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PRODUCTION PERFORMANCE OF MANGO IN DINAJPUR DISTRICT OF BANGLADESH (A CASE STUDY AT SADAR UPAZILLA)

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ABSTRACT: *A study was conducted to identify the status of mango production, mango varieties produced, and problems confronted by the growers and to explore their relationship with some selected characteristics. Data were collected from randomly selected 105 mango growers from eight selected villages of sadar upazila under Dinajpur district through personal interview during March to August, 2008. 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. Relationship between the selected characteristics and dependent variables was done by Pearson's product moment co-efficient of correlation. In the study, 30 germplasm of mango were identified. Baramashi droop was found as the only year round variety. Gopalbhog holds the first position (15.90%) according to rank of recognized mango varieties based on their availability in respondents' farm. About three fourths (77.10 %) and more than the same (70.50 %) of the respondents had medium mango production and income respectively. Majority ((75.20 %) of the growers confronted medium problems. Although respondents certified that Dinajpur 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 upazillas of Dinajpur district.*

KEYWORDS: Mango Production, Variety, Respondents farm, Income, Bangladesh

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INTRODUCTION

General Background

Mango (*Mangifera indica*) is the favourite fruit in Bangladesh and has been repeatedly acclaimed as the King of Fruits. (Ahmed, 1994). Mango belongs to the family Anacardiaceae 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 (Candole, 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. Bangladesh produces 240,000 tons of mangoes per annum from 68.60 thousand hectares of land (BBS, 2008).

Another study says that Mango trees occupy the largest area in Bangladesh but its production position is third among the fruits grown in Bangladesh. At present (BBS, 2009), Bangladesh produces 242,000 tons of mango annually from 65 thousand hectares of land at the rate of 3.72 tons per hectare. But According to FAO, mango production in 1969-1970 in Bangladesh (The then East Pakistan) amounted to an average of 424,000 tons per annum (BBS, 2009). The main reason for the decline in mango production is due to the lack of proper cultural management practices and general neglect. But this low yield may be increased through the proper scientific cultural management practices.

Rationale of the Study

The Northern and North-western parts of Bangladesh are well known for better mango production (Bhuiyan, Roy & Ganguly, 1999). Dinajpur is one of the districts of these parts. A good percentage of farmers in this district depend on mango production as the major source of income but no study was conducted on mango production as well as on growers in this area. This is why study was conducted in the district.

Objectives of the Study

1. To find out the status of mango production in the study area.
2. To find out the mango varieties produced by the growers in the study area.

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3. To determine the extent of problems confronted by the mango growers in the study area.
4. To explore the relationship between the selected characteristics of mango growers with dependent variables.

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 programme in one hand and motivate to the authority to reduce hazards cause decline in mango production and source of earning money and reducing poverty.

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 eight villages namely Kashba, Ulipur, Nashipur, Ghugudanga, kawga, Basherhat, Gobindapur and Gopalgonj of sadar upazila under Dinajpur district i.e. the Northern and North-Western region of Bangladesh.
2. The study was confined mainly to status of mango production, mango varieties produced and problems confronted by the grower.
3. Out of many characteristics of mango growers only twelve 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. However, only 18 problems have been considered for investigation in his study.

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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.

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:

Locale of the study

Sadar upazila under Dinajpur district was selected for conducting this investigation because it was an intensive mango production area. The study was conducted in eight villages Kashba, Ulipur, Nashipur, Ghugudanga, kawga, Basherhat, Gobindapur and Gopalgonj which are well known as highly mango produced area of the sadar upazila under Dinajpur district i.e. the Northern and North-Western region of Bangladesh. (Map of the locale, Figure 1)

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 Dinajpur sadar. A total number of 105 respondents were selected randomly out of 448 mango growers. The list comprised Kashba-71, Ulipur-67, Nashipur-60, kawga-55, Ghugudanga-52, Basherhat-45, Gobindapur-46 and Gopalgonj-52 Thus, the 448 farm households of eight selected villages constituted the active population of the study.

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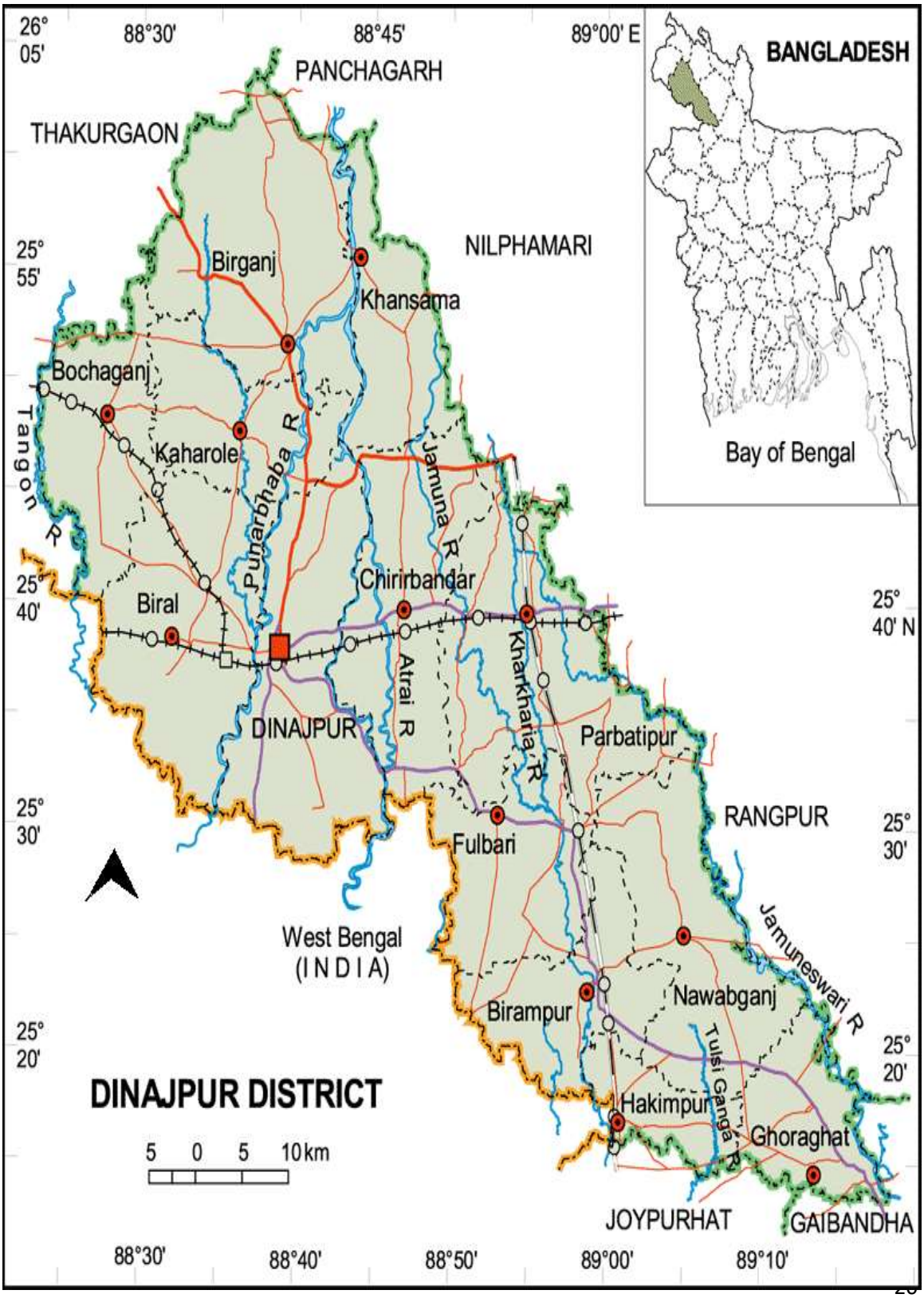

Figure 1. A Map of Dinajpur district showing sadar Upazila, the study area

Instrument for collection of data

An interview schedule was prepared for data collection in Bangla in accordance with the objectives of the study in view. The Interview schedule (IS) contained both simple and direct form of question to collect data on the selected variables. The draft interview schedule was prepared in Bangla version and it was pretested among 25 farmers in the sample villages before preparing the final version for collecting the data for the main study. After pre-test, necessary corrections, additions and alterations, and rearrangements were made in the schedule on the basis of experience of the pre-test. The interview schedule was then multiplied in its final form for collection of data.

Data collection

Data were collected with the help of the interview schedule 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 March to August'2008.

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.

Selection of dependent and independent variables

The following four (4) were main focus of this study and considered as the dependent variables as the four dimensions of production performance of mango. The researcher also selected following twelve (12) independent variables.

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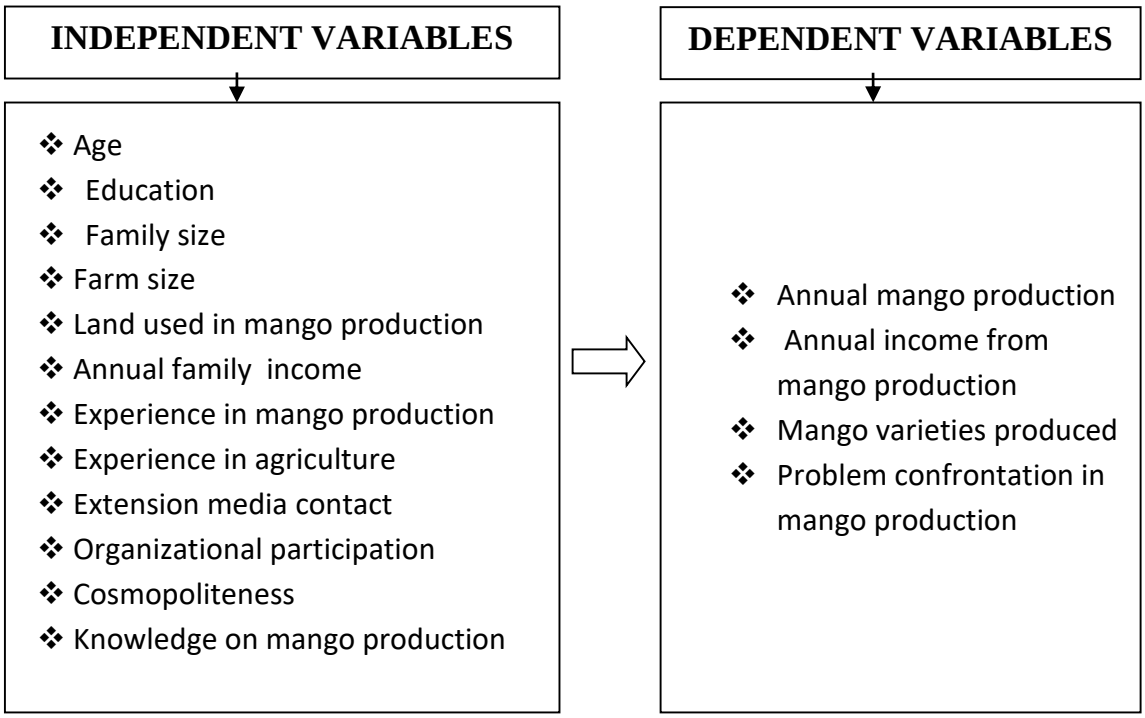

Figure 2. Conceptual framework of the independent and dependent variables of the study

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.

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.

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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	V1-X
Higher secondary level	X1-XII
Graduate and above	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 by using the following formula:

$$\text{Farm size} = A_1+A_2+ \frac{1}{2}(A_3+A_4) + A_5 + A_6+ A_7$$

Where,

A_1 = Area under homestead
A_2 = Area under own cultivation
A_3 = Area given to others on borga
A_4 = Area taken from others on borga
A_5 = Area taken from others on lease
A_6 = Area given to others on lease
A_7 = Others

Land used in mango production

The total amount of land under mango production was measured under this title.

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Annual family income
The yearly income referred to the income of a respondent earned from different sources, viz. agriculture, business, share market investment, fish, fruit, and others.

Experience in agriculture
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.

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

Extension media contact
Extension media contact is defined as a person's communication with different sources of information available in and out of his social system. A 4 points scale such as "frequently"(3), "occasionally"(2), "rare"(1), and "not at all"(0) were used to determine the extent of Extension media contact of the respondents.

Organizational participation
Relationship of respondents with different organizations was referred to his participation in different associations or organizations. The different organizations enlisted in the interview schedule were government organization, non-government organization, government nursery, private nursery, mosque committee, NGO committee, school committee, madrasa committee, market committee, cultural and sports organizations etc. A 4 points scale such as "Executive officer"(3), "Executive member"(2),” General member "(1), and "not related at all"(0) were used to determine the extent of Organizational Participation.

Cosmo politeness
Cosmo politeness is defined as a person's orientation to outside his own social system. A 4 points scale such as "frequently"(3), "occasionally"(2), "rare"(1), and "not at all"(0) were used to determine the extent of Cosmo politeness.

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, mango varieties produced and problems confrontation in mango production were the dependent variables of the study. Their measurement categorization is separately shown below.

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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 per hectare mango production

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

Mango varieties produced

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. Category of number of mango varieties produced

Categories	*Categorized range (Number of varieties)*
Small	1-10
Moderate	11-20
Large	>20

Problem confrontation in mango production

The respondents were asked about the problems they faced during the cultivation on mango. An item was prepared in the interview schedule. The problems obtained from them were categorized into 6 types viz. very severe, severe, moderately severe, moderate, negligible, not at all.

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Problem Confrontation Index (PCI) was measured for each problem-item with help of the following formula:

$PCI = P_{vs} \times 5 + P_s \times 4 + P_{ms} \times 3 + P_m \times 2 + P_{ng} \times 1 + P_n \times 0$

Where,

PCI = Problem Confrontation Index
P_{vs} = No. of respondents confronted very severe problem
P_s = No. of respondents confronted severe problem
P_{ms} = No. of respondents confronted moderately severe problem
P_m = No. of respondents confronted moderate problem
P_{ng} = No. of respondents confronted negligible problem
P_n = No. of respondents confronted no problem at all

Varietal status of mango

Local mango germplasm

The researcher collected information about the local germplasm of mango trees. The information included size of mango fruits, degrees of sweetness, number of trees, age, fruiting age, how many times it bear fruit in a year and when, production per plant in number of fruit and their weight.

Information about year round mango varieties

The researcher collected information about the year round germplasm of mango. The information included name of the germplasm, number of trees, age, fruiting age, how many times it bear fruit in a year and when, production per plant in number of fruit and their weight.

Use of manures and fertilizers

The name of different manures and fertilizers were included in the interview schedule. The fertilizers and manures were urea, TSP, MP, cow dung, farm yard manure, compost, Gypsum, Zink sulphate etc.

Intercultural operation done in mango plants

The researchers categorized the intercultural operation in to weeding, irrigation, mulching, spading, insect and disease control, fruit thinning, pruning and training, inter cropping and others. On the other hand how many times and when it was done in a year and by what means it was done.

Insect and disease infestation

To know the situation about insect and disease infestation information were collected by asking question about the symptoms and their control measures they adopted. An item was prepared in the interview schedule in this purpose. Here the name of the disease and insects

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with their symptoms and control measures were asked. All the name of the diseases and insects were compiled from the interview schedule.

Propagation of mango trees

The respondents were asked about the propagation of mango trees. They were asked about the mode of propagation, time of propagation, number of propagules produced per year and percentage of their success.

Fruit and flower dropping

The respondents were asked about the flower and fruit dropping, their comments about the dropping and the preventive measures taken by them.

Study conducted on the following causes of dropping

1. Diseases
2. Insects
3. Nutrient deficiency
4. Water deficiency

Data processing and analysis

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.

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.

Statistical technique

The analysis was performed using SPSS (Statistical Package for Social Sciences) computer package. Descriptive analysis such as range, number, percentage, mean, standard deviation and rank order were used whenever possible. Pearson's product Moment Co-efficient of Correlation (r) was used in order to explore the relationship between the concerned variables. Throughout the study, at least five-percent (0.05) level of probability was used as basis of rejecting a null hypothesis.

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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 (*Mangifera indica*) at sadar upazila under Dinajpur district of Bangladesh. In accordance with the objectives of the study, presentation of the findings has been made in four sections of this chapter.

Section 1: Selected characteristics of the mango growers.
Section 2: Dependent variables.
Section 3: Status of mango production.
Section 4: Relationship between the selected characteristics of the mango growers and dependent variables.

Table 5.1.a Selected characteristics profile of the mango growers

SL. No	Selected characteristics	Measuring unit	Observed range	Categories	Respondents		Mean	SD
					Number	Percent		
1	Age	Year	21-56	Young (<25)	8	7.60	39.55	8.88
				Middle aged (25-50)	80	76.20		
				Old (>50)	17	16.20		
2	Education	Years of schooling	0-13	Illiterate (0)	20	19.00	6.19	4.216
				Primary level (1-5)	40	38.10		
				Secondary level (6-10)	28	26.70		
				Higher Secondary level 11-12	14	13.30		
				Graduate and above (>12)	3	2.90		
3	Family size	No. of members	0-9	Small family (0-2)	22	21.00	3.74	1.743
				Medium family (3-5)	70	66.60		
				Large family ≥6	13	12.40		
4	Farm size	Hectare	0.187-3.5	Land less (<0.02)	0	0.00	1.58	0.869
				Marginal (0.02-0.20)	5	4.80		
				Small land holder (0.21-1.0)	21	20.00		
				Medium land holder (1.01-3.00)	67	63.80		
				Large land holder (>3)	12	11.40		

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Table 5.1.b Selected characteristics of the mango growers (Continued)

SL. No.	Selected characteristics	Measuring unit	Observed range	Categories	Respondents		Mean	SD
					Number	Percent		
5	Land used in mango production	Hectare	0.186-3.19	Small (Up to 0.20)	8	7.60	1.53	0.845
				Moderate (0.21-1.00)	27	25.70		
				Moderately large (1.01-2.80)	63	60.00		
				Large (>2.80)	7	6.70		
6	Annual family income	Taka	190000-721000	Low (Up to 200000)	16	15.20	351.69	177.970
				Medium (200001-300000)	14	13.40		
				High (300001-500000)	56	53.30		
				Very high (> 500000)	19	18.10		
7	Experience in mango production	Year	4-32	Low (<10)	15	14.30	15.08	5.452
				Medium (10-20)	67	63.80		
				High (>20)	23	21.90		
8	Experience in agriculture	Year	5-40	Very low (<10)	6	5.70	20.08	8.337
				Low (10-15)	29	27.60		
				Medium (16-25)	40	38.10		
				High (26-30)	14	13.40		
				Very high (>30)	16	15.20		
9	Extension media contact	Score	8-27	Low (<10)	7	6.70	14.85	5.522
				Medium (10-15)	58	55.20		
				High (>15)	40	38.10		
10	Organizational participation	Score	0-2	Not at all (0)	54	51.40	0.69	0.788
				Low (1)	30	28.60		
				High (>1)	21	20.00		
11	Cosmo politeness	Score	5-26	Low (<15)	47	44.80	14.84	4.133
				Medium (15-20)	50	47.60		
				High (>20)	8	7.60		
12	Knowledge on mango production	Score	7-16	Low (≤ 7)	12	11.40	12.15	2.731
				Medium (8-10)	22	21.00		
				High (>10)	71	67.60		

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Age

The observed age of the respondents ranged from 21 to 56 years and the average was 39.55 years with a standard deviation of 8.880. 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 (76.20%) were middle aged followed by the old aged (16.20%) and only 7.60% of respondents were young. It is evident that middle-aged peoples are interested in mango production.

Education

The observed education of the respondents ranged from 0 to 13 years of schooling and the average was 6.19 with a standard deviation of 4.216. On the basis of general education, the respondent were classified into five categories as presented in table 5.1

Data contained in the table 5.1 showed that the majority (38.10 %) of respondents were in the primary level followed by secondary level (26.70 %) and illiterate (19 %). The lowest proportions of respondents (2.9 %) were graduate and above. About 13.3 % respondents were of Higher Secondary level. 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.

Family size

The observed family size of the respondents ranged from 0 to 9 members with a mean and standard deviation 3.74 and 1.743 respectively. 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 (66.6 %) had medium family size (3-5 members) followed by small family size (0-2 members) with 21 % of respondents. Only 12.4 % of the respondents had large family size (≥ 6 members). So, from the tabulated data it is clear that in the study area people like to live together in joint family. It was also revealed that most of the respondents having medium sized family were engaged in mango production.

Farm size

The observed farm size of the respondents ranged from 0.187 to 3.50 hectares. The average farm size of the respondents was 1.58 ha which is greater than the national average (0.81 hectare) and standard deviation (Std.) was 0.869. 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 (63.80 %) were medium land holder having 1.01-3.00 ha of land followed by 20 % of respondents which were small land holder having 0.21-1.0 ha of land, 4.80 % were marginal land holder having 0.02-0.20 ha and only 11.40 % were large land (>3ha) holder. No landless (<0.02 ha) were found.

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Land used in mango production

The observed land used in mango production of the respondents ranged from 0.186-3.19 hectares with a mean of 1.53 ha and standard deviation of 0.845. 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 (60%) of respondents had moderately large sized (1.01-2.80 ha) of lands followed by 25.70 % of respondents having moderate sized (0.21-1.00 ha) of lands and only 6.70 % 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. 190000 to 721000. The annual mean family income of the respondents was 351.69 and standard deviation was 177.97. 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 (53.30 %) had high income ranging from Tk. 300001-500000 followed by 18.10 % of respondents that having very high income (>500000 taka). 15.20 % of respondents had low income (Up to Tk. 200000) and only 13.40 % 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.

Experience in mango production

The observed experience in mango production of the respondents ranged from 4 to 32 years with a mean and standard deviation of 15.08 and 5.452 respectively. 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 (63.80 %) had medium experience (10-20 years) followed by the respondents (21.90 %) having high (>20 years) experience. Rest 14.30 % of respondents had low experience (<10 years).

Experience in agriculture

The observed experience in agriculture of the respondents ranged from 5 to 40 years with a mean and standard deviation of 20.08 and 8.337 respectively. On the basis of experience in agriculture, 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 (38.10 %) had medium experience (16-25 years) followed by the respondents (27.60%) having low experience (10-15 years). More than one-sixth (15.20 %) of respondents had high experience (>30 years) and only 5.70 % of respondents had very low experience (<11 years)

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Extension media contact

Farmers use various information sources and media to a different extent in order to receive production information.The observed of extension media contact of the respondents ranged from 8 to 27 scores. The average and standard deviation were 14.85 and 5.522 respectively. On the basis of extension media contact scores, the respondents were classified into three categories as shown in table 5.1

Deliberate analysis of the data presented in table 5.1 showed that the highest percentage (55.20 %) of the respondents had medium extension media exposure or contact as compared to 6.70 % had low media exposure and 38.10 % had high extension media contact. Growers' exposure to a variety of information sources usually guides them to identify problems in mango production.

Organizational participation

The observed organizational participation of the respondents ranged from 0-2 years with a mean and standard deviation of 0.69 and 0.788 respectively. On the basis of organizational participation, the respondents were classified into three categories as shown in table 5.1

Analysis of the data presented in table 5.1 showed that majority (51.40 %) of the respondents had no participation at all. However, 28.60 % of the respondents had low participation. Only 20% of the respondents had high participation.

Cosmo politeness

The observed Cosmo politeness of the respondents ranged from 5-26 scores with a mean and standard deviation of 14.84 and 4.133 respectively. On the basis of Cosmo politeness, the respondents were classified into three categories as shown in table 5.1

The data presented in the table 5.1 indicated that majority (47.60 %) of the respondents had medium Cosmo politeness as compared to 44.80 % had low Cosmo politeness and it means that most of the respondents have more or less orientation to out of his own social system which might help them in order to improve mango production.

Cosmo politeness enhances the opportunity for an individual to have himself to contact with outside information sources. It is, therefore, possible that an individual with substantial Cosmo politeness would have an augmented possession of accumulated knowledge, experience and problem solving means.

Knowledge on mango production

The observed knowledge on mango production of the respondents ranged from 7-16 scores with a mean and standard deviation of 12.15 and 2.731 respectively. 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 (67.60 %) had high knowledge while 21 % of the respondents had medium and 11.40 % had low knowledge on mango production. That means the mango grower of the study area belongs to high knowledge group which added them extra advantages.

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Table 5.2 Dependent variables

SL. N	Selected characteri	Measuring unit	Observed	Categories	Respondents		Mea	SD
					Numb	Perce		
1	Annual mango production	Ton	5.89-15	Low (< 7)	11	10.50	8.11	1.577
				Medium (7-10)	81	77.10		
				High (> 10)	13	12.40		
2	Annual income from mango production	Taka	178000 - 500000	Low (Up to 200000)	4	3.80	240.22	46.372
				Medium (200001-250000)	74	70.50		
				High (250001-500000)	27	25.70		
3	Mango varieties produced in the study area	No. of varieties	4-26	Small (1-10)	34	32.40	12.59	4.959
				Moderate (11-20)	62	59.00		
				Large (>20)	9	8.60		
4	Problem confrontation in mango production	Score	29-58	Low (< 30)	7	6.70	41.93	7.874
				Medium (30-50)	79	75.20		
				High (>50)	19	18.10		

Annual mango production

The observed per hectare annual mango production of the respondents ranged from 5.89-15 tons with a mean and standard deviation of 8.11 and 1.577 respectively. 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 (77.10 %) of respondents involved in mango production had medium (7-10 ton) production followed by high production (> 10 ton) with 12.40 % of respondents. Low production (<7 ton) was only for few percent (10.50 %) of respondents.

Annual income from mango production

The observed annual income from per hectare mango production of the respondents ranged from Tk. 178000 to 500000 with a mean and standard deviation of 240.22 and 46.372 respectively. On the basis of annual income from per hectare mango production, the respondents were classified into five categories as shown in table 5.2.

Data shown in the table 5.2 indicated that majority of respondents (70.50 %) had medium income (tk. 200001-250000) from mango production followed by 25.70 % of respondents having high income (Tk.250001-500000). Only 3.80 % of respondents had low (Tk. Up to 200000).

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Mango varieties produced in the study area

The observed mango varieties produced of the respondents ranged from 4-26 in number with a mean and standard deviation of 12.59 and 4.959 respectively. On the basis of number of mango varieties produced, 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 (59 %) had moderate number (11-20) of mango varieties followed by 32.40 % of respondents having 1-10 varieties. Only 8.60 % of respondents had large (>20) number of varieties. From these analyses it is clear that growers of the study area are adapted with a lots of mango varieties.

Problem confrontation in mango production

The observed scores that were obtained by the Problem Confrontation Index (PCI) formula to calculate problem confrontation status in mango production ranged from 29 to 58 with a mean and standard deviation of 41.93 and 7.874 respectively. On the basis of overall problem confrontation scores, the growers were classified into three categories as shown in table 5.2.

Data presented in the table 5.2 indicated that majority (75.20 %) of the growers confronted medium problem while 18.10 % of them confronted high problem and only 6.70 % of growers faced low problem. These analyses indicate that the desired level of mango production will not be achieved if the different problems confronted by the growers are not solved by the concern authority.

Status of mango production

Production status in other than homestead area

Total cultivable land size

The observed range of total cultivable land size of the respondents was from 0.187-3.200 hectares with a mean and standard deviation of 1.56 and 0.848 respectively. On the basis of total cultivable land size, the respondents were classified into five categories as shown in table 5.3

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Table 5.3a Distribution of the respondents according to total cultivable land size

Categories	Observed range (Hectare)	Categorized range (Hectare)	Respondents		Mean	Standard deviation
			Number	Percent		
Very small	0.187-3.200	Up to 0.20	5	4.80	1.56	0.848
Small		0.21-0.50	10	9.50		
Moderate		0.51-1.00	11	10.50		
Moderately large		1.01-2.80	68	64.70		
large		> 2.80	11	10.50		
Total			**105**	**100**		

Data presented in the table 5.3a indicated that majority percent (64.70%) of the respondents had moderately large sized (1.01-2.80 ha) of lands followed by 10.50 % of respondents having both large (>2.80 ha) and moderate sized of lands individually. Only 9.50 % had small (0.21- 0.50 ha.) and 4.80 % had very small sized (Up to 0.20 ha.) of land.

Fruit cultivable land size

The observed range of fruit cultivable land size of the respondents was from 0.186-3.200 hectares with a mean and standard deviation of 1.55 and 0.844 respectively. On the basis of fruit cultivable land size, the respondents were classified into four categories as shown in table 5.3b.

Table 5.3b Distribution of the respondents according to fruit cultivable land size

Categories	Observed range (Hectare)	Categorized range (Hectare)	Respondents		Mean	Standard deviation
			Number	Percent		
Small	0.186-3.200	Up to 0.20	7	6.70	1.55	0.844
Moderate		0.21-1.00	24	22.80		
Moderately large		1.01-2.80	66	62.90		
large		> 2.80	8	7.60		
Total			**105**	**100**		

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Data presented in the table 5.3b indicated that majority percent (62.90 %) of the respondents had moderately large sized (1.01-2.80 ha) of lands followed by 22.80 % of respondents having moderate sized (0.21-1.00 ha) of lands. Only 7.60 % of respondents had large (> 2.80 ha.) and 6.70 % of respondents had small sized (Up to 0.20 ha.) of lands.

Fruit cultivated land size

The observed range of fruit cultivated land size of the respondents was from 0.186-3.190 hectares with a mean and standard deviation of 1.54 and 0.843 respectively. On the basis of fruit cultivated land size, the respondents were classified into four categories as shown in table 5.3c.

Table 5.3c. Distribution of the respondents according to fruit cultivated land size

Categories	Observed range (Hectare)	Categorized range (Hectare)	Respondents		Mean	Standard deviation
			Number	Percent		
Small	0.186-3.190	Up to 0.20	8	7.60	1.54	0.843
Moderate		0.21-1.00	25	23.80		
Moderately large		1.01-2.80	65	61.90		
large		> 2.80	7	6.70		
Total			**105**	**100**		

Data presented in the table 5.3c indicated that majority percent (61.90 %) of the respondents had moderately large sized (1.01-2.80 ha) of lands followed by 23.80 % of respondents having moderate sized (0.21-1.00 ha) of lands. Only 6.70 % of respondents had large (> 2.80 ha.) and 7.60 % of respondents had small sized (Up to 0.20 ha.) of land.

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 with a mean and standard deviation of 0.01 and 0.009 respectively. On the basis of fruit cultivable land size in homestead area, the respondents were classified into three categories as shown in table 6.

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

Categories	Observed range (Hectare)	Categorized range (Hectare)	Respondents		Mean	Standard deviation
			Number	Percent		
No land	0.000-0.040	0.00	26	24.80	0.01	0.009
Small		0.001-0.01	45	42.80		
Large		>0.01	34	32.40		
Total			**105**	**100**		

Data presented in the table 6 indicated that majority percent (42.80 %) of the respondents had small sized (0.001-0.01 ha) of lands followed by 32.40 % of respondents having large sized (>0.01 ha) of land. About 24.80 % of the respondents had no land for the definite purpose.

Fruit cultivated land in homestead area

The observed range of fruit cultivated land size in homestead area of the respondents was from 0.000-0.030 hectares with a mean and standard deviation of 0.01 and 0.008 respectively. On the basis of fruit cultivated land size in homestead area, the respondents were classified into three categories as shown in table 7.

Table 7. Distribution of the respondents according to fruit cultivated land in homestead area

Categories	Observed range (Hectare)	Categorized range (Hectare)	Respondents		Mean	Standard deviation
			Number	Percent		
No land	0.000-0.030	0.00	42	40.00	0.01	0.008
Small		0.001- 0.01	46	43.80		
Large		>0.01	17	16.20		
Total			**105**	**100**		

Data presented in the able 7 indicated that majority percent (43.80 %) of the respondents had small sized (0.001-0.01 ha) of lands followed by 40 % of respondents having no land and only 16.20 % of the respondents had large sized of (>0.01) land used for fruit production.

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Mango cultivated land in homestead area

The observed range of mango cultivated land size in homestead area of the respondents was from 0.000-0.010 hectares with a mean and standard deviation of 0.002 and 0.004 respectively. On the basis of mango cultivated land size in homestead area, the respondents were classified into two categories as shown in table 8.

Table 8. Distribution of the respondents according to mango cultivated land in homestead area

Categories	Observed range (Hectare)	Categorized range (Hectare)	Respondents		Mean	Standard deviation
			Number	Percent		
No land	0.000-0.010	0.00	84	80.00	0.002	0.004
Small to medium		0.001- 0.01	21	20.00		
Total			**105**	**100**		

Data presented in the table 8 indicated that majority percent (80 %) of the respondents had used no land for mango production followed by 20 % of respondents having small to medium sized of lands used for mango production.

Production status with relative measurements

Annual mango sale

The observed range of annual mango sale from per hectare production of the respondents was from 5.89-15 tons with a mean and standard deviation of 8.11 and 1.577 respectively. On the basis of annual mango sale from per hectare production, the respondents were classified into three categories as shown in table 9.

Table 9. Distribution of the respondents according to the annual mango sale from per hectare production

Categories	Observed Range (Ton)	Categorized range (Ton)	Respondents		Mean	Standard deviation
			Number	Percent		
low	5.89-15	< 7	11	10.50	8.11	1.577
Medium		7-10	81	77.10		
High		> 10	13	12.40		
Total			**105**	**100**		

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Data shown in the table 9 indicated that majority (77.10 %) of respondents involved in mango production had medium (7-10 ton) annual sale followed by high sale (> 10 ton) with 12.40 % of respondents. Low sale (<7 ton) was only for few percent (10.50 %) of respondents.

Annual expenditure for per mango tree

The observed annual expenditure range per mango tree was from Tk.80-250 with a mean and standard deviation of 156.67 and 40.231 respectively. On the basis of annual expenditure for per mango tree, the respondents were classified into three categories as shown in table 10.

Table 10. Distribution of the respondents according to the annual expenditure for per mango tree

Categories	Observed Range (Taka)	Categorized range (Taka)	Respondents		Mean	Standard deviation
			Number	Percent		
low	80-250	≤ 100	10	9.50	156.67	40.231
Medium		101-200	84	80.00		
High		201-300	11	10.50		
Total			**105**	**100**		

Data shown in the table 10 indicated that majority (80 %) of the respondents involved in mango production had medium expenditure (Tk.101-200) for per mango tree followed by 10.50 % of respondents with high expenditure (201-300). Very poor percent 9.50 % of respondents had low (≤ 100 taka) expenditure. The above analyses explore that the growers were very caring about their production.

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 six categories as shown in Table 11.

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Table 11. Distribution of the respondents according to the weight of per fruit

Categories	Observed range (gm)	Categorized range (gm)	Respondents	
			Number	Percent
Very low	150-750	<200	7	6.70
Low		201-250	7	6.70
Moderate		251-350	13	12.40
Moderately high		351-500	21	20.00
High		501-700	37	35.20
Extra high		>700	20	19.00
Total			**105**	**100**

The table 11 showed that weight of individual mango fruit was markedly varied. The maximum percent of (35.20 %) of the respondents had high weighed fruits (501-700 g) followed by 20 % and 19 % of the respondents having moderately high (351-500 g) and extra high (>700 g) weighed fruits.

Varietal status of mango

Status of recognized mango varieties

Thirty (30) recognized mango varieties were cultivated by the growers of my study area. Their percentages are shown in the table 12 which indicated the status of the varieties. Gopalbhog ranked 1st as it occupied the highest percentage (15.90 %) out of total mango varieties which is followed by Mishribhog (15.70 %) which ranked 2nd, Mishribhog (Moshokortia) (10 %) which ranked 3rd, Langra (Hazipuri) (9.90 %), Surjapoori (8 %), Fazli (6.60 %) etc.

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Table 12. Ranking status of recognized mango varieties based on their availability in respondents' farm

Mango Varieties	Percentage	Ranking Status
Gopalbhog	15.90	***1st***
Mishribhog	15.70	***2nd***
Mishribhog (Moshokortia)	10.00	***3rd***
Langra (Hazipuri)	9.90	*4th*
Surjopoori	8.00	*5th*
Fazli	6.60	*6Th*
Fukulbiyan	4.90	*7th*
Green Shaheber Brindabuni	4.50	*8th*
Ashwina	3.10	*9th*
Mohonbhog	2.80	*10th*
Kufpuri	1.60	*11th*
Chini Fazli	1.40	*12.5th*
Kalua Gopalbhog	1.40	*12.5th*
Darika fazli / Bandiguri	1.30	*14.5th*
Surma Fazli	1.30	*14.5th*
Kadua Fazli	1.20	*17th*
Jethua Mishribhog	1.20	*17th*
Amrapali (BARI Aam-3)	1.20	*17th*
Mallika	1.10	*19th*
Chatapara	0.80	*21.5th*
Vaduria	0.80	*21.5th*
Dilsad	0.80	*21.5th*
Shaheb Khawka	0.80	*21.5th*
Bou fushlani	0.70	*24.5th*
Rajbhog	0.70	*24.5th*
Ruier mura	0.60	*26th*
Hilshapetti	0.50	*27.5th*
Dudh shagor	0.50	*27.5th*
Benison	0.40	*29th*
Baramashi droop	0.30	*30th*

Local mango germplasm

Local mango germplasm are categorized based on their number belonged by the growers (table 13). The farm of most of the respondents (85.70 %) was not provided with local mango germplasm while only 14.30 % had grown small to medium number of (1-6) local mango germplasm.

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Table 13. Distribution of the respondents based on number of local mango germplasm available in their farm

Categories	Range (Germplasm number)	Respondents	
		Number	Percent
Not at all	0	90	85.70
Small to medium	1-6	15	14.30
Total		**105**	**100**

Status of year round mango varieties

Quantitative status of year round mango varieties

Year round mango varieties are categorized as presented in table 14. Majority of the respondents (77.20 %) had no year round mango varieties in their farm while 11.40 % had both large (6-10) and small (1-5) number of year round mango trees.

Table 14. Distribution of the respondents based on number of year round mango varieties available in study area

Categories	Range (No. of trees)	Respondents	
		Number	Percent
No tree	0	81	77.20
Small	1-5	12	11.40
Large	6-10	12	11.40
Total		**105**	**100**

Varietal status of year round bearing mango trees

Varietal status of year round bearing mango is shown in the Table 15. The only year round mango variety is *Baramashi droop* which is belonged to 100 % of the respondents having (24 growers) year round bearing trees.

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Table 15. Distribution of the respondents based on year round varieties available in the study area

Varieties	Respondents	
	Number	Percent
Baramashi droop	24	22.80
Total	**24**	**100**
No year round varietal trees	81	77.20
Grand total	**105**	**100**

Management status of mango trees

Fertilizer usage

It was observed that all of the respondents (100%) used cow dung and compost to the mango trees while 95.20 % used Urea and TSP individually. MP, Gypsum and Zinc sulphate were used by 94.30%, 50.50 % and 65.70 % of the respondents respectively (Table 16).

Table 16. Percentage of fertilizer use

Fertilizer	Citation Number	Percentage
Urea	100	95.20
TSP	100	95.20
Compost	105	100
Cow dung	105	100
MP	99	94.30
Zinc sulphate	69	65.70
Gypsum	53	50.50

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 17). Most (53 %) of the respondents practised spading 1-2 times and 47 % did it for 3-4 times. 51 % of respondents practised

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pruning and training. 47 % irrigated their trees for 3-4 times. Mulching and inter cropping were completely avoided by 98 % and 58% respectively.

Table 17. After care of mango trees practiced by the respondents

Operations	1-2 times (%)	3-4 times (%)	Not at all (%)
Irrigation	43	47	10
Inter cropping	35	7	58
Mulching	2	0	98
Spading	53	47	0
Fruit thinning	44	33	23
Pruning and training	51	3	46
Weeding	46	35	19

Propagation of mango trees

Propagation of mango trees was practiced by 68.60 % of the respondents because a significant number of respondents (33.40 %) did not practise propagation (Table 18). Of them 42.80 % practised seed propagation followed by Grafting (25.80 %).

Table 18. Distribution of the respondents based on propagation practices for mango in the study area

Propagation method	Respondents	
	Number	Percent
Grafting	27	25.80
Seed	45	42.80
No propagation	33	31.40
Total	**105**	**100**

Problems in mango production

On the basis of Problem Confrontation Index (PCI) formula (Chapter 3), out of the 16 problems, insects and diseases infestation was identified as the major problem followed by dropping of fruits and flowers. The observed problem confrontation index of the problems ranged from 15 to 431. 1st, 2nd and 3rd ranked problems with their PCI are shown below (Table 19).

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Table 19. Rank order of the problem confrontation by the growers in mango cultivation

SL. No.	Problem items	PCI	Rank order
1	Insect and disease infestation	431	1st
2	Dropping of fruits and flowers	413	2nd
3	Scarcity of better varieties/ Seedling/ grafts etc.	399	3rd

For the major problems status, causes and solutions are discussed below.

Insect and disease infestation status

It was found from the survey that majority of the growers (62.90 %) emphasized on diseases infestation (Table 20).

Table 20. Distribution of the respondents based on insect and disease infestation status

Infestation	Respondents	
	Number	Percent
Diseases infestation	66	62.90
Insects infestation	39	37.10
Total	**105**	**100**

Disease infestation of mango

The diseases of mango had been presented in table 21. From the survey it was found that the mango plants were mostly (48.50 %) attacked by Anthracnose which is followed by 25.70 % of Powdery mildew and 12.40 % of Sooty mould.

Table 21. Distribution of the respondents based on disease infestation of mango

Disease type	Respondents	
	Number	Percent
Anthracnose	51	48.50
Powdery mildew	27	25.70
Sooty mould	13	12.40
Die-back	7	6.70
Stem end rot	7	6.70
Total	**105**	**100**

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Insect infestation of mango

The occurrence of insect infestation had been shown in the table 22. Most of the respondents (39 %) reported that their plants are attacked by hopper which is followed by fruit fly (23.80 %), stem borer (14.30 %), leaf cutting weevil (10.50 %) and others.

Table 22. Distribution of the respondents based on insect infestation of mango

Insects type	Respondents	
	Number	Percent
Fruit fly	25	23.80
Stem borer	15	14.30
Hopper	41	39.00
Gall insects	6	5.70
Leaf cutting weevil	11	10.50
Fruit weevil	3	2.90
Defoliator	2	2.00
Spider mite	1	0.90
Termite	1	0.90
Total	**105**	**100**

Dropping of fruits and flowers

The occurrence of dropping of fruits and flowers has been shown in table 23. From the table it was evident that all (100%) of the respondents said that the dropping of fruits and flowers is a common problem.

Table 23. Response on dropping fruits and flowers

Occurrence of dropping	Yes	No
Flower	100%	-
Fruit	100%	-

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Causes of dropping fruits and flowers

The causes of flower and fruit dropping had been shown in the table 24. It was found that the main cause of fruit and flower dropping was diseases (41.90 %) and then insects (37.10 %). The other causes they mentioned were water deficiency and nutrient deficiency were same in percentage (10.50 %).

Table 24. Distribution of the respondents based on causes of dropping of fruits and flowers of mango in the study area

Causes	Respondents	
	Number	Percent
Diseases	44	41.90
Insects	39	37.10
Nutrient deficiency	11	10.50
Water deficiency	11	10.50
Total	**105**	**100**

Treatments to protect the flower and fruit dropping

The treatments for the protection of flowers and fruits dropping had been shown in table 25. Most of the respondents (90.50 %) took protective or curative measures for controlling the dropping of fruits and flowers. Fungicides were used by 41.90 % of respondents followed by insecticides (37.10 %).

Table 25. Distribution of the respondents based on treatments to protect the flower and fruit dropping

Causes	Respondents	
	Number	Percent
Inter cultural operation	12	11.50
Insecticide	39	37.10
Fungicide	44	41.90
Not at all	10	9.50
Total	**105**	**100**

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Profit from mango production

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

Relationship between the selected characteristics of the mango growers and dependent variables

The purpose of this section was to examine the relationship between twelve (12) selected characteristics of the mango growers and four (4) dependent variables in mango production. The 12 selected characteristics of the mango growers included age**,** education, family size, farm size, land used in mango production, annual income, experience in mango production, experience in agriculture, extension media contact, organizational participation, Cosmo politeness and knowledge on mango production. Each of the characteristics constituted the independent variables while annual mango production, annual income from mango production, mango varieties produced and problem confrontation in mango production were the dependent variables. To explore the relationship between the selected individual characteristics of the growers and their dependent variables, Pearson's product moment co-efficient of correlation (r) was used. Five percent level of probability was used as the basis for rejection of a null hypothesis. The computed values of `r` were compared with relevant tabulated values for 103 degrees of freedom at the designated level of probability in order to determine whether the relationships between the concerned variables were significant or not and other status of significance.

The summary results of the correlation analysis have been presented in table 26 showing the relationship between concerned variables in mango production.

Table 26. Co-efficient of correlation showing relationship between selected characteristics of the mango growers and dependent variables in mango production (N=105)

Dependent Variables / Independent Variables	Annual mango production	Annual income from mango production	Mango varieties produced	Problem confrontation in mango production
Age	0.144 ^{NS}	0.181 ^{NS}	0.372**	0.635**
Education	0.148 ^{NS}	0.090 ^{NS}	0.299**	-0.214*
Family size	-0.180 ^{NS}	-0.181 ^{NS}	0.321**	0.420**
Farm size	0.539**	0.509**	0.766**	0.433**
Land used in mango production	0.573**	0.547**	0.760**	0.431**
Annual income	0.451**	0.419**	0.756**	0.442**

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Experience in mango production	0.270**	0.290**	0.547**	0.719**
Experience in agriculture	0.122 NS	0.159 NS	0.342**	0.651**
Extension media contact	0.215*	0.271**	0.347**	-0.567**
Organizational participation	0.062 NS	0.071 NS	0.159 NS	0.356**
Cosmopoliteness	-0.083 NS	-0.100 NS	-0.167 NS	-0.083 NS
Knowledge on mango production	0.304**	0.335**	0.416**	0.707**

NS= Not significant
** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Relationship between selected characteristics of the mango growers and annual mango production

According to the table 26, the following observations are made regarding the relationship.

a) The relationships of annual mango production respectively with age, education, farm size, land used in mango production, annual income, experience in mango production, experience in agriculture, Extension media contact organizational participation and knowledge on mango production showed a tendency in the positive direction.

b) The relationships of annual mango production respectively with family size and cosmopoliteness showed a tendency in the negative direction.

c) The relationship of annual mango production with extension media contact (-0.215*) was found significant as the co-efficient of correlation (r) of the variable was found larger than the tabulated value with 103 degrees of freedom at 0.05 level of probability.

d) The respective relationships between annual mango production and farm size (0.539**), land used in mango production (0.573**), annual income (0.451**), experience in mango production (0.270**), knowledge in mango production (0.304**) were found significant as the co-efficient of correlation (r) of these variables were found larger than the tabulated value with 103 degrees of freedom at 0.01 level of probability.

e) The relationships of annual mango production respectively with age, education, family size, and experience in agriculture, organizational participation and cosmopoliteness were found insignificant.

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Relationship between selected characteristics of the mango growers and annual income from mango production

According to the table 26, the following observations are made regarding the relationship.

a) The relationships of annual income from mango production respectively with age, education, farm size, land used in mango production, annual income, experience in mango production, experience in agriculture, extension media contact, organizational participation and knowledge on mango production showed a tendency in the positive direction.

b) The relationships of annual income mango from production respectively with family size, and cosmopoliteness showed a tendency in the negative direction.

c) The relationships of annual income mango from production respectively with farm size (0.509**), land used in mango production (0.547**), annual income (0.419**), experience in mango production (0.290**), extension media contact (0.271**) and knowledge in mango production (0.335**) were found significant as the co-efficient of correlation (r) of these variables were found larger than the tabulated value with 103 degrees of freedom at 0.01 level of probability.

d) The relationships of annual income mango from production respectively with age, education, family size and experience in agriculture, organizational participation and cosmopoliteness were found insignificant.

Relationship between selected characteristics of the mango growers and mango varieties produced

According to the table 26, the following observations are made regarding the relationship.

a) The relationships of number of mango varieties produced respectively with age, education ,family size, farm size, land used in mango production, annual income, experience in mango production, experience in agriculture, extension media contact, organizational participation, knowledge on mango production showed a tendency in the positive direction.

b) The relationship of number of mango varieties produced with cosmopoliteness showed a tendency in the negative direction.

c) The relationships of number of mango varieties produced respectively with age (0.372**), education (0.299**) ,family size (0.321**), farm size (0.766**), land used in mango production (0.760**), annual income (0.756**), experience in mango production (0.547**), experience in agriculture (0.342**), extension media contact (0.347**) and knowledge in mango production (0.416**) were found larger than the tabulated value with 103 degrees of freedom at 0.01 level of probability.

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d) The relationships of number of mango varieties produced respectively with organizational participation and cosmopoliteness were found insignificant.

Relationship between selected characteristics of the mango growers and problem confrontation in mango production

According to the table 26, the following observations are made regarding the relationship.

a) The relationships of problem confrontation in mango production respectively with age, family size, farm size, land used in mango production, annual income, experience in mango production, experience in agriculture, organizational participation and knowledge on mango production showed a tendency in the positive direction.

b) The relationships of problem confrontation in mango production respectively with education, extension media contact and cosmopoliteness showed a tendency in the negative direction.

c) The relationship between problem confrontation in mango production and education (-0.214*) was found significant as the co-efficient of correlation (r) of this variable was found larger than the tabulated value with 103 degrees of freedom at 0.05 level of probability.

d) The relationships of problem confrontation in mango production respectively with age (0.635**), family size (0.420**), farm size (0.433**), land used in mango production (0.431**), annual income (0.442**), experience in mango production (0.719**), experience in agriculture (0.651**), extension media contact (-0.567**), organizational participation (0.356**)and knowledge in mango production (0.707**) were found significant as the co-efficient of correlation (r) of these variables were found larger than the tabulated value with 103 degrees of freedom at 0.01 level of probability.

e) The relationship between problem confrontation in mango production and cosmopoliteness was found insignificant.

CONCLUSION AND RECOMMENTATIONS

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 (60%) 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.

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2. Majority (77.10 %) of respondents involved in mango production had medium (7-10 ton) production and high production percentage was also so sound with 12.40 % of respondents (>10 ton). Production per hectare for some growers reached up to 15 tons. So, it may be concluded that, the study area bears a better mango production sign.

3. Highest proportions of the respondents (76.20%) were middle aged men as well as medium (1.01-3.00 ha) land holder who had primary level of educational qualification, medium (3-5) sized family, medium experience both in mango (10-20 years) production and in agriculture (16-25 years), medium extent media contact, no organizational participation, medium cosmopoliteness and high (>10 score) knowledge in mango production.

4. Most of the respondents (53.30 %) had high annual family income ranging from Tk. 300001-500000. But majority of respondents (70.50 %) had medium income (Tk. 200001-250000) from mango production followed by 25.70 % of respondents having high income (Tk.250001-500000). Majority (77.10 %) of respondents involved in mango production had medium (7-10 ton) annual sale.
5. Thirty (30) recognized mango varieties were cultivated by the growers in the study area. Of them Gopalbhog, Mishribhog & Mishribhog (Moshokortia) ranked 1st (15.90 %), 2nd (15.70 %) and 3rd (10 %) respectively. Most of the respondents (90 % & 77.20% respectively) had no local mango germplasm and year round mango trees.

6. Majority (75.20 %) of the growers confronted medium problems. From 16 listed problems, insect and disease infestation was identified as the major problem followed by dropping of fruits and flowers.

7. The findings indicate that farm size, land used in mango production, annual income, experience in mango production, extension media contact and knowledge in mango production respectively had significant relationship with 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.

8. The findings indicate that age, education, family size, farm size, land used in mango production, annual income, experience in mango production, experience in agriculture, extension media contact and knowledge in mango production respectively had significant relationship with number of mango varieties produced Hence, it is concluded that the growers having higher these characteristics, the higher become the number of mango varieties produced.

9. The findings indicate that age, family size, farm size, land used in mango production, annual income, experience in mango production, experience in agriculture, organizational participation and knowledge in mango production respectively had

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significant relationship with problem confrontation in mango production. So, the above characteristics are proportional to problem confrontation in mango production.

10. The findings indicate that education and extension media contact had individual negatively significant relationship with problem confrontation in mango production. Therefore, it is concluded that education and extension media contact are inversely proportional to problem confrontation in mango production.

11. The findings indicate that age, education and organizational participation respectively had positively and family size and Cosmo politeness respectively had negatively insignificant relationship with annual mango production and annual income from mango production respectively. Cosmo politeness had negatively insignificant relationship with number of mango varieties produced and problem confrontation in mango production individually. Organizational participation had positively insignificant relationship with 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 programme. 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.

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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 eight villages of sadar upazila under Dinajpur district. Similar studies may be undertaken in other parts of the country to verify the findings of the present study.

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

3. The study investigated only sixteen problems related to mango production. So it is required to investigate other problems related to mango production.

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