

**PROFITABILITY OF LITCHI CULTIVATION IN SOME
SELECTED AREAS IN THAKURGAON DISTRICT OF
BANGLADESH.**

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**PROFITABILITY OF LITCHI CULTIVATION IN SOME SELETED
AREAS IN THAKURGAON DISTRICT OF BANGLADESH.**

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CERTIFICATE

This is to certify that the thesis entitled ‘**PROSPECT OF LITCHI CULTIVATION IN SOME SELETED AREAS IN THAKURGAON DISTRICT OF BANGLADESH.**’ submitted to the Faculty of Agribusiness Management, Sher- e- Bangla Agricultural University, Dhaka-1207, in partial fulfillment of the requirements for the degree of **Master of Science in Agribusiness And Marketing**, embodies the result of a piece of bona fide research work carried out by **PALASH CHANDRA ROY**, Registration Number: **18-09222**, under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

Dated:
Dhaka, Bangladesh

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ABSTRACT

The present study was undertaken to examine the costs and returns of producing litchi by using both primary and secondary data. The primary data were collected in production period of litchi during March to May, 2019 through direct interviews. Considering the scope and potentials of litchi production, this study was based on a sample survey and employed farm level cross section data of total 80 litchi growers. In the first stage, one litchi growing district (Thakurgaon) with two Upazilas (Thakurgaon Sadar and Pirganj) was selected randomly. In the second stage, two villages from each Upazila were selected randomly. Descriptive statistics was employed for analyzing the data and testing the hypotheses of the study. This study shows that litchi production has greatly influence on the socioeconomic condition such as age, literacy rate, occupation, training received, household income and expenditure of litchi growers. The major findings of the present study revealed that litchi production was profitable to the litchi growers. The production of litchi largely depends on its age and climates during the four months of litchi production. Per acre total cost, gross revenue, gross margin and net revenue of litchi production were estimated at Tk.118245.72, TK. 241450, TK. 196816 and TK. 123204.28 per season i.e. per year production of litchi is profitable. But it is difficult to get the overall figures of cost and production of the whole life of litchi within the one season of production. In the study area, litchi orchards were leased out by the owner for 1 to 6 years which is known as Deed. On the basis of primary data collected from respondent and reviewed by other agricultural personnel BCR was calculated 2.04Tk. .It indicates that litchi production project is acceptable and highly profitable. The study also identified some problems and constraint faced by the litchi growers which hindered the higher production and yield of litchi and also suggested some recommendations to improve the present production situation. This study would be a guideline for further research about other fruit crops like mango or jackfruit and the result of this study would help the planners and policy makers to formulate suitable policy for increasing litchi production in Bangladesh.

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The author



**DEDICATED
TO MY
BELOVED
PARENTS**

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CHAPTER 1

INTRODUCTION

1.1 Importance of Agriculture:

Bangladesh is mainly an agricultural country with an area of 147570 sq. kilometer. The total population of this country is 163.61 million with the annual growth of 1.27 percent. Population density of this country is 1253 persons per sq. kilometer (BER, 2019).

Agriculture is the main economic activity in Bangladesh. This sector has a large impact on employment generation, poverty reduction, food security and human resource development. It is known as the main source of food as it has crops, livestock and fisheries sector. We get from this sector: industrial raw materials, timbers used in construction and foreign exchange for the country by exporting agricultural commodities those may be raw or processed.

The cropping intensity of Bangladesh is now 193 percent (BBS, 2018). Bangladesh has about 14.943 million hectare of total cropped area. Out of total cropped areas, 2.23 million hectare is single cropped, 4.107 million hectare double cropped and 1.485 million hectare triple cropped areas (Tama, 2018). Rice, wheat, pulses, oilseeds, vegetables, sugarcane and potato are the major crops grown in Bangladesh among which rice is the staple food grown in all the three seasons (BBS, 2018). In Bangladesh the major cereals are rice and wheat; the minor cereals include barley/jab, joar, bazra, cheena and kaon; of the oil seeds, rape and mustard are most important. Fiber crops include jute, cotton, hemp and kenaf. Jute dominates among fiber crops having about 737000 metric tons annual production (Banglapedia, 2019).

The Gross Domestic Product (GDP) is a basic measure of a country's overall economic performance. Agriculture is vital for the economy of Bangladesh as it contributes about 1.11 percent to the country's GDP of which the contribution of crop sub-sector alone about 7.05 percent, 1.58 percent from forestry, 11.47 percent from livestock and 3.50 percent from fisheries (BER, 2019). The trends of contribution of different sub-sectors of agriculture to GDP during 2011-12 to 2019-20 are presented in Table 1.1

Table 1.1: Contribution of different sub-sectors of agriculture to GDP at constant market price (In percentage).

Sector/sub-sector	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Agriculture	14.27	13.70	13.09	12.81	12.32	11.70	11.12	10.67	10.11
Crop	10.50	10.01	9.89	9.28	8.87	8.35	7.86	7.51	7.05
Livestock	1.98	1.90	1.84	1.78	1.73	1.66	1.60	1.53	1.47
Forestry	1.79	1.78	1.76	1.74	1.72	1.69	1.66	1.62	1.58
Fisheries	3.73	3.68	3.68	3.69	3.69	3.65	3.61	3.56	3.50

Source: Bangladesh Economic Review, 2019.

1.2 Importance of Litchi in Bangladesh Agriculture

Being an agro-based country, different agricultural product provides economic return to Bangladesh. But all the agricultural products do not give higher returns. In every region production of agricultural commodity differs based on different agro-ecological zone. On the basis of soil criteria and temperature litchi grow well in Thakurgaon district. Bangladesh is a country whose economy is largely based on agriculture which contributes about 13.35 percent to the Gross Domestic Product (GDP) at constant market prices. The growth rate of GDP in Bangladesh depends on the performance of crops, fruits and vegetables. In the year 2017-2018 the total area under litchi cultivation is about 40889 acres and total annual production is about 94160 metric tons (BBS, 2018) fruits such as mango, litchi and jackfruit etc. although its losses due to natural calamities like storm of April or May (known as *kaiboishakhi*). A significant position of agriculture is also embedded in its role as provider of employment of rural labor forces. About 80 percent of the total population of the country live in rural areas and are directly or indirectly engaged in a wide range of agricultural activities. About 40.60 percent of the labor forces are employed in agriculture (Biological and Environmental Research, 2018). High population growth with declining death rate together with low growth in agricultural productivity adversely affects the living standard in the country. Land is the basic resources of human society. Because of the rapid growth of population and indiscriminate destruction of forest, it is difficult to meet the huge demand for timber, fuel, food and fodder and maintaining ecological balance. Litchi cultivation is one of the most important income sources for small-scale farmers.

This change in litchi cultivation endangers sustainable land use and accelerates soil erosion. To avert such developments, supportive measures to find upgrading possibilities within the value chain of litchi that put the upland in a more strategically advantaged position are required.

The present fruit production situation is not sufficient to meet domestic requirement. The long term fruit production growth rate was less than population growth rate, and the price of fruit increased in subsequent years due rapid population growth, lower per capita arable land and less developed agricultural production system. In Bangladesh, arable cultivable land is limited and there is little scope to expand. So, to increase the litchi production, productivity of litchi should be increased through adoption of improved technology and integrated farming of litchi with other crops. The nutritional value of fruits places them on the crest of our edibles. Fruits contain vitamins and minerals in large quantities. Fruits are the oldest food of mankind. Taking fruits everyday strengthens our vitality. Nutrition scientists advise us to take at least 115 grams of fruit every day for balanced diet. But at present our country has the capacity to provide each of us with only 38 grams of fruits every day (Chowdury, 2019).

We need fruits for economic reasons too. Most fruit trees live for years. Fruit farming is quite profitable although it may be a little expensive at the beginning. Fruits can be processed for preservation in many ways. For example, different kinds of healthy foods like jam, jelly, candy, etc. and drinks can be made from fruits. Some fruits can be dehydrated for marketing.

Orchard means a long term establishment and maturity period investment and careful planning is essential to ensure economic success. Litchi orchard is no exception in this regard. Knowledge of investment costs to establish the orchard and to analyze production and return analyses for this crop is needed to help growers assess profitability and evaluate future ventures.

1.3 Origin and Description of Litchi

Litchi (*Litchi chinensis*), which originated in southern China and possibly northern Vietnam belongs to the Sapindaceae family. The Sapindaceae is a relatively large family containing at least 125 genera and 1,000 species, which are widely distributed in the tropics and warm sub-tropics. The most widely cultivated fruit trees in this family other than litchi are rambutan (*Nephelium lappaceum* Linus.) and longan (*Dimocarpus longan* Linus.) (Minas and Frank, 2012).

Litchi is a juicy fruit and one of the most important evergreen fruit trees. It is also regarded as one of the kings of subtropical fruits and famous for its excellent quality such as slightly sour-sweet taste, pleasant characteristics and for attractive color. Litchi is delicate and highly perishable, with a short storage life, hence, fruit should be sent to consumers on the day of harvest to avoid physiological loss in weight and ensure for maximum fruit quality. Insects, diseases, disorders,

nutrition deficiencies injuries litchi due to transit and storage environment may shorten the post harvest life of litchi.

Although the precise knowledge of growth processes is complicated and of little relevance to the litchi growers, but the basic understandings are important and will help us to make wise decisions in the field.

1.4 Historical Background of Litchi Research

Litchi are cultivated as very popular fruit and have a long history of acceptance in China and many parts of Southeast Asia. The cultivated litchis originated in the region between southern China, northern Vietnam and Malaysia. Litchis have a long history in Southeast Asia with unofficial Chinese records going back to about 2000 BC. From about 1600 AD, the species was distributed too much of the tropical land sub-tropical world, but it is currently not widely grown as it does not give flower and crop successfully over a wide range of climates. The main center of origin of litchi is believed to be between latitudes 23° and 27° north in the subtropical parts of southern China, northern Viet Nam, and Malaysia. It seems to have been in cultivation since about 1500 BC by people of Malayan descent and has since been subjected to intense selection. China has a long history of litchi cultivation for more than 2000 years and from China it reached Burma (Myanmar) by the end of 17th century and was introduced in India and Thailand about 100 years later. Litchi reached Madagascar and Mauritius around 1870 and was introduced in Hawaii in 1873 by a Chinese trader. It arrived in Florida, from India, between 1870 and 1880 and was introduced in California in 1897. Litchi was probably brought to Australia by Chinese migrants in 1954 and arrived in Israel sometimes between 1930 and 1940. China, Taiwan province of China, Thailand, India, South Africa, Madagascar, Mauritius and Australia are now major litchi producing countries in the world. A native of South China, it reached India by the end of seventh century. India ranked second in the world next to China in litchi production. Most area falls in north Bihar comprising Muzaffarpur, Vaishali, Samastipur, Begusarai, east and west champaran and Bhagalpur districts. Litchi is famous for its excellent quality, pleasant flavor, juicy pulp (aril) with attractive red color (Food and Agricultural Research of United States, 2018).

Litchi originated in China, where it has been cultivated for 300 years and was introduced to Burma and India by the end of the 17th century (Goto, 1960). It was introduced to Australia, South Africa and Hawaii by the end of the 19th century. (Menzel and Simpson, 1986) Other litchi growing countries of the world are Bangladesh, Pakistan, Philippines, Thailand, Madagascar and Hong Kong. It has even high level of Beta-carotene, greater than carrots. It has even helps to prevent blood clots, severe cell damage and reduces stroke in heart attack patients. It is a good source of carbohydrates and fibers which are quite essential for the body. It helps in increasing the energy of the body, increases fluids in the body, which are required for good health. It contains unsaturated fatty acids which help in the absorption of beta carotene, and many other fat soluble vitamins. Litchi is the major important fruit crop in Bangladesh due to its calorific and nutritive values and of its versatile use by the consumers (Sathe, 2011).

1.5 Variety of Litchi

The varieties of litchis are China, Madrazi, Purbi, Early & Late Bedana, Mclean, Muzaffarpur, Rose Scented, Shahi, Kasba, Muzaffarpur, Bombai, China, Saharanpur, Dehradun, Calcuttia, Muzaffarpur, Seedless (Late) & Rose Scented , Rose Scented, Early & Late Seedless, Early Large Red, Late Large Red, Bombai, Goothi, Bedana, Kalyani etc. among them china, deshi, bedana, bombai, madrazi etc. are cultivated in Bangladesh (Molla et al,2010).

1.6 Nutrient Elements of Litchi

Fruits are important as food because they have sufficient amount of vitamin and mineral. We should eat 115 grams fruit every day. Fruits increase our digestive power. An intake of fruit every day keeps us hale and hearty. Litchi is extremely rich in vitamin-C than orange. Litchi contains 77.83% water, 6.74-20.60% sugar, 0.08-.09% protein, 0.03% fat, mineral specially calcium, phosphorus and 0.7% iron and vitamin 40.2-90 mg/100 gm C of fruits (Bose and Mitra, 2017). Litchi makes an excellent canned fruit. A highly flavoured squash is also prepared from the litchi fruits, which is used during summers. Various other products such as pickles, preserves and wine are also made from litchi in China. Dried litchi commonly called litchi-nut is very popular among the Chinese.

1.7 Litchi Production in Bangladesh and in the Study Area

Litchi (*Litchi chinensis*) is one of the most popular and delicious fruits of Bangladesh. It is grown almost all over the country but its production is mostly concentrated in the northern and eastern region. A considerable amount of litchi fruits losses every year during harvesting, sorting, storing, transportation, selling and consumption due to its perishability. The perishability of this fruit is attributed to immense physiological changes after harvest (Momen et al,1993).

Litchi is a highly priced, popular and major available fruit in Bangladesh. It has a great demand among all classes of people. Litchi is a non-climacteric fruit (Wills et al,2004) and it deteriorates very fast after harvest. Pericarp browning is the first and important visual sign of fruit quality deterioration. The pericarp browning is considered the most important post-harvest problems of litchi. Browning that occurs during the first few days after harvest is usually caused by dehydration of the pericarp. Fruit start to brown once they loss a few percent of the harvested pericarp fresh weight (Jiang and Fu, 1999).

Once the initial fresh weight goes below 50 percent, the pericarp becomes entirely brown. The brilliant colors of mature litchi fruits are largely due to a range of anthocyanins located in the mid to upper mesocarp (Underhill and Critchley, 1993). The anthocyanins are stable at pH below 3 but are converted to colorless chromenols in an acid reversible reaction as the P^H rises. Anthocyanins are also prone to enzymatic and non-enzymatic oxidations often leading to the production of melanin by products (Kaiser, 1994).

Litchi is a highly priced, popular and major table fruit in Bangladesh. It has a great demand among all classes of people. It comes to the market in such a period when other fresh fruits are available in the markets. But in spite of the availability of different types of fruit, the demand for fresh litchi is always very high due to its unique taste. It lasts only about 60 to 80 days during the months from April to June in Bangladesh. Due to certain limitations of soil and climatic conditions, litchi grows well in some selected areas of Bangladesh. The leading litchi growing districts are Thakurgaon, Dinajpur, Rajshahi, Rangpur, Jessore, Pabna, Chittagong, Dhaka, Sylhet, and Mymensingh. Most fruits available in our country do not grow in the cold countries. It gives us an opportunity to export our fruits there for earning foreign currency.

1.8 Justification of the Study

Litchi is decidedly a delicious, highly nutritious and popular fruit. It has also commercial fruit. In the context of Bangladesh it is grown in limited areas for consumption and commercial purpose. But the demand of litchi exists all over the country. Adequate care is not taken for its cultivation and proper marketing. There is no special programme of the government to develop its cultivation and marketing.

Litchi is a highly perishable fruit that requires careful handling and quick marketing. No modern

storage facilities for litchi have yet been developed in the country. As the fruit rotten soon and need time to reach the purchasers, therefore, becomes a compulsion. So, selling of litchi at a reasonable price and at desirable time are the major problems.

It is reported that litchi growers are not getting fair price due to the lack of proper marketing facilities and urgency of money required by growers immediately after its harvesting. A large portion of litchi produced is reported to be wasted. Moreover, due to continuous increase in the cost of carrying and freight charges, this small producer and the local traders are not getting fair returns by marketing litchi.

In the past there is no adequate study on production of litchi as such it felt that a study on production of litchi could be of much importance. It is hoped that the findings and specific suggestion from the study will help the producers, trader, consumers, extension workers and researchers in their efforts for the improvement of production and marketing of litchi in Bangladesh.

1.9 Objectives of the Study

The main aim of study is to identify and explain possibilities for improving productivity and profitability of litchi by increasing the efficiency of litchi.

The specific objectives of this study are as follows:

- a. To assess the socio-economic characteristics of litchi growing farmers.
- b. To calculate the profitability of Litchi cultivation.
- c. To identify the factor affecting the production of litchi cultivation.
- d. To explore the problems and constrains faced by the litchi growing farmers.

Chapter 2

REVIEW OF LITERATURE

The purpose of review of literature in any research is to review the past research works, which are related to the present study. The review of literature in any research is necessary as it provides a new dimension for reviewing the stock of knowledge and information relevant to the proposed research. This knowledge gives a guideline in furnishing the future research problem and validating the existing findings. Many studies on production of different agricultural commodities have been conducted in Bangladesh. But a very few studies have been conducted to deal with the production of fruit crop. Research works relating to various aspects of litchi production carried out all over the world including Bangladesh are overviewed here. This chapter identifies the methodology used in the previous studies, findings and also makes justification of conducting the present study. With this end in view, literature and research works in the line with the present study were searched in the relevant libraries, research institutes, offices and websites. The important studies which were conducted in the recent past related to the present study are discussed below:

FAO (2002) conducted a study on "Litchi production in the Asia-pacific region" which stated that, Litchi is widely spread across south China, between latitudes 31° and 18°N and Longitudes 101° and 120°E, whereas the commercial production zone lies between latitudes 19° and 24°N.

Chen and Huang (2000) studied that, in south China litchi has become a major industry since the 1980s. It provides huge scope for employment of the local populace and about 320,000 people are involved in this industry. In 1999, litchi output was about 950,000 tons from 530,000 hectares for China as a whole. Guangdong Province is the most important area for litchi production in China. Other provinces where litchi grows well include Guangxi, Fujian, Hainan and Yunnan.

Ghosh (2000) revealed that, in India litchi is grown mainly in the states of Bihar, West Bengal and Uttar Pradesh. It is also grown in limited scale in Tripura, Orissa, Punjab, Himachal Pradesh, Assam and the Nilgiri hills in the south. Current production of litchi is about 429,000 ton from an area of about 56,200 hectares.

Boer and Schipman (2008) conducted an assessment entitled, " Assessment of Different Value-Chain Upgrading Strategies for litchi in Northern Upland Parts in Thailand". They found that different upgrading strategies in comparison to the present situation of upland are the focus of an ongoing field research in Chiang Mai province in northern Thailand. The overall objective is the assessment of different upgrading strategies to give recommendations about the most suitable

alternative for upland; meaning solutions that align high benefits with sustainable land use. One upgrading strategy within the value chain is the production of higher quality litchi that can be sold to special "niche" markets rather than ordinary wholesale markets. Another strategy is upgrading production through the adoption of further activities in the value chain, in particular the case of litchi drying. Necessary equipment for the drying is foremost a drying oven, fuelled by either gas or wood. The intention of litchi drying directly by the litchi growers is a decoupling of the volatile fresh market and a takeover of an activity that offers additional value. It is believed both strategies can increase and sustain net profits of upland.

Chowdhury (2009) studied on the effect of weather factors on the incidence and severity of leaf spot disease of litchi seedling. In case of leaf spot disease of litchi seedlings the highest incidence (50.10%) and severity (40.62%) were recorded during the month of October, 2007 at temperature, relative humidity and rainfall of 27.45°C, 81.33% and 14.9 cm, respectively. On the other hand, no incidence (0.00%) and severity (0.00%) were observed during the month of July, 2007 and April, 2008 at temperature, relative humidity and rainfall of 28.87°C, 85.67% and 62.60 cm and 28.53°C, 67.67% and 4.93 cm in April 2008, respectively.

Hossain *et al* (2011) made an extensive survey on the incidence and severity of nursery diseases of litchi in different locations of major fruit growing areas of Bangladesh. In addition they were working on isolation and identification of disease causal organisms. Moreover, management of nursery diseases was their main target of research.

Coates *et al.* (2003) studied diseases of litchi, their distribution, importance and control of diseases of litchi (*Litchi chinensis*) with characteristics and production of the fruits. Saponins in litchi may be responsible for the paucity⁷ of major diseases in these crops. Root rots (*Anillariamellea* and *Anillariasodalis*) and diebacks (associated with *Hemicriconemoides mangiferae* and *Xiphinemabrevicolle*) tend to be exacerbated by water stress and leaf spots and flower blights do not tend to be serious. A wide range of fungi are reported to cause postharvest disease if fruit are not handled correctly, including *Alternaria*, *Aspergillus*, *Fusarium*, *Cladosporium* and *Penicillium* species.

Pathok (1980) observed a serious leaf spot of litchi incited by *Microdiplodia litchi* at Udaipur, India. The diseased leaves showed yellowish-brown to brick-red areas mostly around the margin. The colored areas gradually become light brown and show black, dot-like pycnidia.

Rahman *et al* (1997) conducted a study on "The cultivation of fruit". In this study they suggested to plant fruit trees around the homesteads, on the high fallow land, on the sides of ponds, etc. These

types of tree plantation can earn a handsome amount of money with a comparatively less capital and labor. However, fruit farming requires many people for the production of saplings, seeds and cuttings as for the processing and marketing of the yield. As a result, it opens job opportunities for many people. The processing of fruits can be done at home with a little effort.

So it creates further employment for women. They reported that different foodstuffs like jam, jelly, pickles, candy, drinks, etc. can be produced from litchi.

Ha Mirt Trung (2000) found that, Northern Viet Nam includes part of the geographical area where litchi originated. This species has been grown commercially for many centuries near Hanoi, but production has only expanded rapidly in the past five years. The total area under cultivation is about 25,000 hectares, with 10,000 hectares under bearing trees and the total production in 1998 was 27,000 tons.

Amiruzzaman (1990) reported that the magnitude of postharvest losses in fresh fruits including litchi in Bangladesh is 25-50%, while it is only 5-25% in developed countries.

Aklimuzzaman (2011) revealed that, the fruit quality attributes of three commercially important litchi varieties of Bangladesh, namely 'Bombai', 'Bedana' and 'China 3'. Physico-chemical parameters such as peel colour, pericarp browning, weight loss, dry matter content and pulp pH to increase with the duration of storage, whereas moisture content and vitamin C content decreased with the progress of storage. Among the varieties, changes in the above parameters were slower in 'Bedana' as compared with 'China 3' and 'Bombai'. On the other hand, pulp to peel ratio and TSS increased initially but declined afterwards in all varieties. The level of disease incidence and severity increased proportionally during the storage period. Fungal pathogens like *Aspergillus* spp, *Rhizopus* spp and *Penicillium* spp were identified from the infected fruits. Significant difference in respect of shelf life was also observed among the varieties. The longest shelf life was observed in 'Bedana' (3.75 days) as compared to those of 'China 3' (3.07 days) and 'Bombai' (2.08 days) varieties. Ting *et al.* (2013) Publish Chemistry Central Journal which identified that Fruit were treated with pyro gallol at 1 mm and then stored at ambient temperature (25°C) or low temperature (4°C). Compared with control, pyro gallol significantly reduced pericarp browning and delayed the rotting of fruit day 4 at 25°C, and on day 30 at 4°C. The chemical treatment reduced respiration rate and the activities of peroxidase (POD) and polyphenol oxidase (PPO), and delayed the loss of membrane permeability. Pyro gallol increased the activity of phenylalanine ammonia-lyase (PAL), delayed the loss of anthocyanin and phenolics, and maintained high 2, 2-diphenyl 1-1-picrylhydrazyl (DPPH) radical scavenging activity and reducing power.

Molla *et al.* (2010) investigated that the postharvest losses were reported mainly at harvesting (8.0%), handling from orchard to selling point by the growers and beparies involved in harvesting (4.61%) and after buying to consumption by the consumers (7.5%). Considering the channels involved in litchi marketing, the growers and beparies engaged in harvesting had the highest percent of losses (16% in Dinajpur, 12% in Ishurdi, and 11 % in Natore) followed by the consumers (7.5%).

The above mentioned discussion and review indicates that literature on production of litchi was considerably inadequate particularly in Bangladesh. A number of attempts were made to investigate socio-economic aspects of litchi cultivation in other countries, but no systematic study was available in Bangladesh regarding litchi production. Therefore, the present study will generate valuable knowledge and information which would be highly useful both at micro and macro level. Government Organization and NGOs and policy makers for formulating appropriate policy for wide spread cultivation of litchi in Bangladesh.

Chapter 3

METHODOLOGY OF THE STUDY

Methodology is a noun which means a set or system of methods, principles and rules for regulating a given discipline, as in the arts or science. The creditability of a scientific research depends to a great extent on appropriate methodology used in the research. A farm management research needs reliable data from individual to fulfill the objectives and the researcher needs to follow a systematic course of actions. There are various methods of collection of primary data and information. Selection of particular method among the various methods of collecting data for farm management research depends on many considerations; such as the nature of the study and its objectives, time constraints, availability of research funds etc. The following steps are followed to design the survey of the present study:

3.1 Selection of the Study Area

Selection of the study area which is an important step largely depends on the objectives set for the study. Selection of the area depends on several factors like availability of data, purpose of the study, access to the area and the possible cooperation of the litchi growers. Before selecting the study area some preliminary visits were made by the researcher himself to a few villages to get acquainted with the respectable persons, Sub Assistant Agricultural Officer (SAAO) and the litchi growers. Based on preliminary information received four villages namely, Shundarban, Shadarpur, Shundarpur and Dhonikgram from Thakurgaon Sadar and Pirganj Upazillas of Thakurgaon district were selected as the study areas to address the specific objectives. The reasons for selecting these areas were:

There were a large number of litchi growers in this area; These villages had some identical characteristics like topography, soil and climate condition for producing litchi;

1. Easy accessibility and good communication system existed in the selected villages and it was convenient for the researcher to collect necessary data and information;
2. Researchers himself was fairly well known to the local customs and practices and was able to speak the litchi growers language.
3. A good cooperation was expected from the respondents to obtain reliable data and information; and
4. No study like the present one was conducted previously in these areas.

3.2 Study Design and Sampling Techniques

It was impossible to interview all the litchi growers in the sample areas due to limitation of time and resources. For this reason, reasonable sizes of sample litchi growers were chosen which can at least satisfy the objectives set for the study. The simple random sampling procedure was followed to select litchi growing areas. In the first stage, one litchi growing district (Thakurgaon) with two Upazillas (Thakurgaon Sadar and Pirganj) was selected radomely. In the second stage, two villages from each Upazila were selected randomly. Finally, a total of 80 growers were selected from the collected lists by adopting simple random sampling method from each village. Sampling design and distribution of sampled litchi growers in the study areas are presented in the following figure:

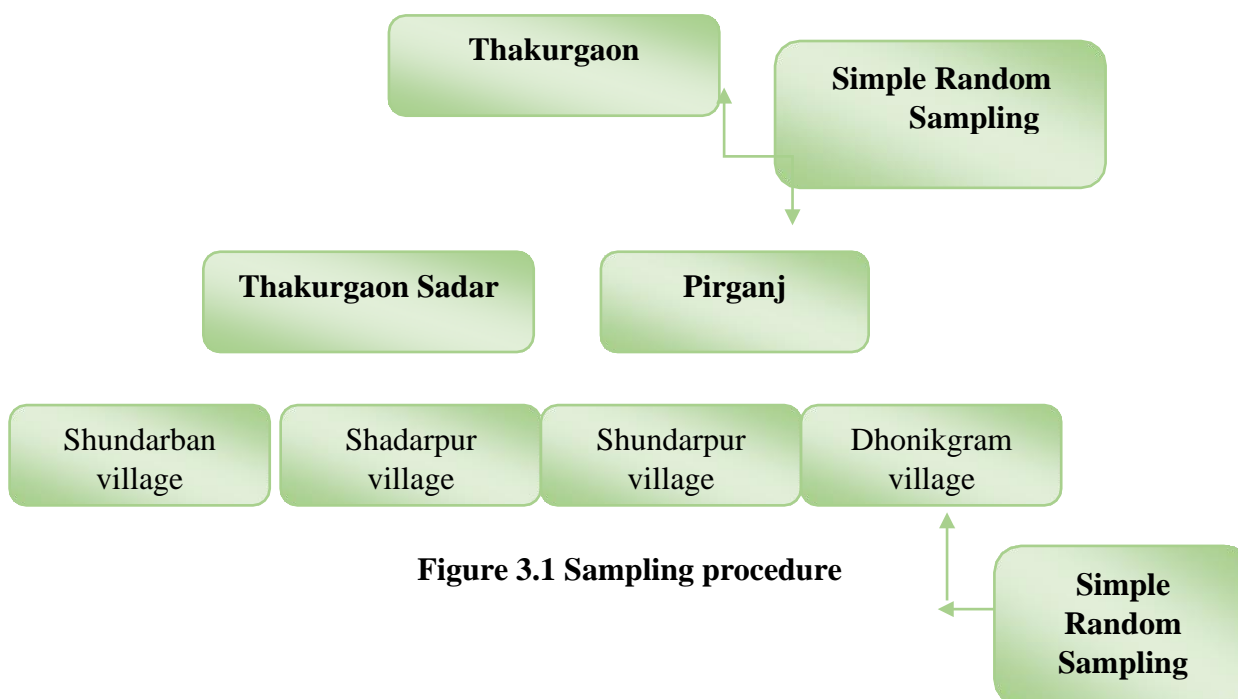


Table 3.1 Study design and distribution of sample of litchi growers

District	Upazila	Village	Number of Litchi growers
Thakurgaon	Thakurgaon Sadar	Shundarban village	20
		Shadarpur village	20
	Pirganj	Shundarpur village	20
		Dhonikgram village	20
Total litchi growers			80

3.3 Selection of the Varieties

In the study area different varieties of litchi are produced such as Bombai, Bedana, Madrazi, Chaina-2, Chaina-3, and Mozaffari etc. But Bombai is popular among all the varieties because of its higher production and good taste. However Bombai litchi 53 sample, Bedana litchi 17 sample, Madrazi litchi 5 sample, Chaina-2 litchi 3 sample, and Chaina-3 litchi 2 sample were selected for this study.

3.4 Period of Data Collection

To satisfy the objectives of the study, necessary data were collected by researcher himself through personal interview with the sample litchi growers. The duration of data collection was March to May 2019. In order to obtain reliable data, the researcher visited the study area and introduces himself with the litchi growers.

3.5 Preparation of Interview Schedule

Preparations of interview schedule for collecting data are a crucial need in any socioeconomic survey. Before preparing the final interview schedule a draft interview schedule was developed keeping in view the objectives of the study. Then it was field-tested by interviewing a few respondents for necessary modifications before starting data collection. As a result of pretesting, some items irrelevant to local conditions were deleted and some more understandable points were included. Finally, this edited copy was duplicated, processed and printed for making interviews. The final interview schedule was developed in logical sequence so that the Litchi growers could answer systematically. Information was gathered on socioeconomic condition of farm household costs and returns of their production activities, issues and options for Litchi production, problems faced by the respondents and their probable suggestion.

3.6 Methods of data collection

Both primary and secondary sources of data were collected for this study. Primary data were collected through direct interviews by making personal visits were made by the researcher to the selected litchi growers. Normally, the interviews were conducted in the early morning and also in the evening because litchi growers were very busy with their work at the day time. Before starting interview, each respondent was given a brief idea about the nature and purpose of the survey and they were made convinced that this research was purely an academic one. The questions were asked by the researcher systematically with simple words and were recorded accordingly in the interview schedule. After each visit, the collected information was checked for accuracy and clarifies. If there were any missed or overlooked items, the correspondent farmer was revisited.

Initially, data were recorded in local units for example, locally used unit of land was bigha (1 bigha=50 decimals). Later they were converted in international units after editing. The data were collected from 80 sample litchi growers through personal interview. In addition to field level primary data and information having relevance with this study were also collected.

3.7 Data Entry and Analysis

The data and information collected from field surveys, interviews, discussion and communications were scrutinized, classified, edited and coded. The responses of the respondents were recorded in the interview schedule. Data entry was then done by the researcher himself and analysis was done using the concerned computer software packages Microsoft Excel. A list of tables with their meaningful interpretations were prepare on the basis of the aims and objectives of the study.

3.8 Analytical Framework of the Study

Analytical techniques enable researchers to examine complex relationships between variables. A combination of descriptive analysis was used to achieve the objectives and to get the meaningful results. The following techniques were used for analyzing data. In agricultural production, cost of inputs is an important element and to expense incurred in organizing and carrying out the production processes decision about production is mainly influenced by the cost of inputs. Inputs used in the study areas were both purchased and family supplied. The input items were valued at the existing market price in the area during survey period. The total cost and benefit analysis is done on the basis of early and full bearing stage of litchi.

3.8.1 Descriptive Analysis

Descriptive technique is well known and widely used techniques to show the result of farm management research because it is simple convenient and very easy to understand. It is the technique that is commonly followed to find out the crude association or different between variable and output. Various descriptive statistical measures (i.e., sum, average, percentage etc.) were employed to examine the objectives and for testing the hypotheses. Tabular analysis included socioeconomic characteristics of sample, production practices and their cost and return, input use, problem faced by the respondents and their probable suggestions. Per acre profitability of litchi production from the view of individual litchi grower was measured in terms of gross revenue, gross margin and net revenue.

Gross revenue: Gross return was calculated by multiplying the total volume of output of P

includes the physical quantity of main product. The following equation was used to estimate gross return in producing litchi:

$$GR_i = \sum Q_i P_i$$

GR_j = Gross revenue from total number of tree (Tk.)

Q_i = quantity of the product (thousand number of litchi) P_i - average price of the litchi (Tk. / thousand)

Gross margin: Gross margin calculation was done to have an estimation of the difference between total revenue and variable costs. The analysis is also easily understandable because its simplicity. The following equation was used to assess gross margin:

$$GM = TR - TVC$$

Where,

GM = Gross margin;

TR = Total revenue;

and

TVC = Total variable cost.

Net revenue: Net revenue analysis consider fixed cost of land rent, interest on operating capital, depreciation of farm implements etc. Net revenue was calculated by deducting all costs (variable and fixed) from gross return. To determine the net revenue of litchi production, the following equation was used in the present study;

Where,

II = Net Return,

PM = per unit price of product (Tk. /1000 litchi)

OM = Quantity of Production per acre (Number of litchi in thousands)

P_{xi} = Per unit price of i th inputs (Tk.)

X_i = Quantity of i th inputs per acre (kg)

TC = Total fixed cost (Tk. and

$i = 1, 2, 3, \dots, N$ (number of inputs).

Benefit Cost Ratio (BCR): The BCR of an investment is the ratio of the discounted value of all cash inflows to the discounted value of all cash outflows. It can be estimated as follow:

$$BCR = \frac{\sum_{t=1}^n \frac{B_t}{(1+i)^t}}{\sum_{t=1}^n \frac{C_t}{(1+i)^t}}$$

$$NPV = \sum_{t=1}^n \frac{B_t - C_t}{(1+i)^t}$$

3.8.2 Econometric analysis

Functional analysis was designed to this study as the contribution of resources involved in the production of these enterprises. Production function analysis was carried out to find out the productivity of the individual inputs. The data were arranged on per farm per hectare basis. Then suitable variables were included to run the regression model. To determine the effect of the variable inputs, Cobb Douglas forms of production function were estimated for litchi. Six variables for litchi were hypothesized to explain the production of litchi. Regression analysis was used to determine the effect of these inputs. The general model was specified comprehensively in such a way that it can specify adequately the production process of the litchi.

The specification of the Cobb-Douglas production function for litchi was as follows:

$$\ln Y = a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + U_i \text{ Where,}$$

Y= Gross Revenue (Tk. /acre);

X₁=Human labor cost (Tk. /acre);

X₂=Land rent cost (Tk. /acre);

X₃=Insecticide cost (Tk. /acre);

X₄= Fertilizer and manure cost (Tk. /acre);

X₅=Irrigation cost (Tk. /acre);

X₆=Safety and security cost (Tk. /acre);

a=Intercept;

b₁, b₂, b₃, b₄, b₅, b₆ =The coefficient of the respective variable to be estimated;

U_i = Error term.

3.9 Problem Faced In Data Collection

There were some problems or difficulties which were faced by the researcher during the period of data collection. These problem and difficulties were given below:

Due to limitation of time, money and personnel, all the data for the present study are collected from a limited area with a very small number of samples within a short time which may not present the actual situation prevailing all over Bangladesh.

It was too difficult to convince the litchi growers on the utility of the study partly due to their ignorance and busy schedule of work.

With respect to data on land area, volume and quantity of production, the litchi growers answered according to local units of measurement which were converted to standard units. These area produced litchi in a large scale, litchi growers are interested in litchi production for its economic gain.

CHAPTER 4

DESCRIPTION OF THE STUDY AREA

4.1 Demographic Features of the study

Research areas were confined to the villages of Thakurgaon Sadar and Pirganj Upazilla under Thakurgaon district. The reasons for selecting these areas mainly due to these area produced litchi in a large scale. The litchi growers are interested in litchi production for it economic gain.

4.2 Physical Features, Topography and Soil Type

Thakurgaon district has an average elevation of 37 meters above the sea. The study areas were belongs to the old Himalayan piedmont plain of Agro-Ecological Zones (AEZ). The area contains a lot of cultivatable land where various crops are grown. The quality of soil influences the productivity of a crop. The land elevation of this area was observed to be high land and medium high land. Litchi is generally grown in high and medium high lands with loamy to sandy loam soil. So, the selected areas are suitable for litchi production.

4.3 Climate, Temperature and Rainfall

Climate means the regular pattern of weather condition (such as, temperature, humidity, amount of rain, wind speed, fogs etc.) of a particular place. The study areas compromised in tropical monsoon climate with periodic thundershower during summer. The summer begins from the middle of June. The monsoon usually starts from the month of middle October. There are no arrangements for recording temperature and rainfall in the study areas at Upzila level. There is a metrological center in Thakurgaon sadar Upazilla of Thakurgaon district. The monthly temperature, relative humidity and rainfall according to Thakurgaon meteorological station are presented in Table 4.1.

Table 4.1: Climate data for Thakurgaon dist.

Climate Data for Thakurgaon

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Year
Average high	24	27	31	32	33	31	32	31	31	31	28	25	29
Average low	14	17	22	25	26	27	27	27	27	25	21	16	23
Precipitation mm(inches)	8 0.3	20 0.8	58 2.3	117 4.6	267 10.5	358 14.1	368 15.7	318 12.5	257 10.1	163 6.1	30 1.2	5 0.2	1979 77.9

Source: Internet, 2019.

The highest temperature of the area varies from 24°C (January) to 33°C (May) in 2019. The highest rainfall was in July (368 mm) and the lowest was in December (5 mm) in 2019.

4.4 Occupation

The main occupation of most of the people is agriculture. Almost all households are dependent on agriculture directly or indirectly. Agriculture is the main occupation of 63.90 percent of people in Thakurgaon district. About 12.89 percent people had commerce as the second occupation in Thakurgaon district. Apart from agriculture, some people lived as agricultural laborer and wage laborer and some people lived on weaving, services and other occupations. There are also a number of unemployment youth in the study area. Women in the villages are mostly involved in household works, livestock rearing, farm activities like threshing and winnowing of farm products, etc. (BBS, 2018).

4.5 Agriculture

Agriculture in the selected areas is mainly based on crop cultivation. In the study areas, there are single, double and triple cropped areas. Excepting the low lying , areas of the selected areas, the farmer grow two or three crops in the medium and moderate high land in a year. The farmers' grow HYV boro or deep water aman in the low lying land. As mentioned earlier, soil quality of the study areas is suitable for producing a number of crops and vegetables. Major crops in the study area are paddy, wheat, jute, maize, potato, pulses, oil seed, vegetables, onion, garlic etc. Different kinds of fruits such as litchi, jackfruit, mango, banana, papaya, blackberry and litchi are grown in the area. (BBS, 2019).

4.6 Government Organization

There are various Government and autonomous organization like Agricultural Extension Office (AEO), Upazila Fisheries office (UFO), wheat Research Centre (WRC), Bangladesh Agricultural Development Corporation (BADC) etc. in the study areas. But all of the organizations are working at the district level of Thakurgaon Sadar and Pirganj Upazila have experience about crop cultivation. But the litchi growers of Thakurgaon Sadar and Pirganj Upazilla have little knowledge about litchi cultivation.

4.7 Transportation, Communication and Marketing Facilities

Transportation, communication and marketing facilities are important to modern economy and play a significant role in the development of particular areas as well as of the economy. It becomes impossible for the rural people to enjoy the facilities of modern technology without improved transport system. The study areas are well communicated through pacca and semi-pacca, mud roads and railways. The road networks facilities the litchi producer to market their product to the nearby and distance market places. Due to well communication with the different markets, usually farmer get fair price for their products. However, they very often go to district town for buying and selling their products. Modes of transportation of this area are rickshaw, van, tempo, truck, by- cycle, motorcycle; train etc. on rainy days, the roads become muddier and villagers have to ace troublesome movements. There are many big hats, which sit on more than one day in a week and the local bazaars are held on every morning and noon. Thus the transportation, communication and marketing facilities of the study area are reasonably satisfactory for producing and marketing of litchi.

4.8 NGO Activities

The NGOs have started their work in Bangladesh from early 1970s. Several NGOs are working in the country with the vision that they can provide a better life for under privileged and marginalized communities of Bangladesh and can help the litchi growers. There are different NGOs operating in Bangladesh and listed by the Association of Development Agencies in Bangladesh, among them some are registered and some areas non-registered. Various NGO networks have been formed on different issue such as women development, environment integrity, water and sanitation facilities, education, aquaculture, fisheries, livestock and land reform, Some operationally important NGOs in the study areas are BRAC, ITCL, Grameen Bank, Thenggamara Mohila Sambay Somoittee (TMMS), Pallisri, Bangladesh Jubo Kalia Sangstha, Proshika, Grameen Unnayan Samiti etc. these NGOs provide agricultural credit to litchi growers, micro-credits to women and landless at a reasonably higher interest rate. Besides, NGOs are also providing technical training on the use of

modern technology, poultry rearing and livestock rising. They also arrange training for educational facilities for poor village children.

Chapter 5

SOCIOECONOMIC CHARACTERISTICS OF THE LITCHI GROWERS

The socioeconomic condition of litchi growers gives a complete picture of litchi production. Socio-economic characteristics of the litchi growers affect their production process and technology use. Persons differ from one another in many respects. Behavior of any individual can be determined by their characteristics. There are numerous interrelated and constituent attributes that characterized a person and these profoundly influence development behavior. Decision making, enterprise combination, consumption pattern and employment status of different farm households would be influenced by their characteristics. For this reason, the socioeconomic background of sample litchi growers particularly the age of the farmer, educational status, occupation, household income and household expenditure are discussed in this chapter.

5.1 Distribution of Age among the Selected Litchi Growers

Age plays an important role in the crop production and better management of the farming activities. It could be seen that age of the working people varies from 25 to 65 years in the study areas. The age groups of the selected litchi growers were classified into four categories in this study such as below 30 years; 31-40 years; 41-50 years; and above 50 years.

Table 5.1 Age distribution of the selected litchi growers

Age group (years)	Number of litchi growers	Percentage of total litchi growers
Below 30	8	10
31-40	30	37.50
41-50	22	27.50
Above 50	20	25.00
Total	80	100

Source: Field survey, 2019.

Table 5.1 indicates that the highest number of selected litchi growers was 37.50 percent belonged to the age group of 31-40 years. About 10 percent of the selected litchi growers were in the age group of 20-30 years and that 25 percent were in the group of above 50 years; 27.50 percent were in 41-50 years. So, maximum litchi growers belong to the age group of 31-40 years.

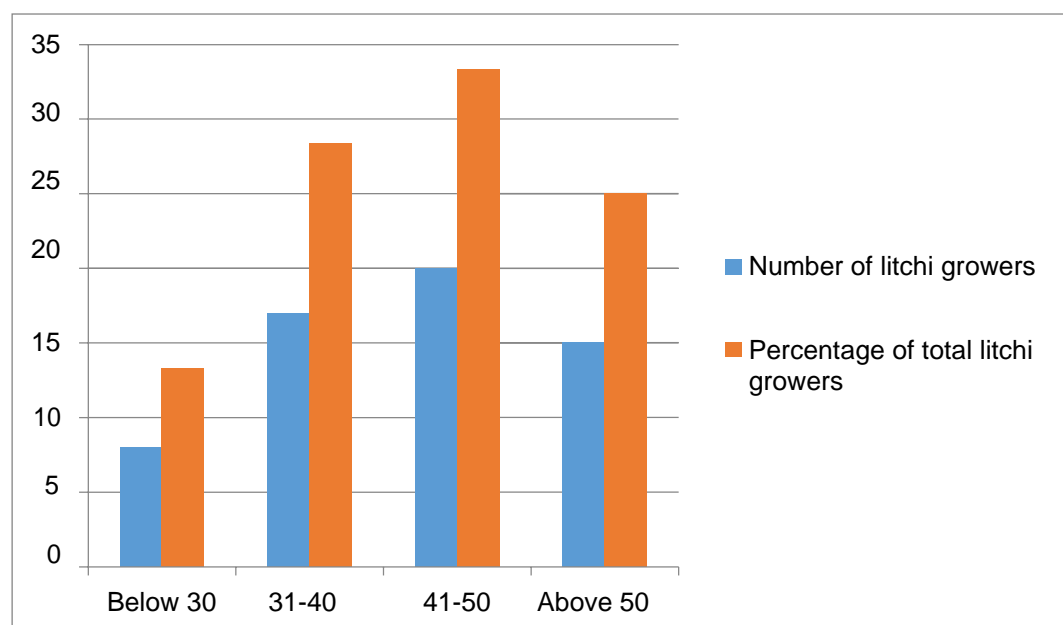


Figure 5.1 Age distribution of selected litchi growers

5.2 Literacy Level of Selected Litchi Growers

In agricultural production, education is an important element of decision making process of agricultural products. It plays a vital role in the acquisition of information about the innovation in various production processes of agriculture. In order to adopting improved technology and scientific knowledge regarding farming education plays a significant role. Educated litchi growers can have better access to the relevant technical information for improved production and can make rational economic decisions. It makes a man more capable to manage scarce resources and hence to earn maximum profit.

Table 5.2 indicates that 11.67 percent were illiterate, that means the majority of the were literate, among which 20 percent were educated up to primary level, 33.33 percent of the selected were educated up to secondary level, 26.67 percent of the selected growers were educated up to higher secondary level and 8.33 percent of selected up to graduation level. So most of the selected litchi growers were educated up to secondary level and they are in need of certain knowledge of farming and technology.

5.2 Educational status of the selected litchi growers

"Literacy level	Number of litchi growers	Percentage of litchi growers
Literate	15	11.67
Up to primary	18	20
Up to secondary	25	33.33
Up to Higher Secondary	22	26.67
Up to graduation and above	10	8.33
Total	80	100

Source: Field survey, 2019.

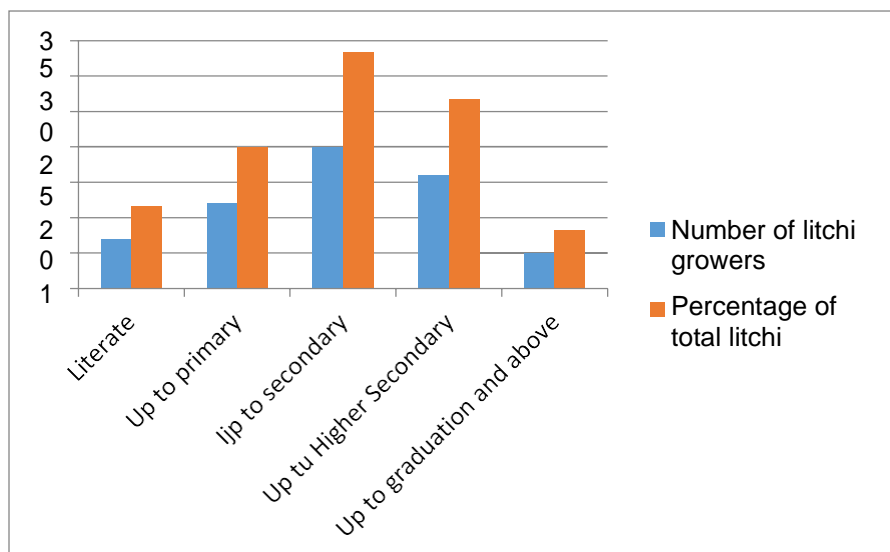


Figure 5.2 Educational status of selected litchi growers

5.3 Occupation of the Litchi Growers

The litchi growers are engaged in various types of occupation. The main occupation of the farm family considered in the present study was the occupation from which most of the income was earned. The distribution of principal occupation varies greatly depending on how much they are involved and what level of income is earned from the present occupation. Main source of income of the sample litchi growers is rice and litchi cultivation, limited numbers of people are

Engaged in other occupation like Vegetable cultivation business and other services (teacher, village doctor etc.). The occupations of selected litchi growers of different categories are presented in Table 5.3. Most of the litchi growers in the study area were involved in agriculture (85%). Generally a rational farmer of the study area cultivates rice and involved in litchi orchard farming. But besides their main occupation 10 percent litchi growers are businessman and 5 percent farmer earn their income from different services.

Table 5.3 Distribution of sample litchi growers according to their main occupations

Occupation	Number of litchi growers	Percentage of total
Agriculture	68	85
Business	8	10
Service	4	5
Total	80	100

Source: Field survey, 2019.

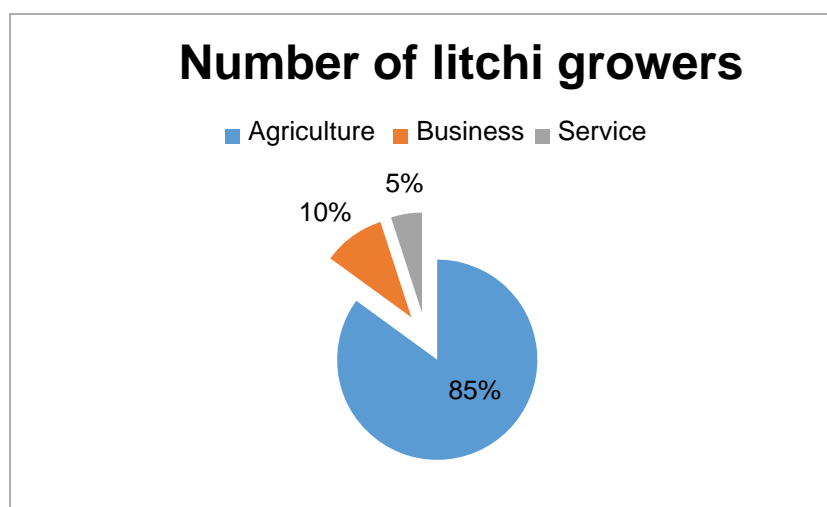


Figure 5.3 Distribution of sample litchi growers according to occupation

5.4 Training Received by the Litchi Growers

Training is the most important tool for acquiring knowledge about a technology. It will increase farmer's skill regarding production practices and related aspects. It may be observed from Table 5.4 that on an average sample litchi growers receiving 70 percent agricultural training. It is noted that 13.75 percent litchi growers had no any institutional training regarding agriculture. Litchi growers of Sadar Upazila received more training facilities than Pirganj Upazila. This is due to lack of training facilities of litchi cultivation and the distance of the field level workers from the litchi growers for training.

Table 5.4 Distribution of sampled litchi growers according to the training received

Location	Number of training receiver	Number of respondent not receiving training
Thakurgaon sadar Upazila	27	7
Pirganj Upazila	29	4
Total amount	56 (70%)	11 (13.75%)

Source: Field survey, 2019.

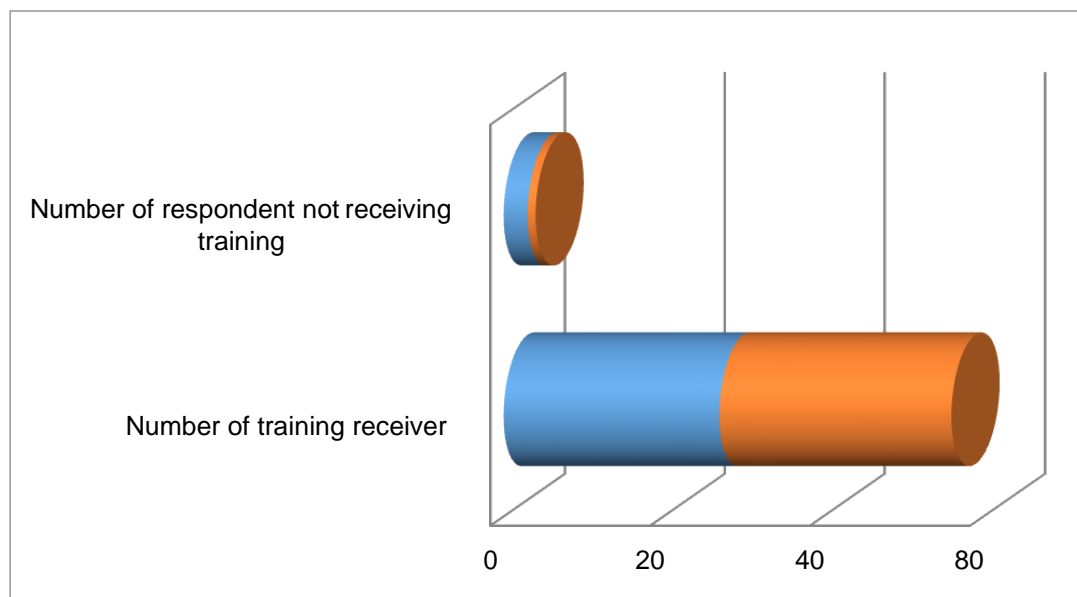


Figure 5.4 Distributions of sampled litchi growers according to the training received

55 Litchi Varieties Grown by the litchi growers

Variety is very important for litchi production because the amount of yield and profit largely depends on litchi variety. Different varieties of litchi are grown in litchi orchard those are Bombai, Madrazi, China-2, China-3, Bedana etc. among these varieties Bombai is the highest in number of litchi trees are grown which gives comparatively highest yield than others. Madrazi gives lower production than Bombai and it is disease intensive. Bedana is highly demandable among all other varieties, ^haina-2 and chaina-3 do not give production in every year. Table 5.5 shows that the share of Bombai is highest (62.69%) among the total variety.

Table 5.5 Distribution of trees according to varieties

Name of the variety	Number of trees	Percent of the total varieties
Bombai	1810	62.69
Madrazi	721	24.97
Bedana	180	6.23
China-2	103	3.57
China-3	73	2.54
Total	2887	100

Source: Field survey, 2019.

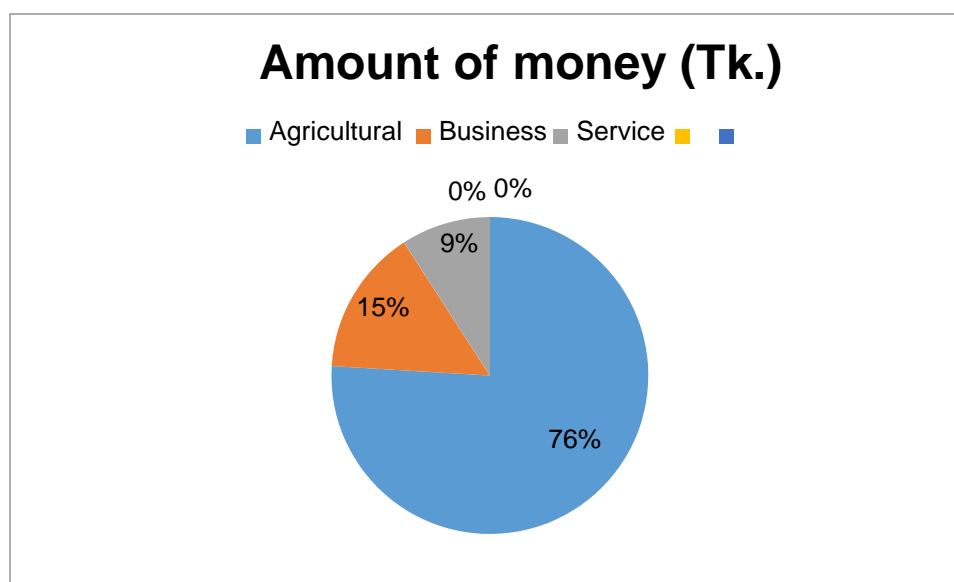


Figure 5.5 Distribution of trees according to varieties

5.6 Sources of Household Income

The level of income reflects upon the socioeconomic status of sample litchi growers. In the study areas, source of household income includes every form of income, e.g. agriculture, business and service, salaries and wages etc. and the average household income can be used as an indicator of standard of living.

Average annual household incomes of the selected litchi growers are presented in Table 5.6. Thus, agriculture was the highest contributor to the household income and it was 76 percent for business and services it was 15 and 9 respectively. So, from the results it can be concluded that agriculture was the significant contributor of the household income. '

Table 5.6 Average annual farm household income

Source of household income	Amount of money (Tk.)	Percent of total (%)
Agricultural	233000	76
Business	45800	15
Service	28000	9
Total	306800	100

Source: Field survey, 2019.

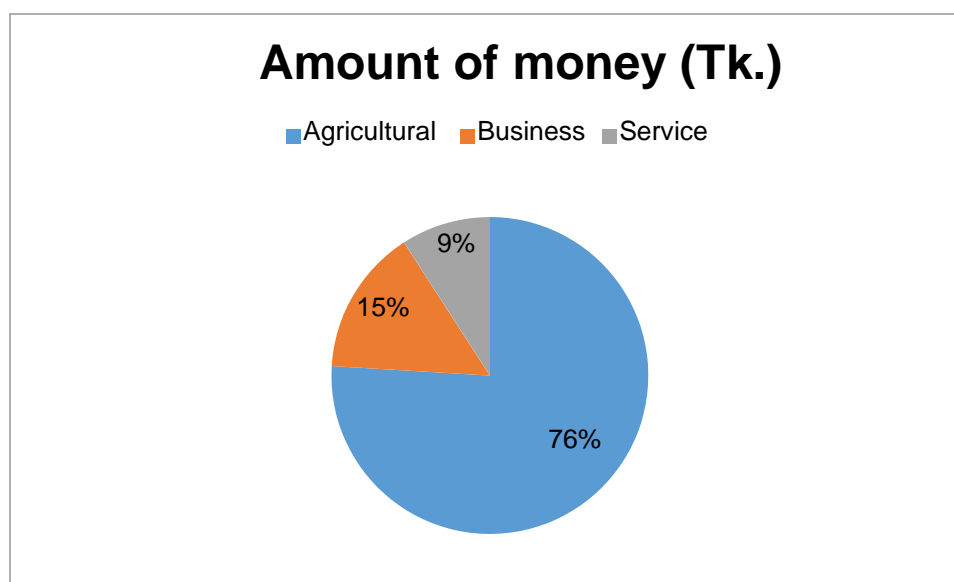


Figure 5.6 Average annual farm household income

5.7 Household Expenditure

Household income was spent on different heads such as food, clothing, health care, education, housing, farming, electricity and miscellaneous in the study areas. Table 5.7 shows annual expenditure of farm households. From the Table it can be seen that the highest expenditure spent on farming (29.31%). For the other sectors such as food, clothing, health care, education, housing and furniture, electricity and miscellaneous the percent of expenditure is 25.44, 8.39, 4.07, 16.89, 13.53, 0.67 and 1.68 percent respectively.

Table: 5.7 Average annual heads of expenditures of farm households

Heads of Expenditure	Amount of money (Tk.)	Percent of the total expenditure (%)
Food	75800	25.44
Clothing	25000	8.39
Health care	12123	4.07
Education	50335	16.89
Housing and Furniture	40328	13.53
Housing and furniture	40328	13.53
Farming	87401	29.31
Electricity /fuel	2013	0.67
Miscellaneous	5000	1.68
Total	298000	100

Source: Field survey, 2019

58 Concluding Remarks

This chapter analyzed the socio economic condition of respondents. The finding of the analysis presented from section 5.1 to 5.8, clearly indicate that socioeconomic characteristics differ from each other in respect of age, literacy rate, occupation, training, household income and expenditure. Litchi production creates a great impact on their socioeconomic condition.

Chapter 6

COSTS AND RETURNS OF LITCHI PRODUCTION

This chapter deals with the estimation and analysis of cost and returns from litchi orchard. Profitability is one of the major criteria for determination of acceptance of a crop. An attempt has been made in this chapter to determine per acre total costs, gross return, gross margin and net return of litchi production in selected areas. All these cost and returns were calculated for duration of four months (February to May) operation of growing litchi.

6.1 Estimation of Production Cost of Litchi

When the cost of inputs deducted from the value of output, then it expresses the profitability analysis. In calculating the production cost some components were considered. Those are human labor, fertilizers, irrigation, insecticides, safety and security operation, interest on operating capital and land rent cost. For the convenience of analysis, cost items were classified into two groups: (a) variable cost and (b) fixed cost.

6.1.1 Variable cost

Variable costs are the cost of using the variable inputs. These costs vary with the level of production and using various inputs such as labor, organic and inorganic fertilizer, irrigation, insecticides and vitamin etc. are considered as variable costs. Costs of using these inputs are discussed below:

6.1.1.1 Cost of labor

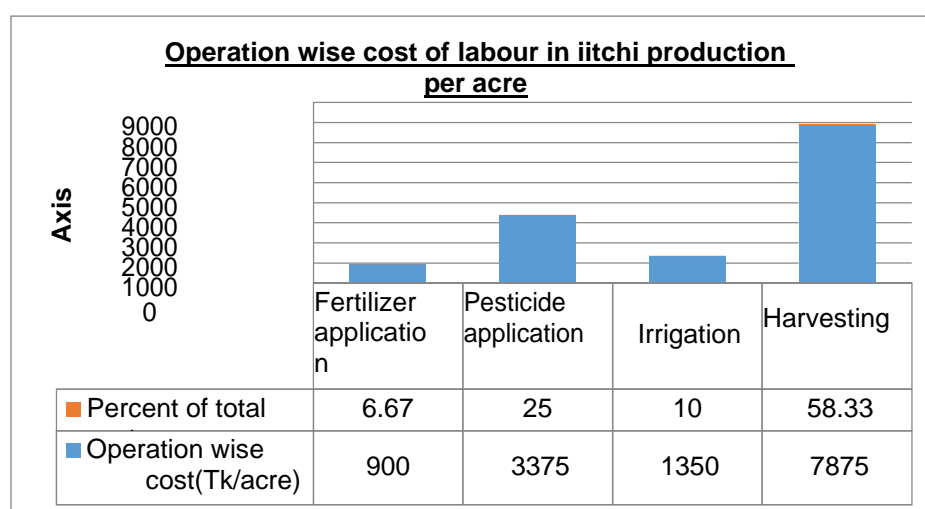
Labor required for almost all the operations of litchi production such as fertilizing, insecticide, harvesting, etc. and there were two sources of supply of human labor in the study areas, one was family labor and another was hired labor. Family labor included the farmer himself and his family members. Labor was measured in terms of man-day unit which consisted of 8 hours of work by an adult man. For child and women, man equivalent hours were estimated. The valuation of purchased labor was done as the nominal cash wages paid plus the monetary value of kind payments provided by the litchi growers. Average wages of the purchased labor was taken as the opportunity cost of home supplied labor. In the study area, the average wage rate was Tk. 220.00 per man-day. However, this rate varies from 150 to 250 per man-day basis of different operation of litchi production.

Table 6.1 reveals that in litchi production per acre total labor cost Tk. 1350. Among the labor cost 6.67, 25, 10, and 58.33 percent were spent for using fertilizer, pesticide, irrigation and harvesting respectively.

Table 6.1 Operation wise cost of labor in litchi production per acre

Labor types	Cost of labor Tk./man day	No. of labor	Operation wise cost	Percent of total cost
Fertilizer application	300	3	900	6.67
Pesticide application	375	9	3375	25
Irrigation	270	5	1350	10
Harvesting	525	15	7875	58.33
Total		32	13500	100

Source: Field survey, 2019.



6.1.1.2 Cost of fertilizer

In litchi production, fertilizer was applied mainly after harvesting litchi. Sometimes small quantity of fertilizer applied before fruiting of litchi. Fertilizers have slight importance in litchi production. Litchi growers used different types of fertilizers such as urea, TSP, MP, Boron, Zink and organic manure etc. The total cost of fertilizer was Tk. 2512 in case of litchi production.

Table 6.2 Per acre cost of applying fertilizer

SL. No.	Types of fertilizer	Quantity (kg)	(Tk./Kg)	Total cost(Tk.)
1	Organic Manure	11	3	33
2	Urea	9	16	144
3	TSP	7	25	225
4	MP	10	16	160
5	Other	13	150	1950
Total				2512

Source: Field survey, 2019.

6.1.1.3 Cost of Insecticides

Litchi growers used different kinds of pesticide to protect their litchi from the attack of pest and diseases. Name of some insecticides which are used in litchi production are rival, ripcord, nitro, companion, carbon dazing and alba etc. Cost of insecticides was calculated on the basis of actual amount of money paid by the litchi growers. On an average, per acre cost of insecticides was calculated at Tk. 8715 which constituted 7.37 percent of the average total cost of production (Table 6.3)

6.1.1.4 Cost of irrigation

Irrigation is an essential input for cultivating litchi. Most of the litchi growers had to pay mechanical irrigation water charges and they used manual labor for irrigation. In the study area most of the litchi growers used Shallow Tube Well (STW) for irrigating their litchi orchard. production period litchi orchard need 5 to 7 time irrigation. Considering all the sampled litchi growers, average irrigation cost per acre was estimated at Tk. 3392 which constituted 2.86 percent of total cost of production (Table 6.3).

6.1.1.5 Safety and security operation

Litchi is a fruit crop. It needs extra care than cereals and Vegetables. Watch man is must in a litchi orchard at the time of fruiting to harvesting to protect the litchi fruit against thief. Year wise extra cost also needed in litchi production such as pruning of branch, fence around the orchard (if the branch lies near to the soil), and covering the fruit for protecting from bird etc. on the basis of this safety and security operation, on an average Tk. 16515 is needed per acre. This is 13.96 percent of the total cost.



Figure 6.2 Safety and Security Operation of litchi

6.1.1.6 Total variable cost of production

Total variable cost included all cash expenses/ hired variable input costs and non-variable cost of litchi was Tk. 44634 per acre. However the cost incurred for cultural and management practices include human labor. Some variable cost was quite higher for those litchi growers who have not proper knowledge and training facilities about litchi cultivation.

6.1.2 Fixed cost

Fixed cost are those which do not change in magnitude as the amount of output changes and are incurred even when production not undertaken. The interest on operating capital and land use cost (with litchi tree) were considered as fixed cost for litchi production.

6.1.2.1 Rental value of land (with litchi tree)

Rent of the land (with litchi tree) varies from different period of time (Usually it varies from 1 to 6 years). Land use cost varies from one place to another depending on the location, soil fertility, topography of soil etc. In the study area rental value of land also varies depending on number of trees per acre and age of the litchi tree within the orchard. On the basis of the information from the sample litchi growers, the rental value of land varies from Tk. 80000 to Tk.125000 per acre. The average amount of rental value of land is Tk. 65332 per acre.

6.1.2.2 Interest on operating capital

Interest on operating capital (IOC) was calculated by taking into account the amounts spent for different operations such as cost for human labor, fertilizers, manure, insecticides, etc. Moreover, not all the operating costs were incurred at the period of litchi production. Interest on operating capital was calculated by taking into account the costs incurred on all field operations but excluding those items for which interest had already been calculated. Interest on operating capital was worked out on the basis of opportunity cost principle, that is, it was assumed that if the litchi growers borrowed the money from a bank, they had to pay the interest at the same rate. Therefore, the standard formula for calculation of operating capital is as follows (Miah, 1987):

Interest on operating capital (IOC) = $AI \times i \times t$ Where,

AI= average investment = (total investment/2)

i=interest rate which was 11 percent during the study period; and

t=length of the period of litchi production (Falgun-Jaistha=4 months)

Table 6.3 shows that the estimated capital was Tk. 8279.52, which is 11.86 percent of their total cost of production.

6.1.2.3 Total fixed cost

Table 6.3 reveals that on an average, fixed cost of litchi cultivation was Tk. 73611.52 per acre. Land use cost shared 88.75% of fixed cost.

6.1.3 Total cost

The total cost was calculated by adding up total variable cost and fixed costs. Table 6.3 represents the gross cost of litchi production. In the present study per acre gross costs for producing litchi were estimated at Tk. 118245.72 for litchi growers. Figure 6.2 shows the various cost items for all categories of litchi growers.

Table 6.3 Per acre costs of litchi production per season

Sl.NO.	Items	Amount (TK/acre)	Percent of total cost (%)
1.	Total Variable cost (a+b+c+d+e)	44634	-
a.	Labor	13500	11.41
b.	Fertilizer	2512	2.12
c.	Insecticide	8715	7.37
d.	Irrigation	3392	2.86
e.	S	16515	13.96
2.	Total Fixed cost (a+b)	73611.52	-
a.	Rental value of land	65332	55.25
b.	Interest on operating capital	8279.52	7.00
3.	Total cost	118245.72	99.97

Source: Field survey, 2019.

6.2 Gross Revenue

Gross revenue from litchi cultivation is the sum of the returns from different varieties of litchi. Table 6.4 shows the average gross return estimated for having 80 trees per acre. The production of litchi depends on the age of the tree. For the convenience of calculation, the age of litchi tree belongs the age bracket of 15 to 30 years was used to calculate the gross return from litchi production. Among all the varieties cultivated in the study area Bombai gives the highest production and that of, Madrazi gives lower litchi production than Bombai but it gives early production of litchi and it also disease intensive. China-2 and Bedana have got the higher price. China-3 gives lower production in the study area.

Table 6.4 Per acre gross return earned from litchi orchard per season

SL No,	Litchi varieties	Number of tree planted	Quantity(piece)	Price (Tk./ per litchi)	Return from different varieties (Tk.)
1.	Bombai	53	94000	1.9	171000
2.	Madrazi	17	27000	1.1	29700
3	Bedana	5	18000	1.5	27000
4.	Chaina 2	3	7500	1.3	9750
5.	China 3	2	4000	1	4000
Total revenue					241450

Source: Field survey, 2019.

6.3 Gross Margin

Gross margin is the difference between the gross return and total variable costs. The argument for using gross margin analysis is that the litchi growers of Bangladesh are more interested to know their return over variable costs. Per acre gross margin of litchi production amounted Tk. 196816 per season.

Table 6.5 Per acre cost and profitability of litchi per season (considering)

1.	Total variable costs	44634
2.	Total fixed costs	73611.52
3.	Total cost (1+2)	118245.72
4	Gross revenue	241450
5.	Gross margin (4-1)	196816
6.	Net revenue (4-3)	123204.28
7.	BCR(4/3)	2.04

Source: Field survey, 2019.

6.4 Net revenue

Net return is obtained by deducting all costs from gross return. Table 6.5 reveals that per acre net return of litchi considering' all varieties is Tk. 123204.28 which means litchi production is a profitable enterprise.

6.5 Benefit Cost Ratio (BCR)

Benefit cost ratio (BCR) is the ratio between gross return and total cost. From table 6.5 it seems that, gross revenue is TK. 241450 and total cost is TK. 118245.72. So Per acre BCR of litchi are 2.04. Now we can say that litchi production is profitable.

6.6 Concluding Remarks

Litchi provided high return to the litchi growers . Higher yield of litchi largely depends on climate of the year of production, after than timely operation and appropriate level of input use are important for achieving higher profit. From the previous discussion it is easy to understand about the different cost items and their application doses, yields and returns per acre of litchi cultivation. Timely and efficient use of inputs are the most important to increase production and profitability. It is evident from the results presented in the summary Table 6.5 that litchi cultivation is a profitable business and the litchi growers achieved higher level of profit per acre of litchi orchard.

CHAPTER 7

FACTORS AFFECTING PRODUCTION OF LITCHI

7.1 Introduction

In order to estimate the effects of various inputs for the production of litchi. Cobb-Douglas production function model was chosen, because of its best fitness and significant effects of using various inputs or returns from producing litchi. In the analysis of litchi we could see that six independent variables such as costs of human labor, Land rent, insecticide, Fertilizer and manure, Irrigation and safety and security cost were taken into considerations, which have an impact on production of Litchi respectively. All variables were expressed in monetary terms.

7.2 Functional Analysis

Functional analysis was designed to this study as the contribution of resources involved in the production of these enterprises. Production function analysis was carried out to find out the productivity of the individual inputs. The general model was specified comprehensively in such a way that it can specify adequately the production process of the litchi.

The specification of the Cobb-Douglas production function for litchi was as follows:

$$\ln Y = a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + U_i$$

In the Linear form it can be written as follows:

$$\ln Y = a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + U_i \text{ Where,}$$

Y= Gross Revenue (Tk. /acre);

X₁=Human labor cost (Tk. /acre);

X₂=Land rent cost (Tk. /acre);

X₃=Insecticide cost (Tk. /acre);

X₄= Fertilizer and manure cost (Tk. /acre);

X₅=Irrigation cost (Tk. /acre);

X₆=Safety and security cost (Tk. /acre);

a = Intercept;

b₁, b₂, b₃, b₄, b₅, b₆, = The coefficient of the respective variable to be estimated;

U_i = Error term.

7.3 Estimated Values of the Cobb-Douglas Production Function Model of litchi

Estimated values of the coefficients and related statistics of the Cobb-Douglas production functions of litchi are presented in Table 7.1.

The major criterions of the model are:

- ❖ For testing the significance level of individual coefficient one, five and ten percent

probabilities were used and

- ❖ Total variation of the output was measured by coefficient of multiple determination (R^2);

7.4 Interpretation of the Results

The independent impact of each of the variables on gross income for producing Litchi is interpreted below:

Table 7.1: Coefficient and related statistics of Cobb-Douglas production function of Litchi.

Explanatory Variables	Litchi			
	Estimated coefficient	Standard errors	t-value	P value
Constant	7.69	1.65	4.66	0.03
Human labor cost (X_1)	0.16***	0.10	1.60	0.08
Land rent cost (X_2)	0.03	0.25	0.13	0.90
Insecticide cost (X_3)	0.08*	0.06	1.83	0.03
Fertilizer and manure cost (X_4)	0.05**	0.27	2.34	0.02
Irrigation cost (X_5)	0.06*	0.04	1.19	0.03
Safety and Security Cost (X_7)	0.60*	0.09	-1.95	0.01
R^2	0.82			
Adjusted R^2	0.79			
F- value	15.42			
Return to scale ($\sum b_i$)	0.98			

Source: Author's calculation, 2020.

- *=Significant at 10 percent level;
- **=Significant at 5 percent level and
- ***=Significant at 1 percent level.

7.4.1 Explanation of Explanatory Variables of Litchi

Human labor cost (X_1):

The calculated regression coefficient of Human labor cost for litchi was 0.16 which was positive for litchi and was significant at 1 percent. It indicates that, an increase in 1 percent of money spent on Human labor cost, keeping other factors constant, would result in increase of gross return by 0.16 percent for litchi (Table 7.1).

Land rent cost (X_2):

The result showed that the Land rent cost of the farmers had a positive coefficient and it was 0.03. The meaning is, other things remaining the same, one percent increase in the land rent the farmer gross return will increase by 0.03 percent and (Table 7.1).

Insecticide cost (X_3):

The regression coefficient of insecticide cost was 0.08 which was positive for litchi and was significant at 10 percent. It indicates keeping all other factors constant, 1 percent increase in insecticide cost would increase gross return by 0.08 percent for litchi and for insecticide cost the P-value became 0.03, which is significant at 10% level of significance (Table 7.1).

Fertilizer and manure cost (X_4):

The coefficient of Fertilizer and manure cost for litchi was 0.05 which was positive for litchi and was significant at 5 percent. It indicates that keeping other factors constant, 1 percent increase in fertilizer and manure cost would increase the gross return by 0.05 percent for litchi. The P-value for fertilizer and manure cost became 0.02, which is significant at 5% level of significance (Table 7.1).

Irrigation cost (X_5):

The coefficient of Irrigation cost for litchi was 0.06 which was positive and indicated that keeping other factors constant, 1 percent increase in Irrigation cost would increase the gross return by 0.06 percent for litchi. The P-value for irrigation cost became 0.03, which is significant at 10% level of significance (Table 7.1).

Safety and Security cost(X_6):

The coefficient of Safety and security cost had a positive coefficient and it was 0.60 with one percent level of significant and indicated that keeping other factors constant, 1 percent increase in safety and security cost would increase the gross return by 0.60 percent for litchi (Table 7.1).

Value of R^2 :

The coefficient of determination R^2 of the model was 0.82 for litchi which indicates that about 82 percent variation in the gross return from litchi has been explained by the explanatory variables, which were included in the model (Table 7.1).

Adjusted R^2 :

The adjusted R^2 was at 0.79. It indicated that about 79 percent of the variation in the dependent variable was explained by the explanatory variables in the model (table 7.1).

Goodness of fit (F-value):

The F- values of the estimated production function were significant at one percent probability level for litchi farmers, (Table 7.1), which implies good fit of the models. That is, all explanatory variables included in the model were important for explaining the variation of litchi production

Return to scale ($\sum b_i$)

The summation of all the regression coefficients or production elasticity of the estimated model gives information about the returns to scale, that is, in response of output to a proportionate change in all inputs. The sum of all the production coefficients of the equations for litchi production was 0.98 (Table7.1). These indicate that the production function exhibited decreasing returns to scale for the selected farming production was 0.98 (Table7.1). These indicate that the production function exhibited decreasing returns to scale for the selected farming.

7.5 Conclusions

The overall performance of Cobb-Douglas production function model for Litchi productions was satisfactory as indicated by the estimated R^2 . The estimated values of the model, however confirm that the selected variables had significant impacts on the gross return of litchi productions.

Chapter 8

PROBLEMS AND CONSTRAINTS IN LITCHI PRODUCTION

There are several problems mentioned by the litchi growers in the study area which are classified on the basis of the objectives.

8.1 Socioeconomic Constraints

Litchi growers in the study area mentioned some socioeconomic problems and constraints which affected litchi production. The summary of socioeconomic constraint is discussed in the following sections:

Lack of technical knowledge of growing trees:

Knowledge is powerful tool to increase productivity of any crop. The litchi growing in the study areas mentioned that they lacked proper knowledge regarding various aspects of litchi production. The knowledge gap prevails in every stage of litchi production. Most of the litchi growers had knowledge gap about new varieties, plant treatments, soil test, optimum sowing of litchi plant recommended fertilizer management which were essential for yield increment. It may be mentioned that there have not enough opportunity of the 92 percent respondents received training on any aspect of litchi.

Lack of operating capital:

This is a common problem of the subsistence farming in Bangladesh. Litchi production required considerable amount of investment due to land preparation, purchase of various inputs such as litchi plant, fertilizer, labor, pesticide etc. which the 32 percent small litchi growers cannot easily afford.

High price, imbalance and use of fertilizer:

Fertilizer is indispensable for increasing crop productivity. Sometimes soil related constraints severely limit crop productivity or may even make a desired cropping pattern agro economically impractical (Ahmed *et al*, 1996). Based on 35 percent litchi growers' opinion, the third ranking socioeconomic constraint was high price and scarcity of fertilizers. Such problem lead to apply fewer amount of fertilizers which further aggravated the unbalanced use of comerial fertilizer per acre is increasing over the years, still the used less than recommended and imbalance doses.

Inefficient marketing systems and low product price:

Modernization of agriculture involves higher investment as well as more risk, namely, physical loss through natural calamities and price risk. Thus markets and marketing policies plays a crucial role in modernizing subsistence agriculture. A successful production programme requires, apart from modern variety and improved production technologies, a satisfactory deliver system of inputs and positive and effective pricing and marketing policies for the output. Bangladesh agriculture is dominated by very small (average farm size less than 2.49 acre), do not get the appropriate price of their products due to an unorganized marketing system. Price of any product is very important for marketing decision for the next time crop production. Inefficient marketing systems and the price of litchi was low when the litchi growers want to sell it to the market. But if they sell the whole garden before harvesting period they get the legal price from the syndicate and 52 percent growers faced this problem.

Lack of loan facilities: Litchi is capital intensive enterprise and its needed large amount of money for cultivation but many of the litchi growers could not afford it. For this reason they have to take loan. In the study areas, Rajshahi Krishi Unnayan bank (RKUB), Grameen Bank (GB), and Palli Daridro Bimochan Foundation (PDBF) provided credit for the purpose of agriculture and they charge a higher amount of interest rate. The 48 percent producers also faced problems in obtaining bank loans for different terms and conditions and sometimes they do not get loans in due time. Therefore, the litchi growers have to borrow money from other source such as money lender with high interest rate.

Inadequate extension services: The extension personnel are responsible to provide the latest information to the litchi growers. Litchi growers were using traditional method of cultivation or sometimes by the help of the advice of neighboring /relatives/traders. The litchi growers mentioned that they obtained little technical suggestion from workers and Upazilla Agricultural Officers (UAO). Most of the litchi growers complained that, extension officers or SAAO did not visit their areas regularly/timely and did not contract to the all because their lands are not close to the roped sides or nearby markets, they did not help them.

Lack of storage facility:

Though litchi is a perishable fruit, it needs space for storage. Litchi can stored by processing it in different types of fruit products such as litchi juice, jam, litchi nuts, litchi candy etc. which is totally unknown to the farmer of Bangladesh and there is not enough litchi processing industries in

the study area. Due to lack of proper knowledge, the 43 percent of litchi growers could not store their produced litchi in proper place resulted storage loss. On the other hand, they could not keep it for selling later on when market price would go up.

8.2 Production Constraints

The main problem is unavailability of space and good quality seed/seedlings. The major production problems are irregular flowering and poor fruit retention, while alternate bearing and small fruit size can also reduce grower returns. Trees take three to five years to come into production, and will not produce substantial crops until year seven or eight humidity less than 60%.

Stealing: Stealing of litchi is also a problem in litchi production and the guard needed to protect litchi from stealing create extra cost for litchi growers. The 83 percent of litchi growers faced this problem.

Natural calamities: Sun-burning and skin-cracking in developing fruits is a serious problem in litchi. High temperatures, low humidity and soil moisture conditions during fruit development promote this disorder and 92 percent of litchi growers indicated this problem. Inadequate moisture during early period of fruit growth results in the skin becoming hard and sun-burnt. It may crack when it is subjected to increase internal pressure as a result of rapid aril growth following irrigation or rain. Fruit cracking in litchi is also favored if temperature goes above 38° C and relatively.

Damaged caused by insect and diseases: It is also a matter of great concern for the litchi growers. They require regular chemical control measures for pests and suffer heavy losses to b and fruit bats in some areas if not netted 97 percent respondent indicates it as their problem.

Low price of litchi: The fruits only ripen on the tree and have short shelf- life without refrigeration as the crop deteriorates very quickly after harvest. So, it needs quick sell. Intermediaries get the chance and give the growers lower price. If growers could not sell their litchi, the litchi were deteriorates and above 50 percent litchi growers indicated this problem.

8.3 Managerial and technical problems

There are some other constraints which gathered through observation and discussion with litchi growers, personnel of GO and NGOs. These constraints are to cut the litchi plant by the elite of the society, introduce alternative profitable crops, lack of specific enterprise wise training

facilities, there is not proper marketing channel fixed by government for litchi, sun burn of litchi flowers, heavy wind, low temperature facilities, lack of knowledge about soil test, do not get fair price etc. in the study area under litchi production. Maximum respondent indicate lack of training facilities as their main managerial and technical problem.

8.1 Problems faced by the litchi growers

Name of the problem	Number of growers	Percentage of growers reporting the problem
Inadequate extension services	80	95
Natural calamities	60	92
Damaged caused by insect and diseases	58	97
Lack of technical knowledge of growing trees	55	92
Stealing	50	83
Inefficient marketing systems and low product price	31	52
Lack of loan facilities	29	48
Lack of storage facility	26	43
High price, imbalance use and spot of fertilizer	21	35
Lack of operating capital	19	32

Source: Field survey, 2019.

8.4 Farmers Suggestion to Overcome Problems and Constraints

The litchi growers in the study areas were requested to give suggestions to overcome the constraints identified earlier in litchi production.

Their suggestions are discussed below in brief: Provision of training on litchi production: Training is an important tool to enhance knowledge and skill. Formal training should be provided to the litchi growers by the government authorities and responsibilities of local agriculture officers should be monitored periodically by some higher authorities.

Introduction of storage and processing facilities: In the study areas growers did not receive higher price due to lack of storage facility or processing industries. The total government authority may develop low cost storage facilities at the primary and processing industries at secondary

markets. This would provide storage facilities to the litchi growers. Some processed products of litchi are shown below:



Fig 8.1:Some storage product of Litchi

Availability of input subsidized rate: Good variety of litchi plant, fertilizer and insecticides are important inputs for producing litchi. So, these inputs should make available to the litchi growers at subsidized rate. Litchi growers proposed those valuable solutions for higher production of litchi. Government should take due steps to encourage litchi growers in litchi production.

Provide proper price of litchi: Product price is an important item to the litchi growers for higher production of litchi. Above 95 percent of Litchi growers suggested that there are huge differences of price among different intermediaries. Harvesting price should be fixed by the government like other crops which would be acceptable to all.

Availability of institutional credit: Need cash money at the time of cultivation. So, institutional credit facilities should be made available at the right time of the litchi growers for increasing the volume of production. Government should provide such facilities through various institutional and non-institutional sources at low interest rate on easy terms and conditions.

To improve marketing facility: In the study areas the 52 percent litchi growers reported that they were faced serious problem due to lack of marketing facilities, A dependable transportation system is another prerequisite for the successful operation of the marketing system. Transport facilities the movement of goods from places where they were less useful to places where they were in much demand. They furthermore suggested that market information and weather forecasts should be

made at right time. On the basis of priority, village roads should be developed at least brick bedded road so that rickshaws or motor vehicles could move easily. It should help to reduce transport cost. Market facilities such as *pucca* floor, tin shed, drainage, water supply, electricity supply, etc. should be arranged by the appropriate government authorities so facilitate proper markets of litchi in the study areas. Also government should ensure a stable price to stop market price fluctuation to establish formulation of farmers organization.

Formulation of farmer's organization: It is necessary to establish litchi growers' organization that might improve bargaining power of the litchi growers. It would help the litchi growers to face the intermediaries and ensuring them, better revenue from litchi production.

8.5 Concluding Remarks

The above discussion clearly indicates that litchi growers are facing a good number of problems in litchi production. In this regards, the litchi growers put forward a number of suggestions to overcome the aforesaid constraints. Therefore, it may be conducted that litchi acreage as well as its production could possibly be increased to large extent if the above mentioned problems could be solved.

Chapter 9

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

On the basis of discussion made on the earlier chapters, a summary of the results, some conclusions on the basis of empirical findings and policy implications to improve the existing inefficiency of litchi production in Bangladesh is presented in this chapter.

9.1 Summary of the Study

Agricultural sector play a significant role in supplying nutrition, creation of rural employment, poverty alleviation, earning foreign exchange and more importantly socioeconomic stability in the rural areas. Bangladesh is turning to be sick society due to huge malnutrition with a vast majority of people living below the poverty line. High population growth with declining death rate together with low growth in agricultural productivity adversely affects the living standard in the country. The present fruit production system is not sufficient to meet the domestic demand. Litchi is highly nutritious and high energy fruit source. The popularity of litchi as a fruit is gaining momentum year after year and it has reached such a point that people all over the country try to teats it in the summer season. So, litchi can be a great source of agricultural income.

Litchi has become now an important fruit crop in Bangladesh due to complementary cultivation with other crop in juvenile stage, higher yield and nutritional value. Profitability is certainly an important consideration to the litchi growers; or selection of crops and adoption of new technologies. The return from the litchi and the productivity of resources determine the availability of litchi growers to acquire, utilize and sustain a certain type and quantity of resources which in turn will be used for further increase of productivity, though the agricultural land of our country is limited we can increase litchi production by using higher yielding variety and proper care of litchi tree provide such facilities through various institutional and non-institutional sources at low interest rate on easy terms and condition.

Formulation of farmer's organization:

It is necessary to establish litchi grower's organization that might improve bargaining power of the litchi growers. It would help the litchi growers to face the intermediaries and ensuring them better return from litchi production.

9.2 Conclusions and Policy Recommendations

Flowing conclusions and policy recommendations are made based on millings of the study:

Conclusions

- Socioeconomic conditions of the litchi growers are relatively better compared to other enterprises produced by the farmers.
- The cultural and management practices of litchi growers are poor. Due to lack of knowledge about proper cultural and management practices they can not get better production of litchi.

considering the production period, litchi production is more profitable in the long-run compared to the short-run enterprises produced by the farmers

Litchi growers face many problems and constraints regarding cultural management and marketing from field to market or other place and distribution of litchi.

Recommendations

Management as well as varieties selection is important for improving yield and economic return of litchi production. Accordingly DAE and other related organizations should come forward to help farmers to this end.

Good variety of litchi plants supply should be increased.

A requisite number of cold storage should be established for the well preservation of litchi.

Establish linkage with banking institution for credit support.

Management practices should be improved by providing training on litchi production and distribution. GO and NGOs should arrange multi-disciplinary training on litchi production to enrich litchi growers' knowledge and skill.

The credit facilities should be available to the litchi growers through bank or financial institutions on easy terms and conditions to meet the cash requirements for litchi production.

The scheme of litchi insurance may be introduced to cover the risk and uncertainty prevailed in litchi production.

9.3 Limitations of the Study

The present for conducting the research in a manageable way the researcher consider the following limitations on litchi production in the study area. These limitations are as follows:

- a. The present study is mainly concerned with the production aspect of the litchi and was restricted to a particular area where litchi production was concentrated. Two Upazilas and four villages from these Upazillas were selected by simple random sampling. The study might provide more meaningful results if it covered a good number of Upazillas producing litchi.

- b. Most of the litchi growers did not keep record of their farming business. Then the researcher had to depend on the memory of the litchi growers. To overcome this problem, several visits were made by the researcher herself to ensure the collection of reasonably accurate data from the field.
- a) Age of litchi tree cannot consider in this research to identify the cost of production.
- b) Different varieties of litchi are ignored in terms of cost and benefits from litchi tree.
- c) In this study, only one important litchi growing area of Bangladesh was selected due to the practical situation. Covering all regions of Bangladesh would increase the accuracy and reliability of the study for comprehensive development policy.
- d) Profitability of litchi production is certainly influenced by the degree of efficiency of the marketing of inputs and outputs. The result of the study would be more enriched, if the study would include marketing aspects of input and output.
- e) Climate is gradually becoming more variable and also changing day by day. This has a greater impact on litchi production as well as production of other food crops and thereby on food security of farm households.

9.4 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 fruit as a whole or some of it. The weakness of the present study, of course, opens avenues of further research which are given below:

- a) A broad based study on the profitability of litchi production should be undertaken with and without intercropping of litchi.
- b) A comparative study can also be undertaken to assess the relative profitability of different varieties of litchi and other fruit crops.
- c) An aspect requiring further study is the variety of litchi currently being used by the litchi growers. It is suggested that carrying out a detailed survey for the development of litchi Varieties.

REFERENCES

- Aklimuzzaman IvL, Goswami G., Howiader J., Kadar H. A. and Hasan, IvL. K. 2011. Postharvest Storage Behaviour of Litchi. *journal of Horticulture, forestry and biotechnology*. Vol. 15(3), i-8.
- Amiruzzaman M. 1990. Post Harvest Handling and Processing of Fruits and Vegetables, In: Kitchen Gardening and Homestead Productive Activities.
- Akter R., Serajul Islam M., and Jahan H. (2015): Profitability of litchi production in Dinajpur district of Bangladesh. Vol.13 (2). pp. 283-289.
- Bangladesh Bureau of Statistics (BBS) 2016. Year Book of Agricultural Statistics of Bangladesh, Bangladesh Bureau of Statistics, Planning Division, Ministry of Planning, Government of the Peoples Republic of Bangladesh, Dhaka.
- Bangladesh Bureau of Statistics (BBS) 2017. Year Book of Agricultural Statistics of Bangladesh, Bangladesh Bureau of Statistics, Planning Division, Ministry of Planning, Government of the People s Republic of Bangladesh, Dhaka.
- Bangladesh Bureau of Statistics (BBS) 2018. Year Book of Agricultural Statistics of Bangladesh, Bangladesh Bureau of Statistics, Planning Division, Ministry of Planning, Government of the People s Republic of Bangladesh, Dhaka.
- Bangladesh Bureau of Statistics (BBS) 2019. Year Book of Agricultural Statistics of Bangladesh, Bangladesh Bureau of Statistics, Planning Division, Ministry of Planning, Government of the People s Republic of Bangladesh, Dhaka.
- Bangladesh Bureau of Statistics (BBS) 2020. Year Book of Agricultural Statistics of Bangladesh, Bangladesh Bureau of Statistics, Planning Division, Ministry of Planning, Government of the People s Republic of Bangladesh, Dhaka.
- Bose T, K., and Mitra S. K. 1990. Fruits: Tropical and Sub-tropical. Naya Prokash, 206 Bidhan SaranL India.
- Banglapedia, 2020. Litchi. Banglapedia, National Encyclopedia of Bangladesh.<http://en.banglapedia.org/index.php?title=Horticulture> [2-11-20].
- Barkar IvL. A. K. Z OI2. A study on economic efficiency and sustainability of Wheat Production in Selected areas of Dinajpur District. M.Sc. Ag. Econ. Thesis, Bangladesh Agricultural University, Mymensingh.
- Chowdhury M. S. M. 2009. Seed and Seedling Diseases of Some Selected Fruits of Bangladesh. Ph. d. Thesis, Department of Plant Pathology, Bangladesh Agricultural University, Mymensingh
- Chowdhury M. S. M., Hossain I. and Islam M. A. 2011. Seedling Diseases of Guava and Effect of Temperature, Rainfall and Humidity on the Prevalence.
- Crosse J. E. 1966. Epidemiological Relations of *Pseudomonas* Pathogens of Deciduous Fruit Trees, Annual Rev. of Phytopathol, 4:291-310.j. L. and Hardaker . D. 1993. Farm Management

Research Small Farmer Development, University of New England, Australia.

FAO, 2020. Production Yearbook, Food and Agriculture Organization of United Nations, Rome, Italy.

Gaian 5. V. 1989. Lychee Cultivation, FAG Plant Protection and Production Paper 83, FAG, Rome.

Gittmger. P. 1982. Economic Analysis of Agricultural Projects. 2nd edn., The Johns Hopkins University Press, Baltimore and London.

Goto, Y. B. 1960. Lychee and its Processing Pacific Region Food Con.

Hossain I. 2011, Nursery Diseases of Some Selected Fruit Species in Bangladesh. Eco-friencily Plant Disease Management Laboratory, Department of Plant Pathology, Bangladesh Agricultural University, Bangladesh, Mymensingh.

Hossain M. K. 1999. Shade Effect on the Yield and Quality of Pineapple in a Jackfruit-Pineapple agroforestry system. Unpublished [MS Thesis],

Hossain, M. L., Rubaiyat, A., Hasan, M. A. and Foysal, M. A. 2013. Economics of Homestead Forestry and Their Management Activities at Fatikchan Upazila of Chattagong district. Chattagong, Bangladesh.

<http://www.sciencepuDiismnggroup.com>

[Accessed on 23-03-2015]

jiang Y.M., Vvang Y., Song L., Liu H., Lichter A., Kerdchoechuen G., Joyce D.C., and Shi J., 2006. Postharvest Characteristics and Handling of Litchi Fruit -An overview. *Australian Journal of Expenmental Agriculture*, Vol. 4b(12): 3

Iviacfie G. B. 1955. Wrapping and Packaging of Fresh lychees. Florida Lychee Growers' Association Yearbook 1, 25-28 Postharvest practices and losses of litchi.

Jiang Y. M. and ruji. K. 1999. Rost harvest browning of Litchi Fruit by Water Loss and its Prevention by Controlled Atmosphere Storage at High Relative Humidity. *Lebensmittie Wissenschaft Technologic*, 32(5): 278-283 [Cited from CAB Abst. 2000].

Kaiser C. 1994. Pericarp colour retention of Litchi (*Litchi chinensis* Sonn.). South African Litchi growers Assoc. Yearbook, 6:32-35.

Khader A. A. 1992. Fostharvest Technology of Horticultural Crops, 2nd edn. Univ. of California, Divn. of Agriculture and Natural Resources, Publication.No.33-11.

- Maiti S. C. 1985. Litchi. In: Fruits of India, Tropical and subtropical, 1st edn. edited by T. K. Bose., Naya Prokash, Calcutta, India.
- Manandhar P. K. 1986. Introduction to Agroforestry in Bangladesh. Community Forestry Project Report, BCD/81/028, Banbhavan, Dhaka.
- Miah IvI. T. H. 1987. Appraisal of Deep and Shallow Tubewell Irrigation Project in the Tangail District in Bangladesh. Ms Thesis, Department of Agricultural Economics and Business Management, University of New England, Australia.
- Mian M. I. Jrt. and Hardaker, J. Rl., 1Vol. Benefit cost Analysis of deep and shallow Tubewell Projects in Tangail District in Bangladesh. *Bangladesh Journal of Agricultural Economic*. Bangladesh Agricultural University, Mymensingh.
- Minas K. P. and Frank . D. 2002. Litchi production in the Asia- pacific region. Bangkok. Thailand.
- Molla M. IVL, Islam M. IN., Nasr M. A. A. and Bhuyan, M. A. J. ZUIU. Survey on Postharvest Practices and Losses of Litchi in Selected areas of Bangladesh. *Bangladesh journal of Agricultural research*, Vol. (3): 439-451.
- Momen IvI. N., Kahim IvI. A., Rarouque A, IvI. and Choudhury M. b. H. 1993. Effect of some Coating Materials and Physical Measures on the Prolongation of Shelf Life of Banana, *Agric*. 4(i-2).
- Mondal F. M, 2000. "Production and Storage of Fruits" (in Bangla), Mrs. Afia Mondal, BAU Campus, Mymensingh.
- Mortensen C. N. 1997. Seed Biotechnology Laboratory Guide, Danish Govt. Inst. Seed Pathoi, Copenhagen, Denmark.
- Mukherjee S. K., Rao D. P., Mukherjee S., Ray M. and Mohanty B. B. 1983. *Indian } Hort* 40.
- Pathak V. IM. iv»u. Diseases of fruit crops, Uxtord IBrl Publishing Co., iNew Delhi.
- Rasel S. M. M. 2004. Identification of Tackfruit trunk Borer Species and Assessment of its Severity of Damage, Unpublished [MS Thesis], Department of
- Rashid M. H. 1993. A Comparative Analysis of Deep Tubewells with Buried Pipe and deep tubewells with open channel irrigation system in a selected area of Sakhipur thana of Tangail district.
- Rashid M. M. 1999. "Sabjibagan" (Olericulture, Second Ed.), Rashid publishing house, Joydebpur, Gazipur.
- Rashid M. M., Kadir M. A. and Hossain M. A. 1987. *Bangladeshher Fai* (Fruits of Bangladesh), Rashid publishing house, Joydebpur, Gazipur.
- Ribeiro I. J. A. and Pommer C. V. 2004. Breeding guava (*Psidium guajava*) for Resistance to Rust Caused by *Puccinia psidii*, *Acta-Horticulturae*, *capta-frutas*, Institute Agronomico, C.F. 28,

13001-970 Campinas, Brazil, Leuven, Belgium: International Society for Horticultural Science (ISHS).

Sathe M. S. N., 2011. Management of Nursery disease of Guava and Litchi: M.Sc. Ag. P. Path. Thesis, Bangladesh Agricultural University, Mymensingh.

Snowdon A. L. 1990. A Colour Atlas of Postharvest Disorders of Fruits and Vegetables Vol. 1, General Introduction and Fruits, Wolfe Scientific Ltd., London.

Uddin M. J. and Hasan M. K. 2003. Homestead Agroforestry in Char Areas at Noakhali: An Economic Analysis, *Bang: J Agri Ref* 28(3).

Underhill J. R., Coates L. Eds. 1994. *Postharvest Physiology and Storage of Tropical and Subtropical Fruits*. Edited by S. K. Mitra, CAB International, Wallingford, Oxon OX10 9DE, UK.

UNDP and FAO 1988. Land Resources Appraisal of Bangladesh for Agricultural Development, Report 1, Agro-ecological Regions of Bangladesh, UNDP.

Yessad C. S., Manceau C. and Luisetti J. 1994. Occurrence and specific Reactions induced by *Pseudomonas syringae* pv. *syringae* on bean pods, lilac and pear plants, Plant Pathology.

Young J. and Triggs C. M. 1994. Evaluation of Determinative Tests for Pushovers of *Pseudomonas syringae* Van HALL 1902, *J. Appl Bacteriology*.

Zaccardelli I., Spasiano A., Merighi I. and Bazzi C. 2003. Detection of *Pseudomonas syringae* pv. *tomato* by PCR, Presentations-From-the-6th-International-Conference on *Pseudomonas syringae* Pathovars and Related Pathogens, Maratea, Italy.

