MANGO PRODUCTION IN CHAPAINAWABGANJ DISTRICT: A CASE STUDY OF SHIBGANJ UPAZILA

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CERTIFICATE

This is to certify that thesis entitled, **"Mango production in Chapainawabganj district : A case study of Shibganj upazila. "** submitted to the Department of Agricultural Statistics, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE IN AGRICULTURAL STATISTICS,** embodies the result of a piece of bona fide research work carried out **JOSIM UDDIN**, Registration No. **19-10186** under my supervisor and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

Dated: December, 2021

Place: Dhaka, Bangladesh

_____

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DEDICATED
TO
MY BELOVED
PARENTS

ABSTRACT

A study was conducted to identify the status of mango production, mango varieties produced, and to explore their relationship with some selected characteristics. Data were collected from randomly selected 120 mango growers from six selected villages of Shibganj upazila under Chapainawabganj district through personal interview during March to August, 2022. Data were collected on age, education, family size, farm size, land used in mango production, annual income, experience and knowledge on mango production, varieties and number of mango trees and so on. Estimated three dependent variables on some selected characteristics of mango production. In the study, about three fourths (79.20 %) and more than the same (70.80 %) of the respondents had high mango production and very high income respectively. Majority (74.2 %) of respondents involved in mango production had high (>10 ton) production and medium production percentage was also so sound with 13.3% of respondents (7-10 ton). So, it may be concluded that, the study area bears a better mango production sign. For mango production, highest proportion (45%) of respondents had moderately large sized (1.01-2.80 ha) of land which were almost entire (1.01-3.00 ha) of the farm size though mango cultivated land in homestead area were negligible and had no effect on total production. The study indicated that large farm size, land use in mango production, annual income, and knowledge in mango production had major determents' of annual mango production and annual income from mango production individually. Although respondents certified that Chapainawabganj district is profitable in respect of mango production but further study should be taken place with other variables and characteristics that related to farmers in mango production in different upazila of Chapainawabganj district.

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ACRONYMS AND ABBREVIATIONS

BARI : Bangladesh Agricultural Research Institute

BINA : Bangladesh Institute of Nuclear Agriculture

BBS   : Bangladesh Bureau of Statistic

FAO   : Food and Agricultural Organization

NGO   : Non-governmental organizations

BDT   : Bangladeshi Taka

BER   : Bangladesh Economic Review

DAE   : Department of Agricultural Extension

SAAOs: Sub - Assistant Agriculture Officers

et al.   : and others (at elli)

HYV   : High Yielding Variety

kg   : Kilogram

mt   : Metric Ton

NGO   : Non-Government Organization

t   : Ton

$: Dollar

SPSS   : Statistical Package for the Social Sciences

CIMMYT : The International Maize and Wheat Improvement Center

MoA   : Memorandum of Association

BRAC   : Bangladesh Rural Advancement Committee

BADC   : Bangladesh Agricultural Development Corporation

IPM   : Integrated Pest Management

RDRS   : Rangpur Dinajpur Rural Service

CHAPTER I
INTRODUCTION

1.1 General Background:

Mango (*Mangiferaindica*) is the favorite fruit in Bangladesh and has been repeatedly acclaimed as the King of Fruits. (Ahmed, 1994). Mango belongs to the family Anacardiaceous is a tropical to sub-tropical fruit, originated in the Indian sub-continent (Indo-Burma region) in the prehistoric times. It is the most important economic and delicious fruit. It has been cultivated for more than 4000 years (Candolle, 1984). Mango is a commercial horticultural crop in many countries of South-East Asia, India, Pakistan, Philippines, Malaysia, Thailand, Burma, Srilanka and Java. The main mango producing countries of world are India, Pakistan, Mexico, Brazil, Haiti, the Philippines and Bangladesh. Mango ranks third among the tropical fruit grown in the world with a tropical fruits production of 25 million tons (Anonymous, 2007). India, the largest producer that alone produces 15.5 million tons mango followed by Brazil, Pakistan, Mexico, the Philippines, Indonesia, Haiti, China, Bangladesh, Sudan, Srilanka and Cuba (Bhuiyan, 2008). The present per capita mango production in various countries is approximately: India-11.94 kg, Philippines- 10.30 kg, Mexico- 8.70 kg, Tanzania- 8.20 kg, Pakistan- 6.70 kg, Zaire- 4.70 kg, Brazil- 3.90 kg, Indonesia- 3.0 kg and Bangladesh- 1.30 kg. In Bangladesh, mango ranks first in terms of area and third in production. According to the Agricultural Extension Department, in the current (2021-22) season, mangoes have been cultivated on 18,515 hectares of land. Another study says that Mango trees occupy the largest area in Bangladesh but its production position is third among the fruits grown in Bangladesh. According to the Bangladesh Bureau of Statistics (BBS), the country has produced about 12 lakh (1.2 million) tones of mango in the 2019-20 fiscal year. Mango production provides more income to the farmers than any other crops. Mango production of the areas now on danger by different constraints like a high rate of pesticides, fertilizers, lack of fruit processing and preserving system, marketing facilities

1.2 Objectives of the Study:

1. To find out the status of mango production in the study area.

2. To determine annual mango production in the study area.

3. To estimate and test the effects of different socioeconomic characteristics of mango production.

1.3 Scope of the study:

The present study was undertaken with a view to have an understanding about the status of mango production, mango varieties produced, problems confronted by the grower and to explore their relationship with some selected characteristics. The findings of this study will be particularly applicable to the farmers of the respective study area. The findings may also have applicability to other areas of the country when the physical conditions are mostly similar with those of the study area. However, the findings of the study will be helpful for the specialist of different organizations and planners, policy makers and horticulturists to deal with mango production. The administrators, supervisors, field workers and others who are to work in the field of mango may find this study informative. This study could be helpful for commercial mango production programmer in one hand and motivate to the authority to reduce hazards cause decline in mango production and source of earning money and reducing poverty.

1.4 Limitations of the study:

The present study was designed with a view to have an understanding about the status of Mango production, mango varieties produced, problems confronted by the grower and to explore their relationship with some selected characteristics. Considering the time, money and other necessary resources available to the researcher and also to make the study meaningful and manageable the researcher had to impose certain limitations as follows:

1. The study was confined to six villages namely Laxmipur, kantinagor, Tikori, Bagbari, Mobarokpur, koragpur, of shibganj upazila under Chapainawabganj district i.e. the Northern and North-Western region of Bangladesh.

2. The study was confined mainly to status of mango production.

3. Out of many characteristics of mango growers only fourteen characteristics were selected for investigation in this study.

4. For information about the study, the researcher was depended on the data furnished by the selected respondents during data collection.

5. The respondents for data collection were kept limited within the heads of farm families.

6. Various problems in adopting mango production were likely to be confronted by the growers.

1.5 Rationale of the Study:

The Northern and North-western parts of Bangladesh are well known for better mango production (Bhuiyan, Roy &Ganguly, 1999). Chapainawabganj is one of the districts of these parts. Most of the of farmers in this district depend on mango production as the major source of income but few study was conducted on mango production as well as on growers in this area. This is why study was conducted in the district.

1.6 Assumptions of the study:

An assumption is the supposition that an apparent factor or principle is true in the light of the available evidence (Goode, 1945). In this study the researcher has the following assumptions in mind.

1.The growers selected for this study were capable of furnishing proper response to the questions included in the interview schedule.

2. The researcher was well adjusted to the environment of the study area. Hence, the data collected were free from any bias.

3. The responses furnished by the respondents were reliable. They expressed the truth about their conversations and opinions.

4. Views and opinions furnished by the mango growers included in the sample were the representatives' views and opinions of the objectives.

CHAPTER II

REVIEW OF LITERATURE

Rahman et al (2021) attempt to examine mango farming and process industries. Mango grows all over in Bangladesh but specially in rajshahi district with the annual production in Bangladesh 2.4 million metric ton (MT) and in rajshahi 195,000 metric ton (MT) of mango per year. More than 500 varieties of sweet edible mangoes can be found in rajshahi division. 85% people are depending on mango farming and business. Most of the mangos consumed by house hold and 15% are processing. The price is 50 TK/kg for house hold 12 TK/kg for process industry. Mango farming is more profitable than any other crops but the difficulties are high price of pesticides, fertilizer and also preserving as all varieties rips at a time. At present there are four processing plant in rajshahi district. They were producing juice, pulp, mango bar and mango leather but the quantity is not significant. Dry mango and mango pickles are home made. There are huge scopes for expansion of mango cultivation in rajshahi if they can overcome the barrier and took opportunity for commercial production, marketing and diversification. Few govt. Organization and NGOs are working for mango farming development.

Sampa et al (2019) found to status and rationale of mango cultivation based on some selected areas. They conducted among 104 mango producer through primary data collection to assess the profitability in mango production, demographic and socio-economic condition of farmers in four villages of northern region of Bangladesh. They study encompasses the comparison of cost and profit of other crop with mango cultivation. Most farmers depend on mango production because the climate is unfavorable for field crop production but very conducive for mango cultivation in barind ecosystem. Problem confrontation index (pci) was used to measure the problems of mango production. On the basis of PCI formula, out of the 16 problems, insects and diseases infestation was identified as the major problem with pci 429 followed by dropping of fruits and flowers with pci 409. Lack of better varieties/ seedling/ grafts, modern technology and climate change was also three major problems with pci 387, 193 and 276 respectively.

Sultana et al (2018) investigated to find out the present status of mango cultivation in Bangladesh. Purpose of the study was to identify the present status of mango cultivation and to determine the problems faced by the farmers in mango cultivation in Bangladesh. Status of mango cultivation was measured by area under mango cultivation, number of mango plants, number of mango varieties, disease and insect infestation of plants, uses of chemicals and fruit yield. Among the 101 respondents, 97 respondents cited that they cultivate fazli variety followed by khirshapat, langra, guti, so on . 92 respondents used pesticides followed by other chemicals and 54 respondents used cow dung as organic supplies. Among the respondents, 62 respondents cited that mango hoppers are devastating for mango cultivation and 75 respondents cited that anthracnose causes at a great extent in mango plants. It was revealed that the majority (81.7%) of the respondents faced medium level problems followed by 12.3% faced low and only 6% faced high problems during mango cultivation for commercial purpose. Computed co efficient of correlation shows that educational level, family size , farm size, organizational participation, extension media contact, cosmopolitanism and training experience are significantly related with the status of mango cultivation.

Alam et al (2017) conducted a case study on production of mango at Sadar upazila in Dinajpur. They collected data randomly through personal interview from 105 growers during march to august 2008. They collected data on age, education, family size, farm size, land used in mango production, annual income, experience and knowledge on mango production, varieties and number of mango trees and so on. They identified 30 germplasm and found baramashi droop as the only year round variety. They found gopalbhog holds the first position (15.90%) according to rank of recognized mango varieties based on their availability in respondents' farm. Majority percent (75.20 %) of the growers confronted medium problems.

Ali et al (2019) analyzed to physic-chemical characteristics of seven cultivars mango. The fruit characteristics of seven varieties mango cultivars grown at Chapainawabganj, Rajshahi, Satkhira and Meherpur district were studied from march 2017- June 2019 fruiting seasons. Seven locally cultivated important mango cultivars (Guti mango, khirsapat, langra, harivanga ,fazli, amropali and ashwani) were selected. they were arranged in complete randomize design (crd) with three replications. Results showed that cultivars had significant differences in physical characteristics fruit weight, pulp weight, seed weight, fruit length, width, depth, diameter, edible non edible portion, moisture content, weight loss, dry moisture content and

the chemical characteristics was to evaluate tss, ph, ascorbic acid, total sugar, reducing and non reducing sugar, β- carotene of different types of mango fruits grown in selected regions in the three seasons. The highest firmness peel was gutimango 1.73n/cm2 and pulp in ashwinawas, 0.50 n/cm2, respectively. The highest values of brightness (peel) of l-value were in the range 49.93 to 61.94 &pulp were highest indicators of 84.63 followed by 81.21. The weight losses (%) highest decreases during storage from 3 to 9 days 2.11% to 5.55% in khirsapat.

Khan et al (2020) observed that mango fruit infestation at home garden. They undertaken to determine the insect infestation in mango fruit in the farmers' field of Uchalhila, ishwargonj, mymensingh, bangladesh, during the period of months march to July 2020 under natural condition. Visual searching method followed for identifying the infested and healthy mango fruit. The total healthy and infested (14.86%; 22 out of 148) and (85.13%; 126 out of 148), respectively in mango fruit. The healthy and infested ranged (0.00-3.33%) and (66.67 93.33%), respectively in mango fruit. The insects vizthrips, stone weevil, and fruit borer (0.00-33.33) %, (33.33-73.33) and (23.33-46.67) % in this study, respectively. In the rural area of Bangladesh. they were not using any fertilizer, insecticides to manage the constraints in mango production. They studied that plans are needed in the rural area of Bangladesh to minimize insect infestation with bio-rational insecticides

Islam et al (2017) analyzed prospects and problems analysis of mango cultivation. They conducted among 104 mango producer to assess their, profitability in case of mango production, demographic and socio-economic condition e.g. Age, education, profession number of family member ,number of income earner, amount of land, number of school going children, amount gardens area ,fertilizer dose, pesticides ,mango variety cultivated ,cost of capital, profit, , vehicle used for transportation, market size, market distance, presence of cooperative society and membership, types of marketing harvesting, grading, yield, weather, disease ,use of fellow land, training requirement, government intervention, storage facilities, export etc condition of in selected areas of four villages namely baushahadatipara village under baghaupazila, baruipara village under puthiaupazila, kismotbogura village under durgapurupazilapannapara village under charghatupazila northern region of bangladeshduring january-march 2018 .Average profit from mango cultivation was higher than average profit from onion cultivation which amounted tk. 299010 per hectare and 260412 per hectare

Respectively .out of 104 mango producer, 59 producers were engaged in both supporting crop and mango,45 farmers were with mango only.

Daula et al (2016) looked for insecticides and fungicides use in largest mango cultivation area in Bangladesh. They conducted to assess the present scenario of spraying insecticides/fungicides during the whole cultivation period of mango in Shibganj upazila of Chapainawabganj district. A total number of 250 mango growers were randomly selected and interviewed by structured questionnaires from December, 2014 to June, 2015. The data were collected with respect to their educational level, cultivating land, times and types of insecticides/fungicides spray, and farmer's consciousness about the excessive use of insecticides/fungicides. Out of the 250 mango growers, 184 were illiterate which accounts almost 74% followed by under H.S.C, 51 (20%) and higher educated, 15 (6%). Around 1-3 acre of land was used by 145 (58%) mango growers for cultivation followed by 3-7 acre by 85 (34%) and more than 7 acres by 20 (8%). Eight insecticides and seven fungicides under different trade names were most commonly sprayed at 2, 3, 4, and even more than 7 times in the stage of mango flowering, green mango, and finally, in mature stages.

Amin et al (2015) studied physico-chemical and microbiological qualities of some selected brand of mango fruit juice. They studied, carbohydrate profiles of juices were determined using hplc, crude protein content of the samples were determined using the kjeldahl method and other parameters were determined using standard aoac methods (horwitz, 2003). Standard culture techniques were followed to assess total viable count (tvc), fecal coliform and escherichia coli. In this study, the ph of the fruit juices varied from 3.55 to 3.80. The highest quantity of monosaccharide (58.88%) was recorded in acme mango juices while the lowest in homemade and mangolee juices (5.648% and 9.867% respectively). Maximum content of acidity 0.24% (as citric acid) was recorded and minimum was (0.21%). The tss content of all samples varied from 19% to 12 %. The highest quantity of reducing sugar (6.87%) and the lowest (3.62%) was recorded in different company's mango juices. Most of the mango juices are low in protein content and very low in fat content which is negligible. Total viable count of different types of fruit juices varied from 1×10^3 - 3×10^3cfu/ml. No e. Coli and fecal coliform were detected in these juices.

Sarkar et al (2018) identified the problems and prospects of mango growers. Mango is one of the most popular fruit crop in the tropics. It was universally considered as one of finest fruit in the world .mango is called the king of fruits and it is also known as national fruit of india. India has about 110 varieties and 20 varieties are now accepted as commercially well established. Mango is also an important fruit of west bengal. In west bengal mango occupies about 80.90 thousand hectares which is more than 41% of total area under fruits west bengal is unique in having more than 200 varieties. Among the varieties himsagar and amrapali are commercially cultivated in the district of nadia. Numerous number of mango orchards found in nadia district nearly fulia and santipur area. They survey of the orchard owners and leaseholders was made in the year 2017-18 to identify the problems faced by them. It was observed that most of the big orchards are more than 40 years old and the owners sell their gardens on lease before or during appearance of fruit. The problems were ranked according to their importance. They were irregular bearing habit(rank 1) followed by nonavailability of good qualitysaplings, drying of branches , disease infestations (anthracnose, powdery mildew, mango malformation), insect attack (mango hopper, mealy bug, fruit fly etc), old orchard, poor harvesting and post harvesting technology respectively. They suggested Emanated from the discussion with farmers were planting of high-yielding, regular bearing improved varieties, regular application of nutrient as per recommendation, regular surveillance for control of pest and diseases, improvement of irrigation and drainage system, replacement of old plant with young one. A coordinated, integrated and strategic effort of all the stake holders must to solve the problems.

Vairam et al (2015) conducted to trends of mango cultivation among indian states – an economic analysis. Fruits and vegetables are considered to be the protective food because these help us to develop defense mechanisms in our body. Mango (mangiferaindica), which was the king of fruits for over 4000 years, was also our national fruit. There were more than thousand mango varieties in india. India is one of the largest producers of mango; however, only about 30 varieties are grown on a commercial scale in different states. Important mango varieties are cultivated in different states of india in which tamilnadu cultivates the varieties like banganpalli, bangalora, neelum, rumani, and mulgoa. More than 50 per cent of world mango production is contributed by india, the productivity of mango in tamilnadu state was found to be low when compared to the national average productivity.

Mazhar et al (2010) looked for a survey based study on mango fruit quality through the supply chain. They used this system based approach, the fruits of two promising mango cultivars ('sindhri' and 'chaunsa') were monitored from tree to retail outlets. Fruit quality was analyzed at all levels in the supply chain (on the tree, at harvest, at the packing shed, at wholesale markets and at retail outlets) to determine the extent of fruit quality losses at each stage. For every 100 fruits on the tree at harvest, only 32 and 25 fruits of 'sindhri' and 'chaunsa' respectively reached retail outlets at a quality level acceptable to the market. This study is important because determination of losses throughout the chain and managing them using an integral supply chain approach, in developing countries, has not been reported in the horticultural literature before.

Andayani et al (2017) undertaken to development of mango agribusiness. they studied qualitative design using case study method and system thinking of soft system methodology (ssm) approach. They results showed that the formulation of improvements to be made in mango cultivation is the coordination and collaboration among related parties which are optimized through control activities by performing intensive coaching and mentoring. There is also dissemination of information and technology related to the implementation of innovation in supporting the continuity of supply that generates a model of agribusiness development in integration with related parties which supported government regulation. Similarly, a partnership with industrial companies or structured market through the principles of justice should be reorganized with the establishment and strengthening cooperatives as facilities for mango farmers in realizing a strong mango agribusiness system and implementing appropriate corrective measures according to ssm results.

Dessalegn et al (2014) analyzed that mango production is steadily expanding in amhara region, ethiopia. However, its productivity was below the national average. They survey conducted in four representative districts of amhara region using 70 randomly selected mango growers in order to assess mango production knowledge and technological gaps of smallholder farmers. Data collected through individual interview using semi-structured questioner and field observation, and analyzed using SPSS statistical software version 15. Majority (91.4%) of the respondents had less than 21 year mango production experiences.

Further, 54.3% of the respondents did not attend formal education. Only 1.4 % of the respondents can do mango grafting. Majority of the respondents did not apply inorganic fertilizer, did not spray pesticides and fungicides to control pests and diseases, and did not prune their mango trees. These depict mango production knowledge and skill gaps of smallholder farmers. They found that there is no site specific recommendation on irrigation interval, fertilizer rate, spacing, pruning season, scion and rootstock varieties, and insect pest and disease control methods for mango production. About 66% of the mango trees of the respondents are developed from seedlings and need to be converted into improved varieties through top-working.

Dibaba et al (2019) obserbved that owing to challenges and opportunities of mango production. In support of stimulating growth, economic development, food security and alleviating poverty in benishangul- gumuz region in particular mango fruits play an important role in an on-going or future fruit development plan. In spite of the importance of mango fruits in generating income for smallholders' farmers, challenges and opportunities in mango production and marketing have not yet studied. As a result a cross sectional data was collected from 150 mango producer farmers. Moreover, focus group discussions using pre-tested semi structured questionnaires and checklists respectively and it was supplemented by secondary data collected from different published and unpublished sources. As a result, it provides basic and relevant information on production trends; marketing and consumption, access to governmental institutions, micro-finance, and technology transfer of mango improved varieties of the smallholder farmers were identified. Hence, developmental endeavors should be work on the identified gaps that could milk the opportunities and fill skills and knowledge gaps of smallholder farmers so as to improve their livelihoods. In this arena, emphasis should be given to improve effective production and marketing of mango.

Ali et al (2020) estimated the postharvest handling and marketing constraints of mango. Mango (mangifera indica l.)Is called as the king of fruits due to its high deliciousness, exceptional taste and flavor, is a very much popular fruits to the people of Bangladesh. There are several varieties of mango fruits containing deviation taste and flavors. The study was conducted to appraise the postharvest loss during harvesting; packaging, transportation, marketing activities and to identify the marketing problems and steps to be taken at minimized. The survey was conducted from July/2017 to June/2019 to determine the causes

to extend postharvest losses of mango in Bangladesh from cradle to table of the end consumer. A total of 160 respondents were interviewed face to face (questionnaire and field survey) from five districts: Chapainawabganj, Rajshahi, Shatkhora, Meherpur and Mhuadanga. Sixteen problems were identified from farmers' response. Results obtained from the study area exposed that the problem "transportation and packaging" was ranked 1st for mango harvesting to marketing.

CHAPTER III

METHODOLOGY :

Research is a systematic investigation for some pertinent information on a specific topic. Importance of methods and procedures in conducting any research can hardly be over emphasized. Keeping this in mind the researcher took utmost care for using proper methods in all aspects of this investigation. The methods and procedures used in conducting this research are presented below:

3.1 Locale of the study:

Shibganj upazila under Chapainawabganj district was selected for conducting this investigation because it was an intensive mango production area. The study was conducted in six villages Laxmipur, kantinagor, Tikori, Bagbari, Mobarokpur, koragpur, which are well known as highly mango produced area of the Shibganj upazila under Chapainawabganj district, the northern and north-western region of Bangladesh.
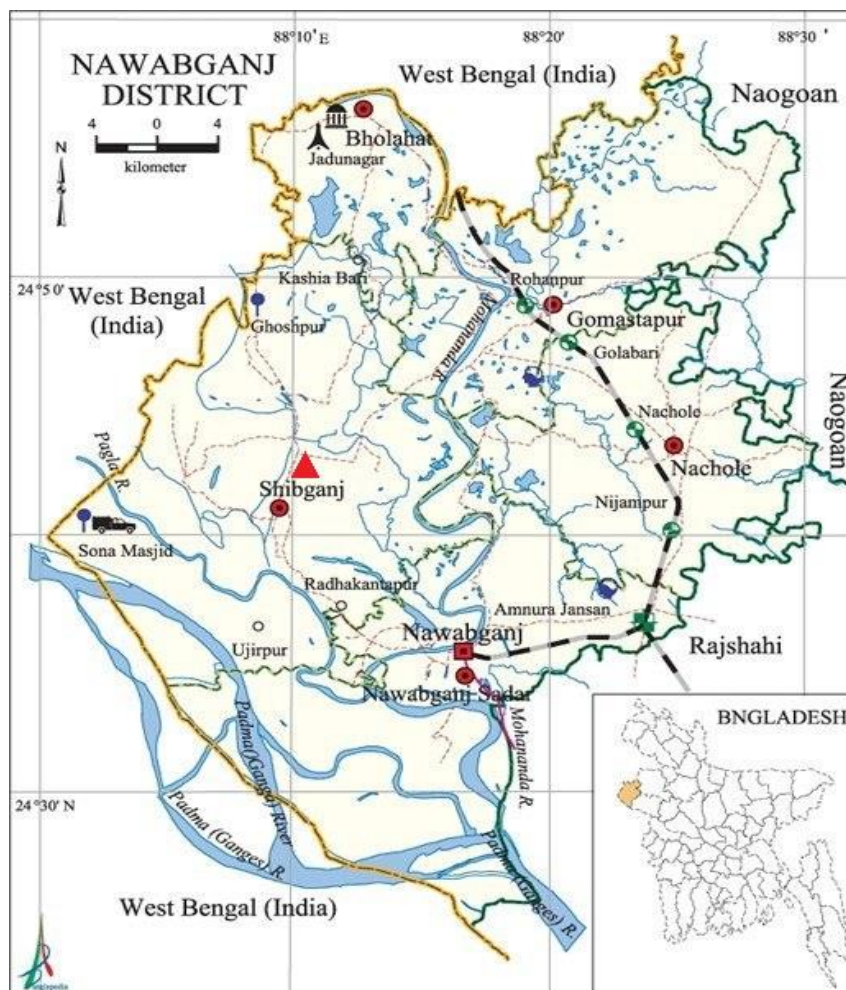
(Map of the locale, Figure 1)

3.2 Sampling of the respondents:

A list of the farmers who have mango plants was collected with the help of the Sub Assistant Agriculture Officer (SAAO) of the Department of Agriculture Extension (DAE) of Shibganj upazila. A total number of 120 respondents were selected randomly out of 480 mango growers. Thus, the 480 farm households of twelve selected villages constituted the active population of the study.

3.3 Instrument for collection of data:

Questionnaire was prepared for data collection in English in accordance with the objectives of the study in view. The Interview schedule (IS) contained both easy and direct form of question to collect data on the selected variables. The draft interview schedule was prepared in English and finalized after pretest. The interview schedule was then multiplied in its final form for collection of data.

3.4 Data collection:

Data were collected with the help of the questionnaire by the researcher himself. The researcher met to the selected respondents and explained the purpose of the study and requested them to help and co-operate him for collecting data for the study. The member involved in mango production of the respondents' family was selected for answering. The respondents were interviewed at their homes during their leisure period. Prior information was given to them for interviewing and a good rapport was established with the respondents during interview. However, if any respondent failed to understand any question, the researcher took utmost care to explain the issue. Excellent cooperation was obtained from all respondents during data collection. Usually one respondent was visited many times and thus great reliance was placed on the ability of the householders to recall the relevant information. Respondents were assured about the confidentiality of their information by the researcher. To preserve the confidentiality, the interview was conducted in absence of other persons. Data were collected from the respondents during May to July, 2022.

3.5 Data coding and tabulation:

After completion of survey all the interview schedules were compiled for its data processing. At the beginning of the data processing all the qualitative data were converted into quantitative form by means of suitable code and score whenever necessary. Local units were converted into standards units. In several instances, indices and scales were constructed

through the simple accumulation of scores assigned to individual or pattern of attributes. Indices and scales are considered the efficient instrument for data reduction and analysis.

3.6 Selection of dependent and independent variables:

The following two (2) were main focus of this study and considered as the dependent Variables as the three dimensions of production performance of mango. The researcher also Selected following eleven (11) independent variables.

DEPENDENT VARIABLES
- ❖ Annual mango production
- ❖ Annual income from mango production

INDEPENDENT VARIABLES
- ❖ Age
- ❖ Education
- ❖ Family size
- ❖ Farm size
- ❖ Land used in mango production
- ❖ Annual family income
- ❖ Experience in mango production
- ❖ Experience in agriculture
- ❖ Annual mango sale
- ❖ Annual expenditure for per mango tree
- ❖ Knowledge on mango production

The selection and measurement of variables constitute a significant task in the scientific Research. In this connection the researcher went through the past related literature as far as available. He also discussed with the departmental teachers and concerned researchers of the relevant fields. He also carefully noticed the various characteristics of the farmers of the study. Availability of time, money community under study area and other resources were also kept in view in selecting the variables.

3.7 Measurement of variables

Measurement of independent variables

The procedures followed in measuring the independent characteristics are briefly discussed below:

Age:

The age of a respondent was measured in terms of actual years from his birth to the time of interview on the basis of his response

Educational qualification:

The educational qualification of the respondents was measured in terms of year of schooling. A score of '1' was given to one year of schooling and so on. A score of '0' was given to the respondent who does not read and write. Besides a score of '1' also given to those respondents who can sign their name. The categories of respondents is shown in table 1.

Table 1. Categories of the respondents according to their educational qualification

Categories	Score
Illiterate	**0**
Primary level	**I-V**
Secondary level	**VI-X**
Higher secondary level and above	**XI-XIII**

Family size:

The family size of the respondents was determined on the basis of the number of members In his family including himself, his wife, children and other dependents, living under same roof and sharing same kitchen.

Farm size:

The farm size refers to the total amount of land under the profession of the respondents get benefit. Farm size of a respondent was measured in terms of hectares.

Land used in mango production:

The total amount of land under mango production was measured in terms of hectares.

Annual family income:

The yearly income referred to the income of a respondent earned from different sources, agriculture, business, fish, fruit, and others.

Experience in agriculture and mango production:

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

Knowledge on mango production:

To determine the knowledge of the respondents about fruit cultivation, a series of question (15 questions) were asked to each of the respondents. An equal, weight of one was assigned to each question.

Measurement of dependent variables:

Annual mango production, annual income from mango production, profit from mango production were the dependent variables of the study. Their measurement categorization is separately shown below.

Annual mango production:

The quantity of per hectare annual mango production was expressed in ton. The categories on amount of mango production are shown in table 2.

Table 2. Categories on amount of annual mango production

Categories	Quantity of mango production(Ton)
Low	<7
Medium	7-10
High	>10

Annual income from mango production:

Annual income from per hectare mango production was expressed in taka categorized according to the table 3.

Table 3. Category of annual income from mango production

Categories	Categorized range (Taka)
Low	Up to 200000
Medium	200001-250000
High	250001-500000
Very high	>500000

Profit from mango production:

Number of recognized and local mango varieties is categorized into low, medium and high which are possessed by the respondents in the following scales:

Table 4. Profit from mango production:

Categories	Categories range (TK)
Small	<200000
Medium	200001-300000
Large	>300000

3.8 Data processing and analysis

3.8.1 Compilation of data:

Collected data from the farmers were compiled, coded tabulated and analyzed in accordance with the objectives of the study. In this process, all the response in the interview schedule was given numerical coded values. Local units were converted into standard units and qualitative data were converted into quantitative ones by means of suitable scoring whenever necessary. The response to the questions in the interview schedule was transferred to a master sheet to facilitate tabulation.

3.8.2 Categorization of data:

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

3.8.3 Statistical technique:

The analysis was performed using SPSS 23V (Statistical Package for Social Sciences) computer package. Descriptive analysis such as range, number, percentage, mean, standard deviation and rank order were used whenever possible. Regression analysis was used in order to explore the relationship between the concerned variables. Throughout the study, one percent(0.01) and five-percent (0.05) level of probability was used as basis of rejecting a null hypothesis

RESULTS AND DISCUSSION

In this chapter the findings of this study are presented and results have been discussed in relation to the present findings and also to those found in other studies. The study investigated the production performance of mango (*Mangiferaindica*) at Shibganj upazila under Chapainawabganj district of Bangladesh. In accordance with the objectives of the study.

Age :

The observed age of the respondents ranged from 20 to 62 years. On the basis of age, the respondents were classified into three categories as presented in table 5.1 Data presented in the table 5.1 showed that the highest proportions of the respondents (70.8%) were middle aged followed by the old aged (25.8%) and only 3.3% of respondents were young. It is evident that middle-aged peoples are interested in mango production.

Table 5.1 selected characteristics profile of the mango growers

SL	Selected characteristics	Measuring unit	Observed Range	Categories	Respondents	
					number	Percent
1	Age	year	20-62	Young (<25)	4	3.4
				Middle(25-50)	85	70.8
				Old(>50)	31	25.8
2	Education	Years of schooling	0-18	Illiterate (0)	15	12.5
				Primary level (1-5)	55	45.8
				Secondary level (6-10)	32	26.7

				Higher secondary and above (>10)	18	15
3	Family size	No. of members	2-10	Small family(0-2)	2	1.7
				Medium (3-5)	94	78.3
				Large(>5	24	20
4	Farm size	hectare	0.21-4	Landless (<0.02)		
				Marginal(0.02-0.20)		
				Small land holder(0.21-1)	45	37.5
				Medium land holder(1.01-3.00)	63	52.5
				Large land holder(>3)	12	10
5	Land used in mango production	Hectare	0.20-4	Small (up to 0.20)		
				Moderate (0.21-1.00)	44	36.7
				Moderate large (1.01-2.800	55	45.8
				Large(>2.80)	21	17.5
6	Annual family income	Taka	150000-550000	Low (up to 200000)	14	11.7
				Medium(200001-3000000	22	18.3
				High(300001-5000000	56	46.7
				Very	28	23.3

				high(>500000)		
7	Experience in mango production	Year	10-34	Low (<10)		
				Medium(10-20)	93	77.5
				High(>20)	27	22.5
8	Experience in agriculture	year	10-36	Low (10-15)	57	47.5
				Medium (16-30)	47	39.2
				High (>30)	16	13.3
9	Annual mango sale	Ton	4-84	Low (<7)	15	12.5
				Medium (7-10)	16	13.3
				High(>10)	89	74.2
10	Annual expenditure from per mango tree	Taka	2500-3000	Low (<20		
				Medium(20-25)	25	20.8
				High(>25)	95	79.2
11	Knowledge on mango production	Score	7-35	Low(<7)		
				Medium(8-10)	2	1.7
				High(>10)	118	98.3

Education:

The observed education of the respondents ranged from 0 to 18 years of schooling. On the basis of general education, the respondent were classified into four categories as presented in table 5.1 Data contained in the table 5.1 showed that the majority (45.8 %) of respondents were in the primary level followed by secondary level (26.70 %) and higher secondary and above (15 %). The lowest proportions of respondents (12.5 %) were illiterate. The literacy percentage of the study area is under national average. But the trend of literacy percentage is becoming higher as the Secondary level indicates the second highest percentage.
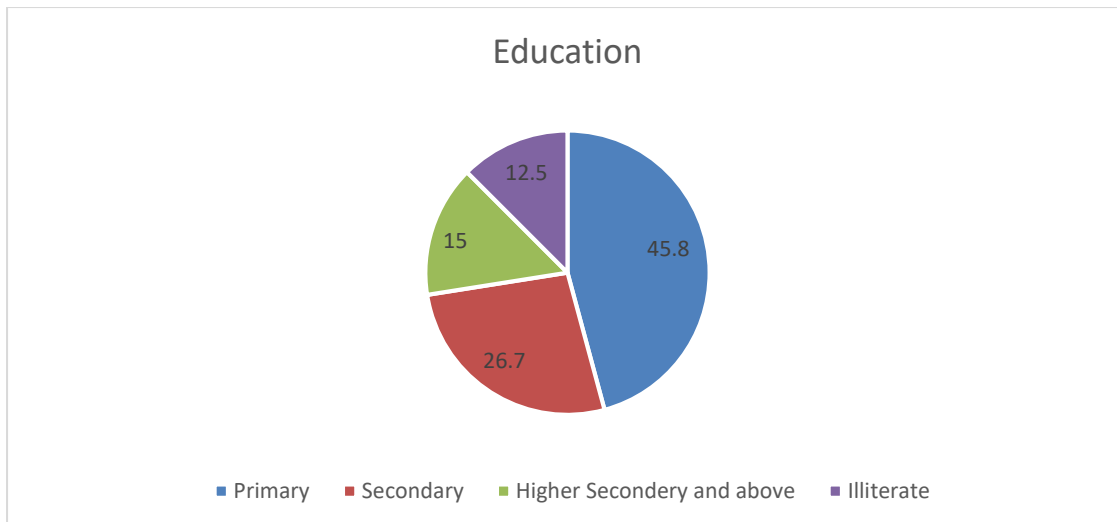
Figure 2: Education of respondents in the study area

Family size:

The observed family size of the respondents ranged from 2 to 10 members. Categories and distribution of the respondents on the basis of family size is shown in table 5.1 Data presented in the table 5.1 indicated that most of the respondents medium family 78.3% and 20 % large family. About 1.7 % small family.
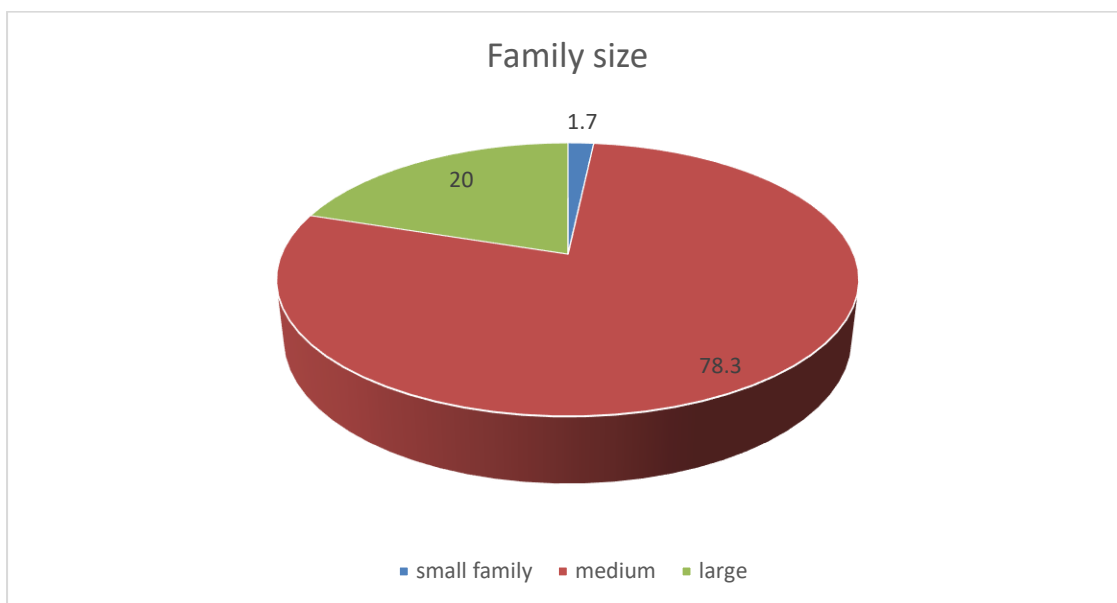
Figure 3: Family size of respondents in the study area

Farm size:

The observed farm size of the respondents ranged from 0.21 to 4 hectares. On the basis of farm size the growers were classified into five categories as shown in table 5.1 Data shown in the table 5.1 indicated that most of respondents (52.5 %) were medium land holder having 1.01-3.00 ha of land followed by 37.5 % of respondents which were small land holder having 0.21-1.0 ha of land, and only 10 % were large land (>3ha) holder.

Land used in mango production:

The observed land used in mango production of the respondents ranged from 0.20-4 hectares. On the basis of mango production land the respondents were classified into four categories as shown in table 5.1 Data shown in the table 5.1 indicated that majority (45.8%) of respondents had moderately large sized (1.01-2.80 ha) of lands followed by 36.70 % of respondents having moderate sized (0.21-1.00 ha) of lands and only 17.5 % had large sized (>2.80 ha.) of lands. So it could be concluded that the respondents of the study area were very much adaptive for mango production.

Annual family income:

The observed annual family income (includes all income sources, Chapter 3) of the respondents ranged from Tk. 150000 to 550000.On the basis of annual family income the respondents were classified into five categories as shown in table 5.1 Data shown in the table 5.1 indicated that most of the respondents (46.7 %) had high income ranging from Tk. 300001-500000 followed by 23.3 % of respondents that having very high income (>500000 taka). 11.7 % of respondents had low income (Up to Tk. 200000) and only 18.3 % of the respondents had medium income (Tk. 2,00001-3,00000). Annual family income of the growers is a vital factor for farming enterprise. In this study most of the growers having high income probably possessed more positive benefit from using improved production technology.
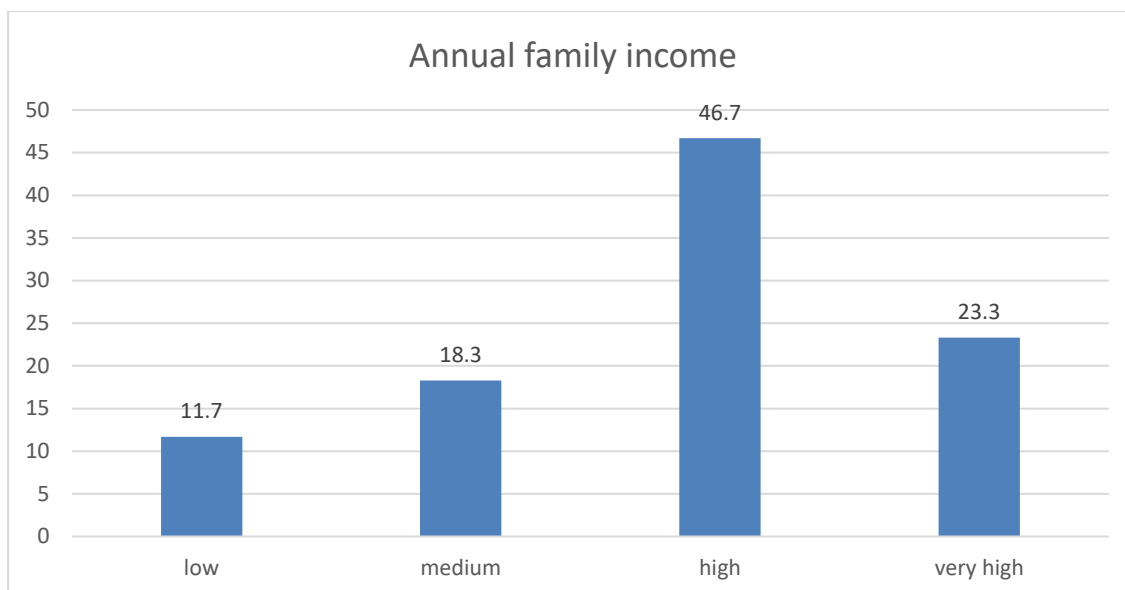
Figure 4: Annual family income of respondents in the study area

Experience in mango production:

The observed experience in mango production of the respondents ranged from 4 to 32 years.

On the basis of experience in mango production, the respondents were classified into three categories as shown in table 5.1 Data shown in the table 5.1 indicated that the highest percent of respondents 77.5 %) had medium experience (10-20 years) followed by the respondents (22.5 %) having high (>20 years) experience. In this study most of the growers having medium and high experience.

Experience in agriculture:

The observed experience in agriculture of the respondents ranged from 10 to 36 years .On the basis of experience in agriculture, the respondents were classified into three categories as shown in table 5.1 Data shown in the table 5.1 indicated that most of the respondents (47.5 %) had low experience (10-15 years) followed by the respondents (39.2%) having medium experience (16-30 years). More than (13.3 %) of respondents had high experience (>30 years).

Annual mango sale:

The observed range of annual mango sale from per hectare production of the respondents was from 4-84 tons .On the basis of annual mango sale from per hectare production, the respondents were classified into three categories as shown in table 5.1. It was revealed from

the table (5.1) 74.2% of the respondents having high mango sale and 13.3 having medium mango sale. Only 12.5% of responds had low sale.
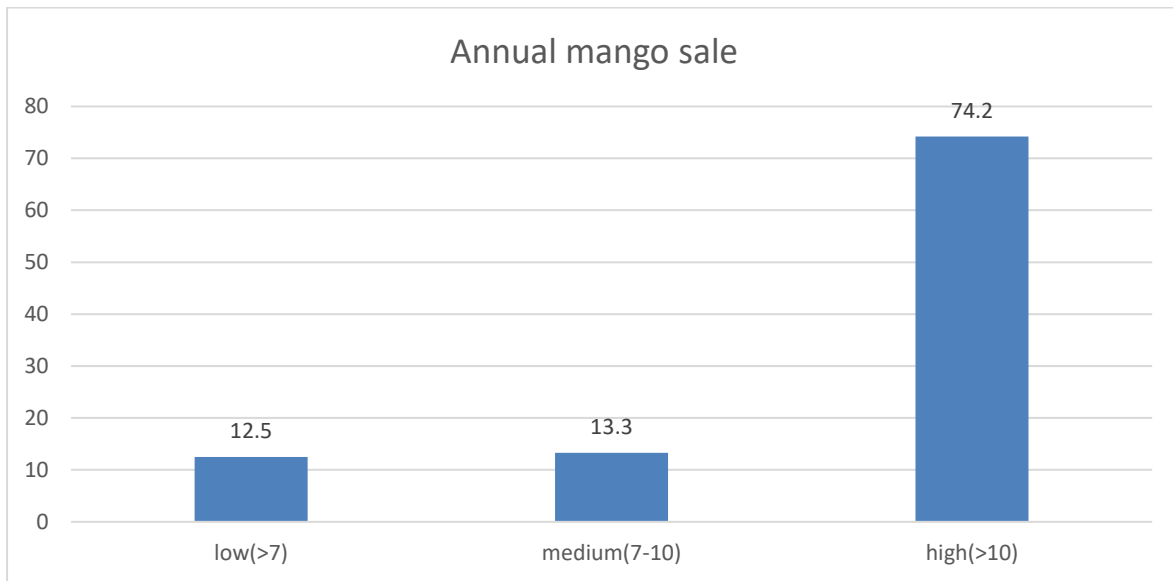
Figure 5: Annual mango sale of respondents in the study area

Annual expenditure for per mango tree:

The observed annual expenditure range per mango tree was from Tk.2500-3000. On the basis of annual expenditure for per mango tree, the respondents were classified into three categories as shown in table 5.1 It was revealed from the table (5.1) 79.2% of the respondents having high per   mango expenditure and 20.8% having medium per mango expenditure .

Knowledge on mango production:

The observed knowledge on mango production of the respondents ranged from 7-35 scores. On the basis of knowledge, the respondents were classified into three categories as shown in table 5.1 Deliberate analysis of the data presented in the table 5.1 showed that most of the respondents (98.3 %) had high knowledge while 1.7 % of the respondents had medium knowledge on mango production. That means the mango grower of the study area belongs to high knowledge group which added them extra advantages.

Table 5.2 Dependent variables

Sl	Selected characteristics	Measuring unit	Observed Range	Categories	Respondents	
					Number	percentage
1	Annual mango production	Ton	5-96	Low (<7)	12	10
				Medium (7-10)	13	10.8
				High (>10)	95	79.2
2	Annual income from mango production	Taka	200000-3600000	Low (up to 200000)	7	5.8
				Medium (200001-250000)	5	4.2
				High (250001-500000)	23	19.2
				Very high (>500000)	85	70.8
3	Profit from mango production	Taka	50000-390000	Low (<200000)	32	26.66
				Medium (200001-300000)	48	40
				High (>300000)	40	33.33

Annual mango production:

The observed per hectare annual mango production of the respondents ranged from 5-96 tons .On the basis of per hectare annual mango production, the respondents were classified into three categories as shown in table 5.2. Data shown in the table 5.2 indicated that majority (79.2 %) of respondents involved in mango production had high (>10 ton) production followed by 10.8% medium production (7- 10 ton) with 10% of respondents Low production (<7 ton) .

Annual income from mango production:

The observed annual income from per hectare mango production of the respondents ranged from Tk. 200000 to above 3600000 .On the basis of annual income from per hectare mango production, the respondents were classified into four categories as shown in table 5.2. Data shown in the table 5.2 indicated that majority of respondents (70.80 %) had very high income

(>500000). 19.20 % of respondents having high income (Tk.250001-500000). 0nly 5.80% and 4.2% of respondents having low (Tk. Up to 200000) and medium (Tk. Up to 200001-250000) income respectively.

Profit from mango production:

The observed annual income from per hectare mango production of the respondents ranged from Tk. 50000 to 390000. On the basis of per hectare mango production, the respondents were classified into three categories as shown in table 5.2. Data shown in the table 5.2 indicated that majority of respondents (40 %) had medium profit (tk. 200001-300000) from mango production followed by 33.33 % of respondents having high profit (above Tk.300000). and 26.66 % of respondents had low (Tk. Up to 200000).

Production status in homestead area

Fruit cultivable land in homestead area:

The observed range of fruit cultivable land size in homestead area of the respondents was from 0.000-0.040 hectares. On the basis of fruit cultivable land size in homestead area, the respondents were classified into three categories as shown in table 6. Indicated that majority 62.5%of the respondents had no fruit cultivable land and 37.5% of the respondents had small fruit cultivable land.

Table 6. Distribution of the respondents according to fruit cultivable land in homestead area.

Categories	Observed range (hectare)	Categorized range(hectare)	Respondents	
			number	Percentage
No land	0.000-0.040	0.00	75	62.5
Small		0.001-0.01	45	37.5
Large		>0.01		
Total			120	100

Production status with relative measurements

Weight of per fruit:

The observed weight range of per mango was from 150-750 g. On the basis of weight of per fruit, the respondents were classified into five categories as shown in Table 7. On Data shown in the table 7 indicated that majority of respondents (36.66 %) had high weight per mango (501-700) .20.83 % of respondents having moderately high weight per mango (351-500). 16.66% of the respondents having extra high weight per mango (>700) and 13.2 % of respondents had low weight per mango (<250). Only 12.5% of the respondents having moderate per weight mango (251-350).

Table 7. Distribution of the respondents according to the weight of per fruit

Categories	Observed range (gm)	Categorized range(gm)	Respondents	
			number	percentage
Low	150-750	<250	16	13.2
Moderate		251-350	15	12.5
Moderately high		351-500	25	20.83
High		501-700	44	36.66
Extra high		>700	20	16.66
Total			120	100

Varietal status of mango

Local mango germplasm:

Local mango germplasm are categorized based on their number belonged by the growers (Table 8). The farm of most of the respondents (79.16 %) was not provided with local Mango germplasm while only 20.84 % had grown small to medium number of (1-6) local Mango germplasm.

Table 8. Distribution of the respondents based on number of local mango germplasm available in their farm

Categories	Range (germplasm number)	Respondents	
		number	%
Not at all	0	95	79.16
Small to medium	1-6	25	20.84
Total		120	100

Management status of mango trees

Fertilizer usage:

It was observed that all of the respondents (83.3%) used cow dung and compost to the mango trees while 91.66 % used Urea and TSP individually. MP, Gypsum and Zinc sulphate were used by 75%, 40.83 % and 54.16 % of the respondents respectively (Table 9).

Table 9. Percentage of fertilizer use

Fertilizer	Citation number	Percentage
Urea	110	91.66
TSP	110	91.66
Compost	105	87.5
Cow dung	100	83.3
MP	90	75
Zinc sulphate	65	54.16
Gypsum	49	40.83

After care of mango trees:

It was found that maximum percentages of the respondents did not practice any intercultural operations in their mango farm (Table 10). Most (53 %) of the respondents practiced spading 1-2 times and 47 % did it for 3-4 times. 51 % of respondents practiced

Table 10. After care of mango trees practiced by the respondents

Operations	1-2 times (%)	3-4 times (%)	Not at all (%)
Irrigation	43	45	12
Inter cropping	35	10	55
Mulching	5	5	90
Spading	53	45	2
Fruit thinning	44	36	20
Pruning and training	51	4	45
weeding	46	34	20

Insect and disease infestation status:

It was found from the survey that majority of the growers (61.66 %) emphasized on

Diseases infestation and 38.33% emphasized on insect infestation.

Table 11. Distribution of the respondents based on insect and disease infestation status

Infestation	Respondents	
	number	%
disease infestation	74	61.66
Insect infestation	46	38.33
Total	120	100

Disease infestation of mango:

The diseases of mango had been presented in table 12. From the survey it was found that the mango plants were mostly (45 %) attacked by Anthracnose which is followed by 25% of Powdery mildew and 13.3 % of Sooty mold.

Table 12. Distribution of the respondents based on disease infestation of mango

Disease type	Respondents	
	Number	%
Anthracnose	54	45
Powdery mildew	30	25
Sooty mould	16	13.3
Die back	10	8.33
Stem end rot	10	8.33
Total	120	100

Insect infestation of mango:

The occurrence of insect infestation had been shown in the table 13. Most of the respondents (35.83 %) reported that their plants are attacked by hopper which is followed by fruit fly (23.33 %), stem borer (15 %), leaf cutting weevil (10 %) and others.

Table 13. Distribution of the respondents based on insect infestation of. mango

Insect type	Respondents	
	Number	%
Fruit fly	28	23.33
Stem borer	18	15
Hopper	43	35.83
Gall insects	8	6.66
Leaf cutting weevil	12	10
Fruit weevil	4	3.33
Defoliator	3	2.5
Spider mite	2	1.66
Termite	2	1.66
Total	120	100

Dropping of fruits and flowers:

The occurrence of dropping of fruits and flowers has been shown in table 14. From the table it was evident that all (100%) of the respondents said that the dropping of fruits and flowers is a common problem in mango cultivation.

Table 14. Response on dropping fruits and flowers

occurrence of dropping	Yes	No
Flower	100%	
Fruit	100%	

Causes of dropping fruits and flowers:

The causes of flower and fruit dropping had been shown in the table 15. It was found that the main cause of fruit and flower dropping was diseases (40 %) and then insects (35.83 %). The other causes they mentioned were water deficiency and nutrient deficiency were respectively in (11.66 %) and (12.5%)

Table 15. Distribution of the respondents based on causes of dropping of fruits and flowers of mango in the study area

Causes	Respondents	
	Number	%
Diseases	48	40
Insects	43	35.83
Nutrient deficiency	15	12.5
Water deficiency	14	11.66
Total	120	100

Treatments to protect the flower and fruit dropping:

The treatments for the protection of flowers and fruits dropping had been shown in table 16. Most of the respondents (90.50 %) took protective or curative measures for controlling the dropping of fruits and flowers. Fungicides were used by 40.83 % of respondents followed by insecticides (36.66 %).

Table 16. Distribution of the respondents based on treatments to protect the flower and fruit dropping

Causes	Respondents	
	number	%
Inter cultural operation	17	14.16
Insecticide	44	36.66
Fungicide	49	40.83
Not at all	10	8.33
Total	120	100

Profit from mango cultivation:

The profit from mango cultivation had been shown in table 17

All (100%) of the respondents reported that mango production is profitable in Chapainawabganj district. None indicated mango production as a non profitable enterprise.

Table 17. Profit from mango cultivation

Categories	Number	Percentage
Profitable	120	100
No profitable	0	0

Multiple Regression Analysis :

Three multiple regression model with dependent variables annual mango production , annual income from mango production and profit from mango production was proposed for the data. The models included a set of independent variables comprising quantitative as well as qualitative/categorical variables. The categorical variables has been represent by dummy variables used in the regression analysis and their notations are given below:

Dependent variable		
Notation	**Variable**	**Measurement technique**
Y_1	Annual mango production	per hectare annual mango production in ton
Y_2	Annual income from mango production	Annual income per hectare mango production of the respondents in TK
Independent variable		
X_1	Age	The age of the respondent was measured in term of year
X_2	Family size	Number of Family members of the respondents
X3	Land use in mango production	Land used in mango production of the respondents in hectare
X_4	Annual family income	Annual family income of the respondents in TK
X_5	Experience in mango production	Experience in mango production of the respondents in year
X_6	Experience in agriculture	Experience in agriculture of the respondents in number of year
X_7	Knowledge on mango production	Knowledge on mango production of the respondents in score
X_8	Annual mango sale	Annual mango sale of the respondents in ton
X_9	Annual expenditure from per mango	Annual expenditure from per mango of the respondents in taka
E_1	Dummy	$E_1=1$,if the education was illiterate,0 otherwise
E_2	"	$E_2=1$, if the education was primary,0 otherwise

E$_3$	"	E$_3$=1, if the education was secondary,0 otherwise
E$_4$	''	E$_4$=1, if the education was higher secondary and above ,0 otherwise
F$_1$	Dummy	F$_1$=1,if the farm size landless,0 otherwise
F$_2$	"	F$_2$=1,if the farm marginal,0 otherwise
F$_3$	"	F$_3$=1,if the medium,0 otherwise
F$_4$	"	F$_4$=1,if the farm large land holder,0 otherwise

Table 18:   Model Summary : dependent variable (Y$_1$)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.831^a	.691	.656	.3785	1.089

a. Predictors: (Constant), X$_9$, E$_2$, X$_4$, X$_5$, X$_2$, E$_4$, E$_1$, X$_8$, X$_6$, X$_7$, F$_4$, X$_1$, E$_3$, X$_3$

b. Dependent Variable: Y$_1$

Table 19: Analysis of variance dependent variable: Y$_1$ (Annual mango production)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	33102.833	14	2364.488	4672.476	.000^b
	Residual	52.629	104	.506		
	Total	33155.462	118			

a. Dependent Variable: Y$_1$

b. Predictors: (Constant), X$_9$, E$_2$, X$_4$, X$_5$, X$_2$, E$_4$, E$_1$, X$_8$, X$_6$, X$_7$, F$_4$, X$_1$, E$_3$, X$_3$

Table 20: parameter estimates of Regression model Dependent variable : Y_1 (Annual mango production).

Coefficients

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	T	Sig.
1	(Constant)	.338	2.097		.161	.872
	X_1	-.018	.014	-.011	-1.294	.198
	E_1	-.123	.461	-.002	-.266	.790
	E_2	-.106	.386	-.003	-.275	.784
	E_3	-.088	.337	-.003	-.261	.795
	E_4	.399	.421	.009	.946	.346
	X_2	.096	.051	.008	1.896	.061
	F_4	.426	.264	.012	1.612	.110
	X_3	-.596**	.225	-.035	-2.649	.009
	X_4	1.525E-6	.000	.008	1.173	.243
	X_5	-.009	.024	-.003	-.378	.706
	X_6	-.006	.016	-.002	-.347	.729
	X_7	.043*	.019	.016	2.332	.022
	X_8	1.141**	.013	1.015	85.125	.000
	X_9	5.644E-5	.001	.000	.073	.942

Regression analysis: Following regression equation was obtained as the result

$$Y_1 = 0.338 - .018X_1 - .123E_1 - .106E_2 - .088E_3 + 0.399 E_4 + 0.096 X_2 + 0.426 F_4 - 0.596 X_3 + 1.525E\text{-}6 X_4 - .009 X_5 - .006 X_6 + .043 X_7 + 1.141X_8 + 5.644E\text{-}5X_9 .$$

It was revealed that 14 independent variables included in the estimated model together explained more than 69% of the total variation in annual mango production. Out of 14 variables in the estimated full model three variables were found to have significant influence y_1. These variable are X_3(land used in mango production), X_7(knowledge on mango production), and X_8(Annual mango sale). The result implied that land used in mango production, knowledge of mango production and annual mango sale were major determinants of annual mango production.

Table 21: Model Summary (Dependent variable Y_2)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.869[a]	.755	.728	53146.07991	1.842

a. Predictors: (Constant), X_9, E_2, X_4, X_5, X_2, E_4, E_1, X_8, X_6, X_7, F_4, X_1, E_3, X_3

b. Dependent Variable: Y_2

Table 22: Analysis of variance dependent variable : y_2 (Annual income from mango production)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	59619990891560.110	14	4258570777968.579	1507.722	.000[b]
	Residual	293748604238.246	104	2824505809.983		
	Total	59913739495798.350	118			

a. Dependent Variable: Y_2

b. Predictors: (Constant), X_9, E_2, X_4, X_5, X_2, E_4, E_1, X_8, X_6, X_7, F_4, X_1, E_3, X_3

Table 23: parameter estimates of Regression model Dependent variable: Y_2 (Annual income from mango production).

Coefficients

:Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	125359.183	156684.582		.800	.425
X_1	-234.497	1038.309	-.003	-.226	.822
E_1	7968.725	34453.998	.004	.231	.818
E_2	-2050.068	28824.506	-.001	-.071	.943
E_3	5028.538	25194.814	.004	.200	.842
E_4	-3288.341	31472.502	-.002	-.104	.917
X_2	4090.598	3802.002	.008	1.076	.284
F_4	-38158.660	19748.926	-.026	-1.932	.056
X_3	127719.546**	16798.547	.175	7.603	.000
X_4	.259**	.097	.032	2.671	.009
X_5	1472.081	1785.348	.010	.825	.412
X_6	-2279.150	1216.306	-.023	-1.874	.064
X_7	3021.958*	1385.062	.026	2.182	.031
X_8	39139.656**	1001.503	.819	39.081	.000
X_9	-83.763	57.503	-.010	-1.457	.148

Regression analysis: Following regression equation was obtained as the result

Y_2 = 125359.183 -234.497X_1 +7968.725E_1 -2050.068E_2+5028.538E_3 -3288.341E_4 + 4090.598X_2-38158.660F_4+127719.546X_3+.259X_4+1472.081X_5– 2279.150X_6+3021.958X_7+39139.656X_8-83.763X_9 .

It was revealed that 14 independent variables included in the estimated model together explained more than 75% of the total variation in annual mango production. Out of 14 variables in the estimated full model four variables were found to have significant influence Y_2. These variable are X_3(land used in mango production), X_4(annual family income) X_7(knowledge on mango production), and X_8(Annual mango sale). The result implied that land used in mango production, annual family income, knowledge on mango production and annual mango sale were major determinants of annual income from mango production.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Conclusions and recommendations were drawn on the basis of findings of this study and Their logical interpretation of findings and other relevant facts were stated below:

1. For mango production, highest proportion (45%) of respondents had moderately large sized (1.01-2.80 ha) of land which were almost entire (1.01-3.00 ha) of the farm size though mango cultivated land in homestead area were negligible and had no effect on total production.

2. Majority (74.2 %) of respondents involved in mango production had high (>10 ton) production and medium production percentage was also so sound with 13.3% of respondents (7-10 ton). So, it may be concluded that, the study area bears a better mango production sign.

3. Highest proportions of the respondents (70.8%) were middle aged men as well as old aged men were 12.5%.It was revealed that medium experience both in mango (10-20 years) production and in agriculture (16-30 years), and high (>10 score) knowledge in mango production.

4. Most of the respondents (46.7 %) had high annual family income ranging from Tk. 300001-500000. But some of respondents (23.3 %) had very high income (Tk. >500000) from mango production. Majority (74.2 %) of respondents involved in mango production had high (>10 ton) annual sale.

5. The findings indicate that large farm size, land used in mango production, annual income, experience in mango production, and knowledge in mango production respectively had major determinants of annual mango production and annual income from mango production individually. That means the growers having higher these characteristics, the higher are the annual mango production and annual income from mango production.

6. The findings indicate that large farm size, annual income had major determinants of profit from mango production. Hence, it is concluded that the growers having higher these characteristics, the higher become the number of mango varieties produced.

Recommendations based on both the findings and conclusions of the study are presented below:

1. Mango has a high demand in local and foreign markets and its production is highly profitable. The farmers in the study area confronted medium problems in mango production. So, Government, concern GOs and NGOs should take necessary steps to minimize the problem confrontation of the farmers.

2. The education of the growers is essential for any development programmed. It is necessary for creating awareness about any improved production technologies. To increase the level of education of the growers, Government, concern GOs and NGOs should take proper steps.

3. To increase the annual income and production, mango growers need financial support in time. GOs, NGOs and concerned authority should take proper steps to reduce the financial problem of the farmers.

4. Growers confronted various problems during the whole production season. So, proper contact with extension personnel is necessary for reducing problem in mango production. The DAE, Horticulture Centre and non-government organizations should strengthen their services to the farmers to overcome their problem confrontation in mango production.

5. The agriculture officers and SAAO should also help the farmers for better production Techniques and improved information so that the growers could increase their production and sell their products at a higher price.

6. Training exposure and organizational participation of the growers in mango production seem to increase production and income as well as minimize problem confrontation. Therefore, it is recommended that the Govt. and other NGOs should take steps, so that farmers can get more opportunity to receive training and organizational participation and other related practices.

RECOMMENDATIONS FOR FURTHER STUDY

The present study was investigated with a view to have an understanding about the status of mango production, socioeconomic condition of the mango growers, number of varieties produced & problems confronted by them and to explore their relationships with some selected characteristics. The following future studies should be undertaken, covering more dimensions in related matters-

1. The study was conducted on the farmers of eleven villages of Shibganj upazila under Chapainawabganj district. Similar studies may be undertaken in other parts of the country to verify the findings of the present study.

2. The study estimated only three dependent variables in mango production. Further research should be undertaken for exploring relationship of other characteristics of the farmers with other dependent variables.

CHAPTER VI

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