FINANCIAL PROFITABILITY OF GINGER CULTIVATION IN SOME SELECTED AREAS OF NILPHAMARI DISTRICT IN BANGLADESH

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CERTIFICATE

This is to certify that the research work entitled, **"FINANCIAL PROFITABILITY OF GINGER CULTIVATION IN SOME SELECTED AREAS OF NILPHAMARI DISTRICT IN BANGLADESH"** conducted by **MD. SAZZAD BIN AZAD** bearing Registration No.**10-04037 (July-December/2018)** under my supervision and guidance in the partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (M. S.) IN DEVELOPMENT AND POVERTY STUDIES** in the Faculty of Agribusiness Management, Sher-e-Bangla Agricultural University, Dhaka 1207, Bangladesh. No part of this thesis has been submitted for any other degree or diploma.

I further certify that any help or source of information received during this study has been dully acknowledgement by him.

Dated: December, 2018

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THIS THESIS IS LOVINGLY DEDICATED TO MY PARENTS

FINANCIAL PROFITABILITY OF GINGER CULTIVATION IN SOME SELECTED AREAS OF NILPHAMARI DISTRICT IN BANGLADESH

ABSTRACT

The study assessed the cost and return of ginger cultivation in the study area and find out the factors affecting of ginger cultivation and also identify the problems to ginger cultivation. This study applied Cobb-Douglas production function to achieve set objectives. The study conducted in four villages of Nilphamari sadar upazilla of Nilphamari district. Primary data were used for this study. Analysis revealed that, per hectare gross return, net return and gross margin were found Tk. 897150, Tk. 508681 and Tk. 568902 respectively. Total cost of ginger cultivation was calculated at Tk. 388469 per hectare. Benefit Cost Ratio (BCR) was found 2.31. It implied that ginger cultivation was highly profitable. From Cobb-Douglas production function, it was observed that the coefficients of land preparation cost, cowdung use, use of MP, human labor cost and cost of irrigation were positively significant for influencing the yield of ginger cultivation but cost of seed was negatively significant and the coefficients of use of urea, use of TSP and cost of pesticides was insignificant. Study also revealed that lack of scientific knowledge was the 1st problem followed by lack of marketing facilities and lack of extension services in the study areas.

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December, 2018 **The Researcher**

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ABBREVIATIONS

BBS	Bangladesh Bureau of Statistics
IBS	Irritable Bowel Syndrome
FAO	Food and Agricultural Organization
LDL	Low-Density Lipoprotein
NRCS	National Research Centre for Spices
MVP	Marginal Value Productivity
MFC	Marginal Factor Cost
BARI	Bangladesh Agricultural Research Institute
RA	Rheumatoid Arthritis
BCR	Benefit Cost Ratio
NGOs	Non-Governmental Organization
BB	Bangladesh Bank
MP	Muriate of Potash
HYV	High Yielding Variety
TSP	Triple Super Phosphate
STW	Shallow Tube- Well
DTW	Deep Tube-Well
SPSS	Statistical Package for Social Science
LUC	Land Used Cost
TVC	Total Variable Cost
TFC	Total Fixed Cost
NR	Net Return
TC	Total Cost
GM	Gross Margin
GR	Gross Return

CHAPTER I
INTRODUCTION

1.1 Background of the study

Ginger is a plant with leafy stems and yellowish green flowers. The ginger spice comes from the roots of the plant. Ginger is native to warmer parts of Asia, such as China, Japan, and India, but now is grown in parts of South American and Africa. It is also now grown in the Middle East to use as medicine and with food.

Ginger is commonly used for various types of "stomach problems," including motion sickness, morning sickness, colic, upset stomach, gas, diarrhea, irritable bowel syndrome (IBS), nausea caused by cancer treatment, HIV/AIDS treatment and vomiting after surgery, as well as loss of appetite. It has other uses include pain relief from rheumatoid arthritis (RA), osteoarthritis, menstrual pain, and other conditions. However, there is no strong evidence to support the use of ginger for these conditions. Some people pour the fresh juice on their skin to treat burns. The oil made from ginger is sometimes applied to the skin to relieve pain. Ginger extract is also used to the skin to prevent insect bites.

Ginger (*Zingiber officinale Rose*.) is an important commercial spices crop in tropical and sub-tropical countries including Bangladesh. Among the spices crops, ginger is one of the important cash crops in Bangladesh. The rhizome is used worldwide as spices for flavoring in a number of foods and food-products and also used in medicines. It is rich in secondary metabolite, such as oleoresin (Bhagyalakshmi and Singh, 1988). In Bangladesh, it occupies an area of about 23,745 acres with the production of 79,438 metric tons (BBS, 2019). It is used in almost all types of curry and is also essential in cooking meat. It is used for making various pickles, cake and chatni and also used in preparing medicine like ayurvedic, homeopathic, and also allopathic. It contains 80 percent water, 2.5 percent albaminoids, 12.3 percent carbohydrate, 1 percent fat, and 1.2 percent minerals (Ahmed and shaha, 1990).Official statistics show that ginger production has increased (86%) substantially from last three decades. It's demand is getting higher but we do not have sufficient farm level information regarding ginger production. It has also little information about its production technologies gains at farm

level. This lack of information limits the researchers to identify and prioritize research needs and policy makers to adopt proper policy. In this study it would provide guidelines for making adjustment in the use of farm resource in rationale direction and thereby increasing crop production. The present study will help to find out the financial profitability of ginger cultivation in Nilphamari Sadar Upazilla under Nilphamari District and also identify the problems faced by ginger cultivators as well as recommend policy guideline to overcome the problems.

1.2 Key research questions

1. Is ginger a profitable crop in the study area?
2. What types of input are using in ginger cultivation?
3. What are the factors affecting the ginger cultivation in the study area?

1.3 Objectives

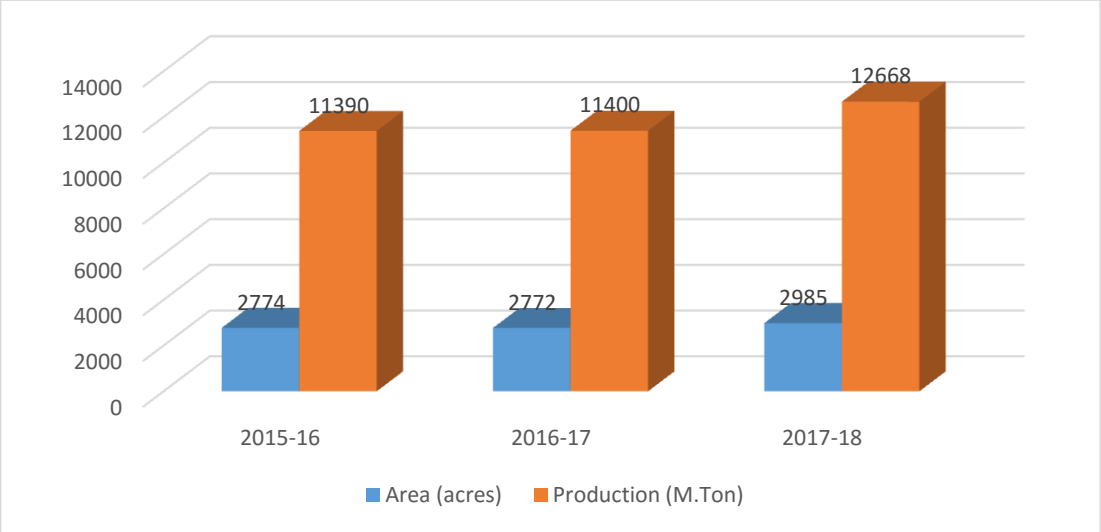
1. To delineate socio-economic characteristics of the ginger farmers in the study area;
2. To determine profitability of ginger cultivation in the study area;
3. To find out the factors affecting of yield of ginger cultivation in the study area;
4. To identify the problems of ginger cultivation and give policy recommendations from a foresaid result.

1.4 Justification of the study

Prior to giving emphasis on the production of ginger, it requires relevant and adequate information on different aspects of production at the farm level. Such knowledge of production is also necessary to make appropriate decision by the growers especially when several alternatives are open to them. There are several factors like institutional, economic, physical, natural calamities that can limit agricultural production. Production of ginger can be increased by enhancing the technical efficiency of ginger growing farmers using existing technology. It is generally assumed that farmers are not enough efficient at producing ginger crop and there are significance inefficiency differences among farm groups. Agriculture production policy in Bangladesh is concerned by lack of information about the relative profitability of ginger production. This study may be informative in this field and may serve as a foundation for the further research to the researchers. Finally it is expected that the findings of the study will be helpful for the individual farmers for increasing the profitability by effective operation and

management of their farms through pointing drawbacks and policy makers and extension workers to frame out a useful policy.

1.5 Ginger production in Nilphamari district



Source: BBS, 2019

Figure 1.1 Ginger production in Nilphamari district since 2015 to 2018

In Nilphamari district, ginger occupies an area of about 2,985 acres with the production of 12,668 metric tons (BBS, 2019), where in Bangladesh, it occupies an area of about 23,745 acres with the production of 79,438 metric tons (BBS, 2019). It means Nilphamari district produces almost 16 percent of total ginger in the country. So, it is one of the major ginger producing areas of the country.

1.6 Time of ginger planting and harvesting

Ginger is cultivating in one season in Bangladesh. Non-water logging soil such as sandy loam or loamy soil is the best for ginger cultivation. Optimum temperature for ginger cultivation is between 24°c to 29°c. Timely sowing is the preconditions for higher yield. Time of planting and harvesting of ginger production are given below:

Table 1.1 Time of planting and harvesting of ginger production in Bangladesh

Planting time	Harvesting time
1stApril-1stMay	4thDecember-3rd January

Source: BBS, 2018

1.7 Ginger production in Bangladesh

Ginger is one of the earliest known oriental spices and is being cultivated in Bangladesh for both as fresh vegetable and as a dried spice, since time immemorial. Ginger is obtained from the rhizomes of Zingiber officinale. The ginger family is a tropical group, especially abundant in Indo-Malaysian region, consisting of more than 1200 plant species in 53 genera.

Table 1.2 Area, production and yield of ginger in Bangladesh from 1990/91 to 2016/17

Year	Area (000' ha)	Production (000' metric ton)	Yield (t/ha)
1990-91	7.02	42.68	6.08
1991-92	7.05	41.53	5.88
1992-93	7.06	41.94	5.93
1993-94	7.02	40.16	5.72
1994-95	6.90	39.46	5.71
1995-96	6.89	38.98	5.66
1996-97	6.89	38.75	5.62
1997-98	6.91	38.66	5.59
1998-99	6.87	38.06	5.54
1999-00	6.90	38.26	5.54
2000-01	7.29	41.94	5.75
2001-02	7.49	42.65	5.69
2002-03	7.57	42.82	5.66
2003-04	7.91	48.18	6.09
2004-05	7.71	49.40	6.40
2005-06	8.04	57.09	7.10
2006-07	7.48	45.67	5.7
2007-08	7.85	53.67	6.33
2008-09	8.40	61.98	7.70
2009-10	8.13	56.78	7.26
2010-11	8.65	57.85	7.48
2011-12	8.46	54.59	7.43
2012-13	8.26	52.46	7.20
2013-14	7.95	51.89	6.90
2014-15	8.58	57.89	7.70
2015-16	8.96	59.83	8.30
2016-17	8.69	56.78	7.73
2017-18	9.60	79.43	8.47

Source: BBS, 2019

1.8 World scenario

The total production of ginger in the world is 1,683.00 thousand tons with the total acreage of 310.43 thousand ha. China, India, Nepal and Thailand are the major producers of ginger in the world, having production of 396.60 thousand tons, 385.33 thousand tons, 210.79 thousand tons and 172.68 thousand tons respectively. India and Indonesia have the largest area under cultivation (FAO, 2018).

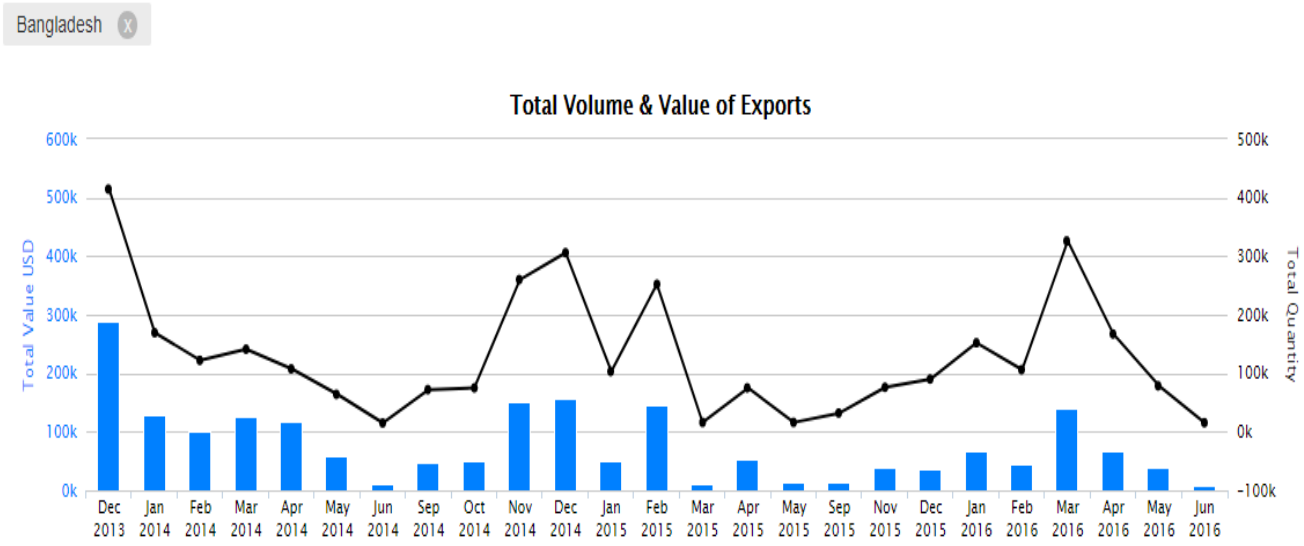
Table 1.3: Area, production and yield of ginger in the world

Country	Area (000' ha)	Production (000'metric tons)	Yield (ton/ha)
China	36.10	396.60	10.99
India	107.54	385.33	3.58
Nepal	18.04	210.79	11.68
Thailand	10.25	172.68	16.85
Nigeria	52.33	162.22	3.10
Indonesia	60.47	109.02	1.80
Bangladesh	9.07	74.84	8.26
Philippines	3.97	27.10	6.83
Republic of Korea	2.09	24.97	11.98
Sri Lanka	2.07	12.05	5.82
Other Countries	8.51	107.39	12.62
Total	**310.43**	**1683.00**	**5.42**

Source: FAO, 2018

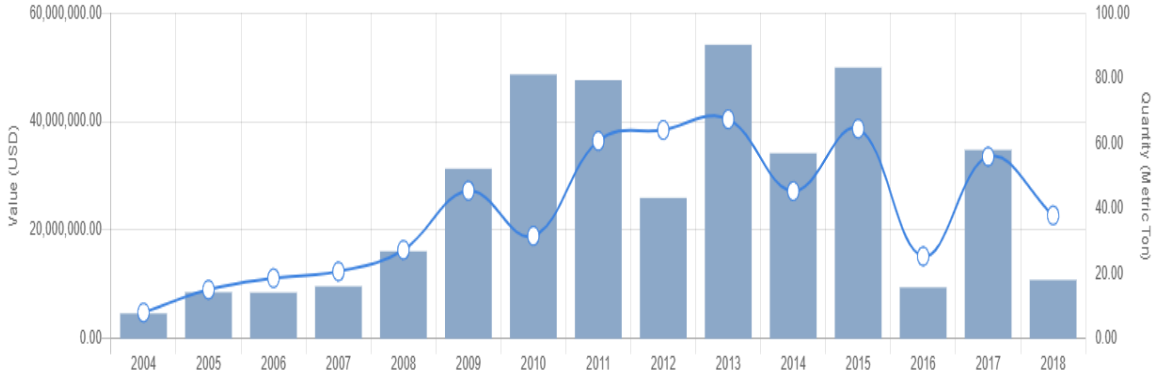
Here, from table 1.3 we can see that Bangladesh is ranked 7th in ginger production. It produces lower than China, India, Nepal etc. but higher than Philippines, Republic of Korea, Sri Lanka etc.

1.9 Bangladesh's export import trend of ginger



Source: (https://www.zauba.com/exportanalysis-FRESH+GINGER/fp-bangladesh-report.html)

Figure 1.2 Export trend of ginger in Bangladesh



Source: (https://www.tridge.com/intelligences/ginger/BD/import)

Figure 1.3 Import trend of ginger in Bangladesh

Here, from figure 1.2 and 1.3 we can see that in 2016 total export was 10 metric ton where as total import of ginger was 30 metric ton. So, demand is higher than supply. So, there is shortage of supply of ginger in our country.

1.10 Health benefits of ginger

1.10.1 Ginger contains gingerol, a substance with powerful medicinal properties

Ginger is a flowering plant that originated from China. It belongs to the *Zingiberaceae* family, and is closely related to ginger, cardamom and galangal. The rhizome (underground part of the stem) is the part commonly used as a spice. It is often called ginger root, or simply ginger. Ginger has a very long history of use in various forms of traditional/alternative medicine. It has been used to help digestion, reduce nausea and help fight the flu and common cold, to name a few. Ginger can be used fresh, dried, powdered, or as an oil or juice, and is sometimes added to processed foods and cosmetics. It is a very common ingredient in recipes. The unique fragrance and flavor of ginger come from its natural oils, the most important of which is ginger. Ginger is the main bioactive compound in ginger, responsible for much of its medicinal properties. It has powerful anti-inflammatory and antioxidant effects (https://www.healthline.com).

1.10.2 Ginger can treat many forms of nausea, especially morning sickness

Ginger appears to be highly effective against nausea. For example, it has a long history of use as a sea sickness remedy, and there is some evidence that it may be as effective as prescription medication). It may also relieve nausea and vomiting after surgery, and in cancer patients undergoing chemotherapy). But it may be the most effective when it comes to pregnancy-related nausea, such as morning sickness. According to a review of 12 studies that included a total of 1,278 pregnant women and found that 1.1-1.5 grams of ginger can significantly reduce symptoms of nausea. However, ginger had no effect on vomiting episodes in this study. Although ginger is considered safe, talk to your doctor before taking large amounts if you are pregnant. Some believe that large amounts can raise the risk of miscarriage, but there are currently no studies to support this nation (https://www.healthline.com).

1.10.3 Ginger may reduce muscle pain and soreness

Ginger has been shown to be effective against exercise-induced muscle pain. In one study, consuming 2 grams of ginger per day, for 11 days, significantly reduced muscle pain in people performing elbow exercises. Ginger does not have an immediate impact, but may be effective at reducing the day-to-day progression of muscle pain). These

effects are believed to be mediated by the anti-inflammatory properties (https://www.healthline.com).

1.10.4 The anti-inflammatory effects can help with osteoarthritis

Osteoarthritis is a common health problem. It involves degeneration of the joints in the body, leading to symptoms like joint pain and stiffness. In a controlled trial of 247 people with osteoarthritis of the knee, those who took ginger extract had less pain and required less pain medication. Another study found that a combination of ginger, mastic, cinnamon and sesame oil, can reduce pain and stiffness in osteoarthritis patients when applied topically (https://www.healthline.com).

1.10.5 Ginger may drastically lower blood sugars and improve heart disease risk factors

This area of research is relatively new, but ginger may have powerful anti-diabetic properties. In a recent 2015 study of 41 participants with type 2 diabetes, 2 grams of ginger powder per day lowered fasting blood sugar by 12%. It also dramatically improved HbA1c (a marker for long-term blood sugar levels), leading to a 10% reduction over a period of 12 weeks. There was also a 28% reduction in the ApoB/ApoA-I ratio, and a 23% reduction in markers for oxidized lipoproteins. These are both major risk factors for heart disease (https://www.healthline.com).

1.10.6 Ginger can help treat chronic indigestion

Chronic indigestion (dyspepsia) is characterized by recurrent pain and discomfort in the upper part of the stomach. It is believed that delayed emptying of the stomach is a major driver of indigestion.

Interestingly, ginger has been shown to speed up emptying of the stomach in people with this condition. After eating soup, ginger reduced the time and took for the stomach to empty from 12 to 16 minutes. In a study of 24 healthy individuals, 1.2 grams of ginger powder before a meal accelerated emptying of the stomach by 50 % (https://www.healthline.com).

1.10.7 Ginger powder may significantly reduce menstrual pain

Menstrual pain (dysmenorrheal) refers to pain felt during a woman's menstrual cycle. One of the traditional uses of ginger is for pain relief, including menstrual pain.In one study, 150 women were instructed to take 1 gram of ginger powder per day, for the first 3 days of the menstrual period. Ginger managed to reduce pain as effectively as the drugs mefenamic acid and ibuprofen (https://www.healthline.com).

1.10.8 Ginger may lower cholesterol levels

High levels of LDL lipoproteins (the "bad" cholesterol) are linked to an increased risk of heart disease. The foods you eat can have a strong influence on LDL levels. In a 45-day study of 85 individuals with high cholesterol, 3 grams of ginger powder caused significant reductions in most cholesterol markers. This is supported by a study in hypothyroid rats, where ginger extract lowered LDL cholesterol to a similar extent as the cholesterol-lowering drug atorvastatin. (https://www.healthline.com).

1.10.9 Ginger contains a substance that may help prevent cancer

Cancer is a very serious disease that is characterized by uncontrolled growth of abnormal cells. Ginger extract has been studied as an alternative treatment for several forms of cancer. The anti-cancer properties are attributed to 6-gingerol, a substance that is found in large amounts in raw ginger. In a study of 30 individuals, 2 grams of ginger extract per day significantly reduced pro-inflammatory signaling molecules in the colon. However, a follow-up study in individuals at a high risk of colon cancer did not confirm these findings. There is some, albeit limited, evidence that ginger may be effective against pancreatic cancer, breast cancer and ovarian cancer. More research is needed.(https://www.healthline.com).

1.10.10 Ginger may improve brain function and protect against alzheimer's disease

Oxidative stress and chronic inflammation can accelerate the aging process. They are believed to be among the key drivers of Alzheimer's disease and age-related cognitive decline. Some studies in animals suggest that the antioxidants and bioactive compounds in ginger can inhibit inflammatory responses that occur in the brain. There is also some evidence that ginger can enhance brain function directly. In a study of 60 middle-aged women, ginger extract was shown to improve reaction time and working memory.

There are also numerous studies in animals showing that ginger can protect against age-related decline in brain function (https://www.healthline.com).

1.10.11 The active ingredient in ginger can help fight infections

Gingerol, the bioactive substance in fresh ginger, can help lower the risk of infections. In fact, ginger extract can inhibit the growth of many different types of bacteria. It is very effective against the oral bacteria linked to inflammatory diseases in the gums, such as gingivitis and periodontitis. Fresh ginger may also be effective against the RSV virus, a common cause of respiratory infections (https://www.healthline.com).

1.11 Outline of the study

This thesis contains a total of eight chapters which have been organized in the following sequence. Chapter 1 includes introduction. The review of literature is presented in Chapter 2. Methodology of the relevant study is discussed in Chapter 3. Chapter 4 contains the socio- demographic profile of the ginger farmers. Chapter 5 deals with profitability of ginger cultivation. Chapter 6 describes the factors affecting returns of ginger cultivation. Chapter 7 presents problems of ginger cultivation. Finally, Chapter 8 represents the summary, conclusion and policy recommendations to increase profitability of ginger cultivation.

CHAPTER II
REVIEW OF LITERATURE

Ginger is an important spice crop of the world as well as Bangladesh. Very little work has been done on financial analysis (cost and return) and yield performance of ginger in Bangladesh. There is no direct literature related to economics of ginger production. That is why the most pertinent and available literatures concerning with the ginger has been reviewed under the following. Various studies have been conducted by different researchers to explore different aspects of this ginger cultivation.

Akhter *et al*. (2011) conducted a study on "An economic analysis of winter vegetables production in some selected areas of Narsingdi district". These studies revealed that production of all the selected vegetables were profitable.

Hasan et al. (2003) conducted a study on Profitability of cabbage cultivation in different growing periods at Jessore Area. The highest gross return as well as net return was obtained from pre-rabi period of cabbage cultivation. The lowest gross return and net loss was obtained from late-rabi period of cabbage cultivation. The study revealed that cabbage cultivation is more profitable in pre-rabi period and less profitable (actually negative profit) in the late-rabi period. The benefit cost ratio was the highest for pre-rabi period in both variable cost and total cost basis. Return to labour was calculated highest for pre-rabi cultivation indicating best use of highest cost involvement input. Marginal rate of return was found1667% for pre-rabi cultivation which implies that taka one hundred additional investment to pre-rabi rather than optimum-rabi will provide additional taka1667 to the growers.

Inbasekar (2011) analyzed the resource use efficiency in the production of ginger in Warangal district of Andhra Pradesh, India. The OLS estimates of the Cobb-Douglas production function revealed that the coefficients of planting material, labour, and organic manure were positive and significant at 5%, on marginal farms. The coefficients of fertilizer and irrigation were positive and significant at 5%, on small farms and the coefficients of human labour and irrigation were significant at 1% level of probability on large farms.

Islam et al. (2012) conducted a study on economic performance of ginger cultivation in some selected locations of Bangladesh. Results found that ginger production was profitable and the average benefit cost ratio (BCR) was found 2.17. The estimated results showed that the mean technical efficiency of the sample farmers was 85. It implies that technical efficiency could be increased by 15 percent. In inefficiency model, the coefficient of farmer's education and experience in ginger cultivation was negative and significant. It implies that education and experience can increase technical efficiency significantly. Sixty eight percent farmers produced outputs to the maximum frontier output level (81-95%). Farmers in the study area also mentioned some problems like incidence of root rot disease, high price of seed, insect infestation etc hamper to ginger production.

Khandoker et al. (2016) conducted a study on profitability and resource use efficiency of winter vegetables production in selected areas of Bangladesh. Total cost of brinjal, country bean and radish production per hectare were Tk. 208,101, Tk. 167,757 and Tk. 13,0267, respectively. Per hectare average yield of brinjal, country bean and radish were 29.84 tonnes, 16.96 tonne and 31.30 tonnes, respectively. The net return of brinjal, country bean and radish were Tk. 179780, Tk. 69683 and Tk. 63944 per hectare, respectively. The benefit cost ratio on full cost basis for brinjal, country bean and radish were 1.86, 1.42 and 1.50 respectively. Cost of human labour, land preparation, seed, TSP, experience in farming and training had positive and significant effect on country bean production. Likewise, cost of human labour, land preparation, insecticides, education and experience had positive and significant effect on brinjal production. For radish production, cost of land preparation, seed cost, cost of urea, education and experience in farming had positive and significant effect.

Mannan and Rahman (2017) conducted a study on situation of vegetable cultivation in the Khulna region of Bangladesh due to climate change and shrimp farming. Most of the respondents use cow dung, urea, TSP and MoP in vegetable cultivation. Viral disease was the most occurring disease in vegetables cultivation. Leaf cutting caterpillar was most commonly occurring insect. A number of problems were identified in vegetable cultivation faced by the farmers in the study area.

Mohammad (2009) conducted study on structure and efficiency analysis of vegetable production and marketing in Sindh, Pakistan. The study made a valuable addition to the knowledge required for efficient production and marketing of onion, tomato and chilies in Sindh. The results revealed that there was high degree of competition among wholesalers and retailers, which suggested that their market margins were not excessive except wholesalers where indications of collusive oligopoly could be said as the profit margins and returns to investment of wholesalers were significantly higher when compared with other actors.

Monnaf et al. (2010) A field experiment was conducted to study the effect of planting method and rhizome size on the growth and yield of ginger under the logistic support of the 'Action Plan for Spices Project' of BAU, at the Horticulture Farm, Bangladesh Agricultural University, Mymensingh. The study comprised two factors viz. planting method and rhizome size. The main effects and the combined effects of three planting methods namely ridge method, furrow method and flat method with five rhizome sizes viz. 10-15g, 15-20g, 20-25g, 2530g and 30-35g were evaluated. Planting methods and rhizome size and their combined effects showed significant influence on the yield and yield components of ginger. The highest yield (18.78 t/ha) was recorded from ridge method of planting followed by furrow (14.56 t/ha) and flat method (11.06 t/ha). The highest yield (19.64 t/ha) was recorded from 30-35g of rhizome size and the lowest (11.30 t/ha) was from 10-15g of rhizome size. The most satisfactory yield (22.78 t/ha) was found from the treatment combination of ridge method with 30-35g of rhizome size; while the poorest yield (8.34 t/ha) was obtained from the treatment combination of flat method with 10-15g of rhizome size.

Mukul et al. (2013) conducted a study on farmer's profitability of potato cultivation at Rangpur district: the Socio-economic context of Bangladesh and found that per acre cost of potato cultivation of small, medium and large farmers are shown. Total cost was highest for medium farmers (TK. 679260.) followed by large farmers (TK.577650) and small farmers (TK. 93390).

Noonari *et al.* (2015) examined the costs and returns indicate that farmers incurred an average per hectare fixed costs. Rs 33187.00 include Rs 700.00 for land tax, Rs 32487.00 for rent of land. The results revealed that tomato farmers incurred an average

per hectare cost of Rs 19780.75 as labor cost. An average per acre marketing cost of 30457.65 on tomato capital input used, and an average per acre marketing cost was Rs. 4191.73 On an average per acre spent a total cost of production of Rs. 87617.13. An average per acre Physical productivity was 186.00 in mounds. An average per acre Revenue productivity was Rs.158750.00 and the Net income was 71133.00 an availed input output ratio 1:1.81 it means that with the investment of Rs.1.00 in tomato enterprises they yielded Rs.1.81. The cost benefit ratio of the cultivation of tomato at 1:0.81 it means that the tomato growers fetched Rs.0.81 on each rupee investment of tomato.

Ramya (2009) analyzed the production and marketing of major vegetables in Bilaspur District of Chhattisgarh, the result revealed that the cost of cultivation of Tomato, Brinjal and Okra was calculated Rs 29782.82, Rs 26252.01 and Rs 29788.78 respectively and its input output ratio was 1:2.76, 1:2.83 and 1:2.36 on the sample farms.

Ravindran *et al.* (1994) National Research Centre for Spices (NRCS) have been taken a trial on evaluation of some ginger cultivars for various morphological, yield and quality characters revealed considerable variability for most of these traits. The NRCS has an *in vitro* gene bank for medium term storage of germplasm and is working on the use of cryopreservation for long-term storage. The NRCS is also working on the development of high yielding, disease resistant, high quality lines.

Sangeetha and Banumathy (2011) conducted a study on economic analysis of marketing of major vegetables in Cuddalore district. The first hypothesis of the study was there exist a direct relationship between total marketing cost and the number of middlemen involved in the identified marketing channel. It was clear from the results that the total marketing cost of Tomato and Brinjal was observed as the highest in the marketing channel I.

Sharma *et al*. (2008) in their study revealed that there is inefficiency in terms of input application. The ratio of marginal value productivity (MVP) to marginal factor cost (MFC) was more than one in case of 50 per cent of inputs for all the crops. The analysis

also revealed that a majority of the farmers operate at low level of efficiency due to practicing of traditional methods.

Shende *et al.* (2013) study revealed that the cost of cultivation per hectare for tomato over the cost C2 was found 76417.41 Rs/ha, the net over cost C2 was found to 65139.23 Rs/ha. For tomato. The B: C ratio over cost A2 which is known as available cost was found to 3.73 for tomato. However the B: C ratio over C2 i.e. cost of cultivation was 1.85 for Tomato. The study identified for different marketing channel for Tomato vegetable. . It shown that Channel-I i.e. Producer to Consumer was best channel for marketing for selected vegetable. The marketing efficiency was worked out with three different method viz; Conventional method, Shepherd method and Acharya method. It reveal that efficiency was decline with increase in number of intermediaries. The different constraints were identified during production and marketing of Tomato vegetable.

Singh (2005) using data collected for the agricultural year 1997-98, this study analyses the production and marketing of selected vegetables (tomato, onion, arvi, okra, brinjal and potato) in Madhya Pradesh, India. Examined in detail are the following: production costs and returns; marketable and marketed surplus; marketing costs, channels, margins and efficiency; and production and marketing problems.

Sujon et al. (2017) conducted a study on profitability and resource use efficiency of potato cultivation in Munshiganj district of Bangladesh and found that average gross return, gross margin and net return were found Tk. 3,47,200, Tk. 1,47,125 and Tk. 1,17,300, respectively. Benefit-cost ratio was found 1.51 and 1.74 on full cost and variable cost basis, respectively.

Swaminathan *et al.* (2014) studies were addressed farm profitability and value chain management aspects of tomato growers in the Salem, Dindigul and Krishnagiri districts of Tamil Nadu. A sample size of 300 respondents was used for the study. The study has revealed a skewed ginger spread at the farmers' end. At the same time, Shepherd's index has also been found very low (1.22), indicating market efficiency to be dismal. The total cost of tomato cultivation, on an average, was estimated to be 48,951/ ha.

Zaman et al., (2010) conducted a study on comparative profitability of winter vegetables in a selected area of Dhaka district and found that per acre gross margin and net return of brinjal were the highest and the corresponding figures were TK 130051.5 and TK 125226 respectively. The lowest gross margin and net return were found in the case of cabbage and these were TK 45185.5 and TK 37407 respectively. The highest share of total cost of each vegetable goes to labor. In case of brinjal, Benefit Cost Ratio (BCR) was 3.2 and higher than BCR of cabbage (1.8), tomato (1.7) and cauliflower (1.6). BCR indicates that vegetable growing is a profitable farm activity in a short duration of time. So it is evident from the results that vegetable production is a profitable business.

Profitability of ginger is very important in the context of Bangladesh. Till now sufficient research study had not been conducted in this important area. So, very extensive and in-depth research works are urgently needed for providing information for the policy makers so that better policies can be formulated. The aforesaid reviews reveal that studies were undertaken exclusively on the marketing aspect of ginger. A few studies on profitability of ginger production have been undertaken in Bangladesh. So the existing research has been undertaken to make an in depth study to provide knowledge in the field of ginger production. The findings of the study might help researchers, farmers, traders and consumers to take decision in production and trading.

CHAPTER III
METHODOLOGY

3.1 Introduction

Researcher follows a set of tools and techniques in order to fulfill the aims and objectives of the farm management study essentially involves collection of data from the farmers. This chapter deals with the methodology used for the study. The chapter comprises two parts. The first part deals with the design and conduct of a survey to collect data and later part to the technique used for estimating technical efficiency of ginger production.

3.2 Method of investigation

A farm business study usually involves collection of information from individual farmers. Collection of data for farm business analysis involves compromises and the judgments of the analyst selecting data collection methods within the limits imposed by the resources available for the work. For this study, farm survey method was adopted for collecting data because of its two major advantages a. Survey enables quick investigations of large number of cases, and b. Its results have wider applicability.

There are three methods by which farm survey data can be gathered (Dillon and Hardaker, 1993).These are

i. Direct observation,
ii. Interviewing respondents, and
iii. Records kept by respondents

Since the farmers of Bangladesh do not usually maintain records and accounts of their term operations, the second method was followed to achieve the objectives of this study. However, survey method is not free from drawbacks. The main drawback of this method is to rely on the memory of the respondents. To minimize errors, repeated visits were made to collect data and in case of any omission or contradiction, the farmers were revisited to obtain the missing and/or correct information.

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3.3 Selection of the study area

Research area in terms of management or production economics, where the collection of primary data is involved, requires selection of an area which would offer a scope to fulfill the objectives of the study. Selection of the study area is, therefore, an important step for farm management study. The area in which a farm business survey is to be conducted relies on the particular purpose of the survey and possible cooperation from the farmers and other respondents. It may be noted here that ginger is concentrated in certain areas of Bangladesh. Nilphamari sadar upazila is one of the important areas of Bangladesh where ginger cultivation is concentrated. Keeping in mind, to fulfill the main objectives of the present study, some preliminary visits were made in the four villages namely 1. Uttar kanial khata, 2. Debirdanga, 3. Panchopukur and 4. Vobaniganj village of Nilphamari Sadar Upazila under Nilphamari district were selected randomly as a locale of the study.

There were two main reasons behind the selection of these areas. These were

a) A good number of ginger growing farmers were available in the selected district, and

b) The study area was easily accessible to the researcher and was familiar with the local language, belief and other socio-economic characteristics of the farmers. These familiarities and accessibility allowed the researcher to establish rapport with the ginger growing farmers and as is well known, this is a necessary precondition for obtaining accurate information.

3.4 Selection of sample size

A reasonable size of sample which could at least satisfy the objectives set for the study was taken into account. During the research period, a total of 80 ginger farmers listed in the study areas considering the limitation of time and funds. Finally sample size was considered 80. Among 80 ginger farmers, 20 from each village were selected randomly.

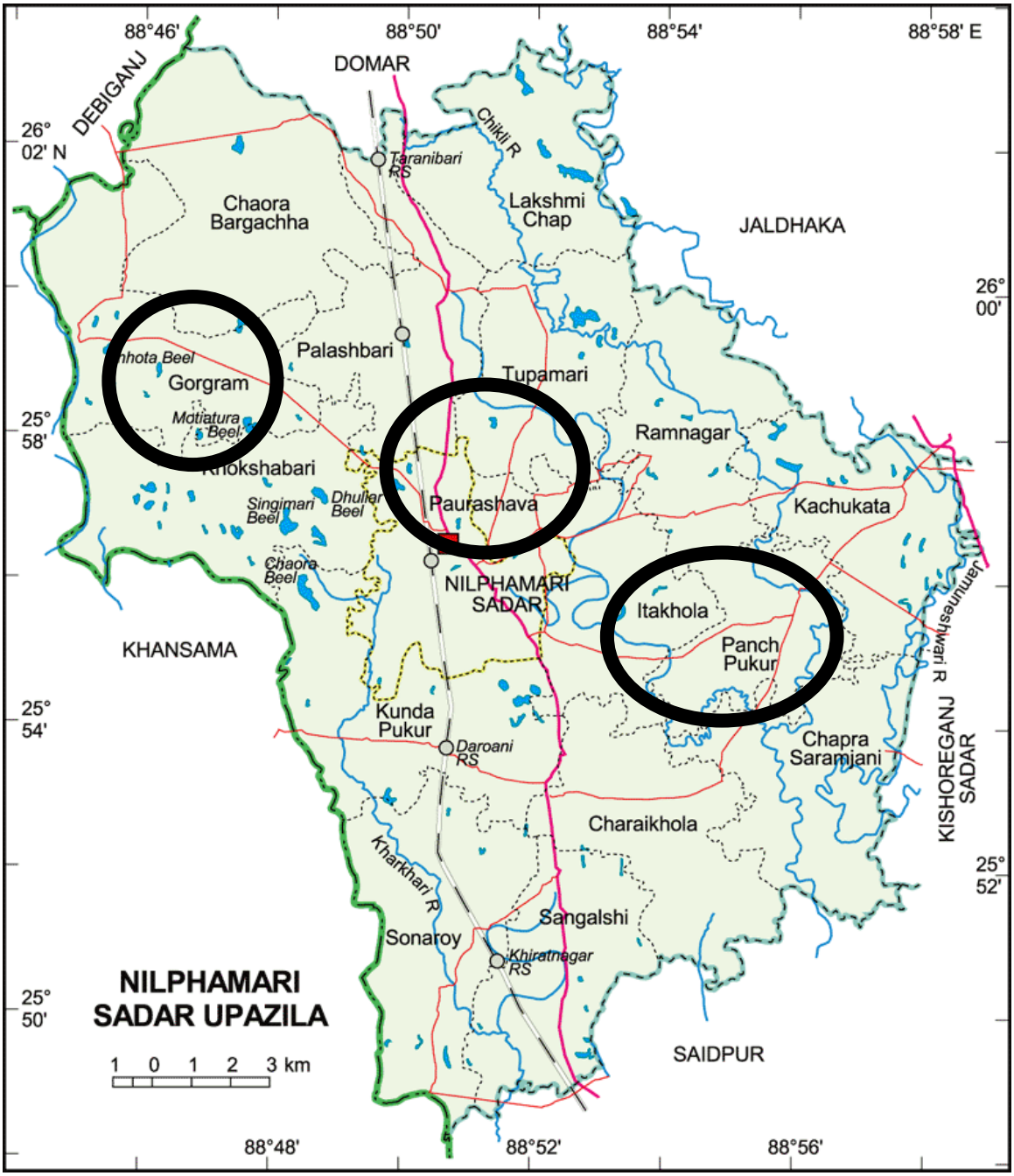

Figure 3.1: Map of Nilphamari sadar upazila showing the study areas

3.5 Sampling technique

A sample of relevant farm should be selected in such a way that the data fulfill the objectives of the study. It was not possible to make survey of all farmers because of funds as well as time consideration. A sample survey was considered to have required information for the present study. Eighty ginger producers from selected Upazila were chosen randomly for this study.

3.6 Design of questionnaire

In conformity with the objectives of the study, a preliminary survey schedule designed for collecting data from the selected respondents. In the farm business analysis, survey schedule should be prepared very carefully and efficiently. The draft schedule was pre-tested with a few sample farmers of the study area by the researcher himself. Thus, some parts of the draft schedule were improved, rearranged and modified in the light of the actual and practical experiences gained from the pre-tested questionnaire. The schedule was finally developed in a simple manner so that accurate information could be obtained without repetition and misunderstanding.

3.7 Period of the survey

For the present study, data were collected by the researcher himself through face-to-face interview with the selected farmers. Data were collected during 1st, July to 30th July, 2019. Here the sowing and harvesting period were April-May 2018 and December-January, 2019 respectively.

3.8 Collection of data

In addition to these data other necessary information required to fulfill the objectives of the study were also collected. As the secondary source, research reports and publication related to the study were used to develop and enrich the research work. In time of data collection, when the selected farmers were not busy with their respective works, they had been asked to stay in their working places to provide required data and information. Before the actual interview was made the aim and purpose of the study were explained to each farmer, the researcher explained the purpose of this research to them and made it clear that this was simply an academic exercise. Then the questions were asked systematically and explanation was made whenever it was felt necessary. After completion of each interview, the schedule was checked to be sure that information to

each of the items had been properly recorded. In order to minimize the errors, data were collected in local units, and afterwards these were subsequently converted into standard international units. In addition, secondary data were collected from various books, journals and different publications of BBS, Yearbook of Agricultural Statistics.

3.9 Processing of data

The collected data were manually edited and coded. Then all the collected data were summarized and scrutinized carefully. Data were processed to transfer to master sheets to facilitate tabulation in order to meeting the objectives of the study. Moreover, data entry was made in computer and analyses were done using the concerned software.

3.10 Data collection method

Primary data are needed for this study and researcher himself was collected necessary data by interviewing the selected farmers. Data was collected by using a structured questionnaire.

3.11 Analytical techniques

Both tabular and statistical tools were used for analyzing the data. Tabular tools were used for calculating profitability, average, percentage, total etc. Cobb-Douglas production function was used to know the factor affecting on the ginger production. Because in Cobb-Douglas production function, the regression co-efficient directly shows production elasticity and as all the sum of the production elasticities indicate whether the production process as an increasing, constant, or decreasing returns return to scale.

The empirical Cobb-Douglas production function with double log form can be expressed as:

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + b_8 \ln X_8 + b_9 \ln X_9 + ui$$

Where,

ln = Natural logarithm,

Y = Yield of ginger of the i-th farm (kg/ha)

X_1= Land preparation (power tiller) cost used by the i-th farm (Tk/ha)

X_2= Tuber used by the i-th farm (kg/ha)

X_3= Manure used by the i-th farm (kg/ha)

X_4= Urea used by the i-th farm (kg/ha)

X_5= TSP used by the i-th farm (kg/ha)

X_6= MP used by the i-th farm (kg/ha)

X_7= Human labor used by the i-th farm (Tk/ha)

X_8= Insecticides cost used by the i-th farm (Tk/ha)

X_9= Irrigation cost used by the i-th farm (Tk/ha)

b1, b2, b3, b4, b5, b6, b7, b8 and b9 = Coefficient of relevant variables.

u_i=Disturbance term

i= 1, 2,……9.

3.12 Problems faced in collection of data

During the period of data collection, the researcher had to face the following problems:

- Due to limitation of time, all the data for the study were collected within a short time.
- The farmers tried to avoid providing true information relating to the actual size of land holding and income accrued from ginger production because they afraid of imposition of taxes.
- It was very difficult to convince the farmers on the utility of the study partly due to their ignorance and partly due to their busy schedule of work.

3.13 Estimation of cost items

This section mainly deals with estimating cost items and return of ginger production. The cost items considered in this study were as follows i) cost of human labour, ii) cost of draft power and power tiller, iii) cost of tuber (rhizome) , iv) cost of manure, v) cost of fertilizers, vi) cost of pesticide, vii) cost of irrigation, vii) interest on operating capital, ix) land rental use cost.

In the production processes of ginger, farmers used purchased inputs. The input items were valued at the prevailing local market rates. For purchased inputs, farmers had to pay cash was actually paid, and pricing was very difficult in such cases. However, in calculating the cost of such inputs, the principle of opportunity costs was followed. In

determining the opportunity cost of an individual enterprise the relevant input ginger is the value forgone by replacing this input from another enterprise. The cost was calculated at the Nilphamari sadar price rate.

3.13.1 Cost of human labor

The sources and supply of human labor were classified into, (a) family labor for which no payment was made, and (b) hired labor for which farmers had to pay in cash. Family labor includes the operator's own labor and other family members. The labor of woman and children has been converted into man-equivalent hours by representing a ratio of 2 children hours = 1.5 women hours = 1 man equivalent hours. In pricing the labor as such no distinction was made between the unpaid family and hired labor. The human labor was calculated in man-day units which usually consist of 8 hours a day. The cost of family labor was determined by applying opportunity cost principle and the cost of hired labors was calculated at actual paid by the farmers. In the study areas fixed wage rate was found which was calculated Tk. 400 per man- days.

3.13.2 Cost of land preparation

The determining of the animal power cost is really a complex procedure. But in this study, a simple method was followed. The animal power was employed only during the land preparation in the production processes of ginger. The cost of animal labour was calculated based on the opportunity cost principles when home supplied animal power was used by the farmers own farm. On the other hand, the cost of hired animal power was calculated by the prevailing market rate or the gingers actually paid by the farmers. The measuring unit of the draft power was locally called hal by the farmers of the study area. One hal included a pair of bullock or cow and one human attendant with tools and implements like plough, yoke, and ladder and works for 6 hours a day. The wage rate of the animal power and power tiller were found different from one place to another in the study area and the average wage rate was used in this study. The average wage rate was calculated at Tk. 250 per pair-days.

3.13.3 Cost of seeds/rhizome

The sample farmers were mostly used purchased seeds were also used by the farmer's in ginger production. The seed cost was calculated on the basis of actual gingers used by the farmers in the locality. It may be noted here that there was a variation in the cost of per kilogram (kg) seed in the study area.

3.13.4 Cost of manure

In the study areas, farmers used cowdung, ash and oilcake as organic fertilizer in their land during ginger production. A large quantity of manure was supplied from the farmer home. While some farmers bought cowdung from other farmers.

3.13.5 Cost of fertilizer

There are five kinds of chemical fertilizers namely urea, triple super phosphate (TSP), muriate of potash (MP), zink and gypsum which were used by the farmers. Fertilizer costs were charged at actual gingers paid by the farmers. The average prices of these fertilizers were Tk. 18/kg, Tk. 29/kg, Tk. 18/kg and Tk. 180/kg respectively.

3.13.6 Cost of pesticides

Farmers applied pesticides to ginger production but were foiled to provide its exact quantity and brand names. The cost of insecticides was calculated on the basis of actual amount of money paid by the farmers.

3.13.7 Cost of irrigation

Farmers used shallow tube-well (STW) and Deep tube-well (DTW) for irrigating purpose. In the study area, only one payment system was practiced, under this system farmers had to pay cash taka for irrigation water charge per unit of land. The cost of irrigation water was estimated as the actual amount of money paid by the fanners in cash.

3.13.8 Land use cost

The cost of land use may be estimated using one of the following three alternative concepts

• Opportunity cost of alternative use of land

• Calculating interest on the value of the land forth concerned period

• Seasonal rental amount or leased value of the land used

For calculating land use cost, seasonal rental value of land was considered as reported by the farmers. Rental value of the land depended on location, fertility and topography of the soil. The land use cost was thus determined in accordance with the reported values.

3.13.9 Interest on operating capital

Interest on operating capital was charged on taking all variables costs incurred for various operations in ginger farming such as power tiller and animal labor cost, seed/rhizome cost, hired labor cost, fertilizer cost, irrigation cost and pesticide cost. As the variable cost items were short time investments, interest rate (IR) on these items was charged at the rate of 9 percent per annum. It was assumed that if the owners of ginger farmers had put money in bank, he would have received an income in the form of interest money at the above rate. The cost of land use may be estimated using one of the alternative concepts:

Interest on operating capital (IOC) was computed by the following formula:

$$IOC = \frac{OC * IR * \text{Time consideration}}{2}$$

Where,

OC = Operating capital;

IR=Interest rate

3.14 Profitability analysis

Costs and return analysis is the most common method of determining and comparing the profitability of different farm enterprise. In the present study, the profitability of ginger cultivation is calculated by the following way-

3.14.1 Calculation of 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) + Rhizome

3.14.2 Calculation of gross margin

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

Gross margin = Gross return – Total variable cost.

3.14.3 Calculation of net return

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

Net return = Total return – Total production cost.

The following conventional profit equation was applied to examine farmer's profitability level of ginger producing farms in the study areas.

$$\text{Net profit, } \pi = \Sigma P_m Q_m - TFC.$$

Where, π = Net profit/Net return from ginger cultivation (Tk/ha);

P_m = Per unit price of ginger (Tk/kg);

Q_m= Total quantity of the ginger cultivation (kg/ha);

TFC = Total fixed cost (Tk) and

i = 1, 2, 3,....., n (number of inputs).

3.14.4 Undiscounted benefit cost ratio (BCR)

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

$$\textbf{BCR}_{\text{(On full cost basis)}} = \frac{\text{Total Return}}{\text{Total Cost}}$$

$$\textbf{BCR}_{\text{(On variable cost basis)}} = \frac{\text{Total Return}}{\text{Total Variable Cost}}$$

CHAPTER IV

SOCIO-ECONOMIC CHARACTERISTICS OF THE GINGER FARMERS

This chapter of this study have been discussed in relation to the present findings. Thirteen characteristics of the farmers were selected for this research. The characteristics include: age, gender, education, family size, time spent in ginger cultivation, experience in ginger cultivation, land under ginger cultivation, training on ginger cultivation, annual family income, organizational participation, credit received and knowledge on ginger cultivation. However, for ready reference, separate tables are provided while presenting categorizations, discussing and /or interpreting results concerning each of the characteristics in this chapter.

4.1 Age

Age of the farmers ranged in between 27 to 80 years. On the basis of age, the farmers were classified into three categories: "young" (up to 35), "middle aged" (36-50) and "old" (above 50). The distribution of the farmers according to their age is shown in Figure 4.1.

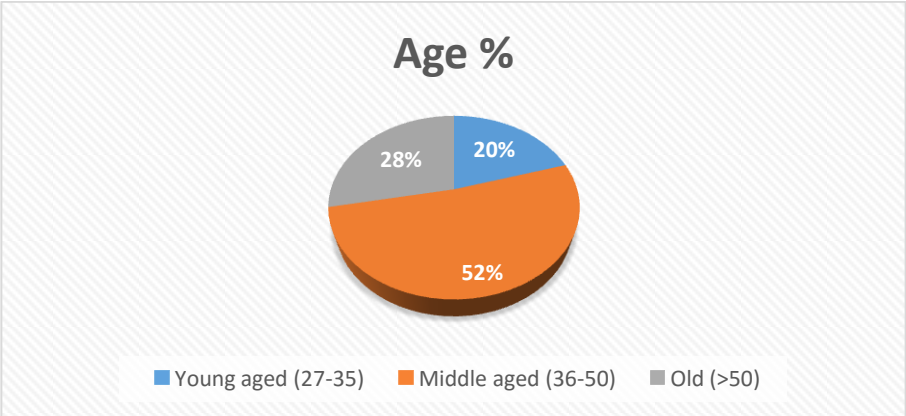

Figure 4.1 Distribution of the farmers according to their age

Figure 4.1 showed that the highest proportion 52 percent of the ginger farmers fell in the "middle aged" category, while 28 percent of them fell in the "old" category and 20 percent in the "young aged" category.

4.2 Gender

Gender scores of the farmers ranged from 1 to 2. On the basis of their gender, the respondents were classified into two categories namely, male and female. The scale used for computing the gender score of a respondent is given Figure 4.2.

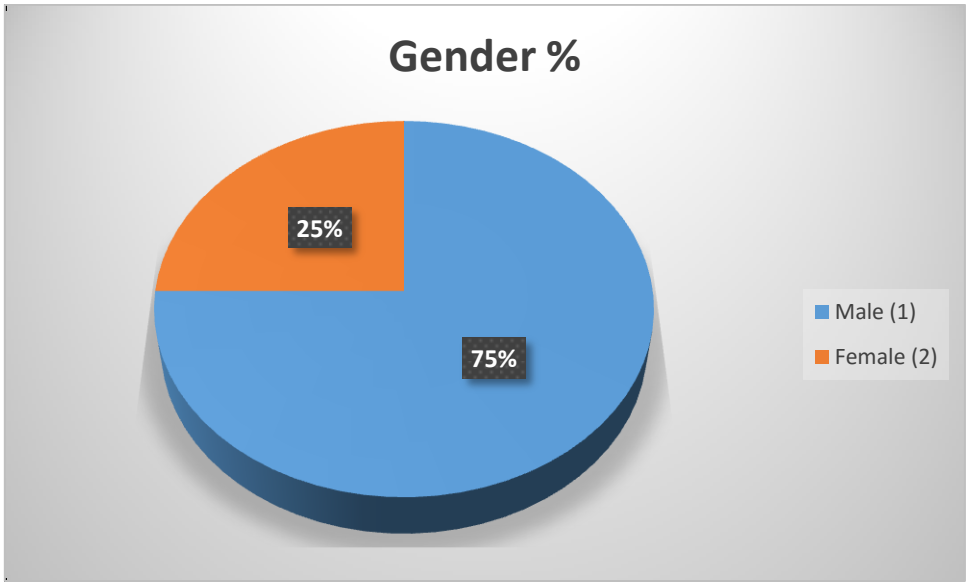

Figure 4.2 Distribution of the farmers according to their gender

Data contained in the Figure 4.2 indicated that the highest proportion (75.0%) of the respondents was male and (25%) was female, respectively.

4.3 Education

The education scores (years of schooling) of the farmers ranged from 0 to 18 years. On the basis of their educational scores, the farmers in ginger cultivation were classified into four categories, namely "illiterate (0), primary (1-5), secondary (6-10) and above secondary (above 10). The distribution of the farmers according to their education is shown in Figure 4.3.

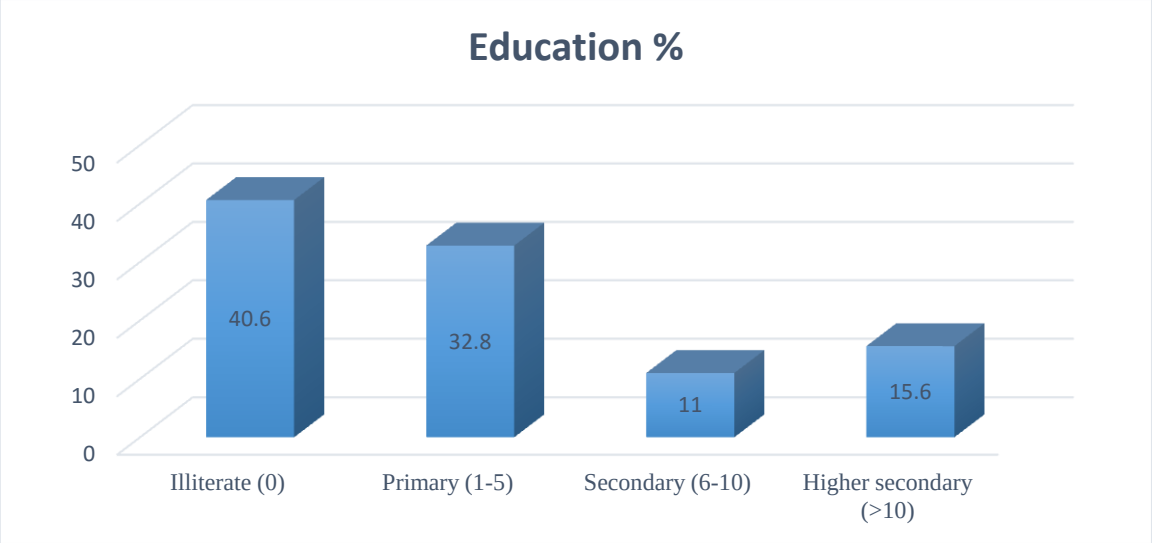

Figure 4.3 Distribution of the farmers according to their education

Figure 4.3 indicated that the majority (40.6 percent) of the farmers had illiterate compared to 32.8 percent of them having primary level education. About 11 percent of the farmers were secondary, while 15.6 percent had above secondary level of education.

4.4 Family size

The family size of the farmers ranged from 6 to 12 members. On the basis of their family size the farmers were classified into the following three categories: "small family" (6-7), "medium family" (8-9) and "large family" (above 9). Figure 4.4 contains the distribution of the farmers according to their family size.

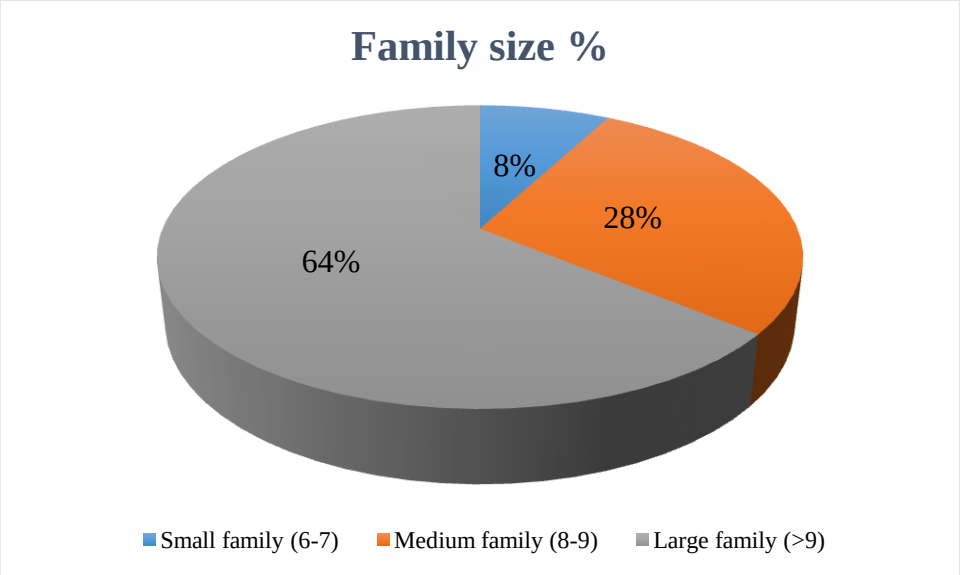

Figure 4.4 Distribution of farmers according to their family size

Figure 4.4 showed that the majority of the 64 percent of the ginger farmers had "large family" of above 9 members compared to more different than 28 percent of them having "medium family" of above 8-9 members. The proportion of "small family" was 8 percent. On the basis of the report of national household survey average family size is 4.35 where in rural it is 4.36 and urban is 4.29. In this study most of the respondents hold "large family" of above 9 members.

4.5 Time spent in ginger cultivation

Time spent in ginger cultivation of the respondents ranged from 10 to 14. On the basis of the time spent in ginger cultivation, the respondents were classified into three categories as shown in Table 4.1.

Table 4.1 Distribution of the farmers according to their time spent

Categories	**Farmers**		**Mean**
	Number	**Percent**	
Low time spent (9-10) hrs\week	35	43.7	15.13
Medium time spent (11-12) hrs\week	25	31.3	
High time spent (above 12) hrs\week	20	25	
Total	**80**	**100**	

Source: Field Survey, 2019

Data presented in Table 4.1 indicate that the highest proportion (43.7 percent) of the respondent had short time spent in ginger cultivation, while (31.3 percent) had medium time spent in ginger cultivation and (25 percent) had high time spent in ginger cultivation.

4.6 Experience in ginger cultivation

The experience of the respondents ranged from 5 to 35 years. On the basis of experience, the respondents were classified into three categories namely, low experience, medium experience and high experience, as shown in Table 4.2.

Table 4.2 Distribution of the farmers according to their experience in ginger cultivation

Categories	Farmers		Mean (years)
	Number	Percent	
Low experience (5-10 years)	15	18.7	24.15
Medium experience (12-20 years)	56	70	
High experience (above 20 years)	9	11.3	
Total	**80**	**100**	

Source: Field Survey, 2019

Data contained in the Table 4.2 revealed that the majority (70%) of the farmers had medium experience as compared to (18.7%) and (11.3%) having low and high experience respectively.

4.7 Land under ginger cultivation

Land under ginger cultivation of the respondents varied from 5 to 96 decimal. The respondents were classified into the following three categories based on their farm size: "small land" (5-14 decimal), "medium land" (15–70 decimal), and "large land" (>70 decimal). The distribution of the farmers according to their land under ginger cultivation is shown in Figure 4.5.

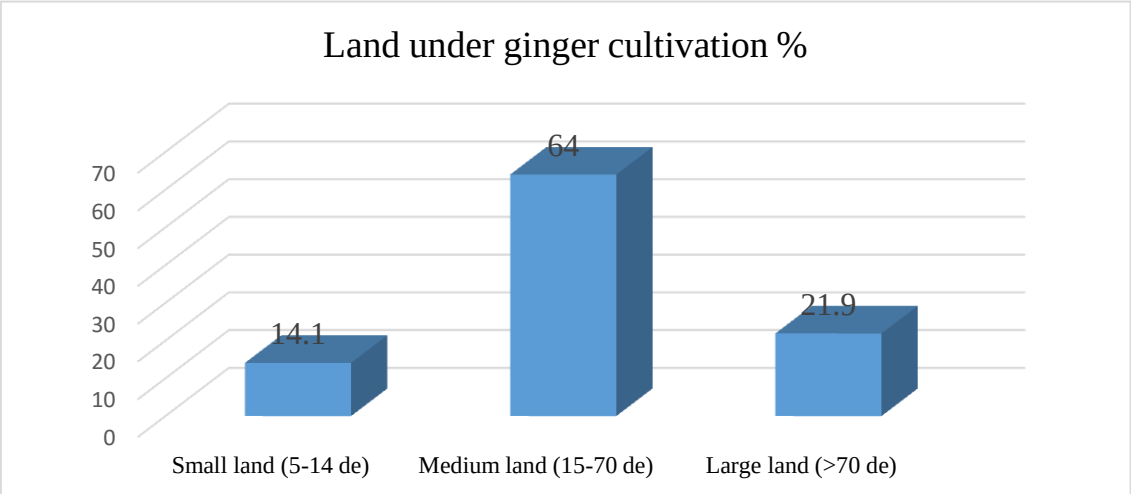

Figure 4.5 Distribution of the farmers according to their land under ginger cultivation

Figure 4.5 indicated that more than half (64 percent) of the farmers possessed small land under ginger cultivation compared to above 14.1 percent of them having small

land and 21.9 percent large land under ginger cultivation.

4.8 Training on ginger cultivation

Training received on ginger cultivation of the respondents was found to be varying from 0 to 12 days. Based on their score, the farmers were classified into three categories as shown in Table4.3.

Table 4.3 Distribution of the farmers according to their training received on ginger cultivation

Categories	Farmers		Mean
	Number	Percent	
No training (0)	28	35	3.21
Low training (1-4)	36	45	
Medium training (5-8)	13	16.3	
High training (above 8)	3	3.7	
Total	**80**	**100**	

Source: Field Survey, 2019

The Table 4.3 indicate that 45% of the farmers had low training on ginger cultivation that comprised by 35 percent and 16.3 percent farmers have no training and medium training on ginger cultivation. Only 3.7% of the respondents had high training on ginger cultivation.

4.9 Annual income of the respondents

Annual income of the respondents ranged from Tk. 78.70 to 290.50 (in thousands). On the basis of the annual income, the respondents were classified into three categories as shown in Table 4.4.

Table 4.4 Distribution of the farmers according to their annual income

Categories	Farmers		Mean(000'Tk)
	Number	Percent	
Low income (78-96)	37	46.3	186.67
Medium income (97-193)	32	40	
High income (above 193)	11	13.7	
Total	**80**	**100**	

Source: Field Survey, 2019

Data presented in Table 4.4 indicate that the highest proportion (46.3 percent) of the respondent had low annual income, while (40 percent) had medium income and (13.7 percent) had high income. On the basis of the report of national household survey per capita per year poverty threshold income is tk 58,948. In this study average income per capita respondent per year is tk 1, 86,670.

4.10 Organizational participation

The observed organizational participation score of the respondents ranged from 0 to 12. From the observed range, on the basis of organizational participation, the respondents were classified into four categories namely, no organizational participation, low organizational participation, medium organizational participation and high organizational participation, as shown in Table 4.5.

Table 4.5 Distribution of the farmers according to their organizational participation

Categories	Farmers		Mean
	Number	Percent	
No participation (0)	25	31.3	4.64
Low participation (1- 4)	31	38.7	
Medium participation (5 - 8)	22	27.5	
High participation (above 8)	2	2.5	
Total	**80**	**100**	

Source: Field Survey, 2019

Data contained in the Table 4.5 revealed that the majority (38.7%) of the farmers had low organizational participation as compared to (31.3%) had no participation, 27.5 % had low participation and (2.5%) having high organizational participation respectively.

4.11 Credit received

The credit received of the farmers ranged from 0 - 75 thousand. On the basis of credit received, the respondents were classified into four categories namely, 'no', 'low', 'medium' and 'high'. The scale used for computing the credit received is presented in the Table 4.6

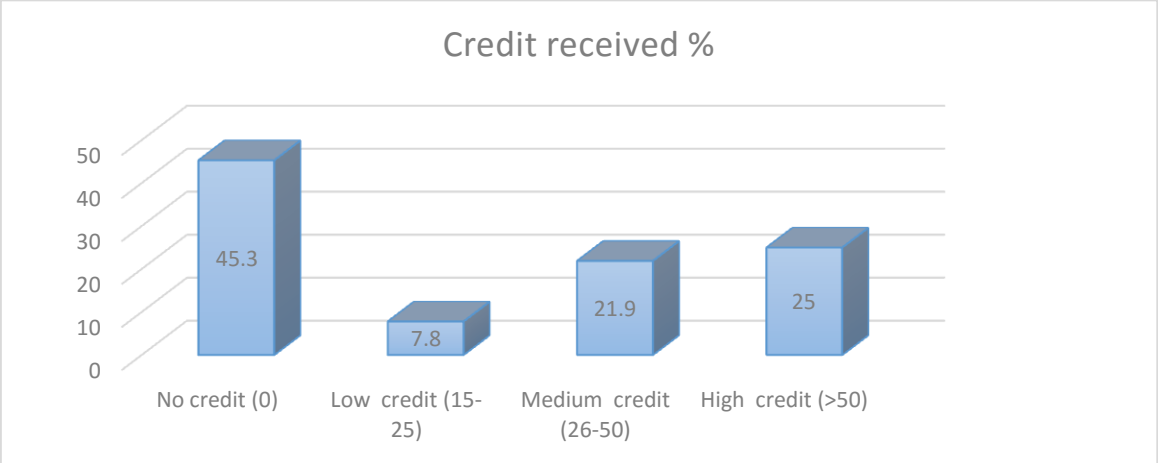

Figure 4.6 Distribution of the farmers according to their credit received

Data contained in the Figure 4.6 showed that the highest proportion 45.3% of the respondents had no credit received, 7.8%, 21.9% and 25% of them had low, medium and high credit received, respectively.

4.12 Knowledge on ginger cultivation

The score of knowledge on ginger cultivation of the farmers ranged from 8 - 14. On the basis of knowledge on ginger cultivation, the respondents were classified into three categories namely, 'low', 'medium' and 'high'. The scale used for computing the knowledge score is presented in the Table 4.7.

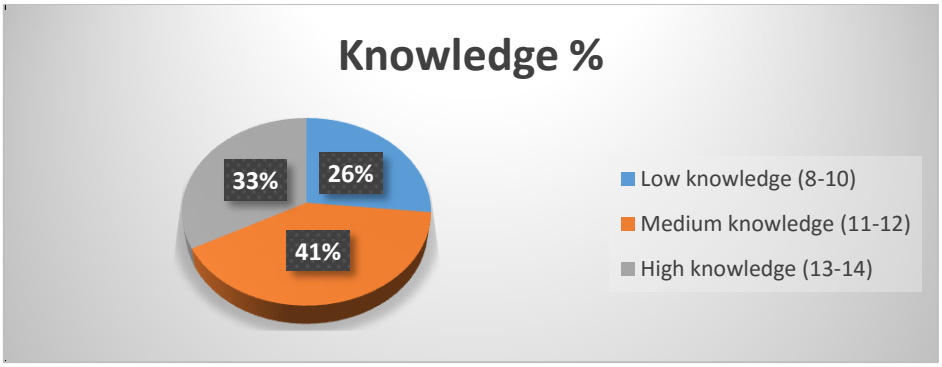

Figure 4.7 Distribution of the farmers according to their knowledge

Data contained in the Figure 4.7 shows that the highest proportion (41%) of the respondents had medium knowledge on ginger cultivation and 33% of them had high knowledge on ginger cultivation and 26% of the farmers had low knowledge on ginger cultivation.

4.13 Concluding remarks

This chapter analyzed the socioeconomic attributes of the sample farmers. The Findings of the study indicates the socioeconomic characteristics from each other in respect of age, gender, education, family size, time spent in ginger cultivation, experience in ginger cultivation, land under ginger cultivation, training on ginger cultivation, annual family income, organizational participation, credit received and knowledge on ginger cultivation.

CHAPTER V
FINANCIAL PROFITABILITY OF GINGER CULTIVATION

5.1 Introduction

This chapter is designed to analyze and compare the per hectare profitability of ginger production of the farmers. The related cost items include fertilizer cost, seed cost, animal and power tiller cost, manure cost, insecticide cost, irrigation cost, labor cost, land rental value and interest on operating capital. The average gross return and average net return are estimated in this chapter. The Benefit cost ratio (BCR) is also estimated for determining the profitability of the farmers.

5.2 Profitability of ginger cultivation

To determine the profitability of ginger cultivation the following costs and returns items were calculated.

5.3 Estimation of costs

Costs are the expenses incurred in organizing and carrying out the production process. In the production process farmers used two categories of cost, variable cost and fixed cost. The variable costs of ginger include the cost of seed, animal and power tiller cost for land preparation, fertilizer, manure, irrigation and pesticide. In this study the fixed costs include own labor cost, interest on operating capital and land rental value. Farmers used both home supplied and purchased inputs. The costs of purchased inputs were estimated on the basis of the actual payments made by the farmers and for home supplied inputs, opportunity cost principle was applied to determine their value.

5.3.1 Cost of power tiller and animal labor

In the study area, power tiller and animal labor were used for land preparation. Power tiller was used on contact basis. By adding power tiller cost and animal labor cost, the total land preparation cost was found Tk. 4075 which was 1.05 percent of their total costs of production (Table-5.1).

5.3.2 Cost of seed /rhizome/tuber

In the study area, farmers used both home supplied and purchased seed/rhizome/tuber. The cost of home supplied seed/rhizome/tuber was determined at the ongoing market

rate and costs of purchased seed were calculated on the basis of actual gingers paid by the farmers in the study area. Per hectare costs of seed/rhizome/tuber of ginger was Tk.213750 for farmers which was 55.02 percent of their total costs of production (Table-5.1).

5.3.3 Cost of cowdung

Per hectare cost of cowdung was Tk.10635 and their percentages of total cost was 2.74 percent.

5.3.4 Cost of fertilizer

In the study area farmers used three types of chemical fertilizer namely, urea, triple supper phosphate (TSP) and muriate of potash (MP) and zinc. These chemical fertilizers were charged at the rate of market price paid by the farmers. Table 5.1 shows per hectare costs of chemical fertilizers.

Per hectare costs of Urea was Tk. 4410 for the farmers and their percentages of total cost was 1.14 percent. Per hectare costs of TSP was Tk.6525 for farmers and their percentages of total cost was 1.68 percent. Per hectare costs of MP was Tk.3798 for the farmers and their percentages of total cost was 0.98 percent. Per hectare costs of Zinc were Tk.4320 for farmers and their percentages of total cost was 1.11 percent.

5.3.5 Cost of hired labor

For ginger production hired labor is the most important inputs. It was required for different operations like land preparation, transplanting, weeding, fertilizing, using pesticide, harvesting, carrying, threshing, drying and storing, etc. In this study, human labor was measured the basis of man-days. One man-day was equivalent to 8 hours work of an adult man. For women and children, man equivalent day was estimated. This was computed by converting all women and children day into man equivalent day according to the following ratio. 1 man–day = 1.5 woman day = 2 child day.

Hired labor cost of ginger has shown in Table 5.1. Per hectare human labor costs was Tk. 71200 which comprised 18.33 percent of their respective total costs.

5.3.6 Cost of pesticides

The different pesticides used by the farmers in the study area were Basudin, Dimecrone, Sumithion, Theovit, Furadon, Malatheanon, etc. Results reveal that per hector cost of pesticide was Tk.6450 and their percentages of total cost was 1.66 percent (Table 5.1).

5.3.7 Cost of irrigation

Ginger needs a huge amount of irrigation water. In the study area, farmers had to depend on shallow tube well (STW) or a deep tube-well (DTW). These tube-wells were diesel operated or electricity operated. The cost of irrigation water was charged at fixes rate for per unit area of irrigated land. Irrigation water charge was paid in cash. Per hectare costs of irrigation was Tk. 3085 and their percentages of total cost was 0.79 percent.

5.3.8 Total variable cost (TVC)

Total variable cost of ginger production was Tk. 328248 for ginger cultivation and their percentages of total cost was 84.50 percent (Table 5.1).

5.3.9 Fixed cost

5.3.9.1 Land use cost

In the present study the cost of land use was estimated on the basis of cost rental value per hectare land for the period of 12 months. The land use cost per hectare was Tk. 21850 for the farmers and their percentages of total cost was 5.26 percent.

5.3.9.2 Own labor cost

For ginger production, own labor cost is the most important part of the production. Table 5.1 shows that total own labor cost per hectare was Tk. 23600 for ginger cultivation and their percentages of total cost was 6.08 percent.

5.3.9.3 Interest on operating capital

It is evident from table 5.1 that interest on operating capital per ha was Tk. 14771 which covered 3.80 percent of the total cost.

5.3.10 Total fixed cost (TFC)

Total fixed cost of ginger production was Tk. 60221 and their percentages of total cost was 15.50 percent. (Table 5.1).

5.4 Total cost of ginger production

Total cost was calculated by adding all the cost of variable and fixed inputs. In the present study per hectare total cost of ginger cultivation was found to be Tk. 388469 (Table 5.1).

Table 5.1 Level of inputs use and total cost structure of ginger cultivation in the study locations

Cost items	Quantity (kg/ha)	Price (Tk./kg)	Cost (Tk./ha)	Total cost (%)
Power tiller and animal labor			4075	1.05
Seed/tuber/rhizome cost	1425	150	213750	55.02
Cow dung cost	3545	3	10635	2.74
Urea	245	18	4410	1.14
TSP	225	29	6525	1.68
MP	211	18	3798	0.98
Zn	24	180	4320	1.11
Hired labor cost	178	400	71200	18.33
Pesticides			6450	1.66
Irrigation			3085	0.79
Total variable cost			**328248**	84.50
Land use cost			21850	5.62
Own labor	59	400	23600	6.08
Interest on Operating capital @ 9% per year			14771	3.80
Total fixed cost			60221	15.50
Total cost			**388469**	100

Source: Field Survey, 2019

5.5 Return of ginger production

5.5.1 Gross return

Return per hectare of ginger is shown in table 5.2. Per hectare gross return was calculated by multiplying the total amount of produce with respective per unit ginger. It is evident from table that the average yield of ginger per hectare was 6520 kg. Average price per kg of ginger was Tk. 120. Total production of mother rhizome per ha was 765 kg and the average output price per kg of rhizome was Tk. 150. Therefore, the gross return was found to be Tk. 897150 per hectare (Table 5.2).

Table 5.2 Per hectare return of ginger cultivation

Items	**Yield Kg/ha**		
	Quantity kg/ha	Price Tk./kg	**Return Tk/ha**
Ginger	6520	120	782400
Rhizome/tuber	765	150	114750
Total Gross Return			897150

Source: Field Survey, 2019

5.5.2 Gross margin

Gross margin is the gross return over variable cost. Gross margin was calculated by deducting the total variable cost from the gross return. In this study, gross margin was found to be Tk. 568902 per hectare (Table 5.3).

5.5.3 Net return

Net return or profit was calculated by deducting the total production cost from the gross return. In this study, net return was estimated as Tk. 508681 per hectare (Table 5.3).

Table 5.3: Per hectare profitability of ginger cultivation

Sl. No.	Items	Amount (Tk./ hectare)
A.	Gross return (GR)	897150
B.	Total variable costs (TVC)	328248
C.	Total costs (TVC+TFC)	388469
D.	Net return (GR-TC)	508681
E.	Gross margin (GR-TVC)	568902
F.	Benefit-cost ratio (Full costs basis) = GR/TC	2.31
G	Benefit-cost ratio (Variable cost basis) = GR/TVC	2.73

Source: Field Survey, 2019

5.5.4 Benefit cost ratio (Undiscounted)

Benefit cost ratio (BCR) is a relative measure, which is used to compare benefit per unit of cost. Benefit cost ratio (BCR) was 2.31 on the basis of total cost and 2.73 on the basis of variable cost which implies that one-taka investment in ginger cultivation generated Tk. 2.31 and 2.73 (Table 5.3). From the above calculation it was found that ginger cultivation is profitable in Bangladesh both in full cost and variable cost basis.

5.6 Concluding remarks

From the above discussion and the results presented in Table 5.3 it is clear that ginger cultivation is a profitable business for the farmers in this study areas of Nilphamari district.

CHAPTER VI
FACTORS AFFECTING YIELD OF GINGER CULTIVATION

6.1 Introduction

This chapter is designed to estimate and compare the relative economic potential of ginger production in tabular form. The main focus of the present chapter is to estimate the factor affecting yield of ginger cultivation.

6.2 Factors affecting production of ginger cultivation

For producing ginger, different kinds of inputs, such as human labor, power tiller, seed, fertilizer, manure, irrigation and insecticides were considered as explanatory variables responsible for variation in ginger production. Cobb-Douglas production function analysis was employed to understand the possible relationships with the production of ginger and inputs used.

6.3 Method of estimation

For determining the effect of variable inputs to the production of Ginger, Cobb-Douglas production function was chosen to fulfill the set of objectives. Moreover, use of Cobb-Douglas production function enables one to obtain the returns to scale directly. The functional form of the Cobb-Douglas model equation is as follows:

$$Y= a\, X_1^{b1}\, X_2^{b2}\, X_3^{b3}\, X_4^{b4}\, X_5^{b5}\, X_6^{b6}\, X_7^{b7} X_8^{b8}\, X_9^{b9}\, e^{ui}$$

This equation may be alternatively expressed as:

$$\ln Y= \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + b_8 \ln X_8 + b_9 \ln X_9 + ui$$

Where,

ln = Natural logarithm,

Y = Yield of ginger of the i-th farm (kg/ha)

X_1= Land preparation (power tiller) cost used by the i-th farm (Tk/ha)

X_2= Tuber used by the i-th farm (kg/ha)

X_3= Manure used by the i-th farm (kg/ha)

X_4= Urea used by the i-th farm (kg/ha)

X_5= TSP used by the i-th farm (kg/ha)

X_6= MP used by the i-th farm (kg/ha)

X_7= Human labor used by the i-th farm (Tk/ha)

X_8= Insecticides cost used by the i-th farm (Tk/ha)

X_9= Irrigation cost used by the i-th farm (Tk/ha)

b1, b2, b3, b4, b5, b6, b7, b8 and b9 = Coefficient of relevant variables.

u_i=Disturbance term

i= 1, 2,……9.

6.4 Interpretation of results

Interpretation of the estimated co-efficient and related statistics of Cobb-Douglas production function of the farms which produced ginger have been shown in Table 6.1. The following features were noted.

- ✓ The values of coefficients of multiple determinations R^2 were 0.893 for farms which indicates that 89 percent of the total variations in yield were explained by the independent variables included in the model.

- ✓ The F-value (50.018) was highly significant at 1% level of probability. It implies it is good fit model.

- ✓ The sum of all the co-efficient of farmers was 1.798. It implies that production process followed increasing returns to scale.

6.5 Factors affecting yield of ginger production

Land preparation/ Power tiller Cost (X_1):

It is evident from Table 6.1 that the coefficient of land preparation was 0.121 which was significant at 5 percent level of probability for ginger production. That means, in 1 percent increase of land preparation cost increased yield by 0.121 percent while other factors were kept constant.

Seed used (X_2):

The estimated co-efficient of seed was -0.039 which was negatively insignificant effect on yield. That means, in 1 percent increase of seed used decreased yield by 0.039 percent while other factors were kept constant.

Manure used (X_3):

Table 6.1 reveals that the coefficient of manure was 0.104 and which was significant at 1 percent level of probability. That means, in 1 percent increase of manure used increased yield by 0.104 percent while other factors were kept constant.

Urea used (X_4):

The estimated co-efficient of urea fertilizer value was 0.053 for and was insignificant. It can be said that 1 percent increase in urea used keeping other factors constant, would increase the yield by 0.053 percent.

TSP used (X_5):

The estimated co-efficient of TSP fertilizer value was 0.126 for ginger cultivation and was insignificant. It can be said that 1 percent increase in TSP used keeping other factors constant, would increase the yield by 0.126 percent.

MP used (X_6):

The estimated co-efficient of MP fertilizer value was 0.704 and was significant at 1 percent probability level. It can be said that 1 percent increase in MP fertilizer used keeping other factors constant, would increase the yield by 0.704 percent.

Human Labor cost (X_7):

The co-efficient for human labor was 0.408 and was significant at 1 percent level of probability. This indicates that 1 percent increase in no. of human labor keeping other factors constant, would increase the yield by 0.408 percent.

Pesticide cost (X_8):

The co-efficient of the pesticide was 0.049 and insignificant. This indicates that 1 percent increase in pesticide cost keeping other factors constant, would increase the yield by 0.049 percent.

Irrigation cost (X_9):

The co-efficient of the irrigation was 0.272 and significant at 5 percent level of probability. This indicates that 1 percent increase in irrigation cost keeping other factors constant, would increase the yield by 0.272 percent.

Table 6.1 Estimated coefficient values of Cobb-Douglas production function in the study areas

Explanatory variables	Coefficient	Standard error	p- value
Intercept	2.311	0.518	0.000
Land preparation (X_1)	0.121*	0.052	0.031
Seed (X_2)	-0.039 NS	0.082	0.797
Manure (X_3)	0.104**	0.108	.002
Urea (X_4)	0.053 NS	0.164	0.762
TSP (X_5)	0.126 NS	0.127	0.414
MP (X_6)	0.704**	0.152	.000
Human labor (X_7)	0.408**	0.080	.004
Pesticide (X_8)	0.049 NS	0.127	0.754
Irrigation (X_9)	.272*	0.111	0.015
R^2	0.893		
Adjusted R^2	0.875		
Return to scale	1.798		
F-value	50.018**		

Source: Field Survey, 2019

Note: ** Significant at 1 percent level; * Significant at 5 percent level and NS: Not Significant

Value of R^2:

The co-efficient of multiple determinations, R^2 was 0.893 which indicates that about 89 percent of the total variation in yield of ginger production is explained by the variables included in the model.

F-Value:

The F-value of the equation was highly significant at 1% level of probability and it implies that the included variables are important for explaining the variation in yield of ginger production.

Returns to Scale

The sum of all the estimated production coefficients indicates returns to scale. For ginger production, the sum of the coefficients was 1.798. It indicates that the production process showed increasing returns to scale.

CHAPTER VII
PROBLEMS OF GINGER CULTIVATION

7.1 Introduction

Generally, farmers in Bangladesh have been cultivating ginger for a long time following the age-old method. Since a few economic studies have yet been conducted on ginger production, we have a very little knowledge about the problems facing the farmers in cultivating ginger. The problems are socio-economic, technical and marketing. This chapter is, therefore, designed to identify the problems of ginger producing farmers in conducting ginger farming. The problems faced by the farmers are identified according to opinions given by them. The major problems related to ginger cultivation are discussed below:

7.2 Problems faced by ginger growing farmers

For the sake of convenience, the problems faced by the ginger growing farmers of the study areas have been categorized under three general groups such as

1. Socio-economic problem
2. Technical problem
3. Marketing problem

7.3 Socio-economic problems

Economic problem is related to financial aspects such as lack of operating capital, high price of ginger seed in the planting time, lack of high yielding variety (HYV) seed (rhizome), lack of extension services and theft of ginger from the field.

Lack of operating capital

Cash money is required for purchasing required amount of various inputs like, human labours, seed (rhizome), fertilizers, pesticides, etc. But most of the farmers did not have enough money to purchase the required inputs. They were not able to meet the production costs timely and properly during the production period. So, financial help is needed for better production. About 70.00 per cent of the farmers claimed that lack of capital was one of the major problems for ginger production (Table 7.1). It was also

reported that farmers did not receive any financial support from institutional sources during the production period of ginger.

Lack of HYV seed (rhizome)

HYV seed is necessary for increasing productivity .A few farmer give emphasis for HYV seed of ginger in the study area. But most farmers have been used local seed for long time. About 55.50 percent farmers claimed that they felt the need for HYV seed is essential for better production.

Lack of extension services

During the field survey, most of the farmers reported that they did not receive any extension services regarding unproved method of ginger cultivation from the relevant officials of the Department of Agriculture Extension (DAE). A few numbers of farmers told that they received extension services during the production period of ginger. About 75.00 per cent farmers did not get extension services. Since ginger is an annual crop and has a great opportunity to inter-cropping but most of the farmers do not practice intercropping. They do not know how to cultivate it with intercropping in a scientific way. Hence, extension workers need to be informed about the cultivation of the spice with intercropping and farmer could earn more return than single production of ginger. Therefore, extension service needs to be expanded for acquiring technical knowledge from researchers to farmers for the better earnings to their production and economic development.

7.4 Technical problems

Technical problem relates to production techniques and technology such as attack of disease and pest and lack of scientific knowledge of farming.

Attack of disease and pest

The problems of attack of pest and diseases of ginger in the study area were also severe. Soft rot is the most serious disease of ginger in the study area which is caused by pythium spp. They spent large amount of money to protect the crop from the pest and diseases. It was evident from Table 7.1 that about 60.00 per cent of farmers claimed that attack of disease is a major problem in ginger production. They also reported that if the disease attack in the crop field, the yield of rhizomes decreases

heavily and sometimes farmers even do not get any return. Farmers then face a very risky position and lost a huge amount of money invested for the enterprise.

Lack of scientific knowledge of farming

Scientific knowledge and skilled labour are essential for running of ginger farming. Some farmers had basic knowledge of the techniques of input use. There were some farmers who had major gaps in their knowledge about ginger production. In the study area 88.50 percent ginger growers were encountered this problem (Table 7.1).

7.5 Marketing problems

Marketing problems are related to marketing aspects such as lack of storage facilities, lack of marketing facilities and lack of transportation.

High price of ginger seed in the planting time

Seed was the essential input for the production of ginger. But during the planting time, the ginger seed price remained very high. In the study area 50.75 percent of ginger growing farmers reported this problem (Table 7.1).

Lack of storage facilities

There is a lack of storage facilities for ginger growers in the study area. Most of the producers sold after harvesting at lower price due to the lack of proper storage facilities. Moreover, a great deal of spoilage occurs during the post-harvest period for want of an appropriate storage facility. The study showed that about 37.50 per cent of the farmers did not have storage facilities (Table 8 1).

Lack of marketing facilities

It is an important problem of ginger growing farmers in the study area. Ginger growers generally sell their produce in the local market. But there is a communication gap among the producers and traders regarding market of ginger. In addition, there is little regard for quality control and grading facilities. About 78.50 per cent farmers reported that they did not get the adequate marketing facilities to sell their produce in the big market in the Nilphamari district.

Lack of transportation

During the field survey, most of the farmers opined that they did not have enough transportation facilities. Study revealed that about 70.50 per cent farmers had to sell their product at home or local market at lower price due to lack of transportation facilities.

Table 7.1 Problems of ginger cultivation in the study areas

Nature of problems	% of farmer opinion facilities
A. Socio-economic Problem	
Lack of operating capital	**70.00**
Lack of HYV seed (rhizome)	**55.50**
Lack of extension services	**75.00**
B. Technical problem	
Attack of disease and pest	**60.00**
Lack of scientific knowledge	**88.50**
C. Marketing problem	
High price of seed in planting time	**50.75**
Lack of storage facilities	**37.50**
Lack of marketing facilities	**78.50**
Lack of transportation facilities	**70.50**

Source: Field Survey, 2019

7.2 Suggestion to overcome the problems

Suggestions	% of farmer opinion
Needs availability of capital	**65.00**
Supply more seedling from the government side	**50.50**
Increase extension contact to the farmers	**70.00**
Pesticides should be available in time	**55.00**
Arrange training programme about ginger production	**80.00**
Reduce price of ginger seed in planting time	**45.75**
Increase storage facilities	**30.50**
Improve access to market facilities	**75.00**
Transportation facilities should be improved	**60.00**

Source: Field Survey, 2019

7.6 Concluding remarks

The above-mentioned problems, of course, are interrelated with one another and hence, need to be removed comprehensively through an integrated approach for the overall development of ginger production. Problems faced by the farmers were ranked on the basis of corresponding percentages. Most of the farmers were reported that lack of scientific knowledge regarding ginger production was the main problem. Arrange different training programme to increase scientific knowledge as well as increase ginger production.

CHAPTER VIII
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

8.1 Introduction

There is little research regarding management practices such as cultivation of spices, economic aspects of production irrigation, input use and plant protection practices. So, there is a lack of available information regarding production, consumption and exports of spices. Farmers grow spices with local seeds using age-old method of cultivation In addition, vanities currently used for ginger, is almost annual. It is, therefore, difficult to adequately plan any development efforts. Moreover, research, development and extension services related to the promotion of spices in the country have historically been neglected and the agencies responsible for production, extension and marketing of spices, so efforts are fragmented and uncoordinated. To find out the profitability of ginger cultivation the following objectives were set up.

1. To delineate socio-economic characteristics of the ginger farmers in the study area;
2. To determine the profitability of ginger cultivation in the study area;
3. To find out the factors affecting yield of ginger cultivation in the study area;
4. To identify the constraints to its higher production and give policy recommendations from a foresaid result.

8.2 Summary

From the socio-economic characteristics of the farmers, the highest proportion 52 percent of the ginger farmers fell in the middle-aged category, while 28 percent of them fell in the old category and 20 percent in the young aged category. The highest proportion (75.0%) of the respondents had male and (25%) had had female, respectively. The majority (40.6 percent) of the farmers had illiterate secondary education compared to 32.8 percent of them having primary level education. About 11 percent of the farmers were secondary, while 15.6 percent had above secondary level of education. The majority of the 64 percent of the ginger farmers had medium family of above 9 members compared to more different than 28 percent of them having medium family of above 8-9 members. The proportion of small family was 8 percent. The highest proportion (43.7 percent) of the respondent had short time spent in ginger cultivation, while (31.3 percent) had medium time spent in ginger cultivation and (25

percent) had high time spent in ginger cultivation. The majority (70%) of the farmers had medium experience as compared to (18.7%) and (11.3%) having low and high experience in ginger cultivation respectively.More than half (64 percent) of the farmers possessed small land under ginger cultivation compared to above 14.1 percent of them having small land and 21.9 percent large land under ginger cultivation. The majority (45%) of the farmers had low training on ginger cultivation that comprised by 35 percent and 16.3 percent farmers have no training and medium training on ginger cultivation. Only (3.7%) of the respondents had high training on ginger cultivation. The highest proportion (46.3 percent) of the respondent had low annual income, while (40 percent) had medium income and (13.7 percent) had high income.The majority (38.7%) of the farmers had low organizational participation as compared to (31.3%) had no participation, 27.5 % had medium participation and (2.5%) having high organizational participation, respectively. The highest proportion (45.3%) of the respondents had no credit received, (7.8%), (21.9%) and (25%) of them had low, medium and high credit received, respectively. The highest proportion (41%) of the respondents had medium knowledge on ginger cultivation and (33%) of them had high knowledge on ginger cultivation and (26%) of the farmers had low knowledge on ginger cultivation.

Per hectare animal labor and power tiller cost for producing ginger was Tk. 4075 for farmers which were 1.05 percent of their total costs of production. Per hectare costs of seedlings of ginger was Tk. 213750 for farmers which was 55.02 percent of their total costs of production. Per hectare costs of cowdung was Tk. 10635 and their percentages of total cost of production was 2.74 percent. Per hectare costs of Urea was Tk. 4410 and their percentages of total cost of production was 1.14 percent. Per hectare costs of TSP was Tk. 6525 and their percentages of total cost of production was 1.68 percent. Per hectare costs of MP was Tk. 3798 and their percentages of total cost of production was 0.98 percent. Per hectare costs of Zinc were Tk. 4320 and their percentages of total cost of production was 1.11 percent. The per hectare human labor costs was Tk. 71200 which comprised 18.33 percent of their respective total costs of production. Per hector cost of pesticides was Tk. 6450 and their percentages of total cost of production was 1.66 percent. Per hectare costs of irrigation cost were Tk. 3085 and their percentages of total cost of production was 0.79 percent.

The total variable cost of ginger production was Tk. 328248 for ginger cultivation and their percentages of total cost of production was 84.50 percent. Total fixed cost of ginger production was Tk. 60221 for ginger cultivation and their percentages of total cost of production was 15.50 percent. Per hectare total cost of ginger cultivation per years was found to be Tk. 388469. The gross return was found to be Tk. 897150 per hectare. Gross margin was found to be Tk. 568902 per hectare. Net return was estimated as Tk. 508681 per hectare. Benefit Cost Ratio (BCR) was found to be 2.31. From the above calculation it was found that ginger cultivation is profitable in Bangladesh.

To measure the factors affecting of ginger cultivation, Cobb-Douglas production function model was employed. Nine variables were taken into account to explain the variation in production, as well as yield. The value of $R^2$was 0.893 which means that the included variables in the model represent 89.30 per cent of the variation in yield. The F-value is highly significant at one per cent level of probability. The F-value implies that all the included variables are important for explaining the variation in yield.

The present study was identified some of the problems and constraints associated with ginger cultivation. Farmers faced in different types of problems and constraints such as economic and technical problems, marketing problems, social problems. Lack of operating capital, high price of seed in the planting time, lack of HYV seed and seedling, attack of disease and pest, lack of scientific knowledge of farming, lack of storage facilities, lack of marketing facilities, lack of transportation facilities and lack of extension services were the problem of ginger cultivation.

The above mentioned problems and constraints are interrelated and need to be removed comprehensively through an integrated programme for the development of spice production more particularly ginger. If the proper steps are taken by the relevant authorities to solve the above mentioned problems and constraints the output of ginger as well as benefits of the farmers would possibly be increased tremendously.

8.3 Conclusions

The study revealed that ginger production is highly profitable. Furthermore ginger is labour intensive spices crop. Ginger is nutritive and it has medicinal value. So, cultivation of this spice can help in increasing farm income, employment and nutritional status of farmers. The management practices of ginger production in the study areas were not found efficient enough. Farmers were not known about the application of inputs in right time with right doses. Thus well planned, and management training in accordance with their problems and needs base can lead them to increase farm production and income from ginger cultivation. If proper remedial measures could be taken, ginger farming could be a more viable and attractive commercial enterprise.

8.4 Policy Recommendations

Based on findings of the study following recommendations were made

- ✓ For increasing production of ginger, necessary inputs particularly HYV seeds, fertilizers, insecticides and pesticides etc. should be made available to the farmers just before the growing period.

- ✓ Shortage of credit was also one of the problems for the resource poor farmers in the study area. Institutional credit programme should be launched aiming at particularly the farmer's level. The commercial banks should open a separate window to provide loans to the farmers. Most of the farmers are not aware about special credit on spices at only two per cent interest rate.

- ✓ Scientific method of cultivation should be introduced to increase production. The farmers should be provided with training, adequate services, information and necessary facilities to cope with new and changed situation.

- ✓ The farmers, who were more experienced and contacted frequently with extension workers, were more efficient. So, experience and frequency of extension contact should be increased to help skill development.

- ✓ Immediate attention should be given to develop good marketing facilities both

for inputs and outputs so that the ginger farmers can have fair price round the year.

8.5 Limitations of the study

The present study provides some important information for farmers, extension workers and decision-makers regarding the economics of ginger production .However, a number of limitations of the study are indicated below:

- Almost all the ginger growing farmers did not keep any written records related to their farm related transactions. As a result, the accuracy of data fully relied upon their memories and sincerity. The task of obtaining data proved to be very challenging and the possibility of data errors, therefore, cannot be fully ruled out.

- In the production function analysis, some variables like management, farm size, soil condition, quality of seeds, spacing and depth of planting etc. were not taken into account for which there remains and possibility of over estimation of the regression coefficient.

- The study was conducted in a limited number upazilla in Bangladesh with a small number of samples. Therefore, the scope of generalization is very limited and findings of the study may not represent the actual situation of other regions of the country

- Quantification of family labors was very difficult, because it was not so easy to separate the productive use of labors from non-productive use.

8.6 Scope for further study

A number of areas are identified where further economic study may be conducted to develop and fine-tune policies dealing with the spices as a whole or some of it. The weaknesses of the present study, of course, open avenues for further research which are given below:

- ✓ A broad based study on the profitability of ginger production should be undertaken with intercropping and without intercropping of ginger.

- ✓ Further study may also be undertaken considering the annual arrangements to know the magnitude of benefits on different annual categories.

- ✓ A comparative study can also be undertaken to assess the relative profitability of ginger and other spices or competing crops.

- ✓ An aspect requiring further study is the variety of ginger currently used by the farmers. It suggested carrying out a detailed topographic survey for the development of the spices.

- ✓ Acreage response growth and instability of ginger production can be studied with respect to Bangladesh.

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APPENDIX

An Interview on

"FINANCIAL PROFITABILITY OF GINGER CULTIVATION IN SOME SELECTED AREAS OF NILPHAMARI DISTRICT IN BANGLADESH"

(This interview is entitled for a research study)

Serial No:

Respondent Name:

Village:

Union:

Upazilla:

District:

Mobile No:

[Please provide the following information. Your information will be kept confidential and will be used for research purpose only.]

1. Age: How old are you? ……years

2. Gender: 1. Male 2. Female

3. What is the level of your education?

a) Illiterate

b) Literate (can only sign)

c) Primary (class 01-05)

d) Secondary class (class 06-SSC)

e) Higher Secondary

f) Degree or above

4. Family Size:

Please mention the members of your family who are involve in agriculture

a) Male member …….. person
b) Female member …….. person
c) Child member ……person

Total member …….. person

5. Time spent in Ginger cultivation: ……hrs/week

6. Experience in Ginger Cultivation:

Please state the duration of your direct involvement in Ginger cultivation.

Ans:……years

7. Farm Size:

Please indicate the area of land under your possession:

Sl No.	**Types of land use**	**Land area**	
		Local unit	**Hectare**
1.	Homestead area (A)		
2.	Own land under own cultivation (B)		
3.	Given to others as borga (C)		
4.	Taken borga from others (D)		
5.	Taken lease from others (E)		
	Total =A+B+½(C+D)+E		

8. Land under Ginger cultivation……bigha

9. Training on Ginger Cultivation:

Have you received any training on Ginger cultivation?

Ans: (Yes) (No)

If yes, please give the following information:

Sl. No.	Name of the Training	Sponsoring Organization	Duration (Days)
1.			
2.			
3.			
Total			

10. Annual Family Income:

Please indicate the income of your family from different sources in the last year.

Sl. No.	Sources of other income Crops & non-crops	Amount of Production (kg/ha)	Value (TK)
1.	Rice		
2.	Jute		
3	Garlic		
4	Wheat		
5	Vegetables		
6	Livestock & Poultry		
7	Fisheries		
8	Service		
9	Business		
10	Others (please specify)		
Total			

11. Income from Ginger cultivation……Taka last year

12. Farmer Expenditure (Please mention your monthly expenditure in following

SL. No.	Items	Monthly Expenditure (Taka)	Yearly Expenditure (Taka)
1	Food		
2	Energy (Petrol, Gas, Electricity)		
3	Health care		
4	Education		
5	Transportation		
6.	Clothing		
7	Festivals & Social Economics		
8	House Rent		
9	Cell phone expense		
10	Entertainments		
11	Others(.....		

13. Crop Management Information

Please mention the following regarding Ginger cultivation

Management practices	Ginger Cultivation
Amount of land (bigha)	
Variety	
Tuber rate (Kg/bigha)	
Number of irrigation	
Number of Inter-cultural operation	

14. Organizational Participation:

Please state the nature of your participation in the following organizations:

Sl. No.	Name of the organization	Nature of participation			
		Not involved (0)	Ordinary member (1)	Executive member (2)	President/ Secretary (3)
1.	Farmers' co-operative association				
2.	IPM club				
3.	NGO association				
4.	Common Interest Group (CIG)				

15. Credit received: Did you receive any credit from any sources? (Yes / No)

If yes, please mention the sources of receiving credit and the amount of credit received.

Sl. No.	Sources of credit	Amount of credit
1.	NGO	
2.	Banks	
3.	Money leader	
4.	Friends	
5.	Neighbours	
6.	Relatives	

16. Profitability of Ginger cultivation:

A. Cost of Cultivation (Tk/bigha)

a. Human Labor Requirement (man/day), please mention of your Human Labor requirement

Name of items	**Ginger Cultivation**			
	No. of labor		**Taka/labor**	**Total(Tk)**
	Own	**Hired**		
Main land Preparation (tillage & laddering)				
Tuber Planting				
Manure & fertilizer				
Weeding				
Irrigation				
Harvesting				
Carrying & storing				
Total				

Note: 1 bigha=33 decimal

b. Cost of animal or mechanical powers used

(Please mention your cost of animal or mechanical power used)

Name of practice		**Ginger Cultivation**			
		Name of Machine/Animals	**Rent Per Acre (Taka)**	**Cultivated Area (Bigha)**	**Total (Taka)**
Tillage	Mechanical power				
	Animals power				
Weeding	Mechanical power				
	Animals power				
Total					

c. Materials inputs used (per bigha)

(Please mention about material input used)

Inputs	Unit Price	Ginger Cultivation	
		Amount (kg)	Taka
Tuber			
Manure			
Fertilizer			
a. Urea			
b. TSP			
c. MP			
d. Gypsum			
e. Zink			
Pesticide			
Irrigation			
Others(.....)			
Total			

B. Total Return (Per Bigha)

(Please mention about ginger production)

Harvesting	Total Production (monds)	Unit Price (Tk)	Total taka

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

17. Knowledge on Ginger Production

Please answer the following questions

SL. No.	Questions	Assigned score	Obtained marks
1	Mention two major insects of Ginger	2	
2	What is the proper sowing time of Ginger tuber?	2	
3	What type of soil is suitable for Ginger cultivation?	2	
4	Name two major diseases of Ginger	2	
5	Mention two harmful weeds of Ginger	2	
6	Mention at least one insecticide, one fungicide and one herbicide of Ginger	2	
7	Describe line sowing method and crop rotation of Ginger Cultivation	2	
Total		**14**	

14. Please mention the problems faced by you in Ginger cultivation

Please mention the extent of problems you faced

Sl. No.	Problems	Extents of problems			
		High	Medium	Low	Not at all

A. Socio-economic problem

1.	Lack of operating capital				
2.	Lack of HYV seed (rhizome)				
3.	Lack of extension services				

B. Technical problem

1.	Attack of disease and pest				
2.	Lack of scientific knowledge				

C. Marketing problem

1.	High price of seed in planting time				
2.	Lack of storage facilities				
3.	Lack of marketing facilities				
4.	Lack of transportation facilities				

Thank you for your co-operation.

Date:…… …….

Signature of interviewer