SOCIO ECONOMIC ASPECTS OF GINGER CULTIVATION IN SOME SELECTED AREAS OF NILPHAMARI DISTRICT OF BANGLADESH

MD MASUD RANA

DEPARTMENT OF AGRICULTURAL ECONOMICS

SHER-E-BANGLA AGRICULTURAL UNIVERSITY

DHAKA-1207

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SOCIO ECONOMIC ASPECTS OF GINGER CULTIVATION IN SOME SELECTED AREAS OF NILPHAMARI DISTRICT OF BANGLADESH

BY

MD MASUD RANA

REGISTRATION NO,:15-06790

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APPROVED BY

…….....	**……...**
Dr. Bazlul Ameen Ahmad Mustafi **Former Director (Admin), BRRI** **Adjunct Faculty,** **Dept.of Agricultural Economics** **Sher-e-Bangla Agricultural University** **Supervisor**	**Dr. Md. Sadique Rahman** **Professor** **Dept.of Management and Finance** **Sher-e-Bangla Agricultural University** **Co-Supervisor**

……

Dr. Monoj Kumar Majumder
Chairman
Department .of Agricultural Economics
Sher-e-Bangla Agricultural University

DEPARTMENT OF AGRICULTURAL ECONOMICS

Sher-e-Bangla Agricultural University
Sher-e-Bangla Nagar, Dhaka-1207
Website: www.sau.edu.bd

CERTIFICATE

This is to certify that the thesis entitled **"SOCIO ECONOMIC ASPECTS OF GINGER CULTIVATION IN SOME SELECTED AREAS OF NILPHAMARI DISTRICT OF BANGLADESH"** *submitted to the Department of Agricultural Economics, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of* ***Master of Science in Agricultural Economics,*** *embodies the result of a piece of bona fide research work carried out by* ***MD MASUD RANA****, Registration Number:* ***15-06790*** *under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.*

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

…...……..

Dr. Bazlul Ameen Ahmad Mustafi
Former Director (Admin), BRRI
Adjunct Faculty,
Department of Agricultural Economics
Sher-e-Bangla Agricultural University

Dedicated
To
My Beloved Parents

ABSTRACT

The study was aimed to assess the cost, return, and profitability of ginger farming in specific districts of Bangladesh. It has potential to be marketed both domestically and internationally. Bangladesh's Nilphamari district makes a major contribution to the nation's overall production of ginger. In this region, the climate and land composition are suitable for ginger growth. The aim of this study is to explore the performance of ginger cultivating in this district and to identify the challenges and prospects of ginger cultivation .This research made use of primary data. The study indicates that the gross margin, net return, and return per hectare were found to be Tk.738038.76, Tk.568259.09, and Tk.1053910.6 respectively. Necessary descriptive and statistical analyses are done to achieve the objectives. The Cobb-Douglas production function was used to assess the impacts of various inputs on ginger cultivation, and the undiscounted benefit-cost ratio for ginger cultivation was 2.17 in this study. The result found that ginger cultivation was profitable. According to the Cobb-Douglas production function, ginger production has a decreasing return to scale. The model's co-efficient of multiple determination R^2 was 0.40 for ginger cultivation, indicating that the explanatory variables included in the model explained approximately 40% of the variation in gross return .Farmers in the research region stated that challenges such as the occurrence of root rot disease, high seed prices, insect infestation, and so on are major problems for their production and require the attention of the appropriate authority to solve.

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June, 2022 **The Author**

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ABBREVIATIONS

BBS	Bangladesh Bureau of Statistics
FAO	Food and Agricultural Organization
BCR	Benefit Cost Ratio
BER	Bangladesh Economic Review
BRRI	Bangladesh Rice Research Institute
DAE	Department of Agricultural Extension
HYV	High Yield Variety
TSP	Triple Super Phosphate
MOP	Muriate of Potash
GDP	Gross Domestics Products
IOC	Interest on Operating Capital
MOA	Ministry of Agricultural
MT	Metric ton
TVC	Total Variable Cost
TFC	Total Fixed Cost
GR	Gross Return
GM	Gross Margin
TC	Total Cost
GM	Gross Margin
USDA	United State Department of Agriculture
et al	And others (at elli)

CHAPTER I
INTRODUCTION

1.1 Background of the Study

The agricultural sector has been emphasized in order to make Bangladesh self-sufficient in food. The government attempts to improving the whole agriculture sector in accordance with the objectives outlined in the Eighth Five Year Plan and the National Agriculture Policy. Sustainable growth has maintained and GDP growth of more than 7 percent on an average during the last decade in the economy of Bangladesh. The GDP growth go beyond the 8 percent in FY 2021-22 and stood at 7.25 percent. Among the 3 wide sectors of economy the growth of agriculture sector 2.20 percent of GDP .Compared to the previous fiscal year, the growth rate of crops, horticulture, and fishing has declined during this period, while the growth rate of animal farming, forest products, and related businesses has increased. (BER, 2022).

Spices are useful both as food and as medicine. They bring out the separate natural flavors of cuisines and can be used to alter the appearance of food to make it more visually appealing in color. Almost everyone has become used to using spices in curries and other dishes. They contribute various flavors and aromas. Spices are important not just in medicine but also in diet.

A large number of growers in the Nilphamari district have been cultivating this spicy crop following their tradition and more than 50 percent of the countrys ginger produce here. Many spice-processing firms, such as Square, BD Foods, PRAN, Archu, Advanced Chemical firms (ACI), Amrita, Dekko, and others, have since established themselves in Bangladesh. They export spices as final products outside of the country. As a result, as these businesses expand their production, the need for spices as raw materials rises and total spice demand is expanding at a steady rate. As a result, there is presently a large discrepancy between supply and demand .To overcome this deficit, the country must spend a large amount of foreign currency each year on purchasing spices from other countries. Recognizing the value of spices, the Bangladesh government began exporting ginger through the Uttara EPZ. 81 technologies for production, soil and water management, disease and pest management, and post-harvest management, on the other hand, have been established. BARI, BARC, DAE, and (NGOs) have increased their efforts to expand these technologies. As a result, overall spice production has increased.

1.2 Ginger production in Bangladesh

Ginger is an important spice cash crop .It is cultivated in the tropical and sub-tropical and humid climate. In Bangladesh, for the past ten year ginger production has essentially stagnated at roughly 80000 tonnes despite a five-fold increase in demand for the essential herbal spice. The country must import 0.5–0.6 million tonnes of ginger annually, costing billions of Taka, due to the country's increasing demand .Ginger production totaled 82,152 tonnes in the most recent fiscal year (FY) 2021-22, up from 81,715 tonnes in FY 21 and 84,887 tonnes in FY 20. (Financial Express, April 8, 2023). The production of spices was 77,052 tonnes in FY 14 and 83,004 tonnes in FY 15, respectively, which was nearly identical to that of the previous decade. Ginger demand in the country rose from 0.15 million tonnes in FY 10 to 0.5-0.6 million tonnes in FY 22. Depending on its global rates, the import of ginger from countries like India, China, and some African nations is estimated to cost Bangladesh Tk 25–40 billion yearly. The average price that customers have been paying for ginger over the past five years has been Tk 120 per kg. Its selling cost regularly exceeded Tk 300 per kg. The Rangpur region, particularly the Nilphamari district, produced huge amounts of ginger up to the 2000 tonnes. Due to low profit margins, farmers in Nilphamari increasingly turned away from growing ginger and toward growing summer vegetables, Aman, and other crops. The output of local ginger has significantly decreased in the northern regions, with Chittagong and the hilly districts now serving as major sources. In 2022, the Chittagong region produced around 35,000 tonnes of ginger, whereas the combined production of Rangpur and Dinajpur regions was just about 20,000 tonnes. The cropping intensity increased by 213% over the previous ten years. However, disease outbreaks, farmers' lack of enthusiasm in growing ginger (since it takes 160–180 days to grow the tuber spice), and essentially no assistance from the relevant government organizations were to blame for this dull condition of its production .The ginger plant requires close monitoring because even a few days of water logging could significantly reduce its ability to produce. In return, the northern areas' farmers hardly ever make their required profit, causing many of them to give up ginger production .Further that farmers in hilly places might make profit as they produce other crops with ginger at the same time. Farmers on may lose interest in growing ginger without profitable incentives. Ginger's demand would rise by 10-12% every year because to its growing appeal as a herb among health-conscious people, as well as its use as a spice in cooking. Currently, ginger growing is engaged in by no more than 0.1 million farmers. If the Ministry of Agriculture merely offers ginger farmers Taka 200 million as an incentive, their output can be

tripled in five years. Bangladeshis are unable to comprehend cuisine without spices. Spice trees can be quite expensive. Large spices also have a big advantage that is advantageous. It can significantly contribute to improving Bangladesh's societal development, eradicating poverty, empowering women, increasing farmer revenue, creating jobs, and eradicating hunger. Spices are extremely nutritious in terms of taste and flavor, and modern scientists have justified the quantity of treatment. The use of spices as medicine dates back to primordial times. Ginger, onions, garlic, turmeric, chili, pepper, cinnamon, cardamom, clove, coriander, cumin, mint, fenugreeks, fennel, and tamarind are among the most often used spices. In addition to this, humans use a variety of other spices in various contexts.

(Source: Financial Express, April 8, 2023)

Table-1.1: Area and Production of Ginger in Bangladesh

Year	Production (MT)	Area (Ha)	Per hectare yield (t/ha)
2015-16	77290	23514	3.24
2016-17	77438	24513	3.16
2017-18	79438	24953	3.18
2018-19	80234	23747	3.38
2019-20	84887	25461	3.33
2020-21	81715.76	25393.53	3.22
2021-22	82152	25463	3.23

Source: BBS (2022)

1.3 Origin and Status of Ginger

The spice ginger is the underground the rhizome of the ginger land known botanically as ***Zingiber officinale***, a herbaceous perennial plant of the Zingiberaceae family, is thought to have evolved in Southeast Asia. Ginger's strong, fragrant rhizome is used to season food, flavor it, and make medicines. (underground stem). Zingiber, which is derived from the Sanskrit term singabera for the spice, is the common name for ginger. The generic name for ginger is zingiber, which derives from the Greek zingiberis, which in turn is derived from the Sanskrit name singabera. Ginger has been used in India and China for centuries, and by the first century CE, merchants had brought it to the Mediterranean region. By the eleventh century, England was a well-known country. The Spanish brought it to Mexico and the West Indies shortly after the conquest, and by 1547 Santiago, Chile, was exporting ginger to Spain. Ginger is a root crop with the characteristics of a typical herb grown across the world for it underground stem or rhizome which has nutritional and medicinal value.

Table1.2: Worldwide production

Country	Area (ha)	Production (Ton)
India	164000	1788000
Nigeria	84156	691239
China	55059	581137
Nepal	22132	297512
Indonesia	8077	174380
Thiland	10118	166923
Camerron	8145	83434
Bangladesh	9610	80234
Japan	1729	45506
Philippines	3924	26929

Source: www.nationmaster.com (2023)

Since the beginning of a period of time Bangladesh has been cultivating ginger for use as a dried spice and as one of the oldest known oriental spices. Zingiber officinale's rhizomes are used to make ginger. The ginger family consists of around 1200 plant species divided into 53 genera. It is most common in the Indo-Malaysian area.

1.4 Nutritive, Medical Value of Ginger

Ginger is high in antioxidants, which protect your body's DNA from stress and harm. They may help your body fight chronic diseases like high blood pressure, heart disease, and lung diseases, as well as promote healthy aging and also help with cancer, reduce pain, healthier skin, weight loss aid, prevent cardiovascular disease, and improve brain function.

Table 1.3: Nutritive value of ginger (Value per 100gm)

Name	Amount(gm)	Daily value
Calories	80	
Total Fat	0.8	1%
Saturated fat	0.2	1%
Cholesterol	0	0%
Sodium	13	0%
Potassium	415	11%
Total Carbohydrate	18	6%
Dietery fiber	2	8%
Protein	1.8	3%
Vitamin C	NA	8%
Iron	NA	3%
Vitamin B6	NA	10%
Magnesium	NA	10%
Calcium	NA	1%

Source: USDA (2023)

The percentage the daily values are based on a 2,000 calorie diet. Your daily numbers may be greater or lower depending on your calorie requirements.

1.5 Statement of the Problem

Ginger is a valuable commercial spice crop in tropical and subtropical regions, including Bangladesh. There are many factors behind Bangladesh's low ginger production that must be explored. A significant portion of the country's economic growth is attributed to agriculture. But in our country, ginger producers deal with a number of problems. They may experience issues with inputs, money, high-quality rhizome, irrigation, and a variety of other problems. They might also run into issues with prices. In the growing season for ginger, they are not paid fairly. There is little room for them to keep the ginger and needs appropriate resources to improve the situation of ginger farmers. However, research on the economic aspects of ginger cultivation is very rare. To fill the void .The current study was carried out to analyze the economic and ginger cultivation in the country's main producing areas.. Therefore the present study was undertaken to address the aforementioned issues for policy making.

1.6 Specific objectives of the Study

1. To describe the socio-economic profile of ginger grower.
2. To determine the profitability level of ginger cultivation.
3. To assess the various factors affecting ginger cultivation and find their relationships with the production and
4. To identify the problem of ginger cultivation.

1.7 Justification of the Study

An agriculturally-based nation like Bangladesh relies heavily on the expansion of its agricultural sector for its economy to grow. Although Bangladesh's agro-climate is favorable for a wide variety of plants, only grains, particularly rice, are presently grown in 80% of the country's cultivated areas. Population growth has significantly raised the demand for cereals. Bangladesh's environment is also ideal for growing ginger. There are many reasons why ginger yields in Bangladesh are poor, and the government should help ginger farmers by subsidizing input costs. Due to a lack of knowledge about ginger farming, credit options, and marketing strategies, the majority of ginger farmers are hesitant to engage in the farming. When deciding how much to produce, they weigh the crop's yield against the expense of production. Ginger production, yield, and area have fluctuated over time in the Nilphamari region. The fact that producers do not receive a fair price for their goods is one of the major causes. Even they are unable to decide with certainty whether to continue growing ginger the next year. A few studies have been conducted in Bangladesh to evaluate the financial viability and resource efficacy of ginger production. Finally, the study's findings are expected to aid individual farmers in improving the efficiency of resource usage on their farms through better operation and management by emphasizing shortcomings, as well as policymakers and extension specialists in developing an appropriate policy.

1.8 Organization of the study

The study consist of eight chapter .The first chapter described the study's context, ginger cultivation in Bangladesh, origin and status of ginger, nutritive medicinal value of ginger, statement of the problem and objective. The second chapter is a review of the literature. The methodology and analytic techniques are described in Chapter three. The fourth chapter discusses the socioeconomic characteristics of ginger farmers. In chapter five describes profitability of ginger cultivation in selected area. Chapter six discussion the factor affecting return of ginger production, following chapter seven are described the problem of ginger cultivation .The summary, recommendation and conclusion are described in chapter eight.

CHAPTER II
REVIEW OF LITERATURE

This chapter's main goal is to review some studies that are relevant to the present study. Only a small number of studies have been done so far on how effectively gingers are used as resources and how profitable they are in Bangladesh. Furthermore, while some of these studies may not be totally applicable to present research, the conclusions, analytical method, and suggestions have a significant impact on it. A review of some of the previous research endeavors linked to the current study is discussed in the following sections.

Jamir *et al*.(2022) Research survey of farmers producing organic ginger was conducted in 2022 in Pongo, Yongnyah, Yonyam and Bhumnyu villages. Total of thirty (30) organic ginger producers were selected using random sampling methods from each of the four villages with a total sample size of one hundred twenty (120). The results revealed that the organic ginger production was profitable on cash cost basis (BCR 1.75). Seed have major cost share for ginger production (65.1%). The estimated coefficients of Cobb-Douglas production function showed that seed, labour and number of years for crop rotation were the significant factors for organic ginger production.

Islam *et al*.(2021)The experiment was conducted at Spices Research Sub-Center, BARI, Lalmonirhat in two consecutive years, 2015-16 and 2016-17, to observe the productivity and profitability of intercropping maize with ginger. The experiment was laid out in randomized complete block design with three replications. Maize was intercropped twice- after harvesting 1st planted maize again, maize was planted into the ginger field. Significant differences were exposed among the treatments regarding yield and intercrop efficiency. Higher ginger equivalent yield (GEY), gross return, gross margin and benefit cost ratio (BCR) were observed in T4, T5 and T6 where maize was planted on 3rd, 4th and 5th ginger row with 100% ginger and in T3 where maize was planted after 4 row ginger. Among those T6 was the most productive and profitable

Gurung *et al.*(2021)Conducted a research was to examine how profitable, effectively marketed, and how efficiently ginger was produced in Rukum West. Slovin's formula was used to calculate the sample size of 62 ginger-growing farmers out of 187 farmers. Twenty traders from Simrutu and Jhulneta, two important market hubs, were also questioned. An arbitrarily chosen sample size was interviewed using the semi-structured interview schedule that had been pre-tested. The Cobb-Douglas production function and other descriptive and statistical methods were used to evaluate the data. The typical area used for ginger cultivation, according to the results, was 0.14 per ha. In ginger cultivation, it was discovered that the seed alone accounted for a significant part (46.56%) of the costs. The benefit-cost ratio (2.02), which shows that the ginger manufacturing business was successful.

Namami Gohain *et al* (2020) Conducted study on, Assam's major cash crop, ginger, holds a distinctive place in the state's output. The crop has great potential for increasing agricultural income, creating jobs, and raising the living standards of farmers. Due to the paucity of study on the production side of ginger cultivation in the state, a thorough examination of the economics of ginger cultivation becomes important in order to identify the different cost and return patterns of ginger production. The study in question was carried out in the Assam area of Tinsukia in 2013, which is well-known for its enormous output of the crop. While fixed costs were found to be directly proportional to farm size, the overall costs of ginger production followed the same pattern. Furthermore, the data revealed that, while the rental value of owned land accounted for the largest proportion (74-78%) of overall fixed expenses, seeds accounted for a larger amount of variable costs across all farm sizes. Data study showed that large-scale farms had the highest net returns from ginger cultivation and were highly profitable.

Islam *et al* (2019) Zingiber officinale L., also known as ginger, is a key product grown in Asia for its spices. Ginger is a high-value product that can be grown from sea level to an altitude of 1500 meters above sea level and does well in warm, humid climates (Kandinnan, et al. 1996). For tropical nations where it is produced and consumed in significant amounts, it has special importance (Islam, 2017; BARI, 2012, 2013 and 2014). Both spices and medicines are made from the fragrant rhizomes. India, Jamaica, Sierra Leone, Nigeria, China, Japan, Taiwan, and Australia are the top ginger producers in the globe (Rana and Sharma, 1998). Bangladesh uses ginger as a condiment much more frequently and it is grown essentially everywhere in the nation. Only 74380 metric tons of ginger were grown nationally from 9120 ha of land, with an average

yield of 8.15 kg (BBS, 2011). Chattogram, Khagrachhari, Rangamati, Tangail, and Nilphamari are the main ginger-producing areas in Bangladesh. In 2017–2018, it filled a space of approximately 9609 ha and produced 79438 metric tons. Between 1961–1970 and 2011–18, the average area used for ginger production grew by 4217 ha to 9358 ha. Ginger productivity grew from 6.85 metric tons to 8.14 metric tons per hectare, while average ginger production increased from 29022 metric tons to 76023 metric tons.

Azad *et al* (2018) The study assessed the factors influencing ginger production and also identified the challenges linked with ginger production. It also calculated the cost and return of ginger cultivation in the study region. This study used Cobb-Douglas production function to meet defined goals. Four communities in the Nilphamari Sadar Upazilla in the Nilphamari district were studied. This research made use of primary data. Analysis showed that the gross margin, net return, and return per hectare were determined to be Tk. 897150, Tk. 508681, and Tk. 568902, accordingly. A total of Tk. 388469 per hectare was found to be the cost of growing ginger. A 2.31 benefit-cost ratio was found. It suggested that ginger farming was quite profitable.

Chalise *et al* (2017) Conducted study for being a major cash crop for small farmers across the nation, ginger, due to its high cost of goods and low yield, has an inadequate economic situation. The study, which focused on the cost variables of various inputs, was carried out in 2012 in four ginger-growing regions of Palpa, Nepal. According to the analysis, the cash cost foundation for ginger production was profitable. (BCR 7.22). For ginger production, seeds account for the majority of costs (65.1%). The computed coefficients of the Cobb-Douglas production function revealed that the key determinants of ginger production were seed, labor, and the number of years of crop rotation. The study came to the conclusion that ginger production might become a profitable business with more attention paid to the development and marketing of source seeds.

Hasan *et al* (2016) conducted a study ginger's price and production fluctuations in Bangladesh. The simplest approach for fluctuation and the Koyck model of distributed lag were tested using time series data on ginger area, output, and prices obtained by the Bangladesh Bureau of Statistics from 1975 to 2013. Ginger's annual price fluctuations varied from 50 to 63 percent, while variations in yield, production, and area ranged from 5 to 13 percent, 17 to 22 percent, and 20 to 11 percent, respectively. The research found that the average price lag value that developed in the market had an impact on ginger production in Bangladesh.

Islam *et al*. (2012) conducted a study on the economic impact of ginger farming in a few chosen Bangladeshi regions. The production of ginger was profitable according to the findings, and the average benefit-cost ratio (BCR) was 2.17. According to the estimated findings, the sample producers' mean technical efficiency was 85. It suggests that a 15% increase in technical efficiency is possible. The farmer's training and expertise in ginger cultivation had a negative and significant coefficient in the inefficiency model. It suggests that technical proficiency can be greatly increased by experience and education. Farmers in 68% of the countries generated at or above the frontier output level (81–95%). Farmers in the study region also stated a few problems that hamper ginger production, such as the prevalence of the disease root rot, costly seed, insect infestation, etc.

Inbasekar *et al*. (2011) studied resource utilization efficiency in ginger production in the Warangal district of Andhra Pradesh, India. On marginal farms, the coefficients of planting material, labor, and organic manure were positive and significant at 5%, according to the OLS estimates of the Cobb-Douglas production function. On small farms, the correlation between irrigation and fertilizer was positive and significant at 5%, while on big farms, the correlation between irrigation and labor was significant at 1% level of probability

Monnaf *et al*. (2010) A field experiment was carried out at the Horticulture Farm of the Bangladesh Agricultural University, Mymensingh, to study the impact of planting technique and rhizome size on the development and yield of ginger, with logistical support from the BAU's "Action Plan for Spices Project." Planting technique and rhizome size were the two factors that comprised the research. Five rhizome sizes—10g, 15-20g, 20g, 25g, and 30-35g—along with three planting techniques—ridge, furrow, and flat—were assessed for their primary impacts and combined effects. Ginger yield and yield components were significantly influenced by planting

techniques, rhizome size, and their combined impacts. The ridge method of planting produced the greatest yield (18.78 t/ha), followed by the furrow method (14.56 t/ha) and the flat method (11.06 t/ha). The 30-35g rhizome size produced the highest output (19.64 t/ha), while the 10-15g rhizome size produced the lowest yield (11.30 t/ha). The ridge method combined with 30-35g of rhizome size generated the maximum output (22.78 t/ha), while the flat method combined with 10-15g of rhizome size produced the lowest yield (8.34 t/ha).

Ravindran *et al.* (1994) Study conducted by the National Research Centre for Spices (NRCS) to evaluate a few ginger cultivars for various morphological, yield, and quality traits showed significant variation for the majority of these properties. The NRCS is focusing on the use of the preservation process. For long-term storage and has an in vitro gene bank for medium-term genetic storage. The creation of high yielding, disease-resistant, and high-quality strains is another project the NRCS participates.

Summary

According to the perspectives expressed above, a few studies on ginger growing have been undertaken in Bangladesh .But ginger's profitability plays vital role in the situations of Bangladesh. In this area, not enough research has not yet been done. Therefore, there is an urgent need for very thorough and in-depth research studies to provide information to policy makers so that improved policies can be developed. According to the evaluations described above, studies on the marketing side of ginger were only conducted. In Bangladesh, a few research paper on the economic potential of ginger cultivation have been conducted. To give information about ginger production, an in-depth study has been developed utilizing the available research. Researchers, farmers, traders, and consumers may find the study's results useful in making decisions about production and trading.

CHAPTER III
METHODOLOGY AND ANALYTICAL TECHNIQUES

3.1 Introduction

Research on farm managing must follow the desired methodology. A good study requires proper methodology. The purpose, nature, and goals of the study heavily influence the design of every survey. It also relies on whether the required time, materials, and resources are available. For farm management study, data can be gathered using a number of different techniques. For a farm business study, individual farmer data is typically collected; for agricultural business analysis, data collection includes the analyst's discretion in selecting data gathering methods within the limits imposed by the task's available resources. In this farm research, the "survey method" was predominantly applied. A large number of cases can be quickly investigated thanks to surveys, and their findings have a broader range of applications. The primary disadvantage of the survey method is that the researcher must rely on the farmers' memories. To address this issue, many excursions to the research region were made to collect data, and if there were any discrepancies or omissions, the farmers were called again to obtain the "missing or correct information". The following stages were followed in the current study's survey design.

3.2 Selection of the study area

An important stage in conducting a study on farm management is choosing the study location. The area chosen fit the study's specific goal as well as the possibility of working with the farmer. Despite the fact that ginger is produced throughout Bangladesh, the district of Nilphamari and the majority of the district division are the significant regions where it is grown very widely. Therefore, 60 farmers from villages in the Nilphamari district were chosen based on the greater concentration in production.

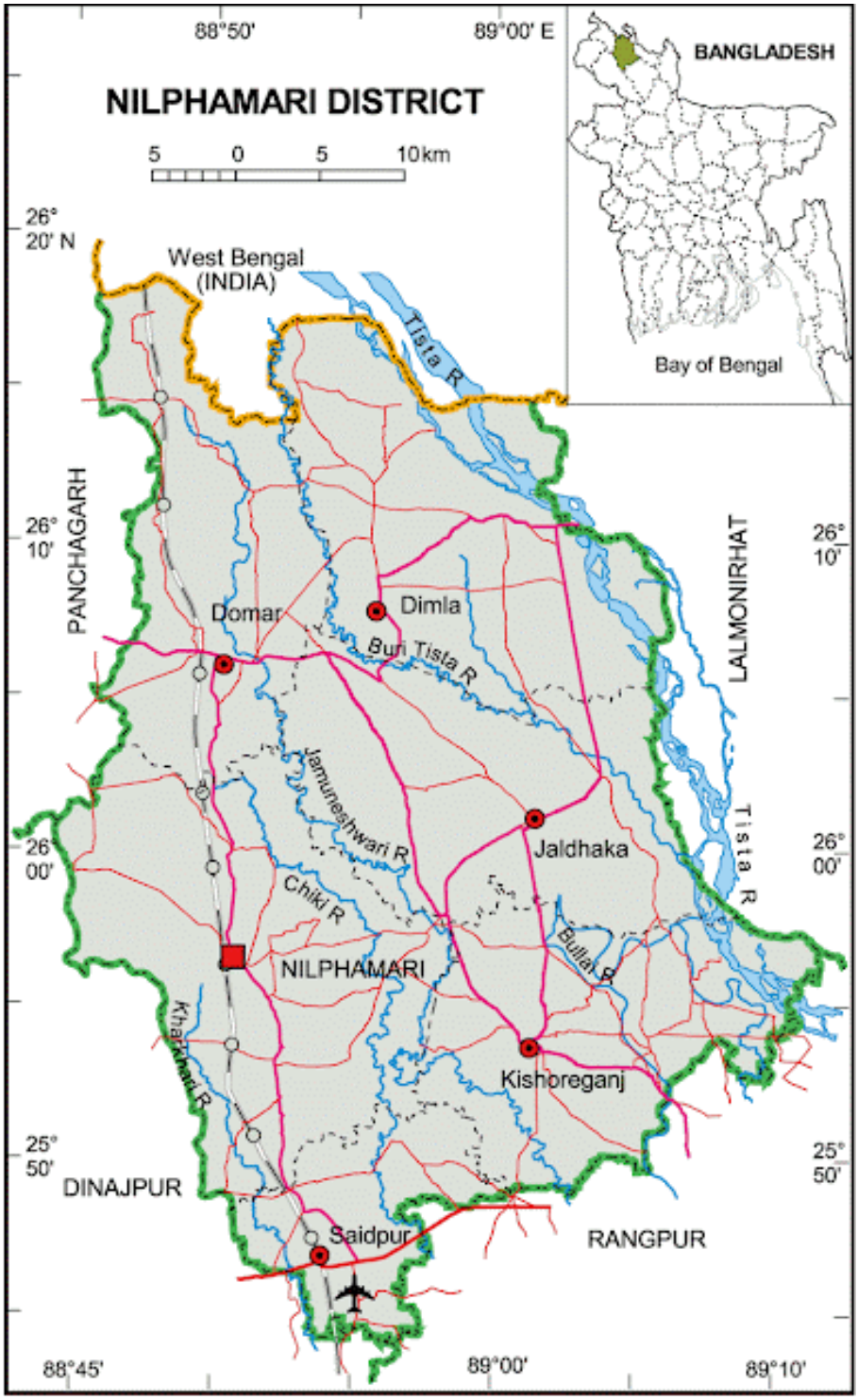

Figure-3.1: Map of Nilphamari district

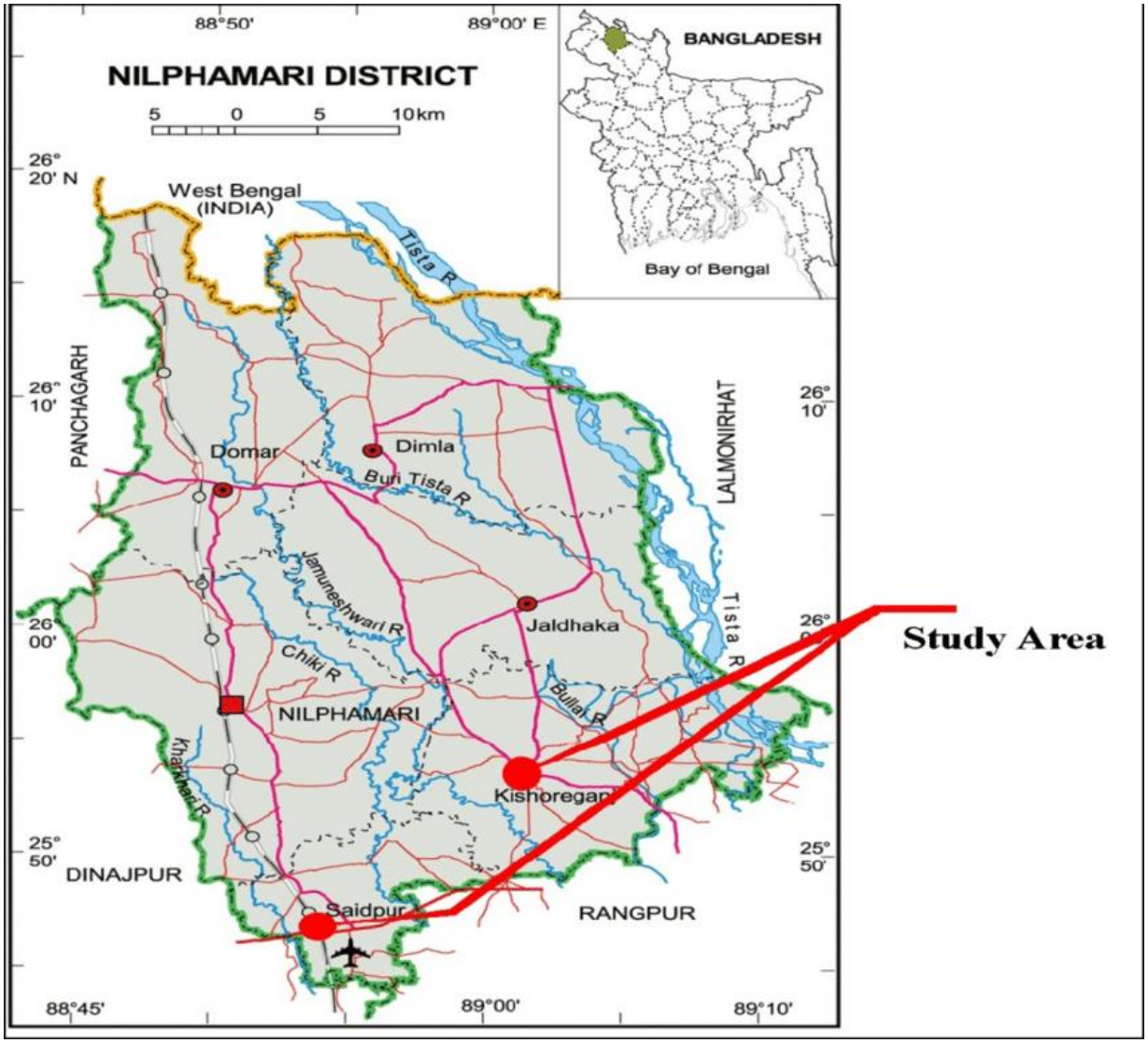

Figure-3.2: Map of Nilphamari district

3.2.1 Area and Population

Table 3.1 shows the total area and population of chosen areas, with Sayedpur Upazila having the highest population (2174 per square km), the medium population density (1273 per square km) is in Kishorgonj, while the lowest population density (1166 per square km) is in Nilphamari Sadar Upazila..

Table 3.1: Area and Population of the Study Area.

Upazila	Area (sq.km)	Population	Male	Female	Population density
Nilphamari Sadar	373.30	435165	219080	216082	1166
Sayedpur	121.66	265461	134737	131784	2174
Kishorgonj	205.01	261069	130931	130138	1273

Source: Zilla statistics (2011)

3.2.2 Educational and Occupational Status

Nilphamari has a 49.69% literacy percentage, based on the 2011 Bangladesh census. Nilphamari has 940 elementary schools, 295 high schools, 95 colleges, 1 medical college, 2 government technical institutes, 17 non-government technical institutes, 1 basic teachers training institute, 115 Dakhil Madrasas, 24 Alim Madrasas, 14 Fazil Madrasas, and 1 Kamil Madrasa. The economy of this area depends on agriculture .Wheat ,rice, potatoes, tobacco, and various crops are all produced in Nilphamari. The majority of the population works in agriculture. The working populations includes 45.28% farmers, 27.11% agricultural laborers, 3.42% daily workers, 8.65% business owners, 6.07% of employers are government or non-government, and 8.77% people who work in other occupations.

3.3.3 The Temperature and Rainfall

The district's average annual temperature ranges from a high of 32.3°C to a minimum of 12°C, and its annual rainfall is 2931 mm.

3.2.4 Agriculture work:

Agriculture work includes all planning, management, and operational tasks performed by a landowner and his or her labor force. This activity includes land preparation, sowing, weeding, harvesting, feeding and caring for livestock and poultry, kitchen gardening, supervising agricultural workers, maintaining farm records and accounts, preparing agricultural products for marketing (including packaging), repairing farm equipment, constructing farm buildings and fences, and engaging in land reclamation and improvement. Homework and other household duties are not included.

3.3 Method of Investigation

In order to conduct a farm business study, material from individual farmers is typically collected. When gathering data for farm business analysis, the analyst must make decisions and make compromises within the constraints set by the tools at their disposal. Farm surveys were chosen as the technique of data collecting for this study due to two major advantages: a) they allow for speedy investigations of a large number of instances, and b) their conclusions have broader applicability. Farm survey data can be collected using one of three ways (Dillon and Hardaker, 1993).These are

1. Personal observation,
2. Respondents were interviewed, and
3. Respondents' records

The second method was used to accomplish the goals of this research because Bangladeshi farmers typically don't keep note of their long-term operations. The survey technique is not without errors though. The main drawback to this approach is that it depends on the respondents' memories. Repeated gathering of data trips were made to help reduce errors, if there was an error or a discrepancy, the farmers were called again to obtain the missing or right information.

3.3.1 Sampling selection and Technique

When selecting samples for study, two factors must be considered. The sample number needs to be as large as possible to give the statistical analysis enough degrees of freedom. Administration of field studies, data processing, and analysis, on the other hand, should be manageable within the restrictions imposed by existing physical, human, and financial resources. 2001 (Mannan). Prior to drawing any conclusions, it is essential to sample a large portion of the population due to the diversity of the technical and social environment. Therefore, the goal of selection is choose a

population subset that is descriptive of the entire community (Rahman 2000). Due to a lack of resources (time, money, and personnel), it was impossible to include all the farmers in the selected region.60 farmers were picked at random. All of the data was taken during November and December 2022.

3.3.2 Defining the Population

Individual separation is the first stage in the sampling process, which also includes selecting the category or characteristic being studied, the sample unit, the investigation's location or level, and the investigation's timing. (Kinnear and Taylor, 1987). Ginger was the subject of the inquiry. Ginger farmers in the district of Nilphamari represented the sample groups.

3.3.3 Design of Questionnaire

At the survey planning stage, designing a questionnaire is a challenging task (Casely and Lury, 1981). Two major issues are frequently identified during the construction of a questionnaire:

1. The questionnaire is often excessively long or covers too many topics.
2. The question sequence is not properly ordered.

A preliminary survey created to gather information from the chosen sample in accordance with the study's goals. The survey schedule should be created cautiously and effectively for the farm business analysis. The draft timetable was pre-tested by the researcher herself with a few sample farmers from the study region. As a result, certain portions of the draft plan were enhanced, reorganized, and changed in light of the real-world and applicable insights gleaned from the pre-tested questionnaire. Finally, a straightforward schedule was created to ensure that accurate information could be acquired without duplication or misunderstanding.

The questions for this study were created with the following headings -

- The sample farmers' general information;
- Socio economic information;
- Sample farmers' occupations and educational backgrounds;
- Land-related information;
- Annual income and expenditure
- Profitability information
- Yield from rhizome and
- Farmers' difficulties in cultivating ginger.

3.4 Data collection

In addition to these data, additional data was gathered to help the research achieve its goals. Research papers and publications that were linked to the study were used as a secondary source to expand and improve the research project. The chosen farmers were requested to remain in their workplaces during the data collection period when they were not busy with their respective tasks in order to provide the necessary data and information. Before the actual interview, each farmer was informed of the study's goal and objective. The researcher made it obvious that this was just an academic exercise. Following that, questions were systematically asked, and justifications were offered when deemed essential. It was verified that the information on the schedule was accurate after each encounter. To prevent inaccuracies, data were originally collected in local units before being converted to normal international ones.

3.4.1 Primary data collection technique

Given that ginger cultivation is seasonal, the researcher must determine to what extent the data for a specific year reflects average or usual conditions, including yields, annual production, and price level. Ginger is usually sown by farmers between April- May, with harvesting time December-January. Primary statistics were gathered from ginger producers at the farm level. With the aid of pre-tested questionnaires, a few chosen respondents were directly questioned. The main information gathered from 60 ginger growers was used to calculate the profitability level.

3.4.2 Technique for collecting secondary data

Secondary data was gathered from various research materials such as thesis papers, articles, and other statistical studies. The research materials were gathered from the documents listed below:

- Agriculture Statistics Yearbook
- Economic Reviews of Bangladesh
- Bangladesh Statistical Yearbook
- National and international journals, articles, and publications
- Master's and Ph.D. thesis
- Internet browsing

3.5 Editing and coding of data

Other important steps of the questionnaire consisted of data coding and editing, which were essential for data processing. Prior to data handling, it should be finished. In the instance of this survey, coding had been completed concurrently with the creation of the questionnaire so that the person counting could quickly and precisely mark the correct responses. Data editing is the process of analyzing and cleaning up previously obtained field data.

3.6 Processing of data

Data processing required numerous procedures, each of which had a significant impact on survey results. The following activities were conducted during data processing.

- Entering data
- Adding and combining files
- Data validation (further computer verification, editing, and imputation).
- Error determination final
- Completion of data processing and production of data files
- Complete documentation
- File conversion
- File storage for all files.

3.7 Processing, tabulation and analysis of data

The data was manually edited and coded. The information gathered was then properly examined and summarized. Additionally, studies were carried out using the relevant versions of STATA and Excel. It should be noted that information was initially collected by local units. After the necessary inspections, it was translated into standard international units.

3.8 Analytical techniques

The study applied both observational and statistical methods and the tabular technique was used for a substantial percentage of the data analysis. To analyze data and characterize socioeconomic characteristics of ginger growers, input use, costs, and returns of ginger production, as well as compute the undiscounted benefit cost ratio, simple statistical techniques such as percentage and arithmetic mean or average were used. (BCR). The Cobb-Douglas production function was employed in order to estimate functional relationship between farm input and output to the analysis.

3.8.1 Profitability study

The total returns of ginger were computed using a collection of financial prices. The economical prices were the real market rates that farmers during the study time paid for inputs purchased and got as payment for outputs. The following cost items were chosen for the research.

- Human labor
- Machinery
- Seed
- Urea
- TSP
- MoP
- Insecticides
- Irrigation Interest on Operating Capital
- Land use

Based on value of the primary crop and the value of the product, the returns were estimated. This study described variable cost, fixed cost, and total cost. The total variable cost (TVC) included human labor, seedlings, urea, TSP, MOP, pesticides, and irrigation. Fixed costs (FC) includes land rental value and working capital interest. Total cost (TC) accounted for both fixed and variable expenses.

3.8.1.1 Human labor cost

One of the most costly factors affecting the production process was thought to be the cost of human effort. It is frequently required for a number of chores, such as clearing the soil, preparing it for sowing and transplanting, weeding, applying fertilizer and pesticides, irrigating, reaping and hauling, washing, drying, and storage. To calculate the cost of human work, the recorded man-days per hectare were multiplied by the wage per man-day for a certain task.

3.8.1.2 Cost of machinery

One of the most vital elements of an agricultural process is the financial cost of the machinery. The cost of the machinery used in the production of ginger, plowing, laddering, digging, and other tasks were covered.

3.8.1.3 Seed cost

A number of factors, including its quality and availability, seed prices differed greatly. Cost of seed was calculated using market rates for estimated rhizome. To calculate the cost of seeds in the research areas, the total amount of seed required per hectare was multiplied by the market price of seed.

3.8.1.4 Urea cost

Urea was a significant fertilizer in the growth of ginger. The urea price was calculated by multiplying the market price of urea by the measured unit of urea per hectare.

3.8.1.5 TSP cost

Additionally, the market price was used to determine the price of TSP. To calculate the cost of TSP, the market price of TSP was multiplied by the indicated unit of TSP per hectare.

3.8.1.6 MOP cost

MOP was one of the three basic fertilizers used in ginger cultivation. To calculate the cost of MOP per hectare, the market price of MOP was multiplied by the unit cost of that input per hectare for a certain method.

3.8.1.7 Insecticides cost

Farmers used various insecticides 2-3 times per year to maintain their crops free of pests and diseases. The cost of pesticides was computed using the market price of the insecticides employed in the research regions per hectare.

3.8.1.8 Irrigation cost

Farmers employed both short tube wells and deep tube wells for irrigation. The only payment method used in the study region required farmers to per unit of land. The actual sum of money paid by the fanners in cash was estimated as the expense of irrigation water.

3.8.1.9 Interest on operating capital

Because all expenditures were not incurred at the beginning or at any single point in time, the operating capital represented the average operating cost across the period. As a result, a 12-month interest rate of 9% was calculated for ginger. The following formula was used to compute interest on operating capital:

IOC=AI*i*t

Where,

IOC= Interest on operating capital

i=Rate of interest

AI=Total investment /2

t=Total time period of cycle

3.8.1.10 Rental value of land

The rental value of land was computed using the opportunity cost of land usage per hectare over a four-month cropping period. As a result, the cash rental value of land was calculated for the cost of land use.

3.8.1.11 Calculating Returns

Return on investment

The gross return per hectare was computed by multiplying the entire amount of product and by-product by their corresponding per unit pricing.

Gross return = quantity of product * average product price + value of by product (mother rhizome)

The gross margin (GM)

The gap between the gross return and variable costs is known as the gross margin. The farmers are interested in getting returns above variable costs, which is why they use gross margin analysis. On a TVC basis, gross margin was determined. The gross margin per hectare was calculated by deducting variable costs from the gross return. The gross margin was calculated by adding the gross return and the total variable cost spent.

$GM = [(Py*Y)+(Pz*Z)] – \sum Pxi*Xi$

Where,

GM = gross margin

Py = price of main product

Y = quantity of main product

Pz = price of by-product

Z = quantity of by-product

Pxi = price of ith input

Xi = quantity of ith input

Benefit-cost ratio

The benefit-cost ratio is the ratio of a farm's gross return to its total cost. The benefit-cost ratio in this study was derived using the following formula:

B/C Ratio = GR/TC

Where,

B/C Ratio= Benefit-Cost ratio

GR=gross return (achieved by including ginger income)

TC = total cost (obtained by summing all expenditures in the producing process)

TVC=Total variable cost.

B/C Ratio on Cash cost basis (BCR)=GR/TVC.

3.8.1.12 Net Return

The net return or profit was computed by subtracting the total production cost from the total return or gross return. That is,

Net return = Total return – Total production cost.

3.8.2 Functional Analysis

To identify the factors influencing ginger output. Because the regression coefficient in the Cobb-Douglas production function directly represents production elasticity, the function used to assess if the production process has a growing, constant, or decreasing return to scale.

Analysis of Production Function Estimation

The model used for the analysis to estimate the functional relationship between farm inputs and outputs was of the type

$$Y = a\ X_1^{b_1}\ X_2^{b_2}\ X_3^{b_3}\ X_4^{b_4}\ X_5^{b_5}\ X_6^{b_6}\ U$$

The empirical Cobb-Douglas production function in double log form is as follows:

$$\ln Y = \ln a + b \ln X_1 + b \ln X_2 + b \ln X_3 + b \ln X_4 + b \ln X_5 + b \ln X_6 + \ldots\ldots + b \ln X + ui$$

The Cobb-Douglas production function has been turned to the next logarithmic form so that it can be solved in the standard tiny square format.

Where,

Y = Total annual return (tk/ha)

X_1= Labor cost (tk/ha)

X_2= Seed cost (tk/ha)

X_3= Fertilizer cost (tk/ha)

X_4= Manure cost (tk/ha)

X_5= Pesticides cost (tk/ha)

X_6= Irrigation cost (tk/ha)

a = Constant

b_1…..b_6 = Coefficient of corresponding fluctuations

Ui = Error Time

i = 1 2 3…..6

Significance of the regression co-efficient ('t' test):

Using the following formula, the t' test was used to assess the significance of regression coefficients.

tcal = bi /SE(bi)

Where,

Bi = regression coefficient

SE(bi) standard error of bi

tcal = bi / SE(bi)

Where, bi =regression coefficient

SE(bi)= standard error of bi

Furthermore, the significance of the regression equation is determined using the F' test based on the value of R^2.

$F = R^2 (n-k-1) / K (1-R^2)$

Where,

n = sample size

K = Number of variables

R^2 = Coefficient of multiple determination.

Return to Scale

The total of the co-efficient values for each value input contained in the Cobb-Douglas production function and its return to scale, as illustrated below.

a) $b_1 + \ldots\ldots\ldots + b_n = 1$, It means constant scale of return.

b) $b_1 + \ldots\ldots\ldots + b_n < 1$, It means decreasing scale of return

c) $b_1 + \ldots\ldots\ldots + b_n > 1$, It means increasing scale of return

The sum of the values of the input co-efficient indicates that contribution to ginger production

CHAPTER IV
GINGER PRODUCING FARMERS' SOCIOECONOMIC PROFILE

4.1 Introduction

The objective of this chapter is to provide a brief summary of ginger producing farmers. Various viewpoints can be taken when investigating the farmers' socioeconomic backgrounds. The scope to which farmers participate in national development initiatives, the socioeconomic environment in which they are located, and their status as a source of livelihood are all factors that influence these activities. The socioeconomic situation of the sample farmers is vital when planning the study because it has a significant impact on how a person develops their behavior and personality. Because social factors vary, people vary from one another. However, for the purposes of this study, is to address a few of the socioeconomic characteristics. To find out about the socioeconomic profile of the ginger growers, data on a variety of socioeconomic variables were collected. This chapter discusses the general characteristics of ginger growing farmers, including their age, educational level, family size, annual income, farm size, level of farming experience, association membership.

4.2 Farmers' Age Distribution and Family Size

Farmers' age helps with production and better farming system management. According to some researchers, young farmers are more likely than older farmers to utilize new technology.

Table 4.1 Age Distribution of the Sample Farmer

Age category	No.	Percent (%)
15-35 years	22	36.67
36-50 years	30	50
Above 50 years	8	13.33
Total	60	100

Source: Field survey, 2022.

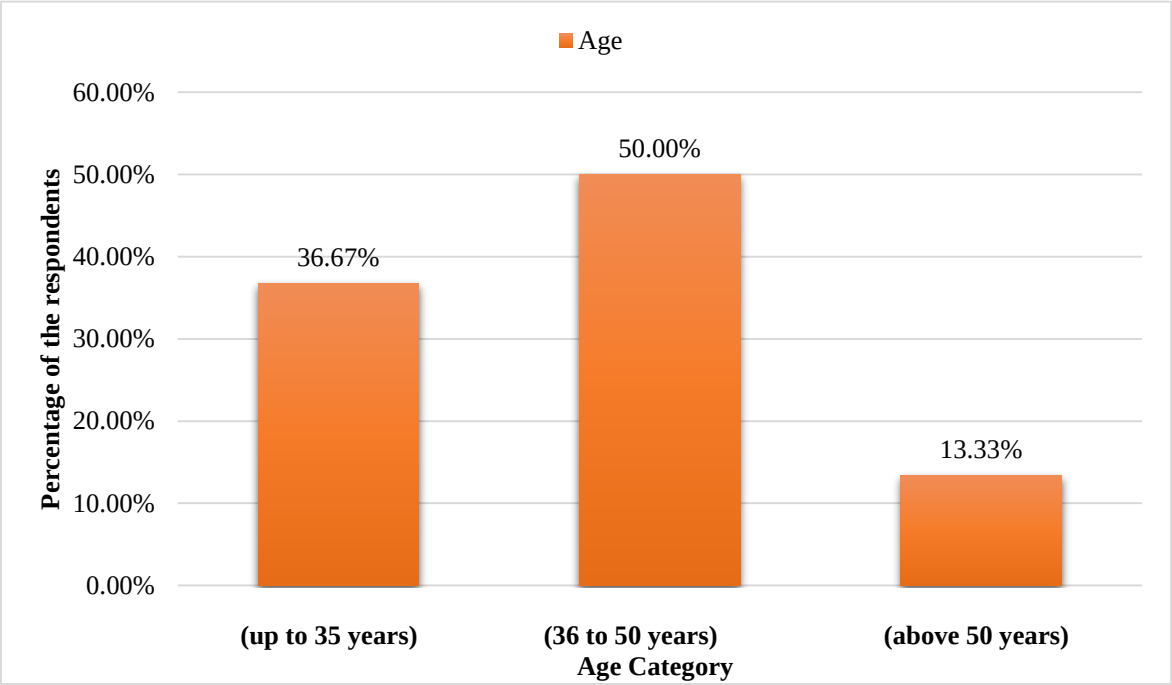

Fig 4.1 Age Distribution of the Sample Farmer

Table 4.1 shows how all types of farmers in the study area were grouped into different age groups in the current study. The table shows that the majority of the farmers in the study area were between the ages of 36 and 50. Growers of ginger were noticed up to 35 years old, with a percentage of 36.67, and above 50 years old, with a percentage of 13.33.

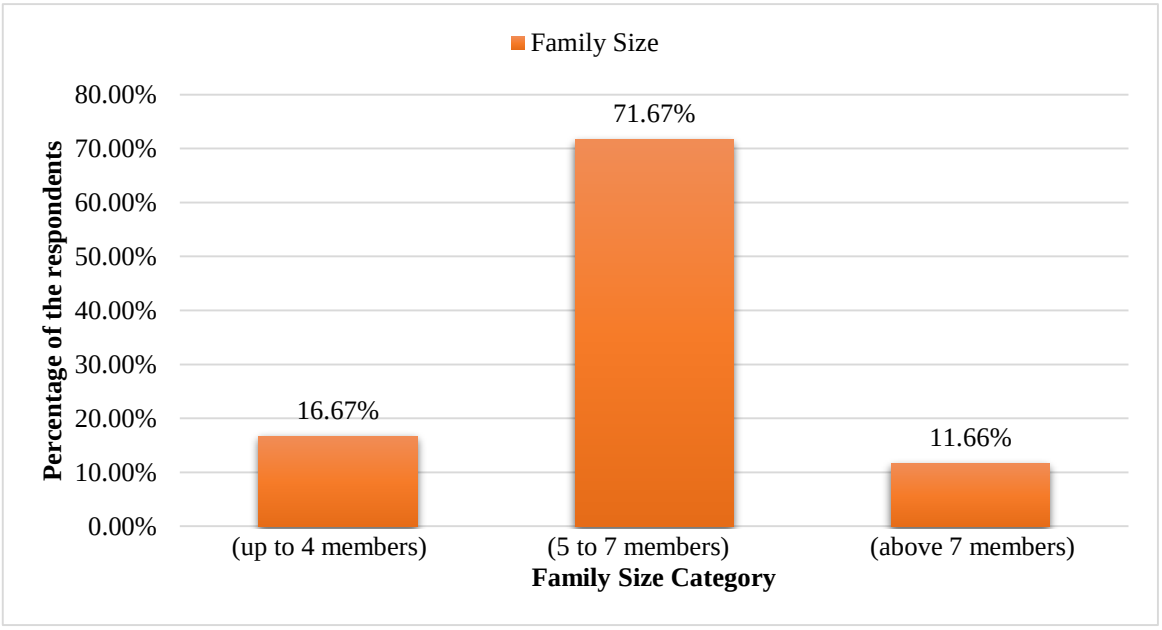

Fig-4.2: Family size of Household

The average size of a ginger producer's family was found to be 5 to 7 individuals, which was slightly higher than the country's average family size. The percentage for families with up to four members is 16.67, whereas the rate for families with more than seven members is 11.66.

4.3 Respondents' Educational Qualifications

The sample farmers' schooling ranged from 0 to 16. The ginger cultivars were divided into four categories based on their educational scores: "illiterate (0), primary (1-5 years of schooling), secondary(6-10 years of schooling), and above secondary and higher (more than 10 years of schooling). Figure 4.3 exhibits the distribution of sample farmers based on their schooling.

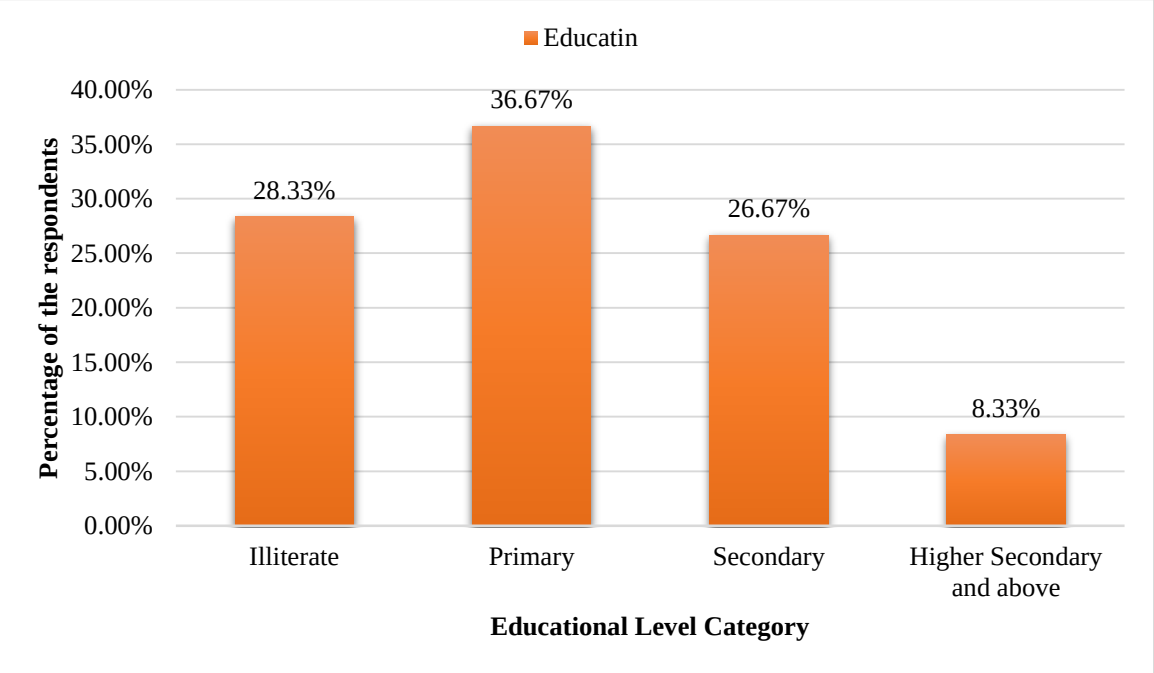

Fig.4.3. Respondents' Educational Qualification

Literacy is vital in increasing a country's agricultural growth because literate farmers use contemporary technologies. Figure 4.2 illustrates that out of 60 sample farmers from all categories, 28.33 percent are illiterate, 36.67 percent have a primary level of education, 26.67 percent have a secondary level of education, and 8.33 percent have a higher level of education.

Table 4.2 Respondents' Educational Qualifications

Level of Education	No.	Percent (%)
Illiterate	17	28.33
Primary	22	36.67
Secondary	16	26.67
Higher Secondary & above	5	8.33
Total	60	100

Source: Field Servey,2022

4.4 Annual income

The annual household income of the sample farmers covered all revenue streams, such as agriculture (crop, vegetable livestock), service, business, and others. Respondents' annual household income in the research area ranged from 0.6 to 4 lakh. Table 4.3 shows the distribution of ginger farmers based on their annual household income

Table 4.3: Farmer distribution based on annual income

Income group ("000" Tk.)	Farmers	
	Number	Percent (%)
Income (Up to 100)	30	50
Income (101 to 200)	25	41.67
Income (Above 200)	5	8.33
All income group	60	100

Source: Field survey, 2022

According to the results, 50 percent of the 60 sample farmers were in the (up to 100,000) income group, 41.67 percent were in the above one lakh to two lakh income group, and 8.33 percent were in the above two lakh income group.

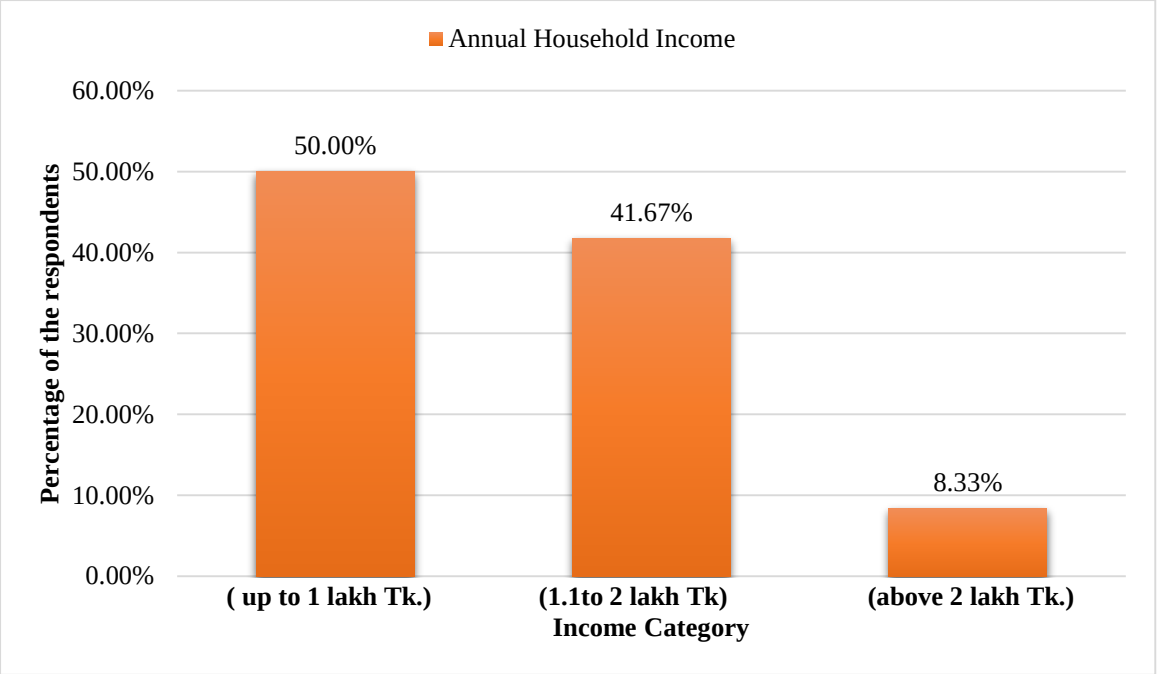

Fig 4.4 Annual income distribution

4.5 Farm size

The household farm size of sample ginger producers in the research area ranged from 0.21 to 3 hectares. Ginger farmers were found according to their farm size (up to 1 ha), (1-3 ha), (above 3 ha). Table 4.4 exhibits the distribution of farmers.

Table 4.4: Farmer distribution based on farm size

Farm size (Ha)	Farmers	
	Numbers	Percent (%)
(up to 1)	55	91.67
(1 to 3)	5	8.33
(> 3)	0	00
Total	60	100

Source: Field survey, 2022

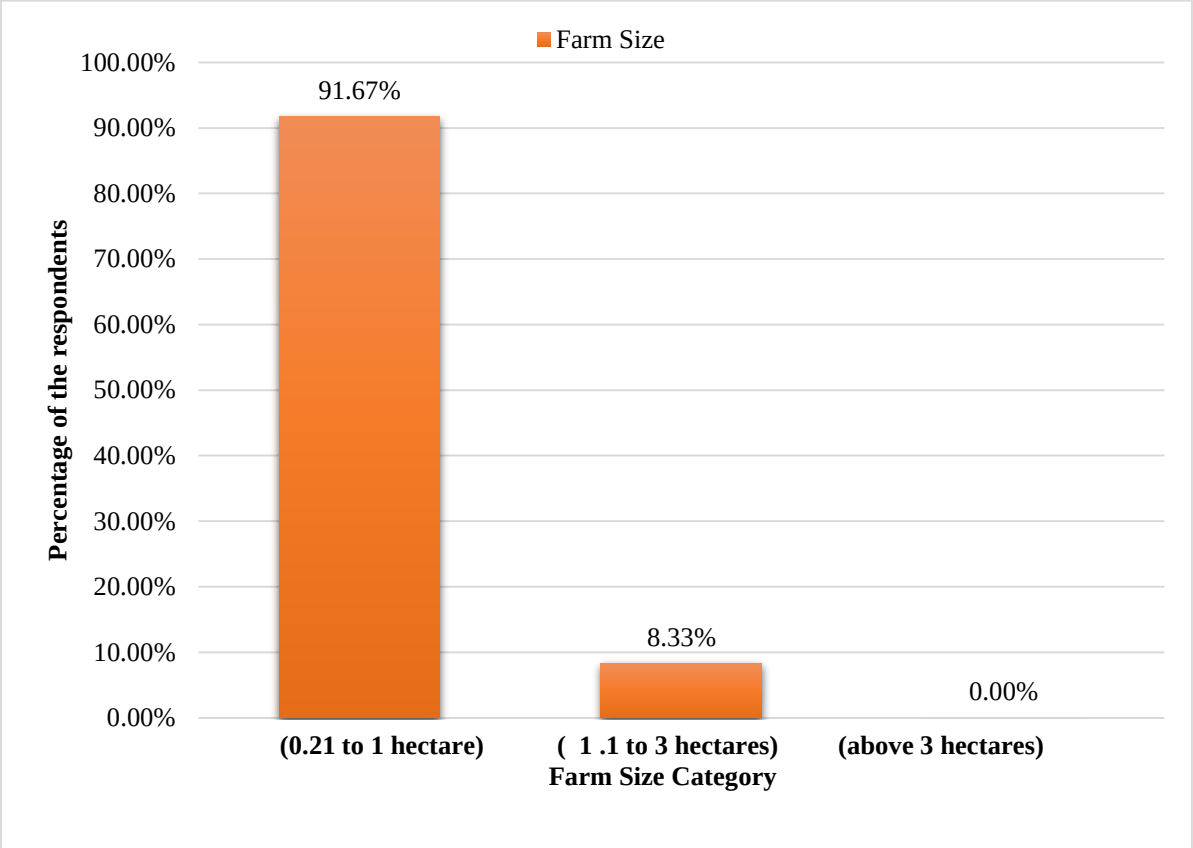

Fig 4.5 Farmer distribution based on farm size

The data shows that (0.21 to 1 hectare) farm holders account for the biggest share of respondents (91.67%). And, among the 60 responders, 8.33% belong to (1.1 to 3 hectares).

4.6 Annual Household Expenditure

Food, housing, clothing, education, medication, festivals, and other expenses were all included in the example farmers' annual household expenditures. The respondent's annual household expenditure ranged from 1 to 3 lakh taka in the study area. Table 4.5 shows the distribution of ginger farmers by annual household income.

Table 4.5 Annual Household Expenditure

Expenditure group ("000" Tk.)	Farmers	
	Number	Percent (%)
(Up to 100)	32	53.34
(101 to 150)	20	33.33
(Above 150)	8	13.33
Total	60	100

Source: Field survey, 2022

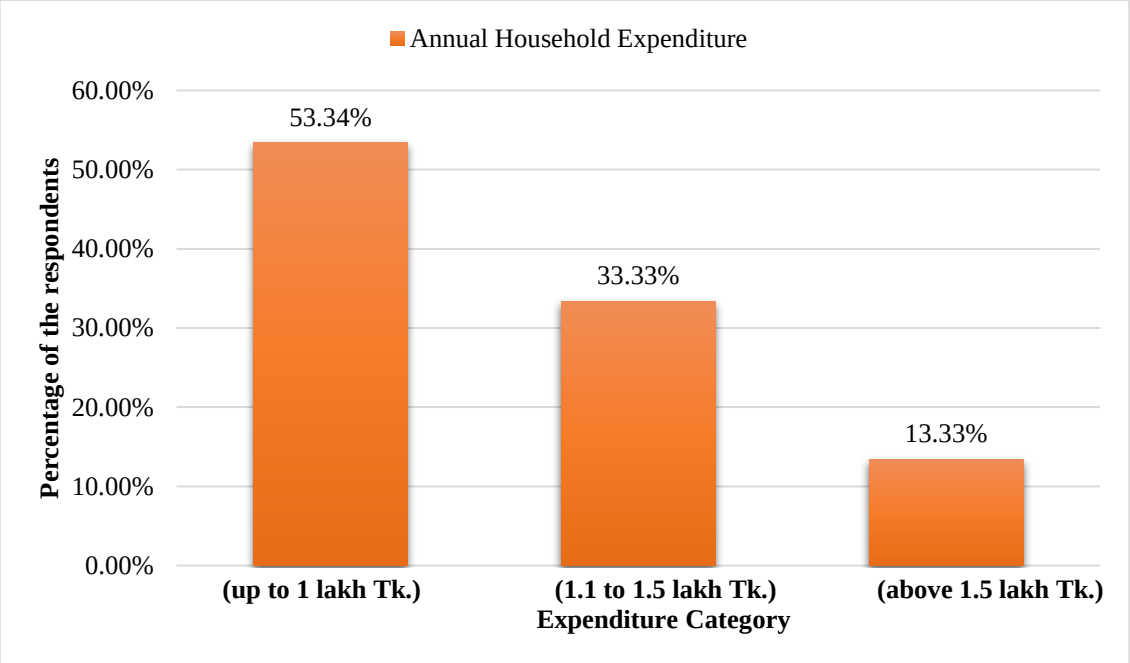

Fig 4.6 Annual Household Expenditure

4.7 Farming Experience in Agriculture

Respondents' farming experience ranged from 15 to 60 years. agricultural experience is divided into three categories: agricultural experience up to 10 years, farming experience 11-20 years, and farming experience >20 years. Table 4.6 shows the distribution of responders based on farming experience.

Table 4.6: Farming Experience in Agriculture

Farming experience (years)	Farmers	
	Number	Percent (%)
(Up to 10)	6	10
(11-20)	25	41.67
(> 20)	29	48.33
Total group	60	100

Source: Field survey, 2022

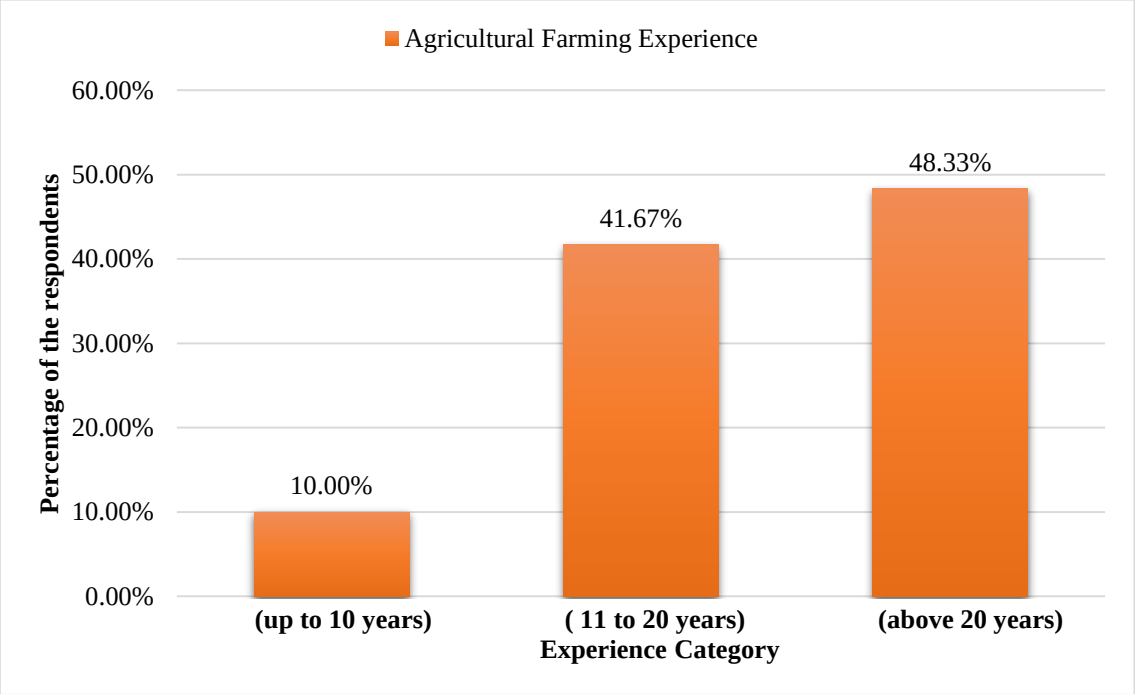

Fig 4.7 Agricultural Farming Experience

4.9 Organization membership

Table 4.5 illustrates the distribution of the sample farmers based on their membership in various organizations. According to Table 4.8, 33.33% of responding farmers are members of various organizations, whereas 66.67% are not members of any organization.

Table 4.7: Distribution of the Organization membership

Membership on organization	Farmers	
	Number	Percent (%)
Yes	20	33.33
No	40	66.67
Total	60	100

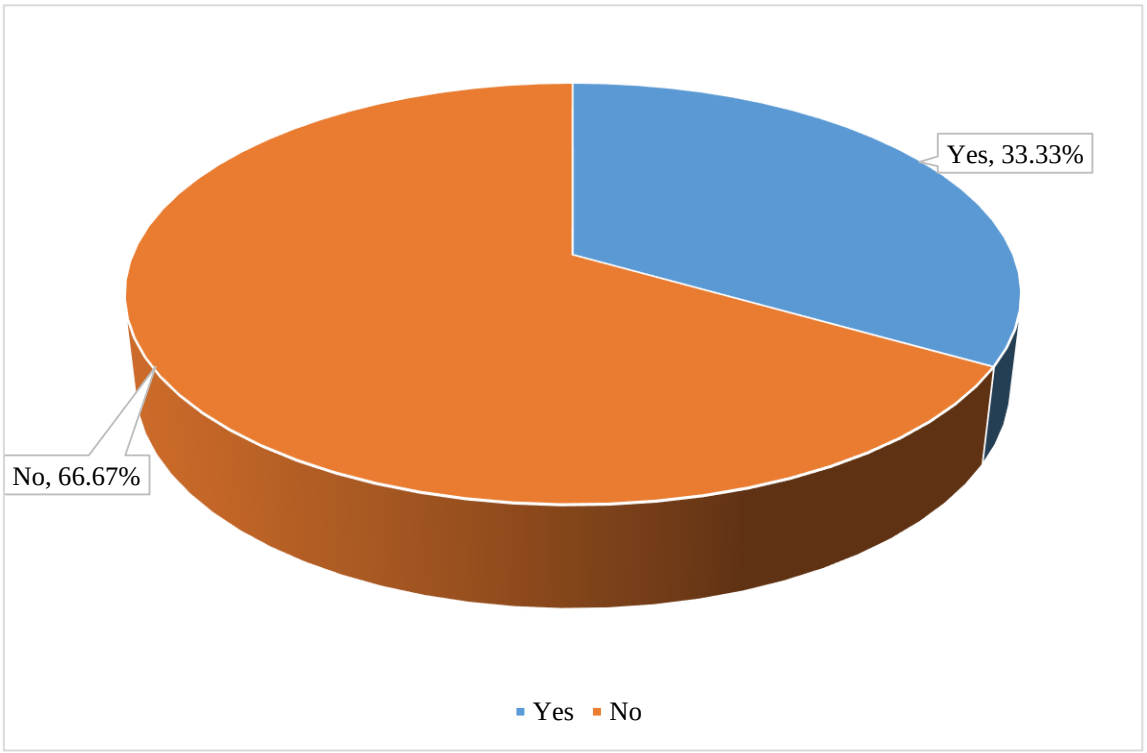

Fig.4.8 Organization membership

4.10 Summary

This chapter investigates features of sample farmers' economic well-being .The analysis' conclusions clearly reveal each other's socio-economic characteristics in terms of age distribution, education, farm size, annual revenue and spending, membership in social organizations, and so on ,which affects the cultivation of ginger. Farmers' socioeconomic features influence their production method and resource use.

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CHAPTER V
PROFITABILITY OF GINGER CULTIVATION

5.1 Introduction

The primary goal of this chapter is to evaluate the cost, benefits, and profitability of ginger farming. Profitability is an important consideration when considering whether to grow any product on a farm. It can be computed using the net return, gross margin, and percentage of return on total cost. The cost elements for ginger production were divided into two groups for the purpose of calculating costs and returns: variable cost; and fixed cost. All variable costs, such as the cost of contracted people, equipment inputs, seedlings, fertilizer, irrigation, and insecticides, were included in the variable cost. On the other hand, operational capital interest, using land costs, and family labor costs were tallied as fixed costs. This section computed the gross return, gross margin, net return, and the undiscounted benefit cost ratio (BCR).

5.2 Variable Costs

5.2.1 Human Labor Cost

The cost of labor is one of the most expensive components of the process of production. It is among the most major and frequently used components for the cultivation of ginger. The amount of contracted human labor employed in the production of ginger was determined to be approximately 135 man-days per hectare, with an average wage of Tk. 500 per man-day. As a result, it was found that the overall cost of hired labor was Tk. 67500.00, or which percentage of total cost was 13.90 percent. (Table 5.1).

5.2.2 Cost of Land Preparation

The vital steps in the cultivation method are those related to land preparation. The process of preparing the land for ginger farming included ploughing, laddering, and other task. As a result, the cost of field preparation for ginger production was calculated to be Tk. 4644.22 per hectare, or 0.96 percent of the total cost. (Table 5.1)

Table 5.1: Ginger Cultivation Costs Per Hectare

Items	Quantity	Price per unit	Total	Percentage of total
Hired Labor (Man-days)	135	500	67500.00	13.90
Land Preparation			4644.22	0.96
Machinery			12619.74	2.60
Seed (Kg)	1318.82	150	197823.00	40.73
Manure (Kg)	3513.54	5	17567.70	3.62
Urea (Kg)	106.36	22	2339.92	0.48
TSP (Kg)	106.42	22	2341.24	0.48
MOP (Kg)	174.15	15	2612.25	0.54
Pesticide			6008.11	1.24
Irrigation			2415.66	0.50
Total Variable Cost			315871.84	65.04
Fixed Cost				
Family Labor (Man-days)	85	500	42500.00	8.75
Interest on Operating Capital (@9%)			28428.47	5.85
Rental Value of Land			98851.20	20.35
Total Fixed Cost			169779.67	34.96
Total Cost			485651.51	100.00

Note: Note: The quantity and rate of land preparation are indicated in number of tillers per hectare and Tk. per tiller unit, respectively. Human labor quantity and rate are represented in man-days per hectare and Tk. per man-day, respectively

5.2.1.3 Seed (Rhizome) cost

Rhizome (seed) prices depended greatly according to their quality. The estimated cost of rhizome for ginger cultivation per hectare was Tk. 197823.00, or 40.73% of the overall cost. (Table 5.1).

5.2.1.4 Manure cost

Manure cost Tk.17567.70 per hectare and represented 3.62 percent of total cost.

5.2.1.5 Urea cost

Farmers in the study region used a variety of fertilizers. In general, producers applied 106.36 kg of urea per hectare. The price of urea was Tk. 2339.92 per hectare, or 0.48 of total expenses. (Table 5.1).

5.2.1.6 TSP cost

The rate for using of TSP (106.42 kg), among the various fertilizers used, was comparable to urea fertilizers. Tk. 2341.24 was the average price of TSP, which percentage of total cost is 0.48 percent. (Table 5.1).

5.2.1.7 MOP cost

MOP was found to depend on less application per hectare (174.15 kg) than other fertilizers. The MOP was per hectare was Tk 2612.25, or 0.54 percent of total costs. (Table 5.1).

5.2.1.8 Cost of Pesticides

To keep their agricultural produce clear of pests and diseases, farmers used a variety of pesticides. Pesticides were found to be 1.24 percent of the total cost of production, or Tk. 6008.11, on average, for the production of ginger. (Table 5.1).

5.2.1.9 Irrigation cost

Irrigation is one of the most expensive aspects of ginger farming.. Irrigation is a major factor in ginger production. When irrigation water is applied properly, it increases plant height, clove and leaf yield, and rhizome size. The result is an increase in yield per hectare. A study showed that the cost of irrigation per hectare was Tk. 2415.66, or 0.50 % of the total cost. (Table 5.1).

5.2.1.10 Total Variable Cost

Thus, it was evident from the above-mentioned various cost factors that the total variable cost of ginger output per hectare was Tk. 315871.84, which represented the percentage of total cost is 65.04 percent. (Table 5.1).

5.3 Fixed Cost

5.3.1 Family Labor

The amount of family labor utilized in the cultivation of ginger is estimated man-days per hectare to be around 85, with wage of Tk. 500 per man-day. As a result, the total cost of family labor was computed to be Tk. 42500, or 8.75 percent of the entire cost. (Table 5.1).

5.3.2 Operational Capital Interest

It should be remembered that the rate of interest on operating capital includes all operational costs generated during the ginger production period. The cost of interest on operating capital for ginger production was computed at Tk. 28428.47 per hectare, or 5.85 percent of the total cost. (Table 5.1).

5.3.3 Rental Value of Land

In the present study, the cost of land use was calculated using the cost rental value per hectare of land over a 12-month period. For the farmers, the expense of using the land per hectare was Tk98851.20, and their share of the overall cost was 20.35 percent.

5.3.4 Total Fixed Cost (TC) of Ginger Production

The whole fixed cost of ginger production was Tk. 169779.67, and its percentage of total cost was 34.96 percent. (Table 5.1).

5.4 Total cost

Total cost was computed by summing all variable and fixed costs. The current study indicated that the total cost of ginger production per hectare was Tk. 485651.51 (Table 5.1).

5.5 Gross Return

Return per hectare of ginger is shown in table 5.2. The total quantity of produce and the appropriate per unit ginger were multiplied to determine the per hectare gross return. The table indicates that there was a 6676.34 kg average yield of ginger per hectare. Ginger cost about Tk. 140 per kg on average. The average output price per kg of mother rhizome was Tk. 130, and the amount of by product produced per hectare was 917.10 kg. As a result, it was found that the total return per hectare was Tk.1053910.60 .(Table 5.2).

5.6 Gross Margin

The total cover variable costs is known as gross margin. The gross margin was calculated by subtracting the full variable cost from the gross return. According to the data, the gross margin per hectare was Tk. 738038.76 (Table 5.3).

Table 5.2. Total return

Items	Quantity (kg)	Price per unit	Total	Percentage of total
Product	6676.34	140	934687.6	88.69
By-product (mother rhizome)	917.10	130	119223	11.31
Total Return			1053910.6	100.00

5.7 Net Return

The net return or profit was computed by subtracting the total production cost from the gross return .The net return was estimated to be Tk. 568259.09 per hectare based on the data (Table 5.3).

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Table 5.3: Ginger production costs and returns per hectare

Criteria for Evaluation	Quantity (kg/ha)	Rate (Tk./kg)	Cost (Tk./ha)
Product Value	6676.34	140	934687.6
Mother rhizome	917.10	130	119223
Gross Return (GR)			1053910.6
Total Variable Cost (TVC)			315871.84
Total Cost (TC)			485651.51
Gross Margin (GR-TVC)			738038.76
Net Return (GR-TC)			568259.09
BCR (undiscounted)(GR/TC)			2.17
BCR Cash cost basis (GR/TVC)			3.33

Source: Field survey, 2022.

5.8 Benefit Cost Ratio (Undiscounted)

Benefits are evaluated for each unit of expense using a comparative metric called the benefit cost ratio (BCR). According to (BCR),one-taka expenditure in ginger cultivation yielded returns of 2.17, based on total cost. (Table 5.3). Ginger farming is attractive in Bangladesh on both a full cost and variable cost basis, according to the above assessment.

5.9 Summary

The above overview makes it simple to understand the numerous cost elements, farmer application doses, yields, and returns per hectare of ginger cultivation. Growing of ginger involves a lot of work. The efficient use of contemporary inputs, including lighting, fertilizers, labor, power tillers, pesticides, and irrigation, is necessary. Based on the explanation above, it is feasible to reach the cautious conclusion that ginger farming in the Nilphamari district is profitable. Growing ginger would be beneficial and farmers is to improve their income.

CHAPTER VI
FACTOR AFFECTING RETURN OF GINGER CULTIVATION

6.1 Introduction

This chapter provides an effort to quantify the main variables that affect the output of ginger. To calculate the impact of important factors on cultivation process of growing ginger, Cobb-Douglas was assigned as the production function. In Table 6.1.factors affecting production of ginger cultivation is shown.

As explanatory factors for the variation in ginger output, a number of inputs such as human labor, a power tiller, seeds, fertilizer, manure, irrigation, and pesticides were considered .To evaluate potential connections between ginger inputs and outputs, Cobb-Douglas analysis was utilized.

Table 6.1 Estimated Coefficients and Related Statistics of Ginger Cultivation Production Function.

Variable	Parameters	Coefficient	Standard Error	t-value
Constant	β_0	11.94***	1.82	6.57
Human Labor Cost	β_1	0.009	0.12	0.07
Seed Cost	β_2	0.043*	0.024	1.79
Fertilizer Cost	β_3	0.02	0.137	0.15
Manure Cost	β_4	0.17*	0.096	1.77
Pesticide Cost	β_5	-0.17***	0.056	-3.07
Irrigation Cost	β_6	0.11	0.126	0.91
F-value	5.89***			
R^2	0.40			
Return to Scale ($\sum\beta i$)	0.182			

Note that *** and * denote significance at the 1% and 10% levels, respectively. The Seed coefficient was positive and significant at the 10% level.

Manure coefficients were similarly positive and significant at the 10% level

The coefficient of Pesticide was negative and significance at 1% level.

Human labor, Fertilizer and Irrigation cost were not significant but positive.

6.2 Interpretation of the production function and results

6.2.1 Total labor cost (X_1)

For the cultivation of ginger, the estimated coefficient of the total labor cost was 0.009. According to this, increasing total labor costs by 1% and keeping other variables at their constant levels would result in a 0.009 % rise in gross returns. (Table 6.1).

6.2.2 Cost of seed (X_2)

For the cultivation of ginger, the estimated ginger seed cost regression coefficient was 0.043. It suggests that a 1% rise in seed cost will be increased in gross returns of 0.04% keeping other variables unchangeable. (Table 6.1).

6.2.3 Fertilizer cost (X_3)

The predicted coefficient of total fertilizer cost was 0.02; however, it was not significant but positive at the required degrees of freedom. (Table-6.1)

6.2.4 Manure Cost (X_4)

The estimated coefficient of manure cost was 0.17 and it was significant 10% level .It indicates that if manure cost increase by 1% and keeping other variables at their constant levels the gross return will be increased 0.17 % .

6.2.5 Pesticides cost (X_5)

The estimated coefficient of Pesticide cost was -0.17. It indicates that the total pesticides costs increase by 1% and keeping other variables at constant levels would result in a 0.17 % decrease in gross returns.

6.2.6 Irrigation cost (X_6)

The estimated coefficient of Irrigation cost for ginger cultivation was 0.11 but it was not significant but positive at the required degrees of freedom (Table 6.1).

6.3 Multiple determination coefficient (R^2)

The multiple determination (R^2) value was calculated to be 0.40, indicating that the selected independent variable explained 40% of the variation in farmer income.

6.4 Goodness of fit (F-Value) :

The estimated production function's F-value (5.89) was highly significant, indicating that the model was well-fit. That is, the model's explanatory variables were all necessary in explaining the variation in ginger production.

6.5 Return to scale ($\sum \beta i$)

The calculated production function of ginger's regression co-efficient was 0.182.This implies that the production function exhibits decreasing return to scale.

6.6 Summary

The basic concepts in front of total cost of seed have not been fully utilized but inclusion of their important have a significant impact on ginger cultivation. Using the most of important factors has given ginger cultivation the chance to improve productivity and profitability.

CHAPTER VII
GINGER CULTIVATION PROBLEMS

7.1 Introduction

This chapter's main objective is to determine the difficulties faced by the ginger producers. Producing ginger presented many obstacles to farmers. Financial, technical, and social problems were present. The purpose of this chapter is to demonstrate various socioeconomic problems and barriers to ginger growing. According to the feedback provided by the farmers, the problems and limitations they faced were identified. The following paragraphs discuss the main problems and limitations with ginger cultivation:

7.2 High price of Quality Seed/rhizome in sowing time

One of the greatest challenges with producing ginger in research region quality seed cost is high. In Table7.1 approximately 75% of ginger growers rated this as a high problem, and it is ranked first.

7.3 Pest and disease infestation

One of the major obstacles to producing ginger is disease. The problem of pest and disease attacks had an impact on ginger farmers. Ginger output is decreased by pests and diseases, which also raises production costs. Approximately 71.67% ginger farmers said they were having this problem. (Table 7.1). For the growers of ginger, this problem comes in at number second.

7.4 Lack of operating capital

For the necessary amount of inputs, including laborers, fertilizers, pesticides, and seeds (rhizomes), cash is needed. However, the majority of producers lacked the resources to buy the necessary inputs. During the production period, they were unable to meet the cultivation costs. Thus, economical assistance is required for greater cultivation. Seventy percent of farmers claimed that one of the biggest issues with ginger production was a lack of funding. (Table 7.1). Furthermore, farmers claimed that they received no financial aid from institutional sources during the ginger production period

7.5 Lack of Scientific knowledge of Farming

To operate a ginger farm, expert labor and scientific knowledge are required. Some producers had a fundamental understanding of how to use inputs. There were some farmers who had significant information gaps regarding the cultivation of ginger. This problem affected 66.67 percent of the ginger growers in the study region.

7.6 Inadequate Extension Service

Most farmers who participated in the field survey said that the appropriate Department of Agriculture Extension officials had not offered them any extension services regarding an unproven way of growing ginger. (DAE). A number of growers reported receiving extension services while ginger was being produced. 60% of farmers didn't have access to extension programs. Despite the fact that intercropping is a wonderful option for ginger because it is an annual crop, the majority of farmers do not do it. They lack the scientific knowledge necessary to grow it with intercropping. As a result, it is essential to train extension workers on the cultivation of the spice through intercropping so that farmers can profit from more than only producing ginger.

7.7 Lack of storage facilities

The study region does not have enough storage space for ginger farmers. Because of insufficient storage facilities, a large number of producers sold their products at lower prices after harvest. Furthermore, insufficient suitable storage causes a significant amount of spoilage to occur during the after harvesting period. According to the survey, about 50% of farmers lacked storage facilities. (Table 8 1).

7.8 Inadequate marketing facilities

Farmers in the study region who grow ginger face this significant problem. Normally, ginger farmers offer their products in the neighborhood market. However, there is a connection gap between the ginger market's cultivators and dealers. Furthermore, tools for grading and quality control are not given much consideration. According to about 33.33% of farmers, they lacked the necessary marketing tools to create large market in Nilphamari district.

Table 7.1 Farmers' Problems with Ginger Cultivation

Problems	Farmers	Farmers (%)	Rank
High price of quality seed	45	75	1st
Attack of pest and disease	43	71.67	2nd
Lack of operating capital	42	70	3rd
Lack of scientific knowledge	40	66.67	4rd
Inadequate extension services	36	60	5th
Lack of storage	30	50	6th
Lack of market facilities	20	33.33	7th

Source: Field Survey, 2022

7.9 Summary

In Table 7.1 the above mentioned findings demonstrated that ginger farmers in research region are presently dealing with some significant difficulties in conducting ginger cultivation. These are the main obstacles to enhancing the development of ginger in the research region. For better ginger production, steps should be made to lessen or eliminate these problems. The ginger farmers' need subsidy for proper consideration.

CHAPTER VIII
SUMMARY, CONCLUSION AND RECOMMENDATIONS

8.1 Introduction

The importance of the discussions in the preceding chapters, the current chapter concentrates on the summary. Based on the findings of the research, a conclusion has been reached. Illustrated policy suggestions are made to address the current ginger cultivation problems in Bangladesh. The study's main conclusions are summarized in Section 8.1, and Sections 8.2 and 8.3 provide a conclusion and policy suggestions.

8.2 Summary

After liberation, Bangladesh's major economic driver was the agricultural industry. Around 60% of the GDP was contributed by it. Agriculture is significant for people's livelihoods, jobs, and GDP contribution in Bangladesh. Over the past ten years, it has made less of an impact, from 17% in 2010 to 12.6% in 2020. The sector is important to our economy because it reduces poverty and ensures nutritional security. The sector has nevertheless remained resilient in terms of profitability and output despite the ever-increasing population, which is expected to increase from 147.6 million in 2010 to 164.7 million in 2020 when the impact of the pandemic and climate change are also taken into account. Mainstream farming's GDP contribution decreased, whereas the business and industry sector's GDP contribution rose as more people moved from the countryside to the cities. The agricultural industry now also includes the service sector. The only farming sector considered to be the main driver of economic growth is agriculture. The various agricultural sub-sectors followed. The performance of this sector is directly connected with growth of the economy. The contribution of this sector of the economy significantly affects important macroeconomic goals like job creation, poverty reduction, the development of human resources, and food security. Nearly 40.46% of the country's population is engaged in farming. (BER, 2022). Regarding its contribution to GDP, agriculture plays a significant part in the global economy. (GDP). Crops, livestock, fisheries, and forestry make up the broad-based agricultural industry, which accounts for GDP 12.52 % in FY 2021–22. (BER, 2022). Numerous spices come from pricey vegetation. Large seasonings have a lot of positive effects, which is advantageous. It can be very helpful in improving the livelihood of farmers, generating employment, poverty eradication, food security, and advancing societal development in Bangladesh.

The area with the most intensive ginger cultivation was chosen as the sampling frame for the present research. The research used villages in Nilphamari district's was chosen for the research. For the ginger research 60 farmers in total were chosen at random. Usually farmers sow ginger in April to may harvesting it 9/10 months later. December 2022 was chosen for the collection of data for the current research. The primary data were gathered from farmers who were chosen at random. With the aid of pre-tested questionnaires, a few chosen respondents were directly questioned. To ensure consistency and accuracy, the gathered data were verified and confirmed. Prior to input the data into the computer, editing and formatting were performed. To obviate any possible errors, all data were thoroughly analyzed and summarized. Data entry was done electronically, and STATA and Microsoft Excel were used for the research.

Age, educational level, family size, annual income, farm size, agricultural experience, closeness to market, participation in organization, and facilities were all considered for defining the socioeconomic position of the sample home..

At the farm level, economic profitability is one of the main factors when deciding whether to grow any product. It is measurable in terms of profit margin, overall cost, and rate of return on total cost. The price per hectare for estimated land preparation costs for the production of ginger was determined to be Tk.4644.22. It was found that the human labor force required to produce ginger was approximately 220 days per individual per hectare, with an average daily labor needs of Tk. 500. Therefore, Tk. 110000.00, or 22.65 percent of the total cost, was found to be the total labor cost. Ginger seed costs per hectare was found to be Tk.197823.00. Farmers apply urea 106.36 kg ,TSP 106.42 kg, and MoP 174.15 kg per hectare. Pesticides used to grow ginger are expected to cost Tk. 6008.11, while irrigation costs are Tk. 2415.66 per hectare on average. Ginger production had a total variable cost per hectare of Tk. 315871.84, or 65.04 percent of the total cost. The ginger (rhizome) price was Tk. 140.00 per kg, and the cultivation was 6676.34.00 kg per hectare. The ginger (mother rhizome) price was Tk. 130.00 per kg, and the cultivation was 917.10.00 kg per hectare. The gross return, gross margin, and net return per hectare were Tk. 1053910.6, Tk. 738038.76, and Tk. 568259.09, respectively. The Benefit Cost Ratio (BCR) was found to be 2.17, indicating that one costs in the cultivation of ginger yieldsTk.2.17and BCR on cash cost basis was taka.

In this study, the Cobb-Douglas production function model was utilized to examine the effects of important variable inputs. The model incorporated the top six explanatory variables to describe the gross income or return on ginger production. The coefficient with the expected sign indicates that the set of inputs enhanced the gross yield. The coefficient of multiple determination for ginger cultivation was 0.40, indicating that the model included explanatory variables could explain for 40.00 percent of the overall variation in the gross return.

To explore the effects of key variable inputs, the Cobb-Douglas production function model was employed in this study. The model contained the six most relevant explanatory variables to explain the gross income or return on ginger production. Except for the negative and significant influence of pesticide cost, half of the variables in the production function explained the gross return. The predicted sign of the coefficient implies that whichever inputs contributed positively to the gross return. The proportionate change in output as a result of the proportionate change in input is shown by return to scale. The sum of all the coefficients of all the inputs that were coincident in the regression function was computed at 0.182, indicating that the production function had a decreasing return to scale.

Therefore, major components in the production process of year-round ginger cultivation had a positive effect. This research also identified a few problems related to ginger farming. High cost of quality seed, low quality seed, pest and disease attacks, inadequate extension services, a lack of agricultural science, natural disasters, labour shortage, low cost of production .The main challenge to growing ginger in the study area is the seed costs, pest and disease attacks, as well as inadequate storage facilities in the study area.

8.3 Conclusion and Recommendation

The research found that growing ginger is very profitable. Ginger is also a labor-intensive spice item. Ginger is both nutritious and therapeutic. Therefore, growing this spice can improve farmers' nutritional condition, employment opportunities, and farm earnings. The research areas' ginger production management techniques weren't deemed effective enough. Farmers lacked knowledge regarding the timing and dosage of applications. Thus, with careful planning and management training based on their problems and requirements, they can raise farm output and revenue from ginger cultivation. Ginger farming might be a more economically sustainable and marketable business venture if appropriate corrective actions could be done.

8.4 Recommendations

Based on the study's findings, it was evident that producing ginger was a viable business that could give money and work opportunities for people in rural Bangladesh. As a result, policymakers must take the necessary measures. The results of the study may lead to the development of some policy recommendations that could be useful in the creation of policies. The following suggestions for enhancing the ginger business can be made based on the study's findings.

- HYV seeds, fertilizers, insecticides, and pesticides, among other required inputs, should be made available to farmers just before the growing season in order to increase ginger output.
- For increased output, scientific growing techniques should be used. Farmers should be provided with the tools, instruction, information, and services they need to deal with new and changing circumstances.
- The scanty of labor in agriculture in Bangladesh is becoming a major problem. Therefore, appropriate steps should be made to improve farm mechanization.
- Farmers of ginger were forced to sell their produce for a low price either during or right after harvest. The government should create a suitable storage plan so that producers aren't forced to sell their goods at lower prices during the harvest period.

8.4 Research Limits

There are some limitations on both study and research conducted on farmers across a country via interview programs.

a) A small number of research was done in the Bangladesh in ginger cultivation. As a result, there is little scope for generalization, therefore the study's findings may not adequately reflect the situation in other parts of the country.
b) The result of the study is mainly carried out on the response of the ginger growing farmers.
c) The present study could not cover more areas of ginger cultivation due to limitation of time and resource.

The study's findings, however, may provide relevant information to decision makers and users.

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An Interview Schedule for the Study Entitled

SOCIO ECONOMIC ASPECTS OF GINGER CULTIVATION IN SOME SELECTED AREAS OF NILPHAMARI DISTRICT IN BANGLADESH

Serial number: ☐ **Date:**

Dear Respondent,
All of your information will be kept confidential and will be used for research purpose only. Please provide the following information.

A. General information

Name: ……..

Address: Village: ……..……..…… Upazila: ……..……..

District: ……..…….. Mobile: ……..……

B. Socio-economic information

1. Age of the respondent: ……..... years
2. Year of schooling: ……..... years
3. Main source of income (Use code): ☐

   (Use code: Crop farming = 1, Livestock rearing = 2, Fish farming = 3, Day labour = 4, Service = 5, Business = 6, others =7)

4. Agricultural farming experience …….. years
5. Ginger farming experience ……..……..... years
6. Total farm size

Sl. No.	Types of land use	Area of land	
		Decimal	Hectare
F1	Homestead area (including pond and orchard)		
F2	Land under own cultivation		
F3	Land given to others on borga		
F4	Land taken from others on borga		
F5	Land given to others on lease		
F6	Land taken from others on lease		
Total farm size = F1+F2+1/2(F3+F4) + F5+ F6			

7. Farm size under Ginger cultivation: ……..……..…… decimal
8. Total no. of family member: ……..……..…… No.

9 Annual household income (Tk.):

ne source	Income (Tk./Year)
a) Agriculture	
i) Crop & vegetables	
ii) Fisheries	
iii) Livestock	
b) Service	
c) Business	
d) Remittance	
e) Others (If any)	

10 Annual expenditure (Tk.)

ose	Unit	Expenditure (Tk.)
a. Consumption expenditure		
i) Food	Weekly	
b. Non-food expenditure		
i) Housing	Yearly	
ii) Cloths	Yearly	
iii) Education	Yearly	
iv) Medical	Yearly	
v) Festivals	Yearly	
vi) Others (If any)	Yearly	

11 Membership on societal organization (put √ mark): Yes / No

A. Profitability related information

12 Cost of Cultivation

a) Variable cost

Activities		Quantity	Cost (Tk)	Total
1.Land preparation (power tiller/tractor)				
2.Cowdung/Manure				
	Own			

3. Seeds	Purchase			
4. Fertilizer	Urea			
	TSP			
	MoP			
Activities		**Quantity**	**Cost (Tk)**	**Total**
5. Pesticide (liter)				
6. Irrigation				
7. Hired labor (man-days)				
8. Others (Specify)				
Total				

b)Fixed Cost

Items	**Quantity**	**Cost (Tk.)**	**Total**
1. Land rent			
2. Family labor (man-days)			
3. Interest on operating capital @9%			
4. Machinery			
Total			

13 Return from cultivation

Output (s)	Quantity	Price/unit	Total
Product (Kg)			
By-product (Unit)			
Total			

14 Please mention the problems in Ginger cultivation.

a)

b)

c)

d)

15 Suggest me measures to overcome these problems in Ginger Cultivation

a)

b)

c)

d)

Thank you for your nice cooperation