ASSESSING THE CONTRIBUTION OF HARIBHANGA MANGO GARDENING ON FARM INCOME

A Thesis By

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MASTER OF SCIENECE IN AGRICULTURAL EXTENSION AND INFORMATION SYSTEM

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CERTIFICATE

This is to certify that the thesis entitled, **"ASSESSING THE CONTRIBUTION OF HARIBHANGA MANGO GARDENING ON FARM INCOME"** submitted to the Department of Agricultural Extension and Information System, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **Master of Science in Agricultural Extension and Information System,** embodies the result of a piece of bona fide research work carried out by **MOST. MARTUJA AKTAR** Registration No. **1910020** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

Dated: June, 2021

Place: Dhaka, Bangladesh

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Dedicated
To
My Beloved Parents

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The Author

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ASSESSING THE CONTRIBUTION OF HARIBHANGA MANGO GARDENING ON FARM INCOME

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ABSTRACT

The purpose of the study was to assess the contribution of Haribhanga mango gardening on farm income and to explore the contributing relationship between the farmers characteristics and contribution of Haribhanga mango gardening on farm income. The study has been conducted based on data collection in the selected villages of Rangpur Sadar upazila and Mithapukur Upazila. Data were collected from 105 mango growers with structured questionnaire from 2nd July to 21st July, 2021. Multiple regression was used to determine the contribution of selected characteristics of the mango growers on farm income. The results show that the highest proportion (70.5%) of the mango growers had medium contribution while 15.2 percent and 14.3 percent of them had low and high contribution, respectively. Among ten characteristics family size, knowledge on mango cultivation, experience in Haribhanga mango cultivation and number of Haribhanga mango tree had positive significant relationship while rest of the six characteristics i.e., age, educational qualification, size of mango orchard, training on mango cultivation, organizational participation, time spent in Haribhanga mango orchard management and number of Haribhanga mango tree had no significant relationship to assess the contribution of Haribhanga mango gardening on farm income. Therefore, it is recommended that the DAE, Horticultural Center, Mango Research Station and NGOs should take necessary steps considering the significant variables with a view to motivating the mango growers towards Haribhanga mango cultivation.

Key words: Haribhanga mango, Contribution, Farm income, Rangpur sadar and Mithapukur upazila of Rangpur district.

CHAPTER I

INTRODUCTION

1.1 General Background

Bangladesh basically an agro-based country, is considered one of the world's most densely populated country (1125 person per square kilometer) with an annual population growth rate 1.3 percent (BBS, 2020). About 50 percent of the population are employed in this sector and about 70% people overall depend on agriculture for their livelihood (Bangladesh Economic Review, 2021). There exists a little scope of horizontal expansion of land for increasing agricultural productivity. To increase farm income intensive use of land through scientific farming and horticultural crops cultivating would be one of the promising alternatives. Moreover, it is a method to fulfill farmers diversified need for higher return with a balance use of nutritional requirements (Singh et al.1986). In agriculture sector, subsistence farming is traditionally practiced by the farmers. But there is no cost benefit calculation. Now a days Bangladesh is in transition from subsistence agriculture to commercial agriculture. Many entrepreneurs are invested in agriculture. Farmers are commercially cultivating crops specially horticulture corps like mango, litchi, jackfruit etc. The rate of increase fruit production in our country has added a dimension to the agricultural economy, there is also a large contribution to the export potential. The existing mango based agro forestry is profitable and has a great opportunity to increase national production to feed the growing people (Khatun, 2015).

Mangoes are juicy stone fruits belonging to the genus Mangifera, cultivated mostly for edible fruit. The mango is native to South Asia, from where it has been distributed wild wide to become one of the most cultivated fruits in the tropics. It is an important and popular fruit in the world for its excellent flavors, attractive colors, delicious taste high nutritive value. Mango has great prospects in Bangladesh. It is one of the most common, important and popular fruit in Bangladesh. In Bangladesh mango ranks first in terms of area and third in production (BBS, 2008). Diversification with new varieties for export, processing, and the domestic market is resulting in the area to expand.

The Haribhanga mango is produced in the northern part of Bangladesh, specially in the Rangpur district. Haribhanga later popularized around 2003 by Abdus Salam Sarker. Cultivation of Haribhanga mango has recently gained popularity among the farmers of northern districts. Locally called Haribhanga, these mangoes are round in shape. Haribhanga is highly fleshy and typically weighs 200-400 grams. They have been recorded weighing up to 700 grams. There is perhaps no fruit other than ripe mango that contains so much carotene and unripe mango has the first position major fruits in containing iron (Hossain 1989). Nowadays Haribhanga mango is the leading seasonal cash crop of the country's northern region. The climate condition of northern part is suitable for Haribhanga mango production. The growers of Haribhanga mango variety in Rangpur are expecting a good yield of this delicious fruit, which is considered a revolutionary crop in changing the agriculture economy in the district over the last ten years.

1.2 Statement of the Problem

The demand for food with the increase of population is gradually increasing across the country. Crop agriculture in northern part of Bangladesh is constrained every year due to climate change induced hazards (drought, flood, salinity, riverbank erosion etc.) and by a number of challenges such as inadequate management practice, population growth, unfair crop price, insufficient credit facilities, loss of arable land and so on. In agriculture sector, subsistence farming is traditionally practiced by the farmer. Cultivation of others crop which is used to be grown on a vast area in Rangpur cannot play a great role to increase the farm income. As a result, the growers are not getting their due returns for their produce and the country is being deprived of potential sources. To increase the farm income, farmers are now interested in Haribhanga mango cultivation in northern part of Bangladesh. Therefore, the researcher took a study on assessing the contribution of Haribhanga mango gardening on farm income. In this context, the researcher takes the study to set answer of the following questions

i) What extent Haribhanga mango gardening contribute to increase farm income?
ii) What were the characteristics of the Haribhanga mango growers?
iii) What is the level of contribution of selected characteristics of mango growers on their contribution of Haribhanga mango gardening on farm income?

1.3 Specific Objectives of the Study

The objectives of the study were

a) To describe the selected characteristics of Haribhanga mango growers.

b) To assess the contribution of Haribhanga mango gardening on farm income.

c) To explore the contributing relationship between the farmers characteristics and contribution of Haribhanga mango gardening on farm income.

1.4 Justification of the Study

Mango has a unique position in respect of nutritional quality, taste consumers preference among fruits grown in Bangladesh (Ahmed, 1985). Despite Haribhanga mango cultivation is not a completely new phenomenon, its adoption by the farmers varies significantly. Moreover, to increase the cultivation rate of this variety requires us to study the phenomenon critically. Hence, it is assumed that the findings of this study would provide insights for extension program to promote Haribhanga mango cultivation at farmers' fields. In addition, this study might help the agricultural research institutes to undertook program on various issues of Haribhanga mango cultivation such as fertilizer management, plant population, insect and diseases control etc.

At present there is a lack of adequate information to influence farmers' extent of cultivating Haribhanga mango. This fact indicates the need for an investigation to ascertain the contribution of Haribhanga mango gardening on farm income. This study will be helpful to the researchers for further studies of similar nature and to the extension personnel to speed up the cultivation rate of Haribhanga mango variety.

1.5 Limitations of the Study

To make the study meaningful, the following limitations were taken into considerations:

i. The study area was confined to Sadar upazila and Mithapukur upazila under Rangpur district.
ii. For information about the study the researcher depends on the data furnished by the selected respondents during data collection.

iii. There were many attributes or characteristics of the farmers, but only (10) were selected for investigation in this study. This was done to complete the study within limited resources and time.

iv. For some cases, the researcher faced unexpected interference from the over interested side-talkers while collecting data from the target populations. However, the researcher tried to overcome the problem as far as possible with sufficient tact and skill.

1.6 Assumptions of the Study

An assumption is the supposition that an apparent fact or principle is truly in the light of the available evidence (Good and Hatt., 1952). An assumption is taken as a fact or belief to be true without proof. The research was carried out keeping the following assumptions in mind:

i. The respondents included in the sample for this study were capable enough to furnish proper responses to the questions set up in the interview schedule.

ii. The sample size was representative of the whole population of the study area.

iii. Views and perceptions furnished by the respondents were reliable and they expressed the truth while passing their perceptions and providing information and data.

iv. The data collected by the researcher were free from bias.

v. The researcher who acted as interviewer was well adjusted to the environment of the study area. Hence, the collection of data was reliable.

1.7 Definition of Important Terms

Farm income: Farm income refers to profits and loans that are incurred through the operation of a farm or agricultural business.

Mango orchard: The area of land devoted to the cultivation of mango trees.

Variable: Variable is that factor which is manipulated by the researcher in his attempt to ascertain its relationship to an observed phenomenon.

Independent Variable: An independent variable is that factor which is manipulated by the researcher in his attempt to ascertain its relationship to an observed phenomenon.

Dependent variable: A dependent variable is that factor which appears, disappears or varies as the researcher introduces, removes or varies the independent variable.

Size of mango orchard: It refers to the area of land owned by a mango groweron which mango growing activities are carried out.

Time spent in mango farming: Time spent in mango farming was determined by the total of time involved in mango farming per week.

Knowledge on mango cultivation: Acts, information, and skills acquired by a person through experience or education; the theoretical or practical understanding of on mango cultivation.

Organizational participation: Organizational participation of a respondent refers to the participation in different organizations at a period of time.

Hypothesis: A supposition or proposed explanation made on the basis of limited evidence as a starting point for further investigation.

Population: Population is the entire pool from which a statistical sample is drawn. The information obtained from the sample allows statisticians to develop hypotheses about the larger population. Researchers gather information from a sample because of the difficulty of studying the entire population.

CHAPTER II

REVIEW OF LITERATURE

Review of literature gives the researcher a clear and concise direction for conducting the study. The purpose of this chapter is to review the literature having relevance to the present study. This present study is primarily concerned with the extent of contribution of Haribhanga mango gardening on farm income. A few of these studies relevant to this research are briefly discussed in this chapter under the following four sections. The first section deals with concept on origin, distribution and production of Haribhanga mango variety. The second section deals with the relationship between the Haribhanga mango growers characteristics and cultivation of fruits, the third section deals with the research gap and the 4th section deals with conceptual framework.

2.1 Origin, Distribution and Production of Haribhanga Mango Variety

In addition to the traditional mangoes another potential mango has made its debut on the soil of Bengal and has already gained a reputation in the country and abroad under the name "Haribhanga". The Haribhanga mango was introduced by Abdul Salam Sarkar in 2003, a retired government official at Podagonj village under Mithapukur upazila of Rangpur district. Local farmers said late Nafal Uddin Paikar of Tekani village in Mithapukur upazila of Rangpur was the pioneer of the Haribhanga mango cultivation around 62 years ago (Daily Star, 2021). The fence of the Haribhanga tree is about 10 feet, the height of the main stem is 6 feet and the thick stalks beyond it are about 35/38 feet wide around the tree.

According to National portal (2019), the origin of Haribhanga mango is Bangladesh. The farming of the Haribhanga variety began in the northern district of Bangladesh, especially in Rangpur. It is now cultivated massively in Rangpur and also being supplied to elsewhere the country. The farming of the variety began in the district since late 1990s. Farmers planted the variety in their crop lands and made number of orchards at Mithapukur and Badargang. Cultivation of Haribhanga is recently gained popularity among the farmers. Locally called Haribhanga, these mangoes are round in shape. Haribhanga is highly fleshy and typically weighs 200-700gm. The Haribhanga is grown in other northern districts including Nilphamari, Dinajpur, Thakurgaon and Panchagarh but it is more delicious if it is from Rangpur, for the favorable weather and soil. Haribhanga now sees large-scale cultivation in Mithapukur, Pirgang and Sadar upazila in Rangpur district as well as

other areas of northern region. Haribhanga mango is mostly being cultivated in the orchards of Podagonj, Khoragach, Ruposhi, Rangatipara, Bangaon, Paikaserhat, Ruknigonj, Tekani, Moyenpur, Kadamtola, Lalpukur, Sukurer hat, Sikarpur, Ful chowki, Tilak para, Kashimpur, Ucha balua, Matherhat and many other villages in Mithapukur upazila of Rangpur district.

In Rangpur at least 3,300 hectares of land have been brought under mango cultivation, of them Haribhanga mango variety has been cultivated in 1,865 hectares of land. The production would be around 27,925 metric tonnes. Overall mango production in the district would be around 44,000 metric tonnes. There are around 4,000 commercial mango orchards in Rangpur (Daily Star, 2021). The variety is now a blessing for the farmers of Rangpur. Many farmers have switched to mango cultivation over the last 20 years as the demand of this particular fruit has increased for its unique taste. Agronomist Masudur Rahman, the additional deputy director of DAE in Rangpur said that, the area of Haribhanga cultivation is increasing in Rangpur every year as the farmer is getting good profit. It requires less labor, pesticide and investment. Farmers are expecting a bumper production of Haribhanga mango in Rangpur Agriculture region this year. Hundreds of farmers have cultivated Haribhanga mango on 2,500 hectares of land in all five districts of the region, including on 1,865 hectares of land in Rangpur and expecting 25,000 tons of Haribhanga mango worth about tk175 crore this season (Dhaka Tribune, 2021). Last year, farmers produced over 24,000 tons of Haribhanga mango in Rangpur, Gaibandha, Kurigram, Lalmonirhat and Nilphamari districts of the region. Around 30 thousand people of Rangpur district are directly dependent on the cultivation and trading of the highly fleshy, fibreless and tasty variety mango.

According to New Age (2017), farming of Haribhanga, a local variety of mango, changed the fortune of hundreds of farmers in Rangpur bringing huge profit and generated job for the unemployed and day labors. Many of the farmers got huge profit cultivating the variety and later they expanded the farming bringing more lands to make mango orchard. The farming has now become very popular in the area and the farmers were making more orchards on their farm lands on commercial basis. Mango farmers Mostafizur Rahman said cultivation of Haribhanga mango gives -him more profit than other crops. Cultivating mangoes with summer vegetables including spices in his mango orchard he got expected output. Around 1450 hectares of lands were brought under the variety cultivation in 4,250 small, medium, big orchards and homesteads in the district targeting production 9.5 tonnes in per hectares. Several farmers achieved self- reliance in recent

years as the farming became very lucrative. Haribhanga a highly tasty local variety of mango, will soon become very famous and popular globally (The Financial Express, 2017). The agriculture researchers, scientist and experts should engage more efforts to further expand and popularize cultivation of Haribhanga mango through disseminating the latest technologies among the farmers.

2.2 Relationship between Haribhanga Mango Growers Characteristics and Cultivation of Fruits

The findings of studies dealing with the relationship between the selected characteristics of the farmers and cultivation of fruits. Ten characteristics of the mango growers were selected as independent variables of this study. The independent variables were age, educational qualification, family size, size of mango orchard, training on mango cultivation, knowledge on mango cultivation, organizational participation, time spent in Haribhanga mango orchard management and no of Haribhanga mango tree in Haribhanga mango gardening. The researcher made utmost effort to search out studies dealing with the contribution of mango on farm income. This section presents a review of expert opinions relating to the selected independent variables and cultivation of fruits.

2.2.1 Age

Setu (2010), Rahman (2015), Hasan (2011), Khatun (2001) and Islam (2017) conducted some studies on fruits cultivation and reported that age was not a significant factor for cultivating fruits. On the contrary Islam (2017) conducted a study on Hindrance and prospects of mango cultivation in Bangladesh from the prospective of farmers and found negative significant association between age of the farmers and their cultivation of mango.

2.2.2 Educational qualification

Ahmed et al., (2015), Pervez et al., (2018), Hasan (2019), Alam (2016) and Khatun (2016) observed that in most cases, education and cultivation of mango was significant and positively associated and reported that the improved methods of cultivation were adopted more by educated farmers. Similarly, Hasan (2011) found the negative significant relationship between the cultivation of Lotkon and educational qualification. On the other hand, Rahman (2015), Setu (2010), Islam (2017) revealed that there is negative association between fruits cultivation and educational qualification. With few exception majority studies reported a positive relationship

between education and fruits cultivation. Hence, it can be summarized that education has a great influence in cultivation of mango. It is easier for the literate farmers to be more innovative compare to farmers who had low education level. Education is in fact helped them in decision making as well as clear understanding of the innovation.

2.2.3 Family size

Chowdhury et al., (2018) found positive significant relationship with family size and cultivation of mango. Muthini (2015) also found in his study positive significant relationship with the mango cultivation and family size. While some studies such as Alam et al., (2017), Alam (2016), and Hossain (2010) found negative relationship with the fruit's cultivation and family size.

2.2.4 Size of mango orchard

Khatun (2016) and Pervez et al., (2018) conducted a study and revealed that there was positive significant relationship between farm size and mango cultivation. Simillarly Islam (2017), Khatun (2016), and Alam (2015) reported that percentage of farmers and home makers cultivation of mango tended to increase with the increase in farm size and they reported a positive association between size of the farm and mango growers. On the contrary, few studies notably Muthini (2015), Hasan (2011), Rahman (2015) reported no significant relationship between farm size of the farmers and fruits cultivation. A considerable number of studies reported positive relationship between farm size and mango cultivation while few studies reported no relationship. Therefor it can be concluded that farm size positively affects the mango cultivation. A farmer having more farm size has more scope to try out new ideas and practices and hence their farm income rate is expected to be higher than the small and marginal farmers.

2.2.5 Training on mango cultivation

Islam (2017), Hossain (2010) and Chowdhury et al., (2018) observed that training had a positive significant relationship with fruits cultivation. Hasan (2011) found negative significant relationship in his study. On the contrary, Muthini (2015), Setu (2010) found that there is no relationship between training experience and cultivation of mango. However, given that the training might help to change human behavior through increase his ability and reinforce him to change his motivation towards technology adoption, training exposure is expected to be positively influenced farmers behavior.

2.2.6 Knowledge on mango cultivation

Alam (2017) studied on adoption of litchi cultivation and found positive significant relationship between the knowledge and cultivation of litchi. Similarly, Setu (2010), Hasan (2011), Rahman (2015), Islam (2016) and Rahman (2017) revealed that agricultural knowledge had significant contribution to the cultivation of fruits.

2.2.7 Organizational participation

Organizational participation was mostly found to be positively associated with farmers farm income. Alam et al., (2017) and Pervez et al., (2018) found his study that organizational participation was positively associated with mango cultivation. On the contrary Islam (2017), Hossain (2010) and Khatun (2016) found negative relationship between agricultural practices and organizational participation.

2.2.8 Experience in mango cultivation

Chowdhury et al., (2018), Islam (2016) and Muthini (2015) found positive significant relationship between experience and mango cultivation. While some studies such as Khatun (2016), Setu (2010) observed negative association between experience and mango cultivation.

2.2.9 Some other selected characteristic of mango growers

There was found no review on time spent in Haribhanga mango orchard management and number of Haribhanga mango tree on fruits cultivation.

2.3 Research Gap

A lot of researches on fruits cultivation can be found but few researches have so far been conducted on the cultivation of mango. To the best of my knowledge there is no research on the contribution of Haribhanga mango gardening on farm income. The present study was conducted to solely assess the contribution of Haribhanga mango gardening on farm income. Moreover, the present study was conducted assessing the contributing factors of Haribhanga mango gardening on farm income.

2.4 Conceptual Framework of the Study

In scientific research, selection and measurement of variables constitute on important task. The hypothesis of a research while constructed properly contains at least two important elements i.e.,

"a dependent variable" and "independent variable". A dependent variable is that factors which is manipulated by the researchers in his attempt to ascertain its relationship to an observed phenomenon.

The independent variables of selected characteristics of the farmers were age, educational qualification, family size, size of mango orchard, training on mango cultivation, Knowledge on mango cultivation, organizational participation, experience in Haribhanga mango cultivation, time spent in Haribhanga mango orchard management and number of Haribhanga mango tree. On the other hand, the dependent variable was the assessing the contribution of Haribhanga mango gardening on farm income.

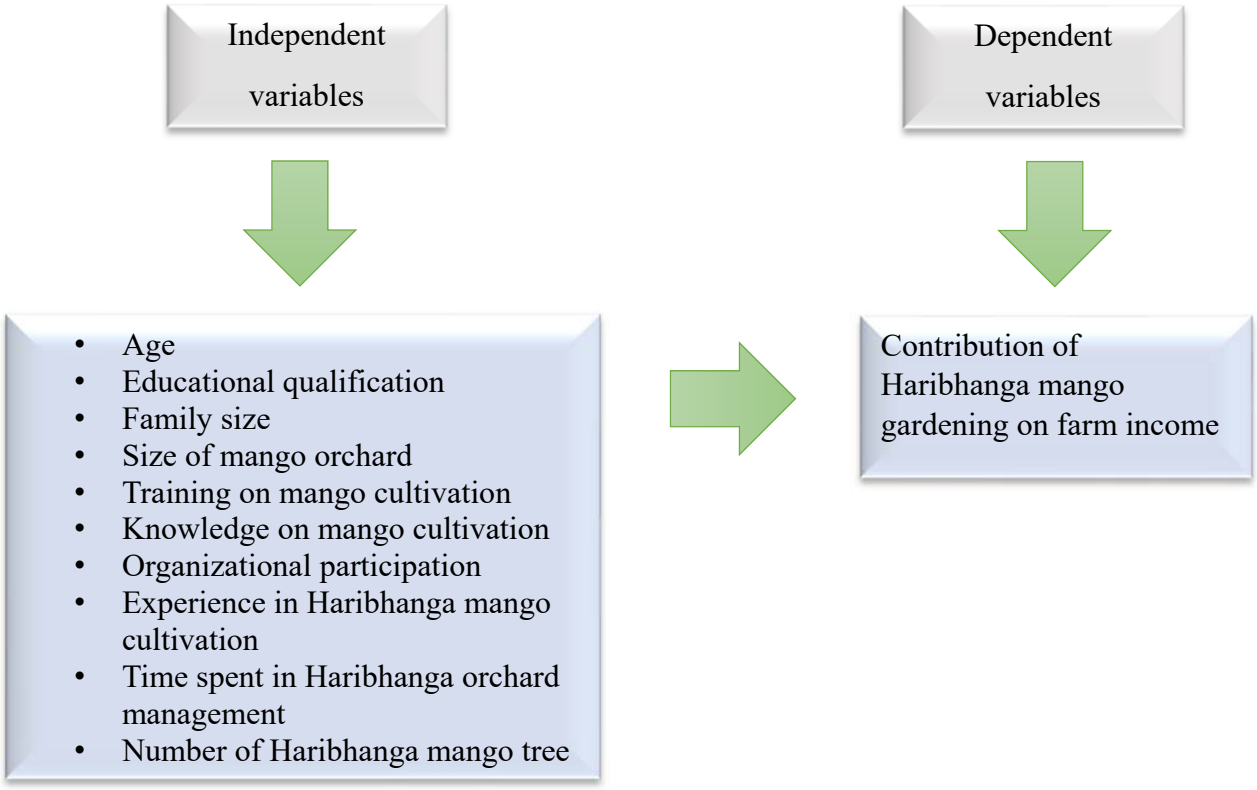

Figure 2.1 Conceptual framework of the study

CHAPTER III

METHODOLOGY

Methods play an important role in scientific research. To fulfill the objectives of the study, a researcher should be very careful while formulating methods and procedures in conducting the research. According to Mingers (2001), research methodology is a structured set of guidelines or activities to generate valid and reliable research results. This Chapter illustrates the research methodology and procedures used to collect and analyze the data for answering the research questions and attaining the purposes. A chronological description of the methodology followed in conducting this research work has been presented in this chapter.

3.1 Locale of the Study

The study was conducted in the Rangpur district. Sadar upazila and Mithapukur upazila of Rangpur district was purposively selected as the study area. In Sadar upazila and Mithapukur upazila Haribhanga mango grows in abundance. The Four villages were selected from Rangpur Sadar upazila and Mithapukur upazila randomly. The villages were Darshana Pahari Manjai, Kishamot bishu Manjai, Janki Dhaperhat and Rupshi Shoulmary. A map of Rangpur district showing the locale of the study is presented in Figure 3.1, 3.2 and figure 3.3.

3.2 Population and Sampling

3.2.1 Population

Haribhanga mango growers of the selected villages were the population of the study. An up-to-date list of all the mango growers of the village was prepared with the help of Sub-Assistant Agriculture Officer (SAAO) of the upazila Agricultural Office (UAO). Total number of mango growers was 349 which constituted the population of the study.

3.2.2 Determination of the sample

As the size was small, it is better to follow a representative percentage rather than standard statistical formula. Considering time and other resources, thirty percent (30%) of population was considered as sample of the study. Thus, the sample size is 105.

3.2.3 Distribution of the population and sample of the respondents in four villages with reserve list

The population comprised of 349 mango growers. A reserve list of 10 mango cultivators (about ten percent of the sample size) were also prepared so that the mango growers of this list could be used for interview if the mango growers included in the original sample were not available at the time of conduction of interview. The mango growers of the villages were selected for data collection by following proportionate sampling technique. The distribution of the population, the number of sample size and number of respondents along with the reserve list are given in the following Table 3.1.

Table 3.1 Distribution of respondents of the selected village with a reserve list

Upazila	Village	Population	Respondents	
			Sample	Reserve list
Rangpur Sadar	Darshana Pahari Manjai	71	22	2
	Kishamot bishu Manjai	74	23	2
	Janki Dhaperhat	95	24	3
Mithapukur	Rupshi Shoulmary	109	36	3
	Total	349	105	10

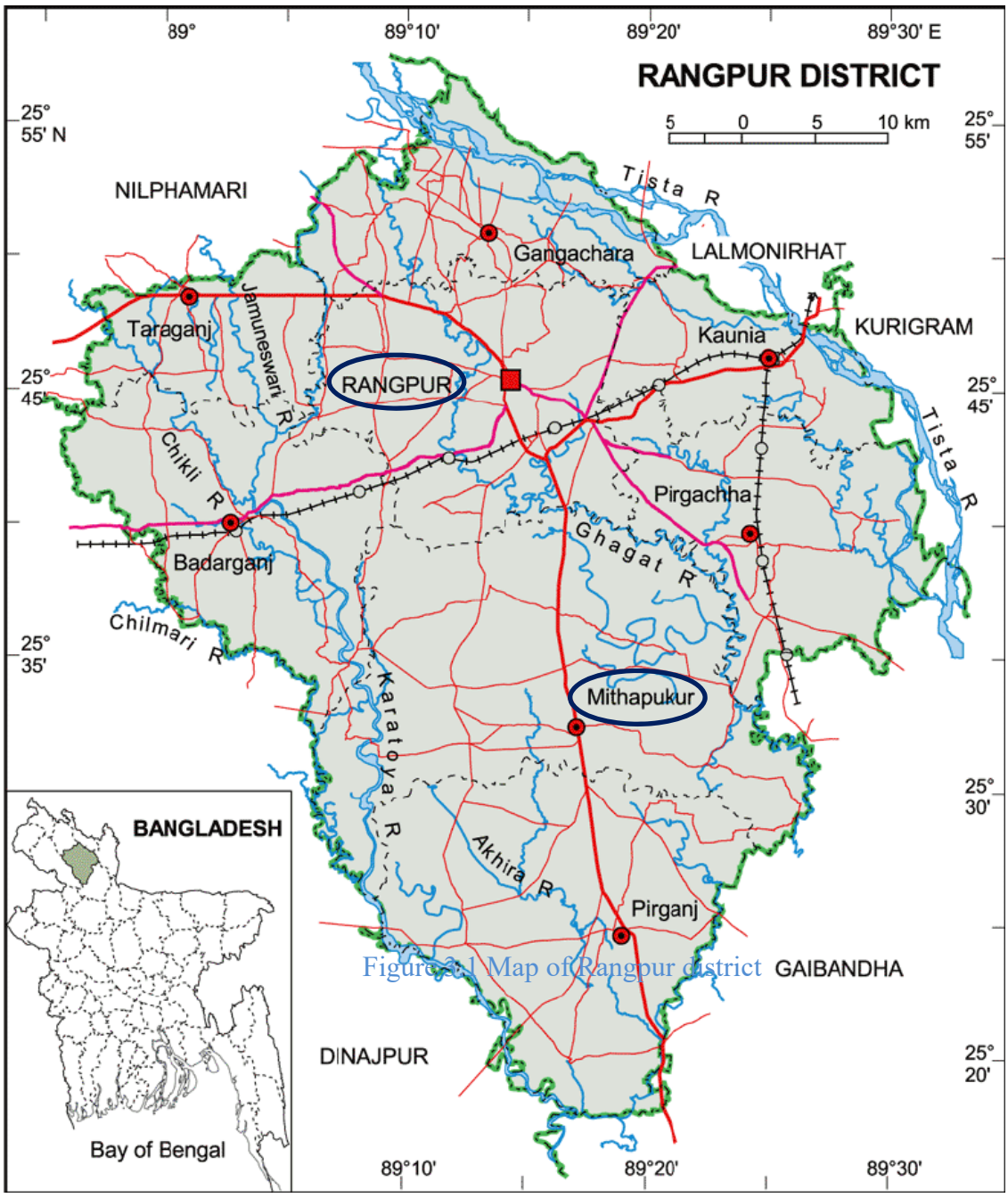

Figure 3.1 Map of Rangpur district showing Sadar and Mithapukur upazila

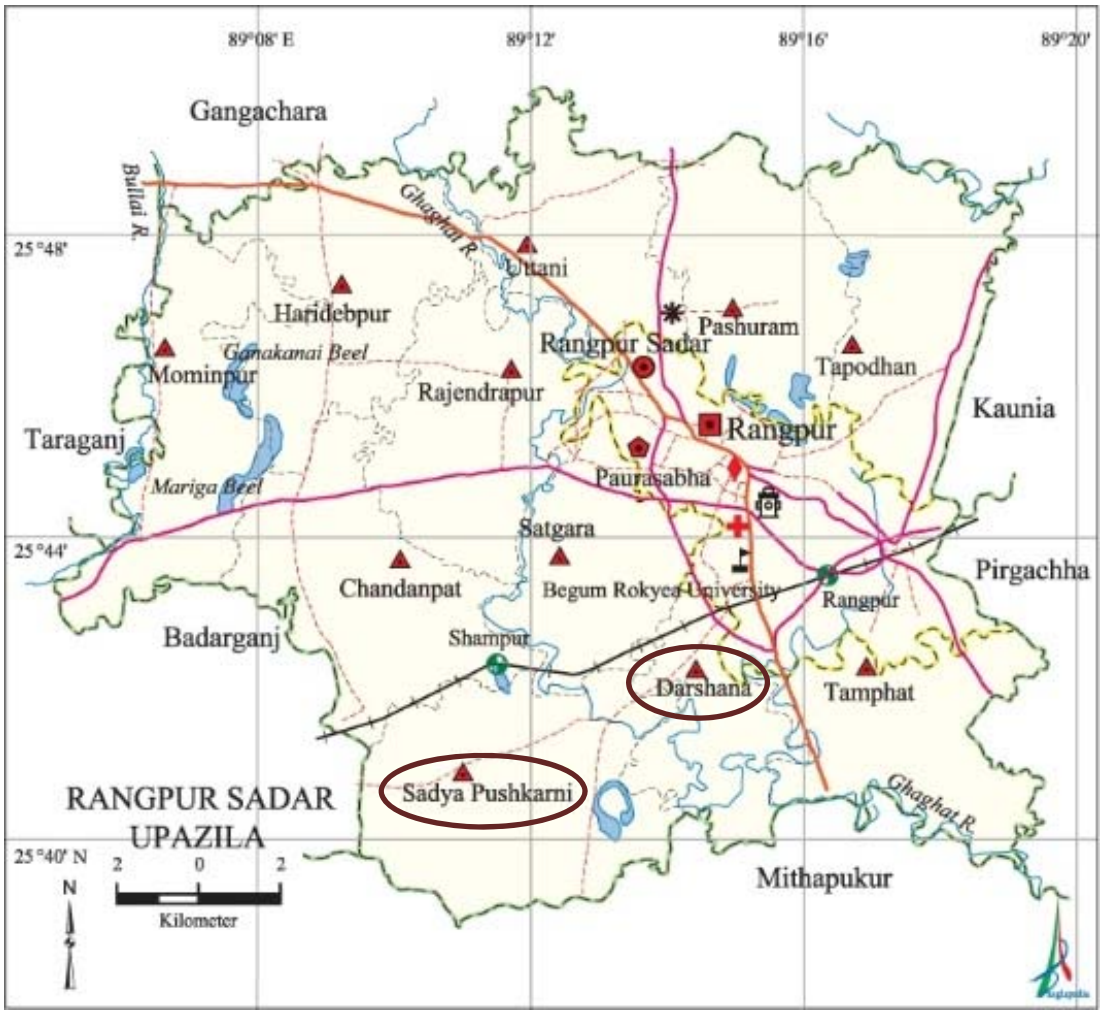

Figure 3.2 A map of Rangpur sadar upazila showing the study area

Figure 3.3 A map of Mithapukur upazila showing the study area

3.3 Research Instrument

In order to collect relevant information an interview schedule was carefully designed keeping in view the objectives of the study. The interview schedule was designed in English. At the time of interview, it was converted into Bengali version. Appropriate scales were developed to operationalize the selected characteristics of the farmers and the dependent variable as well. The interview schedule was pre-tested by administering among fifteen mango growers of the study area. The pre-test was helpful to identify faulty questions and statements in the draft schedule. Necessary addition, correction, alteration and adjustment were made in the schedule on the basis of the pre-test experience. The schedule was multiplied in its final form for the collection of data. The final interview schedule is presented in Appendix-A.

3.4 Collection of Data

The researcher himself collected data from the farmers by using the interview schedule. The interviews were conducted individually in the farm of the respondents during their leisure period. Only 5 mango farmers of the original list were not available during interview and they were replaced from the reserve list. Advanced information was given to the respondents before going to them for interviewing. The researcher took all possible care to establish rapport with them. While any respondent faced difficulty in understanding any question, the researcher took utmost care to explain the issue. He obtained excellent cooperation from the respondents and others concerned during the time of interview. The entire process of collecting data took 20 days from the 2nd July to the 21st July, 2021.

3.5 Variables

Variables can be defined as any aspect of a theory that can vary or changes as part of the interaction within the theory. In a study, the independent variable is the variable that is varied or manipulated by the researcher, and the dependent variable is the response that is measured. Any event or condition can be conceptualized as either an independent or a dependent variable.

3.5.1 Independent Variables

The independent variable refers to the status of the presumed cause. The selected individual characteristics of the mango farmers were the independent variables for this study. The characteristics were: age, educational qualification, family size, size of mango orchard, training on mango cultivation, knowledge on mango cultivation, organizational participation, experience in

Haribhanga mango cultivation, time spent in mango orchard management and number of trees on a mango orchard.

3.5.2 Measurement of independent variables

The measurement of the independent variables is an important task. In accordance with the objectives the procedures of measurement of independent variables are stated below:

3.5.2.1 Age

The age of a respondent was measured in terms of actual years from his/her date of birth. A score of one (1) was assigned for each year of age. In this study age of Haribhanga mango growers was measured.

3.5.2.2 Educational Qualification

Education of a respondent was measured on the basis of her/his years of schooling. If a respondent passed class 4, his/her education score was given as 4. If a respondent did not know how to read and write his education score was given as zero (0). A score of 0.5 was given to that respondent who could sign his/her name only. If a student passed the S.S.C examination, her education score was given as 10. Question regarding this variable appears in the item number 2 in the interview schedule.

3.5.2.3 Family size

Family size of a respondent was determined as the total members of his/her under Haribhanga mango cultivation. Question regarding this variable appears in the item number 3 in the interview schedule.

3.5.2.4 Size of mango orchard

Size of a mango orchard of a respondent was determined as the total area of his/her under Haribhanga mango cultivation. The unit of measurement was in hectare and was considered as the farm size of a respondent. Question regarding this variable appears in the item number 4 in the interview schedule.

3.5.2.5 Training on mango cultivation

Training on mango cultivation was determined by the total number of days agricultural training received in his/her life. A score of one (1) was assigned for each day of training.

3.5.2.6 Knowledge on Haribhanga mango cultivation

Mango cultivation knowledge of a mango grower was measured by asking 10 questions related to different components of mango cultivation. It was measured assigning weightage two marks for each question. So, the total assigned scores for all the questions became twenty. The score was given according to response at the time of interview. Answering a question correctly an individual could obtain full score. While for wrong answer or no answer he obtained zero (0) score. Partial score was assigned for partially correct answer. Thus, the mango cultivation knowledge score of a mango grower could range from zero (0) to twenty (20), where zero indicates no knowledge and twenty indicates highest knowledge on mango cultivation. This variable appears in item number six (6) in the interview schedule as presented in Appendix-A.

3.5.2.7 Organizational participation

Organizational participation of a respondent was computed on the basis of his/her participation in six different organizations. Scoring of the organizational participation was done using the following formula and in the following way:

$$OP = P_{om} + P_{em} + P_{eo}$$

Where,

OP = Organizational participation score

P_{om}= Participation as ordinary committee member

P_{em} = Participation as executive committee member and

P_{eo} = Participation as executive committee officer (president/secretary)

Nature of participation	Score assigned
No participation	0
Participation as ordinary member	1
Participation as executive member	2
Participation as secretary/president	3

For example, if a respondent participated as an executive committee member of school committee for three years, an ordinary member at NGO organized society for 1 year and no participation in other organizations, that respondent would have a total participation score 7.

3.5.2.8 Experience in mango cultivation

Experience in Haribhanga mango cultivation of the mango grower was determined by the total number of years involved in mango cultivation. A score of one (1) was assigned for each mango cultivation. This variable appears in item number 8 in the interview schedule as presented in Appendix-A.

3.5.2.9 Time spent in mango orchard management

Time spent in mango gardening was determined by the total time (hrs.) involved in mango farming per week during the mango season. A score of one (1) was assigned for each hour mango farming activities. This variable appears in item number 9 in the interview schedule are present in Appendix-A

3.5.2.10 Number of Haribhanga mango tree

Number of Haribhanga mango tree of a mango growers was determined by how many trees are there in mango orchard. This variable appears in item number 10 in the interview schedule are present in Appendix-A.

3.5.3 Dependent Variables

Dependent variable refers to the status of contribution of Haribhanga mango gardening on farm income in which researcher is interested.

3.5.3.1 Measurement of dependent variable

The contribution of Haribhanga mango gardening on farm income was the dependent variable of this study. Contribution of Haribhanga mango gardening on farm income was measured by the following formula.

$$\text{Contribution of Haribhanga on farm income} = \frac{\text{Income from Haribhanga}}{\text{Total farm income}} \times 100$$

3.6 Statement of Hypothesis

According to Kerlinger (1973), a hypothesis is a conjectural statement of the relation between two or more variables. Hypotheses are always in declarative sentence form and they relate either generally or specifically variables to sentence form and they relate either generally or specifically variables to variables. Hypothesis may be broadly divided into two categories, namely research hypothesis and null hypothesis.

3.6.1 Research hypothesis

The following research hypothesis was put forward to know the relationships between each of the ten selected characteristics of the farmers and the contribution of Haribhanga mango gardening on farm income.

Hypothesis: "Each of the ten selected characteristics of the farmers will have relationships with their contribution of Haribhanga mango gardening on farm income."

3.6.2 Null hypothesis

A null hypothesis states that there is no relationship between the concerned variables. The following null hypothesis was undertaken for the present study:

H_0: There is no relationship between the selected characteristics of farmers and their contribution of Haribhanga mango on farm income

If a null hypothesis is rejected on the basis of a statistical tests, it is assumed, that there is a relationship between the concerned variables.

3.7 Data Processing and Analysis

3.7.1 Compilation of data

After completion of field survey, data from all the interview schedules were coded, compiled, tabulated and analyzed in accordance with the objectives of the study. In this process, all responses in the interview schedule were given numerical coded values. Local units were converted into standard units and qualitative data were converted into quantitative data by assigning suitable scores whenever necessary. The responses of the questions in the interview schedule were transferred SPSS v.23 to facilitate tabulation.

3.7.2 Categorization of data

For describing the different characteristics and their contribution on farm income, the respondents were classified into several categories. These categories were developed by considering the nature of distribution of data, general understanding prevailing in the social system and possible observed scoring system. The procedure for categorization of data in respect of different variable is elaborately being discussed.

3.8 Statistical Treatments

Data collected from respondents for this study were compiled, coded, tabulated and analyzed in accordance with the objectives of the study. The analysis was performed using Statistical Package for Social Sciences (SPSS v.23) computer package. Descriptive analyses such as range, number, percentage, mean, standard deviation was used whenever possible. To find out the contribution of Haribhanga mango gardening on farm income identified characteristics of the Haribhanga mango growers of Sadar upazila and Mithapukur upazila under Rangpur district, multiple regressions was used. Throughout the study, at highest five percent (0.05) level of significance was used as basis of rejecting a null hypothesis.

CHAPTER IV

FINDINGS AND DISCUSSION

This Chapter deals with the result and discussion of research work. Necessary explanations and appropriate interpretations have also been made showing possible and logical basis of the findings. However, for convenience of the discussions, the findings are systematically presented in the following sections.

4.1 Characteristics of the mango growers

This section deals with the selected characteristics of the Haribhanga mango growers which were assumed to be associated with the contribution of Haribhanga mango gardening on farm income. Different farmers possess different characteristics which are focused by his/her behavior. In these section 11 characteristics have been discussed. The selected characteristics of the mango growers were; age, educational qualification, family size, size of mango orchard, training on mango cultivation, knowledge on mango cultivation, organizational participation, experience in Haribhanga mango cultivation, time spent in Haribhanga mango cultivation, number of Haribhanga mango tree and contribution of Haribhanga mango gardening on farm income. Measuring unit, range, mean and standard deviations of those characteristics of Haribhanga mango growers described in this section. Table 4.1 provides a summary profile of Haribhanga mango growers characteristics.

Table 4.1 Characteristics profile of the respondents

Sl. No	Characteristics	Measuring unit	Range		Mean	Standard Deviation
			Possible	Observed		
1	Age	Actual year	Unknown	20-76	43.41	12.03
2	Educational Qualification	Schooling year	Unknown	0-17	6.71	4.71
3	Family size	Members	Unknown	2-10	4.99	1.31
4	Size of mango orchard	Hectare	Unknown	0.08-1.02	.2398	.164
5	Training on mango cultivation	Days	Unknown	0-5	1.70	1.51

6	Knowledge on mango cultivation	Score	Unknown	9-19	13.36	2.66
7	Organizational participation	Score	Unknown	0.0-9	3.69	1.5
8	Experience in Haribhanga mango cultivation	Year	Unknown	3-13	7.15	2.54
9	Time spent in Haribhanga mango orchard management	Hour	Unknown	1-10	3.59	1.67
10	Number of Haribhanga mango tree	Score	Unknown	20-300	81.11	50.66
11	Contribution of Haribhanga mango gardening on farm income	Percentage	Unknown	3.12-79.78	27.6	17.46

4.1.1 Age

The age of the mango growers has been varied from 20 to 76 with a mean of 43.41 and standard deviation of 12.03, respectively. Considering the recorded age mango growers were classified into three categories namely 'young', 'middle' and 'old' aged following MoYS (2012). The distribution of the mango grower in accordance of their age are presented in Table 4.2.

Table 4.2 Distribution of the mango growers according to their age

Category	**Basis of Categorization (years)**	**Respondents**	
		Number	**%**
Young age	Up to 35	31	29.5
Medium age	36 to 50	47	44.8
Old age	Above 50	27	25.7
Total		105	100.0

Table 4.2 reveals that the medium aged mango growers comprised the highest proportion (44.8%) followed by young aged category (29.5%) and the lowest proportion were made by the old aged category (25.7%). Data also indicates that medium and young aged category constitute 74.3 percent of total mango growers. The young and medium aged mango growers were generally more

involved in farm activities than the older that might be due to the energetic, enthusiastic nature of young and middle-aged mango growers.

4.1.2 Educational qualification

Educational qualification of the respondents ranged from 0 to 17 in accordance with year of schooling. The average education score of the respondents was 6.71 with a standard deviation of 4.71. On the basis of their level of education, the farmers were classified into six categories as shown in Table 4.3.

Table 4.3 Distribution of the mango growers according to their educational qualification

Category	Basis of categorization (Schooling year)	Respondents	
		Number	%
Illiterate	0 to 0.5	31	29.6
Primary Level	1 to 5	11	10.5
Secondary Level	6 to 10	44	41.9
Higher Secondary	11 to 12	15	14.2
Above higher Secondary	>12	4	3.8
Total		**105**	**100**

Data presented in the Table 4.3 indicates that respondent under secondary level category constitute the highest proportion 41.9 percent followed by illiterate only 29.6 percent. On the other hand, the lowest proportion 3.8 percent in above secondary education category followed by primary level category 6.7 percent.

4.1.3 Family size

Family size of the respondents ranged from 2 to 10 with the mean of 4.99 and standard deviation of 1.31. On the basis of their family size, the farmers were classified into three categories as shown in Table 4.4.

Table 4.4 Distribution of the mango growers according to their family size

Category	Basis of categorization (members)	Respondents	
		Number	%
Small family	Up to 4	40	38.1
Medium family	5 to 6	55	52.4
Large family	Above 6	10	9.5
Total		**105**	**100**

Data presented in the Table 4.4 shown that highest proportion 52.4 percent of the mango growers had medium family, 38.1% had small family and 9.5 percent had large family. The findings of the study reveal that majority of the mango farmers were medium to small family members which is standard family size in respect of Bangladesh.

4.1.4 Size of mango orchard

Farm size of the respondents ranged from 0.08 hectare to 1.02 hectares with the mean of 0.24 and standard deviation of 0.164. On the basis of their farm size, the farmers were classified into three categories followed by DAE (1999) as shown in Table 4.5.

Table 4.5 Distribution of the mango growers according to their farm size under mango cultivation

Category	Basis of Categorization (Hectare)	Respondents	
		Number	%
Marginal farm	Up to 0.2	33	31.4
Small farm	0.21>1	68	64.8
Medium farm	1 – 3	4	3.8
Total		**105**	**100.0**

Data presented in the Table 4.5 showing that highest proportion 64.8 percent of the farmers had small farm compared to 31.4 percent had marginal farm and only 3.8 percent had medium farm. The findings indicated that overwhelming majority (96.2 percent) of the mango growers had small to marginal farm. The researcher thinks that land fragmentation and over population is responsible for marginal and small land.

4.1.5 Training on mango cultivation

Training on mango cultivation of the Haribhanga mango growers ranged from 0 to 5 days with a mean of 1.70 and standard deviation of 1.51. On the basis of farming experience, the respondents were classified into two categories as follows in Table 4.6.

Table 4.6 Distribution of Haribhanga mango growers according to their training on mango cultivation

Category	Basis of Categorization (days)	Respondents	
		Number	%
No training	0	35	33.3
Up to five days	Above 0	70	66.7
Total		**105**	**100**

Data presented in Table 4.6 showing that 66.7 percent of the mango growers had training where as 33.3 percent had no training. It means that overwhelming majority (66.7 percent) of the mango growers had training. Nowadays Mango growers are more interested to receive training because training received enhances the abilities of the mango farmers by updating their knowledge and quickly motivate them towards improved practices.

4.1.6 knowledge on mango cultivation

Knowledge on mango cultivation of the respondents ranged from 9 to 19 having an average of 13.66 and standard deviation 2.66. On the basis of knowledge scores, the respondents were classified into three categories namely, ‘poor knowledge’, ‘good knowledge’ and ‘excellent knowledge’. The distribution of the respondence according to their knowledge on Haribhanga mango cultivation is given in Table 4.7.

Table 4.7 Distribution of Haribhanga mango growers according to their knowledge

Category	Basis of Categorization (Score)	Respondents	
		Number	%
Poor knowledge	Up to 10	14	13.3
Good knowledge	11 to 16	77	73.3
Excellent knowledge	Above 16	14	13.4
Total		**105**	**100**

Data presented in Table 4.7 showing that the highest proportion 73.3 percent of the respondents felt in medium knowledge category followed by 13.3 percent in low knowledge category and also 13.4 percent in high knowledge category. Knowledge is to be considered as vision of an explanation in any aspect of the situation regarding Haribhanga mango cultivation. To perform optimum cultivation and contribution, farmer should have adequate knowledge and different aspects of Haribhanga mango cultivation.

4.1.7 Organizational participation

The observed organizational participation score of the respondents ranged from 0 to 9. The mean score was 3.69 with the standard deviation 1.5. Based on the organizational participation scores, the respondents were classified into three categories namely low, medium and high participation. The Distribution of the Haribhanga mango growers according to their organizational participation is given in Table 4.8.

Table 4.8 Distribution of the Haribhanga mango growers according to their organizational participation

Category	Basis of Categorization (score)	Respondents	
		Number	%
Low participation	Up to 2	17	16.2
Medium participation	3 to 5	77	73.3
High participation	Above 5	11	10.5
Total		**105**	**100**

Data presented in Table 4.8 showing that the highest proportion (73.3 percent) of the respondents had medium participation, while 16.2 and 10.5 percent of the respondents had low and high organizational participation, respectively. The researcher thinks that it might be logical because the respondents of the study area were busier in their income generating activities. Hence, the high organizational participation in the study area was low.

4.1.8 Experience in Haribhanga mango cultivation

On the basis of their experience Haribhanga mango growers were classified into three categories: ‘low experience’, ‘medium experience’ and ‘high experience’ The observed experience score in Haribhanga mango cultivation is 3 to 13 years with mean of 7.15 and standard deviation of 2.54.

On the basis of experience in Haribhanga mango cultivation the respondents were categorized into three groups as shown in Table 4.9.

Table 4.9 Distribution of the Haribhanga mango growers' characteristics according to their experience in Haribhanga mango cultivation

Category	Basis of Categorization (years)	Respondents	
		No. of farmers	%
Low experience	Up to 5	39	37.1
Medium experience	6 to 10	60	57.1
High experience	Above 10	6	5.8
Total		**105**	**100**

Data presented in the Table 4.9 showing that 57.1 percent of the mango growers felt in medium experience, whereas 37.1 percent farmers in low experience and 5.8 percent in high experience category. Here data revealed that most of the mango growers in the study area had medium experience in Haribhanga mango cultivation. Farmers have medium experience as Haribhanga is a new variety of mango. To increase farm income farmers are gradually involve in Haribhanga mango cultivation.

4.1.9 Time spent in Haribhanga mango orchard management

The observed time spent in Haribhanga mango orchard ranged from 1-10 hour, again the mean and standard deviation were 3.59 and 1.67, respectively. According to this score, the mango grower was classified into three categories: 'low time spent', 'medium time spent' and 'high time spent'. The distribution of the Haribhanga mango growers according to their time spent in Haribhanga mango orchard shown in Table 4.10.

Table 4.10 Distribution of the Haribhanga mango growers according to their time spent in Haribhanga mango orchard management

Category	Basis of Categorization (hours/week)	Respondents	
		No. of farmers	%
Low time spent	Up to 3	39	37.2
Medium time spent	4 to 5	56	53.3
High time spent	Above 5	10	9.5
Total		**105**	**100**

Table 4.10 indicates that the highest proportion of 53.3 percent of the mango growers had medium time spent compared to 37.2 percent in low time spent and 9.5 percent mango growers in high time spent category, respectively. The researcher thinks that this result might have due to positive attitude towards mango cultivation and mango cultivation climatic condition.

4.1.10 Distribution of number of Haribhanga mango tree

The score of number of Haribhanga mango tree ranged from 20 to 300. The mean was 81.11 and standard deviation was 50.66. On the basis of number of Haribhanga mango tree, the respondents were categorized into three groups as shown in Table 4.11.

Table 4.11 Distribution of the Haribhanga mango grower's characteristics according to their number of Haribhanga mango tree

Category	Basis of Categorization (Days)	Respondents	
		No. of farmers	%
Low number	Up to 55	38	36.2
Medium number	56 to 106	49	46.7
High number	Above 106	18	17.1
Total		**105**	**100**

Data presented in the Table 4.11 showing that 46.7 percent of the farmers had medium number, 36.2 percent had low number and 17.1 percent had high number of trees. It means that an overwhelming majority (82.9 percent) of the mango growers had low to medium number of trees. The researcher thinks that this is due to majority of the farmers in study area had small farm land.

4.2 Distribution of the Contribution of Haribhanga Mango Gardening on Farm Income

The scores of contributions of Haribhanga mango gardening on farm income of the respondents ranged from 3.12 to 79.78 with a mean of 27.6 and standard deviation of 17.46. Based on the observed scores of contributions of Haribhanga mango gardening, the respondents were classified into three categories i.e., low contribution, medium contribution and high contribution. The distribution has been shown in Table 4.12.

Table 4.12 Distribution of the contribution of Haribhanga mango gardening on farm income

Category	Basis of Categorization (percentage)	Respondents	
		No. of farmers	%
Low contribution	Up to 33	16	15.2
Medium contribution	33 to 66	74	70.5
High contribution	Above 66	15	14.3
Total		**105**	**100**

Data presented in the Table 4.12 showing that among the respondents the highest 70.5 percent had the medium contribution, 15.2 percent had the low contribution and the 14.3 had the high contribution, respectively. Among the mango growers, the contribution of Haribhanga mango gardening on farm income 85.7 percent have low to medium contribution. The researcher thinks that this result might have due to getting huge profit and positive attitude towards Haribhanga mango cultivation.

4.3 Contributing Relationship between Individual Characteristics of the Mango Growers and the Contribution of Haribhanga Mango Gardening on Farm Income

This section deals with the findings exploring the contributing relationship between the selected characteristics of the mango cultivators and the contribution of Haribhanga mango gardening on farm income. The contributing factors were age, educational qualification, family size, size of mango orchard, training on mango cultivation, knowledge on mango cultivation, organizational participation, experience in Haribhanga mango cultivation, time spent in Haribhanga mango orchard management, number of Haribhanga mango tree. Assessing the contributing relationship between the selected characteristics of the mango growers and the contribution of Haribhanga

mango on farm income a multiple linear regression analysis was done. The multiple linear regression result has been shown in the Table 4.13.

Table 4.13 Multiple regression coefficients showing the relationship between selected characteristics the Haribhanga mango growers and the contribution of Haribhanga mango on farm income

Dependent variable	**Independent variables**	**B**	**P**	**R^2**	**Adj R^2**	**F**
Contribution of Haribhanga Mango gardening on farm income	Age	-0.002	0.978	0.646	0.608	17.16
	Educational qualification	0.077	0.318			
	Family size	0.171	0.023*			
	Size of mango orchard	0.061	0.636			
	Training on mango cultivation	0.108	0.182			
	Knowledge on mango cultivation	0.1 98	0.027*			
	Organizational participation	-0.089	0.216			
	Experience in Haribhanga mango cultivation	0.479	0.000**			
	Time spent in Haribhanga mango cultivation	0.093	0.440			
	No of Haribhanga mango tree	0.417	0.010*			

*Significant at $p<0.05$, ** Significant at $p<0.01$

Data presented in Table 4.13 showing that family size, knowledge on mango cultivation, experience in Haribhanga mango cultivation and no of Haribhanga mango tree were the most important variables in this study. Among these four, experience in Haribhanga mango cultivation was found to be strongest predictor (significant at the 1% level of significant) and family size, knowledge on mango cultivation and number of Haribhanga mango tree was also contribution factor (Significant at 5% level of significant). While coefficients of other selected variables did not have any contribution. The value of R^2 is a measure of how of the variability in the dependent

variable is accounted by the independent variables. So, the value of R^2=0.646 means that independent variables account for 65% of contribution of Haribhanga mango on farm income. The F value is 17.16 which is highly significant.

4.3.1 Contributing relationship between family size and Haribhanga mango gardening on farm income

The contribution of family size of Haribhanga mango growers by testing the null hypothesis; "there is no contribution of family size and Haribhanga mango gardening on farm income.'' The regression coefficient of the concerned variable was 0.171 and the p value of the concerned variables was 0.023. The following observations were made on the basis of the value of the concerned variable of the study under consideration.

- The contribution of the family size was at 5% significance level so, the null hypothesis could be rejected.

Based on the above findings, it can be summarized that a Haribhanga mango grower had more the family members gave the more time to manage the Haribhanga mango orchard. Family size enhances the abilities of the Haribhanga mango growers at short time to increase production. Pervez et al. (2018) finds the similar findings in his study.

4.3.2 Contributing relationship between knowledge and Haribhanga mango gardening on farm income

The contribution of knowledge of Haribhanga mango growers by testing the null hypothesis; "there is no contribution of knowledge and Haribhanga mango gardening on farm income". The regression coefficient value of the concerned variable was found 0.198 and the P value was found 0.027. The following observation were made on the basis of the value of the concern variable of the study under consideration.

- The contribution of knowledge of Haribhanga mango growers was at 5% level of significant. So, the null hypothesis could be rejected.

Based on above findings, it can be summarized that having knowledge about Haribhanga mango cultivation increased the production of Haribhanga mango. It means the mango growers who had knowledge on mango cultivation get more profit than the mango growers with less knowledge on

mango cultivation. Haribhanga mango growers should have adequate knowledge on different aspects of Haribhanga mango cultivation. Khatun (2015), found similar findings in his study.

4.3.3 Contributing relationship between experience on mango cultivation and Haribhanga mango gardening on farm income

The contribution of experience of Haribhanga mango growers by testing the null hypothesis; 'there is no contribution of experience of Haribhanga mango growers and Haribhanga mango gardening on farm income''. The regression coefficient value of the concerned variable was found 0.479 and the P value was found 0.000. The following observation were made on the basis of the value of the concern variable of the study under consideration.

- The contribution of Haribhanga mango growers experience for mango cultivation was at 1% level of significant. So, the null hypothesis could be rejected.

Based on above findings, it can be summarized that with the increase of experience of the mango growers will increase the production of mango. It is very logical that individuals having more experience in mango cultivation can produce more mango.

4.3.4 Contributing relationship between the number of Haribhanga mango tree and Haribhanga mango gardening on farm income

The contribution of number of Haribhanga mango tree by testing the null "hypothesis there is no contribution of number of Haribhanga mango tree and Haribhanga mango gardening on farm income". The regression coefficient value of the concerned variable was found 0.417 and the P value was found 0.010. The following observation were made on the basis of the value of the concern variable of the study under consideration.

- The contribution of Haribhanga mango tree was at 5% level of significant. So, the null hypothesis could be rejected.

Based on above findings it can be summarized that a farmer having more number of trees having more scope to get more production of mango. The increased production of mango increased the income of a Haribhanga mango growers. Moreover, it is logical that more the number of mango trees the higher would be the profit of mango growers.

CHAPTER V

SUMMARY OF FINDINGS, CONCLUTIONS AND RECOMMENDATIONS

This chapter presents summary of major Findings, conclusions and recommendation of the study.

5.1 Summary of Findings

5.1.1 Contribution of Haribhanga mango gardening on farm income

The highest proportion (70.5 percent) of the farmers fell under the medium contribution category while 15.2 percent had low contribution and 14.3 percent had high contribution on farm income.

5.1.2 Selected characteristics of the Haribhanga mango growers

Ten characteristics of the farmers were selected for exploring their relationship with the contribution of Haribhanga mango gardening on farm income. Findings in respect of the selected characteristics are summarized bellows.

Age

Age of the farmers ranged from 20 to 76 years with the average of 43.41 years and the standard deviation was 12.03. Highest proportion (44.8 percent) of the farmers was under medium aged category.

Educational qualification

Education score of the respondents ranged from 0 to 17 with the average of 6.71 and the standard deviation was 4.71. Highest proportion (41.9 percent) of the farmers was under secondary level of education.

Family size

Family size of the respondents ranged from 2 to 10 with the mean of 4.99 and standard deviation of 1.31. Highest proportion (52.4 percent) of the farmers was under medium family.

Size of mango orchard

Farm size of the respondents ranged from 0.08 hectare to 1.02 hectares with the mean of 0.24 and standard deviation of 0.164. The highest proportion (64.8 percent) of the respondents belonged to small farm size.

Training on mango cultivation

Mango cultivation experience of the farmers ranged from 0 to 5 days with a mean of 1.70 and standard deviation of 1.51. The highest proportion (66.7 percent) of the respondents belonged to received training.

Knowledge on mango cultivation

Knowledge on mango cultivation of the respondents ranged from 9 to 19 having an average of 13.66 and standard deviation 2.66. The highest proportion (73.3 percent) of the respondents belonged to medium knowledge.

Organizational participation

The observed organizational participation score of the respondents ranged from 0 to 9. The mean score was 3.69 with the standard deviation 1.5. The highest proportion (73.3 percent) of the respondents belonged to medium organizational participation.

Experience in Haribhanga mango cultivation

The observed experience score in Haribhanga mango cultivation is 3 to 13 years with mean 7.15 and standard deviation 2.54. The highest proportion (57.1 percent) of the respondents belonged to medium experience.

Time spent in Haribhanga mango orchard management

The observed time spent in Haribhanga mango orchard ranged from 1 to 10 hour, again the mean and standard deviation were 3.59 and 1.67 respectively. The highest proportion (53.3 percent) of the respondents belonged to medium time spent.

Number of Haribhanga mango tree

The score of number of Haribhanga mango tree ranged from 20 to 300. The mean was 81.11 and standard deviation was 50.66. The highest proportion (46.7 percent) of the respondents belonged to medium number of mango tree.

5.1.3 Results of hypothesis testing

Out of ten selected characteristics of the mango grower's family size, knowledge of mango cultivation, experience in Haribhanga mango cultivation and number of Haribhanga mango tree had significant relationship with their contribution of Haribhanga mango gardening on farm income. Rest 6 characteristics i.e., age, educational qualification, size of mango orchard, training on mango cultivation, organizational participation and time spent in Haribhanga mango orchard management had no significant relationship with their contribution of Haribhanga mango gardening on farm income.

5.2 Conclusions

"A conclusion presents the statements based on major findings of the study and these statements mostly confirm to the objectives of the research in the shortest form. It presents the direct answer of the research objectives, or it relates to the hypothesis" (Labon and Schefter,1990).

Finding of the present study and logical interpretation of other relevant facts, prompted the researcher to draw the following conclusions.

1. Contribution of Haribhanga mango gardening on farm income according to three aspects was investigate in this study. Overall contribution of Haribhanga mango gardening of the three aspects was low among 15.2 percent of the Haribhanga mango growers, medium among 70.5 percent and high among 14.3 percent of the mango growers. Above three-fourths (85.7 percent) of the respondents had medium to low contribution of Haribhanga mango gardening on farm income.
2. Family size of the mango growers had positive and significant contribution with their cultivation of Haribhanga mango. Majority (52.4 percent) of the respondents had medium family members. Therefore, it can be concluded that the more the family member the higher the production of mango.

3. Knowledge on mango cultivation had positive significant impact on mango cultivation. The result indicates that two thirds (71 percent) of the respondents had medium knowledge on mango cultivation. So, initiative should be taken to improve knowledge of the mango growers.
4. The results indicate that 57.1 percent of mango growers had medium experience of mango cultivation. So necessary steps should be taken to encourage mango growers to cultivate more mango to increase experience.
5. The number of Haribhanga mango tree had positive significant relationship with mango cultivation. The result shows that 46.7 percent of the mango growers had medium number of trees. Therefore, it can be concluded that the more the number of mango tree of the respondents, the higher would be production.

5.3 Recommendations

5.3.1 Recommendations for policy implication

1. Majority of the farmers of the study area were found to have medium level of contribution on farm income of Haribhanga mango. So DAE should take different initiatives such as different training programs, campaigns, workshops and so on to encourage farmers on Haribhanga mango cultivation.
2. Ministry of Agriculture through Bureau of Non formal Education (BNFE) and NGOs can take necessary steps to increase farmers knowledge on mango cultivation by arranging training program and regular farmers workshop program. Rally needs to be organized to broaden their knowledge on cultivating Haribhanga mango.
3. The study indicated that experience on mango cultivation had a positive significant contribution on farm income. So, extension agencies should take necessary steps to encourage farmers to cultivate Haribhanga mango.
4. The study indicated that majority of the farmers (46.7 percent) had medium number of tree and only 17.1 percent had high number of trees. So DAE and NGOs should take necessary steps to motivate the farmers to increase their number of mango tree.

5.3.2 Recommendations for further study

On the basis of scope and limitations of the present study and observation made by the researcher, the following recommendations are made for future study.

1. Only Rangpur Sadar and Mithapukur upazila were selected to conduct the present study. It is recommended that similar studies should be conducted in other areas of Bangladesh.
2. In the present study only ten (10) independent variables were studied. There will be some other important characteristics of the mango farmers' that could not be included in this study. So, opportunity will remain to study with other important variables.
3. The present study was concerned only with the contribution of Haribhanga mango gardening on farm income. It is therefore suggested that more reliable measurement of concerned variable is necessary for further study.

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APPENDICES

Appendix – A

(English version of the interview schedule)

Department of Agricultural Extension and Information System

Sher-e-Bangla Agricultural University

An interview schedule for a research study entitled:

ASSESSING THE CONTRIBUTION OF HARIBHANGA MANGO GARDENING ON FARM INCOME

Serial no: …….
Name of the respondent: ……..
Village: ……. Upazila: ……
Ward: …… District:……

(Please provide following information. Your information will be kept confidential and will be used for research purpose only)

Part A

1. Age: How old are you? ……..…years

2. Educational Qualification: Please mention your educational status from the following:

i. Don't know reading and writing ☐

ii. Can sign only ☐

iii. Did not go to school but can read and write which is equal to …… class

iv. I've studied up to ……class

3.Famly size: How many members in your family?.....

4. Size of mango orchard: What is your total farm size according to use in Haribhanga mango cultivation?.....Ha

5. Training on mango cultivation:
Have you received any training on Haribhanga mango cultivation?
Yes/No. If yes please provide the following information

SL. No	Name of Training Course	Name of organization	Duration (Days)
i			
ii			

iii			
iv			
Total			

6. Knowledge on mango cultivation:
Please mention the following information

SL. No	Questions	Total marks	Marks Obtained
i	Mentioned the name of two high yielding mango variety	2	
ii	What measures do you take for field sanitation at your mango orchard?	2	
iii	Mention the plant to plant and row to row distance for Haribhanga variety	2	
iv	Mention the rate of fertilizer at 100 decimals for Haribhanga variety	2	
v	How do you control fruit fly at your mango orchard?	2	
vi	How do you control mango hopper at your mango orchard?	2	
vii	How do you control leaf eating weevil at your mango orchard?	2	
viii	Where does the mealy bug attack at mango tree?	2	
ix	Mention the procedure of fertilization and maturing at your mango orchard?	2	
x	Mention any two diseases and their control measures of mango	2	

7. Organizational participation:
Please mention the nature of your participation.

		Nature of participation			
SL. No	Name of organizations	Not involved (0)	Ordinary Member (1)	Executive Member (2)	President/ Secretary (3)
i	GO organized co-operative				
ii	Youth Club				
iii	NGO co-operative				
iv	Farmers' co-operative organized by themselves				
v	IPM club				
vi	FFS				
vii	Religious committee				

8. Experience in Haribhanga mango cultivation:
How long have you been cultivating mango as commercial?.....years.

9. Time spent in Haribhanga mango orchard management:
How much time do you spend in mango farming? …… hours/week.

10. No of Haribhanga mango tree: How many trees are there in your Haribhanga mango garden?.....

11. Contribution of Haribhanga mango gardening on farm income:
Please mention the amount of annual farm income including Haribhanga gardening from the following sources during last year

SL. No	Name of income items	Production (Kg or Pound)	Income/Unit (Tk)	Total Income (Tk)
i	Rice			
ii	Wheat			
iii	Potato			
iv	Vegetables			
v	Fruits			
vi	Livestock			
vii	Poultry			
viii	Fish resources			
ix	Haribhanga mango			
Total				

Contribution of Haribhanga mango on farm income = $\frac{\text{Income from Haribhanga}}{\text{Total farm income}} \times 100$

=

=

Thank for your kind co-operation.

Dated:

……..……...
Signature of the Interviewer