HINDRANCES AND PROSPECTS OF MANGO CULTIVATION IN BANGLADESH FROM THE PERSPECTIVES OF FARMERS

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CERTIFICATE

This is to certify that the thesis entitled, **"HINDRANCE AND PROSPECTS OF MANGO CULTIVATION IN BANGLADESH FROM THE PERSPECTIVES OF FARMERS"** submitted to the faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **Master of Science (MS) in Agricultural Extension,** embodies the result of a piece of bona fide research work carried out by **Md. Shofikul Islam,** Registration No. **15-06990,** under my supervision and guidance. No part of this thesis has been submitted for any other degree or diploma.

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

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Dedicated to

My

Beloved Parents

Md. Abu Bakker Siddique

And

Selina Akhter

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The Author

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LIST OF ABBREVIATIONS

Aabbreviation	Full word
Ag. Ext. and Info. Sys.	Agricultural Extension and Information System
AEO	Agriculture Extension Officer
AIS	Agriculture Information Service
BAU	Bangladesh Agricultural University
BBS	Bangladesh Bureau of Statistics
BRRI	Bangladesh Rice Research Institute
CV	Co-efficient of Variation
DAE	Department of Agriculture Extension
et. al	All Others
etc.	et cetera, and the other
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
ha	Hectare
MoYS	Ministry of Youth and Sports
SAU	Sher-E-Bangla Agricultural University
SAAO	Sub-assistant Agriculture Officer
SPSS	Statistical Package for Social Science

HINDRANCES AND PROSPECTS OF MANGO CULTIVATION IN BANGLADESH FROM THE PERSPECTIVES OF FARMERS

MD. SHOFIKUL ISLAM

ABSTRACT

The main objective of the study was to describe the socio-economic profile of the mango farmers in the study area, to determine the hindrances and prospects of mango cultivation in Bangladesh from the perspective of farmers, to ascertain the hindrances and prospects of mango cultivation. The study was also conducted to explore the contributing relationship between the selected characteristics of the mango farmers and their hindrances and prospects of mango cultivation. The study was undertaken purposively in Natore Sadar Upazila under Natore district. An authenticated and well-structured interview schedule (questionnaire) was used to collect data from 110 mango farmers during 17th July to 14th August, 2017. Data analysis was done using statistical tools such as frequency counts, mean, standard deviation, co-efficient of variance and multiple regressions. The finding showed that more than half 60.91 percent respondents had moderate hindrance faced while 20.91 percent had minimum hindrance and 18.18 percents had serious hindrance on mango cultivation. Majority 58.18 percent of the farmers were in medium prospects category while 25.45 percent were in low prospects category and 16.36 percent were high prospects category. The results also showed that farmers' age and mango cultivating area had also significant negative relationship with farmers' hindrances on mango cultivation. Age and mango cultivating area had significant positive relationship with the farmers' prospects on mango cultivation.

Key words: Hindrance and prospect, Mango cultivation;

CHAPTER 1

Introduction

1.1 General background

Agriculture remains the most important sector of Bangladeshi economy, contributing 19.6 percent to the national GDP and providing employment for 63 percent of the population. Agriculture in Bangladesh is heavily dependent on the weather, and the entire harvest can be wiped out in a matter of hours when cyclones hit the country. According to the World Bank, the total arable land in Bangladesh is 61.2 percent of the total land area. In addition to these products, Bangladeshi farmers produce sugarcane, tobacco, cotton, and various fruits as mangoes bananas, pineapples etc. Quantity estimated by Hortex Foundation as per average export price of fruits 3205$ /MT on FY2010-11 due to export quantity data from Export Promotion Bureau. (Nations Encyclopedia, 2015)

Mangoes are juicy stone fruit belonging to the genus *Mangifera*, consisting of numerous tropical fruiting trees, cultivated mostly for edible fruit. The majority of these species are found in nature as wild mangoes. They all belong to the flowering plant family Anacardiaceae. The mango is native to South Asia, from where it has been distributed worldwide to become one of the most cultivated fruits in the tropics. While other *Mangifera* species (e.g. horse mango, *Mangifera foetida*) are also grown on a more localized basis, *Mangifera indica*—the "common mango" or "Indian mango"—is the only mango tree commonly cultivated in many tropical and subtropical regions. It is the national fruit of India, Pakistan, and the Philippines, and the national tree of Bangladesh. In 2013, world production of mangoes was nearly 43 million tones, with India accounting for 42% (18 million tons) of the total. China and Thailand were the next largest producers. Though Bangladesh produces a great amount of mango year-round, there are some hindrances in mango production. (Wikipedia, 2015)

Among various reasons for the impaired production of mango, the attack of insect pests and diseases is of particular importance. Insect pests and diseases not only reduce yields but also sometimes account for complete crop failures. About three dozen of insect pests are known to attack mango plants in Bangladesh from their nursery stage to maturity. Infested inflorescence bears a few or no fruits. Infested fruits drop prematurely or become unfit for consumption. Infestations to stem, branch, or roots may result in death or may affect the growth and vigor of a plant. Severe leaf infestations cause loss of vitality of trees which ultimately reduce fruit production. The major insect pests are Mango hoppers, *Idiocopus atkisoni*, *I. clypealis* and *I. niveosparsus* (Cicadellidae: Homoptera); Mango fruit weevils, *Sternochetus frigidus*, *S. gravis* and *S. mangifera* (Curculionidae: Coleoptera); Mango stem borer, *Batocerarubus* (Cerambycidae: Coleoptera); Mango shoot borer, *Alcidodes franatus* (Curculionidae: Coleoptera); Mango fruit fly, *Dacus dorsalis* (Tephritidae: Diptera), etc. Several fungal diseases such as anthracnose, sooty mold, leaf blight, die back, powdery milddew, and a bacterial disease named leaf spot cause considerable damage to mango plantations. Although there are some hindrances in mango production in our country it has great prospects in the future. (Banglapedia, 2014)

Mango has great prospects in Bangladesh. Mango is one of the most common, important and popular fruits in Bangladesh. Besides, having delicious taste, captivating flavor with multifarious colors, it is an excellent source of nutritive values. In Bangladesh, mango ranks first in terms of area and third in production. (BBS, 2008)

The main mango growing regions are around Chapai Nawabgonj, Rajshahi, Dinajpur, Rangpur and Kustia. But, in color, taste and flavor mangoes of Chapai Nawabgonj are very excellent. However, the better varieties of mangoes have exotic names like Fazlee, Langra, Ashhwina, Khisanbogh, Kumphari, Bombai, Lata Bombai, Khoitoor, Amropali, Mohonbogh, Misri Kanto, Brindabon, Sendura, Surjopuri, Batasha, Rajvogh, Kanchon Baromasi,

etc. Out of these mangoes, Fazlee, Langra, Goplvogh and Khirsapat are considered to be the premier varieties food fit for the gods! Each has distinctive flavor and arguments about the superiority of one over the other can get very serious. There we have over 270 varieties of sweet edible mangoes in the Rajshahi region alone. Newer groves are being setup and high-quality fruit trees have been planted along the boundaries of the paddy fields. According to the estimate of agriculture extension department, last year about 9,45,000 tones of mangoes was produced in the country. It is expected that it will exceed up to 10,00,000 tones this year. According to BBS (2009), Bangladesh produces 600 thousand metric tons of mangoes from 64 thousand hectares of land. In 2012, the area of mango garden in Bangladesh was 37,000 hectares. This year mango has been cultivated in 42,000 hectares of land. As per estimate of FAO, in 2012 about 8,90,000 tones mango was produced in Bangladesh, for which Bangladesh occupied the 8th place in the world as a mango producing country. Within two years, production of mango has increased and it has reached up to 10,00,000 tones. Now as a mango producing country the position of Bangladesh is 7th in the world. Bangladesh exported more than 800 tones of mangos, mainly to the European markets. Uses the mango is one of the most delicious fruits of the world and is rightly designated as the 'king of fruits'. Different varieties however, have different tastes and flavors. The best consumption of mango is in the form of fresh fruit. The ripe fruit is peeled and the pulp is eaten as such, the fleshes either cut into pieces or made into small slices. Green fruits are often put into curries or 'dal' (pulse soup) for extra taste. A considerable quantity of both ripe and green fruit is used for making jam, jelly, squash, chutney, pickle (achaar), and similar other products. (The Daily Sun, 2015)

1.2 Statement of the Problem

Mango is the most significant tropical fruit produced in Bangladesh. The mango cultivation is many centuries old and the farmers are unaware of the modern improved cultivation practices. They have many hindrances relating to cultivation, harvesting and marketing.

In the cultivation stage, they have hindrance with decrease in rainfall, natural calamities cause fluctuation in production and frequent drought conditions hampered the development of agriculture. In the harvesting stage perishable nature of fruits are wasted due to lack of storage facilities and lack of effective processing or preservation techniques, leads to high wastage. The pest and disease hindrance also result low output and poor quality of fruits.

In the marketing stage, they have many hindrances relating price fluctuation and lack of marketing hindrances. Bangladesh is far from tapping the prospect of processing and exporting mango processors and exporters currently not available. Among all pre-and postharvest practices, loss of mango is the main hindrance and after that marketing system for commercialization is mainly responsible for losses of hindrance. So, hindrances and prospects of mango cultivation have been taken as present research topic.

In order to minimize farmers' hindrances and maximize prospects mango cultivation, the researcher undertook the investigation entitled "Hindrances and prospects of mango cultivation in Bangladesh from the perspectives of farmers" in selected areas of Natore district, to have an understanding of the extent of losses of mango cultivation by the farmers. Research information is required which could be helpful to the policy maker, regarding supply of inputs, technological knowledge and hindrance being encountered on mango processing.

The purposes of the study were to study the hindrances and prospects of the farmers in mango cultivation and to explore the contributing relationship between the selected characteristics of the farmers and their hindrances and prospects on mango cultivation. In order to make the study manageable, the following research questions were taken into consideration.

1. What is the socio-economic profile of the mango farmers?
2. What are the prospects of farmers in mango production in selected areas?
3. What is the improved cultivation and marketing strategies to overcome the existing hindrances?
4. What is the level of contribution of some selected characteristic of the mango farmers with their prospects of mango cultivation?

1.3 Objectives of the study:

(1) To describe the socio-economic profile of the mango farmers.

- Age
- Educational qualification
- Mango cultivating area
- No. of modern variety practices
- Training experience
- Farming experience
- Knowledge on mango cultivation
- Agricultural extension contact
- Income from mango cultivation

(2) To ascertain the hindrances and prospects of farmers in mango production in selected areas.

(3) To identify the level of contribution of some selected characteristics of the mango farmers with their hindrances and prospects of mango cultivation.

1.4 Justification of the study

Mango has a unique position in respect of nutritional quality, taste, consumer's preference among the fruits grown in Bangladesh (Ahmad, 1985). Mango is rich in several vitamins. Mango provides a lot of energy with as much as 74 kcal per 100 g edible portion. The composition is generally differing with the cultivar and the stage of maturity. However, the unripe green mangoes are reported to have 87.5 g moisture, 0.7 g protein, 0.1 g fat, 20.1 g carbohydrate, 0.4 g mineral, 1.2 g fiber, 10 mg calcium, 2 0.0 mg phosphorus, 54 mg iron, 90 g Vitamin A, 0.04 mg Vitamin B|, 0.01 mg Vitamin B2, 3 mg ascorbic acid and

44 Kcal energy (Anon, 1992). Mango peel which amounts to 10-20% of the fruit by weight also a good source of dietary fiber (Larrauri *et al.* 1996). There is perhaps no fruit other than ripe mango that contains so much carotene and unripe mango has the first position among all major fruits in containing iron (Hossain, 1989).

Though a huge amount of mango is produced in every year in Bangladesh, a significant portion of them goes to waste due to its high perish ability and cramped seasonality. The Peak harvesting period of mango is June to July. It's a hot, humid and rainy period of Bangladesh. In this period, marketing of fruit becomes difficult, as the fruits are rotten.

Lack of knowledge in the growers and latest technologies are also key-reasons behind such spoilage leads to enormous economic losses, the researchers pointed out. During the peak season for example, about 50 percent fruits mainly mango, pineapple, watermelon, jackfruit, tomato etc. is lost due to inadequate processing facilities in Bangladesh (Hussain, 1993).

Preservation of mango ensuring quality would reduce the wide fluctuation of prices between peak harvesting period and off-season. Moreover, if the excess amount of this seasonal fruit can be processed and dried for the future storage that may be an earning source of foreign currency. On the other hand, mango processing industries may generate an employment opportunity which is one of the urgent needs in the present context of Bangladesh.

Therefore, assessing the proper commercialization of mango can be considered important alternatives for finding out the reason behind the pre-and postharvest losses of this nutritive fruit. The necessary steps can be taken to minimize the losses fulfilling the above requirement. The researcher developed a felt need to conduct this sort of research. So, the researcher is eagerly interested to undertake the research entitled "Hindrances and prospects of mango cultivation in Bangladesh from the perspectives of farmers" at Natore Sadar Upazila under Natore district". The findings of the study will be helpful to the extension providers and to the growers, intermediates, wholesalers, retailers, consumers and researchers of mango. It is assumed that if the reason of problems of

mango marketing could be identified and minimized successfully, the deficiency of food and economic condition of our country would be improved undoubtedly.

1.5 Assumptions

An assumption is the supposition that an apparent fact or principle is true in the light of the available evidence (Goode and Hatt, 1952). The researcher had taken the following assumptions into consideration during carrying out the study.

a The respondents had enough capability to provide proper response to the questions furnished in the interview schedule.

b Views and opinions provided by the respondents included in the sample were representative of the whole population of the study area.

c The items, questions, and scale of measurement of the variables were reasonably authentic to represent the actual condition of the respondents.

d The findings of the study would give a clear concept of the impact of hindrances and prospects.

e The data furnished by the respondents were free from bias.

f The researcher was capable to adjust with the social and cultural environment of the study area. So, the respondents could provide their information correctly.

1.6 Limitations of the Study and scope of the study

During the entire research the limitations were:

a The research was confined to the three villages of Sadar Upazila under Natore district.

b Data were collected from a small group of respondents taken as the sample of the study because of time and resource constraints.

c The research was carried out taking unequal number of respondents in study and control group.

d Further research is essential for identifying other sources of bias.

e Only nine socio-demographic characteristics of the farmers were selected as independent variables.

6. Reluctance of the farmer was overcome by establishing rapport.

1.7 Definition of Terms

The term which have been frequently used throughout the thesis are defined and interpreted below:

Respondents: Randomly selected people considered to be re-presentable of the population are known as respondents. They are the people from whom a social research worker usually gets most data required for his research. In this study respondents were mango farmers.

Farmers: The persons who were involved in farming activities are called farmers. They participated in different farm and community level activities like crops, livestock, fisheries, other farming activities etc. In this study, mango growers were treated as farmers.

Age: Age of a respondent referred to the span of life and it was measured by the number of years from his/her birth to the time of interviewing.

Educational qualification: Level of education referred to the formal education received up to ascertain level in a formal educational institution (school, college or university).

Mango cultivating area: In this study mango cultivating area refers to the area of land which was used by the farmers for mango cultivation. It was expressed in hectare.

No. of modern mango variety practices: In this study, it refers to the modern mango variety which is owned by the respondents.

Training experience: Training experience referred to the time spent in receiving agricultural training by the respondents. It was measured in number of days of training received by the respondents.

Farming experience: Farming experience referred to the time period during which he/she is performing agricultural activities.

Knowledge on Mango cultivation: It referred to the extent of basic understanding of the agricultural subject matters like crops, livestock, fisheries, agro forestry, insect and diseases of crops, fertilizer etc.

Agricultural Extension contact: It referred to an individual exposure or contact with different communication media, source and personalities being used for dissemination of new technologies among the farmers.

Income from Mango cultivation: Annual income referred to the total earnings of a respondent and his/her family members from agricultural and non-agricultural sources (business, services, daily labor etc.) during the previous year. In this research, one score was assigned for each lakh taka.

Hindrance: Hindrances was defined as any difficult situation which requires some action to minimize the gap between "what ought to be" and "what is".

Prospect: Prospect may be defined as the possibility that something good might happen in the future.

Chapter 2

Review of Literature

Mango is one of the favorite and delicious fruits of Bangladesh. Mango grows all over the country but cultivation of good quality of mangoes with known varietal name is considered in North-West region. Research on the performance of commercial and promising mango varieties at different agro ecological zone of Bangladesh is scanty. Literature related to the present work has been reviewed here.

2.1 Hindrances of mango cultivation in Bangladesh

(A) An overview of the impact of marketing system on the mango cultivation in Bangladesh

According to Matin et al., (2008), unstable price of mango was the first rank problem in the study area. Establishment of mango processing plant in the intensive growing areas may be the remedy of the problem, which will ensure fair prices for the farmer.

According to Islam (2013), is that the average per kg marketing cost was estimated to be Tk. 1.58 in Volahat Upazila under Chapai Nawabganj District for 'Faria'; Tk. 2.21 for 'Bepari'; Tk. 1.80 for 'Aratdar' and Tk. 1.94 for wholesaler in Kawran Bazar, Dhaka. The retailers of Kawran Bazar of Dhaka incurred with heavy cost (2.62 Taka/kg) and corresponding the highest net margin (3.78 Tk/kg). From the above survey, it was found that the total cost of marketing was 10.15 Taka/kg and the total marketing margin was 12.23 Taka/kg for mango intermediaries (Chapai Nawabganj-Dhaka). The calculated value of marketing efficiency was 2.21. In the mango marketing system, the growers' share was 69.85%, which is higher than 50% and it indicated that mango marketing is quite competitive and marketing system should be improved in the remote areas.

According to Bung (2012), is stated major reasons for ill growth of this sector include: not availability of seedling of right varieties of mangoes that are ideal for processing; lack of necessary infrastructure; lack of cooperative effort

amongst farming community; and lack of integration of all the activities starting from farm gate till final consumers because of ill functioning of the government departments institutions with no clear direction and goals. However, a coordinated, integrated and strategic effort of all the stake holders is must to turnaround this industry.

As described as Ghosh et al., (2013), is stated that both qualitative and quantitative characteristics were considered in order to study the variations among the cultivars. The described cultivars were cross checked with the commercial varieties according to available literature but there was no resemblance between these two categories. The studied characters indicated that there remained considerable variations among those cultivars and these could be used for commercial basis as well as varietal development and needs to take action for sustainable conservation.

(B) An overview of the impact of mango processing plant on the mango cultivation in Bangladesh

Rana (2016), described that Bangladesh is yielding huge numbers of mangoes every year but no significant mango processing plant has been set up here as of yet. Various processed food-items particularly juice, soft drinks, pickles, jams and jellies can be manufactured through the processing of mangoes. If possible, this sector can contribute a lot to the region's economy as the processed foods are in enormous demand, apart from their high market values. Mango is a perishable item. So, it needs immediate consumption or processing for its value addition. Besides, various natural calamities like storms, hailstorms, gusty winds, tornados and droughts cause a significant portion of produced mangoes to fall out of trees. However, the modern processing plant can make the fallen mangoes valued food items and protect them from getting damaged.

According to Khatun (2015), is revealed that the existing mango based agro forestry system is profitable and has a great opportunity to increase national production to feed the growing population. There is a scope of adopting improved management practices and it may increase the total production.

Based on crop condition with mango forest, a total of 12 mango based agro forestry systems were identified. The most frequent observed mango based agro forestry systems were Mango + Turmeric (85.00%) and Mango + Ginger (78.75%). Maximum respondents (72.50%) commented that 10 - 12 years aged mango tree performed best yield. Some problems were identified in respect of mango based agro forestry systems. About 40% respondents faced medium level of problems for marketing of mango. The discounted benefit cost ratio (2.006), and the internal rate of return (29%) clearly indicated that mango based agro forestry system was productive and economical system. However, some problems were identified in respect of mango based agro forestry system among the farmers are lack of communication facilities, middle man interference, lack of storage facilities, lack of marketing infrastructure and lack of processing industries as well as infestation of insect and disease was the severe problems.

(C) An overview of the impact of diseases on the mango cultivation in Bangladesh

According to Khan et al. (2015), incidence and severity of important seedling diseases of has been studied under different geographical locations (viz. Mymensingh, Dinajpur, Rajshahi and Khagrachari) of Bangladesh. The effects of temperature, rainfall, and relative humidity on the incidence and severity of noted diseases were observed the aforesaid locations of Bangladesh. The studied diseases were anthracnose, leaf spot, red rust, powdery mildew, scab, bacterial leaf blight and malformation of mango seedlings. The graphs of weather parameters and incidence and severity of diseases were performed to determine the relationship between different components of climatic factor and seedling diseases of mango. The weather parameters have profound effect on the occurrence of seedling diseases of mango and the effect differs significantly in different weather conditions. However, critical study should be conducted on host-pathogen system to find out the most appropriate time to combat the disease at minimum effort.

According to Kobra (2007), is stated that all the varieties were affected by insects and diseases at different degrees. Lata Bombai was highly susceptible to anthracnose, floral malformation and stem-end-rot at almost all the locations. Other cultivars showed low to medium susceptibility to all these diseases. Incidence of fruit fly and stem borer was low to medium at all locations while fruit weevil infestation was low at Akbarpur and Gazipur and absent at Chapai Nawabgonj. The overall result of the experiment indicated that almost all the cultivars showed better performance in respect of tree growth, yield and fruit quality under Chapai Nawabgonj condition. Only Khirsapat exhibited static performance in yield over locations. so, the initiative should be taken for the better performance of Khirsapat in this area.

According to Islam et al., (2015), is that the fungi anthracnose (*Colletotrichum gloeosporioides*) and leaf spot (*Pestalotiopsis mangiferae*) were identified firstly by symptoms observed and then confirmed by observing under compound microscope from infected leaves while sooty mold (*Capnodium roseum*) was identified only on basis of symptoms observed. Conidia of *Colletotrichum gloeosporioides* were dark colored, single cell barrel shaped. Conidia of *Pestalotiopsis mangiferae* had three thick walled, brownish, non-colors median cells and thin-walled hyaline apical and basal cells, fusi form and straight to slightly curve. Patches on leaf by forming a thin membranous covering over the affected parts was found on the sooty mold affected mango. Maximum incidence and severity of anthracnose and leaf spot was found at Khagrachari district and during the month of October respectively while maximum incidence of the sooty mold was found in January and Khagrachari district.

As described as Krishnan et al., (2009), there are about 1500 varieties of mango in the world of which about 1200 are found in India. Among the known diseases of mango, mango malformation is the most serious disease. The etiology of malformation has not yet been discovered due to paucity of information and thus no effective control measure is known.

As described as Dinh (2003), is that five mango cultivars, Nang Klang Wan, Nam Dok Mai, Chok Anan, Kaew, and Rad were tested for the resistance to the disease by inoculating with *C. gloeosporioides*on fruits and leaves. For the fruit test, both at pre- and post-harvest stages mangoescv. Nam Dok Mai and Nang Klang Wan were found to be susceptible to anthracnose whereas Rad was resistant. The level of difference of anthracnose severity on fruit between the five cultivars was not affected by inoculation time (7days before and a day after harvesting). For all these cultivars, the level of disease resistance of the leaves of grafts or seedlings, those derived from the same tree or fruit, showed no correlation with the level of resistance of the fruits.

(D) An overview of the impact of the pesticide spray on the mango cultivation in Bangladesh

According to, Mele et al., (2001), around 20% of the insecticides used belonged to WHO Toxicity Class I, while the rest nearly all belonged to Class II. Half of all the target sprays were done with three parathyroid products only. Farmers' estimated yield loss due to insect pests was strongly correlated to estimated pest severity. Due to pesticide sellers' recommendations, farmer's spray load significantly increased from 26 to 37 sprays per year, whereas the number of insecticide products used per farmer increased from2.6 to 3.9 with advice from extension staff and media. Expenditure for pesticides was correlated with that of fertilizers. There was no relationship between the amount of pesticides sprayed and yield. On-farm research is needed to evaluate whether significant savings can be obtained given a more judicious use of pesticides.

2.2 Prospects of mango cultivation in Bangladesh

(A) An overview of the impact of IPM on the mango production in Bangladesh

According to, Muriithi et al., (2015), mango yield losses due to fruit fly infestation reduced by an average of 19% among the IPM users. We also found a reduction in expenditure on pesticides, albeit across all the households.

Regression model estimates show that, except for IPM combinations posbiop and pos, farmers using the rest of the IPM practices recorded significantly higher incomes from mango compared to their counterparts in the control group. We also noted that although average expenditure on pesticides decreased across all mango farmer households, the reduction was comparable between the treated and control farmer households. Our findings however, show significant decreases in mango damage due to fruit fly infestations among all farmers using the different IPM treatments.

As described as Ekesi et al., (2015), that the study findings further show mango yield losses due to fruit fly infestation reduced by an average of 19% among the IPM users. We also found a reduction in expenditure on pesticides, albeit across all the households. Regression model estimates show that, except for IPM combinations posbiop and pos, farmers using the rest of the IPM practices recorded significantly higher incomes from mango compared to their counterparts in the control group. We also noted that although average expenditure on pesticides decreased across all mango farmer households, the reduction was comparable between the treated and control farmer households. Our findings however, show significant decreases in mango damage due to fruit fly infestations among all farmers using the different IPM treatments. Our study recommends combinations of affordable and easy to apply and maintain IPM strategies that could yield significant impact on mango fruit fly control.

However, Korir et al., (2015), is revealed that mango growers adopt only particular IPM components instead of the whole IPM package. Possible reason for adoption of specific components could be attributed to lack of knowledge of the combination of IPM components that maximize benefits, both by the farmer and extension workers. Such empirical study that analyzes the impact of different combinations of IPM intervention packages do not exist.

As described by Mugure (2012), is that policy implications in the design and implementation of workable policies that support sustainable dissemination of IPM technologies if the expected high demand and potential benefits to farmers are to be realized. A more systematic ex-post impact assessment study should

however be conducted after the release and adoption of the technology to evaluate the performance of this intervention.

Myat (2012), described as to improve mango fruit quality, government supporting relevant technologies and establishing processing factories are still needed. Information flow among stakeholders is very important from the expert's point of view. Collaboration between the stakeholders, implementation of GAP standards, exhibition and promotion activities are crucial. Government should support loan scheme to the growers, integrated pest management (IPM) and post-harvest practices trainings, supporting agri-business knowledge and sharing knowledge on the quarantine system to meet the requirement of the export target countries. Myanmar mango exporting can be improved by changing trade policies and plant quarantine policies and inviting foreign direct investment. Inclusion of consumers in the future studies is highly recommended in order to span boundaries of knowledge provided by this research study which includes growers, marketers, and exporters.

According to Mugure (2102), the average percentage loss due to fruit fly infestation via rejections at the farm was 24 percent, with some farmers reporting higher losses of up to 60 percent. The results further showed that fruit fly related mango losses increase with the area under mango cultivation and the farmer's age while access to information on pest control, annual income and orchard sanitation are associated with lower losses. Results from the willingness to pay (WTP) analysis showed that 66 percent of respondents were willing to pay the cost of KES 1100 per acre for the IPM fruit fly control package. The descriptive mean WTP among farmers was found to be KES 1700 per acre implying a high potential for its adoption as it is higher than the pre-determined seasonal cost. Farmers' WTP for the package is positively influenced by a host of factors; level of education, mango cropping system, household income, the magnitude of fruit damaged by fruit fly, damage rating and expenditure for pest control using pesticides. Based on the empirical results, the study derives policy implications in the design and implementation of workable policies that support sustainable dissemination of IPM

technologies if the expected high demand and potential benefits to farmers are to be realized. A more systematic ex-post impact assessment study should however be conducted after the release and adoption of the technology to evaluate the performance of this intervention.

According to Njeri et al., (2009), the results indicated that on average Integrated Pest Management fruit fly control package (IPMFFCP) participants had approximately 54.5 percent reduction in magnitude of mango rejection than the non-participants. The participants spent approximately 46.3 percent less on insecticide per acre than the non-participants and on average received approximately 22.4 percent more net income than the non-participants. Results also showed that 78 percent of households perceived the intervention improved human health. The results imply that IPMFFCP participants are better off in terms of magnitude of mango rejection and insecticide expenditure reduction and net income from mango production increment. The study recommends expansion of IPMFFCP intervention to the entire mango growing area.

(B) An overview of the impact of sustainability on the mango cultivation in Bangladesh

According to Archbold (2016), is that although both combinations produced fruit with higher quality than the control, the BT combination produced fruit with the higher total soluble solids, reducing, non-reducing, and total sugar content, and vitamin C content than the NB combination. Both BT and NB combinations of the optimums identified in the prior studies were successful at advancing bloom and harvest and increasing yield more than any of the optimum individual components alone, by 14-fold more than untreated trees for the BT combination, suggesting there were additive, if not synergistic, effects on mango. Further studies are warranted to assess the sustainability of these effects over longer periods of time, and to ascertain if the effects occur across mango cultivars and production environments.

As described as Uddin (2016), is that the study discloses that the inherent antioxidant content of mango varieties had significant effect on the quality and

shelf life in mango products. Inherent antioxidants vitamin A, Beta carotene, and vitamin C have also investigated among some mango varieties gutti, ashina, langra by the apparatus Liquid Chromatography Mass Spectrometer (LCMS). However, finally microbiological investigation on mango slices have executed by the parameters coliform, TPC, Yeast & Mold for the sustainability and checking of its quality.

According to B. K. et al., (2014), mango varieties contain significant amount of vitamin C (46.53- 26.53 mg/100 gm), total sugar (5.48 -4.27%) and total carbohydrate (27.33 - 4.49 gm/100 gm). The maximum calorific value (112.12kcal/100 gm) was found in Amrapali. Heavy metal analysis was also done but no significant amounts were found. Present study thus strongly suggests that different varieties of mango can provide higher amount of vitamin C and important minerals that will be a sustainable health benefit.

Akter (2013), described as that, the highest moisture content (79.65%) was recorded in Amrapali and the lowest was in Sindhu (69.79%). The highest dry matter content (30.62%) was recorded in Sindhu and the lowest (20.35%) was in Amrapali. All the germplasm was chemically analyzed and highly significant differences were recorded among the germplasm. The germplasm Langra and Khirsapat possessed the top most TSS (24.06%). The per cent total sugar, reducing sugar and non-reducing sugar was the highest in Amrapali (22.11%, 6.01%, 16.10%) respectively and the lowest was in Sindhu (13.81%, 3.28%, 10.53%) respectively. The Titratable acidity was the highest in Sindhu (0.62%) and the lowest was in Amrapali (0.32%). From the above findings, it could be said that among the germplasm, Amrapali was found to be the best considering the overall performance of all the germplasm. However, the germplasm of Amrapali has no yet spread all over the country. The Germplasm Amrapali may be considered for extension in our country.

According Musyimi (2013), the highest recovery of juice was found in Kent and Apple (> 71 %) while the lowest was exhibited by Sabine (53%). The extracted juice had a high sugar content ranging from 17.0 - 23.9°Bx. Apple and Ngwee variety exhibited the highest sugar content (> 23°Bx) whereas

Sabine had the lowest (17°Bx). The optimal conditions for wine fermentation were at 25°C and 0.05% yeast concentration using wine yeast. The sensory evaluation indicated that mango wine exhibited similar sensory characteristics in terms of clarity and general acceptability as compared to a reference grape wine. This study provides evidence that mango fruits are suitable for wine processing Contrary, Sabine variety is not suitable for wine production, it is suggested that alternative uses should be sought for its utilization.

2.3 Research Gap

A lot of researches on mango cultivation can be found but very few researches have so far been conducted to measure the hindrances and prospects of mango cultivation. Only a few researchers keep maintain the proper methods and materials to determine the hindrances and prospects of mango cultivation. This was a research gap of the study. Hence the researcher carried out the present study to determine Hindrances and prospects of mango cultivation in Bangladesh from the perspectives of farmer. Very few researchers carried out their study to explore the contribution of the selected characteristics of the farmers on their hindrances and prospects of mango cultivation. This was another research gap of this study. The researcher carried out study to explore the contribution of the selected characteristics of the farmers on their hindrances and prospects of mango cultivation. The researcher carried out the research with both hindrances and prospects of mango cultivation. Eventually, this was the research gaps for that the researcher carried out the research.

2.4 Conceptual Framework

The present study had focused two concepts: first the farmer's selected characteristics and the second, hindrances and prospects of mango cultivation in Bangladesh from the perspectives of farmers. In scientific research selection and measurement of variables constitute an important task. The hypothesis of a research consist at least two important elements i.e.: a dependent variable and independent variable. A dependent variable is that factor which appears, disappears or varies as the researcher introduces, removes or varies the

independent variables (Townsend, 1953). An independent variable is that factor which is manipulated by the researcher in his attempt to ascertain its relationships to an observed phenomenon. Variable together are the causes and the phenomenon is effect and thus, there is cause effect relationship in the universe. Hindrances and prospects of mango cultivation in Bangladesh from the perspectives from farmers will be considered as dependent variables and nine selected characteristics were considered as independent variables. It is not possible to deal with all independent variables in a single study. It was therefore necessary to limit the independent variables which include: (a) Personal Characteristics: i) Age ii) Educational qualification iii) Farming Experience iv) Training experience (b) Economic Characteristics: i) Mango cultivating area ii) Income from Mango cultivation (c) Social Characteristics: i) Agricultural extension contact iii) No. of modern variety practices (d) Psychological Characteristics: i) Knowledge on Mango cultivation. Considering the above mention discussion, a conceptual framework has been developed for this study, which is diagrammatically presented in the following Figure 2.1

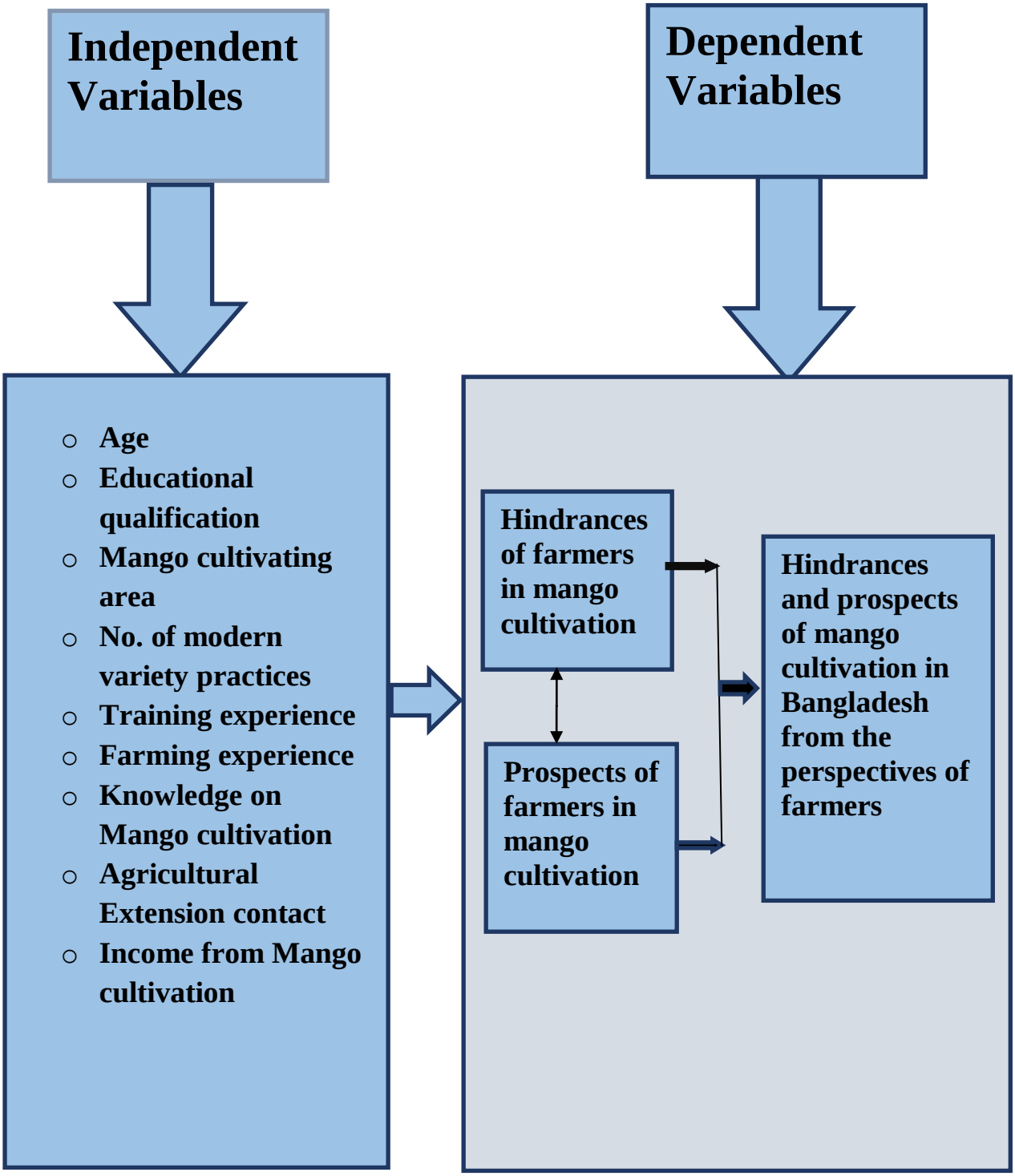

Figure 2.1: The conceptual framework of the study

CHAPTER 3

MATERIALS AND METHODS

Methods and procedures will be used for collection and analysis of data is very important in any scientific research. It requires a careful consideration before conducting a study. The researcher has great responsibilities to clearly describe as to what sorts of research design, methods and procedures he would follow in collecting valid and reliable data and to analyze and interpret those to arrive at correct conclusions. The methods and procedures will be followed in conducting this study has been discussed in this chapter. Further, the chapter includes the operational format and comparative reflection of some variables used in study. Statistical methods and their use have been mentioned in the later section of this chapter.

3.1 Locale of the study

To achieve the objectives of the present study, data will be collected from Natore Sadar Upazila. This Upazila occupies an area of 401.29 square kilometer. Natore Sadar has a population of 400030. It was observed that DAE was organized the numerous number of result demonstration program in Laxmipur Kholabaria Union of Natore. For clarity of understanding, map of Natore district that showing Natore Sadar Upazila and map of Natore Sadar Upazila that showing the study area have been shown in the Figure 3.1 and Figure 3.2.

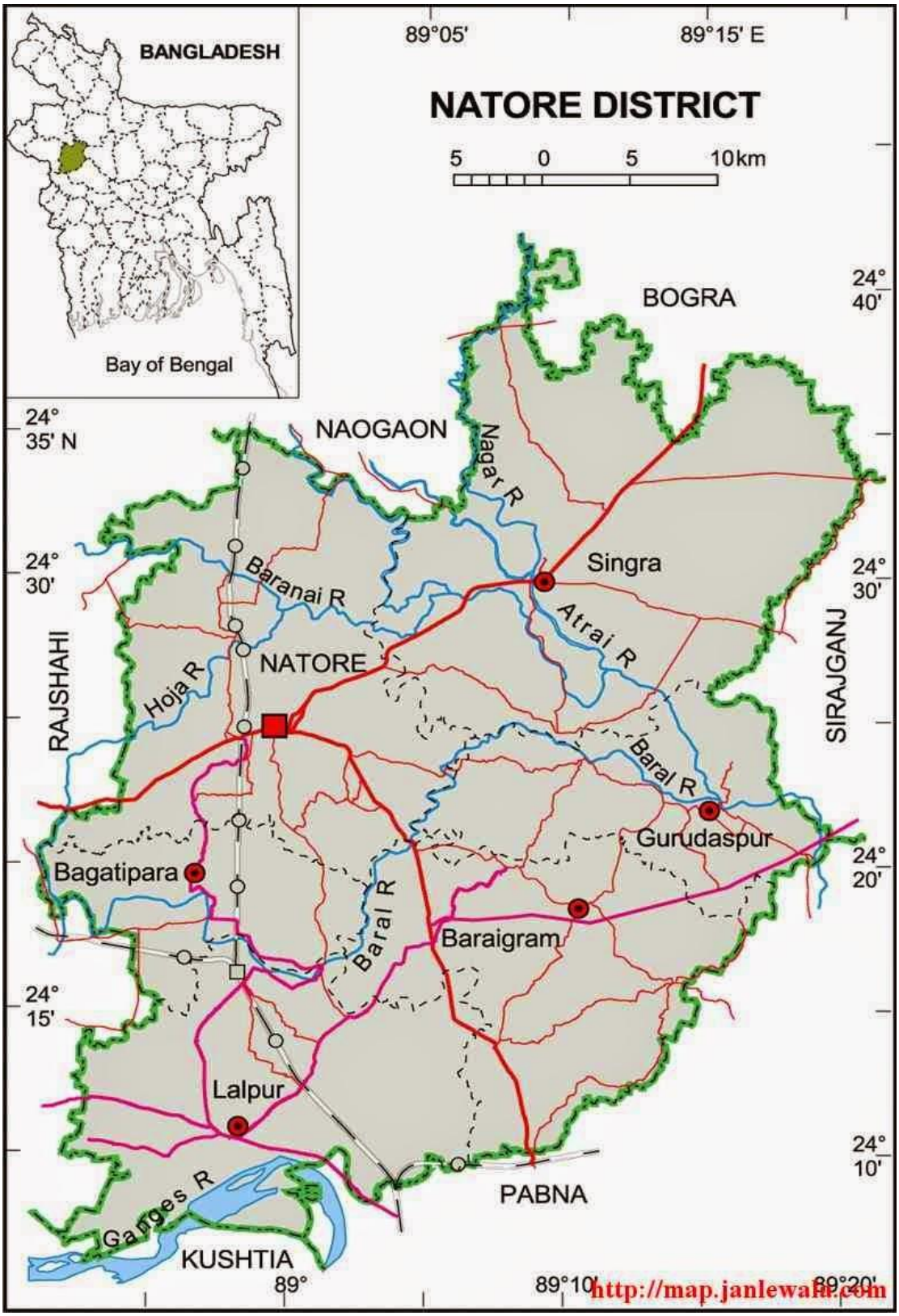

Figure 3.1 Map of Natore District Showing Natore Sadar Upazila

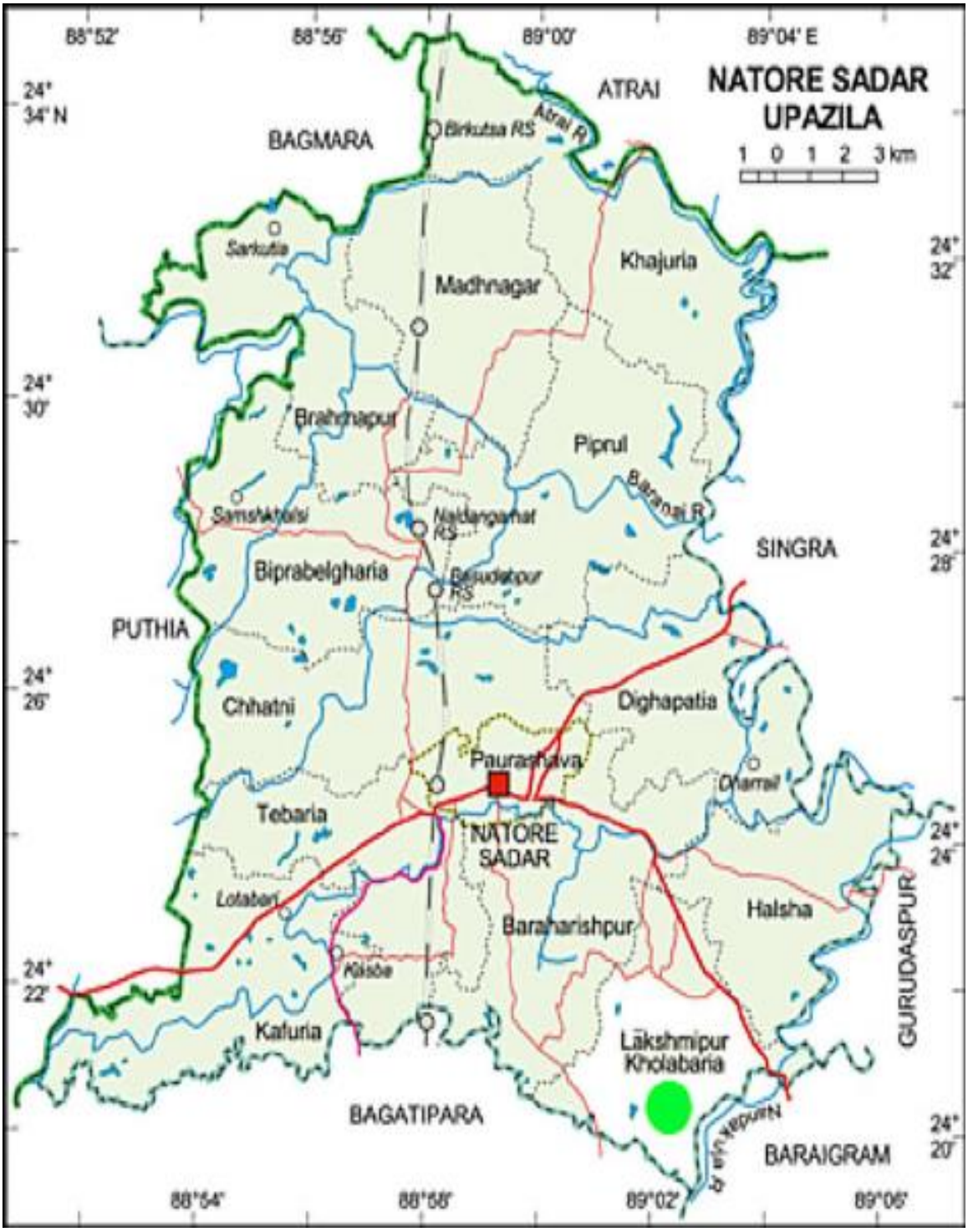

Figure 3.2 Map of Natore Sadar Upazila Showing the Study Area

3.2 Population and Sampling

The list of result demonstrations that organized the previous years will be collected from the local Upazila Agricultural Office with the help of Sub Assistant Agricultural Officers (SAAO). The researcher carefully will be noticed the villages where most of the result demonstration programs will be implemented. Out of these villages, three villages Laxmipur, Kholabaria, and Tabaria under Natore Sadar Upazila will be purposively selected as the population of the study and the size of the population will be 480. According to Yamane's (1967) formula, sample size was determined as 110. A reserve list of 20 farmers will be prepared in case of their absence for any case. In calculating sample size 10% precision level, 50% degree of variability and value of Z=2.57 at 99% confidence level were chosen from the following formula:

$$n = \frac{z^2 P(1-P) N}{z^2 P(1-P) + N(e)^2}$$

Where;

n= Sample size

N= Population size

e= the level of precision

Z= the value of the standard normal variable at the chosen confidence level

P= the proportion or degree of variability

Proportionate random sampling technique will be used to select sample from three villages of study area. According the appropriate proportion of sample size data will be collected from each village of Laxmipur-Kholabaria Union of Natore Sadar Upazila. A reserve list of 20 farmers (about 15%of the sample) will be kept purposively if any respondents will be unavailable at the time of data collection. The distribution of population and sample will be shown in Table 3.1

Table 3.1 Distribution of the sample of farmers in the study area

Study area (Villages)	Population size	Number of Sample	No of Respondents in reserve list
Laxmipur	150	45	7
Kholabaria	145	25	5
Tabaria	185	40	8
Total	480	110	20

3.3 Data collecting Instrument

In order to collect valid and reliable information an interview schedule will be prepared. Interview schedule will be used as the research instrument. It was carefully designed keeping the objectives of the study in mind. Both open and closed form of question will be used to collect information. Simple, direct question and scales will be included in the interview schedule for collecting information regarding the focus of farmer attitude towards mango cultivation in Natore district. Interview schedules will be pre-tested in actual field situations before using it for final data collection among 15 respondents of the study area. Necessary corrections, modifications and additions will be made in the interview schedule on the basis of results of pre-test. The interview schedule will be then the printed in its final forms. Necessary photocopies will be then made. A copy of the interview schedule in English version will be furnished in Appendix-A.

3.4 Collection of data

Before data collection, the researcher met the Agricultural Extension Officer (AEO) and one of the Sub-Assistant Agriculture Officer (SAAO) of that block for necessary help and cooperation. Data will be collected personally by the researcher himself through face to face interview. Interviews will be usually conducted in respondents, house during their leisure period. While starting interview with any respondent, at first the researcher took all possible care to

establish rapport so that he/she did not hesitate to furnish proper responses to the questions and statements included in the interview schedule. However, if any respondent felt difficulty in understanding any questions, the researcher took utmost care to explain and clarify the question. Data were collected from 17th July to 14th August, 2017.

3.5 Variables of the study

In a social research, the selection and measurement of variables constitute an important task. In this connection, the researcher looked into the literature to widen his understanding about the nature and scope of the variables as any measurable characteristics which can assume varying of different successive individual cases. The hypothesis of a research, while constructed properly, contains at least two important elements, an independent variable and a dependent variable.

An independent variable is that factor which is manipulated by the researcher in his attempt to ascertain its relationship to an observed phenomenon (Townsend, 1959). A dependent variable is that factor which appears, disappears or varies as the experimenter introduces, removes or varies in the independent variables. The dependent variables are often called the criterion or predicted variable, whereas the independent variable is called the treatment, experimental and antecedent variables (Dalen, 1977).Variables are very important for social research on which the statistical analysis will be done by obtained score on these variables, these following ten characteristics of farmers will be considered as independent variables in this study and these are:

1. Age
2. Educational qualification
3. Mango cultivating area
4. No. of modern mango variety practices
5. Training experience

6. Farming experience
7. Knowledge on Mango cultivation
8. Agricultural Extension contact
9. Income from Mango cultivation

In this study, the dependent variables will be "Hindrances and prospects of mango cultivation in Bangladesh from the perspectives of farmers".

3.6 Measurement of independent variables

Measurement of all the factors of the rural farmers will be discussed in the following subsection:

3.6.1 Age

The age factor will affect the hindrances and prospects of the mango cultivation from the perspectives of farmers. So, it will be included in the study data. The farmer's age were classified into three categories according to Ministry of Youth, Peoples Republic of Bangladesh, 2013.

Category of farmers according to their age:

Categories (Years)	**Score**
Young aged	18 to 35
Middle aged	36-50
Old aged	Above 50

3.6.2 Educational qualification

Level of education of a respondent will be measured on the basis of classes s/he had passed in formal educational institution. For example, if a respondent passed class 4, her/his education score will be assigned as 4. If a respondent did not know how to read and write her/his education score will be assigned as zero (0). A score of 0.5 will be given to that respondent who could sign her/his name only. The educational background will be categorized into following level:

Category of farmers according to their educational qualification:

Categories (Years)	**Score**
Illiterate	0
Can sign only	0.5
Primary level	1-5
Secondary level	6-10
Higher Secondary level	11-12
Above Higher secondary level	Above 12

3.6.3 Mango cultivating area

The total amount of land under mango production will be measured under this title. One score was assigned for each hectare of land.

Category of farmers according to their mango cultivating area:

Categories (Hectare)	**Score**
Marginal	up to .2
Small	0.201-1
Medium	1.01-3
Large	Above 3

3.6.4 No. of modern mango variety practices

The total number of mango varieties will be produced by mango farmers will be described under this. Number of recognized and local varieties is categorized into low, medium and high which will be possessed by the respondents in the following scale:

Category of farmers according to their no. of modern mango variety practice:

Categories (No. of varieties)	**Score**
Top practices	5 and more variety culture
Medium practices	up to 4
Low practices	up to 2

3.6.5 Training experience

Agricultural training score of a respondent will be measured by the number of days that a respondent had received agricultural training in her/his entire life. If a respondent received training for three days her/his training exposure scale would be 3.

Category of farmers according to their training experience:

Categories (days)	**Score**
No training experience	0 days
Short training experience	up to 3
Medium training experience	above 5

3.6.6 Farming experience

Experience in agriculture will be measured on the basis of years, the respondent involved in agricultural work. One score was assigned for the each of the experience.

Category of farmers according to their farming experience:

Categories (years)	**Score**
Low experience	up to 5
Medium experience	6-16
High experience	above 16

3.6.7 Knowledge on Mango cultivation

Knowledge on mango cultivation of a respondent will be measured by using fourteen (14) different kinds of questions in relation to various aspects of mango cultivation. The score will be assigned 2 for full correct answer. However, partial score will be given for partially correct response and a zero (0) score will be given for a wrong or no answer. The summation of score obtained by a respondent will be the mango cultivation knowledge score of the respondent. The mango cultivation knowledge score could range from 0 to 28 where '0' will be indicated very low knowledge and '24' indicating very high knowledge on mango cultivation.

Category of knowledge in mango cultivation:

Categories	**Score**
Poor knowledge	Up to 22
Moderate knowledge	23-25
Good knowledge	above 26

3.6.8 Agricultural Extension contact

It was measured on the basis of respondent's extent of exposure with different information sources. Extension media contact score of the farmers will be

determined by summing the scores obtained from all the 16 selected extension media contact. The extension media contact score could range from 0 to 48; where 0 (zero) indicates no extension media contact and 48 indicates very high extension media contact.

Category of extension media contact has been presented below:

Extent of extension media contact	Assigned Score
Regularly	3
Often	2
Rarely	1
Not at all	0

3.6.9 Income from mango cultivation

Annual family income will be measured considering last year total earnings of all the family members of a respondent from agriculture, services, business, labor, and other sources. It was expressed in Taka. The total earnings will be measured in thousands taka and a score of 1 was assigned for each one lakh Taka.

Category of annual income from per hectare mango production:

Categories	Categorized range (Taka)
Low	Up to 2000000
Medium	250000-600000
High	Up to 600000

3.7 Measurement of dependent variables

“Hindrance and prospects of mango cultivation in Bangladesh from the perspectives of farmers” will be the dependent variable of the study. The

dependent variables i.e. (1) Hindrances of farmers in mango cultivation will be measured for the study. (2) Prospects of farmers in mango cultivation.

Hindrances of farmers in mango cultivation

Five points rating scale will be used for each hindrance. Five alternative responses will be very low, low, medium, high and very high. The weights will be assigned to these responses as 0, 1, 2, 3, 4 respectively.

For having a clear understanding of the comparative hindrances confrontation by the farmers in each of the 14 hindrances of farmers in mango cultivation, The Hindrance Faced Index (HFI) of each of the 10 problems will be measured using the following formula:

$HFI = 4\times fv + 3\times fh + 2\times fm + 1\times fl + 0\times fn$

Where;

fv= Number of respondents faced very high problem

fh= Number of respondents faced high problem

fm= Number of respondents faced medium problem

fl= Number of respondents faced low problem

fn= Number of respondents faced no problem at all

Extent of hindrances faced score of a respondent will be measured by the summing of all the responses to all the hindrances. Thus, HFI for a particular hindrance will be ranged from 0 to 56 while (0) indicating no hindrance and (56) indicating very high hindrance.

Prospects of farmers in mango cultivation

5 prospects will be selected through validity and reliability test to measure the extent of prospects of farmers on mango cultivation. Five points rating scale will be used for each prospect. Five alternative responses will be very low, low, medium, high and very high prospect. The weights will be assigned to these responses as 0, 1, 2, 3,4 respectively. For having a clear understanding of the comparative prospect confrontation by the farmers in each of the 5 prospects of

farmers in mango cultivation, the Prospect Faced Index (PFI) of each of the 5 prospects will be measured using the following formula:

PFI = 4×fv + 3×fh + 2× fm + 1× fl + 0×fn

Where;

fv = Number of respondents faced very high prospect

fh = Number of respondents faced high prospect

fm= Number of respondents faced medium prospect

fl = Number of respondents faced low prospect

fn= Number of respondents faced no prospect at all

Extent of prospects faced score of a respondent will be measured by the summing of all the responses to all the prospects. Thus, PFI for a particular prospect will be ranged from 0 to 20 whiles (0) indicating no prospect and (20) indicating very high prospect.

3.8 Statement of hypothesis

According to Kerlinger (1973), a hypothesis is a conjectural statement of the relation between 2 or more variables. Hypothesis is always declarative sentence form and relate either generally of specifically variables to sentences form and relate either generally or specifically variables to variables. Hypothesis may be broadly divided into two categories, namely research hypothesis and null hypothesis. To find out relationship between variables a researcher first formulates research hypothesis which states anticipated relationships between variables.

3.8.1 Research hypothesis

Research hypothesis states a possible relationship between experimental treatments that the researcher experts to emerge. Each of the 9 (nine) selected characteristics (Age, educational qualification, mango cultivating area, no. of modern mango variety practices, training experience, farming experience, knowledge on mango cultivation, agricultural extension contact, income from

mango cultivation) of the farmers have contribution on the hindrances and prospects of mango cultivation.

3.8.2 Null hypothesis

A null hypothesis states that there are no effects between the concerned variables. The following null hypothesis was formulated to explore the relationship. Each of the 9 (nine) selected characteristics (Age, educational qualification, mango cultivating area, no. of modern mango variety practices, training experience, farming experience, knowledge on mango cultivation, agricultural extension contact, income from mango cultivation) of the farmers have no contributing relationship with the hindrances and prospects of mango cultivation.

3.9 Data processing

3.9.1 Editing

The collected raw data will be examined thoroughly to detect errors and omissions. As a matter of fact, that the researcher made a careful scrutiny of the completed interview schedule to make sure that necessary data will be entered as complete as possible and well arranged to facilitate coding and tabulation. Very minor mistake will be detected by doing this, which was corrected promptly.

3.9.2 Coding and Tabulation

After completion of field survey, all the data will be coded. Compiled and tabulated according to the objectives of the study. Local units were converted into standard units. All the individual response to questions of the interview schedule will be transferred into a master sheet to facilitate tabulation, categorization and organization, in case of qualitative data into quantitative form.

3.9.3 Categorization of data

The collected raw data as well as the respondents will be classified into various categories to facilitate the description of the independent and dependent variables.

These categories will be developed for each of the variable by considering the nature of distribution of the data and extensive literature review. The procedure for categorization has been discussed while describing the variables under consideration in chapter 4.

3.10 Statistical Procedures

The data was analyzed in accordance with the objectives of the study. Qualitative data will be converted into quantitative data by means of suitable scoring techniques wherever necessary. The statistical measures such as range, means, standard deviation, co-efficient of variation, number and percentage distribution were used to describe the variables. Linear multiple regression will be used in order to explore the level of contribution of each variable for the hindrance and prospect of mango cultivation. Five percent (0.05) level of probability and one percent (0.01) level of probability was the basis for rejecting any null hypothesis throughout the study. The SPSS computer package was used to perform all those process.

CHAPTER 4

RESULTS AND DISCUSSIONS

The findings of the study and interpretations of the results have presented in this chapter. These are presented in five sub-sections according to the objectives of the study. The first sub-section deals with the selected characteristics of the farmers, while the second sub-section deals with the hindrances of farmers in mango cultivation. The third sub-section deals with to explore the contributing relationship between the selected characteristics of the farmers and their hindrances in mango cultivation. The fourth sub-section deals with prospects of farmers in mango cultivation. The fifth sub-section deals with to explore the contributing relationship between the selected characteristics of the farmers and their prospects in mango cultivation.

4.1 Selected characteristics of rural farmers

Nine characteristics of the mango farmers were selected. The selected characteristics are age, educational qualification, mango cultivating area, no. of modern mango variety practices, training experience, farming experience, knowledge on mango cultivation, agricultural extension contact and income from mango cultivation. The characteristics of the farmers are described in this section. However, for ready reference, separate tables are provided while presenting categorizations, discussing and interpreting results concerning each of the characteristics in this chapter. The salient features of the characteristics of farmers were shown in Table 4.1

Table 4.1 Salient features of the selected characteristics of the farmers

Sl. no	Characteristics	Unit of measurement	Possible range	Observed range
1	Age	Years	Unknown	27-68
2	Educational qualification	Level of schooling	Unknown	0-13
3	Mango cultivating area	Hectare	Unknown	2-25
4	No. of modern mango variety practices	No. of varieties	Unknown	1-5
5	Training experience	Number of days	Unknown	0-7
6	Farming experience	Years	Unknown	2-25
7	Knowledge on mango cultivation	Score	0-28	20-27
8	Agricultural Extension contact	Score	0-64	32-56
9	Income from mango cultivation	‘00000’Taka	Unknown	1.00-12.50

4.1.1 Age

The age of the rural farmers ranged from 27 to 68 years, the mean is 45.19. The standard deviation is 10.406 and the co-efficient of variation is 23.03 percent. The farmers were classified into three categories according to Ministry of Youth, Peoples Republic of Bangladesh, 2013 as "young aged" (18 to 35), "middle aged" (36 to 50) and "old aged" (above 50). The distribution of the farmers according to their age is shown in Table 4.2.

Table 4.2 Distribution of the farmers according to their age

Categories (years)	Respondents numbers	Percent	Mean	Standard deviation	Co-efficient of variation (CV)
Young aged (18 to 35)	23	20.90	45.19	10.40	23.03
Middle aged (36-50)	59	53.64			
Old aged (Above 50)	28	25.46			
Total	**110**	**100.0**			

The highest proportion (53.64 percent) of the farmers were middle aged compared to 25.46 percent of them being old aged and 20.90 percent were young aged. It might be due to the middle aged and old aged farmers comparatively give more preference to agricultural activities than the young, as it needs enough technical experience. Green, (2014) was found the similar findings.

4.1.2 Educational qualification

The education score of the rural farmers ranged from 0-13 with mean 5.541, standard deviation 3.0039, and co-efficient of variation was 54.21. Based on their educational scores, the rural farmers were classified into five categories namely illiterate (0), can sign only (0.5), primary educated (1-5), secondary educated (6-10) and above secondary educated (above 10). The distribution of the rural farmers according to their educational qualification is shown in Table 4.3.

Table 4.3 Distribution of farmers according to their educational qualification

Categories (Schooling years)	Respondent Numbers	Percent	Mean	Standard deviation	Co-efficient of variation (CV)
Illiterate (0)	1	0.9	5.54	3.00	54.21
Can sign only (0.5)	3	2.7			
Primary educated (1-5)	56	50.91			
Secondary educated (6-10)	44	40			
Higher educated (above 10)	6	5.49			
Total	**110**	**100.0**			

It is evident from the Table 4.3 that the highest proportion (50.91 percent) of the rural farmers had primary level of education compared to 40 percent of them having secondary level of education, 5.49 percent having higher educated, 2.7 percent having can sign only while only and 0.9 percent of them illiterate. Highest portion (90.91 percent) farmers in this study area had low level of education. It seemed to be the majority of the farmers of the study area could not reach the above level from primary to secondary level. It should be enhanced education at higher level among the farmers which helps the farmer to extent their outlook and expand mental horizon by helping them to develop favorable attitude.

4.1.3 Mango cultivating area

On the basis of the respondent's farm size they were classified into four categories as suggested by DAE (1999): Marginal (land ownership up to 0.2 hectares) and Small (land ownership 0.201-1 hectare), Medium (land ownership 1.01-3 hectares) and Large (land ownership above 3 hectares). The farm size of the farmers ranged from 2 to 25 hectares with an average 8.95, the standard deviation was 5.510 and co-efficient of variation was 61.56. The distribution of the farmers according to their farm size was shown in Table 4.4

Table 4.4 Distribution of farmers according to their mango cultivating area

Categories (Hectare)	Number	Percent	Mean	Standard deviation	Co-efficient of variation (CV)
Marginal	0	0	8.32	5.25	63.10
Small	0	0			
Medium (1.01-3)	14	12.72			
Large (Above 3)	96	87.27			
Total	**110**	**100**			

It was found that majority of the farmers had large cultivating area (87.27 percent) where 12.72 percent had medium cultivating area. There were no marginal and small farmers. It might be due to marginal and small land grasp by different companies like Pran, Natore food agro, etc.

4.1.4 No. of modern mango variety practices

On the basis of no. of modern mango variety practices farmers were classified into three categories: 'Top modern variety practices' (5 and more variety culture), 'Medium modern variety practices' (up to 4) and 'Low modern variety practices' (up to 2) considering their no. of varieties, considering (mean ± 1sd). The no. of modern mango variety practices of the farmers ranged from 2 to 5 with mean 2.65, the standard deviation was 1.331and co-efficient of variation was 50.22.

Table 4.5 Distribution of the farmers according to their no. of modern mango variety practices

Categories (No. of modern varieties)	Respondents numbers	Percent	Mean	Standard deviation	Co-efficient of variation (CV)
Top modern variety practices (5 and more variety culture)	15	13.6	2.65	1.33	50.22
Medium modern variety practices (up to 4)	39	35.49			
Low modern variety practices (up to 2)	56	50.90			
Total	**110**	**100.0**			

It was found that 35.49 percent of the farmers were medium practices category, 50.90 percent were low practices category and the rest 13.6 percent were top practices category. Here data revealed that most of the farmers in the study area were in low modern variety practices category. From the analysis, it is clear that majority of the mango farmers of this area were not under innovator category.

4.1.5 Training experience

On the basis of their training experience scores farmers were classified into three categories: 'No training experience' (0 days experience), 'Low training experience' (1-2 days experience), 'Medium training experience' (3-5 days experience), considering (mean ± 1sd). Training experience of the farmers was ranged from 0 to 7 days; the mean being 4.85, standard deviation 1.476 and co-efficient of variation was 30.43. Distribution of the farmers on the basis of their obtained training score was shown in Table 4.6.

Table 4.6 Distribution of farmers according to their training experience

Categories (Hectare)	Number	Percent	Mean	Standard deviation	Co-efficient of variation (CV)
No training experience (0 days)	0	1.9	4.85	1.48	30.43
Minimum training experience (up to 3)	20	18.18			
Medium training experience (up to 5)	77	70			
Maximum training experience (up to 7)	13	11.8			
Total	**110**	**100**			

Data furnished that a vast portion of the respondents (70 percent) had medium training experience while 18.18 percent had short training experience while 11.8 percent mango farmers had maximum training experience. Data also showed that 0.9 percent had no training experience. It seemed to be that many of the farmers had training experience of farmers was medium Training enhances farmer's knowledge, attitude and perception and enables to show skill which is important to make positive decision. So, it should be increased training experience among farmers by offering them training on commercial cultivation of mango.

4.1.6 Farming experience

On the basis of their farming experience scores farmers were classified into three categories: 'Low farming experience' (Up to 5 years), 'Medium farming experience' (6-16 years' experience), 'High farming experience' (above 16 days), considering (mean ± 1sd). Farming experience of the farmers was ranged from 02 to 25 years; the mean being 11.48, standard deviation 6.944 and co-efficient of variation was 60.49.

Table 4.7 Distribution of the farmers on the basis of their farming experience

Categories (years)	Respondents number	Percent	Mean	Standard deviation	Co-efficient of variation (CV)
Low experience (up to 5)	27	24.55	11.48	6.94	60.49
Medium experience (6-16)	54	49.01			
High experience (above 16)	29	14.55			
Total	**110**	**100.0**			

It was found that 49.01 percent of the farmers had medium farming experience, 24.55 percent had low farming experience and the rest 14.55 percent had high farming experience. Here data revealed that most of the farmers in the study area had medium farming experience. Jahangir, (2011) found the similar result.

4.1.7 Knowledge on Mango cultivation

On the basis of their knowledge, farmers were classified into three categories: "poor knowledge" (up to 22), "medium knowledge" (23 to 25), "high knowledge" (above 26), considering (mean ± 1sd). The observed knowledge of the mango farmers ranged from 20 to 27, the average being 24.60, the standard deviation was 2.095 and co-efficient of variation was 8.52. The distribution of the mango farmers according to their knowledge was shown in Table 4.8.

Table 4.8 Distribution of farmers according to their knowledge on mango cultivation

Categories (score)	Respondents number	Percent	Mean	Standard deviation	Co-efficient of variation (CV)
Poor knowledge (Up to 22)	18	16.36	24.60	2.01	8.52
Moderate knowledge (23-25)	53	48.18			
Good knowledge (above 26)	39	35.46			
Total	**110**	**100.0**			

It was found that 16.36 percent of the mango farmers had poor knowledge, 48.18 percent had medium knowledge and the rest 35.46 percent had good knowledge. Here data revealed that most of the mango cultivators in the study area were medium knowledge. Knowledge is to be considered as vision of an explanation in any aspect of the situation regarding commercial cultivation of mango. To perform optimum production mango cultivators should have adequate knowledge on different aspects of commercial mango cultivation practices.

4.1.8 Agricultural extension contact

On the basis of respondent's agricultural extension media contact score, they were classified into three categories: 'Low agricultural extension contact' (score up to 40), 'Medium agricultural extension contact' (score 41-50) and 'High agricultural extension contact' (score above 50), considering (mean ± 1sd). Agricultural extension media contact score of the farmers was ranged from 32 to 56 against the possible ranged from 0 to 64 while mean being 45.33 and standard deviation was

5.547 and co-efficient of variation was 12.24 respectively. Distribution of the farmers according to their agricultural extension contact was shown in Table 4.9.

Table 4.9 Distribution of farmers according to their agricultural extension contact

Categories (score)	Respondents number	Percent	Mean	Standard deviation	Co-efficient of variation (CV)
Low agricultural extension contact (Up to 40)	19	17.27	45.33	5.55	12.24
Medium agricultural extension contact (41-50)	71	64.54			
High agricultural extension contact (above 50)	20	19.09			
Total	**110**	**100.0**			

Data revealed that about 64.54 percent farmers had medium extension contact while 17.27 percent farmers had low extension contact and 19.09 percent farmers had high extension contact. Highest portion of the respondents (83.63 percent) possess medium to high agricultural extension media contact. Jahangir, (2011) also found similar the result.

4.1.9 Income from mango cultivation

On the basis of their observed income from mango cultivation scores farmers were classified into three categories: low income (up to Taka 200000), medium income (250000 to 600000 Taka) and high income (above Taka 600000), considering

(mean ± 1sd). Annual family income of the farmers ranged from Taka 100000 to 1250000, the mean being 4.0591, the standard deviation was 2.6944 and co-efficient of variation was 66.38. Distribution of the farmers according to their annual family income was shown in Table 4.10.

Table 4.10 Distribution of farmers according to their income from mango cultivation

Categories (00000 Taka)	Respondents number	Percent	Mean	Standard deviation	Co-efficient of variation (CV)
Low income (Up to 200000 Taka)	29	26.36	4.05	2.69	66.38
Medium income (250000-600000 Taka)	65	59.09			
High income (above 600000 Taka)	16	14.54			
Total	**110**	**100.0**			

Table 4.10 shows that majority (59.09 percent) of the farmers were in medium income category while 26.36 percent were in low income category and 14.54 percent were high income category. Highest portion of farmers (94 percent) were in low to medium income category. In this study, most of the growers having income probably possessed more positive benefit from using improved production technology. Jahangir, (2011) also found the similar result.

4.2 Hindrances of farmers in mango cultivation

On the basis of their hindrances, farmers were classified into three categories: “minimum hindrance” (up to 27), “moderate hindrance” (28 to 43), “serious hindrance” (above 43), considering (mean ± 1sd). The observed hindrances of the mango farmers ranged from 20 to 48, the average being 35.22, the standard

deviation was 8.037andco-efficient of variation was 22.82. The distribution of the mango farmers according to their hindrances was shown in Table 4.11.

Table 4.11 Distribution of farmers according to their hindrances of mango cultivation

Categories (score)	Respondents number	Percent	Mean	Standard deviation	Co-efficient of variation (CV)
Minimum hindrance (Up to 27)	20	18.18	35.22	8.04	22.82
Moderate hindrance (28-43)	67	60.91			
Serious hindrance (above 43)	23	20.91			
Total	**110**	**100.0**			

Data revealed that a portion of the respondents (60.91percent) had medium hindrance faced while 20.91 percent had low hindrance and 18.18 percent had minimum hindrance. It also revealed that hindrances faced by the most of the mango cultivators in the study area were medium to serious hindrance. It might be due to their geographical location, facilities of modern technology, institutional co-operation, etc. If hindrances should be minimized by proper policy implications by both GO and NGO authority.

4.3 Hindrance Faced Index (HFI)

The observed Hindrance Faced Index of the hindrance ranged from 99-404 against the possible range of 0-440. Hindrance Faced Index (HFI) of the selected hindrances shown in table 4.12. On the basis of HFI, it is observed that disease infestation in inflorescence was ranked first followed by rotten inflorescence due to insect, inadequate training facilities, damage caused during marketing, lack of proper marketing facilities, poor communication system, lower market price, disease controlling problem, insect controlling problem, high production cost, tree

don’t give mango regularly, unavailability of transporting post-harvest marketing, quick rot after harvesting and deformed fruits.

Table 4.12 Hindrance Faced Index (HFI) with rank order

Sl. No	Hindrances	Extent of problems					HFI	Rank Order
		Very High (4)	High (3)	Medium (2)	Low (1)	Not at all (0)		
1	Tree doesn't give mango regularly	0	0	28	72	10	128	11
2	High production cost	0	0	67	23	20	157	10
3	Rotten inflorescence due to insect	72	35	3	0	0	399	2
4	Disease infestation in inflorescence	78	28	4	0	0	404	1
5	Deformed fruits	0	0	5	89	16	99	14
6	Inadequate training facilities	68	27	15	0	0	383	3
7	Insect controlling problem	21	47	32	10	0	172	9
8	Disease controlling problem	0	20	26	64	0	176	8
9	Poor communication system	24	33	41	12	0	289	6
10	Quick rot after harvesting		7	27	43	33	118	13
11	Lack of proper marketing facilities	19	55	18	18	0	295	5
12	Unavailability of transporting post-harvest marketing	0	0	33	53	24	119	12
13	Lower market price	0	23	65	22	0	221	7
14	Damage caused during marketing	18	54	27	11	0	299	4

4.4 Contributing relationship between individual characteristics of the farmers and their hindrances in mango cultivation

This section deals with the findings exploring the contributing relationship between the selected characteristics of the mango cultivators and their hindrances in mango cultivation. The contributing factors were age, educational qualification, mango cultivating area, no. of modern mango variety practices, training experience, farming experience, knowledge on mango cultivation, agricultural extension contact and income from mango cultivation. Assessing contributing relationship between the selected characteristics of the mango cultivators and their hindrances of mango cultivation, a multiple linear regression analysis was done. The multiple linear regression result has been shown in the Table 4.13

Table 4.13 multiple linear regression coefficients of contributing variables of hindrances of farmers in mango cultivation

Dependent variable	Independent variable	B	p	R-square	Adjusted R-square	F-Value	p
Hindrances of farmers in mango cultivation	Age	-0.588	0.026*	0.674	0.644	22.948	0.000**
	Educational qualification	0.140	0.053				
	Mango cultivating area	-0.479	0.004**				
	No. of modern mango variety practices	0.152	0.089				
	Training experience	0.107	0.409				
	Farming experience	0.102	0.571				
	Knowledge on mango cultivation	0.045	0.691				
	Agricultural extension contact	0.048	0.515				
	Income from mango cultivation	0.027	0.828				

** Significant at $p<0.01$

* Significant at $p<0.05$

The null hypothesis was there is no contributing relationship between selected characteristics of mango cultivators (age, educational qualification, mango cultivating area, no. of modern mango variety practices, training experience, farming experience, knowledge on mango cultivation, agricultural extension contacts and income from mango cultivation.) and hindrances of mango cultivation in Bangladesh from the perspectives of farmers.

The findings of the study revealed that, the nine (9) characteristics of the mango farmers were taken as independent variables together were effective in predicting farmer's hindrances in mango cultivation. The observed F ratio was significant at o. o1 level of significant which was an indication that the combination of the independent variables. Farmer's hindrances were effective at 64 percent (%). (R^2 =0.674) of the variation in the respondent's hindrances can be attributed to their age, educational qualification, mango cultivating area, no. of modern variety practices, training experience, farming experience, knowledge on mango cultivation, agricultural extension contacts and income from mango cultivation.

However, each predictor may expound some of the variance in respondents' hindrances simply by chance. The adjusted R-square value penalizes the addition of extraneous predictors in the model, but values of 0.644 still show that the variance in respondents' hindrances towards commercial cultivation of mango can be attributed to the predictor variables rather than by chance and the F value indicate that the model was significant (p<0.01).

From Table 4.13 it was observed that age and mango cultivating area on mango had significant contribution on farmer's hindrances towards mango cultivation. Data also showed that here mango cultivating area had most significant contribution at 1% (p<0.01) level of significance on hindrances of farmers. It was also showed that age on mango cultivation had also significant contribution at (p<0.05) 5% level of significance on their hindrances of mango cultivation.

In summary, the models suggest that the respective authority should consider the respondent's age and mango cultivating area on mango cultivation when made policy for their hindrances of mango cultivation to be improved.

Data furnished from Table 4.13 that, farmer's mango cultivating area was negatively influenced on their hindrances in mango cultivation and it could be said that farmers with less area had most hindrances on mango cultivation. That is,

farmers with less area have more unfavorable attitude towards mango cultivation. They are converting their land into other more beneficial business like year round guava cultivation and nursery business.

Data revealed from Table 4.13 showed that, farmer's age on mango cultivation was negatively influence on their hindrances it could be said that young aged farmers had most hindrances on mango cultivation. That is, younger respondent had more unfavorable attitude towards mango cultivation. The younger farmers are not interested in mango cultivation, they are interested on industrialization. It seemed that the old and middle aged farmers were more conscious about farming than the young farmers. Magdalena et al, (2016) was found the similar findings.

4.5 Prospects of farmers in mango cultivation

On the basis of their prospect**s**, farmers were classified into three categories: "low prospects" (up to 6), "medium prospects" (7 to 14), "high prospects" (above 14), considering (mean ± 1sd). The observed prospects of the mango farmers ranged from 6 to 19, the average being 10.08, the standard deviation was 4.080 and co-efficient of variation was 40.47. The distribution of the mango farmers according to their prospects was shown in Table 4.14.

Table 4.14 Distribution of farmers according to their prospects of mango cultivation

Categories (score)	Respondents number	Percent	Mean	Standard deviation	Co-efficient of variation (CV)
Low prospects (Up to 6)	28	25.45	10.08	4.08	40.47
Medium prospects (7-14)	64	58.18			
High prospects (above 14)	18	16.36			
Total	**110**	**100.0**			

Table 4.14 shows that majority (58.18 percent) of the farmers was in medium prospects category while 25.45 percent were in low prospects category and 16.36 percent were high prospects category. Highest portion of farmers (74.54 percent) were in medium to high prospects category. Findings again revealed that overwhelming majority (74.54 %) of the farmers observed medium to high level prospects of mango commercialization. It is quite consistent that farmers are watching in future, commercialization of mango has great prospects though having severe problems of its commercialization.

4.6 Prospect Faced Index (PFI)

The observed Prospect Faced Index of the prospects ranged from 97-379 against the possible range of 0-440. Prospect Faced Index (PFI) of the selected prospects shown in table 4.15. On the basis of PFI, it was observed that, possibility of provide government facilities for commercial purpose was ranked first followed by if marketing system and exporting policy are developed here enough supply of mango is possible, if industrial demand will high enough supply of mango is possible, is it possible to increase mango cultivation in your area and is it possible to increase mango production even in existing situation.

Table 4.15 Prospect Faced Index (PFI) with rank order

Sl. No	Statements	Extent of prospects					PFI	Rank Order
		Strongly agreed (4)	Agreed (3)	No opinion (2)	Disagreed (1)	Strongly Disagreed (0)		
1.	Possibility of increase mango cultivation in your area	0	0	30	55	25	125	4
2.	Possibility of increase mango production even in existing situation	0	0	29	39	42	97	5
3.	Possibility of provide government facilities for commercial purpose	69	31	10	0	0	379	1
4.	Possibility of enough supply of mango if marketing system are developed here	31	63	16	0	0	329	2
5.	Possibility of enough supply of mango if industrial demand will high	0	3	56	15	36	136	3

4.7 Contributing relationship between individual characteristics of the farmers and their prospects in mango cultivation

This section deals with the findings exploring the contributing relationship between the selected characteristics of the mango cultivators and their prospects in mango cultivation. The contributing factors were age, educational qualification, mango cultivating area, no. of modern mango variety practices, training experience, farming experience, knowledge on mango cultivation, agricultural extension contact and income from mango cultivation. Assessing contributing relationship between the selected characteristics of the mango cultivators and their prospects of mango cultivation, a multiple linear regression analysis was done. The multiple linear regression result has been shown in the Table 4.16

Table 4.16 multiple linear regression coefficients of contributing variables of prospects of farmers in mango cultivation

Dependent variable	Independent variable	B	p	R-square	Adjusted R- square	F-Value	p
Prospects of farmers in mango cultivation	Age	0.519	0.016*	0.674	0.644	22.948	0.000**
	Educational qualification	-0.058	0.318				
	Mango cultivating area	0.637	0.000**				
	No. of modern mango variety practices	0.030	0.548				
	Training experience	-0.204	0.071				
	Farming experience	-0.126	0.388				
	Knowledge on mango cultivation	0.077	0.402				
	Agricultural extension contact	-0.047	0.430				
	Income from mango cultivation	-0.028	0.786				

** Significant at $p<0.01$

* Significant at $p<0.05$

The null hypothesis was there is no contributing relationship between selected characteristics of mango cultivators (age, educational qualification, mango cultivating area, no. of modern mango variety practices, training experience, farming experience, knowledge on mango cultivation, agricultural extension contacts and income from mango cultivation.) and prospects of mango cultivation in Bangladesh from the perspective of farmers.

The findings of the study revealed that, the nine (9) characteristics of the mango farmers were taken as independent variables together were effective in predicting farmer's prospects in mango cultivation. The observed F ratio was significant at o. o1 level of significant which was an indication that the combination of the independent variables. Farmer's prospects were effective at 64 percent (%). (R^2 =0.674) of the variation in the respondent's prospects can be attributed to their age, educational qualification, mango cultivating area, no. of modern mango variety practices, training experience, farming experience, knowledge on mango cultivation, agricultural extension contacts and income from mango cultivation.

However, each predictor may expound some of the variance in respondents' prospects simply by chance. The adjusted R-square value penalizes the addition of extraneous predictors in the model, but values of 0.644 still show that the variance in respondents' prospects towards commercial cultivation of mango can be attributed to the predictor variables rather than by chance and the F value indicate that the model was significant (p<0.01).

From Table 4.16 it was observed that age and mango cultivating area on mango cultivation had significant contribution on farmer's prospects towards mango cultivation. Data also showed that here mango cultivating area had most significant contribution at 1% (p<0.01) level of significance on prospects of farmers. It was also showed that age on mango cultivation had also significant contribution at (p<0.05) 5% level of significance on their prospects of mango cultivation.

In summary, the models suggest that the respective authority should consider the respondent's age and mango cultivating area on mango cultivation when made policy for their prospects of mango cultivation to be improved.

Data furnished from Table 4.16 that, farmer's mango cultivating area was most positively influenced on their prospects of mango cultivation. Thus it can be said

that cultivating area increase, prospects towards mango cultivation is increased. It may be due to farmers with large area have better opportunity to manage his mango cultivating area. So, mango farmers with large cultivating area are very keen to expand their mango cultivation.

Data revealed from Table 4.16 showed that, farmer's age on mango cultivation was positively influence on their prospects. Thus it can be said that age increase, prospects towards mango cultivation is increased. Old aged farmers were more attached to mango cultivation. It may be due to the old age farmers have greater ability to understanding on mango cultivation. It is good sign is that old aged farmers are improving their mango cultivation techniques day by day.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The study was undertaken with the objectives:

(1) To describe the socio-economic profile of the mango farmers

(2) To ascertain the hindrances and prospects of farmers in mango production in selected areas

(3) To identify the level of contribution of some selected characteristic of the mango farmers with their hindrances and prospects of mango cultivation.

In this chapter, the first section deals with summary of the findings; the second section deals with conclusion and the third section deals with recommendations.

5.1 Summary of findings

5.1.1 Farmer's hindrances and prospects in mango cultivation

Data revealed that a portion of the respondents (60.91percent) had medium hindrance faced while 20.91 percent had low hindrance and 18.18 percent had minimum hindrance. It also revealed that hindrances faced by the most of the mango cultivators in the study area were medium to serious hindrance. The observed hindrances of the mango farmers ranged from 20 to 48, the average being 35.22, the standard deviation was 8.037andco-efficient of variation was 22.82. In case of prospects the majority (58.18 percent) of the farmers was in medium prospects category while 25.45 percent were in low prospects category and 16.36 percent were high prospects category. Highest portion of farmers (74.54 percent) were in medium to high prospects category. The observed prospects of the mango farmers ranged from 6 to 19, the average being 10.08, the standard deviation was 4.080 and co-efficient of variation was 40.47.

5.1.2 Socio- economic profile of the mango farmers

The age of the rural farmers ranged from 27 to 68 years, the mean is 45.19. The standard deviation is 10.406 and the co-efficient of variation is 23.03 percent. The highest proportion (53.64 percent) of the farmers were middle aged compared to 25.46 percent of them being old aged and 20.90 percent were young aged.

The educational qualification of the rural farmers ranged from 0-13 with mean 5.541, standard deviation 3.0039, and co-efficient of variation was *54.21*. The highest proportion (50.91 percent) of the rural farmers had primary level of education compared to 40 percent of them having secondary level of education. About 5.49 percent of them were higher educated. Among them 2.7 percent of them were can sign only while only 0.9 percent of them illiterate.

The mango cultivating area of the farmers ranged from 2 to 25 hectares with an average 8.95, the standard deviation was 5.510 and co-efficient of variation was 61.56. It was found that majority of the farmers had large cultivating area (87.27 percent) where 12.72 percent had medium cultivating area. There were no marginal and small farmers.

The no. of modern mango variety practices of the farmers ranged from 2 to 5 with mean 2.65, the standard deviation was 1.331and co-efficient of variation was 50.22. It was found that 35.49 percent of the farmers were medium practices category, 50.90 percent were low practices category and the rest 13.6 percent were top practices category.

Training experience of the farmers was ranged from 0 to 7 days; the mean being 4.85, standard deviation 1.476 and co-efficient of variation was 30.43. Data furnished that a vast portion of the respondents (89 percent) had medium training experience while 20 percent had high training experience. Data also showed that 0.9 percent had no training experience.

Farming experience of the farmers was ranged from 02 to 25 years; the mean being 11.48, standard deviation 6.944 and co-efficient of variation was 60.49. It was found that 49.01 percent of the farmers had medium farming experience, 24.55 percent had low farming experience and the rest 14.55 percent had high farming experience.

The observed knowledge of the mango farmers ranged from 20 to 27, the average being 24.60, the standard deviation was 2.095 and co-efficient of variation was 8.52. It was found that 16.36 percent of the mango farmers had poor knowledge, 48.18 percent had medium knowledge and the rest 35.46 percent had good knowledge.

Agricultural extension media contact score of the farmers was ranged from 32 to 56 against the possible ranged from 0 to 64 while mean being 45.33 and standard deviation was 5.547and co-efficient of variation was 12.24. Data revealed that about 64.54 percent farmers had medium extension contact while 17.27 percent farmers had low extension contact and 19.09 percent farmers had high extension contact. Highest portion of the respondents (81.81 percent) possess low to medium agricultural extension contact.

Annual family income of the farmers ranged from Taka 100000 to 1250000, the mean being 4.0591, the standard deviation was 2.6944 and co-efficient of variation was 66.38 majorities (59.09 percent) of the farmers were in medium income category while 26.36 percent were in low income category and 14.54 percent were high income category. Highest portion of farmers (94 percent) were in low to medium income category.

5.1.3 Significant factors on the extent of hindrances and prospects farmers

Farmers mango cultivating area had most significant contribution at 1% ($p<0.01$) level of significance on prospects of farmers.

Farmers age on commercial cultivation of mango had also significant contribution at ($p<0.05$) 5% level of significance on their prospects of mango cultivation.

Farmers mango cultivating area had most negatively significant (significant at $p<0.01$) contribution on their hindrances on mango cultivation.

Farmers age on mango cultivation had negatively significant (significant at $p<0.05$) contribution on their hindrances towards commercial cultivation of mango.

5.2 Conclusions

Minority 20.91 percent farmers faced serious hindrances in the study area. It also revealed that hindrances faced by the most of the mango cultivators in the study area were low to medium hindrances. It might be due to their geographical location, facilities of modern technology, institutional co-operation etc. So, hindrances should be minimized by proper policy implications by both GO and NGO in the area.

Age of the farmers had negatively significant contribution on their hindrances towards mango cultivation. Farmer's hindrances increase with the decrease of their age.

Mango cultivating area had most negatively significant contribution on their hindrances in mango cultivation. Farmers with less mango cultivating area had more hindrances in mango cultivation.

Majority (74.54 percent) of the respondents had medium to high prospect towards mango cultivation. This fact leads to the conclusion that the study area is more favorable for promoting of all modern aspects of mango cultivation.

Age of the farmers had significant contribution on their prospects towards mango cultivation. Farmer's prospects increase with the increase of their age.

Mango cultivating area of the farmers had most significant contribution to their prospects towards mango cultivation. Farmers with more mango cultivating area had more prospects in mango cultivation.

5.3 Recommendations

In social science research, it is not easy to draw concrete policy implications which can be applied in wide range of situations. But still, there is scope to make some recommendations based on their findings and interpretation of the results, which if addressed properly, would have contribute a lot in solving or minimizing many hindrances.

5.3.1 Recommendations for policy implications

i. In the study area disease infestation in inflorescence was the most serious hindrance in mango cultivation. So, proper treatment should be implemented by DAE for controlling this.

ii. Findings indicated that mango cultivation had a significant positive prospect. So, it may be recommended that cultivation of mango may be extended to the suitable areas of the country by the GOs and NGOs.

iii. Age had significant positive relationship with the prospects of farmer in mango cultivation. It had significant negative relationship with the hindrances of farmers in mango cultivation. Therefore, it may be recommended that DAE and Upazila agriculture office should target young aged farmers to change their prospects towards mango cultivation.

iv. Mango cultivating area of the farmers had a significant positive influence on their prospects in mango cultivation. It had a significant negative influence on their hindrances in mango cultivation. Farmers who have large mango cultivating area are more attached to mango cultivation. In this regard, good farming plan can play a vital role change their outlook about mango cultivation.

v. In this study area government support for increasing mango cultivation in the study area had got the maximum prospect. Government should give subsidy on mango cultivation.

5.3.2 Recommendations for further research

i. The research was conducted in the three villages of Natore Sadar Upazila under Natore district. Similar research is suggested to be conducted covering more mango cultivating area to have more comprehensive idea about the farmer's hindrances and prospects on mango. It was also suggested that the future researchers could take up a broad base study with large samples.

ii. In the present study only eleven (9) independent variables will be 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.

iii. Acreage response, growth and instability of the mango production can also be studied with respect to Bangladesh situation as a whole.

iv. This research was conducted at 8% level of precision of the population. So, study would be conducted at below 5% level of precision for more authentic findings.

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Appendix - A

(English version of the interview schedule)

Department of Agricultural and Information System

Sher-e-Bangla Agricultural University

Dhaka-1207

An interview schedule for a research study entitle:

HINDRANCES AND PROSPECTS OF MANGO CULTIVATION IN BANGLADESH FROM THE PERSPECTIVES OF FARMERS

Serial no…….

Date…….

Name of the respondent……

Village:

Union:

Upazila:

District:

Mobile no:

(Please answer the following questions)

1. a. Age

What is your present age? …….

b. Educational qualification: what is your level of education?

a) Illiterate……

b) Can sign only…….

c) Have passed class…….

d) I took non-formal education……years

c. Mango cultivation area

Please indicate your land under mango cultivation….(Local unit) ……hectare.

d. No. of modern mango variety

What types of cultivars/variety you have cultivated in your mango garden? Please mention the following information:

variety	**Duration of cultivation (Year)**

e. Training experience

Have you received any training on mango cultivation? Yes ---------- No ---------- ----------

If yes, please give the following information:

Sl. No.	**Subject matter of training**	**Duration of training (Days)**
1		
2		
3		
Total		

f. Farming experience

Involved in mango cultivation……...years

g. Knowledge on mango cultivation

Please answer the following questions:

Sl. No.	Questions	Assigned Score	Obtained Score
1.	Name two varieties of mango.	2	
2.	When and how much fertilizer do you apply to a mango trees?	2	
3.	How many times do you spray insecticides on mango trees?	2	
4.	How do you spray insecticides on mango trees?	2	
5.	How do you give training and pruning to the mango trees?	2	
6.	Mention two ways of controlling insects.	2	
7.	Mention two diseases of mango.	2	
8.	Mention the ways of controlling diseases.	2	
9.	What will you do if the inflorescence rot is occur?	2	
10.	Mention the symptoms of a mature mango.	2	
11.	When the right time to harvest mango?	2	
12.	How the mango has harvested?	2	
13.	How the mangoes are graded and sorted?	2	
14.	Why the mango produced in large quantity in your locality?	2	
Total			

h. Agricultural Extension contact

Sl. No	Communication media	Extent of Communication				
		Regularly (4)	Often (3)	Occasionally (2)	Rare (1)	Not at all (0)
A. Personal Contact						
1	Meet with SAAOs					
2.	Meet with Ag Extension Officer					
3.	Meet with local leader					
4.	Visiting neighbors					
5.	Visiting NGO workers					
6.	Meet with Seed /fertilizers dealer					
B. Group Contact						
1	Attaining group discussion session					
2.	Participating on result demonstration program					
3.	Attaining field day					
4.	Attaining farmers field school					
C. Mass Media Contact						
1	Reading Daily Newspaper					
2.	Listening farm Radio talk					
3.	Watching Agricultural Program in Television					
4.	Poster viewing					
5.	Reading Magazine (Krishi katha and Krishi Batra)					
6.	Visiting Krshimela					
Total						

i. Income from mango cultivation

a) Yearly expenditure for mango production……Tk.

b) Yearly income from mango production……. Tk.

c) Yearly profit or loss from mango production (a±b)

2. Prospects of farmers on mango cultivation [Put (√) marks]

Sl. No	Prospects	Strongly agreed (4)	Agreed (3)	No opinion (2)	Disagreed (1)	Strongly Disagreed (0)
1.	possibility of increase mango cultivation in your area					
2.	possibility of increase mango production even in existing situation					
3.	possibility of provide government facilities for commercial purpose					
4.	Possibility of enough supply of mango if marketing system developed here					
5.	Possibility of enough supply of mango if industrial demand will high					
Total						

3. Hindrances of farmers on mango cultivation

Please mention the extent of hindrances related to mango cultivation:

Sl. No.	Hindrances	Extent of hindrances				
		Very High (4)	High (3)	Medium (2)	Low (1)	Not at all (0)
1	Tree doesn't give mango regularly					
2	High production cost					
3	Rotten inflorescence due to insect					
4	Disease infestation in inflorescence					
5	Deformed fruits					
6	Inadequate training facilities					
7	Insect controlling problem					
8	Disease controlling problem					
9	Poor communication system					
10	Quick rot after harvesting					
11	Lack of proper marketing facilities					
12	Unavailability of transporting post-harvest marketing					
13	Lower market price					
14	Damage caused during marketing					
Total						