# PROFITABILITY OF LITCHI CULTIVATION: A STUDY ON POVERTY REDUCTION IN SELECTED AREAS OF PABNA DISTRICT

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# CERTIFICATE

This is to certify that the research work entitled, **"PROFITABILITY OF LITCHI CULTIVATION: A STUDY ON POVERTY REDUCTION IN SELECTED AREAS OF PABNA DISTRICT"** conducted by **PROSHENJIT KARMOKAR** bearing Registration No. **12-05132 (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, 2019

Dhaka, Bangladesh.

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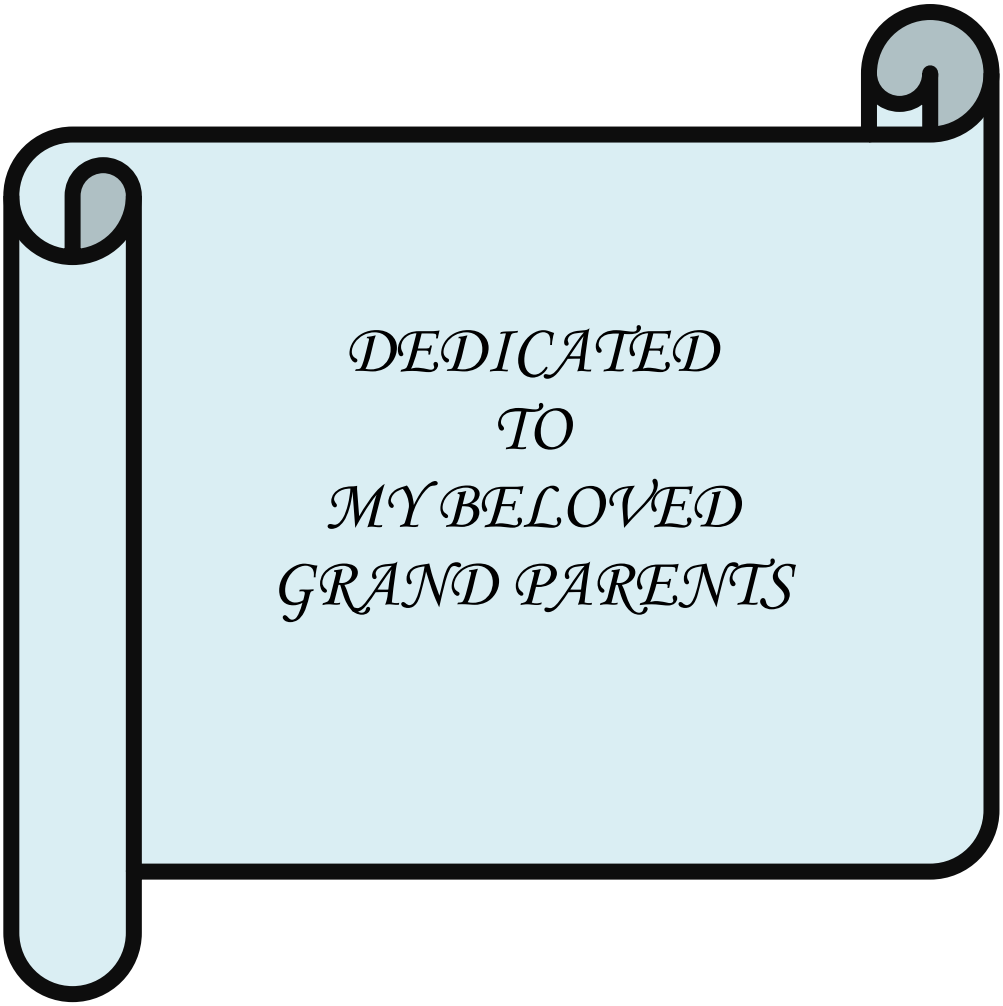
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# PROFITABILITY OF LITCHI CULTIVATION: A STUDY ON POVERTY REDUCTION IN SELECTED AREAS OF PABNA DISTRICT

## ABSTRACT

Litchi is one of the most important sub-tropical evergreen trees. Litchi fruit is famous for its excellent quality, juicy, slightly sour and sweetly taste, characteristics pleasant flavor and for attractive colour. The overall objectives of the present study were to examine the socio-demographic profile of litchi producing farmers, to assess profitability of litchi cultivation. Pabna district was selected for the study on the basis of extensive cultivation of litchi cultivation. Simple random sampling technique had been used for selecting 72 sample farmers. The data was collected by using questionnaire. After analyzing the data, per tree gross return, net return, and gross margin were found to be Tk. 10115, Tk. 4647& Tk. 6613 respectively. Total costs of litchi production were calculated at Tk. 5468 per tree. Benefit Cost Ratio (BCR) was found to be 1.85 for litchi cultivation. Thus it was found that litchi cultivation was highly profitable. Production function analysis suggested that, among the variables included in the model, cost of human labor, and cost of irrigation, cost of urea, and cost of pesticide had a positive and significant effect on the gross return of litchi production, except for cost of land preparation, cost of TSP, cost of MP, cost of cow dung had a positive and insignificant effect on the gross return of litchi. This study also identified some of the problems and constraints associated with litchi cultivation. These were categorized into technical, economic, marketing and social problems. Problems faced by the farmers were ranked on the basis of corresponding percentages. The problems and constraints, of course, are interrelated with one another and hence, need to be removed comprehensively through an integrated programme for the overall development of litchi cultivation.

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*All of my gratefulness to almighty God who enabled me to accomplish this thesis paper. I would like to express my heartiest respect, deepest sense of gratitude, profound appreciation to my* ***Supervisor****,* ***Prof. Dr. Md. Mizanur Rahman Sarker****, Department of Agricultural Statistics, Sher-e-Bangla Agricultural University, Dhaka for his sincere guidance, scholastic supervision, constructive criticism and constant inspiration throughout the course and in preparation of the manuscript of the thesis.*

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**December, 2018** **The Researcher**

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## ABBREVIATIONS

| | |
|---|---|
| BBS | Bangladesh Bureau of Statistics |
| GDP | Gross Domestic Product |
| BCR | Benefit Cost Ratio |
| NGOs | Non-Governmental Organization |
| BB | Bangladesh Bank |
| MP | Murate 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 |
| NR | Net Return |
| MFC | Marginal Factor Cost |
| MVP | Marginal Value Product |
| MPP | Marginal Physical Product |
| GM | Geometric Mean |
| SSC | Secondary School Certificate |
| HSC | Higher Secondary Certificate |

# CHAPTER I
# INTRODUCTION

## 1.1 General Backgrounds of the Study

The litchi (*Litchi chinensis Sonn.*) has a place with the family Sapindaceae and sub-family Nepheleae. It is a standout amongst the most essential sub-tropical evergreen organic product trees which develop well in Bangladesh. Another individual from the sub-family "Anshphal" (*Euphoria longana Lam.*) additionally develops in Bangladesh, for the most part in patios. It bears longan sort yet little measured products of minimal business esteem.

Litchi (*Litchi Chinensis*.) is one of the most important sub-tropical evergreen trees. Litchi fruit is famous for its excellent quality, juicy, slightly sour and sweetly taste, characteristics pleasant flavour and for attractive colour. A bunch of ripen litchi attracts everyone irrespective of all ages. Litchi is mostly consumed as table fruit. It is also preserved and canned. Litchi contains 77.83% water, 6.74% - 20.64% sugar, 0.8-0.9% protein, 0.3% fat, minerals specially calcium, phosphorus and iron 0.7% and vitamin C 40.2-90 mg/100g of fruits (Bose and Mitra, 1990; Scanlan, 1995).

Litchi was originated in southern China but it is now cultivated throughout the warm sub-tropics and is believed to have been introduced in the Indian subcontinent through Myanmar towards the end of the 17th century (Bose and Mitra. 1990). The leading litchi growing countries of the world are China. Myanmar, Taiwan, Thailand, Vietnam, Indonesia, India, Pakistan, Philippines, West Indies, USA (Hawaii and Florida), Brazil. Israel. Madagascar, South Africa and Australia (Menzell and Simpson. 1986; Tindall, 1994).

Due to certain limitations of soil and climatic conditions, litchi grows well in some selective areas of Bangladesh. The leading litchi growing districts are Dinajpur, Rajshahi, Rangpur, Jessore, Pabna, Chittagong, Dhaka and Mymensingh. There are number of litchi cultivars such as Bedana, Bombai, Dinajpur local, Mangalbari growing in different Muzaffarpuri and Madrajee are introduced and cultivated in different areas of Bangladesh. Recently BARI litchi-1, 2 and 3 were released for commercial production by Bangladesh Agricultural Research Institute (BARI) as high

yielding litchi cultivars. From the statistics of litchi cultivation of last 5 years (Table 1.1), it is found that both area and production of litchi cultivation is increasing not only in the whole country but also in Dinajpur district. The yield of litchi is increasing with the production of the increasing area.

Litchi is a profoundly valued, prevalent and significant table natural product in Bangladesh. It comes to advertise in the months of May-June when the business sector is loaded with other crisp natural products, especially mango and jackfruit. Be that as it may, regardless of the accessibility of distinctive sorts of natural product in the business sector the interest for new litchi is dependably high because of its novel taste, flavor and shading. The supply of litchi is lacking and its accessibility is just for around 60 days. Brilliant products of tip top cultivars like "Bedana" and 'China-3' are hard to find because of their exceptionally constrained region scope. The normal per hectare yield of lychee is around 2.5 MT, which is additionally low in correlation to different nations.

No legitimate documentation on the historical backdrop of development of litchi in Bangladesh is accessible. On the other hand, it is trusted that lychee originated from Burma to Bangladesh at some point in the mid nineteenth century. Chinese assortments alongside Indian cultivars like Mujaffarpuri and Bombai Litchi were presented in the mid twentieth century from West Bengal through the endeavors of nurserymen and plant beaus. Litchi is for the most part developed in the patio (2-3 plants), or in little plantations (15-20 plants) nearby the estates.

**1.2 Statement of the Problem**

Litchi is one of the most important fruit in Bangladesh. The importance of the cultivation is increasingly recognized by the implement as of agricultural extension programs as well as policy makers. The government of Bangladesh is promoting the extent of cultivation and production of this fruits through various projects. As a high value fruit, litchi has much potentiality for widespread cultivation by the respondents. But before undertaking any massive programme for its increased cultivation in Bangladesh, it is first necessary to know the existing situation of the extent of cultivation of litchi in the most potential areas of Bangladesh. The Pabna region is mostly well known for cultivation of litchi in this country. To expand the cultivation

of this fruits in other parts of the country, the knowledge on the present situation of litchi cultivation in this region will be significantly contributory to design appropriate programs for its widespread cultivation. In these respects, the answers to the following questions will be very much pertinent.

i. What is the socio-economic status of the respondent farmers?
ii. Why are the respondent farmers cultivating litchi?
iii. What type of input used in litchi cultivation?
iv. How much the profitability of litchi cultivation is?

### 1.3 Objectives of the Study

The specific objectives of the study are as follows:

- To identify the socio-economic characteristics of litchi cultivars in the study area;
- To estimate the costs and returns of litchi production in the study area;
- To find out the factors that affect profitability of litchi cultivation;
- To ascertain the problems of litchi cultivation in the study area; and
- To give some recommendation for policy implication.

### 1.4 Justification of the Study

To meet the nutritional and caloric value of the growing population and for increasing employment opportunities and income of the growers, the government of Bangladesh has much emphasis on the diversified fruit cultivation. Before giving any policy direction towards increasing cultivation of various fruits, relevant and adequate information on different aspects of cultivation at the grower's level are required. So far, little systematic investigations on litchi cultivation have been undertaken either by private or government organizations in Bangladesh.

The present study is an attempt to know the profitability of litchi cultivation. This study will be helpful to the researchers for further studies of similar nature and to the extension personnel who are directly involved in different agricultural development programmes and to the planners for making effective plans. The study will also aid extension workers to learn the cultivation problems of the fruit and therefore, they

will be able to give suggestions to the growers related to various aspects of litchi cultivation.

### 1.5 Current Situation of Litchi Cultivation

Litchi spreads out all over Bangladesh particularly the principle zones of development which are Jessore, Rajshahi, Rangpur, Dinajpur, Khulna, Dhaka, Kushtia, Sylhet, Pabna and Chittagong regions. Lychee was found to develop well in the Government agriculture focuses of three slope regions in particular: Rangamati, Khagrachari and Bandarban furthermore in Jamalpur, Rajbari, Meherpur, Chapainawabgonj and Comilla.

The extension of the litchi territory in these local is generally ease back because of high death rate of youthful litchi plants. The vast majority of the cultivators and also augmentation operators don't have the required information and expertise in lychee development as a consequence of which intrigued agriculturists all the time neglect to build up new plantations. At present the aggregate territory under lychee development is around 4,800 hectares and aggregate yearly generation is around 12,800 MT.

Bombai is the most high yielding assortment in the nation, despite the fact that there are various cultivars developing in diverse regions of Bangladesh. These are Rajshahi, Madrajie, Mongalbari, Kadmi, and Kalipuri. Muzaffarpuri, Bedana and China-3. Bedana and China-3, presented in the 1950s, are currently developed effectively in diverse parts of Bangladesh. Likewise there are numerous anonymous area races, the vast majority of which are harsh in taste with low pulp: stone proportion. The products of cultivars like Bedana, China-3, and Rajshahi nearby contain more eatable part, with great mash. The organic product size in these assortments is greater with alluring skin shading. Bedana is viewed as the best assortment yet gives the poorest yield. Normal yield per plant is around 3,000 natural products. The assortment is limited to the Dinajpur region, northwest Bangladesh, which falls in agro-natural zone-1. As of late three assortments, in particular: BARI Lichu-1, BARI Lichu-2 and BARI lichu-3 were discharged by the Bangladesh Agricultural Research Institute (BARI) for ranchers reception. Among the discharged assortments BARI Lichu-3 is viewed as the best in admiration of organic product size, mash, shading and yield. The assortment nearly looks like China-3 assortment.

**Bombai**

Most generally developed and great yielding assortment of Bangladesh. The trees accomplish a normal tallness of 6 m and bear natural products consistently. It is an early assortment, natural products for the most part develop in the second week of May. Organic products are for the most part heart formed, carmine red in shading and every natural product has another minor immature organic product connected to the natural product stalk. Normal weight of the organic product is 18-20 g. Mash is delicate, delicious and sweet. TSS 17-18 percent, seed huge, pulp: seed proportion 5:1.

**Muzaffarpuri**

The assortment was brought from India and predominantly developed in the northwestern local of Bangladesh. The trees are medium in force and accomplish a normal tallness of 5 m. The organic products are pink in shading, oval molded and develop in the second week of May. Normal weight of organic product is 20 g, mash is long and sweet. TSS 17-18 percent, seed enormous, pulp: seed proportion 4.75:1.

**Bedana**

This assortment is viewed as the best assortment in Bangladesh. The trees of this assortment are medium in tallness (around 5 m) and spread of 6 m and general conveyor. The organic products are for the most part globose fit as a fiddle, splendid red in shading and develop in the second week of June. Normal weight of natural product is 25-28 g., mash is smooth white and delicate, succulent, TSS 18-19 percent, seed little and contracted, pulp: seed proportion 28:1.

**China-3**

One of the best assortments developed in Bangladesh. The trees achieve a normal tallness of 5 to 6 m with generally littler takes off. Bearing is consistent if legitimate administration and consideration is taken, else they demonstrate an unpredictable bearing propensity. This is a late assortment and organic products age in the most recent week of June. Organic products are globose, with a blend of red, orange and patches of green shading. Normal weight of natural product is 25 g. Mash is velvety white, delicate and delicious. TSS 18 percent, seed little, pulp: seed proportion 15:1.

### 1.6 Production of Planting Materials

Litchi may be proliferated both by seed and by vegetative means. In Bangladesh air layering is the most widely recognized and mainstream technique for proliferation of litchi. In this technique a ring of bark around 2.5 cm to 3 cm long is expelled from one-year old twigs. By and large the terminal branch which is chosen for air layering is 60 cm to 75 cm long. In a few ranges ranchers incline toward 2-3 year old and 1 m long branches for engendering. In the wake of evacuating the bark the uncovered wood and the cut surface is secured with an establishing media comprising of clayey soil blended with sand and natural compost (spoiled cowdung). A bit of polythene or jute fabric of advantageous size is wrapped around the establishing media and tied at both closures with fine twine. In around 2 months adequate roots are shaped at the upper end of the ring. The established layer is then separated from the mother plant by giving it a sharp cut beneath the lower end of the ring, ideally in 2-3 stages. A solitary cut operation at times results in high mortality of the layers. Abundance branches and leaves ought to be evacuated to bring an appropriate harmony between the top and root framework. This helps in speedy foundation of roots and low death rate of the layers. The established layers are then kept. In Table 1.1 showed the production of litchi 2014-2017.

**Table 1.1 The litchi production area in Bangladesh**

| **Division and district** | **Area under cultivation (Acres)** | | | **Total production MT)** | | |
|---|---|---|---|---|---|---|
| | 2014-2015 | 2015-2016 | 2016-2017 | 2014-2015 | 2015-2016 | 2016-2017 |
| Barishal | - | - | 1 | - | - | 753 |
| Chittaganj | 854 | 826 | 806 | 6910 | 7280 | 7184 |
| Dhaka | 199 | 199 | 124 | 6093 | 6413 | 9544 |
| Khulna | 999 | 973 | 1110 | 11835 | 12688 | 13512 |
| Mymenshing | 51 | 68 | 20 | 9437 | 11574 | 10621 |
| Rajshahi | 376 | 1452 | 5281 | 15472 | 17778 | 25662 |
| Rangpur | 4547 | 1730 | 1960 | 212223 | 19920 | 20965 |
| Sylhet | 32 | 401 | 44 | 1703 | 1267 | 2056 |
| Bangladesh | 7058 | 5649 | 7136 | 73257 | 77705 | 90297 |
| **Pabna** | **80** | **951** | **1423** | **5548** | **6426** | **6530** |

**BBS, 2018**

# CHAPTER-II
# REVIEW OF LITERATURE

Review of literature is important to know the knowledge and information which are related to the proposed study. This knowledge and information are helpful to give a guideline for designing the future research problem and validating the existing findings. Review of some research works relevant to the present studies, which have been conducted in the past, are discussed below:

Akter *et al. (*2015) conducted a study on the profitability of litchi orchard production at Dinajpur sadar upzila in Dinajpur district where litchi orchards are generally leases out for 1 to 6 years by the owners known as "Deed". In total 312 litchi orchard trees of which 254 were Bombai, 40 Madrazi, 20 China-3, 2 China-2 and 3 were Bedana, were selected to estimate the BCR, NVP and IRR of litchi production. The litchi trees were 18 to 22 years old. Project appraisal techniques and sensitivity analysis was done by using primary data to determine cost and benefits from litchi production. The study revealed that individual's investment on litchi production is profitable. The study also found that in producing litchi Benefit Cost Ratio (BCR), Net Present Value (NPV) and Internal Rate of Return (IRR) were 1.93, Tk. 1643896 and Tk. 1230, respectively. Sensitivity analysis suggested that the investment in litchi production is profitable even for 10% increase in operating and maintenance cost or 10% decrease in gross benefit.

Akter *et al.* (2015) conducted a study on the profitability of litchi production in Dinajpur district of Bangladesh. In total 60 litchi growers were interviewed from four villages of Dinajpur district to collect the necessary information. Profitability analysis was employed for analyzing the data and testing the hypotheses of the study. The life cycle of litchi is divided into five parts; juvenile or non-bearing stage, early bearing stage, young bearing orchards, full bearing orchards and old declining orchard, respectively. Per acre production in a season of its full bearing stage was considered for this paper. The production of litchi largely depends on its age and weather during the four month of litchi production. The major findings of the present study revealed that per acre net return of litchi considering selected varieties was Tk. 171624 based

on one production period (February to May) in its full bearing stages which means litchi production is a profitable enterprise.

Bakhsh *et al.* (2006) cost of production and returns in growing mango orchard are estimated in different ways compared to annual crops. The present study has been designed to investigate cost of production, and returns per acre over the life time of mango trees. A sample of 20 mango growing farmers was taken purposively from various villages of Multan district. The objective was to work out benefit cost ratio and net present worth of growing mango orchard. Net present worth of Rs. 155607.16 per acre was estimated for the sampled respondents which indicate that mango cultivation fetches higher returns whereas benefit cost ratio is reasonably high and it came to be 2.61 implying that investing one rupee in mango cultivation would return Rs. 2.61. These results indicate that investing in mango orchard would bring huge returns to the farmers on one hand and for the country in the form of foreign earnings on the other hand.

Baruwa (2013) the study determined profitability and constraints of pineapple production in Osun State, Nigeria. Multistage sampling technique was used to obtain information from 50 respondents using purposive and random selection. Data collected were analysed using descriptive statistics and budgetary technique. Results indicated that majority of the farmers were males, aged 53.7 years on average and engaged full time in pineapple production. The modal level of farmer's education was primary. The average period of experience in pineapple farming was 13.5 years. The gross margin and net profits in Naira (Nigerian currency) were N182 725 and N162 045, respectively. The questionnaire in the study contained the most serious problems confronting pineapple farmers: limited availability of high-quality planting materials, high fruit perishability, low fruit prices, low access to credits and plant diseases. Availability of high yielding pineapple varieties, establishment of cold storages to reduce fruit perishability, agricultural price support programmes, easier access to credit from formal sources and farmers' education were considered essential to improve productivity and profitability of pineapple production in Nigeria.

Islam *et al.* (2018) conducted a study on profitability of banana cultivation under agricultural credit in Narsingdi district of Bangladesh. Both tabular and econometric

techniques were used to analyze the data. Average amount of loan received were Tk. 13750, 23100, 35100 for the small, medium, and large categories of borrowers, respectively. The overall average amount of loan received was 85.4% of applied amount. Most of the credit amount was utilized for farming purposes. Status shows that repayment rate was highly satisfactory. Multiple regression models indicate that amount of loan received and level of education of the respondents were significant factors affecting loan repayment. It was estimated that overall average annual total cost of production of Banana per hectare was about Tk. 557710 while gross return and net returns were about Tk. 931024 and Tk. 373313, respectively. The overall benefit-cost ratio of Banana cultivation was 1.67. The relationship between loan size and profitability of Banana cultivation indicated that medium size loan receiver farmers were more profitable compare to the small and large amount of loan receiver farmers. The findings of the study indicated that reasonable amount of credit ensures farmers to profitable farming activities. The findings of this study will be helpful for financial institutions officials and policy makers to formulate the loan disbursement policies related to agricultural credit in Bangladesh.

Kamal *et al.* (2015) conducted a study on cost and return analysis of banana cultivation under institutional loan in Bogra, Bangladesh. It was estimated that average annual total cost of production of banana was Tk. 34553.33, while gross return and net returns per farm were Tk. 127533.33 and Tk. 92980.00 respectively. The overall benefit cost ratio of banana farming came out to 3.69 indicating that one Taka investment resulted in a net benefit of Tk. 2.69. The findings also show that scientific uses of inputs have increased the production of bananas. The credit aspects of the study indicate that Rajshahi Krishi Unnayan Bank (RAKUB) has greater contribution as financing agency to banana production than other institutional sources of credit. But it is clear that the banana producers got credit as a part of operating capital which was not sufficient to them. Most of the credit amount (78.22%) was utilized for farming purposes. Rate of repayment was fully satisfactory (100%). RAKUB credit programme benefited the credit receivers in respect of increasing income, spending capacity decision making power and social status.

Kaysar *et al.* (2019) the study was conducted to depict the overall economics of papaya cultivation in four districts namely Tangail, Jashore, Bandarban and Rajshahi.

The objectives of the study were to examine the cost structure, resource use productivities, profitability and the problems of papaya production. A total of 152 farmers taking 38 from each district were selected randomly. Data were collected through a pre-tested interview schedule during January-March, 2017. The per hectare use of human labour, plant protection, manures and fertilizer were found to be maximum at Jashore whereas, the per hectare use of saplings was found to be maximum at Tangail district. The per hectare cost of cultivation of papaya was high at Jossere (365405) followed by Tangail (Tk.334261), Rajshahi (Tk.319754), and Bandarban (Tk. 272664). The average per hectare yield were maximum at Jossere (62MT) followed by Rajshahi (55MT), Tangail (54MT) and Bandarban (52MT). Per hectare gross margin was the highest at Tangail (Tk. 802797) followed by Bandarban (Tk. 658441), Jashore (Tk. 536346) and Rajshahi (Tk.471298). Per hectare net return was highest at Tangail (Tk.633738) followed by Bandarban (Tk.507335), Jossere (Tk.346594) and Rajshahi (Tk.302747). The overall benefit cost ratio was 2.39 which indicates papaya cultivation was profitable in Bangladesh. The yield of papaya would increase by 0.0407, 0.125, 00.0627, 0.0863 and 0.3785 % if papaya farmers apply 1% additional human labour, seedlings/saplings, fertilizer, improved variety, and dummy for loamy soil. Attacks on viral disease, adverse weather condition, non-availability of reliable seed, lack of irrigation facilities, lack of technical knowledge and problems in marketing of papaya were the major constraints of papaya cultivation in the study areas.

Mathew *et al.* (2017) conducted a study on economic analysis of pineapple production in Sindhudurg district of Maharashtra. Per hectare physical input utilization pattern indicated that there was higher utilization of inputs such as hired labour, fertilizers and plant protection chemicals. Per hectare cost of cultivation and the net returns amounted to Rs. 588220 and Rs. 993511 for the three years with an overall benefit cost ratio of 2.68. The farm business analysis indicated that the pineapple cultivation was highly profitable in all the three years.

Mukul and Rahman (2013) conducted a study on Production and profitability of banana in Bangladesh-an economic analysis. In this study investigated total cost, profit and benefit cost ratio for different marketing channel like banana producers, wholesalers and retailers. Profit for producer, wholesaler and retailer in banana

production were Tk. 55002.8 per Hectare, Tk. 59.08 per Chari, and Tk. 122.67 per Chari respectively and benefit cost ratio for producers, wholesalers and retailers were 1.40, 1.30 and 1.41 respectively. We have also followed Cobb-Douglas production model was used to determine the contribution of some important inputs like land preparation, fertilizer, irrigation, insecticides, sucker and labor cost to production of banana. We also investigate to explore the problems of producing banana and offer suggestion for possible improvement in the existing marketing system.

Rahman *et al.* (2019) the study was carried out to investigate profitability of mango farming and to assess the impact of BARI Aam-3 mango variety production on the farmer's livelihood in four mango growing districts namely Khagrachori, Bandorban, Naogaon, and Satkhira of Bangladesh during February to March, 2018. A total of 128 BARI Aam-3 growers were selected using multi-stage random sampling technique. Descriptive statistics and financial profitability analysis was used to analyze data. The net return for one hectare of mango orchard was Tk. 730233 for 6-7 years of BARI Aam-3 mango orchard. Net present value was estimated to Tk. 444397 for BARI Aam-3 which indicates that mango cultivation fetches higher returns. The estimated benefit cost ratio was 2.01 for BARI Aam-3 which ensures that investment in BARI Aam-3 is feasible for the mango farmers. The BARI Aam-3 mango cultivation was also found to be a profitable enterprise since internal rate of return was very high (83.075%). The results also reveal that human capital increased by 54.34%, 68% and 60.54%; physical capital increased by 48.17%, 58% and 50% as well as social capital increased by 28.50%, 43% and 45.95% of the small, medium and large farmers respectively due to cultivation of BARI Aam-3 mango variety. Therefore, it is highly recommended to spread the information of BARI Aam-3 cultivation as a profitable enterprise among the mango growers throughout the country.

Sarker *et al.* (2003) conducted a study on allocation efficiency in irrigated boro rice production: the case of Mymensingh farms. They observed that most of the rice farmers in the study area are predominantly inefficient in allocating their resources. Further efficient use of chemical fertilizer, land preparation and weeding for irrigated MV boro rice would enable farmers to achieve higher economic return.

Sarker *et al.* (2004) conducted a study on resource exploitation for irrigated boro rice cultivation under favorable production environments. They observed that most of the rice farms under study are predominantly inefficient in allocating their resources. More efficient application of chemical fertilizers and land preparation for irrigated HYV rice would enable farms to achieve productivity under similar production environments.

Schreinemachers *et al.* (2009) conducted a study on the declining profitability of litchi orchards in northern Thailand: Can innovations reverse the trend? Litchi is an important crop in the mountainous part of northern Thailand yet its profitability has declined during the last 15 years. The replacement of litchi fruit orchards for seasonal flowers and vegetables has external costs related to increased levels of erosion, pesticide use, and irrigation water use. Using a combination of financial analysis and agent-based modeling, the paper ex-ante assesses the impact of four technologies—artificial flower induction, small-scale cooperative fruit drying, post-harvest treatments to extend the shelf-life of fresh fruits, and greater irrigation efficiency—in terms of profits, farm incomes, litchi acreage, erosion, and pesticide use. The model was calibrated to one watershed in Chiang Mai province where economic development has been rapid. Although each technology substantially increases the profitability of litchi growing, scenario analysis shows that this is not enough to stem the decline in litchi orchards in the study area. To achieve this, the innovations would have to be combined with an increase in the fresh fruit price at the farm gate from about 9 baht/kg at present to at least 12 baht/kg.

# CHAPTER III
# METHODOLOGY

## 3.1 Introduction

The reliability of a survey research depends, to a great extent, on the appropriate methodology used in the research. Use of improper methodology very often leads to erroneous results. Proper methodology is determined by the nature, aims and objectives of the study. It also depends on the availability of necessary funds, materials and time. There are several methods of collecting data for survey research.

The present study was based on primary data, which were collected from the field survey and on secondary data. Those were collected from reliable sources. In this study, survey method was chosen because it is less expensive, it requires less time and after all it is simple and easy technique. But it has also some shortcomings.

The main shortcoming of this method is that the investigator has to depend upon the memory of the respondents. To overcome the shortcoming, repeated visits were made to collect data in the study area and the questions were asked in such a manner that the respondents could answer from memory. The design of the survey for the present study involved some necessary steps.

## 3.2 Selection of the Study Area

Selection of the study area is an important step for conducting a study. It depends on the objectives of the research. For the present study, Ishwardi upazila under Pabna district was selected purposively. Primary data was collected from Salimpur and Sahapur union under Ishwardi upazila. The upazila is the second lowest tier of administrative government in Bangladesh. The districts of Bangladesh are divided into sub-districts called Upazila (Sarker, 2010).

The main reasons for selecting the study area were as follows:

- ✓ Availability of large number of litchi farms in the study area.
- ✓ Expected better cooperation from the owners of litchi garden since the area is well known to the researcher.

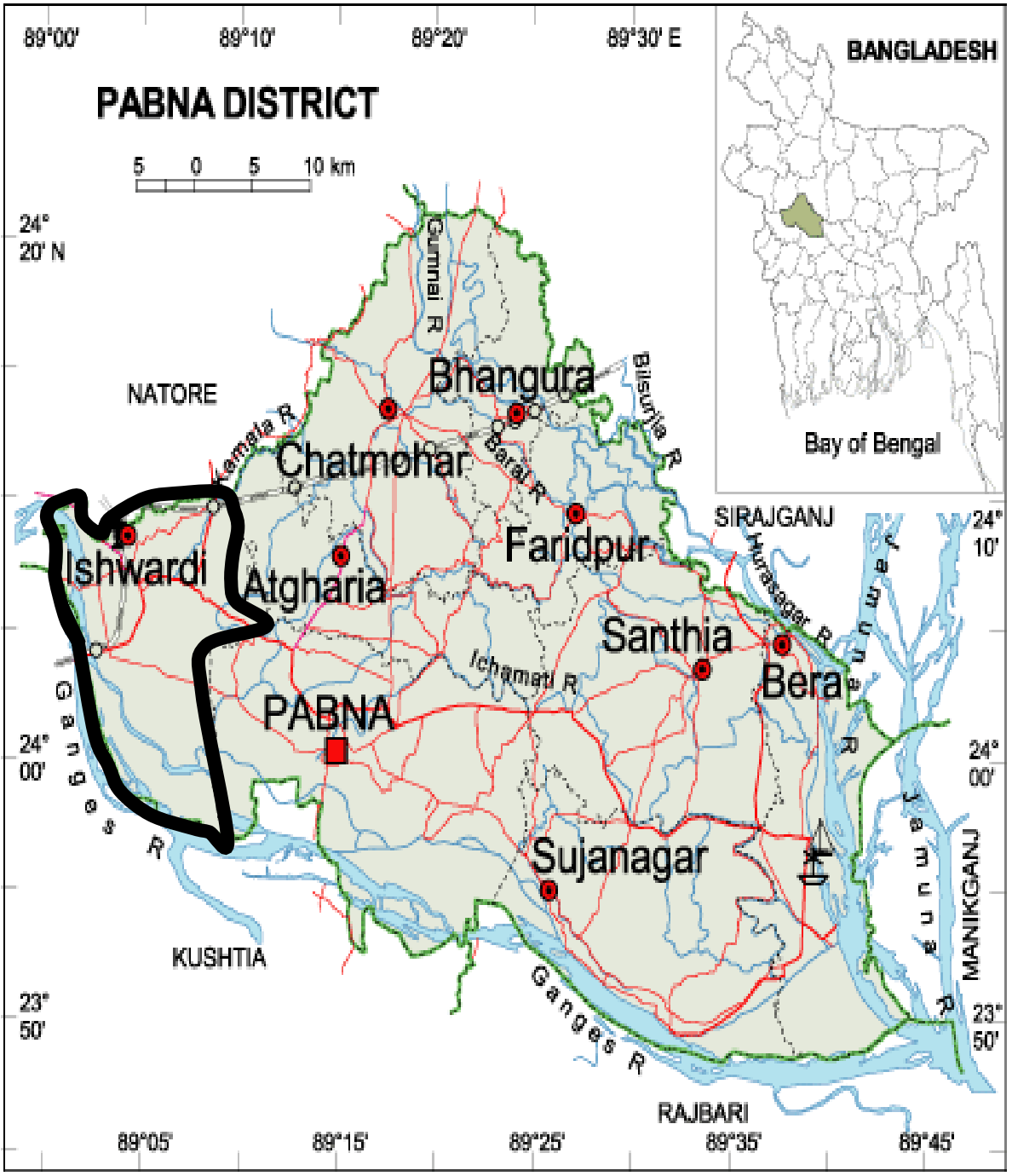



**Figure 3.1: Map of Pabna District showing Ishwardi upazila**

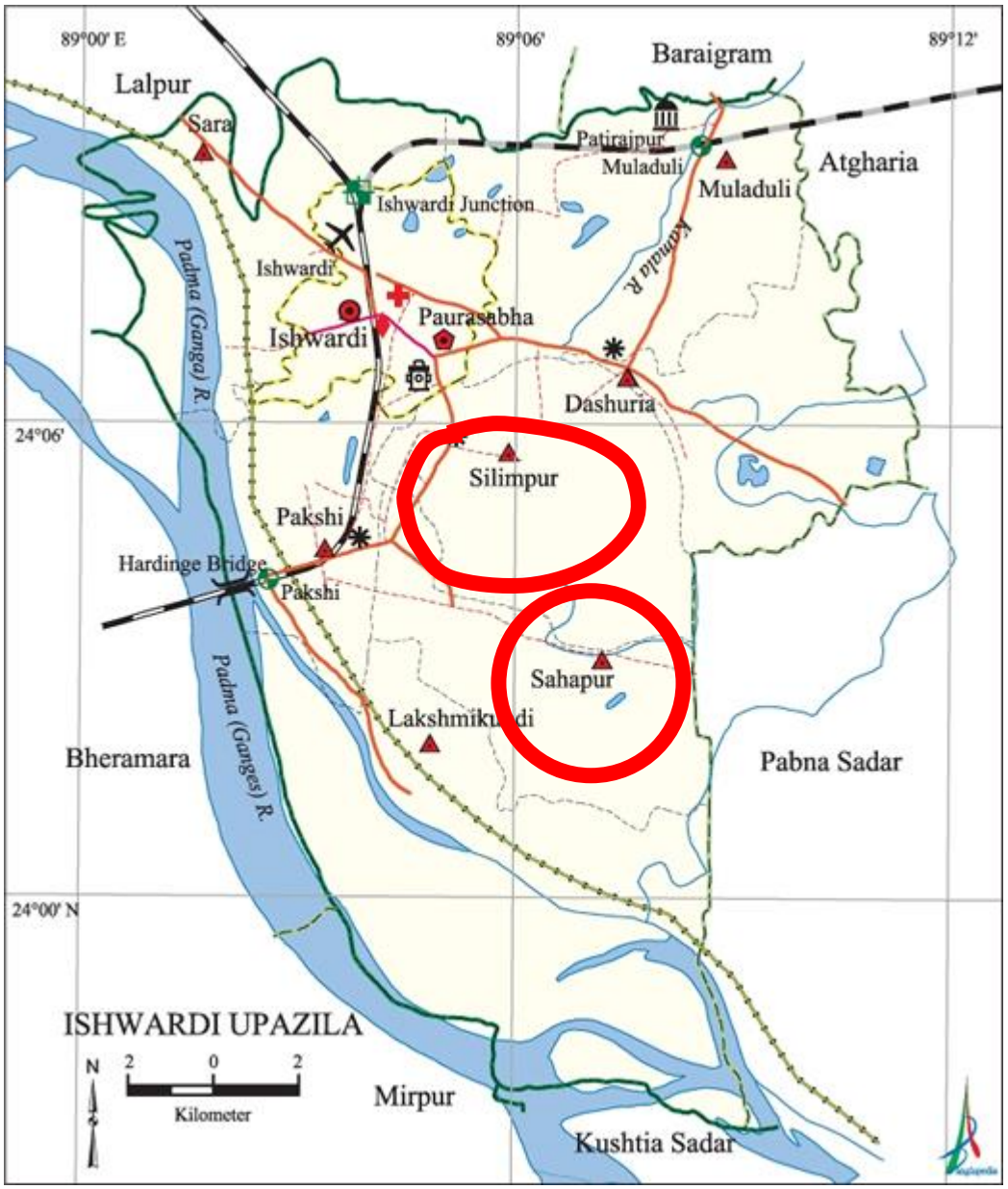



**Figure 3.2: Map of Ishwardi upazila showing the study area**

### 3. 3 Method of Investigation

The method of data collection indeed depends upon nature, aim and objectives of the study. There are several methods of data collection of which survey method is one of them. For this study, survey method has been adopted for collecting data. Necessary data have been collected by the researcher herself by using questionnaire through face to face interview. The respondents were litchi garden owners, from the study areas.

### 3.4 Sampling Procedure

It is very difficult to make a farm business survey covering all farms. For this reason sampling is done to select representative farms to minimize cost in terms of time and resources for the study. A sample of representative farms were therefore, chosen which could represent a reasonably true picture of the region. In selecting samples for a study, two things were taken into consideration. The sample was as large as to allow for adequate degree of freedom in the statistical analysis and administration of field research, processing and analysis of data were manageable with the limits imposed by physical, human and financial resources. There are five union in Ishwardi Upazila. From there two villages namely Shekerdari and Sahapur were randomly selected for the study. There are 288 litchi garden farmers in two villages. Among them 72 litchi garden were randomly selected for the present study.

### 3.5 Preparation of the Questionnaire

The success of the research and survey depends on the proper design of the questionnaire. Keeping in view the objectives of the study, questionnaire was prepared to collect the expected information. Before preparing the final schedule, draft schedule was prepared in accordance with the objectives of the study. Then the schedule was pre- tested to verify the relevance of the questions and the nature of the response. After pre testing and necessary adjustment, final survey was developed. The final survey was developed in logical sequences including items of information as noted below:

1. Socio-economic condition of the litchi garden farmer;
2. Litchi garden related information;
3. Sources of income of farm families;

4. Cost of land preparation;
5. Cost of fertilizers;
6. Cost of human labor;
7. Irrigation cost;
8. Cost of tools and equipment;
9. Pesticides cost;
10. Income from litchi cultivation;
11. Problems faced by farmers in litchi cultivation and
12. Suggestion of litchi farm owners to solve those problems.

For the present study, data were collected during the month of August and September, 2019 through face to face interview with the respondents. For collecting data a number of field visits were made by the researcher himself during the period.

### 3.6 Collection of Data

Collection of accurate and reliable data from the field is not an easy task. The result of any study depends on the accuracy and reliability of data. Reliability of data mostly depends on the method of data collection. For the accuracy of the survey, schedules must be unambiguous. To ensure reliability, data were collected from the sample respondents by using questionnaire designed for the study.

During the interview, each respondent was given a brief introduction about the nature and purpose of the study. So, they could talk freely. Irrelevant questions were avoided to save time for the respondent and researcher. To attain accuracy and reliability of data, care and caution were taken in the course of the data collection. Attention was paid to the mode of the respondent and a congenial relationship was maintained between the respondent and researcher.

### 3.7 Problems Faced in Collecting Data

In collecting primary data, following problems and difficulties were faced by the researcher:

1. Most important problem was the time limitation for collecting primary data.

2. Most of the farmers in the selected areas hesitated to give actual information about their income sources. Because they thought that the researcher was government agent; therefore, they were shy of giving actual information.

3. Another important problem faced by researcher in selected areas was that the researcher had to depend solely on the memory of the respondents for collecting data because they did not keep any written record.

4. Most of the respondents in the study areas did not have any knowledge about research study. It was therefore difficult to explain the purpose of this research to convince them.

5. Sometimes, the farmers did not cooperate willingly with the researcher. They did not find any benefit to give information to the researcher.

6. On many occasions farm respondents were not available at home and in such cases the researcher had to give extra effort and time to collect the information from them.

### 3. 8 Processing and Tabulation of Data

The processing of data is necessary on the basis of objectives of the study. After collection of data from the field all data for the present study were then coded, tabulated, summarized and processed for analysis. The data have been tabulated using SPSS from the questionnaire. Finally, required numbers of tables were prepared and results were obtained by using various statistical techniques.

### 3.9 Analysis of Data

#### 3.9.1 Analytical Techniques

Data were analyzed with a view to achieving the objectives of the study. For this study, the following techniques were used.

a) Tabular analysis and
b) Functional analysis

#### 3.9.1 Tabular Analysis

The collected data were analyzed on the basis of the objectives of the study. Tabular analysis is an analysis that is generally used to find the crude association or variations between variables. In the present study, tabular techniques were applied with the help of statistical measures like the sum average, percentage, etc., to show the comparative performance of litchi farming. Profitability analysis was done on the basis of variable

Cost, fixed cost, etc. The following profit equation was applied to assess the profitability of litchi cultivation.

$\Pi = P_bQ_b + \sum (P_{xi}.X_i) - TFC$

Where, $\Pi$ =Profit (Tk./tree/year);

$P_b$= Per unit price of litchi (Tk./piece);

$Q_b$ = Quantity of litchi (piece/tree);

$P_{xi}$ = Per unit price of ith (variable) inputs used in the litchi cultivation (Tk.);

$X_i$= Quantity of ith (variables) inputs used in kg;

i= (1, 2, 3,……..8) and

TFC = Total fixed cost

### 3.9.2 Functional Analysis

To determine the contributions of the most important variables to the returns of a litchi cultivation, the Cobb-Douglas function was used in the present study.

The model took the following shape:

$Y = aX_1^{b1}X_2^{b2}X_3^{b3}X_4^{b4}X_5^{b5}X_6^{b6}X_7^{b7}X_8^{b8}e^{Ui}$

The function was estimated as follows:

$\text{Ln } Y = \ln a + \beta_1 \ln x_1 + \beta_2 \ln x_2 + \beta_3 \ln x_3 + \beta_4 \ln x_4 + \beta_5 \ln x_5 + \beta_6 \ln x_6 + \beta_7 \ln x_7 + \beta_8 \ln x_8 + U_i$

Where,

Y=Gross return from litchi production (Tk. /tree);

$X_1$= Human labor cost (Tk. /tree);

$X_2$= Land preparation cost (Tk. /tree);

$X_3$= Irrigation cost (Tk. /tree);

$X_4$=Cost of urea (Tk. /tree),

$X_5$=Cost of TSP (Tk. /tree),

$X_6$= MP cost (Tk. /tree),

$X_7$=Cost of cow dung (Tk. /tree),

$X_8$=Pesticides cost (Tk. /tree),

In = Natural logarithm,

a= Intercept,

β=Coefficient of the concerned variables;

i = 1, 2, 3, …..n; and

U=Error term

### 3.10 Procedure for Evaluation of Costs and Returns

The cost items were classified into two broad categories, i.e.

(1) Fixed cost and

(2) Variable costs. The costs and returns were estimated per tree for the reference year. The cost items were divided under the following heads.

#### 3.10.1 Human Labor Cost

There are broadly two different kinds of labor, (1) hired labor and (2) family labor. Again, hired or family labors were of two categories i.e., male and female. The children and female man-days were converted into adult equivalent male man-days using the ratios, 1 adult man = 1.5 adult women = 2 children

#### 3.10.2 Cost of Land Preparation

Human labor and mechanical power were jointly used for ploughing and laddering. Ploughing and laddering cost was the summation of hired and home supplied draft power and human labor. Hired ploughing and laddering cost were calculated by the prevailing market prices that were actually paid by the farmers. Home supplied mechanical power and human labor cost was estimated on the basis of opportunity cost principle.

#### 3.10.3 Cost of Irrigation

The cost of irrigation included the rental charge of machine plus the costs of fuel. Someone rent/borrow only water from the shallow tube well (STW) owners by paying some charge.

#### 3.10.4 Cost of Cow dung

Cow dung may be used from home supplied or through purchased. The value of home supplied and purchased cow dung was calculated at the prevailing market price.

### 3.10.5 Cost of Fertilizer

It is very important for vegetable cultivation to use the fertilizer in recommended dose. In the study area, farmers used mainly three types of chemical fertilizer i.e., Urea, TSP (Triple Super Phosphate), MP (Muriate of Potash) for growing litchi cultivation. Fertilizer cost was calculated according to the actual price paid by the farmers.

### 3.10.6 Cost of Insecticide

Most of the sample farmers used Dithane M-45, Thiovit 80wp and Rovral 50wp for litchi. The cost of these insecticides was calculated by the prices paid by farmers.

### 3.10.7 Cost of Tools and Equipments

Tools and equipment are necessary for successful litchi farming. The farmers generally used water pot, bulb, the heating material etc. Cost of tools and equipment were determined by applying straight line depreciation method.

### 3.10.8 Interest on Operating Capital

Interest on operating capital was charged on taking all variables costs incurred for various operations in litchi garden such 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 litchi garden farmers had put money in bank, he would have received an income in the form of interest money at the above rate.

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

IOC= OC x IR x Time consideration

Where,

OC = Operating capital;

IR=Interest rate

### 3.11 Calculation of Benefits

The return items included values of litchi. The value of litchi was calculated on the basis of piece of litchi sold, multiplied by the average prices of litchi.

### 3.12 Gross Margin

Gross margin is defined as the differences between gross return and variable cost. For short run as well as for farm planning, gross margin analysis is widely used.

### 3.13 Net Return

Net return on total cost was arrived at by deducting all the costs from the gross return.

### 3.14 Benefit Cost Ratio

Benefit cost ratio was calculated by the following formula

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

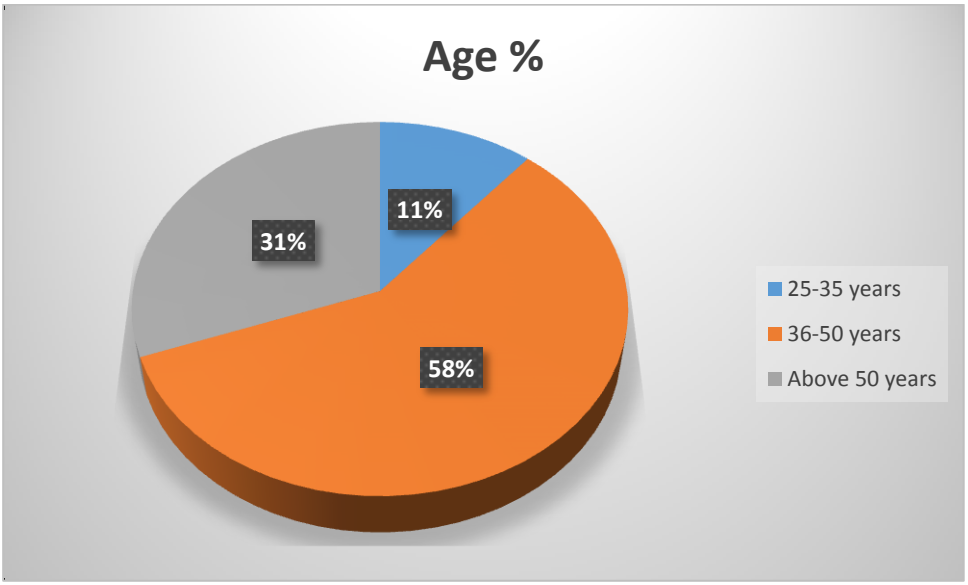
# CHAPTER IV

# SOCIO-ECONOMIC CHARACTERISTICS OF THE LITCHI FARMERS

In this chapter the findings of this study have been discussed in relation to the present findings and also to those found in other studies. Eight characteristics of the farmers were selected for this research. The characteristics include: age, education, family size, occupation, annual family income, and experience in litchi cultivation, total cultivation land and land under litchi 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 from 25 to above 50 years. On the basis of age, the farmers were classified into three categories: 25-35 years, 36-50 years and above 50 years. The distribution of the farmers according to their age is shown in Figure 4.1.



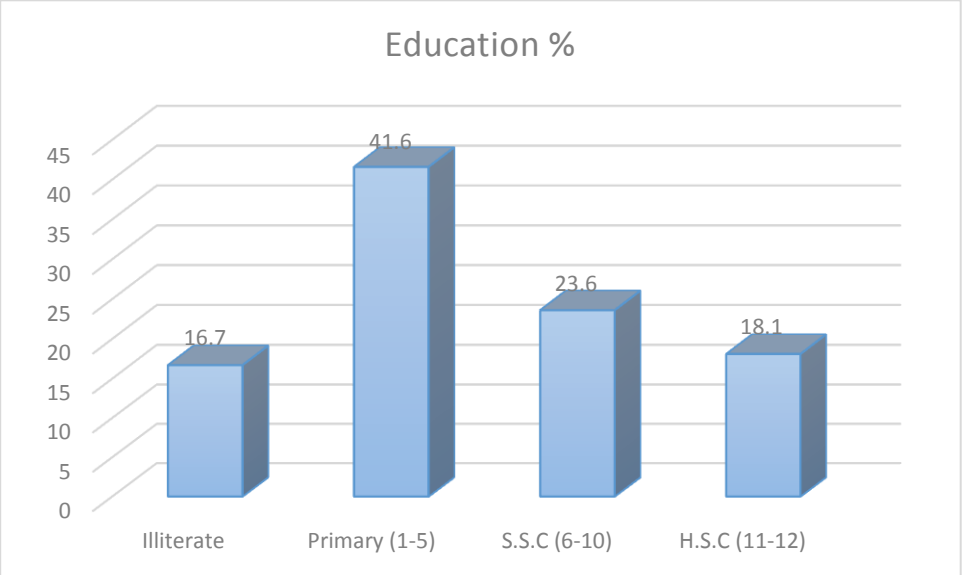

**Source: Field Survey, 2019**

**Figure 4.1 Distribution of the farmers according to their age**

Figure 4.1 showed that the highest proportion 58 percent of the litchi farmers fell in the 36-50 years age, while 31 percent of them fell in the above 50 years age category and 11 percent in the 25-35 years age category.

### 4.2 Education:

The education scores of the farmers ranged from 0 to 12. On the basis of their educational scores, the farmers were classified into four categories, namely "illiterate , primary (1-5), S.S.C. (6-10) and H.S.C (11-12). The distribution of the farmers according to their education is shown in Figure 4.2.



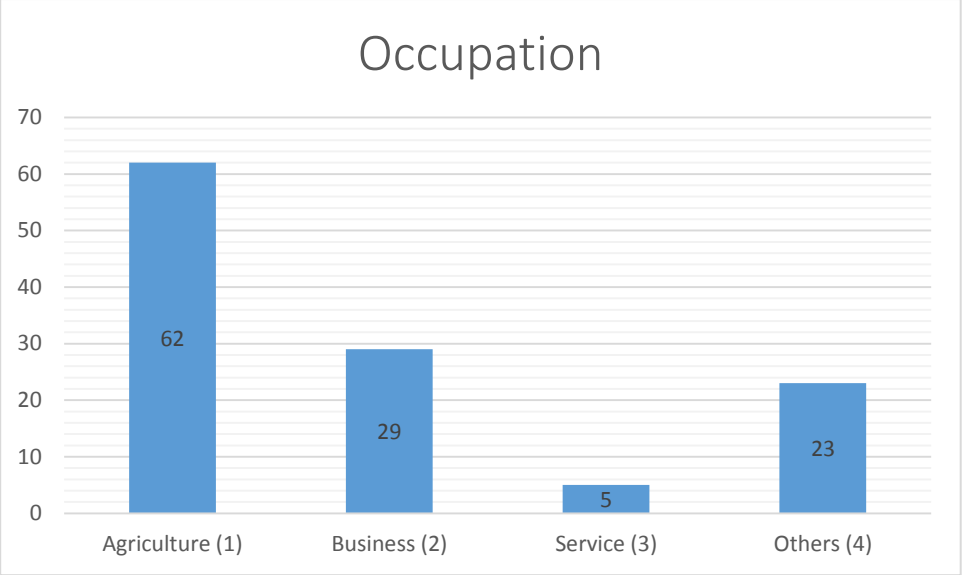

**Source: Field Survey, 2019**

**Figure 4.2 Distribution of the farmers according to their education**

Figure 4.2 indicated that the majority (41.6 percent) of the farmers had primary level of education compared to 23.6 percent of them having S.S.C level education. About 16.7 percent of the farmers were illiterate and18.1 percent had H.SC level of education.

### 4.3 Occupation

Occupation scores of the farmers ranged from 1 to 4.On the basis of their occupation, the respondents was classified into four categories namely, agriculture, business, service and others. The scale used for computing the occupation score of a respondent is given Figure 4.3.



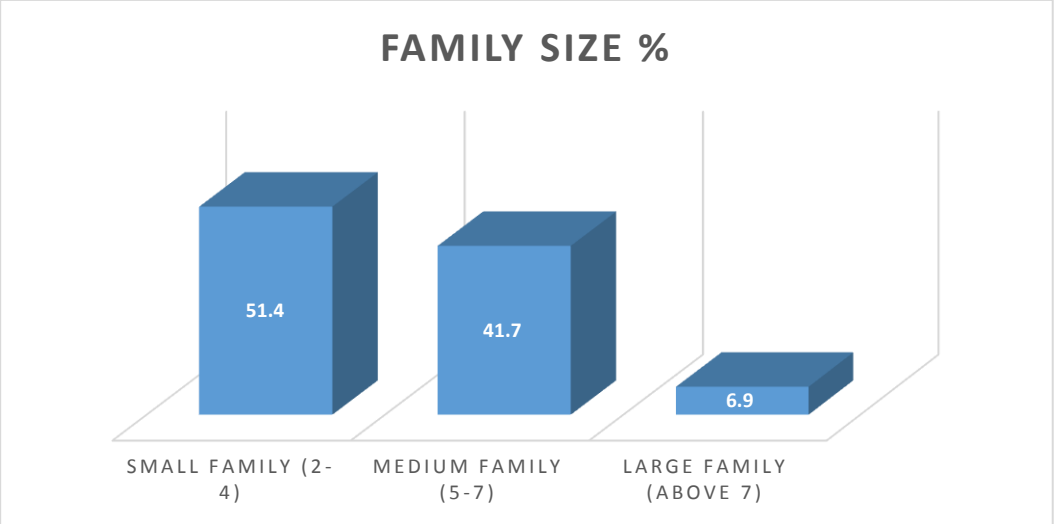

**Source: Field Survey, 2019**

**Figure 4.3 Distribution of the farmers according to their occupation**

Data contained in the Figure 4.3 indicated that the highest farmers (62 percent) of the respondents had agriculture, (29 percent) had business, (5 percent) had service and (24 percent) had others occupation, respectively.

### 4.4 Family size

The family size of the farmers ranged from 2 to 14 members. On the basis of their family size the farmers were classified into the following three categories: 2-4 members, 5-7 members and above 7 members. Figure 4.4 contains the distribution of the farmers according to their family size.



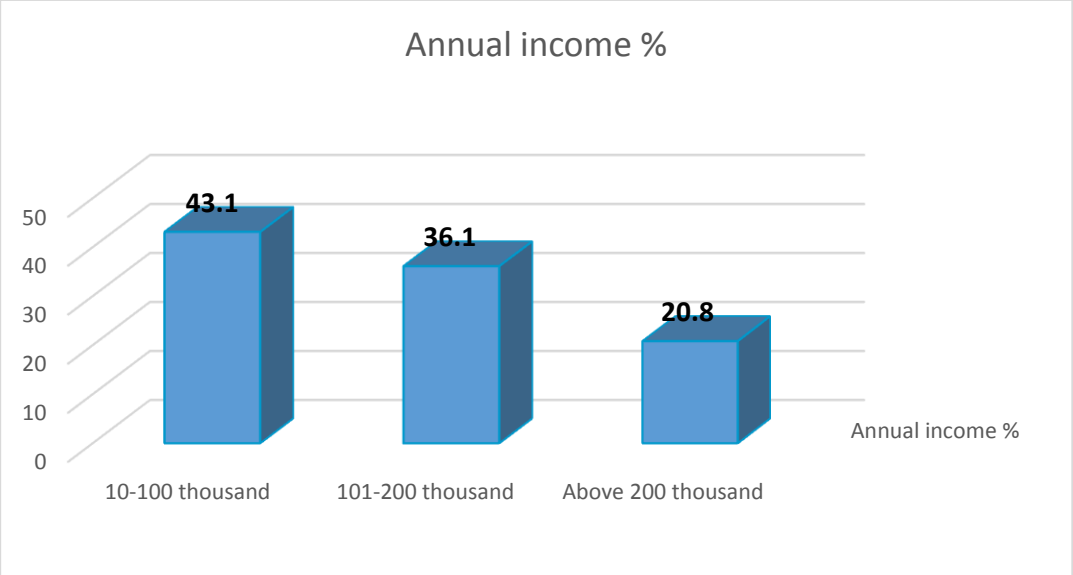

**Source: Field Survey, 2019**

**Figure 4.4 Distribution of the farmers according to their family size**

Figure 4.4 showed that the majority of the 51.4 percent of the litchi farmers had of 2-4 members compared to 41.7 percent of them having of 5-7 members. The proportion of was 6.9 percent.

### 4.5 Annual family income

Annual income score of the respondents ranged from 10 to 905 (in thousands).On the basis of the annual income, the respondents were classified into three categories as shown in Table 4.5.



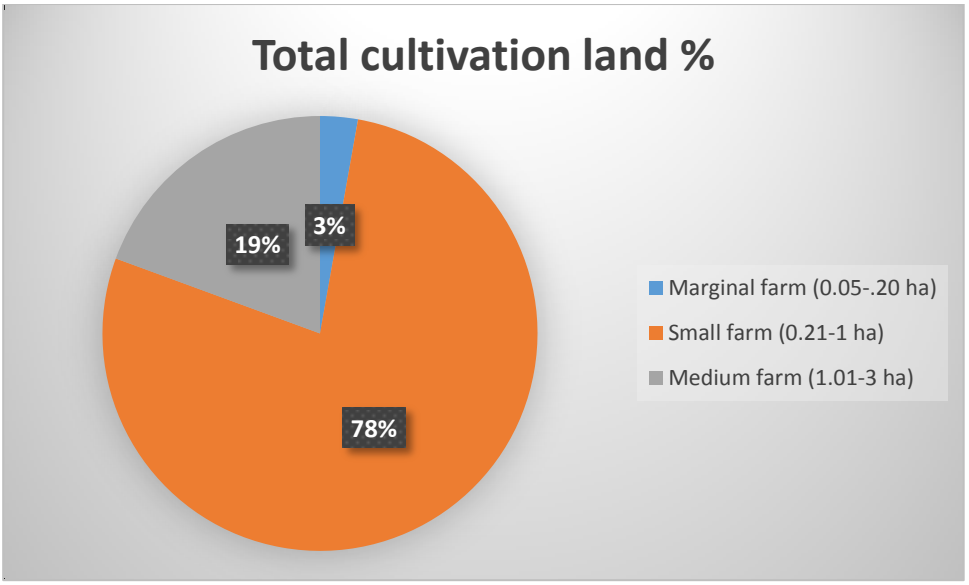

**Source: Field Survey, 2019**

**Figure 4.5 Distribution of the farmers according to their annual family income**

Data presented in Table 4.5 indicate that the highest proportion (43.1 percent) of the respondent to 10-100 thousand income, while (36.1 percent) had 101-200 thousand income and (20.8 percent) had above 200 thousand annual family income.

### 4.6 Total Cultivable Land

Total cultivation land of the respondents varied from 0.05 to 3 hectare. The respondents were classified into the following three categories based on their farm size: "marginal land" (0.05-0.20 ha)", small land" (0.21-1 ha) and "medium land" (1.01-3 ha).The distribution of the farmers according to their total cultivation land is shown in Figure 4.6.



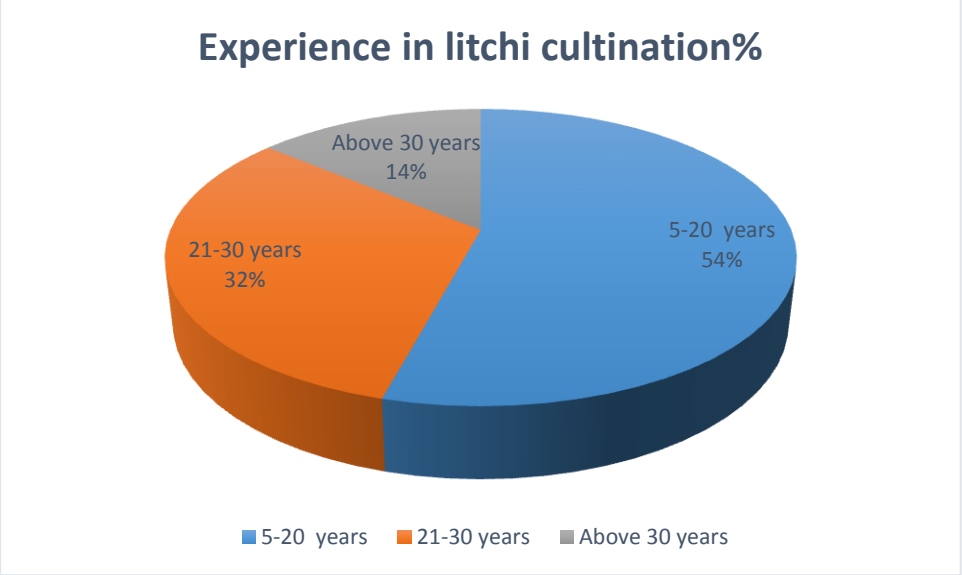

**Source: Field Survey, 2019**

**Figure 4.6 Distribution of the farmers according to their total cultivation land**

Figure 4.6 indicated that the highest (78 percent) of the farmers possessed small farm size compared to 19 percent of them having medium farm size and 3 percent of the farmers having medium farm size.

### 4.7 Experience in Litchi Cultivation

The experience score of the respondents ranged from 5 to 50. On the basis of experience, the respondents were classified into three categories namely, 5-20 years' experience, 21-30 years' experience and above 30 years' experience, as shown in Table 4.7.



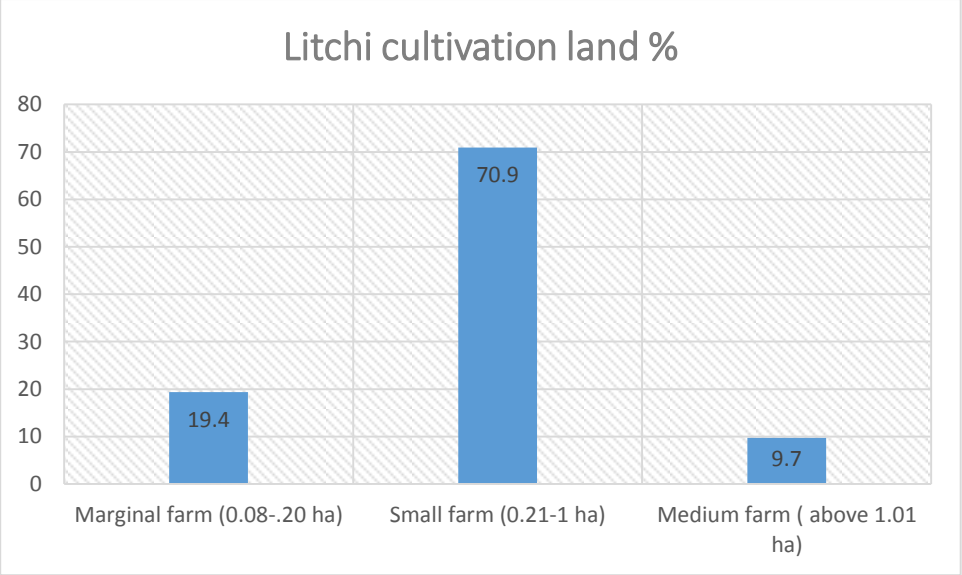

**Source: Field Survey, 2019**

**Figure 4.7 Distribution of the farmers according to their experience**

Data contained in the Table 4.7 revealed that the majority (54%) of the farmers had 5-20 years' experience as compared to (32%) and (14.7%) having 21-30 years' experience and above 30 years' experience respectively.

### 4.8 Land under Litchi Cultivation

Land under litchi cultivation of the respondents varied from 0.08 to 1.01 hectare.The respondents were classified into the following three categories based on their land under litchi cultivation: "marginal land" (0.08-0.20 ha)", small land" (0.21-1 ha) and "medium land" (above 1.01 ha). The distribution of the farmers according to their land under litchi cultivation is shown in Figure 4.8.




**Source: Field Survey, 2019**

**Figure 4.8 Distribution of the farmers according to litchi cultivation land**

Figure 4.8 indicated that more than half (70.9 percent) of the farmers possessed small land under litchi cultivation compared to 19.4 percent of them having marginal land and only 9.7 percent medium land under litchi cultivation.

# CHAPTER V
# PROFITABILITY OF LITCHI CULTIVATION

## 5.1 Introduction

The aim of this chapter is to estimate the costs, returns and profitability of litchi production and to focus on the main factors affecting return of litchi production. In estimating cost of litchi production, total costs per tree per year were considered. Variable costs were determined for human labor cost, land preparation cost, irrigation, urea, TSP, MP, cow dung, pesticides and miscellaneous cost. On the other hand, fixed cost included land use cost, family labor, and interest on operating capital etc. On the return side, gross margin, net return, returns per taka invested on total cost were estimated. The item wise costs and return of litchi production are discussed below.

## 5.2 Cost of Litchi Production

The cost here refers to the total amount of funds used in production.

### 5.2.1 Variable Cost

#### 5.2.1.1 Human Labor Cost

Labor cost is an important component in litchi enterprise and this has implication for income and employment generation. In calculating the cost of farm operation, the services of both hired and family labor were taken into consideration. Family labor includes the operator himself and other working members of the family while the hired labor includes permanent hired labor, and labor employed on daily contract basis. The cost of family labor was estimated on the basis of the principle of opportunity cost. It is revealed from Table 5.1 that the cost of human labor cost litchi tree per year was Tk. Tk. 2800 which covered 79.95 percent of the total variable cost.

#### 5.2.1.2 Cost of Land Preparation

Most of the farmers use power tiller for plowing their land, as it is cost effective and less time considering. There was a competitive rate of land preparation by using power tiller reported in the study area. Sprayer cost was also included with the machine power cost. Per tree cost of machine power litchi production were calculated Tk. 125 which covered 6.57 percent of total variable cost (Table 5.1).

#### 5.2.1.3 Cost of Fertilizer

Proper use of fertilizer can enhance agricultural production largely and help retain of soil fertility. Farmers in the study area used three kinds of chemical fertilizers, namely Urea, Triple Super Phosphate (TSP) and Muriate of Potash (MoP). In the study area, fertilizer use was more or less lower than the recommended level because the price of fertilizers from the farmers' point of view was very high. The litchi growers used fertilizers at the rate of 3-2-3 kg/tree of Urea, TSP and MP, respectively. The market prices per kg Urea, TSP and MP were Tk. 18, Tk. 29 and Tk. 20, respectively (Table 5.1). Thus total fertilizer costs were estimated Tk. 54, 58 and Tk. 60 per tree for litchi production which was 1.54, 1.66 and 1.71 percent of total variable cost, respectively (Table 5.1).

#### 5.2.1.4 Cost of Cow dung

Farmers used one kind of manure, cow dung in producing litchi. Price of cow dung was assumed fixed for litchi farmers at Tk.3.00/kg. It was observed that farmers applied 20kg/tree manure for litchi production. Cost of manure was calculated as Tk. 60 per tree for litchi production. Manure shared a very small portion of total cost of cultivation of litchi that was 1.71 (Table 5.1).

#### 5.2.1.5 Cost of Pesticide

Farmers in the study area applied some kinds of pesticide, mainly insecticides and fungicides in the cultivation of litchi. The cost of insecticides was computed based on the price that the farmers have actually paid. In the study area, Basudin, Tilt, Ostad etc. were found using as pesticides in both powder and liquid forms by the respondent farmers. Per tree average insecticide costs were estimated Tk. 150 for litchi growers which was 4.28 percent of total cost of litchi cultivation respectively (Table 5.1).

#### 5.2.1.6 Miscellaneous Cost

For successful litchi miscellaneous cost are necessary. The major tools and equipment used by the litchi farmers were spade, khurpi, hoe, electrical instruments and heating materials. The tools and equipment cost per tree per year was Tk. 120 which covered 3.43 percent of the total cost.

**Table 5.1 Per Tree Variable Costs of Litchi Cultivation**

| Variable cost items | Units | Quantity (Unit/Tree) | Price (Tk./Unit) | Cost (Tk.) | Percent of total variable cost (%) |
|---|---|---|---|---|---|
| Human labor | Man-days | 7 | 400 | 2800 | 79.95 |
| Land preparation cost | | | | 125 | 3.57 |
| Irrigation | | | | 75 | 2.14 |
| Urea | Kg | 3 | 18 | 54 | 1.54 |
| TSP | Kg | 2 | 29 | 58 | 1.66 |
| MP | Kg | 1 | 60 | 60 | 1.71 |
| Cow dung cost | Kg | 20 | 3 | 60 | 1.71 |
| Pesticides | - | | | 150 | 4.28 |
| Miscellaneous cost | - | | | 120 | 3.43 |
| Total variable cost | - | - | - | 3502 | 100 |

**Source: Field survey, 2019**

#### 5.2.1.7 Total Variable Cost

In the study area, the total variable costs varied from year to year. It was observed that the total per tree variable cost for litchi cultivation was Tk. 3502 which comprised of 64.05 percent of total cost (Table 5.1).

## 5.3 Fixed Costs

### 5.3.1 Land Use Cost

The farmers used the land as per conditions of leasing arrangement. The term leasing cost means the cost which was required for litchi farmers to take land lease which would be used for litchi production to a particular period of time. Leasing cost varies from one place to another depending on the location, soil fertility, topography of the soil and distance from the sources of water etc. Leasing cost was the single highest cost item in the study areas. The value of own land was calculated as opportunity cost concept. Land use cost for litchi production was estimated at the prevailing rental value per tree in the study area. The rental value of per tree land was estimated at Tk. 525 which occupied 26.70 percent of total fixed cost (Table 5.2).

### 5.3.2 Interest on Operating Capital

It is evident from table 5.2 that interest on operating capital per tree for 4 years was Tk. 1441 which covered 73.30 percent of the total fixed cost.

**Table 5.2 Fixed costs of litchi cultivation per tree**

| Fixed cost items | Cost (Tk./Tree) | Percent of total fixed cost (%) |
|---|---|---|
| Land use cost | 525 | 26.70 |
| Operation on Capital | | |
| First year | 315 | |
| Second year | 344 | |
| Third year | 374 | |
| Fourth year | 408 | |
| **Total operation on Capital** | **1441** | **73.30** |
| Total fixed costs | 1966 | 100 |

**Source: Field survey, 2019**

### 5.3.3 Total Fixed Cost

In the study area, it was estimated that per tree total fixed cost for year litchi cultivation was Tk. 1966 which comprised of 35.95 percent of total cost (Table 5.2).

## 5.4 Total Cost

The total costs were calculated by adding up total variable cost and total fixed cost. In the study per tree total cost of litchi cultivation was calculated at Tk. 5468 (Table 5.3).

**Table 5.3 Total Cost of Per Litchi Tree**

| Cost items | Cost (Tk./Tree) | Percent of total cost (%) |
|---|---|---|
| a. Total variable cost | 3502 | 64.05 |
| b. Total fixed cost | 1966 | 35.95 |
| Total cost (a+b) | 5468 | 100 |

**Source: Field survey, 2019**

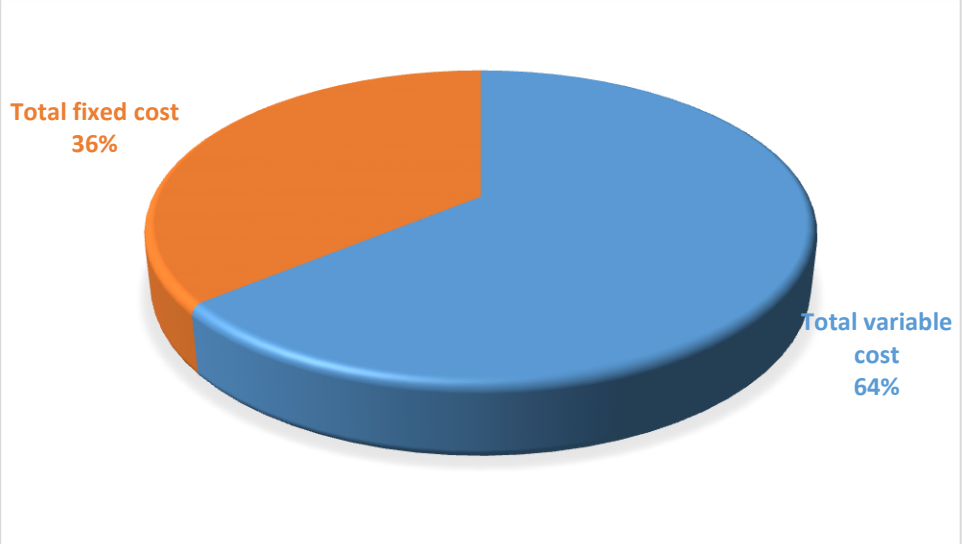



**Figure 5.1: Percentages of Per Tree Total Variable Cost and Total Fixed Cost of Litchi Cultivation**

## 5.5 Returns of Litchi Cultivation

### 5.5.1 Gross Return

Gross return is the pecuniary value of total product. Per tree gross returns were calculated by multiplying the total amount of production by their respective market prices. In the study area, per tree average yield of litchi was 9195 piece and its money value were Tk. 10115 (Table 5.5).

### 5.5.2 Net Return

In general net return is termed as entrepreneur's income. To evaluate the profitability of litchi production, net return is an important aspect. Net return is the difference between gross return and total costs. Per tree net return was estimated at Tk.4647 which indicates that litchi production is profitable business for the farmers (Table 5.5).

### 5.5.3 Gross Margin

Farmers usually want to gain maximum return over variable cost of production. The probable reason is that estimation of fixed cost of production is difficult to determine. Thus, the gross margin analysis has been taken into account to calculate the relative profitability of litchi cultivation. The gross margin of litchi cultivation was estimated at Tk. 6613 (Table 5.5) per tree.

**Table 5.4 Per Tree Return of Litchi Cultivation**

| Items | Yield (Piece/Tree) | Price (Tk./Piece) | Gross Return (Tk./Tree) |
|---|---|---|---|
| Litchi | 9195 | 1.10 | 10115 |

**Source: Field survey, 2019**

**Table 5.5 Gross Margin and Benefit Cost Ratio of Litchi Cultivation**

| Sl. No. | Items | Amount (Tk./Tree) |
|---|---|---|
| **A.** | Gross returns (GR) | 10115 |
| **B.** | Total variable costs (TVC) | 3502 |
| **C.** | Total costs (TVC+TFC) | 5468 |
| **D.** | Net return (GR-TC) | 4647 |
| **E.** | Gross margin (GR-TVC) | 6613 |
| **F.** | Benefit-cost ratio (BCR) = GR/TC | 1.85 |

**Source: Field survey, 2019**

### 5.5.4 Benefit Cost Ratio (Undiscounted)

Benefit cost ratio was calculated by dividing gross return by gross cost or total cost. It implies return per taka invested. It helps to analyze financial efficiency of the farm. It was evident from the study that the benefit cost ratio of litchi cultivation was accounted for 1.85 implying that Tk. 1.85 would be earned by investing Tk. 1.00 for litchi cultivation. So, the litchi cultivation was found to be profitable for farmers (Table5.5).

# CHAPTER VI
# FACTOR AFFECTING RETURNS OF LITCHI PRODUCTION

## 6.1 Introduction

The main focus of the present chapter is to make a quantitative analysis of different inputs used in the production process of litchi. Some crucial input, as stated before in section 3.8 have been included in the Cobb-Douglas production function model to explain the variation of productivity of litchi farming.

## 6.2 General Form of Litchi Production Function

The general form of litchi production function described by Panayotou (1985) as a function of efforts (X) which is a composite index of litchi inputs:

$Y = f(X_1)$ ……(1)

The equation may be written as:

$Y = (X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8)$…….(2)

Where, Y is return from litchi production and all the factors of production as explanatory variables ($X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8$) are for human labour cost, land preparation cost, irrigation cost, urea cost, TSP cost, MP cost, cow dung cost and pesticide cost respectively.

## 6.3 Specification of the Model

In specifying production functional forms are to Once again, decision function for pond fish the usual question applies as to which be used and what variables are to be relevant to the production should be made about the algebraic form of production function whether it will he continuous or discontinuous, linear or non-linear function etc. Correct specification is vital for any model because, any incorrect specification would lead to biased parameter estimate.

However, in real situations, there is always a compromise between theoretical elegance of the model and data availability for econometric estimation with empirical data, two forms of production function model were initially chosen to assess the effect of explanatory variables (inputs) This function was Cobb-Douglas forms Finally. However, a Cobb-Douglas production function with eight independent variables was used. This function was chosen as the specific functional form of the underlying relationship between the value of catch and its explanatory variables on the basis of best-fit and significant result on output.

Covering to the notation used in the text, the Cobb-Douglas function form can be stated as

$$Y=a\ X_1^{\beta 1}X_2^{\beta 2}X_3^{\beta 3}X_4^{\beta 4}X_5^{\beta 5}X_6^{\beta 6}X_7^{\beta 7}X_8^{\beta 8}e^{ui}$$

The alternative form of Cobb-Douglas function in equation can be estimated using OLS (ordinary least squares) method, in a log linear form.

The estimated equation is.

$$\text{Ln } Y= \ln a+\beta_1 \ln X_1+\beta_2 \ln X_2+\beta_3 \ln X_3+\beta_4 \ln X_4+\beta_5 \ln X_5+\beta_6 \ln X_6+\beta_7 \ln X_7+\beta_8 \ln X_8+Ui$$

Where,

Y=Gross return from litchi production (Tk./tree);

$X_1$= Human labor cost (Tk./tree);

$X_2$= Land preparation cost (Tk./tree);

$X_3$= Irrigation cost (Tk. /tree);

$X_4$=Cost of urea (Tk. /tree),

$X_5$=Cost of TSP (Tk. /tree),

$X_6$= MP cost (Tk. /tree),

$X_7$=Cost of cow dung (Tk. /tree),

$X_8$=Pesticides cost (Tk. /tree),

In = Natural logarithm,

a= Intercept,

β=Coefficient of the concerned variables;

i = 1, 2, 3, …..n; and

U=Error term

### 6.4 Interpretation of Result of the Model

The value of the estimated coefficients of the production function for litchi production is presented in Table 6.1.

Characteristics of the model are noted below:

- ✓ F-value was used to measure the goodness of fit for different types of inputs.
- ✓ The coefficient of multiple determinations indicated the total variation of output explained by the independent variables included in the model.
- ✓ Coefficient having sufficient degrees of freedom was tested for significance level at 1 percent and 5 percent probability levels.
- ✓ Stages of production were estimated by return to scale, which was the summation of all the production elasticity of variable inputs.

**Table 6.1 Estimated Value of Coefficient and Relative Statistics of Profitability**

| Explanatory variables | Coefficient | Standard error | p- value |
|---|---|---|---|
| Intercept | 2.733 | 0.971 | 0.000 |
| Cost of human labor ($X_1$) | $0.288^{*}$ | 0.149 | 0.047 |
| Cost of land preparation ($X_2$) | $0.067^{NS}$ | 0.101 | 0.507 |
| Cost of irrigation ($X_3$) | $0.213^{**}$ | 0.050 | 0.003 |
| Cost of urea ($X_4$) | $0.264^{**}$ | 0.061 | 0.005 |
| Cost of TSP ($X_5$) | $0.056^{NS}$ | 0.074 | 0.507 |
| Cost of MP ($X_6$) | $0.022^{NS}$ | 0.051 | 0.780 |
| Cost of cow dung ($X_7$) | $0.042^{NS}$ | 0.072 | 0.659 |
| Cost of pesticide ($X_8$) | $0.274^{**}$ | 0.100 | 0.002 |
| $R^2$ | 0.889 | | |
| Adjusted $R^2$ | 0.875 | | |
| Return to scale | 1.226 | | |
| F-value | $63.014^{**}$ | | |

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

Estimated value of the coefficient and related statistics of Cobb-Douglas production function for the sample farmers producing fish are presented in Table 6.1.

The results indicate that Cobb-Douglas production function fitted well as considering the value of R and F-value. The following features were noted.

**Human labor ($X_1$)**

The regression coefficient of human labor cost ($X_1$) was positive in litchi production and significant at 5 percent level. It reveals that one Taka increase in the labour cost, keeping other factors constant, would increase gross return of litchi production by 0.288 Taka (Table 6.1).

**Cost of land preparation ($X_2$)**

The regression coefficient of land preparation cost ($X_2$) was positive in litchi cultivation production and insignificant indicating that one Taka increase in the cost of land preparation, keeping other factors constant, would increase gross return of litchi production by 0.067 Taka (Table 6.1)

**Cost of irrigation ($X_3$)**

The regression coefficient of irrigation cost ($X_3$) was positive in litchi production and significant at 1 percent level. It reveals that one Taka increase in the cost of irrigation, keeping other factors constant, would increase gross return of litchi production by 0.213 Taka (Table 6.1).

**Urea cost ($X_4$)**

The regression coefficient of urea cost ($X_4$) was positive in litchi production and significant at 1 percent level indicating that one Taka increase in the cost of urea, keeping other factors constant, would increase gross return of litchi production by 0.264 Taka (Table 6.1).

**TSP cost ($X_5$)**

The regression coefficient of TSP cost ($X_5$) was positive in litchi production and insignificant indicating that one Taka increase in the cost of TSP, keeping other factors constant, would increase gross return of litchi production by 0.056 Taka (Table 6.1).

**MP cost ($X_6$)**

In litchi culture, the estimated coefficient of the variable MP cost ($X_6$) was positive in litchi cultivation and insignificant. It shows that one Taka increase the cost of MP, keeping other factors constant, would increase gross return of litchi production by 0.022 Taka (Table 6.1).

**Cost of cowdung ($X_7$)**

The regression coefficient of cowdung cost ($X_7$) was positive in litchi production and insignificant. It shows that one Taka increase in the cost of lime, keeping other factors constant, would increase gross return of litchi production by 0.042 Taka (Table 6.1).

**Cost of pesticides ($X_8$)**

The regression coefficient of pesticides cost ($X_8$) was positive in litchi production and significant at 1 percent level. It shows that one Taka increase in the cost of pesticide, keeping other factors constant, would increase gross return of litchi production by 0.274 Taka (Table 6.1).

**Value of $R^2$**

As it is evident from Table 6.1 that the value of the coefficient of determination $R^2$of litchi production was 0.889 which implies that about 88 percent variation in the gross return was explained by the included explanatory variables of the model (Table 6.1).

**F-value**

The F-value of the equation is 63.014 which were highly significant implying that all the included explanatory variables were important for explaining the variation in litchi

production (Table 6.1). Therefore F-values of the individual coefficient or the relevant inputs should be expected to become significant.

**Return to scale**

If returns to scale are equal to one then there are constant returns to scale. If returns to scale are more than one then there are increasing returns to scale. If returns to scale are less than one then there are decreasing returns to scale. The summations of the production coefficient of selected variables i.e. the returns to scale are 1.226 in litchi production. This means that the production function exhibits increasing returns to scale (Table 6.1)

## 6.5 Concluding Remarks

The results presented in Table 6.1 as well as the above-mentioned interpretations of individual coefficient clearly support the rejection of null hypothesis. This means that the included variables of the model had some significant positive impacts and higher returns might be obtained by applying more doses of the selected inputs of the project.

# CHAPTER VII
# PROBLEMS OF LITCHI CULTIVATION

## 7.1 Introduction

In this chapter, an attempt has been made to identity the major problems and constraints of litchi farmers in conducting their litchi cultivation. The selected litchi farmers were asked whether they faced any acute problem in conducting litchi cultivation. It was reported that the litchi cultivation farmers faced a number of problems in litchi cultivation. The problems and constraints faced by the producers were identified according to opinions given by them farmers

## 7.2 Problems Faced by the Litchi Farmers

Farmers of Bangladesh have been practicing litchi cultivation for a long period, but production of litchi is not yet to achieve the target consistent with adequate availability of litchi to the people of the country. It is stated that the producers do not get the required quantity of fertilizers, technical support and finally the expected price of their products. In this study, these problems and constraints are categorized under the following four general groups such as:

## 7.3 Technical Constraints

Technical constraints are related to production techniques. Technical constraints included non-availability of quality cutting, fertilizer, outbreak of disease and pests attack.

### Non-availability of quality cutting

Cutting is one of the most important inputs in litchi cultivation. Litchi production depends largely upon timely availability of desired quantity of cuttings. Non availability of adequate quantities of cuttings is a remarkable problem. In the study area about 62.5 percent farmers reported that they did not get sufficient healthy cuttings at proper time (Table 7.1) To overcome this problem, farmer should contact nearby cuttings producing farm and it is better not to purchase cuttings from local vendors. Government also should take necessary stapes to supply good and healthy cuttings at proper time.

**Non-availability of fertilizers**

In the study area, about 43.05 percent of litchi farmers reported that availability of fertilizers as their major problems, respectively (Table 7.1)

.

To overcome these problems the relevant organization should take necessary steps to ensure the sufficient amount of fertilizer according to need of litchi farmers.

**Outbreak of diseases and pests attack**

Sudden attack of diseases and pests as causes of damages of litchi. Lake of knowledge to identify litchi disease and its chemical control to prevent its rapid spread was a problem for the litchi farmers. It is evident from Table 7.1 that about 29.16 percent litchi farmers faced this problem.

To overcome financial losses due to outbreak of disease and pests attack, insurance policy for litchi culture should be provided to the farmers and necessary preventing should be taken measures.

## 7.4 Economic Constraints

Economic problems of the litchi farmers were related to financial difficulties such as lack of sufficient funds and complexity of institutional credit system, high input price and low product price.

**Lack of financial capital and insufficient institutional credit**

Regarding problems and constraints relating to economic aspect 73.61 percent litchi farmers faced financial difficulties due to lack of financial capital for re-excavation of their litchi. Again 73.5 percent litchi farmers reported that they were not interest to get loan from banks due to insufficient institutional credit (Table 7.1). To overcome these problems, simplification of lending procedure of banks and availability of credit at the doorsteps of farmers at lower interest rate should be ensured.

**High input price and low product price**

Price of various inputs likes oilcake, urea, TSP and MP is important factors for litchi production. In the study area about 22.23 percent of litchi farmers mentioned high price of inputs a major problem (Table 7.1). The government should take some measures for ensuring easy availability of inputs at reasonable prices

## 7.5 Marketing Constraints

**Lack of adequate transportation facilities**

In the study areas, rickshaw and van were the only means of transportation on the roads. For lack of adequate transportation in the study areas, the farmers had to sell their product in the local market at low price. About 16.66% farmers in Pabna district mention that lack of adequate transportation facilities as a problem. In the rank order, problem of lack of adequate transportation facilities was the 8th in Pabna district.

**High transportation cost**

High transportation cost was another problem of the farmer to litchi production and marketing. For higher transportation cost farmers could not accumulate all types of input and could not get better price to sale litchi. So ultimately profit becomes low. About 15.27% farmers in Pabna district mention that high transportation cost was another problem of the farmer to litchi production and marketing. (Table 7.1) To overcome this problem, some facilities such as storage and transportation should be developed in the areas so that the farmers can get fair prices of their product round the year

## 7.6 Social Constraints

Social problems were theft of litchi from the litchi garden and interference by influential persons in the study area.

**Problems of theft**

Theft of litchi from the garden was considered as one of the important constraints of litchi farming. In the study area about 31.94 percent litchi farmers reported that they faced this problem (Table 7.1). To overcome this problem the people should be taught

about social consciousness and social regulations and the relevant government law should be strictly enforced.

**Interference by the influential persons**

The rich and the village leaders or the influential persons take lease of litchi from the farmers of the villages. If the poor litchi farmers do not agree to give their litchi, they take the litchi by force and do not give any money against it. These types of people always like to theft litchi from the litchi garden without payment. In the study area 19.44 percent of litchi farmers pointed out about this problem (Table 7.1). This problem, rural social workers can take positive stapes so that the influential people could not interfere their business. Lew enforcing agencies can also. To overcome solve this types of problem by iron hands.

**Table 7.1 Problems of litchi cultivation**

| Problems item | No. of reporting farmers | Percent reporting (%) |
|---|---|---|
| **Technical constraints** | | |
| Non-availability of quality cutting | 45 | 62.5 |
| Non-availability of fertilizers | 31 | 43.05 |
| Outbreak of diseases and pests attack | 21 | 29.16 |
| **Economic Constraints** | | |
| Lack of financial capital and insufficient institutional credit | 53 | 73.61 |
| High input price and low product price | 16 | 22.23 |
| **Marketing Constraints** | | |
| Lack of adequate transportation facilities | 12 | 16.66 |
| High transportation cost | 11 | 15.27 |
| **Social Constraints** | | |
| Problems of theft | 23 | 31.94 |
| Interference by the influential persons | 14 | 19.44 |

# CHAPTER VIII
# SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

## 8.1 Summary of the Study

Litchi (*Litchi Chinensis*.) is one of the most important sub-tropical evergreen trees. Litchi fruit is famous for its excellent quality, juicy, slightly sour and sweetly taste, characteristics pleasant flavor and for attractive color. A bunch of ripen litchi attracts everyone irrespective of all ages. Litchi is mostly consumed as table fruit. It is also preserved and canned. Litchi contains 77.83% water, 6.74% - 20.64% sugar, 0.8-0.9% protein, 0.3% fat, minerals specially calcium, phosphorus and iron 0.7% and vitamin C 40.2-90 mg/100g of fruits.

1. To delineate the socio-economic characteristics of litchi cultivars in the study area;
2. To estimate the costs and returns of litchi production in the study area;
3. To find out the factors that affect profitability of litchi cultivation;
4. To ascertain the problems of litchi cultivation in the study area; and
5. To give some recommendation for policy implication.

The highest proportion 58 percent of the litchi farmers fell in the 36-50 years age, while 31 percent of them fell in the above 50 years age category and 11 percent in the 25-35 years age category. The majority (41.6 percent) of the farmers had primary level of education compared to 23.6 percent of them having S.S.C level education. About 16.7 percent of the farmers were illiterate and 18.1 percent had HSC level of education.The highest farmers (62 person) of the respondents had agriculture, (29 person) had had business, (5 person) had service and (23 person) had others occupation, respectively. The majority of the 51.4 percent of the litchi farmers had of 5-7 members compared to 41.7 percent of them having of 2-4 members. The proportion of was 6.9 percent. That the highest proportion (43.1 percent) of the respondent to 10-100 thousand income, while (36.1 percent) had 101-200 thousand income and (20.8 percent) had above 200 thousand annual family income. The highest (78 percent) of the farmers possessed small farm size compared to 19 percent of them having medium farm size and 3 percent of the farmers

having medium farm size. The majority (54%) of the farmers had 5-20 years' experience as compared to (32%) and (14.7%) having 21-30 years' experience and above 30 years' experience respectively. More than half (70.9 percent) of the farmers possessed small land under litchi cultivation compared to 19.4 percent of them having marginal land and only 9.7 percent medium land under litchi cultivation.

Cost of human labor per litchi tree per year was Tk. 2800 which covered 79.95 percent of the total variable cost. Per tree cost of machine power litchi production were calculated Tk. 125 which covered 2.14 percent of total variable cost. Total fertilizer costs were estimated Tk. 54, 58 and Tk. 60 per tree for litchi production which was 1.54, 1.66 and 1.71 percent of total variable cost, respectively. Cost of manure was calculated as Tk. 60 per tree for litchi production. Per tree average insecticide costs were estimated Tk. 150 for litchi growers which was 4.28 percent of total variable cost of litchi cultivation respectively. The tools and equipment cost per tree per year was Tk. 120 which covered 3.43 percent of the total variable cost.

Total variable cost per tree for litchi cultivation was Tk. 3502 which comprised of 64.05 percent of total cost. The rental value of per tree land was estimated at Tk. 525 which occupied 26.70 percent of total fixed cost. Per tree total fixed cost for year litchi cultivation was Tk. 1966 which comprised of 73.30 percent of total cost. Per tree total cost of litchi cultivation was calculated at Tk. 5468. Per tree average yield of litchi was 9195 piece and its money value were Tk. 10115. Per tree net return was estimated at Tk. 4647 which indicates that litchi production is profitable business for the farmers. The gross margin of litchi cultivation was estimated at Tk. 6613. Benefit cost ration per tree was 1.85 in the study area. So, the litchi cultivation was found to be profitable for farmers.

### 8.2 Conclusions

In this study, Cobb-Douglas production function model was used to determine the effects of key variable inputs. The most important eight explanatory variables were included in the model to explain the gross income or return of litchi cultivation. Most of the variables

in the production function were significant in explaining the gross return except the positive and insignificant effect of land preparation cost, cost of TSP, cost of MP and cost of cow dung. The coefficient with expected sign indicates the selected inputs contributed positively to the gross return. The values of the coefficient of multiple determination of litchi cultivation were 0.889 which implied that about 88 percent of the total variation in the gross return could be explained by the included explanatory variables of the model. Production function for litchi cultivation exhibits increasing returns to scale (1.226). This means that, if all the variables specified in the model were increased by 1 percent, gross return would also increase by 1.226 percent. The F-value for the litchi cultivation was 63.014 which were highly significant at 1 percent level. This study also identified some of the problems and constraints associated with litchi cultivation. These were categorized into technical, economical, marketing and social problems. The findings revealed that non-availability of quality cutting, non-availability of fertilizers, outbreak of diseases and pests attack, lack of financial capital and insufficient institutional credit, high input price and low product price, lack of adequate transportation facilities, high transportation cost, problems of theft and interference by the influential persons etc. were the major obstacle which stand in the way of litchi cultivation in the study area.

### 8.3 Policy Recommendations

The study has revealed some valuable information regarding litchi production. Following policy recommendations have been made for increasing the production and financial returns of litchi farmers.

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

- ✓ Farmers used Bombai and chinese varieties but there are so many new varieties with high yield potential are available. So, initiatives should be taken by the research organization, extension departments and NGOs to popularize the new varieties among the cultivation farmers.

- ✓ Bank loan and institutional credit should be made available on easy term and conditions to the litchi farmers.
- ✓ 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 litchi farmers can have fair price during the season.

**8.4 Limitation of the Study**

Apart from selecting the litchi farms on the basis of production, management practices and different sizes including derelict or non-productive farms, the researcher had to face following problems:

- ✓ The main problem of collecting data was that the researcher had to rely upon the memory of the farmers. Since the farmers did not keep any written records of their costs and returns, the farmers provided information mainly from they cannot be ignored. To memories as a result the probability of data this problem, several visits were made by the researcher himself to error overcome ensure the collection of reasonable accurate data from the held.

- ✓ Necessary data were collected from a limited area covering a small number of samples. Results obtained from an observation of seventy-two sample farmers may be inadequate to represent the actual situation of the whole country.

- ✓ Exact quantification of family labor was difficult task. Because the farmers often could not estimate distinctly the use of family labour for different purposes.

- ✓ The findings of the study are based on the primary data from specific area of Ishwardi Upazila in Pabna district of Bangladesh. Findings should, therefore, be interpreted cautiously before generalizing it for the country as a whole.

- ✓ Transportation cost of litchi production was not calculated in this research.

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