Primary Education	19			
Secondary Education	8			
Total	100			

According to table 4.2, it indicates that a substantial number (53%) of respondents were illiterate, compared to 20% who could only sign, 19% who had just a primary education, and only 8% who had a secondary education. Thus, about 47% of respondents had some level of education.

4.4 Family Size

The farmers family sized ranged from 4 to 7. The average score was 6.28, with a standard deviation of 0.75. Farmers were categorized into three groups according to their family size, as indicated in Table 4.3.

Table 4.3 Distribution of the respondents according to their family size

Categories	No. of farmers	Observed range	Mean	Standard deviation
Small Family (up to 4)	2	4-7	6.28	0.75
Medium Family (up to 6)	54			
Large Family (7 & above)	44			
Total	100			

According to the data in table 4.3, the majority (54 percent) of farmers were classified as medium families, compared to 2% as small families and 44% as big families. These statistics suggest that around 98 percent of respondents had a family size of either medium or large.

4.5 Farming Experience

Agricultural experience is critical for farm production, since experienced farmers can execute farm tasks more efficiently. Farmers with more expertise in agricultural operations are often correlated with greater technical efficiency. Farmers' technical inefficiencies are strongly tied to their agricultural experience.

The producers' agricultural experience varied from 8 to 35 years. The mean was 22.87, while the standard deviation was 8.21. Growers were divided into three groups based on their agricultural experience, as indicated in Table 4.4.

Table 4.4 Distribution of the respondents according to their farming experience

Categories	No. of farmers	Observed range	Mean	Standard deviation
Low Experience level (up to 10 years)	17	8-35	22.87	8.21
Medium Experience Level (11 to 25 years)	38			
High Experience Level (Above 25 years)	45			
Total	100			

According to the data in table 4.4, a significant number (45%) of respondents had a "high experience level," compared to 38% who had a "medium experience level" and just 17% who had a "low experience level."

4.6 Agricultural Training

About 48.00 percent of responding farmers in Joymontop had instruction in chilli farming, compared to around 56 percent in Jamirta (Table 4.5). These training sessions enhanced their perspectives of proper seed handling, the use of resistant cultivars, the administration of pesticides and herbicides, and proper water management, among other topics. The Department of Agricultural Extension (DAE) conducts the majority of instruction on chilli production methods.

Table 4.5 Agricultural training of the respondent by the study area

Training Received	Jamirta		Joymontop		Total	
	No.	%	No.	%	No.	%
Yes	28	56.00	24	48.00	52	52.00
No	22	44.00	26	52.00	48	48.00
Total	50	100.00	50	100.00	100	100.00

4.7 Membership of any Social Organization

In Jamirta, 42.00 percent of respondent farmers were found to be members of various NGOs and/or farmers' organizations, while 44.00 percent of respondent farmers were found to be members of various NGOs and/or farmers' organizations in Joymontop (Table 4.6).

Table 4.6 Membership in any organization of the respondent by the study area

Membership	Jamirta		Joymontop		Total	
	No.	%	No.	%	No.	%
Yes	21	42.00	22	44.00	43	43.00
No	29	58.00	28	56.00	57	57.00
Total	50	100.00	50	100.00	100	100.00

4.8 Extension Contact

The respondents' extension contact ratings varied from 5 to 22, with an average of 11.83 and a standard deviation of 5.22. The respondents were categorized into three groups based on their extended contact ratings, as shown in table 4.7.

Table 4.7 Distribution of the respondents according to extension contact

Categories	No. of farmers	Observed range	Mean	Standard deviation
Low contact (up to 9)	37	5-22	11.83	5.22
Medium Contact (10 to 17)	43			
High Contact (18 & above)	20			
Total	100			

According to the data in table 4.7, the majority (43 percent) of respondents in the research region had a medium extension contact, while 37% had a low extension contact and 20% had a high extension contact.

4.9 Annual Family Income

a) Agricultural work

Crops, poultry, livestock and fisheries are the main agricultural income source of the sample. Most of the framer generate income by agriculture sector. Crop production was the main source of income among them average yearly income from crop production found Tk. 85600. Now a days, poultry and dairy farm have been developed in the study

area. Farmers earned Tk. 65780 yearly from poultry. The mean value of annual family income by agriculture was Tk. 206380. (Table 4.8)

Table 4.8 Average family income from agricultural work

Sectors	Average annual Income (Tk.)	Total average annual income from agriculture sources (Tk.)
Crops	85600	206380
Poultry	65780	
Livestock	35000	
Fisheries	20000	

b) Non-Agriculture work

Main non agriculture was found day labor, auto driver, domestic worker, small business, foreign remittance, shopkeeper. Annual average income by non-agriculture source was found Tk 130900. The total average annual income was found Tk 337280.

4.10 Annual Family Expenditure and Savings

Annual average expenditure of farmer was found Tk. 295850. Main family expenditure was used for food consumption. Other main costs were children education cost, clothing cost, medicine cost, transportation, festival cost, entrainment cost etc. Average annual family savings was found Tk 41430. (Figure 4.1)

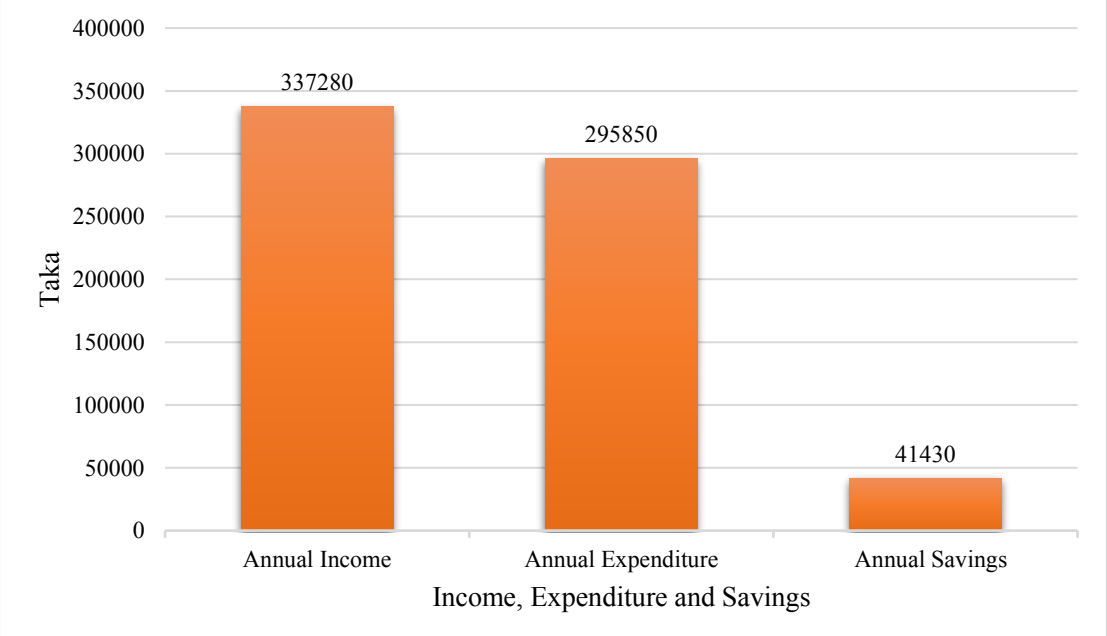

Figure 4.1 Annual family income, expenditure and savings in the study area

CHAPTER 5

PROFITABILITY OF CHILLI PRODUCTION

5.1 Introduction

The primary objective of this chapter is to evaluate the costs, returns, and profitability of cultivating chilli. Profitability is a critical factor in determining whether to produce any crop at the farm level. It may be quantified in terms of net return, gross margin, and return on total cost. The overall cost of manufacturing was determined by adding the expenses of all products. The crop returns have been approximated using the values of the primary products and by-products.

5.2 Profitability of Chilli Production

5.2.1 Variable Costs

Cost of Land Preparation

Land preparation is important components in the production process. Land preparation included ploughing, ridge preparation, earthing up and other activities needed to make the soil suitable for chilli cultivation. Thus, the average land preparation cost of chilli production was found to be Tk. 5373.19 per hectare, which was 3.81 percent of total cost (Table 5.1).

Cost of Hired Human Labor

Human labor cost is one of the major cost components in the production process. It is one of the most important and largely used inputs for producing chilli. It is generally required for different operations such as land preparation, sowing, weeding, fertilizer and pesticides application, irrigation, harvesting and carrying, threshing, cleaning, drying, storing etc. The quantity of average hired human labor used in chilli production was found to be 80 man-days per hectare and average price of human labor was Tk. 500 per man-day. Therefore, the total cost of hired human labor was found to be Tk. 40000.00 representing 28.34 percent of total cost (Table 5.1).

Cost of Seed/Seedlings

Cost of seed/seedlings varied widely depending on its quality and availability. Per hectare total cost of seed/seedlings for chilli production were estimated to be Tk. 4904.02, which constituted 3.47 percent of total cost (Table 5.1).

Cost of Urea

In the study area, farmers used different types of fertilizers. On an average, farmers used urea 404.79 kg per hectare. Per hectare cost of urea was Tk. 8163.35, which represents 5.78 percent of total cost (Table 5.1).

Cost of TSP

Among the different kinds of fertilizers used, the rate of application of TSP was 281.26 kg/ha. The average cost of TSP was Tk. 8437.74 per hectare which representing 5.98 percent of total cost (Table 5.1).

Cost of MoP

The application of MoP per hectare was 209.36 kg and per hectare cost of MoP was found Tk. 4187.24, which represents 2.97 percent of total cost (Table 5.1).

Cost of Pesticides

Farmers used different kinds of pesticides to keep their crop free from insect and diseases. The average cost of pesticides for chilli production was found to be Tk. 4559.46 which was 3.23% of total cost (Table 5.1).

Cost of Irrigation

Cost of irrigation is one of the most important costs for chilli production. Production of chilli largely depends on irrigation. Right doses application of irrigation water helps to increase bulb diameter, number of cloves, and number of leaves and plant height. As a result, yield per hectare is being increased. The average cost of average irrigation was found Tk. 10878.48 per hectare that represents 7.71% of total cost (Table 5.1).

Cost of Cow dung

It was observed in the present study area that farmers used cow dung for producing their enterprises. They bought a large portion of cow dung from the milk producers. It was found Tk. 9403.77 per hectare which was 6.66% of total cost (Table 5.1).

Table 5.1 Per hectare costs of chilli production

Cost Items	Quantity (Kg./ha)	Price Per Unit (Tk.)	Costs/Returns (Tk/ha)	% of total
A. Gross Return				
Green Chilli	12256.12	30	367683.60	100.00
Total return			367683.60	100.00
B. Gross Cost				
C. Variable Cost				
Hired Labor	80	500	40000.00	28.34
Irrigation			10878.48	7.71
Land Preparation			5373.19	3.81
Seed/Seedlings	2.45	2000	4904.02	3.47
Urea	404.79	20	8163.35	5.78
TSP	281.26	30	8437.74	5.98
MoP	209.36	20	4187.24	2.97
Cow dung	6270.05	1.5	9403.77	6.66
Pesticides			4559.46	3.23
Total variable cost (TVC)			95907.25	67.94
D. Fixed Cost				
Land use cost			21420.00	15.17
Family labor	40	500	20000.00	14.17
Interest on operating capital			3836.30	2.72
Total Fixed cost (TFC)			45256.30	32.06
E. Total costs			141163.55	100.00

Total Variable Cost

Therefore, from the above different cost items it was clear that the total variable cost of chilli production was Tk. 95907.25 per hectare, which was 67.94 percent of total cost (Table 5.1).

5.2.2 Fixed Cost

Rental Value of Land

Rental value of land was calculated on the basis of opportunity cost of the use of land per hectare for the cropping period of four months. Cash rental value of land has been used as cost of land use. On the basis of the data collected from the chilli farmers the land use cost was found to be Tk. 21420.00 per hectare, and it was 6.99 percent of total cost (Table 5.1).

Cost of Family Labor

Human labor cost is one of the major cost components in the production process. It is one of the most important and largely used inputs for producing chilli. It is generally required for different operations such as land preparation, sowing, weeding, fertilizer and pesticides application, irrigation, harvesting and carrying, threshing, cleaning, drying, storing etc. The quantity of average family supply labor (Without hired labor) used in chilli production was found to be about 40 man-days per hectare and average price of human labor was Tk. 500 per man-day. If we pay those labor it was found to be Tk. 20000.00 representing 14.17 percent of total cost (Table 5.1).

Interest on Operating Capital

It may be noted that the interest on operating capital was calculated by taking in to account all the operating costs incurred during the production period of chilli. Interest on operating capital for chilli production was estimated @ 9% as bank rate and calculated Tk. 3836.3 per hectare, which represents 2.72 percent of the total cost (Table 5.1).

5.2.3 Total Cost (TC) of Chilli Production

Total cost was calculated by adding all the cost of variable and fixed inputs. In the present study per hectare total cost of producing chilli was found to be Tk. 141163.55 (Table 5.1).

5.2.4 Return of Chilli Production

Gross Return

Return per hectare of chilli cultivation is shown in table 5.2. Per hectare gross return was calculated by multiplying the total amount of product with respective per unit price. It is evident from table that the average yield of chilli per hectare was 12256.12 Kg and the average price of chilli was Tk. 30. Therefore, the gross return was found to be Tk. 367683.60 per hectare.

Gross Margin

Gross margin is the gross return over total variable cost. Gross margin was calculated by deducting the total variable cost from the gross return. On the basis of the data, gross margin was found to be Tk. 271776.35 per hectare (Table 5.2).

Net Return

Net return or profit was calculated by deducting the total cost from the gross return. On the basis of the data, the net return was estimated as Tk. 226520.05 per hectare (Table 5.2).

Table 5.2 Per hectare cost and return of chilli production

Cost Item	Cost/Returns (Tk/ha)
A. Gross Return	367683.60
B. Total Variable Cost	95907.25
C. Fixed Cost	45256.30
D. Total costs	141163.55
E. Gross Margin (A-B)	271776.35
F. Net Return (A-D)	226520.05
G. Undiscounted BCR (A/D)	2.60
H. BCR on the basis of Cash cost (A/B)	3.84

5.3 Benefit Cost Ratio (Undiscounted)

Benefit Cost Ratio (BCR) is a relative measure, which is used to compare benefit per unit of cost. Undiscounted Benefit Cost Ratio (BCR) and BCR on cash cost basis were found to be 2.60 and 3.84, respectively which implies that one taka investment in chilli production generated Tk. 2.60 and Tk. 3.84 (Table 5.2). From the above calculation it was found that chilli cultivation is profitable in Bangladesh.

CHAPTER 6
MAJOR FACTORS AFFECTING CHILLI PRODUCTION

Human labor, land preparation cost, cost of seed/seedlings, cost of urea, cost of TSP, cost of MoP, cost of cow dung, pesticides cost, and irrigation cost were the major inputs used in chilli production in the study area. Fertilizer and pesticides were also significant inputs. These inputs were used as explanatory factors in the chilli production function study to help explain the findings. As a result, it is theorized that these inputs are responsible for chilli production variance. As a result, a Cobb-Douglas production function was used to estimate likely relationships between chilli output and inputs, with the findings reported in study.

6.1 Interpretation of Cobb-Douglas Production Function:

The construction of a mathematical equation for the sample data, known as the Likelihood Function, is the first step in the process of maximum likelihood estimation. It is defined as the probability of getting a collection of data based on the probability distribution model that has been chosen for collecting that collection of data. This phrase contains the parameters of the model that are unknown at this time.

Table 6.1 presents the Cobb-Douglas production function model of chilli growing for all farmers, as calculated using the maximum likelihood method.

Table 6.1 Estimated values of the co-efficient and related statistics of Cobb-Douglas production model

Variables	Parameter	Co-efficient	Standard Error	T-value	P-value
Intercept	β_0	6.419	6.704	0.96	0.341
Human Labor (X_1)	β_1	-0.067	0.062	-1.09	0.279
Land Preparation Cost (X_2)	β_2	0.345***	0.078	4.43	0.001
Cost of Seed/Seedlings (X_3)	β_3	0.47*	0.024	1.95	0.054
Cost of Urea (X_4)	β_4	-0.329	0.202	-1.63	0.107
Cost of TSP (X_5)	β_5	0.468	0.679	0.69	0.492
Cost of MoP (X_6)	β_6	-0.373**	0.177	-2.11	0.038
Cost of Cow dung (X_7)	β_7	0.326**	0.127	2.56	0.012
Irrigation Cost (X_8)	β_8	-0.227***	0.04	-5.69	0.001
Pesticide Cost (X_9)	β_9	0.414***	0.081	5.13	0.001
R^2		0.675			
F-Value		20.766***			

Note: *** = Significant at 1% level, ** = Significant at 5% level, * = Significant at 10% level

As indicated by the F-values and R-square, the Cobb-Douglas model performed well in terms of matching the data. R-square values of 0.675 were found for chilli producers. Chiili production was shown to be 67.5 percent more variable when the explanatory variables were included. The effect of stated factors on chilli production may be seen in the regression equation estimates, which are derived from the regression equation. For chilli growers, the results showed that the co-efficient of land preparation cost,

irrigation cost and pesticide cost were significant at the 1 percent level, and the cost of MoP and cost of cow dung were significant at the 5 percent level, and cost of seed was significant at 10 percent level. But the co-efficient of human labor, cost of urea, and cost of TSP did not have the predicted sign. Aside from that, the F-value (20.766) of the equation was statistically significant at the 1 percent level of significance. This suggests that the explanatory variables in the model account for the majority of the variation in chilli production.

In summary, the models suggest that the respective authority should be considered the land preparation cost, cost of seed/seedlings, cost of MoP, cost of cow dung, irrigation cost, pesticide cost, some predictive importance has been discussed below:

6.1.1 Significant Contribution of Land Preparation Cost to Gross Return

From the multiple regression, it was concluded that the contribution of land preparation cost to the gross return was measured by the testing the following null hypothesis;

"There is no contribution of land preparation cost to the gross return"

On the basis of the value of the concerned variable of the study the following observations were made.

a) The contribution of the land preparation cost was significant at 1% level (.001)

b) So, the null hypothesis will be rejected.

c) The β-value of education is 0.345. So, it can be stated that as land preparation cost increased by 1%, gross return is increased by 0.345%. Considering the effects of all other factors are held constant.

Land preparation cost has positive significant contribution to gross return in terms of chilli production. Hence, we can say that increasing the land preparation cost will increase the gross return in terms of chilli production.

6.1.2 Significant Contribution of Cost of Seed/Seedlings to Gross Return

From the multiple regression, it was concluded that the contribution of cost of seeds to the gross return was measured by the testing the following null hypothesis;

"There is no contribution of cost of seed to the gross return"

On the basis of the value of the concerned variable of the study the following observations were made.

a) The contribution of the cost of seed/seedlings was significant at 10% level (.054)

b) So, the null hypothesis will be rejected.

c) The β-value of education is 0.47. So, it can be stated that as cost of seed increased by 1%, gross return is increased by 0.47%. Considering the effects of all other factors are held constant.

Cost of seed/seedlings has positive significant contribution to gross return in terms of chilli production. Hence, we can say that increasing the amount of seed/seedlings will increase the gross return in terms of chilli production. Similar findings found in previously in the findings of Channa et al., (2020)

6.1.3 Significant Contribution of Cost of MoP to Gross Return

From the multiple regression, it was concluded that the contribution of cost of MoP to the gross return was measured by the testing the following null hypothesis;

"There is no contribution of cost of MoP to the gross return"

On the basis of the value of the concerned variable of the study the following observations were made.

a) The contribution of the cost of MoP was significant at 5% level (.038)

b) So, the null hypothesis will be rejected.

c) The β-value of education is -0.373. So, it can be stated that as cost of MoP increased by 1%, gross return is decreased by 0.373%. Considering the effects of all other factors are held constant.

Cost of MoP has negative significant contribution to gross return in terms of chilli production. Hence, we can say that decreasing the amount of MoP will increase the gross return in terms of chilli production. Similar findings found in previously in the findings of Velayutham and Damodaran, (2015) and Channa et al. (2020).

6.1.4 Significant Contribution of Cost of Cow dung to Gross Return

From the multiple regression, it was concluded that the contribution of cost of cow dung to the gross return was measured by the testing the following null hypothesis;

"There is no contribution of cost of cowdung to the gross return"

On the basis of the value of the concerned variable of the study the following observations were made.

a) The contribution of the cost of cow dung was significant at 5% level (.012)

b) So, the null hypothesis will be rejected.

c) The β-value of education is 0.326. So, it can be stated that as cost of cow dung increased by 1%, gross return is increased by 0.326%. Considering the effects of all other factors are held constant.

Cost of cow dung has positive significant contribution to gross return in terms of chilli production. Hence, we can say that increasing the amount of cow dung will increase the gross return in terms of chilli production. Similar findings found in previously in the findings of Velayutham and Damodaran, (2015) and Channa et al. (2020)

6.1.5 Significant Contribution of Irrigation Cost to Gross Return

From the multiple regression, it was concluded that the contribution of irrigation cost to the gross return was measured by the testing the following null hypothesis;

"There is no contribution of irrigation cost to the gross return"

On the basis of the value of the concerned variable of the study the following observations were made.

a) The contribution of the irrigation cost was significant at 1% level (.001)

b) So, the null hypothesis will be rejected.

c) The β-value of education is -0.227. So, it can be stated that as irrigation cost increased by 1%, gross return is decreased by 0.227%. Considering the effects of all other factors are held constant.

Irrigation cost has negative significant contribution to gross return in terms of chilli production. Hence, we can say that decreasing the irrigation cost will increase the gross return in terms of chilli production.

6.1.6 Significant Contribution of Pesticide Cost to Gross Return

From the multiple regression, it was concluded that the contribution of pesticide cost to the gross return was measured by the testing the following null hypothesis;

"There is no contribution of pesticide cost to the gross return"

On the basis of the value of the concerned variable of the study the following observations were made.

a) The contribution of the pesticide cost was significant at 1% level (.001)

b) So, the null hypothesis will be rejected.

c) The β-value of education is 0.414. So, it can be stated that as pesticide cost increased by 1%, gross return is increased by 0.414%. Considering the effects of all other factors are held constant.

Pesticide cost has positive significant contribution to gross return in terms of chilli production. Hence, we can say that increasing the insecticde will increase the gross return in terms of chilli production. Similar findings found in previously in the findings of Channa et al., (2020).

CHAPTER 7
PROBLEMS FACED BY THE FARMERS IN CHILLI PRODUCTION

7.1 Introduction

The purpose of this Chapter is to determine the magnitude of the issues faced by chilli farmers. Farmers had several difficulties in cultivating chilli. The issues were social and cultural in nature, as well as financial and technological in nature. This chapter will discuss some of the socioeconomic issues and limits associated with manufacturing chilli. Farmers challenges and limits were identified based on their perspectives These problems were first counted in response of the number of respondents. Then the counts were transformed into percentage. Hereafter, the problem that obtained the greatest percentage was ranked number 1. And the other problems were ranked accordingly on the basis of greater percentage of respondents facing these problems, constraints (Table 7.1).

7.2 Lack of Operating Capital

Farmers in the study region were constrained by capital restrictions. To cultivate chilli, a large sum of cash was required to acquire numerous inputs such as human labor, seed, fertilizers, and pesticides. About 93 percent chilli farmers said that they lacked the funds necessary to purchase the appropriate quantity of inputs for the respective operations, classifying this as a severe difficulty (Table 7.1).

7.3 High Price of Quality Seed

The high cost of high-quality seed was also a significant constraint to producing chilli in the research location. About 90% of chillli producers rated this as a serious concern (Table 7.1).

7.4 High Cost of Irrigation Water

Irrigation is the primary factor affecting agricultural productivity. Chilli yields vary according on how much irrigation water is used. In the research locations, the majority of farmers lacked their own shallow tube well or deep tube well, necessitating a higher water bill from the water supply. However, farmers reported having to pay a higher

irrigation water rate. Almost 85% of chilli producers classified this as a serious concern (Table 7.1).

7.5 Low Price of Output

The majority of farmers were forced to sell a big amount of their crop during the harvesting season in order to satisfy different commitments such as family expenses and loan repayment. However, due to abundant availability, the harvest season price of chilli remained low. As a result, they were unable to get an acceptable return on their goods. Around 84 percent of chillli producers rated this as a serious concern (Table 7.1).

Table 7.1 Problems and Constraints to Chilli Production by no. of farmers

Type of Problems	No. of farmers	Percentage of farmers	Rank
Lack of operating capital	93	93.00	1
High price of quality seed	90	90.00	2
High cost of irrigation water	85	85.00	3
Low price of output	84	84.00	4
Attack of pest and disease	80	80.00	5
Lack of quality seed	70	70.00	6
Lack of scientific knowledge of farming	70	70.00	7
Shortage of human labor	70	70.00	8
Adulteration of fertilizer, and pesticides	65	65.00	9
Poor storage facilities in house	50	50.00	10
Natural calamities	50	50.00	11

7.6 Attack of Pest and Disease

Chilli farmers were also impacted by insect and disease attacks. Pests and diseases harm crops, reducing productivity and increasing production costs. Around 80% of chilli producers rated this as a serious concern (Table 7.1).

7.7 Lack of Quality Seed

Lack of quality seed was one of the most important limitations of producing chilli in the study area. From table 7.1, it is evident that about 70.00 percent chilli growers reported this as high problem. Farmers in both unions told that they were cheated by buying so called hybrid seeds from the local markets and from the seed dealers.

7.8 Lack of Scientific Knowledge of Farming

Although modern agricultural technologies have been using in the study area, a large number of farmers have no adequate knowledge of right doses and methods of using modern inputs and technologies of producing their enterprises. About 70.00 percent chillli growers were encountered this problem. (Table 7.1).

7.9 Shortage of Human Labor

The majority of human labor is used in seed/seedling planting and harvesting seasons. chilli peppers are time-consuming to prepare. Human labor shortages were discovered at many phases of production, including planting, intercultural activities, and harvesting. About 70.00 percent of chilli producers rated this as a severe concern (Table 7.1).

7.10 Adulteration of Fertilizer and Pesticides

The most essential inputs in chilli production are chemical fertilizers, insecticides, and pesticides. They were heavily used in chilli production of the research area. Numerous farmers have reported being duped into spreading tainted fertilizers and chemicals to their agricultural fields. About 65 percent of chilli producers confronted this issue severely (Table 7.1).

7.11 Space Shortage in the Cold Storages

Traditionally, the majority of chilli farmers kept their dry chilli in their homes. Inadequate trained staff resulted in significant deterioration of chilli throughout the harvest and post-harvest period. As a result, they had several setbacks, including weight loss and rotting of chilli. About 50% of sample farmers rated the issue of inadequate storage facilities as very important (Table 7.1).

7.12 Natural Calamities

It was discovered that chillli farmers encountered many serious issues related to nature throughout the producing process. Natural disasters such as drought, hailstorms, and extreme rains wreaked havoc on the produce in the field. According to farmers, significant rainfall during the harvesting season affects both the amount and storability of chilli. Around 50% of chilli producers regarded this as a serious issue (Table 7.1).

CHAPTER 8

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

8.1 Summary

Chilli are cultivated extensively across Bangladesh, not only for the domestic market, but also for export. Chilli production is critical for improving the economic situations of farmers, particularly marginal and small farmers, as well as providing the nutritional needs and food safety standards of the Bangladeshi people. The current research will address many critical concerns about the development of this crop, the cost of cultivation, the returns on this commodity, and the limits on its production. As a result, systematic study was necessary for this crop in order to provide comprehensive information to farmers interested in growing it.

The sample frame for this research was purposively chosen to include areas with extensive chilli farming. Due to the significant concentration of chilli crop production in Singair upazila, two unions were chosen: Jamirta and Joymontop. A sample size of 100 is typically considered to be the bare minimum for a bigger population that will produce a degree of assurance suitable for decision-making. In this scenario, individuals who cultivated several types of chilli in the designated locations were chosen as samples. The current research gathered data from 12 June and 11 July of 2021. We gathered primary data from primary producers. Personal interviews using pre-tested interview schedule were conducted with selected respondents. For the purpose of consistency and completeness, the obtained data were examined and validated. Prior to entering the data into the computer, it was edited and coded. All acquired data were thoroughly summarized and analyzed to weed out any probable inaccuracies. The data were entered into a computer and analyzed using the appropriate software, Microsoft Excel and STATA.

Economic profitability is a major criterion to make decision for producing any crop at farm level. It can be measured based on net return, gross margin and ratio of return to total cost. The average land preparation cost of chilli production was found to be Tk. 5373.19 per hectare. The quantity of hired human labor used in chilli production was found to be 80 man-days per hectare and average price of human labor was Tk. 500 per man-day. Therefore, the total cost of hired human labor was found to be Tk. 40000. Per

hectare total cost of seed for chilli production was estimated to be Tk. 4904.02. On an average, farmers used Urea, TSP, and MoP was 404.79 Kg, 281.26 kg and 209.36 kg, per hectare, respectively. The average cost of pesticides for chilli production was found to be Tk. 4559.46. Whereas the average cost of irrigation was found to be Tk. 10878.48 per hectare. The total variable cost of chilli production was Tk. 95907.25 per hectare, which was 67.94 percent of total cost.

The average yield of chilli per hectare was 12256.12 kg and gross return from chilli was Tk. 367683.60. The gross margin and net return were found to be Tk. 271776.35 and Tk. 226520.05 per hectare, respectively. Benefit Cost Ratio (BCR) was found to be 2.60 which implies that one-taka investment in chilli production generated Tk. 2.60.

Cobb-Douglas production function model was used to determine the effects some important inputs of output from chilli cultivation. Human labor (X_1), land preparation cost (X_2), cost of seed (X_3), cost of urea (X_4), cost of TSP (X_5), cost of MoP (X6), cost of cow dung (X_7), irrigation cost (X_8), and pesticide cost (X_9) were the independent variables. While the regression coefficients for land preparation cost (X_2), cost of seed (X_3), cost of cow dung (X_7) and pesticide cost (X_9) were all positive, the coefficients for cost of MoP (X_6) and irrigation cost (X_8) were all negative and significant at various levels of significance. The human labor (X_1), cost of urea (X_4), and cost of TSP (X_5) were determined to be insignificant in relation to the return on chilli cultivation. The positive indication shows that the return on chilli can be enhanced by raising land preparation cost, cost of seed, cost of cowdung and pesticide cost, while the negative sign suggests that the return on chillis may be decreased by lowering cost of MoP and irrigation cost.

Farmers faced a lot of problems in producing chilli. The problems were lack of operating capital, high price of quality seed, high cost of irrigation water, low price of output, attack of pest, lack of quality seed, lack of scientific knowledge of farming, shortage of human labor, adulteration of fertilizer and pesticide, poor storage facilities in house and natural calamities were the major problems faced by farmers. Public and private initiatives should be taken to reduce or eliminate these problems for the sake of better production of chilli.

8.2 Conclusion

The following conclusions are drawn from the findings of this study and its interpretation in light of other relevant factors:

i. The Benefit Cost Ratio (BCR) was 2.60, implying that a single taka investment in chilli production yielded Tk. 2.60.

ii. Human labor, cost of urea and cost of TSP had no significant contribution to gross return in terms of chilli production.

iii. Land preparation cost had positive significant contribution to gross return in terms of chilli production. This implies that increasing the land preparation cost will increase the gross return in terms of chilli production.

iv. Cost of seed had positive significant contribution to gross return in terms of chilli production. Hence, we can say that increasing the amount of seed will increase the gross return in terms of chilli production.

v. Cost of MoP had negative significant contribution to gross return in terms of chilli production. Hence, we can say that decreasing the amount of MoP will increase the gross return in terms of chilli production.

vi. Cost of cow dung had positive significant contribution to gross return in terms of chilli production. Hence, we can say that increasing the amount of cow dung will increase the gross return in terms of chilli production.

vii. Irrigation cost had negative significant contribution to gross return in terms of chilli production. Hence, we can say that deccreasing the irrigation cost will increase the gross return in terms of chilli production.

viii. Pesticide cost had positive significant contribution to gross return in terms of chilli production. Hence, we can say that increasing the pesticide cost will increase the gross return in terms of chilli production.

ix. Lack of operating capital, high price of quality seed, high cost of irrigation water, low price of output, attack of pest and disease, lack of quality seed, lack of scientific knowledge of farming, shortage of human labor, adulteration of fertilizer, insecticides, and pesticide, poor storage facilities in house and natural calamities were the major problems faced by farmers.

8.3 Recommendations

Based on the results of the study, the following suggestions are furnished.

i. Land preparation cost, cost of seed, cost of cowdung and pesticide cost had positive significant contribution to gross returns in terms of chilli production. So, it is recommended that the number of land preparation, seed, cow dung and pesticide should be maximized.

ii. Cost of MoP and irrigation cost had negative significant contribution to gross returns in terms of chilli production. So, it is recommended that the amount of MoP and irrigation should be minimized and reasonable.

iii. This research was conducted only two union in Singair upazila under Manikganj district. To justify the findings of current study, it is important to make scope for more research in other regions.

iv. The study was based on the profitability of chilli production. Further studies may be conducted on the profitability of vegetable production.

v. In this study the investigations explore only 9 selected variables affecting the gross return in terms of chilli production. Other factors may have influenced gross return in terms of chilli production.

REFERENCES

Balraj, Dr. S., and Arockiasamy, Dr. P. (2018). Problems of Chilli Cultivation and Marketing in Ramanathapuram District, Tamilnadu. *International Journal of Research and Analytical Reviews,* 5(4): 617-619.

BBS, (2014), Report on The Productivity Survey of Chilli Crop-2014, Productivity Assessment Survey of Different Agricultural Crops Programme, Statistics and Informatics Division (SID), Ministry of Planning, Bangladesh, 2014.

BBS, (2021). Statistical Yearbook of Bangladesh, Bangladesh Bureau of Statistics, Ministry of Planning, Government of the Peoples Republic Bangladesh, Dhaka.

BER, (2021). Bangladesh Economic Review 2021, Finance Division, Ministry of Finance, Government of the Peoples Republic Bangladesh, Dhaka. August 2021.

Beattie, B.R. and Taylor, C.R. (1985). The Economics of Production. Montana State University, John Wiley & Sons, New York. pp. 316.

Channa, M. H., Sial, M., Dahri, G. N., Jamro, A. S., Solangi, T., Nasir, A. and Aamir (2020). Measuring Profitability of Chilli Pepper Production in Sindh, Pakistan. *Journal of Economics and Sustainable Development,* 11(8): 81-89.

Daundkar KS and Bairagi SK (2015) Economics of production of capsicum in Akola district. *International Journal of Commerce, Business and Management,* 8: 81-83.

Dillon, J. L. and Hardaker, J.B. (1993), Farm Management Research for Small Farmer Development, Food and Agricultural Organization, Rome. 6: 313.

Fuss, M. and Mcfadden, D. (1978). Production Economics: A Dual Approach to Theory and Application. North Holland, Amsterdam. pp. 221-225.

Geetha, R. and Selvarani, Dr. K. (2017). Constraints and Suggestions of Chilli Growers in Virundhunagar District. *International Journal of Advance Research and Innovative Ideas in Education,* 3(1): 1493-1496.

Geo, L., Ariani, W. O. R. and Saediman, H. (2020). Determinants and Profitability of Small-Scale Red Chilli Production in Konawe District of Southeast Sulawesi.

IOSR Journal of Agriculture and Veterinary Science, 13(3): 51-55.

Goode, W. J. and Hatt, P. K. (1952). Methods of social research. New York: McGraw-Hill Book Company, Inc., pp. 386.

Hanumanaikar, R.H., Rajeshwari, N. and Nimbal, M.F. 2006. Socio-economic status, constraints Faced and suggestions expressed by chilli growers in optimum use of pesticide in Tunga Bhadra project area of Bellary district. *Mysore Journal of AgriculturalScience,* 40(2): 261-266.

Hasan, M. K. and Banik, B. R. (2015). Economic Cost and Returns from Research and Development: The Case of Chilli in Bangladesh, *Asian Journal of Agriculture and Development, Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA),* 12(1):1-13.

Heady, E.O. and Dillon (1969). Agricultural Production Functions. Iowa State University Press, Ames. pp. 667.

Hoq, M. S., Matin, M, A., Hossain, T. M. B. and Omar, M. I. (2014). Production and Marketing of Green Chilli in Two Copious District of Bangladesh., *Asian Academic Research Journal of Multidisciplinary,* 1(18): 785-799.

Huda, F. A., Islam, M. S., Biswas, H. and Islam, M. S. (2008). Impact Assessment Study on Selected Spice Crops under Action Plan in Bangladesh. *Progress. Agric.* 19(2): 229-241.

Ila, I. A., Saha, S. and Mukul, A. Z. A. (2019). Financial profitability of green chilli production: a case study in Bogra district of Bangladesh. *J. Biosci. Agric. Res.* 19(01): 1606-1612.

Islam, S., Rahman, M. K. M. and Hasan, K. (2011). Profitability and resource use efficiency of producing major spices in Bangladesh. *Bangladesh Journal Agricultural Economics*, 56 (1-2): 1-13.

Jagtap, P. P., Shingane, U. U., and Kulkarni, K. P. (2012). Economics of chilli production in India. *African Journal of Basic & Applied Sciences*. 4 (5): 161-164.

Jorwar, R. M., Sarap, S. M. and Chavan, V. U. (2018). Economics of Production and Marketing of Chilli in Amravati district. *Journal of Pharmacognosy and Phytochemistry 2018,* 7(2): 310-316.

Kabir S. M. S. (2016). Basic Guidelines for Research: An Introductory Approach for

All Disciplines. Book Zone Publication, ISBN: 978-984-33-9565-8, Chittagong-4203, Bangladesh. pp. 201-275.

Meoya, J.(2011). An Economic Analysis of Chilli Production in some selected areas of Bangladesh, M.S. Thesis, Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh.

Monalisa, N. (2011). An Agribusiness Study of Chilli in IslampurUpazila of Jamalpur District, M.S. Thesis, Department of Agribusiness and Marketing, Bangladesh Agricultural University, Mymensingh.

Olayiwola O. O. (2014). An economic analysis of Chilli crop production in Ilora area of Oyo State. *International Monthly Refereed Journal of Research, Management & Technology,* 3: 47-53.

Patel, V. K., Gupta, S. P. and Patel, K. L. (2015). Economics Performance of Chilli (*Capsicum annuum* L.) Cultivation in Raigarh District of Chhattisgarh State. *International Journal of Agricultural Science and Reseacrh (IJASR),* 5(4): 363-368.

Quasem, A. and A.J. Bhuyan (2000).Concept Paper on Potentialities of Hot Chillies, Workshop Proceedings Year Round Chilli Production for Export, pp.17-28.

Rais, M. N., Mangan, T., Sahito, J. G. M., Qureshi, N. A., Sial, M. U. and Nasir, A. (2021). An Empirical Analysis of Constraints Faced by Chilli Growers and Market Intermediaries in Production and Marketing of Chilli in Sindh, Pakistan. *PalArch's Journal of Archaeology of Egypt/Egyptology,* 18(7): 1485-1491.

Rajput, H.D., Supe, S.V. and Chinchmalatpure, U.R. (2007). Factors association for declining Chilli area and its diversification. *Indian Research Journal of Extension Education,* 7(2): 76-78.

Rosenberg, M.J. & Hovland, C.I.. (1960). Cognitive, affective, and behavioral components of attitudes. Attitude organization and change: An analysis of consistency among attitude components. Attitude Organization and Change. An Analysis of Consistency Among Attitude Components. pp. 1-14.

Sanusi M. M, Ayinde I. A. (2013). Profitability of pepper production in derived Savannah zone of Ogun State, Nigeria. *International Journal of Agriculture and Food Security 4*, :401- 410.

Shaker, B. R. M., Kumar, J. H., Chaitanya, V., Sriranjitha, P., Kumar, K. R. and Rao, P. J. M. (2021). Economics of Chilli Cultivation in Khammam District of Telangana. *Int. J. Curr. Microbiol. App. Sci.,* 10 (02): 893-901.

Shrivastava, K. K. (2003). Constraints of chilli cultivation and their suggestions in Kheda district of Gujrat. Krishi Vistar Samiksha, 13(1):18-21.

Townsend, 1953. Introduction of experimental Method. International student Edition New York : MC. Grow Hill Book Company Inc.

Tsopoe, J. and Murry, N. (2020). Economics of Chilli Cultivation in Wokha District of Nagaland, India. *Curr. Agri. Res.,* 8(1): 46-51.

Velayutham, Dr. L. K., and Damodaran, Dr. K. (2015). An Economic Analysis of Chillies Production in Guntur district of Andhra Pradesh. *International Journal of Research in Economics and Social Sciences.* 5(9): 43-49.

Venkataramulu, M., Hanchinal, S.N. and Hirevenkanagoudar, L.V. (2010). Adoption of improved cultivation practices among chilli growers. *Karnatak Journal of Agricultural Science,* 22(5): 722-725.

WB, (2017). Climate-Smart Agriculture in Bangladesh. CSA Country Profiles for Asia Series. International Center for Tropical Agriculture (CIAT); World Bank. Washington, D.C. pp: 28.

APPENDIX A

DEPARTMENT OF DEVELOPMENT AND POVERTY STUDIES
SHER-E-BANGLA AGRICULTURAL UNIVERSITY

"Profitability Analysis of Chilli Production in Some Selected Area of Singair Upazila"

(English Version of Questionnaire)

1. Identification of the farmers:

Name of the Farmer: ……

Village: ……. Upazila: ……

District: …….

2. Socio-economic characteristics:

Age (Years)	
Main Occupation	
Secondary Occupation	
Experience in Chilli Production	

(Note: 1= Agriculture, 2= Business, 3= Service, 4= Livestock, 5= Fishing, 6= Others)

3. Level of Education:

Mentions your level of education:

a) I can't read
b) I can sign only
c) I Have passed …….. years

4. Family Structure:

Indicators		**Number**
Gender	Male	
	Female	
	Total	
Members involved in agriculture		

5. Land holding and tenancy:

Category of land	Area (Decimal)
Homestead	
Orchards	
Pond	
Own land	
Leased in	
Leased out	
Total Chilli cultivated area	

6. Training Exposure:

Have you received any training program related to chilli production? Yes/No

If yes then furnish the following information

Sl. No	Name of the training Course	Duration (Days)
1		
2		
3		
4		
Total		

7. Extent Contact:

Please state the extent of your contact with the following communication information sources.

Name of Information Sources	Extent of Contact				
	Regularly (4)	Often (3)	Occasionally (2)	Rarely (1)	Not at all (0)
Meeting with agricultural officer/SAAO	>5 times/month	3-4 times/month	2 times/month	1 time/month	
Meeting with progressive farmer	>5 times/month	3-4 times/month	2 times/month	1 time/month	
Visiting exhibition block	>5 times/month	3-4 times/month	2 times/month	1 time/month	

Listening agricultural program in Radio	>5 times/month	3-4 times/month	2 times/month	1 time/month	
Watching agricultural program on TV	>5 times/month	3-4 times/month	2 times/month	1 time/month	
Reading printed media (e.g., agricultural news, poster, leaflet)	>5 times/month	3-4 times/month	2 times/month	1 time/month	
Participation in group discussion	>5 times/month	3-4 times/month	2 times/month	1 time/month	

8. Organizational Participation:

Are you member of any organization? Yes/No

If yes then mention the name of the organization

……

9. Input use and Cost analysis:

A. Human Labor use

Activities		**Man-days**	**Wage rate (Tk./day)**	**Total Cost (Tk.)**
Land Preparation	Family			
	Hired			
Fertilizer application	Family			
	Hired			
Carrying farmyard manure and application	Family			
	Hired			
Weeding	Family			
	Hired			

Irrigation	Family			
	Hired			
Pesticide Application	Family			
	Hired			
Harvesting and Carrying	Family			
	Hired			
Storage and post harvesting activities	Family			
	Hired			

B. Cost of Land preparation:

Items		**No.**	**Rate (Tk./unit)**	**Total Cost (Tk.)**
Ploughing (Power tiller/Tractor)	Owned			
	Hired			
Ridge Preparation	Owned			
	Hired			
Earthing up	Owned			
	Hired			

C. Material Inputs:

Items	**Unit**	**Cost/Unit (Tk.)**	**Total Cost (Tk.)**
Seed (Kg)			
Cow dung (Kg)			
Green Manure (Kg)			

Urea (Kg)			
TSP (Kg)			
MoP (Kg)			
Others (Kg)			
Pesticides			
Irrigation (Times)			
Rental value of land			

10. Information about annual income from Chilli production:

Items	Quantity (Kg)	Price (Tk./Kg)	Total Income

11. Other income sources:

Sources	Items	Total Amount (Tk.)
Farming	Agriculture	
	Livestock	
	Fish	
	Poultry	
Non-farming	Service	
	Business	
	Labor	
	Foreign	
	Others	

12. Information of Expenses:

Items	**Total Amount (Tk.)**
Food	
Medicine	
Cloth	
Festivals	
Education	
Others	

13. Mention some problems faced in the time of Chilli production:

……
……
……
……
……
……
……
……

14. Give some suggestions:

……
……
……
……
……

Sign of the enumerator:

Date: ……../……./……..